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CONTENTS

SAFETY ASPECTS OF UAS INTEGRATION IN PAN-EUROPEAN AIRSPACE

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ABSTRACT

In parallel to the ever increasing air traffic in Pan-European airspace, another aeronautical platform seeks approval to share the airspace with civil aviation; that with no pilot on-board the aircraft – the Unmanned Aircraft System (UAS). The introduction of UAS into civil airspace, under auspices of the Air Traffic management and its services, will generally coincide with anticipated growth of the air traffic with high rate, thus putting additional pressure before UAS community. In same time, different security and safety aspects need to be addressed and positively resolved, mainly in relation to Sense and Avoid functions of UAS, as well as general acceptance of specific nature of UAS flight within ATM procedures and safety protocols.

KEY WORDS

Unmanned Aircraft Systems. UAS. Air Traffic Management. Air Navigational Service. Air Traffic Control. Air Traffic. Non-segregated Airspace. Communications. Ground Control Station. TCAS.

1. INTRODUCTION

The airspace environment witnesses the emergence of Unmanned Aircraft Systems (UAS) with an almost geometrical progression. New aeronautical mission profiles and operational requirements have driven the development of large number of different UAS designs, with increasing system complexities involved. Although initially envisaged as a military means, and operated in respective manner, the achieved technological breakthroughs have effectively migrated into the civil domain, opening new frontiers for an extensive amount of possible civil UAS applications. Meanwhile, UAS have grown in size and their capacity of performing an autonomous operation, in which they have mimicked the various aspects of manned aviation to quite a large degree. But in order to fulfill their ever increasing mission spectrum, they should be given green light to spread from segregated airspace into controlled one, which they then will share with manned aviation.

The UAS industry is among the largest growing in the field of aeronautics, with total number of different UAS more than doubled in the period between 2005 and 2010 [1]. But, in parallel to anticipated integration of UAS in non-segregated airspace, the conventional air traffic will grow with similar rate. Eurocontrol estimates there will be 16.9 million IFR movements in Europe in 2030, which is 1.8 times more than in 2009 [2]. The growth will average 1.6%-3.9% annually and will be faster in early years, especially in Eastern Europe [3]. With these prospects in sight, it is safe to assume that UAS integration into civil airspace, without their full compliance with respective operational routines and procedures of manned aviation, would have a degrading effect on overall air traffic safety. The question that arises here is whether the technology involved is mature enough to allow for this process to start.

The purpose of this paper is to demonstrate; within given Air Traffic Management (ATM) environment, what are the critical safety issues that may determine the pace of UAS integration in Pan-European Airspace.

2. UAS IN NON-SEGREGATED AIRSPACE

The use of UAS is at this point almost exclusively limited to confined (segregated) volumes of airspace due to the absence of appropriate protocols needed for their integration into the auspices of ATM system. Nevertheless, the UAS community and different institutional stakeholders have so far demonstrated firm intention to find modalities that will provide unlimited access for UAS to the controlled airspace. In doing so, many aspects of safe and secure integration must be achieved, while their adaptation to ATM procedures will play the most significant role. Moreover, if UAS are to integrate with other airspace users, they must fit in with those other users and with current procedures, rather than existing ATM being required to adjust to accommodate UAS [4]. Besides procedural, many other aspects will have to be dealt with, including regulatory frameworks and airworthiness, pilot training and certification but also socio-economic issues; such is public acceptance of removing a man from the cockpit of an airborne asset, with remote control loop in charge of flight. Main processes for integration of UAS in European airspace are depicted in *figure 1*.

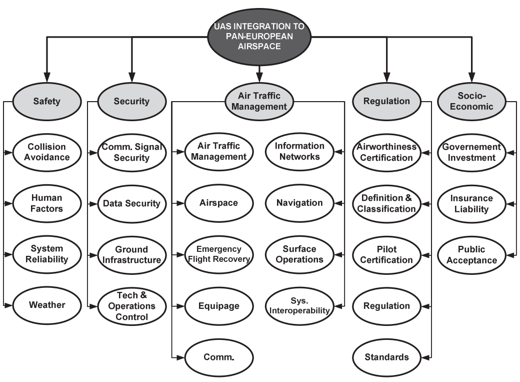

Figure 1: UAS integration main processes
Source: A. Gheorghe, E. Ancel, Unmanned Aerial Systems Integration to National Airspace System

Before UAS start to negotiate their access to the civil airspace, they should be systematically and functionally recognized in terms of regulations. Every sub-system of UAS has to be certified in airworthiness. Similarly, operators should be certified in the similar fashion. Different classifications in regards to size, airframe, flight characteristics and other are needed to facilitate these processes. Few institutions have adopted certain specifications in regard to airworthiness, that correspond to fixed wing UAS with operating mass of 150 kg and more, and these are namely EASA in its policy document [5], and NATO in its standardization document [6]. Both have derived their specification on the equivalence basis of already established EASA CS-23 certification specification codes that correspond to manned aircrafts.

In terms of air operations, many efforts exist in setting different sets of operational requirements, i.e. Eurocontrol specifications in [4] that tend to demonstrate that risk to other airspace users from military UAS operations would be no greater than from manned military Operational Air Traffic (OAT) in non-segregated airspace and would be reduced as far as possible. Eurocontrol in its overly pragmatic approach derives its specifications under condition that UAS should carry similar functionality for flight, navigation and communication as required for manned aircraft.

In order to achieve the same level of separation and collision avoidance functionality as it is the case for manned aircraft, UAS should be design in such a way that it effectively offsets the partial deprivation of situational awareness that is provided with a pilot inside the airframe. This could be done both procedurally and by increasing on-board systems functionality. Since some of the specific procedural actions cannot be performed by UAS, i.e. following other air traffic under ATC instruction, this is where UAS capacity of performing autonomous actions comes in play. The same applies in other instances such is loss of communication between UAS and Ground Control Station, or some other critical system failure that precludes the remote command and control function of the aircraft. In any case, UAS should have the ability of autonomous operation in secondary mode, which would clear the possibility of mid-air conflict by maneuvering different preprogrammed patterns.

As the most important functions of ATC/ANS is provision of separation between different airspace users, both in lateral and vertical plane, it is clear that this will also present a crucial requirement for UAS, and subsequently for the safe conduct of air operations. But while the responsibility for separation provision lies on the ATC where the radar surveillance is provided, it is for pilot-in-command to provide separation from other users by virtue of available means of navigation and collision avoidance systems, in case when radar separation is not available for any reason.

At this point, there is no empirical data that would indicate that situational awareness achieved through the remote operation of UAS, as is, would not have a degrading effect on the safety of flying UAS as OAT in non-segregated airspace. It seems that human factors in operation of UAS are an aspect not yet researched to the extent that would yield precise requirements and technical specification for appropriate human-machine interface designs, although some specifications do exist at present time (NATO STANAG 4586). Such designs should account for sensory deprivation of the UAS operator, as opposed to the pilot in the manned aircraft. The only input in that regard is highly limited visual reference in a narrow field of view, conveyed through the means of data-link. Data-link, furthermore, may suffer from signal latencies that may further diminish situational awareness in that particular regard. Sensory cues that are lost therefore include ambient visual information, kinesthetic/vestibular input, and sound [7].

Lastly, the most intriguing technological domain pending operational confirmation may be the ability of UAS to see and avoid conflicting traffic by means of on-board sensory layout. This function is further elaborated in chapter 3.

3. SENSE AND AVOID FUNCTION OF UAS

The emerging issue of UAS integration in the controlled airspace is its ability to avoid mid-air collisions with other air traffic. In order to do that, UAS have to be able to sense, detect, and avoid that traffic. Considering the robotic nature of UAS, this consideration will not only attract technical, but also ethical discussion on the subject. In the manned aviation, pilot on board supervises the VFR flight and responds with actions to extraordinary developments, including possible conflicts with other aircraft. His situational awareness may be amplified by means of collision avoidance systems, i.e. TCAS (Traffic Collision Avoidance System). In case of unmanned aircraft, the functional requirements of separation provision and collision avoidance functions will have to be achieved in respect to the same safety criteria as for manned aircraft, but without a pilot on board. Consequently, sense and avoid systems for UAS will have to be more versatile and autonomous than those in conventional aviation.

In today's airspace, several safety layers exist to minimize the probability of an airborne collision [8]. In the first layer, airspace structure and respective flight rules form procedural mechanism for collision avoidance. ATC provides surveillance and control functions that effectively form the second safety layer. Identification of cooperative aircraft via transponder, and respective functions of TCAS equipment serve as third layer. Finally, the ability to see and avoid traffic forms the fourth layer of safety. All of the aforementioned layers in civil airspace are shown in *figure 2*. Although it doesn't fall into the remit of this paper, it is worth mentioning that collision avoidance also applies to actions in avoidance of other obstacles, i.e. trees, buildings and terrain.

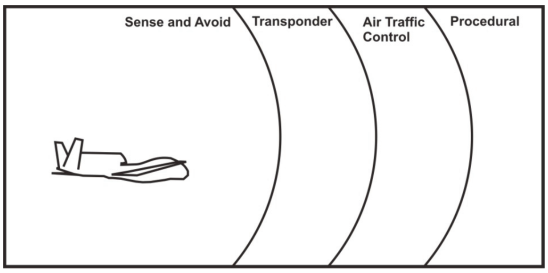

Figure 2. Safety layers in airborne collision avoidance

Source: Author

Safety requirements of Sense and Avoid systems will be derived from appropriate safety metrics, which in this case are represented as a rate at which the mid-air collision occurs. This is also referred to as Target Level of Safety (TLOS). For TLOS to be derived, some authors have used the statistical data of general aviation accidents in which two aircraft were involved in mid-air collision, regardless of the size of fatalities [9]. With that approach, the baseline rate could be established at $1x10^{-6}$ accidents in 100000 flight hours (table 1.) However, although numbers of accidents of UAS do not indicate that TLOS is even remotely achieved, it is important to understand that these accidents are entirely represented through various collisions with obstacles and/or ground, and not with other aircraft in mid-air. Further research is needed to establish more precise baseline for mid-air collisions, which is the primary domain of Sense and Avoid systems operation.

Table 1: Comparison of average accidents between UAS and manned aircraft per flight hour

Number of UAS accidents in 100000 flight hours	Number of accidaents in manned aviation in 100000 flight hours
Predator (MALE) $3,2x10^{-4}$	**F-16 Fighting Falcon** $3x10^{-6}$
Pioneer (MR) $3,3x10^{-3}$	**General Aviation**
Hunter (MRE) $5,5x10^{-4}$	**Regional Aviation** $1x10^{-7}$
	Larger Airliners $1x10^{-8}$

Source: Defence Science Board Study on Unmanned Aerial Vehicles and Uninhabited Combat Aerial Vehicles

The most comprehensive and operationally usable postulation of TLOS so far is seen in NATO document [10] which derives functional requirements for UAS Sense and Avoid operating in non-segregated airspace. According to this postulation, baseline probability of mid-air collision $\left(^{\Delta}MAC\right)$ for UAS with MTOW of 150 kg and above should be no less than $5x10^{-9}$ per flight hour in airspaces classes A to D. For all other operations in airspace classes E, F and G $\left(^{\Delta}MAC\right)$ should be equivalent, or better than, which is acceptable TLOS for conventional aviation in respective classes of airspace.

According to NATO capability group on UAS, apart from TLOS as derived above, Sense and Avoid systems on UAS should also comply with two basic operational functions in order to allow for operations in non segregated airspace. These are:

- Collision avoidance, which applies when the separation provision has failed and an imminent risk of collision exists. It applies at all times, in any class of airspace under any flight rules.
- Separation provision, which is the routine act of keeping aircraft apart, in order to mitigate the risk of collision.

On the basis of these two functions, a number of specific functional requirements are further proposed in order to obtain the desired level of technological and technical capacity of UAS operating in non-segregated airspace. Once again, Sense and Avoid systems are surrogate of human See and Avoid capability which functions in orchestra with TCAS systems. Having said this, functional requirements should account for any latency in relaying relevant flight data to pilot on ground, or should have substantial level of autonomy to act without input from the remote operator for any given contingency during the flight.

4. ATM ASPECTS OF UAS INTEGRATION

First and utmost difference in regards of UAS operations from the ATM perspective is the geographical relation between the Ground Control Station (GCS) and the ATM cell that is in charge of traffic separation en route. In case of manned aviation, this relation is relative to the position of the aircraft and is handled by respective Air Navigational Service (ANS) authority via various communication links (data/voice). In case of UAS operations, on the other hand, GCS remains stationary in relation to the ATM network. In the same time, UAS airborne platform is critically dependant on the input from the ground operator, regardless of the level of its capacity to perform flight mission in autonomous fashion. As today's ATM is not readily network centric-based, this puts a pressure on relying communication in case UAS will fly between multiple airspace sectors and switch between several ANS authorities, respectively. It is essential that any ANS communication relay between the UAS and the GCS meet the performance requirement applicable for that airspace and/or operation, as determined by the appropriate authority. As with manned aviation and to reduce the potential of external interference, this will necessitate the use of designated frequency bands [11].

Communicating with different ANS nods will not be an issue when it comes to aerodrome operations. These are very well an important segment of ATM system in large and need to be dealt with accordingly. Procedures, such is Standard Instrument Departure (SID) or Missed Approach Procedures, would not substantially differ when it comes to UAS. One of the problems that are not yet solved, though, is presented through incapacity of UAS to conform to specific instructions from ATC that encompass visual recognition of near traffic. Example of this situation is a situation when a pilot of general aviation is instructed to follow another airplane inside the traffic circuit, in aerodrome VFR conditions. Logically, with absence of a pilot on-board, UAS would not be able to comply with such instruction, posing a threat to other aircraft.

Although it is widely accepted that integration of UAS into controlled airspace will in no circumstances condition any specific adjustment from the ATM side, it should be noted that development of the future ATM system could account for specific aspects of UAS operations and consequently facilitate their integration. To understand that, it is important to recognize one major aspect of today's ATM system, which is set to be largely modernized. It is the rigidness of its configuration which is also a complex collection of independent systems interconnected by very different technologies from geographically dispersed facilities [12]. Under assumption that the future ATM system will be more network centric-based system, such future arrangements would conveniently address the aforementioned issues with heavy communication loads that UAS operations would bring into ATM system. This way, it is safe to assume that the migration of today's complex and dispersed ATM towards a network centric arrangement would largely facilitate the introduction of UAS operations into Pan-European airspaces.

5. CONCLUSIONS

In present, there is no solid evidence that UAS would be able to address all the safety and security requirements of the operational flying within the controlled airspaces of the European states. In any case, not without operational confirmation of the security protocols, as well as technology related issues of the Sense and Avoid systems installed on UAS. Assuming that other aspects, such are airworthiness standards, regulatory framework and pilot licensing will not present critical issue, there still exists a set of issues related with general acceptance of the remote pilot within the control loop of the aircraft that shares the airspaces with civil airliners. It is no coincidence that ATM community puts a significant emphasis on the designation of the operator that is responsible of the aircraft during all segments of flight, regardless of its actual position relative to UAS.

Although network centric approach in design of future ATM system would largely mirror the design of UAS itself, and in this regard would facilitate the introduction of UAS into controlled airspaces, it is paramount that designated communication bandwidths remain allocated for UAS operations. If those aspects are positively achieved, few issues would remain opposed to migration of UAS into non-segregated airspace, including airspaces of classes A to D.

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BIOGRAPHIE

Tomo Bagaric was born in 1975 in Zagreb. He has graduated on the Faculty of Transport and Traffic Sciences in Zagreb in 2000, in the area of Aeronautics. With military training background, he joined Croatian Air Force in 2001 as a staff officer in the field of Intelligence. During his professional career he was deployed in NATO operations in Afghanistan and NATO Headquaters in Brussels, Belgium, where he was primarily engaged in intelligence-related but also in capability development issues. During this time he was also Croatian representative to NATO Joint Capability Group on Unmanned Aircraft Systems (UAS) on its plenary meetings. He has published a number of articles concerning the development of UAS. At this time, he is still on his mandate in Brussels.

Ms. **Sanja Steiner**, Ph.D., was born 1964 in Zagreb (Croatia). She graduated in 1988 at the Faculty of Transport and Traffic Sciences in Zagreb, Air Traffic study. In 1995 she acquired the Master's degree within the post-graduate study "Multimodal transport" at the Maritime Faculty, University of Rijeka. In 1998 she acquired the Doctoral degree in the field of technical sciences by the University of Zagreb. Since 1988 she has been employed at the Faculty of Transport and Traffic Sciences, University of Zagreb. In 2005 she was elected full professor. Since 2008 she has been head of Air Transport Department. Apart from lecturing activities at the undergraduate, graduate and doctoral studies at University of Zagreb and as visiting professor at University of Sarajevo (BiH), Ms. Steiner is active in scientific research work. She was participating as principal researcher or researcher in ten scientific projects. Since 2007 she is chairing national scientific programme Harmonization of Transport System within Context of Sustainable Development, and within it she is principal researcher in project Strategic Planning of Air Transport Development. Since 2007 she has been appointed by Ministry of Sciences and Education as national representative for transport within administration structure for European Commision Seventh Framework Programme of research and tehnology development. The previous scientific work done by Ms. Steiner includes complex research in the fields of air transport technology and safety, air transport policy and the applied projects of strategic development of the Croatian transport system. She has lectured at numerous conferences in Croatia and abroad and published several dozens of papers in the scientific and technical publications. She has published several course materials and authorised lectures, as well as a university course book Air Transport Safety Elements and Elements of Transport Policy (in Croatian), published by University of Zagreb. The five scientific books have been edited by Ms. Steiner, of which four have been published by Croatian Academy of Sciences and one by University of Sarajevo. Ms. Steiner is a member of the Flight Safety Foundation European Advisory Committee FSF EAC, professional member of Air Traffic Control Association ATCA (2002 nominated for Director for Europe and Africa), and vice-president of Scientific Council for Traffic of the Croatian Academy of Sciences and Arts. She is a member of the editorial/scientific board of the international scientific journal Promet-Traffic-Transportation and Transport Problems in edition of Silesian University of Technology.
The Adriatic Corridor establishing in European air route network is the most important result of Ms. Steiner professional contribution in domain of applied scientific research. Recent work done by Ms. Steiner is oriented towards transport policy harmonization and air traffic management within the processes of European Union enlargement.

MARITIME CABOTAGE OF PASSENGER LINER TRANSPORT IN CROATIA AFTER EU ACCESSION

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ABSTRACT

Maritime cabotage of passenger liner transport services in the EU is regulated by the regulations that all member states are obligated to comply, as well as the Republic of Croatia after becoming full member of EU. Passenger liner transport services in the Republic of Croatia, according to the data of Agency for coastal maritime liner transport, is at the moment carried out by 12 different marine companies: Jadrolinija Rijeka, National Line Voyage Inc. Split, Mediterranean cruise Inc. Korčula, Rapska Plovidba Inc. Rab, G&V Line Ltd. Dubrovnik, U.T.O. Captain port Krilo Jesenice, Miatrade Ltd. Zadar, T.U.O. Mankul Zadar, PRZ "Vrgada" Vrgada, Bura line & Offshore Slatine, Agricultural Cooperative Komiža, City of Šibenik. Liner passenger transport in Croatia is regulated under the Act on liner maritime transport and the Resolution on determining the state lines for public transport in coastal liner maritime transport from year 2008. The transitional period, to begin implementation of Council Regulation (EEC) no. 3577/92 applying the principle of freedom to provide services to maritime transport within Member States (maritime cabotage) in the coastal public passenger liner transport, is until December 31, 2016. All concessions for public transport in coastal maritime line transport signed before the Croatian accession may remain in force until 31 December 2016. After that date new tenders will be published on which all interested ship companies from the European Union will be able to equally compete.

KEY WORDS

Maritime cabotage. Adriatic Sea. regulation. passenger transport.

1. INTRODUCTION

In EU States traditional cabotage market was reserved for domestic companies. Since the adoption of the Regulation No. 3577/92 all service providers domiciled in any EU country can provide cabotage services on the entire EU territory (Art. 6) under the same conditions as domestic persons providing such services.[1]
Under the Regulation 3577/92, the concept of maritime cabotage includes[2]:

1. *"mainland cabotage* – the carriage of passengers or goods by sea between ports situated on the mainland or the main territory of one and the same Member State without calls at islands;
2. *off-shore supply services* – the carriage of passengers or goods by sea between any port in a Member State and installations or structures situated on the continental shelf of that Member State
3. *island cabotage* – the carriage of passengers or goods by sea between ports situated on the mainland and on one or more of the islands of one and the same Member State, and port situated on the islands of one and the same Member State."

2. MARITIME CABOTAGE IN EU

Maritime cabotage in EU was liberalized on 1 January 1993. In case of France, Italy, Greece, Portugal and Spain mainland cabotage was gradually liberalized according to a specific timetable for each transport service type. In these countries maritime cabotage was liberalized in 1999. In the case of Greece[3] this exemption was prolonged until 2004 for scheduled passenger services, lighter services and services involving vessels of less than 650 gross tonnage. The implementation of the Regulation 3577/92 was monitored by the European Commission which adopted four Reports[4] on its implementation, with each report referring to a two-year period. The interpretation of certain provisions of the Regulation, which in practice proved to be controversial and flawed, was given by the Commission in its Communication of 2003[5], and later in its Communication of 2006. Besides the Commission, also the European Court of Justice gave its interpretation of certain provisions of the Regulation thorough issuance of several judgments.[6]
The Regulation 3577/92 allows Member States to restrict the freedom of provision of maritime cabotage services in the following three cases[7]:

1. Member States may adopt their own rules pertaining to ship crews
2. Member States may impose certain obligations to shipping companies regarding the provision of public services in order to ensure adequate transportation services to islands, from islands and between islands
3. Member States may ask the Commission to introduce protective measures in case of serious distortions on the internal market (Regulation 3577/92, Articles 3-5).

According to the Regulation 3577/92 maritime cabotage services may be provided by *Community shipowners* whose vessels are registered in one of the EU Member States, who meet all the cabotage requirements of that

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[1] Radinov, N. et al, Europsko prometno pravo, Pravni fakultet Sveučilišta u Zagrebu (Zagreb, 2011), pp. 241-242
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[3] http://ec.europa.eu/transport/maritime/internal_market/services_en.htm [Accessed 30 April 2012]
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[7] Radinov, N. et al, Europsko prometno pravo, Pravni fakultet Sveučilišta u Zagrebu (Zagreb, 2011), pp. 241-242

Member State (Regulation 3577/92, Article 1), and who fly the flag of one of the Member States[8].

Regulation concerning vessel crew rules is traditionally the responsibility of the flag State. Different Member States have different laws regarding the vessel crew[9]. The Regulation 3577/92, Article 3 defines by the responsibility of the State, both *flag State* (the State in which the vessel is registered) and *host State* (the State in which the vessel is providing maritime transport service), in all matters relating to manning on board vessel crew carrying out maritime cabotage (Table 1.)[10]

Table 1. Jurisdiction for regulating manning on board vessel crew rules in relation to maritime cabotage

Type of maritime cabotage	**All matters relating to manning are responsibility of**
Island cabotage	*host State*
Mainland cabotage	*flag State*
Cruise liners	*flag State*
Mainland cabotage ('small ship[11]')	*host State*
Cruise liners ('small ship')	*host State*
Island cabotage > 650 BRT, when voyage concerned follows or precedes a voyage to or from another State, i.e. consecutive cabotage	*flag State*
Island cabotage > 650 BRT, when voyage concerned follows or precedes a voyage to or from another State + PSO	*host State*

Source: Radinov, N. et al, Europsko prometno pravo, Pravni fakultet Sveučilišta u Zagrebu (Zagreb, 2011), p. 246

The Regulation 3577/92 does not exactly determine the jurisdiction of the state in adopting rules on ship crew and some believe that the State jurisdiction is unlimited, so in its 2003 Communication the Commission stated that the adoption of such rules should be made by taking in consideration 'that host States are competent to specify the required proportion of Community nationals on board ships carrying out island cabotage (and ships smaller than 650 gt). A Member State may therefore require the crews of such ships to be composed entirely of Community nationals. Member States may also require the seafarers on board to have social insurance cover in the European Union. In terms of working conditions, they may impose the minimum wage rules in force in the country. However, as regards the rules on safety and training (including the languages spoken on board), the Commission considers that Member States may do no more than require compliance with the Community or international rules in force (STCW and SOLAS Conventions)[12], without disproportionately restricting the freedom to provide services'[13]

In order to ensure an adequate scheduled transport service to, from and between islands Public service contracts (PSC)[14] or public service obligations (PSO)[15] can be imposed as a

[8] Ibidem p. 244, (note): Ships flying a third country's flag, including flag of convenience cannot perform cabotage in EU. For Community shipowners see Regulation (EEC) No 3577/92, Article 2(2)

[9] Ibidem p. 244, (note): In Spain it is required that min 50% crew members, including both master and chief officer, be Community nationals. In Italy it is required that all crew members are Community nationals (with the exception of less qualified crew members), while in France it is required that all crew members be nationals of that EU Country. See. Appendix 1 of Fourth report on the implementation of Council Regulation 3577/92 applying the principle of freedom to provide services to maritime cabotage (1999-2000), COM (2002) 203 final

[10] Case No C-456/04 Agip Petroli v Capitaneria di porto di Siracusa, [2006] ECR I-3395.

[11] Small ship - the ship smaller than 650 gt. "Host" State conditions (manning rules) may be applied on ships carrying out mainland cabotage and for cruise liners. Five Member States have chosen to avail themselves of these provisions of the Regulation (Spain, France, Portugal, Italy, Greece)

[12] STCW - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (1978.), SOLAS - International Convention for the Safety of Life at Sea (1974)

[13] Commission's Communication of 2003., p.4.1, p 10

[14] *A public service contract* - is „a contract concluded between component authorities of a Member States and a Community shipowner in order to provide the public with adequate transport services. It may cover notably: transport services satisfying fixed standards of continuity, regularity, capacity and quality, additional transport services, transport services at specified rates and subject to specified conditions, in particular for certain categories of passengers or on certain routes, adjustment of services to actual requirements" (Regulation (EEC) No 3577/92, Article 2(3))

[15] *Public service obligations* – is „obligations which Community shipowner in question, if he were considering

condition for carrying out cabotage services, but only for shipping companies participating in regular service[16] to, from and between islands. During such State intervention it is important not to impose any discrimination of service providers on grounds of nationality or residence and, were applicable, any compensation for public service obligations must be available to all Community ship-owners.

Table 2. Shipowners' obligations regarding the provision of PSO and the signing of PSC

Public service obligations that can be imposed by Member States to the Community shipowner	
PSO*	***PSC***
• requirements concerning ports to served • regularity • continuity • frequency • capacity to provide the service • rates to be charged • manning of the vessel	• requirements concerning ports to served • regularity • continuity • frequency • capacity to provide the service • rates to be charged • manning of the vessel • service quality • shipowners' solvency • shipowner has no outstanding tax liabilities or obligations regarding Social Security Insurance

* Member States are limited to the requirements stated (listed) when imposing public service obligations

Source: Radinov, N. et al, Europsko prometno pravo, Pravni fakultet Sveučilišta u Zagrebu (Zagreb, 2011), p. 253

Public service contracts (PSC) must comply with public procurement regulations that are based on public, fair, and non-discriminatory procedures. The Commission's view is that the whole process of awarding Public service contracts should be lead by an independent body, or, in some cases, the independent body may be responsible only of the final part of the process (bids assessment and final decision). (...) The Regulation 3577/92 does not determine the maximum duration of Public service contracts, but in the Articles 1 and 4 of the same Regulation state that contracts which last longer than six years are not in compliance with the proportionality requirement[17].

As stated by the Commission in its 2003 Communication, when signing a PSC in relation to so-called small islands[18], where the interested parties are usually only local operators, there is no need to publish a public call, and it is enough to publish a call for interest on the EU level[19]. In these cases PSCs can have longer duration, maximum twelve years (2003 Communication, point 5.6.).

3. PASSENGER LINER TRANSPORTATION IN CROATIA

Croatia has 718 island, and 467 cliffs and reefs. Total length of the Croatian coastline is 5 790.1 km, out of which 1 777.7 km (30.7%) is mainland coastline length, and 4 012.4 km (69.3%) is island coastline length. 33 200 km^2 of Adriatic Sea area belong to Croatia.[20] Out of 718 islands around 50 are permanently inhabited. In 2001, according to the Croatian Bureau of Statistics, 122 418 people lived on Croatian islands. The most populated islands were Krk (17 860 inhabitants), Korčula (16 182), Brač (14 031) and Hvar (11 103). With the 405.78 km^2 surface area Krk is also one of the biggest islands, the same as island Cres.

his own commercial interest, would not assume to the same extent or under the same conditions“ (Regulation (EEC) No 3577/92, Article 2(4)). PSO can be imposed by declaration regime, a licensing system or an authorisation system. When applying authorisation system it is important not to infringing the standstill provision laid down by Article 7 of the Regulation No 3577/92. (Communication from 2003, p. 14)

[16] Only lines serviced during the whole year are considered as regular lines, season lines are not considered thereat as regular lines (see case C-323/03 Commission v Spain, [2006] ECR I-2161)

[17] More: Radinov, N. et al, Europsko prometno pravo, Pravni fakultet Sveučilišta u Zagrebu (Zagreb, 2011), pp. 253-255

[18] Small island, in Communication of 2003 was defined as an island where the total annual passenger traffic by maritime links are 100 000 passengers or less. In Communication of 2006 the Commission has replaced the criterion of 300 000 or less in accordance with the Commission decision 2005/842/EC on the application of Article 86(2) of the EC Treaty to State aid, according to the Article 2/1 (c) of the Commission Decision 2005/842/EC 'public service compensation for air or maritime links to island on which average annual traffic during the two financial years preceding that in which the service o general economic interest was assigned does not exceed 300 000 passengers.'

[19] Calls are published in *European Journal*

[20] Klemenčić, M. (ed), Atlas Europe, Leksikografski zavod Miroslav Krleža (Zagreb, 1997)

Islands that follow are Brač (394.57 km^2), Hvar (299.66 km^2), Pag (284.56 km^2) and Korčula (276.03 km^2).[21] Along the Croatian coastline, both islands and mainland coastline, there are around 350 ports and small harbours.[22]

Seven main public ports are located along the mainland coast (from north to south): Pula, Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. Two of them are situated on the Northern Adriatic (Pula and Rijeka), three on the Central Adriatic (Zadar, Šibenik and Split), and two on the South Adriatic (Ploče and Dubrovnik).[23] In 2011, the project ADRIMOB[24] (Sustainable coast MOBility in the ADRIatic area), co-financed by IPA Adriatic CBC Programme, identified 94 Croatian sea ports with at least one public passenger maritime connection.

The port with most state line connections (17 different lines), according to the passenger state liner sailing schedule for year 2012[25], is the port of Split (City port). Split is connected with most islands on the Central Adriatic (Brač, Čiovo, Drvenik Mali, Drvenik Veli, Hvar, Korčula, Lastovo, Šolta and Vis), island of Mljet (South Adriatic) and with harbours along the Croatian coast (Rijeka, Trogir, Makarska and Dubrovnik). Except from national lines, Split also has international connections with Italy, i.e., ports of Ancona and Pescara. According to Eurostat data[26], in 2010 the port of Split was the busiest liner passenger sea port in Croatia with total annual turnover of 3.496 mill passengers or 27.81% of total Croatian passenger maritime traffic (excluding cruise passengers). The second busiest port was the port of Zadar (passenger port) with annual turnover of 2.136 mill passengers or 16.99% of total Croatian passenger maritime traffic (excluding cruise passengers). It was followed by the Preko passenger port on the island of Ugljan (11.89%), Cres (11.23%), Jablanac (11.16%) and Supetar on the island of Brač (11%).

The Decision on defining state public transport lines in coastal maritime transport (hereinafter: Decision on state lines) of 05 December 2008[27] and amendments to the Decision of 4 March 2010[28] and of 20 October 2011[29] defined ferry, high-speed lines and conventional passenger ship (classic) lines, the appropriate type of vessels, vessel capacity, route and frequency of transport. The decision defined 27 ferry lines, 16 high-speed lines and 13 conventional passenger shipping lines in coastal maritime line transport. Depending on the time period of the year, whereby three different time periods were defined - off season, pre-season and post-season, and high season the minimum frequency, i.e., number of return trips per week, was determined for all lines. During high season 7 ferry lines[30], out of 27, are required to increase frequency by 100% or more with respect to the number of mandatory lines during off-season, while 3 lines[31] are required to ensure transport solely during pre-season, post-

[21] Statistical Yearbook of the Republic of Croatia, Croatian bureau of statistics (Zagreb, 2011), p. 41

[22] Maritime, river and pipeline transport, Croatian chamber of economy, Transport and communications department (Zagreb, 2010)

[23] Ibidem

[24] Project ADRIMOB. Available from: http://adrimob-ipa.racine.ra.it/ [Accessed 6 March 2012]

[25] Agency for coastline maritime transport, Shipping lines (2012). Available from: http://www.agencija-zolpp.hr/Brodskelinije/tabid/1267/Default.aspx [Accessed 6 March 2012]

[26] Eurostat. Maritime transport-Passengers. Available from: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=mar_pa_qm_hr&lang=en [Accessed 6 March 2012]

[27] Decision on defining state public transport lines in coastal maritime transport of 05 December 2008, Class 342-01/08-01/05; Ref.no: 5030116-08-1

[28] Decision on Amendments of the Decision on defining state public transport lines in coastal maritime transport of 04 March 2010, Class 342-01/10-01/01; Ref.no: 5030116-10-1

[29] Decision on Amendments of the Decision on defining state public transport lines in coastal maritime transport of 20 October 2011, National Gazette 10/2011

[30] In line with the Decision on defining state public transport lines in coastal maritime transport, the lines that are required to have the biggest increase of minimum number of round trips per week during high season in respect to off-season are: line 435 Zadra - Bršanj - (Rava) that increases frequency by 180% during high season, lines that increase frequency by 133.33% are line 401 Zadar - (Ist) - Olib - Silba - Premuda - (Mali Lošinj), line 433 Zadar - (Rivanj - Sestrunj - Zverinac) - Molat - Ist, and line 635 Split - Stari Grad. A min 110% frequency increase during high season is required for line 633 Ploče - Trpanj, a min 100% increase for line 338 Valbiska - Lopar, and line 532 Šibenik-(Zlarin)-Kaprije-Žirje. Other lines are also required to increase frequency of transport during summer months by 16.67- 83.33%, except for the line 606 Drvenik Veli-Drvenik Mali-Trogir (Seget)-(Split) which is required to maintain the same frequency during the whole year. Note: Ports of call in brackets are optional.

[31] Line 101 Rijeka- Split- Stari Grad- Korčula- Dubrovnik, line 604a Vela Luka-Lastovo, and line 641 Drvenik-Dominče.

season and high season. Most high-speed lines, as opposed to the ferry lines, are required to maintain the same level of frequency throughout the year, with the exception of 3 high speed lines: Dubrovnik - Šipanska Luka - Sobra - (Polače - Korčula - Lastovo) line, which is required to increase frequency by 100% during high season with respect to the off season; Žirje-Kaprije-Šibenik line, which is required to increase frequency by 55.56%, and Olib-Premuda-Silba-Zadar, which is required to increase frequency by 14.29 %. Pula-(Unije)-Mali Lošinj-(Ilovik)-Zadar line and Split-(Milna)-Hvar line are required to provide services only during pre-season and post-season, and high season period. Conventional passenger shipping lines and ferry lines are required to increase frequency during summer, i.e., during pre-season and post-season and high season[32]. Three conventional passenger shipping lines, although listed and defined by the Decision on state lines, have not been included in the timetable due to certain technical problems[33].

Statistics on the number of passengers and vehicles transported on state lines in the Republic of Croatia are published by the Agency for Coastal Maritime Line Transport[34] (hereinafter: the Agency). According to data published by the Agency[35], in 2010 a total of 10 927 383 passengers (8 991 862 on ferries[36], 1 061 884 on high-speed lines, and 873 637[37] on conventional shipping lines) and 2 747 363 vehicles were transported on state lines, while in 2011 a total of 11 129 145 passengers (9 141 536 on ferries, 1 121 831 on high-speed lines, and 865 778 on conventional lines) and 2 796 999 vehicles were transported, which is a increase of 1.7% more passengers and 1.8% more vehicles in 2011 in comparison to the 2010.

In 2011 the busiest of 26 ferry lines, considering the number of transported vehicle, was Valbiska-Merag line with 371 109 vehicles (+6.2%), followed by Jablanac-Mišnjak line with 329 780 vehicles (-5.2%) and Split-Supetar line with 316 024 vehicles (+0.6%). Considering the number of passengers, the busiest line was Zadar-Preko with 1 617 167 passengers (but with decrease of -2.41%), the second busiest line was Split-Supetar with 1 538 513 passengers (+0.43%), followed by Valbiska-Merag with 769 177 passengers (+7.27%). For the second year in a row, the biggest increase in traffic was recorded on the ferry line Ploče-Trpanj where, after a 13.4% growth in 2010, in 2011 a 15.4% growth in vehicles number and a 11.2% growth in passengers number was recorded. On passenger line Zadar-Rivanj-Sestrunj-Zverinac-Molat-Ist an even higher growth of vehicles number was recorded (17.6%), but this is by far one of the most modest ferry transport lines. Meanwhile, in 2011 the biggest decrease of passengers number (-15.1%) was recorded on the line Dubrovnik-Suđurađ-Lopud, following by a the 11% decrease on the line Makarska-Sumartin. Decrease was also registered on ferry lines Zadar-Preko, Biograd-Tkon and Zadar-Bršanj-Rava, although significantly less than in 2010. Regarding high speed lines a trend of steady traffic growth continued in 2011with a 5.6% increase in regards to 2010. The busiest lines were Korčula-Prigradica-Hvar-Split (143 178 passengers) and Lastovo-Vela Luka-Hvar-Split (137 461 passengers). Regarding conventional passenger lines, in 2011 a 0.9% decrease was recorded. The busiest line remained Vodice-

[32] Required increase of transport frequency during high season in respect to off-season: line 614 Orebić-Korčula - 115.38%, line 415 Vrgada-Pakoštane-(Biograd) 76.92%, line 612 Komiža-Biševo 40%, line 501 Brodarica-Krapanj 20.45%, line 807 Šipan-Lopud-Koločep-Dubrovnik 7.69%, and line 505 (Vodice-Prvić-Zlarin)-Šibenik 3.13%.

[33] For line 311 Ilovik - Mrtvačka the intention to offer a concession will be published after the Mrtvačka port infrastructure will be built; for line 409 Zadar - (Ošljak) - Preko the intention to offer a concession will be published after the ferry transport will have been moved to Gaženica port and line 506 Prvić Luka-Prvić Šepurine-Vodice

[34] The main task of the Agency is granting concessions for public transport on the conventional passenger ship (classic) lines, high-speed and ferry lines. This means that the Agency publishes tenders, signs concession agreements, and continuously monitors the implementation of both concession agreements, and the Law in general. (Source: http://www.agencija-zolpp.hr/Onama/tabid/1271/Default.aspx, 03 May 2012)

[35] Transportation of passengers and vehicles on state lines, 2011/2010 comparison, Agency for coastline maritime line transport. Available from: http://www.agencija-zolpp.hr/Portals/12/doc/STATISTIKA_2011_novo.pdf [Accessed 02 May 2012]

[36] line 604a Vela Luka-Lastovo is not included

[37] Agency's statistics on number of passengers transported on state traditional lines are not given for the state lines 311, 409 i 506 (see footnote 33)

Prvić-Zlarin-Šibenik, although this line registered a 3.9% decrease in 2011. With a 7.6% increase the second busiest line in 2011 was Šipan-Lopud-Koločep-Dubrovnik with 1 312 passengers.[38]

During the financial years 2010 and 2011 only 9 ferry state lines in the Republic Croatia exceeded the average annual traffic of 300 000 passengers[39] (Table 3). Thus, according to the Commission's 2003 Communication, for most state lines there is no need to publish public tenders when signing a PSC or PSO: it is sufficient to publish a call for interest at the EU level. Accordingly, public service contracts can have a longer duration, up to twelve years.

Table 3. Croatian state ferry lines with average annual traffic exceeding 300 000 passengers during 2010 and 2011

Distance (Relation)	No. of passengers		
	2010	**2011**	**Average 2010 and 2011**
Zadar – (Ošljak) - Preko	1.657.065	1.617.167	1.637.116
Split - Supetar	1.531.933	1.538.513	1.535.223
Valbiska -Merag	717.058	769.177	743.118
Prizna – Žigljen	647.042	697.943	672.493
Jablanac – Mišnjak	650.000	655.620	652.810
Split – Stari Grad	577.272	593.634	585.453
Brestova - Porozina	569.740	584.695	577.218
Orebić - Domiče	457.715	477.227	467.471
Biograd - Tkon	456.103	448.198	452.151
TOTAL	**7.263.928**	**7.382.174**	**7.323.053**

Source: Authors form the data: Transportation of passengers and vehicles on state lines, 2011/2010 comparison, Agency for coastline maritime. Available from: http://www.agencija-zolpp.hr/Portals/12/doc/ STATISTIKA_2011_novo.pdf [Accessed 02 May 2012]

Passenger state liner transport service in the Republic of Croatia, according to the passenger state liner sailing schedule for year 2012[40] is carried out by 12 different shipping companies: Jadrolinija (Rijeka), National Line Voyage Inc. (Split), Mediteranska plovidba Inc. (Korčula), Rapska Plovidba Inc. (Rab), G&V Line Ltd. (Dubrovnik), U.T.O. Kapetan Luka (Krilo Jesenice), Miatrade Ltd. (Zadar), T.U.O. Mankul (Zadar), PRZ "Vrgada" (Vrgada), Bura line & Offshore (Slatine), Agricultural Cooperative Komiža and City of Šibenik.

In 2010 in Croatia there were 139 registered passenger vessels (109 passenger ships, 4 passenger sailboats and 26 ferries).[41]

4. PASSENGER LINER TRANSPORT IN CROATIA AFTER EU ACCESSION

Maritime cabotage in passenger liner transport services in the EU is regulated by rules to which all Member States must comply, including the Republic of Croatia after it will have become a full member of EU.

Main rules that regulate liner passenger transport in Croatia are:

- Act on liner and occasional maritime transport (National Gazette 33/06, 38/09, 87/09, 18/11)
- Regulation (hr. *Uredba*) on requirements and evaluation criteria for granting concessions for public transport in coastal maritime line transport (National Gazette 4/10)
- Rules (hr. *Pravilnik*) on conditions to be met by ships and shipowners to perform public transport in coastal maritime line transport (National Gazette 130/06, 141/08, 143/10)
- Rules (hr. *Pravilnik*) on conditions to be met by ships and shipowners to perform international maritime line transport (National Gazette 130/06)

[38] News, Agency for coastline maritime transport, 2012, Available from: http://www.agencija-olpp.hr/tabid/1534/ articleType/ArticleView/articleId/1053/PUNIJI-TRAJEKTI-OBILJEILI-2011-GODINU.aspx [Accessed 2 May 2012]

[39] According to the data from the Agency for coastline maritime transport: Transportation of passengers and vehicles on state lines, 2011/2010 comparison, Available from: http://www.agencija-zolpp.hr/Portals/12/doc/ STATISTIKA_2011_novo.pdf [Accessed 02 May 2012]

[40] Shipping lines, Agency for coastline maritime linet transport, Available from: http://www.agencija-zolpp.hr/Brodskelinije/tabid/1267/Default.aspx [Accessed 6 March 2012]

[41] Statistical report 1438/2011, Croatian bureau of statistics, Zagreb. 2011

- Decision on defining state public transport lines in coastal maritime line transport of 5 December 2008, 4 March 2010 and 20 October 2011 (National Gazette 10/2011)
- Maritime Code (National Gazette 181/04, 76/07, 146/08, 61/11)

Once Croatia becomes an EU Member State (on 01 July 2013) it will take on specific obligations. After this date all ship companies (both foreign and domestic) will be able to compete on public tenders. Under the Treaty of Accession of Croatia to the European Union[42], point 7 Transport policy[43], a transitional period has been agreed regarding the implementation of Council Regulation (EEC) no. 3577/92 (the appliance of the principle of freedom to provide services to maritime transport within Member States (maritime cabotage) in coastal passenger liner public transport):

1. Concession contracts for the provision of public transport in coastal maritime liner transport signed before the Croatian accession may remain in force until 31 December 2016.
2. Until 31 December 2014 transportation services on round trips between Croatian ports, that are carried by ships up to 650 gross tons, are reserved for vessels registered in the Croatian register of ships and flying the Croatian flag, managed by shipping companies established in accordance with Croatian law, and whose headquarters and the actual control are carried out in Croatia. Until the same date the Commission may decide, based on a reasoned request of a Member State and within 30 working days of receipt of such request, that ships benefiting from this rule may not perform round trips between ports in certain areas of a Member State, except Croatia, if proven that the execution of such services seriously disrupts or threatens to seriously disrupt the internal transport market in those areas. If the Commission does not reach a decision before the 30 working days expiration period, the Member State is authorized to apply protective measures until the Commission reaches a decision. In case of an emergency, the Member State may unilaterally adopt appropriate interim measures that may remain in force up to three months. The Member State shall inform the Commission without delay. The Commission may abrogate or confirm these measures until it reaches its final decision on which it will inform the Member States.

The Decision on publishing state aid in form of public services compensation (National Gazette 39/08) published the Rules on state aid in the form of public services compensation contained in the Commission's Decision of 28/11/2005 on application of Article 106, § 2 of the Treaty on the Functioning of the EU on state aid granted in the form of compensation to certain companies who are entrusted to perform services of general economic interest and the decision of the European Court of 24/07/2003 regarding *Altmark*[44].

Croatia has continued to harmonize its legislation with the *acquis communautaire* in all areas regarding maritime transport[45].

The Agency is currently in the process of granting concessions for the provision of public transport in maritime line transport for 24 state ferry lines. Out of 24 lines, 6 are profitable, while in order to maintain the other 18 unprofitable lines the ship companies will be granted state aid. Contracts in accordance with amendments to EU Directive 3577/92 will be signed with ship companies whose bids will be accepted and will be valid until 31 December 2016. After that date new tenders will be published on which all interested ship companies from the European Union will be able to equally compete[46].

[42] http://www.mvep.hr/custompages/static/hrv/files/111201-Ugovor%20o%20pristupanjuHR.pdf, p. 200-203.

[43] Transport policy in practice is often also called Chapter 14, since during the EU accession negotiations the matters regarding transport policy were discussed under the Chapter 14 called Transport policy.

[44] Report on the fulfillment of obligations under Chapter 14 Transport Policy, Government of the Republic of Croatia, Zagreb, 29.04.2010., p 24

[45] Ibidem, p. 19

[46] http://www.agencija-zolpp.hr/tabid/1534/articleType/ArticleView/articleId/1027/RASPISAN-NATJEAJ-ZA-24-TRAJEKTNE-LINIJE.aspx [Accessed 4 May 2012]

5. CONCLUSIONS

Croatia is an Adriatic country with 718 islands, 50 of which are permanently inhabited. According to the Croatian Bureau of Statistics, in 2001, 122 418 people lived on Croatian islands, which is 2.7% of total Croatian population. In order to ensure sustainability of Croatian islands and to prevent the emigration of island population it is extremely important to ensure adequate transport links between island and the mainland.

Most passengers travel during summer months, as is evident from a significant increase of transport frequency during highly season as compared to pre-season and post-season, especially of ferry lines. Hence, it can be concluded that most passengers on state maritime lines travel for the purpose of pleasure, i.e., pleasure journey: for passengers travelling for pleasure the price of the trip is normally more important than speed or comfort, which, depending on the length of the journey, are less important. On the other hand, for most passengers that permanently live on islands and use public maritime lines for business reasons (work, doctor, etc.), the speed is the most important factor. For both types of passengers the crucial think is mainly on time departure and arrival.

The Agency for coastal maritime liner transport has the task of granting concessions for public transport on the state ferry, high-speed and conventional lines. This means that the Agency publishes tenders, signs concessions contracts, and continuously monitors the implementation of both concession contracts and the Law in general.

Maritime cabotage in passenger liner transport services in the EU is regulated by rules to which all Member States must comply, including the Republic of Croatia after it will have become a full member of EU. So far Croatia has harmonized most of its legislation with *acquis communautaire* in all areas of maritime transport. Once Croatia will have become a full EU Member State (on 01 July 2013) it will take on certain obligations. Under the Treaty of Accession of Croatia to the European Union, Chapter 7 Transport Policy, a transitional period has been agreed regarding the implementation of Council Regulation (EEC) no. 3577/92 (application of the principle of freedom to provide services to maritime transport within Member States (maritime cabotage) in coastal public passenger liner transport). According to this all concessions for public transport in coastal maritime line transport signed before the Croatian accession may remain in force until 31 December 2016. After that date new tenders will be published on which all interested ship companies from the European Union will be able to equally compete.

According to the Agency data, most ferry lines in Croatia are not financially viable and are subsidized by the state. In order to receive state grants Public service contracts (PSC) or public service obligations (PSO) must be signed. Furthermore, an analysis of traffic on the coastal state lines showed that average annual turnover of most lines is less than 300 000 passengers which means that they are defined as small islands, which usually attract only the interest of local operators, and it is to be expected that Croatia's accession to the EU will not bring major changes in state coastal line transport, but due to the current situation in passenger liner market in the EU it is difficult

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BIOGRAPHIE

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EVALUATION OF LEGAL AND INSTITUTIONAL IMPLEMENTATION OF LANDLORD PORT MODEL IN THE FUNCTION OF CROATIAN INLAND PORT SYSTEM MANAGEMENT

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ABSTRACT

The Act on Inland waterway navigation and ports from 1998, and later with amendments during year 2007 has taken over, similarly to the maritime ports, the so called «landlord» model of port system management. Nevertheless, it was necessary to change the landlord model due to technical and technological specificities that characterize inland ports and piers. For legal and institutional implementation of the landlord model it was essential to establish the Port Authority as a regulatory body of total activities, operations as well as port development policy. Arguments were presented that favor the chosen model of port management. With regard to the permanent development of the port system, legal and institutional implementation is shown in three stages: restructuring of the landlord port management model, transitional period of professionalization and improvement of efficiency of the port authority, as well as evaluation of ongoing model implementation on the basis of issued concessions and/or permissions for carrying out activities in the port area of inland ports opened for international transport.

KEY WORDS

landlord. port system. concession. port authority.

1. INTRODUCTION

The Inland waterway navigation and ports Act (1998) has taken over, similarly to the sea ports, the so called «landlord» model according to which the state withholds the powers of managing the ports and port infrastructure, and the port operations have been privatised in the manner that concessions have been allocated to the port operators. However, there is no such 'sea assets' on the inland waters, and the Port Act does not regulate the privatisation of ports separately because it was impossible at the time of its appearance. In the mean time, the ports have gone through transition process namely; some had been privatised before the Act came into force according to the general privatisation law which did not specifically qualify the ports as the assets of public interest to be privatised in conformity with any generally accepted model of privatisation of ports. Due to the aforementioned, there occurred a situation in which some ports have been privatised, and some have mixed property regime.

Owing to the fact that the ports are the assets of public interest, it is desirable for the state to withhold certain forms of control of managing the ports in order to efficiently carry out the relevant development policy of ports. In particular, it is related with the attainment of the ownership of land and port infrastructure in the port area. The organisational and managing model of public inland ports is basically characterised by the division of management and administration, and commercial port operations. Organisational-administrative functions are allocated to port authorities whilst commercial port operations are allocated to commercial companies following the specific permits for the performance of port operations throughout a determined period of time.

The Inland Navigation Act (2007) has introduced certain novelties when compared with the former Port Act. One of them is the introduction of a performance permit instead of a concession. Due to the form of ownership and specific technological requirements of inland ports, concession is impracticable or limiting, and does not allow clear and full definition of the role of landing structure/docking/piers within the port system. Piers/landing structure does not have all characteristics that ports have and they are the specific feature of the inland transport. However, they are a country's constituent part of the port system. In addition, the Act has allowed the establishment of privately owned ports and piers/landing structures but, on the other side, has protected the rights and interests of the Republic of Croatia by allocation of public powers to the port authorities.

The port authorities are the key factor for the implementation of stipulations of the Inland Navigation and Ports Act and accompanying sub-acts, and are responsible for the implementation of the overall inland waterway transport and port policy. In this paper, certain shortcomings have been identified which diminish the functioning of the overall inland port system.

2. LANDLORD PORT MODEL OF INLAND PORT SYSTEM MANAGEMENT

At the global level, various models have been introduced in port management. One way to model the various models for the management of the port-level is differentiation of private sector involvement in four key areas: infrastructure, suprastructure, terminal operations and other services. The World Bank-PPIAF Port Reform Tool Kit defined four types of standardized port management models [1]: Public Service Port Management Model, Tool Port Management Model, Landlord Port Managment Model and Private Port Management Model. Port management models differ in the distribution of risks, roles and responsibilities between the private and public sector. Worldwide, Landlord port model is commonly used for the management of ports. The table below shows how the risks, roles and responsibilities assigned to each of the port management models.

[1] The instruments for Port Reform funded by PPIAF Program, http://www.ppiaf.org/ppiaf/sites/ppiaf.org/files/documents/toolkits/Portoolkit/Toolkit/overview.html

Table 1. Port management models

Model type	Infrastructure	Suprastructure	Operation	Other services
Public Service Port Management Model	Public sector	Public sector	Public sector	Public sector
Tool Port Management Model	Public sector	Public sector	Private sector	Public/Private sector
Landlord Port Management Model	Public sector	Private sector	Private sector	Public/Private sector
Private Port Management Model	Private sector	Private sector	Private sector	Private sector

The prerequisite of successful implementation of so called «landlord» model, which is applied in Croatia, is the full control over the basic infrastructure within the port area including the riverside, port territory, land surfaces in the port area, roads and railway, and public utilities system. The port authority has a role of regulatory body dealing with the overall port activities and port operations in order to ensure competitive conditions of a port, equal status of the port clients, fair treatment of all shippers using the port, and maximal utilisation of the potentials of a port. The main advantage of this model is that both parties (public and private) invest in key resources, both carrying time and a part of the risk. The private sector is given the right to operate the terminal by signing concession contract and/or permission, in exchange for the concession payments paid by private parties and private investment in port infrastructure. Landlord model success is directly related to the quality of the concession/permission contract.

3. TECHNICAL AND TECHNOLOGICAL SPECIFITIES OF INLAND PORT SYSTEM

Technical and technological characteristics of ports of inland ports do not differ significantly from the seaports. The difference, however, exists with regard to the environment in which they operate. This environment has the following particularities:

- dimensions of the vessel
- transportation technology,
- natural conditions-fluctuations in water levels in port aquatorium.

Inland waterway vessels are smaller load capacity, less freeboard, and their dimensions (length, width and draft) are adapted to the fairway. The depth of aquatorium, the number and size of berths are as well adapted to the technical and technological characteristics of inland ports. The major problem of inland ports are definitely water level fluctuations and hydrologic characteristics. Hydrologic changes that manifest as speed and direction of flow, coastal erosion, produce and apply materials in the waterways. It is therefore necessary to adjust the appearance coast, build and control hydrobuildings and as well perform constant dredging activities. Hydrological conditions and water level changes affect the layout of the pier and shore configuration.

The port authorities are the key factor for the implementation of stipulations of the Inland navigation and ports Act and accompanying sub-acts, and are responsible for the implementation of the overall inland waterway transport and port policy. In the implementation process of the regulations, certain shortcomings have been identified which diminish the functioning of the overall port system. These problems are identified and shown in Table 2. A brief remark together with the incurred consequences is added to the each. The plan also suggests the adequate measures for the elimination of the same, or just how to make them local to the most possible extent.

The manner of financing of ports as strategic transport and economy related resources of a country is vital for creation and realization of a successful development policy of ports. The approach which sees the port operators as the only financial investors can have only limited application as regards the inland ports and conceives provision of enough space to be ensured by port authorities, whilst the port operators themselves will take liability of investing into the port facilities and construction namely, the liability of constructing the port infrastructure, port traffic connections, and operational riverside. Such cases are rare in practice and they are related with the sea ports, so called hub-centres. However, the interest in investing into the Croatian inland ports exists in terms of particular kinds of cargo. The interest of the private capital to invest into the terminals of general cargo or multipurpose terminals is limited due to the lack of large profits gained on such terminals in the port loading and unloading processes. In addition, how successful these terminals will be largely depends on the extent to which the transport infrastructure out of the port area has been constructed. Therefore, it is a common practice to construct such terminals through different types of partnerships between public and private sector in terms of financing of the port facilities and structures. The development of a port should be planned in the manner which will obtain attractiveness of the port and port system as a whole, and not to become dependent on only one successful port operator. Due to this fact, each public port and in particular, E- port must have enough space to allow complementary sub activities in the port area, namely within business zone.

Table 2. Key shortcomings and incurred consequences related with the inland port system

	Problem	Remarks	Consequences
1.	Property issues of the port area	Ports have been privatized in pursuance to a general privatization model so that some port commercial companies and port operators became owners of the entire infrastructure, buildings, and land in the port area.	„Land-lord“ model can not be implemented, lack of finance to initiate development cycle
2.	Giving priority Concessions for Port activities	Giving rights to existing companies, founded in privatization, to perform port operations in public ports is understood.	Compliance with standards, defining of business concept/policy, vague business strategy.
3.	Equal status of All public ports	All public ports have the same status regardless the role they have on the international market and development potentials.	It is not possible to develop all four ports at the same time. due to their characteristics financial power, and general economic principals.
4.	Insufficient port Infrastructure	After complete devastation during the War, only partial reconstruction of capacities has been completed, so that some ports do not have elementary port infrastructure.	Limited ability of acceptance of vessels, in particular on the ports on the Sava river.
5.	Poor technological equipment	Lack of advanced technical equipment and specialized terminals for handling with specific kinds of freight.	Lacks of specialized terminals which are technically equipped weaken the market position and competitiveness.
6.	Maintenance of waterways and approaches to ports	Constant deepening and dredging must be carried out due to specific characteristics of waterways of Sava and Drava river which are natural water courses.	Reliability of transport hence the efficiency and competitiveness of ports on the Sava and Drava river has been significantly diminished.
7.	Meeting the requirements of Agn agreement	The most important conditions are: enough space for development of complementary activities and possibility of integration with business zones.	In the EU accession process only E-ports will have possibility of aggregated freight transport.

4. LEGAL AND INSTUTUTIONAL IMPLEMENTATION OF PROPOSED MODEL OF PORT SYSTEM MANAGEMENT

Participation of private sector investment in inland ports and their management in Croatia is regulated by a number of different laws and regulations, including those relating to environmental protection to those relating to construction. The most important of them are:

Act on Inland Navigation and Inland Ports (Off. Gazzette 109/07), Water Act (Off. Gazzette 153/09), Law on Concessions (Off. Gazzette 125/08), 21 Public Procurement Act (Off. Gazzette 110/07), and the corresponding Regulations. Distribution of roles in terms of management, business activities and operation of river ports in the Republic of Croatia are divided between:

1. Ministry of Maritime Affairs, Transport and Infrastructure
2. port authorities, and
3. private operators.

The Ministry appears as the founder of port authority is subject to administrative supervision and inspection by the Ministry. The Governing Council of Inland Ports, which operates within the Ministry, is responsible for monitoring, developing and investing in inland ports. Port authorities are responsible for the continuous and uninterrupted provision of public services and other activities intended to have the management of ports in a particular area in accordance with the plans for the development and maintenance. Port authorities are public institutions that have the following legal authorization:

- preparation of a draft planning documents for the development of the port system,
- concerns about the implementation of planning documents,
- perform activities in related to granting of concessions and/or authorization to carry out port activities,
- management of real estate in the port area owned by the Croatian Government,
- managing the free zone in port area established by Decision of the Government of the Republic of Croatia pursuant to regulations governing the free zones,
- supervising the work of port operators and port users carrying out port activities, in accordance with obligations assumed, ensuring the provision of services of general interest and for those for which there is no economic interest of other economic operators,
- other activities set out by the law.

As described in the previous section, the proposed port management model that would represent the final state of the Landlord port model, where a public port authority granted the concession for the activity of loading and unloading and warehouse rent to private port operator. The proposed implementation plan, which is described in Chapter 2, provides a road map that may lead to the proposed final state.

4.1 Implementation phase no. 1: Restructuring of the "landlord" model

During Phase no. 1 restructuring of a public institution has been established for port management. Furthermore, legal documents with amendments were prepared and preparations had been made for the institutional, administrative and operational separation activities. A temporary concession had been established between port authorities and port operators. Separation of public and private management functions were realized as a result of this phase. The objective of this phase was to implement the desired port structure according to the model Landlord in an environment of public and private actors.

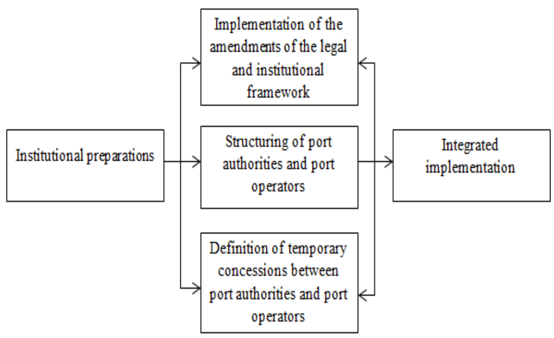

Figure 1. Restructuring of landlord port model

Institutional preparations regarding restructuring relate to the key decisions that include following: restructuring of the inland ports in accordance with the Landlord model with the aim of granting concessions for port activities, foundation of port authorities and the establishment of temporary concessions between port authorities and port operators before the long-term concessions present on market; appointment of responsible entities (ministries) responsible for implementing the project of the reform process. After the institutional preparations, implementation of changes in the legal and institutional framework, as well as the structuring of port authorities and port operators are completed, Landlord model can be really integrally implemented.

4.2 Implementation Phase No. 2: Transitional Period

During Phase No. 2 newly established Port Authority will work on professionalism, strengthening and rationalizing their respective roles within the Landlord model. Port needs a strong and professional Port Authority for the development and promotion of the port area, throughout the provision of fair competition and protection of high standards of safety and environment. Improvement of personnel, recruitment of new associates and collaborators as well as "institutional building" requires the development of appropriate management structures and human resources. Considering above mentioned, following functions are particularly important:

- Project management of major construction projects,
- marketing and promotion of the port on the transport market,
- Know-how in projects of attracting businesses in the port area.

Interesting might be measures of "institutional building", which is the core of recruitment of experts from EU member states and candidate countries. In the case of "normal" procedure of Twinning, experts are suggested for a period of 12 months or longer, for "short" TWINNING there is no need for permanent commitment. Accompanying measures may include the conferences, preparation of documentation, etc.

4.3 Implementation phase No. 3 : Evaluation of implementation

Four Port Authorities are established for the inland waterways in Croatia: in Vukovar for a public port on the Danube River and the future Danube-Sava rivers multi-purpose canal, in Osijek for the ports on the Drava River, whilst the responsibility for the ports on the Sava river is shared between Sisak Port Authority and Slavonski Brod Port Authority. In addition, the port authorities are responsible for issuing of the practice permits for ports and piers/landing structures within the area under their responsibilities. The positive effect of legal and institutional implementation of landlord port model are quantified on the case of issued concessions since year 1998 under the provisions of the inland ports Act, or permissions for performing the port activities upon the entry of Inland Navigation and Inland Ports Act into force during November 2007. (OG 109/07).

Table 3. Indicator of issued concessions / permissions in the port area of Croatian inland ports for the period since 1998 - present

	Port authorities	Number of concessions issued since 1998 - 2007	Number of permissions issued since 2007 – present
1.	Sisak Port Authority	2	5
2.	Slavonski Brod Port Authority	2	19
3.	Osijek Port Authority	1	7
4.	Vukovar Port Authority	4	1

Based on the information from Table 3 it can be concluded that a more liberal system of permission granting for port activities generated positive effects for the interest of investors in the port areas of Croatian inland ports.

5. CONCLUSIONS

Landlord port model is commonly worldwide, used for port management. The prerequisite of successful implementation of so called «landlord» model in Croatian inland ports is full control over the basic infrastructure within the port area including the riverside, port territory, land surfaces in the port area, roads and railway, and public utilities system. Landlord model success is directly related to the quality of the concession/permission contract, which is shown in this paper through an indicator of issued concessions/permissions in the port area of Croatian inland ports for the period since 1998 – present. Due to technical and technological specificities that characterize inland ports and piers it was necessary to restructure the landlord model. This paper shows through three phases how institutional preparations, implementation of changes in the legal and institutional framework, as well as the structuring of port authorities and port operators are important for integral implementation of Landlord model. It can be concluded that a more liberal system of permission granting for port activities generates positive effects for the interest of investors in the port areas of Croatian inland ports.

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CAN HINTERLAND CONNECTIONS COPE WITH THE EXPANSSION PLANS OF THE PORT OF KOPER?

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ABSTRACT

The port of Koper, managed and operated by Luka Koper, is the only Slovenian international cargo port with 55 years of tradition in providing quality port and logistic services, while at the same time making lots of efforts to consistently improve the quality of life of the local community.
The port of Koper records good performance numbers and it has ambitious expanding plans in near future. The authors thus decided to examine what impacts would port's expansion have on hinterland connections, namely rail and road system in Slovenia.

KEY WORDS

port. hinterland connections. expansion. safety. traffic flows. saturation.

1. INTRODUCTION

The port of Koper is the only Slovenian international cargo port. In 55 years it expanded from a one berth port to an important multipurpose port in the North Adriatic area, stretching over 280 hectares of land.

The port of Koper is managed by Luka Koper, public limited company. This company is at the same time the only provider of port and logistics services in the port of Koper. It operates with 12 different terminals and has controls 28 berths on 3.282 meters of quay. Luka Koper has ambitious development plans which have been formulated into the Slovenia's National Spatial Plan that was adopted by the Slovenian government in June 2011.

Yearly more than 2.000 ships call to the port of Koper, accumulating for a yearly throughput of more than 17 million tons. Only one third of this cargo is used to satisfy the needs of Slovenian economy. The other important users of port of Koper services are Austria, Italy, Hungary, Czech r., Slovakia, southern regions of Germany and Poland and the countries of formal Yugoslavia. It is thus obvious that the port of Koper generates huge surface cargo flows, which are, according to Luka Koper, still mainly carried out by rail. According to the five-year strategic plan adopted by Luka Koper in 2011 the throughput should reach 21,4 million tons in the year 2015 (STA, 2011). This will pose additional pressure on already quite saturated Slovenian surface infrastructure.

An introductory chapter on port of Koper leads the reader to the core issue of the paper that is port's hinterland connections. The rail and road connections on Slovenian territory are analysed and some major concerns are pointed out.

2. THE PORT OF KOPER

2.1. Overview of historical development of the port of Koper

When Yugoslavia lost zone A and within it the port of Trieste, the favourable position of Koper was recognized and the construction of the port of Koper started in the 1950s. First berth with a quay length of 135 meters was constructed in 1957 and the first transoceanic ship called to the port of Koper in 1958.

Luka Koper got its present name in 1961 and is ever since present in the port of Koper as the only terminal operator and as port manager.

At the very beginning of the operation the port of Koper recorded good performance numbers although at that time the port was not connected to Slovenian railway system. Accelerated port's development and the acquirement of free trade zone status provoked fast growth of cargo throughput, which revealed the inadequacy of port's link with hinterland; difficulties in coordination of rail and road transport between Kozina and Koper resulted in poor cost competitiveness of the port. It was clear that direct rail connection needed to be established in order to continue the port's operation but the government was not in favour of this although plans for the rail connection construction existed in mid 1950s.

An important milestone in the port's development was the year 1967 when Luka Koper, completed the construction of 31 kilometres long railway track between Koper and Prešnica. Calculations showed the economic viability of the new rail line at the port's throughput of 1,5 million tons which was expected in 1971 (Luka Koper, 2007). However the importance of the rail connection was proved very quickly as the port's throughput increased for 120 % in the first two years of rail operation, reaching almost 1,9 million tons in 1969 (SURS, 1970).

Table 1: Selected milestones in the port of Koper development and the throughput for last 10 years [in 000 t]

Year	Milestone	Throughput
1957	The port of Koper is established	0,025
1958	The first transoceanic ship Gorica is moored	0,030
1963	The status of a free-trade zone is acquired	0,609
1967	Railway connection between Koper and the hinterland is established	0,844
1979	Container Terminal is constructed	2.471
1984	Terminal for Coal and Iron Ore is constructed	2.890
1988	Grain silo is constructed	4.553
1996	Car Terminal is constructed	6.502

1998	Livestock terminal is constructed	8.446
1999	Parking garage is constructed	8.412
2001	Intensive construction takes place at Pier II	9.146
2002		9.305
2003		10.788
2004	Luka Koper, ltd. acquires the status of border inspection post for goods destined for the EU The Terminal for coal and iron ore was finalized and renamed the European Energy Terminal	12.063
2005		12.625
2006		15.482
2007	The foundation stones for the extension of the first pier for container needs and erection of the new warehouse for cars are set up	15.852
2008		16.554
2009	Northern Adriatic ports Koper, Trieste, Venice and Ravenna signed establishing agreement of North Adriatic Port Association (NAPA) Four new container post panamax cranes arrived to our port	13.358
2010	Terminal for alcohols is built European Commission issues an agreement for co-financing 2nd phase of renovation and modernization for Koper – Divača railway	14.591
2011	Slovenian Government adopts the National Spatial Plan for Koper port	17.051

Source: (Luka Koper, 2012b), (SURS, 1966), (SURS, 1970), (SURS, 1982), (SURS, 1987), (SURS, 1991), (SURS, 2002), (SURS, 2007), (SURS, 2012a)

2.2. The port of Koper today

Good knowledge on hinterland markets and smart investment policy into port infrastructure has allowed a constant growth in port's throughput. Luka Koper now operates 12 specialized terminals, 11 of which are cargo terminals.

Table 2: Basic facts on port of Koper

Total port area	2.800.000 m^2
Enclosed warehousing	247.000 m^2
Covered storage areas	76.000 m^2
Open storage areas	900.000 m^2
Quayside	3.300 m
Shore tanks	143.000 m^3
Max sea depth	18 m

Source: (NAPA, 2010a)

The yearly throughput surpassed 17 million tons in 2011, and the throughput increased in all cargo types handled in the port of Koper.

Table 3: Throughput in port of Koper in 2011[in tonnes]

General cargo	1.383.354
Containers	5.309.346
Vehicles	665.878
Dry bulk cargo	6.769.845
Liquid bulk cargo	2.922.891
Total	**17.051.314**

Source: (Luka Koper, 2012a)

The throughput increased by almost 11% in 2011 in comparison to 2010 year producing higher traffic volumes on the existing hinterland connections.

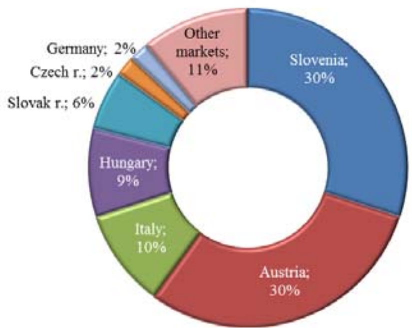

Figure 1: The structure of port of Koper's throughput by market
Source (Luka Koper, 2011b, p. 55)

In 2011 the revenues of Luka Koper increased more than the throughput, more precisely by 13 %, totalling in 134,4 million € (Luka Koper, 2012e). Studies show that the impact of commercial port in the national economy is multiplicative, and the multiplier can range from eight to ten-fold (Korelič, 2001).

2.3. Future development of the port of Koper

Luka Koper is grouped with the ports of North Adriatic, namely port of Trieste, Venice, Ravenna and Rijeka within the North Adriatic Port Association (NAPA) since March 2010. Port act actively on the promotion of North

Adriatic route as these ports provide the shortest maritime route from the Far East via Suez to Europe, while having the facilities to accommodate a huge variety of cargos and offering a huge variety of logistic services.
The vision of NAPA is the formation of a European logistics platform, in particular with regard to servicing the markets of the Far East as well as Central and Eastern Europe (NAPA, 2010), thus it is not surprising that Luka Koper expects to reach a throughput of 21,4 million tons in 2015 (STA, 2011), which is substantially more than 18 million planned within the port's development strategy in 2006 (Luka Koper, 2006, p. 9), and the question is, if hinterland connections have enough capacity to accommodate all cargo flows.
Such a throughput can be reached with accurate planning and the Luka Koper's ambitious expansion plan was confirmed by the Slovenia's National Spatial Plan in June 2011. Among others this plan includes (summed up from (Luka Koper, 2011a)):

- extension of the pier I for about 100 m,
- extension of the pier II for about 370 m,
- construction of the pier III with a length of 1.060 m

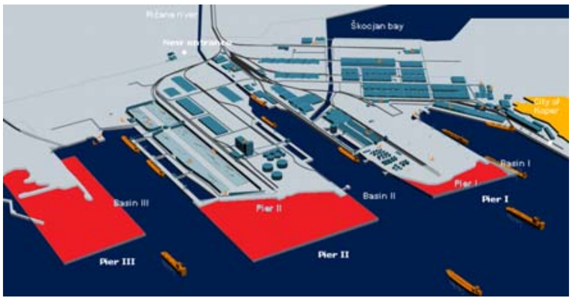

Figure 2: Expansion plans for the port of Koper
Source: Adopted from (Luka Koper, 2012c)

2.4. Port's connection with the hinterland

Today the port of Koper is connected with its hinterland with a modern motorways system and quiete limited railway system.
More than 110 container shuttle trains per week connect port of Koper with major European centers in Austria, Croatia, Serbia, Hungary, Slovakia, Czech republic, Germany, Romania and Bulgaria. More than 650 vaggons (derived from (Kranjec, 2012)) and around 1.000 lorries per day arrive or depart from the port of Koper.

3. SLOVENIAN SURFACE TRANSPORT SYSTEM

3.1. Slovenian railway system

Slovenian railway system consists of 1.228 km of lines, majority of which are single-track rails. The port of Koper is still connected with its hinterland by the rail connection constructed in 19th and 20th century, with long steep slopes and small radiuses, which in addition is poorly maintained, consequently not providing maximum line load or speed on the entire direction towards foreign markets as can be seen from Table 4 and Figure 2.

Table 4: Maximum permissible axle load

Axle load [t/axle]	16	18	20	22,5
Kilometres	145,8	91,0	588,9	407,8
Percentage	11,8	7,4	47,7	33,1

Source: (SŽ, 2012)

In 2009 there were 110 kilometres less lines with the maximum permissible axle load of 22,5 tons in comparison with the year 1992 (Računsko sodišče RS, 2010, p. 14).

Figure 3: Nominal line load
Source: Adapted from (SŽ, 2012)

The Slovenian rail system is currently characterized by highly deteriorated tracks in length of 90 kilometres on which approximately 26.000 concrete blocks have to be replaced as soon as possible; speed and maximum axle load are lowered on about 70 spots, totalling in a length of 39 kilometres; there are 8 kilometres of dangerous slopes with 18 avalanche zones; stations, platforms and underpasses are in obsolete condition etc (OP-ROPI, 2007, p. 23-24), thus making the Slovenian railway system rather inefficient.

Notwithstanding the favourable position of Slovenia on the intersection of V. and X. Pan European corridor and simultaneous fast development of the Port of Koper, only about 25% of projects defined by National Program on the Slovenian railway infrastructure development back in 1996, have so far been realized.

3.1.1. Modernization of the Slovenian railways

The Resolution on National Development Projects 2007 – 2023 has again identified the need of modernization of Slovenian railway system. The estimated cost of the project is around 8,9 billion €, with more than 83 % of this amount allocated to the modernization of railways on corridor V.

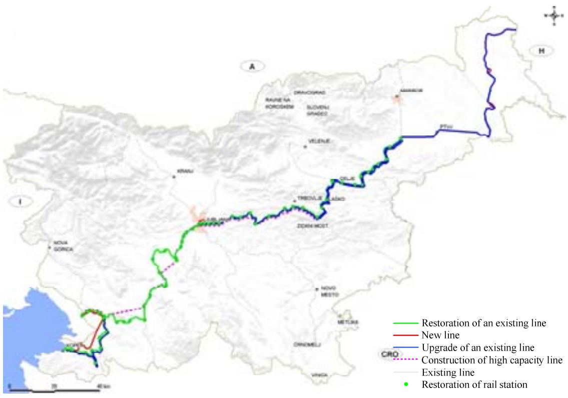

Figure 4: Development of rail infrastructure on the corridor V

Source: Adapted from (Vlada RS, 2006, p. 58)

The modernization of the railway system consists of (Božič, 2006):

- constructing the second track on the section Koper-Divača, Ljubljana-Jesenice and Maribor-Šentilj,
- providing the permissible axle load of category D3 (22,5 t/axle),
- assuring the level of interoperability with EU directived 2001/16 and 50/2004,permiting the maximum speed of at least 160 km/h on main lines, which coincide with corridors V and X,
- providing modern remote control of traffic through the restoration of signalling and safety devices etc.

Koper – Divača railway line

For the port of Koper modernization of the railways that coincide with corridor V is of crucial importance.

The railway line Koper – Divača is the first bottleneck on the port of Koper's connection with its hinterland.

Table 5: Permeability and utilization of sections on the Koper – Hodoš railway connection

Line segment / Section	Number of tracks	Permeability [trains/day]	Utilization [%]
Koper – Divača	1	72	88
Sežana – Divača – Ljubljana	2	135	62
Ljubljana – Zidani Most	2	300	51
Zidani Most – Pragersko – Maribor	2	185	65
Pragersko – Ormož – Središče	1	55	89
Ormož - Hodoš	1	34	88

Source: (Računsko sodišče RS, 2010, p. 15)

The existing rail line currently allows the transportation of around 9,2 million tons of cargo per year. Luka Koper states that around 70 % of cargo arriving or departing from the port of Koper is transported by rail (Luka Koper, 2012d), however it seems that with current capacity in best case only around 54 % of port's throughput can be transported by rail.

Table 6: Current and planned permeability and capacity of railway direction Koper – Divača

	Permeability [trains/day]	Capacity [mio t]
Existing line	72	9,2
Modernization of existing line	82	14,3
New single-track line	95*	14,4
New double-track line	197*	33,1

Note: * Subsection Koper – Črni Kal

Source: (Računsko sodišče RS, 2010, p. 46)

Modernization of the rail direction Koper – Divača is planned in three phases.

The first phase consists of installation of adeqaute signalling and telecommunication devices and should be completed in 2012.

The second phase of modernization includes the expansion of railway terminal within the port of Koper as well as of the freight station of Koper (Sermin). In addition the rail station in Hrpelje-Kozina and Divača will be expaned and rail-road crossing will be modified (Kalman, 2010). This phase should be completed 2014, however some important work has already been done. The construction of six new tracks at the freight station Koper (Sermin) in the total length of 2.500 m increased the stations's capacity for more than 50 %. The construction of eight new tracks in the port's rail terminal started in February 2012. When completed they will increase the terminal's capacity by 60 % (Kranjec, 2012, p. 10). The modernization of existing track is estimated to cost 128 million €, of which 68 million € are gained from European cohesion funds (Kalman, 2010).

The third phase of modernization forsees the construction of second track on the rail section from Koper to Divača as the modernization alone of the existing track would not provide long term solution. The construction of new track will cost around 700 million € and its completion was planned for the year 2015 (Božič, 2006).

The entire project of modernization of the section Koper – Divača is estimated to 900 million €. Slovenia will apllied for European co-financing and eligible costs are estimated to 625 million € (Kalman, 2010).

Delay in preparation of pre-construction documets resulted in a loss of certain amount of European funds, however around 230 million € will be obtained until 2013 for the construction of second track (Šuligoj, 2011).

The delay is most probably caused by the lack of money triggered by the poor financial structure of motorways construction, costing around 6 billion € and leaving behind liabilities of more then 4,1 billion € until the year 2037 (DARS, 2012a).

3.1.2. Slovenian road system

Slovenian road system has undergone through intensive development process in recent decades.

Since the approval of the National Motorway Construction Programme (NMCP) in 1994 more than 500 kilometres of motorways have been constructed. Today, all sections coinciding with corridor V and X have been completed and are fully operational.

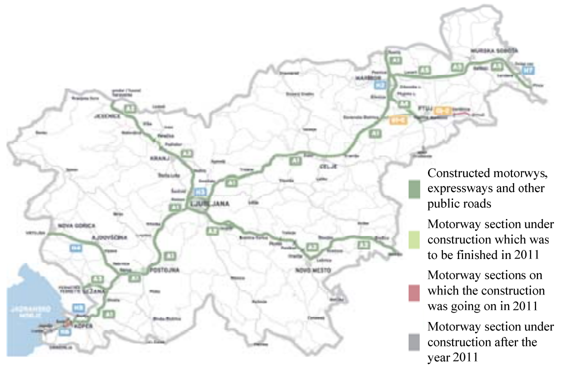

Figure 5: Motorways in Slovenia
Source: Adapted from (DARS, 2011a)

The main bottle neck in the road connection of the port of Koper is the port's entrance positioned deeply in the urban zone of Koper making the urban roads very congested by the road deliveries from and to the port of Koper and vice versa making those deliveries slower especially during peak periods.

In order to relieve traffic congestion in the vicinity of Koper's old town centre, a new entrance to the port zone will be created for lorry traffic. By establishing a direct four-lane highway between the motorway and this new entrance, HGVs will be able to completely avoid the city (Luka Koper, 2011b).

For a section of infrastructure in a given direction, occupancy demand consists of the vehicles to be carried, each corresponding to an elementary time length during which a given point-wise spot is occupied (Leurent, 2011, p. 16).

Table 7: Annual average daily traffic on different sections of Slovenian motorways

	2000	2005	2010
Slovenian Littoral section	25.961	29.904	41.184
Styria section	17.616	23.040	33.108
Upper Carniola section	16.888	19.994	25.883
Lower Carniola section	16.955	20.207	23.250

Source: Adapted from (DARS, 2011b)

The estimated upper capacity of the motorways is defined by 66.000 vehicles per day, and the definition says that a very busy road is such a road on which the annual average daily traffic exceeds 50 % of the estimated upper capacity (DARS, 2012).
The immense growth of traffic is clearly visible especially on the direction of corridor V, namely on the Slovenian Littoral section and Styria section of the motorways system. According to the above definition these sections are very busy thus traffic jams are expected especially during peak periods or on connection with lower category roads.

Table 8: Traffic flows by HGVs on Slovenian motorways and expressways [in million vehicle-kilometres]

	MW	EW	MW + EW	All roads
2000	105,3	50,2	155,5	371,5
2001	117,3	50,5	167,8	392,5
2002	151,7	56	207,7	438,1
2003	213,9	58,4	272,3	519,2
2004	265	70,3	335,3	616,5
2005	349,9	59	408,9	703,7
2006	402,9	57,3	460,2	781,8
2007	498,9	64,6	563,5	916,2
2008	650,6	66,7	717,3	978,9
2009	633,7	55,4	689,1	904
2010	662,6	50,7	713,3	922,6

Note: MW – motorways, EW – expressways

Source: Adapted from (DRSC, 2011)

Nowadays more than 77 % of HGV traffic is accommodated by motorways and expressways, which suggest that the regulation on shifting HGV traffic from lower category road to higher category road wherever it exists is fairly obeyed (in 2000 this share was less than 42 %). However it is necessary to shift cargo from roads to rail otherwise the motorways system will soon become saturated and the external costs of transportation will rise. And those costs are already not negligible as they are estimated 70 range from 6,6 to 9,4 % of GDP (Lep et al., 2004), totalling from 2,35 to 3,35 billion € according to 2011 GDP expressed in current prices (SURS, 2012b).

4. CONCLUSIONS

The development of any cargo port depends on international trade, and international trade relevant to a port depends on development of export and import markets which gravitate towards the port. However, only ports offering good services and good hinterland connections are attractive.
Port of Koper is attractive for many markets besides the Slovenian national market. Many of these markets are still underdeveloped in comparison to developed European countries therefore the biggest development is yet to happen. Luka Koper, the managing company of port of Koper is well aware of that and has thus designed ambitious expansion plan for the port, which was confirmed within the National development plan.
Knowing the size of the revenues that port of Koper generates and considering the studies on multiplicative effects of port's revenues it is clear that the port of Koper contributes to the Slovenian economy very intensively and therefore the modernization of the railway system, especially of the Koper – Divača section, should be a national priority project. The first two phases of the modernization will allow more cargo to be transported to and from the port of Koper by rail, but until then every additional million of port's throughput will mean at least 110 more lorries per day serving the needs of port of Koper. In addition, any damage of the existing line could completely disrupt port's operations or would cause the extensive overload of the road system. Any of these would cause major loss that would in short period of time exceed the construction costs of a second track from Koper to Divača.

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ANALYSIS OF CROATIAN PORTS IN RESPECT TO MOTORWAYS OF THE SEA IMPLEMENTATION

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ABSTRACT

The European Commission introduced the concept of Motorways of the Sea (MoS) in its 2001 White Paper on European Transport Policy for 2010 (revised in 2006). Motorways of the Sea refers to the development of key sea routes between EU Member States (and possibly neighbouring third countries) that will offer high quality regular services in combination with other transport modes. Croatian port system is consisting of six equally treated ports, all public ports: Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik. Standard quality criteria have been developed by the European Commission to assess projects for Motorways of the Sea. Port system is identified as one of the key elements for efficient development of functional MoS concept. Regarding Croatian transport system, at the moment when no MoS is existing, and based on available and reliable fact, efficiency in port and port infrastructure is the only element which can be analysed and is analysed within this article. This paper will give an overview of multicriterial analysis of present port system and infrastructure all Croatian ports as a prerequisite for sustainable development of MoS.

KEY WORDS

Motorways of the Sea. sea ports. port system. multi criteria. European Union. Croatia.

1. INTRODUCTION

The subject of this article is to determine the potential and to analyse Croatian port's system is respect to development of Motorways of the Sea system in Croatia. The Adriatic Sea region is the most endangered region in the Mediterranean Sea — a highly sensitive marine area facing serious environmental challenges that is home to some of the most significant treasures of world heritage. It is expected to be placed on the International Maritime Organization (IMO) list of particularly sensitive sea areas. The Adriatic region is of great significance to the economy of the region, particularly for the tourism and recreation sector, as well as a major transport hub for energy resources, and one of Europe's most highly developed industrial areas.

Recent traffic demand is stressing the capacity of road transportation and has significant impact on the environment. As congestion begins to be particularly worrisome in some border zone, new transport solutions have to be found. The lack of available land and population protest against new roads construction added to road huge cost and funding constraints enhances the development of maritime solutions such as short sea shipping and motorways of the sea.

The European Commission introduced the concept of Motorways of the Sea (MoS) in its 2001 White Paper on European Transport

Policy for 2010[1] (revised in 2006). Motorways of the sea appear to be quite attractive solutions to traffic problems. It is a new concept, building on successful short sea shipping experiences, to shift cargo traffic from the heavily loaded road network to environmentally-friendly waterways. Through the establishment of frequent and high quality maritime-based logistics services between Member States, motorways of the sea will become veritable alternatives to congested roads. As a frequent and regular service, offering a door-to-door solution to customers, it may substantially contribute to bypass road congestion. This mode isn't land consuming and is environmentally friendly. For the carrier, it can guarantee transit time and avoid delays due to traffic congestion, it is reliable and enable door-to-door solutions. It can be cheaper than road transport.

The article will result with comparison of all ports, giving and objective overview on pre-requests and potential of Motorways of the Sea implementation in Croatia.

2. PAST RESEARCH

A limited scientific database on MoS research and implementation is available. Most of it is concerning European Commission and its trying to implement MoS in European transport system. In its Transport White Paper of September 2001, the Commission proposed the development of "Motorways of the Sea" as a "real competitive alternative to land transport." To help these lines develop, the White Paper states that European funds should be made available. These "motorways of the sea" should be part of the Trans-European network (TEN-T)[2].

Four corridors have been designated for the setting up of projects of European interest

Motorway of the Baltic Sea (linking the Baltic Sea Member States with Member States in Central and Western Europe, including the route through the North Sea/Baltic Sea canal);
Motorway of the Sea of western Europe (leading from Portugal and Spain via the Atlantic Arc to the North Sea and the Irish Sea);
Motorway of the Sea of south-east Europe (connecting the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean, including Cyprus);

Motorway of the Sea of south-west Europe (western Mediterranean, connecting Spain, France, Italy and including Malta and linking with the Motorway of the Sea of south-east Europe and including links to the Black Sea).
These corridors provide one essential part of the projects: the "floating infrastructures" of our European seas. However, it is up to industry, Member States and the Community to implement financially and operationally sound projects to use these maritime resources better for new intermodal maritime-based transport systems.

Since 2004, the Commission and Member States initiated coordination activities on MoS. From these activities resulted the first studies on the role of MoS and the first geographic area task forces were set-up. Furthermore, several development projects and studies were carried out by stakeholders with the support of European Institutions and funds such as the EIB, structural funds, Marco Polo and TEN-T. In different geographic areas, MoS calls for proposals have been organised jointly by Member States in order to involve stakeholders, e.g. the joint Call France-Spain in 2009. Unfortunately, large MoS projects have not yet succeeded so far. Until now, four different studies on MoS were carried out, and one MoS Marco Polo project was launched in 2007 under the framework of Marco Polo3. In 2008, 3 MoS TEN-T projects (2008) were selected for funding and are about to be implemented. Under other frameworks, e.g. EIB and structural funds, other MoS or MoS related projects were launched. Still and as the key stakeholders point out, the state of play for the

1 http://ec.europa.eu/transport/white_paper/documents/doc/lb_texte_complet_en.pdf

2 http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_transport_mode/

3 http://ec.europa.eu/transport/marcopolo/

ongoing MoS studies and projects: is markedly insufficient, in particular if compared with all the other maritime transport development actions proposed and retained during the same period.

Scientific literature recognises A. Braid "EU Motorways of the Sea policy" and D. Tsamboulas, P. Moraiti, E. Vlahogianni "Assessing the Effect of Infrastructure and Service Attributes on the "Motorways of the Sea" Realization" relevant and important concerning the concept of development and MoS and criteria for its implementation.

MoS implementation in Croatia

In addition to the existing RO-RO lines that connect Croatian and Italian ports, not even one new MoS service has started in Croatia. So far, research and analysis of potential Croatian ports have been implemented only within East Mediterranean MoS Master Plan[4] which analysed ports of Rijeka, Zadar, Split and Ploče but dealt with partially available data. Based on the results of that project, 9 MoS potential scenarios were identified under which the Croatian ports are represented in all three corridors.

- *MoS potential corridor 3 (Ionian Sea/ West Greece ports cluster & the eastern segment of the North Adriatic ports cluster)*
- *MoS potential corridor 5 (The eastern segment of the North Adriatic ports cluster & the western segment of the North Adriatic ports cluster)*
- *MoS potential corridor 7 (The eastern segment of the Norh Adriatic ports cluster & the central segment of the North Adriatic ports cluster & the northern segment of the South Adriatic - Balkan ports cluster)*

3. RELEVANT CRITERIA FOR IMPLEMENTATION OF MOS CONCEPT

There is no official list of criteria relevant to the development of the MoS concept issued by the European Commission or any other national legislation.

According to Braid[5] development of MoS between two areas depends on following elements6.

a.) Price – The rate charged for the sea crossing, when combined with the cost of road transport at the beginning and end of the journey, would need to be competitive with the current total door-door transport charge;

b.) Departure/arrival schedule – A minimum requirement is a daily sailing in each direction. The ship should sail at the same time each day, and arrive at the time scheduled. Shippers preferred a late evening departure time, offering the potential for next day (i.e. Day B) or Day C delivery of goods;

c.) Reliability – The ship must be able to adhere to the departure/arrival schedule consistently. Frequent disruption of the schedule by bad weather or any other reason would be unacceptable;

d.) Transit time – The SSS option should enable users to maintain existing byroad door-door transit times, which range from 24-48 hours;

e.) Efficiency in port – Speed of loading/unloading, cargo security, absence of bureaucracy, low charges, 24-hour working, and fast access to the road network, were all seen as further essential service attributes;

f.) On-board facilities – Drivers accompanying trailers required restaurant, shower and cabin facilities, with the cabin included in the price.

[4] TEN-T project: 2005-GR-90701-S East Mediterranean Motorways of the Sea Master Plan, http://www.eastmed-mos.eu/

[5] Braid, A.: EU MOTORWAYS OF THE SEA POLICY, European Conference on Sustainable Goods and Passenger Transport, Kristiansand, 2005

[6] European Marine Motorways Study (EC 4th Framework Programme)

Standard quality criteria have been developed by the European Commission to assess projects for Motorways of the Sea, and include[7]:
quality of port services;
- quality of hinterland connections and services (port accessibility);
- overall information systems and monitoring in the supply chain;
- characteristics of the shipping services (e.g. frequency, regularity, safety, security);
- TEN-T dimension (integration of the project into the overall network development).

From both mentioned criteria, port system is identified as one of the key elements for efficient development of functional MoS concept. Regarding Croatian transport system, at the moment when no MoS is existing, and based on available and reliable fact, efficiency in port and port infrastructure is the only element which can be analysed and is analysed within this article.

When analysing potential of MoS service, Tsamboulas, Moraiti i Vlahogianni[8] highlight that freight transportation is a competitive industry with costs and time being as two main decision-making criteria for choice of mode. Transportation companies compete on cost and on the level of service been offered, operating under certain standards and regulations. In addition, the optimum quality of service and infrastructure in ports and their connections to the hinterland, the service provided by shipping lines, road and rail hauliers and forwarders are prerequisites for the successful implementation of MoS. Thus, an adequate functional port system is of utmost importance when analysing potential of MoS.

According to their model, the following attributes, which all are a part of port system, are assumed to determine the operation of a MoS supply chain:
- Port Efficiency
- Accessibility to hinterland
- Security
- Administrative procedures
- Custom Procedures
- Other services

Within their model, the authors present the above parameters together with their respective indicators and units of measurement (qualitative). These are assumed to constitute the attributes related to infrastructure and services for two ports (A and B) and their hinterland access and maritime links.
Within this analysis, Croatian ports system will be analysed according to those attributes, considered only port A, as presented in table 1.

[7] Europen Commission, Report on the Motorways of the Sea – State of play and consultation, Commission staff working document, SEC(2007) 1367, Brussels, 2007.
[8] D.Tsamboulas, P.Moraiti, E.Vlahogianni: Assessing the Effect of Infrastructure and Service Attributes on the “Motorways of the Sea” Realization

Table 1. Attributes for Specific Characteristics of European Intermodal Supply Chains

Attributes	Indicator	Value
Port Efficiency	Port A Productivity (total throughput)	1 (minimum) to 5 (maximum)
	Port A Labor Productivity	1 (minimum) to 5 (maximum)
	Port A Dedicated Berth	yes/no
	Port A Operating Hours	1= 24 hours 0=less than 24 hours
Accessibility	Section to port A Demand/Capacity	1 (minimum) to 5 (maximum)
	Section to Port A Distance to main transit axis	km
	terminal/port efficiency for section A	1 (minimum) to 5 (maximum)
	Section A interoperability	yes/no
Security	Port A degree of surveillance of transportation means	low/medium/high
Administrative Procedures	Port A One-stop shop service, Electronic Data identification	yes/no/partial
Custom Procedures	Port A Harmonization	yes/no/partial
	Port A standardization	yes/no/partial
Other Services	rail Port A	non-existent/ low/medium/high
	maritime connections	non-existent/ low/medium/high

4. ANALYSIS OF MAIN CROATIAN SEA PORTS

Former political and economic circumstances were favourable to the creation of a considerable number of ports and small harbours on the Croatian coast. Of some 350 ports and small harbours on the coast and islands, six can take large ocean going ships, all of them located along the mainland coast. Among them are the following seaports (from north to south): Rijeka, Zadar, Šibenik, Split, Ploče and Dubrovnik, which are considered to be the main Croatian public ports. The above-mentioned seaports are variously positioned in relation to the macroregional and geographical status in general, which determines also their operational focus and position with respect to the targeted areas on the mainland. Rijeka is on the Northern Adriatic; Zadar, Šibenik and Split on the Central Adriatic; and Ploče and Dubrovnik on the South Adriatic. The Port of Rijeka accounts for the major portion of port business among Croatian seaports, generally generating more than 60% of total port traffic in Croatia.

4.1. Port of Rijeka

Within the port area of the Port of Rijeka 5 locations can be distinguished. Central location is basin Rijeka which includes the Port of Rijeka, Sušak and Brajda and it is a constituent part of urban core of the city of Rijeka. Remote parts of the Port of Rijeka are basin Bakar, basin Omišalj-Krk and basin Raša.

Table 2. Characteristics of port of Rijeka concerning MoS

Services in the port of Rijeka		
	Indices	Values
Port Operations	**Annual non-operating time (hours)**	24/7/365
Anchoring services	Anchoring available	YES
	Pilot mandatory	YES for ship > 500 GT
	Tugboat assistance - requirements	Up to Pilot
Security services	Access monitoring system – brief description	Safety of port (control of cars/persons), environmental according to the international rules
	Other security systems – brief description	Radiation monitors, x-ray system
Goods handling support services	Customs services – operation hours	24/7/365
	Electronic documents management systems – brief description	Terminal Operating System (TOS)
Railway services	**Port shunting company**	Croatia Railways
Technical specifications of the Rijeka Container/RO-RO pear		
Features of Terminal	Linear length of quay (m)	300 m + 330 m (from 2013)
	Berths and relative lengths (m)	164 + 300 m + 330 m (from 2013)
	Draught (m)	11,8 m
	Maximum ship length (m)	310 m
	Capacity of yard (n° lorries)	5.000 TEUs (10.000 TEUs from 2013)
	Size of yard (km^2)	0,136 (0,243 from 2013)
Terminal equipment	Number of dedicated entrance gate	1
	Size of parking areas (km^2)	-
	Lighting for night-time operations	YES
	Customs warehouse (m^2)	1.000
	Quay and storage area (m^2)	60.000 (110.000 from 2013)
	Car capacity	N/A
	Trailer capacity	N/A
	Trailer handling services	N/A
	Passenger terminal – brief description	Quay length 300 m Draught 7,5 m Terminal building
	Offices, phones, faxes, internet	YES
Connections of port of Rijeka		
Port infrastructure connections	Number of access to motorways	2
	Direct access to railway line	YES
	Number of road tracks	4

In the Table 2, available data that will be used for evaluation process based on the previously mentioned model are presented. Table shows that the Port of Rijeka is a functional port which operates 24 hours a day and it fulfills all the security standards. However, unfortunately it has limited capacity for parking lots and maintaining of the vehicles which presents one of the preconditions for the MoS service.

4.2. Port of Zadar

The port of Zadar is directly linked to the Zagreb- Split highway and to the central Croatia by two railways. Port system is consisting of three terminals:

- Passenger Port – operating for island, coastal, international ferry traffic and Ro-Ro traffic,

- Cargo Port Gaženica – cargo port for liquid, bulk and general cargo, and
- New Passenger Port Gaženica – currently under construction and will operate for island, coastal, international, ferry traffic, passenger traffic mega cruisers and Ro-Ro traffic.

Table 3 represents characteristics of the Port of Zadar concerning the developmental potential of the MoS service. At this point, Port of Zadar has limited capacities for acceptance of larger freight volumes. However, a direct link with the highway and railway presents a great potential.

Table 3. Characteristics of port of Zadar concerning MoS

Services in the port of Zadar		
	Indices	**Values**
Port Operations	Annual non-operating time (hours)	24/7/365
Anchoring services	Anchoring available	YES
	Pilot mandatory	YES
	Tugboat assistance - requirements	YES
Security services	Access monitoring system – brief description	Main Gateway with two ramps (port entrance and port exit), video control, lighting, fences
	Other security systems – brief description	NO
Goods handling support services	Customs services – operation hours	24/7/365
	Electronic documents management systems – brief description	NO
Railway services	Port shunting company	Croatian Railways
Technical specifications of RO-RO pear		
Features of Terminal	Linear length of quay (m)	150
	Berths and relative lengths (m)	150
	Draught (m)	8,7-10,2
	Maximum ship length (m)	150
	Capacity of yard (n° lorries)	150
	Size of yard (km^2)	100.000
Terminal equipment	Number of dedicated entrance gate	2
	Size of parking areas (km^2)	-
	Lighting for night-time operations	Available
	Customs warehouse (m^2)	2.720
	Quay and storage area (m^2)	Opened warehouse: 150.000 m^2 Closed warehouse: 30.600 m^2 Conditioned warehouse +0 °C: 3.400 m^2
	Car capacity	700
	Trailer capacity	150
	Trailer handling services	2
	Passenger terminal – brief description	Berths: 60-200 m Width: no restrictions Depth: 5-8 m
	Offices, phones, faxes, internet	YES
Connections of port of Zadar		
Port infrastructure connections	Number of access to motorways	2
	Direct access to railway line	YES
	Number of road tracks	4

4.3. Port of Šibenik

Port of Šibenik is linked to hinterland by the railway but does not have direct access to the highway. Road connection to the highway can be considered as a bottleneck.

The port consists of the following terminals:
- Passenger terminal (Vrulje),
- Terminal for transhipment of phosphate (Dobrika),
- Bulk and general cargo terminal (Rogač),
- Timber terminal.

Table 4. Characteristics of port of Šibenik concerning MoS

<table>
<tr><th colspan="3">Services in the port of Šibenik</th></tr>
<tr><td></td><td>Indices</td><td>Values</td></tr>
<tr><td>Port Operations</td><td>Annual non-operating time (hours)</td><td>24/7/365</td></tr>
<tr><td rowspan="3">Anchoring services</td><td>Anchoring available</td><td>YES</td></tr>
<tr><td>Pilot mandatory</td><td>YES</td></tr>
<tr><td>Tugboat assistance - requirements</td><td>YES</td></tr>
<tr><td rowspan="2">Security services</td><td>Access monitoring system – brief description</td><td>NO, security guard on entry</td></tr>
<tr><td>Other security systems – brief description</td><td>24 h surveillance, operation officer: 7.00 – 20.00</td></tr>
<tr><td rowspan="2">Goods handling support services</td><td>Customs services – operation hours</td><td>24/7/365</td></tr>
<tr><td>Electronic documents management systems – brief description</td><td>NO</td></tr>
<tr><td>Railway services</td><td>Port shunting company</td><td>Croatian Railways</td></tr>
<tr><th colspan="3">Technical specifications of port of Šibenik</th></tr>
<tr><td rowspan="6">Features of Terminal</td><td>Linear length of quay (m)</td><td>1.564 m (+ 600m under construction)</td></tr>
<tr><td>Berths and relative lengths (m)</td><td>1.564 m (+ 600m under construction)</td></tr>
<tr><td>Draught (m)</td><td>5,20 – 10,0 m</td></tr>
<tr><td>Maximum ship length (m)</td><td>260 m</td></tr>
<tr><td>Capacity of yard (n° lorries)</td><td>8</td></tr>
<tr><td>Size of yard (km^2)</td><td>0,050</td></tr>
<tr><td rowspan="10">Terminal equipment</td><td>Number of dedicated entrance gate</td><td>2</td></tr>
<tr><td>Size of parking areas (km^2)</td><td>0,010</td></tr>
<tr><td>Lighting for night-time operations</td><td>YES</td></tr>
<tr><td>Customs warehouse (m^2)</td><td>5.000</td></tr>
<tr><td>Quay and storage area (m^2)</td><td>32.000</td></tr>
<tr><td>Car capacity</td><td>200</td></tr>
<tr><td>Trailer capacity</td><td>N/A</td></tr>
<tr><td>Trailer handling services</td><td>N/A</td></tr>
<tr><td>Passenger terminal – brief description</td><td>Under construction:
Berth No. 1: 191 m
Berth No. 2: 133 m
Berth No. 3: 50 m
Berth No. 4: 114 m</td></tr>
<tr><td>Offices, phones, faxes, internet</td><td>YES</td></tr>
<tr><th colspan="3">Connections of port of Šibenik</th></tr>
<tr><td rowspan="3">Port infrastructure connections</td><td>Number of access to motorways</td><td>1 (limited)</td></tr>
<tr><td>Direct access to railway line</td><td>YES</td></tr>
<tr><td>Number of road tracks</td><td>2</td></tr>
</table>

Table 4 represents characteristics of the Port of Šibenik taking into account developmental potential of the MoS service. Port of Šibenik, in comparison to the other Croatian ports has little capacity for acceptance and maintaining of the vehicles and has no direct connection to the highway which presents a large disadvantage in planning the MoS system.

4.4. Port of Split

The port of Split has two locations: passenger port in centre of city (Gradska luka) and cargo terminal in north suburb (Sjeverna luka). No direct access to highway but road connection. The both locations have rail infrastructure which connects port to the hinterland and Croatian railway system.

Table 5. Characteristics of port of Split (Gradska luka) concerning MoS

Services in the port of Split		
	Indices	**Values**
Port Operations	Annual non-operating time (hours)	24/7/365
Anchoring services	Anchoring available	YES
	Pilot mandatory	YES
	Tugboat assistance - requirements	YES
Security services	Access monitoring system – brief description	Video cameras (21) used by port authority and maritime police. On border crossing there are 2 entrances with cameras, controlled by the maritime police
	Other security systems – brief description	Metal–detectors and x ray for luggage, used by police and custom
Goods handling support services	Customs services – operation hours	24/7/365
	Electronic documents management systems – brief description	NO
Railway services	Port shunting company	NO
Technical specifications of port of Split – Gradska luka		
Features of Terminal	Linear length of quay (m)	-
	Berths and relative lengths (m)	28 (63 m-173 m)
	Draught (m)	7,9
	Maximum ship length (m)	250 or more
	Capacity of yard (n° lorries)	175 total for all queys
	Size of yard (km^2)	0,084654
Terminal equipment	Number of dedicated entrance gate	-
	Size of parking areas (km^2)	-
	Lighting for night-time operations	YES
	Customs warehouse (m^2)	-
	Quay and storage area (m^2)	2,807 (length of the quay)
	Car capacity	-
	Trailer capacity	-
	Trailer handling services	NO
	Passenger terminal – brief description	Agencies, shop, coffee shop, forwarding, custom, maritime police,
	Offices, phones, faxes, internet	YES
Connections of port of Split		
Port infrastructure connections	Number of access to motorways	1 (limited)
	Direct access to railway line	NO
	Number of road tracks	2

Regarding the vehicle maintaining, the capacity of the terminal City Port in Split is quite small. The port is situated in the town centre, urban core which represents a bottleneck in the well functioning system. Furthermore, absence of a direct approach to the highway is also a great disadvantage.

Table 6. Characteristics of port of Split (Sjeverna luka) concerning MoS

Services in the port of Split		
	Indices	**Values**
Port Operations	Annual non-operating time (hours)	24/7/365
Anchoring services	Anchoring available	YES
	Pilot mandatory	1
	Tugboat assistance - requirements	1 (2)
Security services	Access monitoring system – brief description	Entrance control, video cameras used by port authority and maritime police
	Other security systems – brief description	-
Goods handling support services	Customs services – operation hours	24/7/365
	Electronic documents management systems – brief description	PML file for container ship stowage planning
Railway services	Port shunting company	1
Technical specifications of port of Split – Gradska luka		
Features of Terminal	Linear length of quay (m)	871
	Berths and relative lengths (m)	6 (171m)
	Draught (m)	10,2
	Maximum ship length (m)	200
	Capacity of yard (n° lorries)	150
	Size of yard (km^2)	160.000
Terminal equipment	Number of dedicated entrance gate	2
	Size of parking areas (km^2)	10.000
	Lighting for night-time operations	YES
	Customs warehouse (m^2)	38.000
	Quay and storage area (m^2)	123.000
	Car capacity	-
	Trailer capacity	4
	Trailer handling services	3
	Passenger terminal – brief description	-
	Offices, phones, faxes, internet	YES
Connections of port of Split		
Port infrastructure connections	Number of access to motorways	1 (limited)
	Direct access to railway line	YES
	Number of road tracks	2

North port which is under private concession is completely allocated for the freight transhipment. It fulfills security standards and unlike the City Port, it has a direct railway infrastructure on the terminal. Big bottleneck is a 15 km long city junction road from the port to the highway.

4.5. Port of Ploče

The port of Ploče is second biggest port in Croatia and is located on the Vc branch of a Pan-European corridor which connects the port directly to the road and rail network in Europe.

The port system operates on the following locations:

- Basin Ploče – dry bulk, general cargo, bulk cargo, containers, special cargo, liquid cargo and passenger terminal,
- Basin Metković - cement, dry bulk and general cargo.

Table 7. Characteristics of port of Ploče concerning MoS

Services in the port of Ploče		
	Indices	**Values**
Port Operations	Annual non-operating time (hours)	36
Anchoring services	Anchoring available	YES
	Pilot mandatory	YES (> 500 GT and for tankers)
	Tugboat assistance - requirements	Liquid cargo – 2 tug boats Other cargoes - according to the Master's decision
Security services	Access monitoring system – brief description	• Access Control Contactless smart card ID of personnel and visitors • CCTV system • AIS (Automatic Identification of vessel traffic) • Port Security Watch Guard
	Other security systems – brief description	X-ray scanners and radioactivity detector (installation in progress)
Goods handling support services	Customs services – operation hours	24/7/365
	Electronic documents management systems – brief description	• NCTS (Customs) • Container application (port operator company Luka Ploče PLC) • PCS (in progress)
Railway services	Port shunting company	Croatian Railways
Technical specifications of container terminal		
Features of Terminal	Linear length of quay (m)	280
	Berths and relative lengths (m)	280
	Draught (m)	13,8
	Maximum ship length (m)	250
	Capacity of yard (n° lorries)	N/A
	Size of yard (km^2)	0,038
Terminal equipment	Number of dedicated entrance gate	1
	Size of parking areas (km^2)	0,001
	Lighting for night-time operations	YES
	Customs warehouse (m^2)	-
	Quay and storage area (m^2)	0,02
	Car capacity	N/A
	Trailer capacity	N/A
	Trailer handling services	YES
	Passenger terminal – brief description	Two ramps: • international traffic vessels (LOA: 120 m, width: 20 m, sea depth: 8 m) • local, internal traffic vessels (LOA: 65 m, width: 14 m, sea depth: 5 m) Administrative buildings and terminal surfaces
	Offices, phones, faxes, internet	YES
Connections of port of Ploče		

Port infrastructure connections	Number of access to motorways	2
	Direct access to railway line	1
	Number of road tracks	4

Advantage of the Port of Ploče is a direct connection to the highway and high security standards. Problem that is identified is limited capacity for the placement of vehicles on the terminal which represents kind of a bottleneck in planning development of the MoS service.

4.6. Port of Dubrovnik

Dubrovnik is a prestigious Mediterranean destination for cruise ships that are in transit. The port consists of the following components:

- Berth Grad - passenger traffic,
- Port of Gruž - passenger traffic; receives up to three mega cruisers from round trips as well as passenger ferries on regular routes between all Croatian major ports and Italian ports of Ancon, Bari and Pescara.

Table 8. Characteristics of port of Dubrovnik concerning MoS

Services in the port of Dubrovnik		
	Indices	**Values**
Port Operations	Annual non-operating time (hours)	24/7/365
Anchoring services	Anchoring available	YES
	Pilot mandatory	YES
	Tugboat assistance - requirements	Available 24 h on request
Security services	Access monitoring system – brief description	YES
	Other security systems – brief description	Video surveillance ID card control
Goods handling support services	Customs services – operation hours	24/7/365; officer: 7.00-22.00
	Electronic documents management systems – brief description	NO Only the information system that supports the document flow concerning the acceptance of ships in port (reservation, arrival, departure, coordination of port services)
Railway services	Port shunting company	-
Technical specifications of port of Dubrovnik		
Features of Terminal	Linear length of quay (m)	1.350 m
	Berths and relative lengths (m)	1.350 m
	Draught (m)	2,5-11,5 m
	Maximum ship length (m)	Over 300 m
	Capacity of yard (n° lorries)	100
	Size of yard (km^2)	0,6
Terminal equipment	Number of dedicated entrance gate	2
	Size of parking areas (km^2)	1.800
	Lighting for night-time operations	YES
	Customs warehouse (m^2)	20
	Quay and storage area (m^2)	-
	Car capacity	300
	Trailer capacity	100
	Trailer handling services	YES

	Passenger terminal – brief description	Spaces for custom, police, information desk, tourist agencies, multipurpose space
	Offices, phones, faxes, internet	YES
Connections of port of Dubrovnik		
Port infrastructure connections	Number of access to motorways	limited
	Direct access to railway line	-
	Number of road tracks	2

Table 8 represents characteristics of the Port of Dubrovnik taking into consideration developmental potential of the MoS service. Table shows that the Port of Dubrovnik has no direct connection to the highway which certainly represents a major deficiency.

5. EVALUATION OF SCENARIOS OF IMPLEMENTATION OF MOTORWAYS OF THE SEA CONCEPT IN CROATIAN PORTS

Based on the data and presented model from the previous Chapter, analysis of all Croatian ports has been performed. Comparison between the evaluation marks in this manner is quite difficult and ungrateful. MoS services in Croatia do not exist, thus the ports do not have separate terminals used only for this purpose. If these did exist, then a comparison made on concrete examples and experiences could be done. This way, it is possible only to present an estimation based on the assumption that terminals are being used only for RO-RO transport.

Furthermore, there is a problem of infrastructure evaluation. Momentary infrastructure is very restrictive for larger amounts of RO-RO transport. However, it is necessary to analyse developmental plans, necessary financial means for construction and cost effectiveness. As all Croatian ports have developmental plans and since these are not taken into consideration in this analysis, it is possible that the results of this analysis would be different if the issue was considered from the future perspective. However, realization of these plans is questionable so these are not taken into account.

According to the abovementioned criteria, Croatian ports can be valued as follows:

Table 9. Values of Croatian ports concerning MoS potential

Attributes	Indicator	Rijeka	Zadar	Šibenik	Split	Ploče	Dubrovnik
Port Efficiency	Port A Productivity (total throughput) [1-5]	4	1	2	2	4	1
	Port A Labor Productivity [1-5]	4	4	4	4	4	4
	Port A Dedicated Berth	yes	yes	no	yes	yes	no
	Port A Operating Hours	1	1	1	1	1	1
Accessibility	Section to port A Demand/Capacity [1-5]	5	2	5	4	5	2
	Section to Port A Distance to main transit axis	0-3 km	0 km	8 km	15 km	0 km	100 km
	terminal/port efficiency for section A [1-5]	2	3	2	3	4	1
	Section A interoperability	yes	yes	yes	yes	yes	no
Security	Port A degree of	medium	low	low	low	medium	low

	surveillance of transportation means						
Administrative Procedures	Port A One-stop shop service, Electronic Data identification	partial	no	no	no	partial	no
Custom Procedures	Port A Harmonization	partial	partial	partial	partial	partial	partial
	Port A Standardization	partial	partial	partial	partial	partial	partial
Other Services	rail Port A	medium	non-existent	non-existent	non-existent	non-existent	non-existent
	maritime connections	medium	low	low	low	medium	low

The multi-criteria analysis of all Croatian ports indicates that the port of Rijeka and Ploče are most acceptable in terms of development of MoS. Due to the fact that MoS concept integrates maritime and rail or road transport, port Dubrovnik has worst potential as there is no direct nor close connection with highway and rail. Road infrastructure is the biggest problem of ports of Šibenik, Split and Dubrovnik, as connection to highway is using city roads. At the same time the port of Šibenik do not have dedicated Ro-Ro terminals, which is main prerequisite for the development of highly reliable and just-in-time system as the MoS is. Thus, in other words, ports of Rijeka and Ploče can, due to present system, be consider as most suitable for development of MoS services. These systems have capacity and infrastructure to serve for sea-land transition in the MoS concept.

6. CONCLUSIONS

The European Commission introduced the concept of Motorways of the Sea (MoS) in its 2001 White Paper on European Transport Policy for 2010 (revised in 2006). Motorways of the Sea refers to the development of key sea routes between EU Member States (and possibly neighbouring third countries) that will offer high quality regular services in combination with other transport modes. Motorways of the Sea aim at providing a viable and more efficient alternative to road only transport and will permit the substantial modal shift of freight traffic from congested roads to key combined “land-maritime routes”. This will be achieved through the improvement of existing or the development of new integrated intermodal maritime-based logistics chains with high quality maritime links that will connect a limited number of strategically located European ports.

With regard that the reliability and high efficiency are main characteristics and comparative advantages of this system, start-up of MoS system requires compliance of all traffic entities. Besides that, infrastructure is basis for building up quality and sustainable service. Croatian hinterland infrastructure is relatively solid and connections to all neighbouring countries and their transport infrastructure are satisfactory.

Analysis of present port system in respect to immediately development of MoS systems and services declares that ports of Rijeka and Ploče are can be consider as most suitable options. MoS services can start trough this ports with relatively small infrastructure investments as all main infrastructure exists. But for further analysis, Master Plans of all ports should be respected and the situation can be much different in coming years. Missing strategy of development and implementation of entire Croatian transport system should define directions of development of all transport sectors including Motorways of the Sea. The strategy should respect present status of port systems presented in this article and feasibility impact of further investments planned by strategy.

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THE IMPACT OF LOGISTIC SYSTEMS PERFORMANCES ON THE QUALITY OF SERVICES IN MULTIMODAL TRANSPORT

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ABSTRACT

The subject of this paper is to define the basic features of logistic systems and their impact on the quality of the transport services performance such complex transport system that is multimodal transportation. As the combined transport ensures continuity in the "door to door" transportation and also achieves more quality and safer transportation services, in terms of logistics it would be vital to identify all the activities and issues that arise in technical and technological connections of all entities of multimodal transport. The process of globalization, the increasing demands of world market, dynamic environment, the amount of operating costs and continuous competitive pressures require a good knowledge and analysis of all key logistic issues which influence the increase in functionality, rationalization and efficiency of transportation. Using the methodology of a systematic approach, the paper is focused on the relationship of the mode of managing the processes in a logistics chain from produces to consumer and the quality of transport services in multimodal transport. The requirements for the quality of a transport services within a multimodal chain imply primarily the organization of processes based on logistic principles, application and modernization of high technical transport equipment and finally, the support of modern information technologies in the functioning of the above. Therefore, the essential point of quality management in transportation consists of managing of all processes requiring compliance with more factors (people, organization, technology, procedures….) and, as a matter of fact, it represents a general aim of the research paper.

KEY WORDS

multimodal transport. logistics. quality. transport services

1. INTRODUCTION

Transportation is a service industry providing quality services to transport passengers and goods, to which each organization, region and beyond, every national economy establishs its existence and development on competitive markets of variable foreign trade goods. Transport system as a whole and in particular multimodal transport as one way of functioning of the transport system, must be characterized by a high degree of quality, safety and reliability, because of its impact on the global economic system, and an exceptionally high value of the property and possible damage in transit.

It's the concept of quality is one of the most widely represented concepts of the modern world and the term is mostly used in the terminology of the business man. This is a criterion whose value is measured and valued with the requirements and satisfaction of all stakeholders involved in trade, and especially with customer service. Looking through the prism of the multimodal concept as a form of transportation of goods in the transport chain, service quality is a fundamental prerequisite for the survival of each multimodal entrepreneur that he was fully or only partially involved in the execution of transportation services.

Also, as a multimodal concept arose as a result of continuous changes in the international transport system over the past decade, the expected value and quality of transport services at the present time are subject to stricter and stricter criteria and standards, given the continuing market competition that exists in all branches of the transport industry. Proceeding from this fact, the crucial is the impact of logistics and implementation of logistics processes at the business success of enterprise traffic and quality of transport services, because in fact, the logistics, by itself is the coordination and synchronization of all activities and processes of the bidder to the end user. So, all these processes and activities necessary to combine in a way that would achieve optimization, rationalization and quality which is from the aspect of multimodality as a dynamic and complex transport system is very and demanding task. Therefore, in these days and age "*many modern transport company with highly developed economies of their business based on the general principles of logistics and logistics management. Logistics as a function of spatial-temporal transformation of goods, energy, information and knowledge according to users' needs and goals, just be soaked as an area of research opportunities in order to increase business efficiency of multimodal transportation company.*"[1]

The fundamantal task of multimodal transport is therefore a fast, efficient, safe, economical transportation of goods from the sender to end user, what are the foundations of the concept of quality transport services. This notion is even more complex since the multimodal transport chain involved multiple forms of transport means, and a far greater number of participants in comparasion to conventional cargo. Therefore, in consideration of the logistical process of multimodal transport is one of the fundamental prerequisite for the evaluation of its quality services.

2. TERM AND THE IMPORTANCE OF SERVICE QUALITY IN TRAFFIC AND MULTIMODAL TRANSPORT

Quality is at the present time the dominant business function of the modern world and one of the most important criteria for success of any modern organization. "*Quality of goods and services is directly proportional to the achieved level of social development and civilization of a country*" [2]. It is acceptable as well the definition of quality by Stevenson who said: „*quality is the ability of products or services that consistently meet or exceed customer expectations*"[3].

The concept of quality can be viewed in terms of products, services and processes. In this respect, consideration and research of service quality is much different from the concept of product quality, since the service is the term that is not physical or material nature, so that it needs more complex criteria for its measurement and evaluation. In general, research of quality in different service sectors should be based on the specifics of a particular service, and the analysis requirements of all stakeholders, especially customers. Quality management of transportation services includes the design and implementation of all necessary actions based on the well-studied current and future needs of service users based on logistics principles, leading to the production of transport services with a market demanding and conditional characteristics. The common goal of quality management in transport is to achieve cost-effectiveness of transport services, taking appropriate positions in the transport market, and achieve competitiveness in meeting the demand for services.

Multimodal system as a form of organization of transport in the transport system as a whole is very complex, stohastic and dynamic system and therefore special attention should be given to the quality of its services. Primarily because it is a combination of two or more forms of transport organized at national, regional and international basis and includes a large number of road users whose service in the transport chain can participate fully or partially.

The fundamental goal of multimodal transport concept is to provide fast, professional and economical handling and transportation of goods from producers to consumers through an appropriate multimodal business operator. In the transport chain must be satisfied by optimization of various transport processes and technological activities such as packing of goods, labeling and handling. In this connection, the quality of multimodal services is measured by the optimal degree of cooperation and coordination of all active participants in the transport system, and the maximum concentration of knowledge, capital and labor resources into economic units.

The concept of quality multimodal service covers several aspects of the observation:

- Research, analysis and identification of potential users requires of a multimodal service.
- Insurance of all the necessary prerequisites to the realization of the transport service takes place in accordance with the designed characteristics of multimodal services, which are based on logistic principles and application of information technology in transport.
- Provide service in accordance with defined characteristics of multimodal concept represented in all forms of transport means.
- Analysis and control of quality of service achieved in the complete multimodal chain from sender to receiver and to take preventive action, appropriate measures and procedures in order to satisfy the interests of customers.

2.1. Importance of TQM in multimodal service

The speed and complexity of today's transportation system as a multimodal transportation system requires a high level of quality management system processes with highly developed structure and a high prevalence of information technology. In theory, the quality of the application is known as TQM (Total Quality Management), which represents the integration of all processes (in this case within the multimodal transport) in the temporal and spatial coordinates.In accordance with author Hrvoje Skoko:

"*total quality management is a concept and a system that is based on the philosophy that assumes a comprenhesive way of enhancing or improving quality and other performances, and it is possible to make with permanent and sophicicitated research of each process and entire organization with activities that take place systematically and consistently integrated.*"[4]

Specifically, in the multimodal transport, the requirements of TQM is related to the following levels of quality management

- A higher level of quality of transport infrastructure.
- A higher level of quality means of transport.
- The existence of applied standards and declaration of areas of safety of passengers and goods and environmental
- Wider application of standardized units for storage, packing and distribution of cargo (intermodal units), which are aligned with the model of standardization.
- Standardization in accordance with the requirements of ISO 9000, ISO 14000, as well as new standards specifically related to transport (QS, TE, TS) and the quality of national policy regarding certification of these standards of quality.
- Respect and recognition of user requirements in terms of possibilities of making of profits and service quality.

It is important to emphasize that the model of multimodal transport in the overall transport system and it came as a result of improved levels of quality of transport services in terms of:

- Better utilization of the benefits of certain forms of transport (using the mode of transport for its technical and exploitation characteristics closest to the projected demand of service users).
- The need to connect a large number of senders and recipients of services that are spatially distant.
- The need to reduce transport costs per unit of individual forms of transport
- Environmental protection especially in the transportation of hazardous substances and adverse effects of road transport.
- Increased reliability and security of delivery
- Simpler control and identification of goods.

2.2. Measuring the quality of multimodal services

In the contemporary and modern researches the most frequently applied quality model is SERVQUAL defined by Parasuraman, Zeithmal and Berry in 1985. According to these authors, quality of service is defined as the relationship between expectations and perceptions; if the assessment scores of perception are pursuant to expectations scores, this means that the customer is satisfied; if the statistical difference was seen between the perceptions and expectations so that the perception exceeds expectations, the customer is "delighted". If the statistically defined differences in expectations are higher than perceptions, the customer is dissatisfied. [5]
SERVQUAL model sets five basic dimensions for determining the service quality that are applicable in the field of multimodal transport as a sub-system of transport in general:
Reliability – ability to realize the agreed services responsibly, accurately and according to the rules of profession. This would mean in terms of multimodality reliable delivery of goods according to terminal plans made for the entire chain of multimodal, safe transport of cargo from point of embarkation to the point of disembarkation to the satisfaction of the client in the optimal timeframe, responsible, professional and safe handling of cargo and/or in the other transport means, etc.
Confidence – knowledge, professionalism and courtesy of staff involved in the processes controlled by the entrepreneur as a multimodal carrier liability business enterprise, and their ability to provide security and confidence to the service users. Here it is necessary to emphasize that it is people and staff are fundamental factors for the success of management processes in multimodal logistic chain.
Perceptibility – ongoing maintenance and upgrading of port machinery, transport equipment, multi-modal terminals, accessories intended for transshipment containers, vocational training and continuous training of personnel involved in multimodal processes.
Helpfulness – provide individualized attention tio customer service.
Identification – willingness to help service users with quick and promt service.
This is not to be ommited for multimodal services cost factor which can be crucial in market competition, however the price does not necessarily always be the most important parameter that determines the range of services. For any transport chain „from door to door“ multimodal transport will always be compared with road transport in terms of cost and reliability. The main challenge for multimodality here is that it must demonstrate superior added value for the demand-supply chains, and in this respect, time, price, frequency of service, security, quality management are the main criteria for comparasion of multimodal transport with other modes of transportation.
Figure 1 provides a pictureqe view of multimodal chain whose quality of service can be viewed from three aspects:

- Total Quality Management
- Defining the dimensions of quality of multimodal services
- Measurability and quality assessment of multi-modal services

3. LOGISTIC PROCESSES IN A MULTIMODAL CHAIN

Whether seen from a legal point of view or from an operational perspective Multimodal Transport is generally considered as the most effective way of handling an international "door to door" transport operation. This is so because Multimodal Transport allows to combine in one voyage the specific advantages of each mode, such as the flexibility of road haulage, the larger capacity of railway and the lower costs of water transport in the best possible fashion. [6]. In this respect, logistics is an essential tool for meeting the challenges of growing mobility and competitiveness. Logistics can optimize the conditions for delivery of goods. It is a crucial means of making transport more efficient, while limiting the effect of pollution and congestion. In accordance with it, the logistics involves several important tasks:

- Getting the right goods
- To the right place
- At the right time
- At the right cost
- In the right condition
- With due care and attention to the environment

Logistics is therefore a system of activities that provides design, planning, directing, guiding and regulating the flow of goods, services, energy and information within the system and its elements. Managing of logistic processes that take place within the multimodal transport chain reduces unnecessary waiting time at the expense or waiting for transportation, as well as

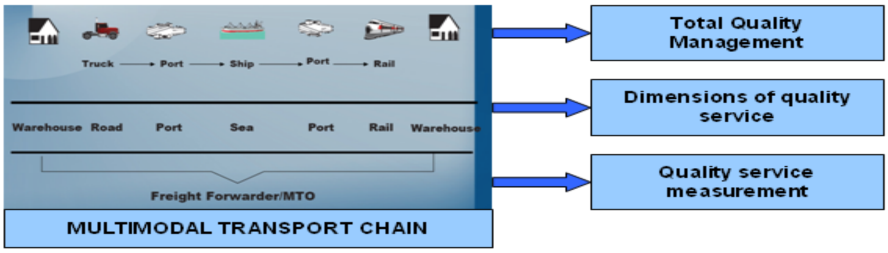

Figure 1. aspects of quality in multimodal transport chain - made by the authors as per sources UNESCAP, Transport & Tourism Division, [7]

many other harmful effects that affect the quality performance of the transport process, and therefore the cost of transportation.

3.1. The basic performances of the logistic system

Knowing the structure of the logistics process and their role within a complex system as the traffic, all the logistics performances can be devided into four groups [8]:
Technical-exploitation performances
Quality of logistic service
Logistics costs
Impact of logistics processes at the man and the environment
From the aspect of multimodal transport chain performance technical and expolitation represent a set of all the technical elements of the system that allow normal functioning of multimodal process: transport means (ships, barges, trucks, trailers, railway wagons), docks and transport infrastructure, auxiliary loading/discharging equipment – fixed (shore cranes) and sliding (forklifts, lift-on, lift off technologies), etc. Optimal use and maintenance of these technical means achieve a satisfactory level of quality of multimodal service that is realized through these levels of quality theory: Total Quality Management, dimensions of quality and quality service measurement. In fact, the very quality of logistics affects the quality of multimodal transport.
Service quality is a compound of many elements that can be represented by the formula [8]:

$$Qn=f\{X1,X2,X3,X4,\ldots\ldots\ldots Xn\} \quad (1)$$

where are:
Qn – quality system logistics as independent from each changeable element of a single;
X1 do Xn – independently changeable
The first two performances of the logistic system (technical-expolitation performances

and quality of logistic service) directly reflect to the level of logistics costs in a multimodal chain. Logistics costs are specified by several groups of costs as follows:

- Transportation costs of goods
- Storage costs
- Maintenance costs
- Costs of supplies and spare parts
- Cost of quality assurance services
- Costs related to the protection of human and environmental

Analysis of the structure of logistics costs can be viewed from the aspect mode and the aspect of movement of goods in a multimodal chain, ie in terms of static and dynamic components of transport chain. Costs of goods were idle can be costs of storage, loading and unloading costs; costs of movement of goods can be costs of transport and cargo handling costs.

In actuality, the development and improvement of logistics processes in terms of improving the organization and technology of distribution, transfer, transport and storage processes, implementation of information technology in logistics, the use of a high degree of standardizaion means and transfer unit (intermodal unit), caused significant protection of man and his environment from the negative effects of the clasic forms of transport (high concentrations of exhaust gases, reduced the number of accidents in road transport, greater cargo control in terms of protection from damage, theft of cargo, etc).

Logistics performances can be studied from theree aspects:

- from the aspect of transport chain (or specifically of multimodal chain)
- from the aspect of the logistics sub-systems within the chain from the aspect of from the aspect of liability of multimodal entrepreneur (the highest level)

Furthermore, logistic performances that affect the quality of services and multimodal transportation system functioning, may have strategic and operational importance. The strategic importance of the support means defining logistics strategy.

Selection of appropriate logistics strategy should lead to the goals of the organization and its capabilities and resources. The modern enterprise combining multimodal management strategy of supply-chain control and strategy of wanted to shorten the cycle time in the transport chain. Operational significance of logistics performance means measurement of the degree of goals, analysis and management of logistics and effectiveness of transportation.

3.2. Criteria for quality transportation services in a multimodal process

In most cases, elements of the quality of transport services is evaluated from zero to its optimal value. This assessment can be quantitative and qualitative nature, carried out over the control functions that compare concordance between projected and realized traffic services. From the standpoint of achieving quality in transport, it is definitely on the list of priorities most important to improve the quality of transport and logistics services. [9].

The value of quality of transport and logistics services that are applicable in the multimodal transport chain can be devided into three criteria:

- transport criteria
- service criteria
- logistic criteria

They have their own sub-criteria that are most transparent in the table 1:

Table 1. Criteria of transport-logistic services, source: Kilibarda, M., Modelling the performance quality of transport services [10]

CRITERIA	Transport criteria	Service criteria	Logistic criteria
SUB-CRITETRIA	- reliability - meeting deadlines - accuracy - flexibility - prevent accidents and damage - availability of transport capacity - transport information	- profesionalism - motivation and confidence - responsability - attentive - market knowledge and marketing - speed of delivery of goods to client - business negotiation	- transp.chain - first hand delivery - custom clearance - insurance - possibility of selling and buying the goods - additional logistic service in transport - monitoring and consultation

These criteria are in the multimodal transport chain allows optimal flows of goods and the overall reproductive system (production, distribution, exchange and consumption).
It all affects to the optimal low of information (input, output and internal). The importance of quality information in a multimodal process enables seamless communication between multimodal entrepreneur and all syb-systems within multimodal transport chain.

3.3. Cycle time of multimodal services as an indicator of its quality

The duration of the transport cycle is the most important image of quality of multi-modal services. Modern technical and technological changes in transport and application of logistics principles, have led to the development of intermodality and multimodality, thus creating a continuous transport chain with minimal or no delays in the manipulation of goods.
The introduction of continuous transport chain that are incurred as a result of multi-modal transport model based on logistic performances, there was a qualitatively new and important changes in transport: [8]

- Unification of technical solutions, rail, road and other vehicles, each vehicle becomes universal for cargo transport units, regardless of the type of cargo.
- Reduction of lost time and labor for loading the goods because the goods in manipulating large cargo units
- Removal of traditional stores and warehouse in the points of contact of different types of transport
- The introduction of standardized technology of transfer in the entire transport chain (transfer from one container to another form of transportation)
- Elimination of transportation and packaging their return transportation
- Reducing the time of transport operations and the residence time of transportation means (this has a direct impact on labor productivity of transportation means, or shorten the turnaround of trucks, railway wagons, etc.)
- Speeding the delivery of goods and reducing delivery time
- Reducing damage to goods in the transport process (reducing damage to the goods resulting from the elimination of the intermediate space and eliminating swiching by container berths)

So, using multimodal technology “from door to door” transport of goods directly from sender to receiver, developing integration processes that eliminate the boundaries between the various branches of transport. The achievement of continuous multimodal chain, is the true role of logistics management.

3.4. Multimodal distribution centres and their impact on the quality of transport services

The construction of modern distribution centres that have the entire range and cover a wide area (two or more countries), homogenous quality logistic services offer. Distribution centres allow and reliance in multimodal transport

operations, which is characterized by the inclusion of the complex logistics processes within a single state, regional or on international level. [8].
Developing a network of distribution centres provide all the necessary preconditions for the realization of technical, economic and environmental goals, and optimize of multimodal transport chain. In these centres, the activities for the entire flow of goods are concentrated. In fact, distribution centres provide meaningful technological, operational and economically viable means of transport between the coordinating and supporting activities. Developing a network of distribution centres fit into some basic principles of strategic management in a complex transport system such as multimodal as:

- transport policy objectives (to achieve a successful and productive cooperation between all participants in a multimodal chain)
- urban design objectives (burden of road traffic networks, and more rational exploitation of vehicles and railway wagons)
- aims to improve the regional economy (improvement of regional and wider of supply of goods, greater participation of inland ports and harbours in the gravitational zone, etc.)
- protecting humans and the environment which can be realized by city roads, reduced pollution and noise, since the processes of transport and transfer of traffic directed towards logistics and distribution centres.

In order to optimal functioning of the logistics and distribution centres, in recent years increasingly come to the fore the development of "hub-spoke" of the terminal whose construction ultimately led to the development of large-port hub centres that play a crucial role in optimizing the flow of goods in a multimodal chain."Hub-spoke" terminal is the name for the main terminal, and the largest concentration of flows and the general supply of logistics services. The name itself evokes the transportation center that links all the radially spaced smaller terminal or smaller distribution centers.
Terminals can be seen as a facility within which cargo and passengers gather and scatter. Also, a terminal can be a place of exchange, which involves the same or different [11]
Hub-spoke model is often identified with "point-to-point" model, but their comparative differences are best seen in figure 2:

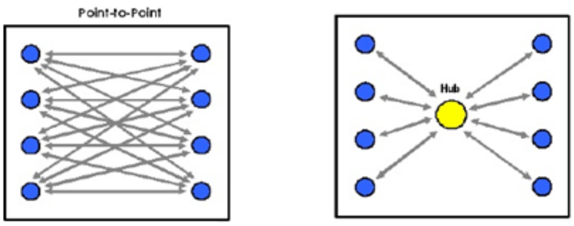

Figure 2: "point-to-point" and "hub-spoke models –source: HUB-SPOKE [11]

In the "hub-spoke" model for a network of n nodes requires (n-1) routes that would connect all the nodes, as opposed to "point-to-point" network that is much more complex with multiple routes.
Benefits of "hub-spoke" model are: a smaller number of routes, complicated operations such as sorting packages, can be performed in the hub-centers rather that out in each node individually [11].
In the multimodal transport chain, it is important to mention the role of "hub ports". As well, the improvement and development of multimodal transport directly influenced on the development of hub ports. The hub approach becomes more favourable as cargo volumes and vessel sizes increase. Cargo from one originating point is loaded onto a vessel irrespective of cargo destination and then transported to a "central hub". In the hub, all freight to different destination points is reloaded, segregated and consolidated, so that freight for each destination points is reloaded on each separate feeded vessels. Hub approach is the ideal logistics concept to achieve cost effective transport. [6]
The development of hub ports, for examplem, significantly influenced to the development of container traffic in the Mediterranean.
As a general, multi-modal development has led to an increase in container ships, and the rationalization of time to keep the ships in ports, thereby to rationalize the cost of shipping. But on the other hands, it should be noted that because the secondary distribution

costs are slightly more, since the transport of "feeder ships and by roads is more expensive.
In early 90-ies the total container traffic in the Mediterranean was about 7 million TEUs (less than a quarter of Europe's), but until 1997 was more than doubled reaching the figure of 16 million TEUs. (amount 35% European traffic). In 2004 it was about 27 million TEUs. [12] In 2009, statistical data show that the 14 major container traffic Mediterranean ports was about 28 million TEUs. [13]. This growth was due to the development of specialized container terminals, or "hub ports" as a node in the network of containerized liner organized by the regiobal distribution of containers by "feeder services offered". Known "hub-pors" in the Mediterranean are Algericas (Western Mediterranean), Damietta, Port Said, Aleksandrija (Eastern Mediterranean), or ports of Marsaxlokk, Gioia Tauro, Cagliari, Limassol that with respect to its position in the Mediterranean ensure its function in transit flows of goods of the Far East and Europe.

3.5. Methods and techniques of analysis of service quality in the transport and logistics chain

Quality of service in transport and logistics chain can be analyzed from several aspect: the aspect of service users, the aspect of service holder and from the aspect of service quality in relation to the competition, etc.
Down below is some important techniques and methods of analysis of quality in transport and logistics, which procedures and processes are applicable in multimodal concept. [8]

- *Logistics process flow diagram* – main feature of this technique is to show the process in a graphical manner. Processes are broken down into activities, and activities to the inputs, outputs and flows between them. The flow diagram allows you to visually define the activities and gain insight into the process.
- *Cause and effect diagram* – This method includes the systematic exploration of all possible samples that could lead to possible consequences. Cause and effect diagram visually presents some problems regarding the quality or the possible consequences and patterns that have influenced to this problem. The literature is also known as Isikawa diagram or "fishbone" diagram as is typical in its form. Typical categories that are studied in the system of services and transport services are: price, place, promotion, human resources, processes and physical evidence.
- *Benchmarking technique* – This technique represents a systematic comparison of performance of an organizational unit in relation to other organizational units and companies on the market services. It is a structured way of observing what other successful companies or organizations, with the aim of identifying, analyzing and adopting best practises in a particular function [14]. Benchmarking includes four basic steps: analysis of processes within our own organization, analysis of processes within other organizations, compare their organization's performance to other observed organization and implementation of activities needed to raise their own performance to the desired level.
- *Checking list* – Facilitates the application of other techniques for quality analysis. It is used for collecting and processing data.
- *Statistical quality control services* – This is a set of activities in the quality management system, which primarily controls, and thereafter take all action to improve the quality of a system. The objectives of this method are: continuous quality improvements process, to catch errors, providing services in accordance with the laws and logistical principle "just in time", satisfy to customer requirements, etc.

4. THE IMPORTANCE OF INFORMATION TECHNOLOGY FOR QUALITY OF SERVICES IN TRAFFIC AND MULTIMODAL TRANSPORT

Nowadays, the work of transportation and logistics organization is inconceivable without implementation of modern information technology. Fast, effective and economical sharing of information allows optimal monitoring of cargo flows through the entire transport chain. Using information technology in the multimodal transport service ensures quality and reduces time tracking of goods through the transport chain. This has contributed significantly the use of "bar code" tags on items and goods, which enables automatic receipt and processing of data at all points in the transport chain. Also, electronic information exchange (exchange of EDI messages) enables multimodal operators at all times know where the goods are in the moment, and when and where to submit.

The information shared in the processes which are in a multimodal chain can be of different nature, namely:

- Information about potential customers and clients of transport
- Information about existing competitors in the transport market
- Information about logistics technologies in the multimodal chain
- Information about the conditions of transport
- Information about the implementation and control of business enterprise
- Information of logistics costs and tariff system
- Information about the condition and maintenance of transport means, and the entire transport infrastructure.
- Information about the marketing strategies in the field of traffic.

Rapid electronic data exchange between all entities involved in a multimodal chain, also allows the monitoring and investigation of future states of the transport system and the flow of goods and selection of optimal solutions in the decision-making. As well, faster access of information will lead to improved quality management of transport system and resources, also to faster response to the occurring accidents [15]. Availability and control of large amounts of information in the traffic system, using simulation methods and techniques are a vital condition for the survival and development of each individual multimodal business, and the condition of survival and development of the transport system as a whole.

5. CONCLUSIONS

Transport is an economic sector which, in the current conditions of globalization, is exposed to fierce competition. This competition is forcing multimodal operator to improve their services, with constantly updating and developing transport means, equipments and processes within the system. The procedures that occur within the multimodal system are very complex, demanding and specific, and require a systematic approach to researches and implementation of logistic rules in transport chain.

In accordance with it, multimodal managers have to set clear strategies, plans and management concepts, which give the best results in terms of quality, efficiency and safety of multimodal services. In other words, the quality, efficiency and safety of multimodal services are fundamental requirements for all users and subjects in multimodal transport chain, which may be measurable in several dimensions and researched from the several aspects of studying.

In the paper elaborates the role of logistics performance as key factor that affect to the quality of transport services, as well as the quality criteria that define a transport service to its optimum level. The implementation of procedures in transport logistics, logistics planning and logistics decision-making greatly reducing the cycle time of multimodal service and unnecessary waiting time, and other adverse impacts that directly affect to the quality of multimodal processes and therefore, to the costs of transport.

As the fundamental goal of multimodal transportation services to be performed quickly, professionally and efficiently, the application of logistics performance in transport logistics in the present time is the condition of each multi-modal competitiveness of every multimodal enterprises. Thus, rational and appropriate management of quality of multimodal transport services, based on logistics processes and procedures, gets a whole new dimension and importance in global transport system.

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BIOGRAPHIE

Serdjo Kos

Dr.sc.Serdjo Kos was born in 1957 in Rijeka. In 1980/89 he was employed as a navigation officer in Croatia-line (ex Jugolinija) shipping company, as the Third, Second and Chief officer. In eight effective years of ocean-going service in navigation, Professor Kos sailed on vessels of various types, sizes, technologies and purposes. In 1986 he received B.Sc. degree at The Faculty of Maritime Affairs and Traffic, course Nautical Sciences. Since 1989, he has been fully employed at the Faculty of Maritime Studies, University of Rijeka, where he obtained his M.Sc degree (in 1992) and Ph.D. degree (in 1994). In 2009, professor has been elected as Full Professor at the Faculty of Maritime Studies in Rijeka, Technical Sciences Department, in the field of traffic technology and transport. Today, professor Kos is obtaining the role of the Dean at the Faculty of Maritime Studies.
Because his achievement in the domain of Navigation theory – Theory of Loxodromic navigation is internationally recognised, the biography of Professor Kos is included in the 8th edition of Who's Who in Science and Engineering, 2005-2006, by the world's eminent publisher Marquis Who's Who, from the United

States of America. Amongst numeruous honourable memberships, Professor Kos is also Fellow of the Royal Institute of Navigation.
The Professor's scientific areas of interest are the following domains: Loxodromic and orthodromic navigation theories; Terrestrial, Electronic and Astronomic navigation; Satellite and inertial navigational systems (Positioning errors of the GPS/GLONASS system regarding ionospheric and tropospheric delay, Correction of the Klobuchar model, Positional dilution of precision of the GPS/GLONASS System, Satellite positioning errors related to the extreme space weather/ionospheric effects, GeoRSS systems and technologies, etc.); Ecology and environmental preservation, Multimodal transport networks; Intermodal, Integrated/Multimodal transport systems and Optimization and simulations in maritime transport.

David Brčić

Born in Rijeka in 1979. After he finished Maritime high school in Mali Lošinj, Croatia, he sailed on general cargo ships before he received the Certificate for the Officer of the Navigational Watch of ships of 3000 GT or more. In the period of 1999/2002 he sailed on chemical tankers in the rank of deck officer. Attended and graduated (2008) at the Faculty of Maritime Studies in Rijeka, Croatia. Enrolled at the same Faculty in postgraduate doctoral degree studies, as well as employed as research assistant in the field of Maritime navigation.

Suzana Šamija

Suzana Šamija, b. Prlenda was born in 1969 in Belgrade. She completed in 1995 from the Department of Shipping Management, Maritime Faculty in Kotor and acquired the professional title of Engineer of marine transport – the direction of Shipping Management.
After one year of work specialization in a shipping agency in Piraeus, Greece, some period she was working as Commercialist and financial assistant in engineering company “Ugo oprema” d.o.o. Zagreb. In period from 2001 until 2010 she was employed as Chartering manager and analyst in shipping company “Split Ship Management” d.o.o. Split. Some short period she was working as Director of a shipping company named “Tanker” d.d. and one of the managers in logistic department at “AD Plastik” Solin. Since 2010, she has been employed at Ministry of Maritime Affairs, Transport and Infrastructure – VTS Croatia.
In 2008, she has enrolled the postgraduate studies of Maritime Faculty in Rijeka on “Logistics and management in maritime transport”.

THE TERM AND DEVELOPMENT OF e-NAVIGATION

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ABSTRACT

e-Navigation is relatively new concept in maritime world and defined briefly as improved or enhanced navigation. The concept of e – Navigation is explained by systematic presentation of the main factors of ship, shore and communication. It is defined and led by International Maritime Organization – IMO as the main vision and service to be provided through the pre-defined elements. It consists of two system: Vessel Traffic System-VTS and RAdio Detection and Ranging –RADAR which are interconnected. Development and further guidance of e-Navigation will have a major impact on mariners, pilots, the marine equipment manufacturers and within VTS system. Existing systems and technologies developed in the maritime industry are considered as the main drivers of further developing of e – Navigation.

KEY WORDS

e-Navigation. VTS system. RADAR system. Ship. Shore communication.

1. INTRODUCTION

There are several definitions of e-Navigation. The main definition can be described as enhanced navigation and letter e is introduced as topic letter. One of the main aims of e-Navigation is improving berth to berth navigation and some other services concerning of e-Navigation. Other services are known as:

- Pilotage
- Towing
- Docking and undocking
- Various other port services.

These services can be shown in the model of e-Navigation:

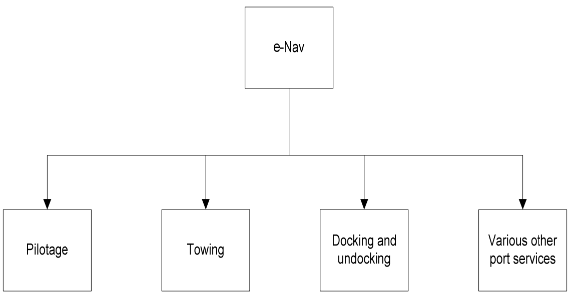

Figure 1. Model for e - Navigation

The main tasks appeared in the field of e-Navigation can be described as follows:

- Need for developing of new ports
- Need for cooperation between countries which are on sea side
- Decreasing the risks for pollution
- Decreasing the risks for safety of ships
- Safer navigation with enhanced controlling systems from the land side
- Better efficiency and decreased costs in the field of maritime transportation
- Enhanced communication on relation ship to ship, ship to shore, shore to ship
- Additional education for developing and implementing of e-Navigation
- Enhanced Human Machine Interface (HMI).

2. TERM OF E-NAVIGATION

e -Navigation is relatively new term in maritime transport which is led and developed by International Maritime Organization – IMO. It is based on unification navigational systems and supporting shore services. The term of e – Navigation is accepted 2006.by IMO as process for harmonizing, collecting, connecting, changing and presenting of maritime information's. The letter ''e'' is defined as enhanced or electronic and this is not generally accepted because this will make basically restriction inside of this term e – Navigation.

The main vision of e – Navigation is collecting all information's on one place and this information's should be available in shorter time period. It can be concluded that e-Navigation is connected with time and can be shown as function of time and information's:

$$(eNav) = f(t, I) \tag{1.1}$$

t=time
I=information's

The term of e-Navigation can be shown by following table 1:

Table 1. Service of e-Navigation and connecting elements

Service of e-Navigation	**The element of services:**
Updating of nautical charts (U)	Change of hydrographic data
Weather reports (W)	Meteorological and oceanographic data
Navigational dangers(D)	Wrecks, shallows, danger areas etc.
Various(V)	Various elements affecting safe navigations

The term of e-navigation can be divided into two sub system:

1. Vessel Traffic System - VTS
2. Radio Detection and Ranging – RADAR

VTS system can be divided as follows:

- Global Navigational Satellite System (GNSS)
- Diferential Global Navigation Satellite System (DGNSS)
- Aids to Navigation AIS (AtoN-AIS)
- Electronic Chart Display Information System (ECDIS).

Radar system can be divided as follows:

- Automatic Identification System (AIS)
- Long Range Identification and Tracking (LRIT)
- Aids to Navigation (AtoN).

These two subsystems are shown by model:

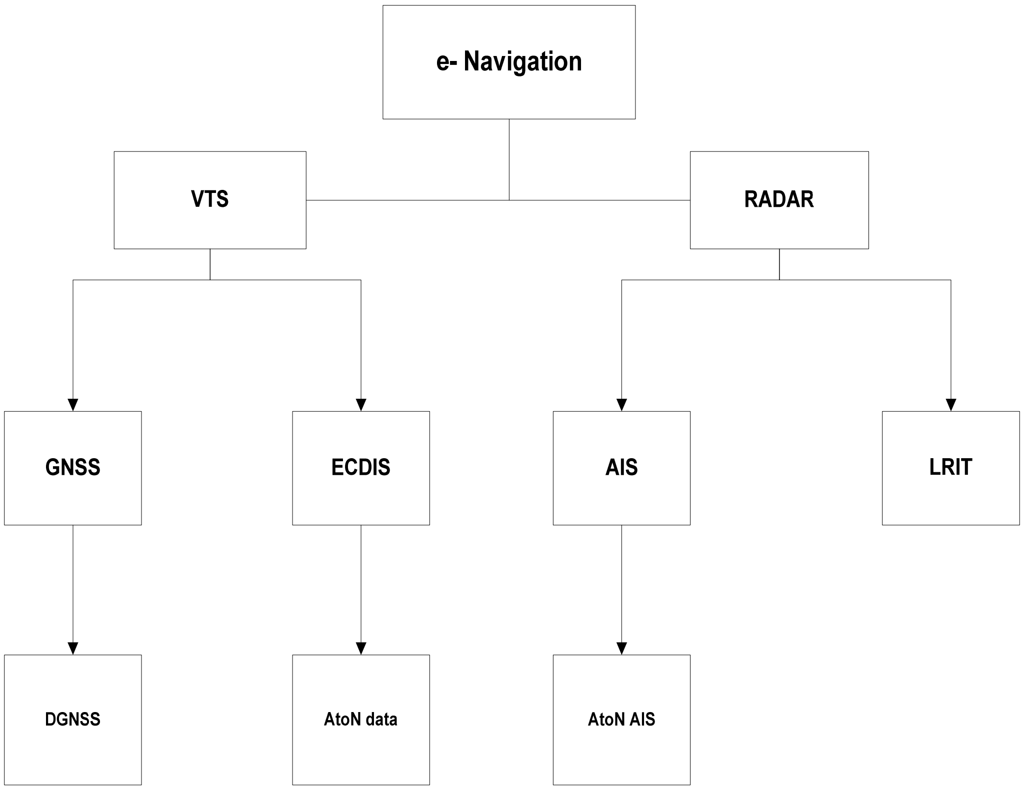

Figure 2. Model for e – Navigation

3. DEVELOPMENT OF E-NAVIGATION

International group formed by IMO organization in may 2006 developed plan for implementing global e-Navigation concept. Implementation and developing plan of e-Navigation are based on demands of users, required functions for e-Navigation, infrastructure on the ship and on the shore, analysis of costs and on gap analysis (which identify free space and distribution resources. IMO strategic plan for development of e-Navigation includes for testing usefulness and efficiency a new element inside of e-Navigation. These elements are related on:

- Operative aspect developing of e-Navigation
- Technical aspect e-Navigation
- Regulatory aspect e-Navigation.

IMO strategic plan for development of e-Navigation is related for coordination and harmonization of procedures for education and technology inside of e-Navigation.
Main impact of the development of e-Navigation will be on seafarers, sea and docking pilots, navigational equipment and manufacturer of same equipment, organization of VTS services, organization for ships inspections, hydrographic offices, ship-owners, ship operators and charterers of ships.

The main elements for development of e-Navigation will be systems which are already developed such as:

- Integrated Navigational System-INS
- Integrated Bridge System-IBS
- Electronic Chart Display Information System-ECDIS
- Vessel Traffic System-VTS

Development of e-Navigation will cause also some consequences such as:

- Need for more efficient and more harmonized data between the ships
- Need for better communication between ship and shore
- Development of new technology will cause also earlier detection and identification of ships outside VTS zone
- Will be required by seafarers and ship operators the best and most effective use of opportunities from e-Navigation
- Need in areas with dense traffic to make safe and efficient navigation.

Development of e-Navigation from side of the vessel will make impact:

- Safety of Life at Sea-SOLAS chapter V (navigation)
- Safety of Life at Sea-SOLAS chapter III (radio equipment for saving life at sea)
- Safety of Life at Sea-SOLAS chapter IV (radio communication)
- Standard Training and Watch Keeping-STCW.

Development of e-Navigation can be presented by figure 3. Systematic review of e-Navigation:

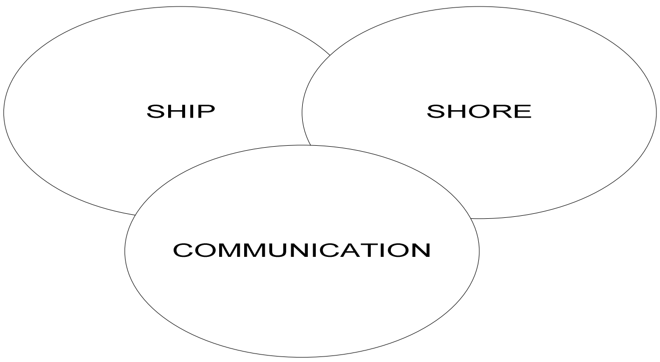

Figure 3. Systematic review of e-Navigation

From figure 3 are visible three main elements important for development of e-Navigation:

- Ship
- Shore
- Communication.

4. CONCLUSIONS

On the end of this work main conclusion is that e-Navigation is still very new project and need to be more developed with continues implementing in maritime world and has to be applied in all sector of maritime transport and wider. Upon completion of process implementation and when e-Navigation becomes completed main aims should be defined as follows:

- Enhanced information's between ships, ship and shore and shore and ship
- Enhanced communication
- Enhanced rescue and searching processes outside of VTS zone without
- Additional education for better using of e-Navigation
- Better coordination shore operators
- Transmission and reception of information's in format which is easy to understand
- Increased ship safety and security
- Increased ship efficiency.

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BIOGRAPHIE

Rino Bošnjak

I was born 16th october 1976 in Imotski, whera I have graduated gymnasium and 1995 I went to Maritime University in Split, nautical department where I have graduated 26th january 2000. From 2001-2011 I have been sailing on various types of ships and sizes.

Since 2007 I am in possesion Master mariner licence for ships bigger than 3000 GT. On Maritime University in Split I am doing as assistant professor for various courses such as Electronic navigation, Safety at sea, Navigational Integrated Systems,Handling with cargo. Presently I am doing doctoral studies on University of traffic sciences.

TRAFFIC IN PORT PLOČE

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ABSTRACT

Port of Ploče is located on the southern part of the Adriatic coast at 43 ° 03 'N and 17 ° 26' E, it is a cargo port of special importance for Croatia. Because of its location, this port is of great importance for the economy of neighboring Bosnia and Herzegovina and also for the partners from Serbia, Montenegro, Hungary and other Central European countries. Port of Ploče is multi-purpose port for transport all cargo represented in international maritime traffic. Transshipment, storage and other services performed at terminals for: general cargo, bulk cargo, loose cargo, timber, containers, petroleumcoke and alumina. Integral part of the port Ploče is port Metković which is located 20 km upstream on the river Neretva, specialized for the handling of cement, slag and granulated stone. The total annual aggregate cargo handling capacity of the port of Ploce is estimated at more than five million tons of general cargo and bulk while the total storage volume of liquid cargo, about 600 000 tonnes. It is connected by road traffic from three directions, one of which is a north-south road is the shortest and most convenient transport links between the Baltic and Adriatic sea. In a north-south harbor of Ploče is connected by rail , as a branch of the Pan-European Corridor Vc. In this paper we aim to explore developmental potential of Ploče in terms of multimodal transport.

KEY WORDS

maritime navigation. multimodal transport. Port Ploče. coridor Vc.

1. THE CURENT SITUATION

Review the current state of the port of Ploče in terms of transport activities should be seen by analyzing the traffic load Figure 1.

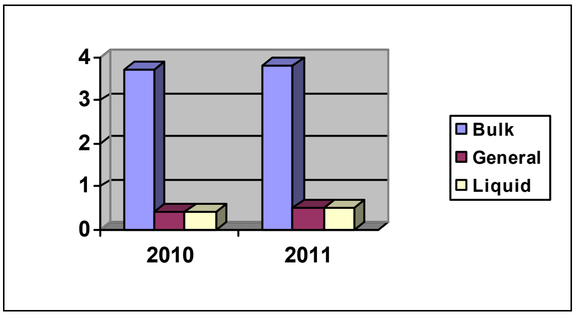


Figure 1. Freight traffic in 2010. and 2011.year in mill. – t.
Source: www.lukaploce.hr

General cargo

According to available sources of information available to the following general cargo traffic Figure 2.

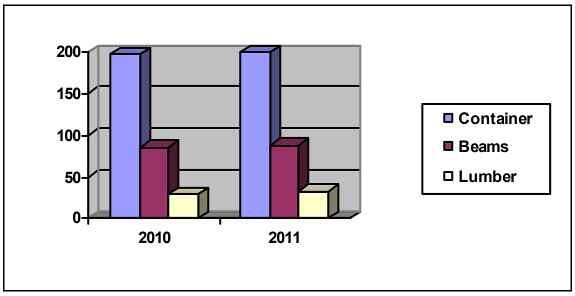


Figure 2. Transportation of general cargo in 2010. and 2011. year in thous. - t.
Source: www.lukaploce.hr

Thorough analysis of the data presented reveals a positive trend in the overall carriage of general cargo in 2011. compared to 2010 ..

1.2. Bulk cargo

According to available sources, has the following general information on the traffic load Figure 3.

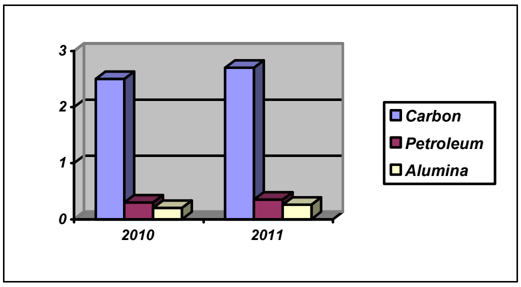


Figure 3. Transportation of bulk cargo in 2010 to 2011.year in mill. – t.
Source: www.lukaploce.hr

Thorough analysis of the data presented reveals a positive trend in the overall carriage of bulk cargo in 2011. compared to 2010 ..

1.3. Liquid cargo

According to available sources, has the following information about the current traffic load Figure 4.

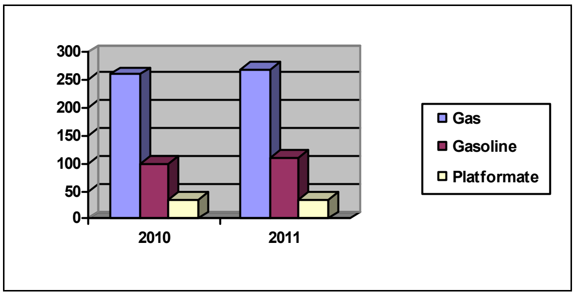


Figure 4 Transportation of liquid cargo in 2010. and 2011. in thous. - t.
Source: www.lukaploce.hr

Thorough analysis of the data presented reveals a positive trend in the overall carriage of liquid cargo in 2011. compared to 2010 ..

2. PORT TRAFFIC CONTROL AND SECURITY

2.1. Ploče port control

Port of Ploče authority's primary duty is to ensure the safe and efficient use of the harbour (Ploce seaport and Metkovic riverport) by those who have a right to use its facilities and navigate its waters. This includes a duty to regulate navigation, traffic density; plan, monitor, or control, the movements of vessels and to protect the environment. "Ploce port control" exchange and share information in respect of vessel traffic services and marine security."Ploce port control" excange information between ships and various port operators like pilots, terminals, tugs and shipping agents.

2.2. Berthing procedure

Due to density of boat traffic in summer time planning permission will almost certainly be required in order to provide and regulate the safety of navigation within the port of Ploce Authority's.Berthing a craft/ Yacht within the port area requires careful planning and consultation with "Ploce port control". All yacht / craft requiring access to the operational area at Port of Ploce (Ferry/ RoRoTerminal - Berth No 9 & 10) must report to "Ploce port control" vhf ch. 09 next informations :

Name/ sign of Craft/ Yacht

Flag and port of registry

IMO number

GT

Overall length, max. breadth, max. arrival draft,

Last port of call

Location/Position at time of report

ETA – Estimated Arrival Date and Time (LT Croatia) and ETD

Number of crew and passengers

2.3. Port safety and security

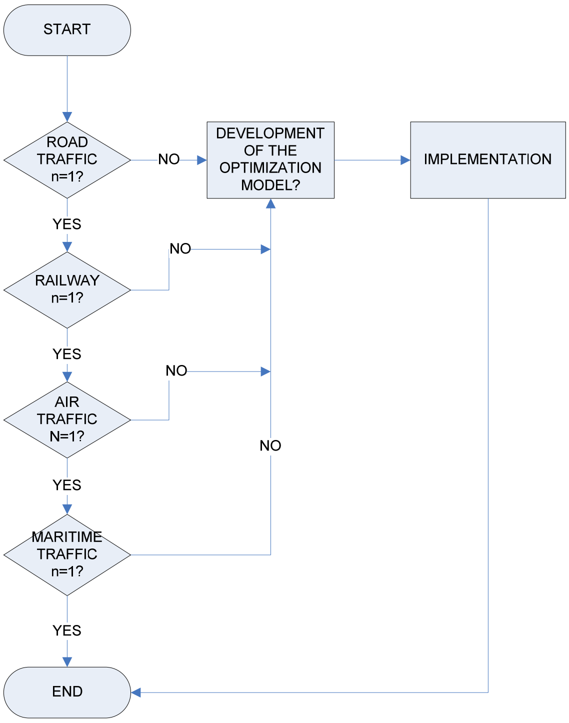
Security and Emergency Management represents a new approach to the management of security and safety in the Port of Ploce Authoritys area. It was developed with the help of a wide range of interests in the Port of Ploce and shipping industries. It aims to improve safety for those who use or work in port, their ships, passengers and cargoes, and the environment. In particular, it focuses upon those affecting the safety of life, property and the environment within harbour limits. The maintenance of a high-level security service consisting of port-wide closed -circuit television monitoring capabilities, water and land-based security guarding and patrolling services, smart card access control and AIS. Information on a ship's security status should be passed to the Port Facility Security Officer (PFSO) of the Port of Ploce Authority, so far as possible, 24 hours in advance of the ship's arrival. Full ISPS information, which includes the ship's last 10 ports of call should be included in the normal written ships pre-arrival message. Port became ISPS-compliant on 30 June 2004.

3. PROPOSED MEASURES AND EXPECTED RESULTS

Intensive investment activities are being carried out in the port of Ploče regarding the construction of the port terminals and quality improvement of the overall port infrastructure. Given the location of the Port of Ploče in order to increase traffic connections with the corridor Vc is proposed to develop measures to optimize the development of the infrastructure division to:

- road,
- rail,
- air and
- maritime traffic.

In accordance with the expected increase in traffic can be evaluated on the existing transport infrastructure assessment (Oi) in a manner that satisfies - Rating (2) or does not meet the score - (1). Then develop an optimization model to be applied and the results achieved.



4. CONCLUSIONS

Comparison of the port of Ploče with other Croatian ports come to know how the traffic load is in second place (after the port of Rijeka). Thorough analysis of available data reveals a positive trend in cargo transport. It is considered that the development of roads and better connectivity with the Corridor Vc condition further growth in cargo traffic in the port of Ploče. Furthermore the construction of roads and increase rail capacity in order to reduce the flow of entities through the system and increasing amounts of cargo.

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BIOGRAPHIE

Mr. **Paško Ivančić** was born on 21 February 1976 in Split. He attended primary school in Split. He graduated from the Matematical High School in Split, in 1994. In 2000, he graduated at the first level of the Faculty of Maritime Studies in Split, and then he graduated at the second level of the same Faculty in 2001. He received his master's degree in 2008. He is student in Ph. D. study level. He is employee of Faculty of Maritime Studies.

Mr. **Frane Kasum** is currently student in Faculty of Maritime Studies at the University of Split.

Mr. **Ivan Ban** is currently student in Faculty of Maritime Studies at the University of Split.

AN ANALYSIS OF ESTIMATION AND REARRANGE HEURISTIC FOR SEDIMENTATION ALGORITHM FOR SOLVING BERTH ALLOCATION PROBLEM IN CONTAINER PORT

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ABSTRACT

This paper presents an analysis of Estimation & Rearrange Heuristic applied in newly proposed combinatorial Sedimentation Algorithm for solving the discrete Berth Allocation Problem (BAP) with fixed handling times of vessels classified by disc | stat | fix | Σ(w1 wait + w2 speed + w3 tard + w4 pos) in Bierwirth and Maisel notation. The subject of analysis is the number of estimations and time duration of estimations for the optimal solution done by Estimation & Rearrange Heuristic in order to get the best estimation in the shortest possible time for the Sedimentation Algorithm.

KEY WORDS

Container port. BAP. heuristic. combinatorial algorithm.

1. INTRODUCTION

Berth Allocation Problem (BAP) is the problem of allocating berths for a set of vessels that have to be served within time horizon in a container port. Vessels are represented by the set of data regarding expected time of arrival, size, projected time of handling, preferred berth in the port, penalties, etc. Port is presented by the structure of the berths. Beside that there is also a given objective function. The problem is to allocated berth and time for each vessel in the set, such that given objective function is minimized. BAP was proven to be hard NP problem by Lim (1998).
BAP, according to Meisel (2009) can by classified by *spatial, temporal, handling time* and *performance measure* attribute. In this work we will consider Discrete Berth Allocation Problem (DBAP), which assumes that port quay is partitioned into discrete berths. This is a special case of spatial attribute denoted by *disc*.
There are two approaches for solving BAP and DBAP: exact and methods using some heuristic or meta heuristic. Because of the complexity of the problem second approach is more popular. There are a number of works based on Langrangean relaxation - Imai et al. (2001); Tabu Search - Cordeau et al (2005), Mauri et al. (2008); Genetic Algorithm - Imai et al. (2008), Han et al. (2006), Zhou et al (2006); Variable Nationhood Search - Hansen et al. (2008), etc.
Exact methods for solving BAP are rare in the literature. Vacca et al. (2011) proposed exact algorithm for solving the Tactical Berth Allocation Problem (TBAP) defined by Giallombardo et al. (2010). In this approach exact integer solution of TBAP is obtain by branch-and-price algorithm.
Authors of this text recently proposed a new exact combinatorial algorithm for solving DBAP called *Core Sedimentation Algorithm* (CSA). Also, authors introduced *Estimate & Rearrange Heuristic* (ERH) which significantly reduce running time of CSA.[1]
The subject of this paper is the number of estimations and time duration of estimations of the exact solution done by ERH in order to get the best estimation in the shortest possible time for the CSA.
In the conclusion of this paper formulas for the number of estimations and time duration of estimations of ERH is presented.

[1] Detailed description of CSA and ERH will be presented at IAME 2012 Taipei Conference.

2. BERTH ALLOCATION PROBLEM DESCRIPTION

Proposed algorithm solves desecrate case of BAP (DBAP). Formulation of the problem is a sub model of the Park and Kim (2003) model. We use only part of that model relevant for the berth allocation without crane assignment. It is generally assumed that vessel can occupy only one berth, since in this paper we will consider discrete case of BAP.

2.1. Input variables

Our model, as well as algorithm, is using input data listed bellow:

T: Total number of time periods in the planning horizon.
m : The number of berths in the port.
l : The number of vessels in the planning horizon.
vessel: Sequence of data relevant for vessels with following structure:

$$vessel = \{ (ETA_k, a_k, b_k, d_k, s_k, c_{1k}, c_{2k}, c_{3k}, c_{4k}) \mid k = 1,\dots,l \}. \quad (1)$$

Elements of vessel 9-tuple represents following data for each vessel:

ETA_k: Expected time of arrival of *vessel*$_k$;
a_k: The processing time of *vessel*$_k$;
b_k: The length of *vessel*$_k$;
d_k: The due time for the departure of *vessel*$_k$;
s_k: The least-cost berthing location of the reference point of *vessel*$_k$;
C_{1k}: The penalty cost of *vessel*$_k$ if the vessel could not dock at its preferred berth;
C_{2k}: The penalty cost of *vessel*$_k$ per unit time of earlier arrival before ETA_k;
C_{3k}: The penalty cost of *vessel*$_k$ per unit time of late arrival after ETA_k;
C_{4k}: The penalty cost of *vessel*$_k$ per unit time delay behind the due time d_k.

As previously mentioned we will consider only desecrate BAP, so the value for the variable b_k will be 1 for all vessels.

2.2. Decision variables and domains

Park and Kim formulation of BAP uses decision variables. Although combinatorial algorithm do not use them, we will list them:

At_k: The arrival time of $vessel_k$ to the berth, $At_k \in \{1,...,T\}$;

Dt_k: The departing time of $vessel_k$ to the berth, $Dt_k \in \{1,...,T\}$;

X_{itk}: If the berth i at the time t is allocated to $vessel_k$ value is 1, otherwise 0; $X_{itk} \in \{0,1\}$.

2.3. Constrains

Every solution of BAP must obey two following constrains.

Constrain 1. Each berth at time t can be assigned to only one vessel:

$$(\forall i \in \{1,...,m\})(\forall t \in \{1,...,T\}) \sum_{k=1}^{l} X_{itk} \le 1. \quad (2)$$

Constrain 2. Berth is allocated for the vessel only between its arrival and departure:

$$\begin{aligned}&(\forall t \in \{1,...,T\})(\forall i \in \{1,...,m\})(\forall k \in \{1,...,l\})\\ &\qquad (At_k \le t \le Dt_k \Rightarrow X_{itk} = 1) \vee \qquad (3)\\ &\qquad (t < At_k \vee Dt_k < t \Rightarrow X_{itk} = 0).\end{aligned}$$

2.4. Objective function

Let us first introduce auxiliary variable Z_k:

$$Z_k = \sum_{t=1}^{T} \sum_{i=1}^{m} \begin{cases} |i - s_k| & : X_{itk} = 1 \\ 0 & : X_{itk} = 0. \end{cases} \quad (4)$$

Objective function for the minimization of the port penalty cost can be formulated as follows:

$$\begin{aligned}\text{VesselCost} = \sum_{k=1}^{l} \{ & C_{1k} Z_k + \\ & C_{2k}(ETA_k - At_k)^+ + \qquad (5)\\ & C_{3k}(At_k - ETA_k)^+ + \\ & C_{4k}(Dt_k - d_k)^+ \}.\end{aligned}$$

From the previous description of the model of BAP we are considering it is clear that it can be classified as:

disc | stat | fix | Σ(w_1 wait + w_2 speed + w_3 tard + w_4 pos).

3. SHORT DESCRIPTION OF THE CSA AND SA+ERH

CSA for exact solving of discrete BAP belongs in the class of combinatorial algorithms. It use backtracking mechanism along with a couple of look-a-head techniques developed by authors for solving DBAP.

CSA is designed to find single optimal solution of DBAP. It can be easily modified to find all of them if more than one exists. As previously mention it search sequentially from vessel to vessel best position for them in order to fine optimal solution. Search through the space of solution is done using backtracking mechanism.

Backtracking mechanism in the algorithm can make ether step forward or step backward. Step forward it makes when it successfully find position for a vessel. Step backward is made when some of the look-a-head techniques finds that position of a vessel is not good, or when algorithm determine the position of the last vessel and then has to go back to check if there are some more solutions of the problem.

During the work of the algorithm solutions for DBAP are generated and algorithm records minimal penalty cost for current best solution. Current best solutions plays important part in the work of algorithm, because using them we can apply some of the look-a-head techniques.

CSA efficiency heavily depends on the order of the vessels. The best ordering for the algorithm is when we sort vessels in the descending order of their penalty costs in optimal solution. The problem is that we can not know this order in advance. Instead, we can allow CSA to run on the couple of different orderings for a limited time. Then we order vessels according to their penalty cost in the best obtain solution. Finally, we start CSA from the new ordering until it stops. This simple heuristic, leads to the significant improvement of the efficiency of CSA. We name this heuristic *Estimation & Rearrange Heuristic* (ERH). Algorithm we get when ERH is applied, and then CSA we name *Sedimentation Algorithm with Estimation & Rearrange Heuristic* (SA+ERH).

4. EXPERIMENTAL RESULTS

Number and duration of estimations depends on the number of vessels l, the number of berths m and the number of time units in time horizon T. In order to establish connections between this parameters 5 class instances of computational experiments will be presented. Classes of test instances are the following:

Class I: 15 vessels, 3 berths, 1 week (56 time units);

Class II: 25 vessels, 5 berths, 1 week (56 time units);

Class III: 30 vessels, 5 berths, 1 week (56 time units);

Class IV: 40 vessels, 5 berths, 2 weeks (112 time units);

For each class of computational experiments SA+ERH was executed with the number of estimations a and execution time of estimation b. Parameter a ranges from 1 to 6, 7 or 9 estimations and parameter b ranges from 1 to 6 seconds. Both parameters increase in a step of 1 unit. For each value of a and b a set of 100 tests where generated randomly. Time limit for solving singular test was 600 seconds. If a test was not solved within the 600 seconds, then test was stopped and we considered its running time to be 600 seconds. This approach was used because of great time length needed for computing all of the class instances test. For example for computing Class II of test instanced two days (48 hours) where needed. Final result for each test class instances is matrix 9×6 consisting of average solving times of SA+ERH for previously described set of values for parameters a and b.
Similar classes of instances can be find in Giallombardo et al. (2010). Size, handling time distribution in time units and penalties in 1000 USD units of the vessels in test instances are given in Table 1. Specifications resembles on those in Meisel (2009), adjusted here to DBAP.

Table 1. Test vessels specifications

Size, handling times and penalties for test vessels						
Vessel type	***Percent in test population***	***Handling time range***	C_1	C_2	C_3	C_4
Feeder	60%	1 – 3	2	3	3	9
Medium	30%	4 – 5	3	6	6	18
Mega	10%	6 – 8	4	9	9	27

Distribution of the least-cost berthing location for vessels is homogeneous.
All the test times in tables are in seconds. SA+ERH have been coded in *Wolfram Mathematica v8.0* programming language. The tests for each class of computational experiments were conducted on computer with *Intel Core i3 and i7 CPUs*, running on *Microsoft Windows 7 64-bit* operating system type. Since we compare results within one class of test instances the fact that classes where executed on different processors plays no rule here.

4.1. Class I of test instances

Class I of DBAP test instances was performed on a set of l=15 vessels in a port with m=3 berths and within time planning horizon of one week, with time unit of 3 hours i.e. T=56. Results of computational experiments for the for Class I is given in the Table 2.

Table 2. Class I test instances times

Class I	b: Times of estimation executions in seconds						
a: Number of estimations	1s	2s	3s	4s	5s	6s	Average
1	1.5113	2.2267	4.4450	9.4347	9.7242	12.3699	**5.8160**
2	8.2015	3.1547	3.8745	4.1725	6.0029	8.5571	**5.1376**
3	8.1092	5.0830	7.0377	6.2163	5.6956	8.9655	**6.3010**
4	8.3887	3.7493	4.4986	4.8622	5.8315	13.6534	**6.4262**
5	2.6514	3.6905	11.2009	6.5538	6.7903	7.8185	**6.2436**
6	2.9520	3.5379	8.8058	11.8474	7.4052	8.5989	**7.0210**
7	2.4094	3.6233	4.7941	5.2607	8.1913	5.9083	**5.3124**
8	3.0378	2.7300	4.4013	5.3025	5.8319	7.7852	**5.2984**
9	3.5829	11.3906	5.4259	6.2558	4.8986	6.1419	**6.6708**
Average	**4.5382**	**4.3540**	**6.0537**	**6.6562**	**6.7080**	**8.8665**	

Class I belongs in a group of a easy DBAP. That is why in the Table 2. the fastest times for solving a problems in Class I are for *a*=1 and *b*=1s and *b*=2s. Therefore, we conclude that for the Class I optimal number of estimations is *a*=1 and duration of estimation b=1.5s. Table 2. can be visualized as a radar chart like in Figure 1. The most closest points in chart to the center of it are the most optimal.

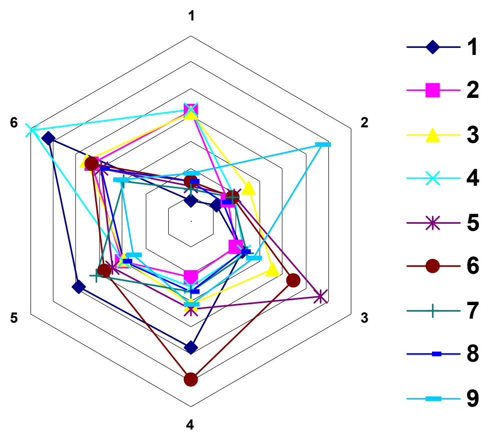

Figure 1. Radar chart for Class I

4.2. Class II of test instances

Class II of DBAP test instances was performed on a set of *l*=25 vessels in a port with *m*=5 berths and within time planning horizon of one week, with time unit of 3 hours i.e. *T*=56. Results of computational experiments for the Class II is given in the Table 3.

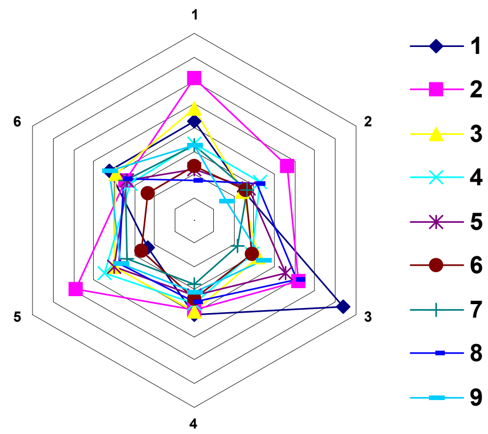

Figure 2. Radar chart for Class II

Class II belongs in a group of a moderate hard DBAP. Table 3. shows much more coherence then Table 2. The fastest problem solving time is for *a*=9 and *b*=2s, second best is for *a*=8 and *b*=2s. However, the most homogenous problem solving times are for *a*=6, ranging from 23.4730s to 33.8445s, making difference between slowest and fastest problem solving time 10.3745s. If we compare range and difference of solving times for *a*=8 and *a*=9, which are 33.6312s and 25.6252s respectively, we can conclude that SA+ERH for a=6 performs more consistently. Therefore, we conclude that for the Class II optimal number of estimations is *a*=6 and duration of estimation *b*=2s. Figure 2. is a radar chart visual representation of the Table 3.

Table 3. Class II test instances times

Class II	b: Times of estimation executions in seconds						
a: Number of estimations	1s	2s	3s	4s	5s	6s	Average
1	42.4024	24.7999	73.2807	40.1393	23.4373	41.6471	**35.2438**
2	61.0490	45.8794	51.0384	38.2843	58.6461	34.0569	**41.5649**
3	48.0292	24.2267	31.2668	39.2918	39.3798	38.9489	**32.0205**
4	33.0184	31.8968	28.2293	35.2759	44.7191	31.3054	**29.7778**
5	22.1814	26.4019	44.9021	31.9271	39.5515	33.7242	**29.0983**
6	23.4759	25.3311	28.6959	33.8445	25.9539	23.4730	**23.8249**
7	32.0091	25.6843	21.5259	27.2028	32.7092	34.0223	**25.7362**
8	17.2896	30.8720	50.9208	34.7043	36.6005	34.7086	**30.4423**
9	31.9565	15.8651	34.5109	30.6727	36.0901	41.4903	**28.5122**
Average	**34.6013**	**27.8841**	**40.4856**	**34.5936**	**37.4542**	**34.8196**	

4.3. Class III of test instances

Class III of DBAP test instances was performed on a set of l=30 vessels in a port with m=5 berths and within time planning horizon of one week, with time unit of 3 hours i.e. T=56. Results of computational experiments for the for Class I is given in the Table 4.

Class III belongs in a group of a hard DBAP. The results in Table 4. are more hard to interpret, because the values in the table vary. However, average sizes help us to conclude that most optimal number of estimations is a=5.

Table 4. Class III test instances times

Class III	b: Times of estimation executions in seconds						
a: Number of estimations	1s	2s	3s	4s	5s	6s	Average
1	96.7503	100.7070	75.8400	119.0830	138.0290	95.5547	**104.3273**
2	105.0790	146.8620	130.0950	154.1510	135.0250	154.8510	**137.6772**
3	152.4430	101.8490	115.0710	138.1170	103.2640	111.8940	**120.4397**
4	128.0500	116.5120	83.7339	105.6560	140.1810	128.8110	**117.1573**
5	70.8286	80.0051	83.8809	102.0460	140.1650	95.7192	**95.4408**
6	79.7355	107.1730	96.1345	100.5050	81.8322	118.7460	**97.3544**
Average	**105.4811**	**108.8514**	**97.4592**	**119.9263**	**123.0827**	**117.5960**	

Duration of estimation can be determine also with the help of the average values, which is lowest for b=3s. The values a=5 and b=3s are consistent with Table 4. because in this area the values are the lowest in the table. This fact can be easily seen in Figure 3. representing radar chart of Table 4.

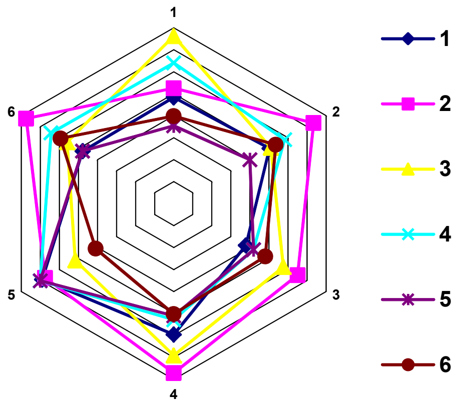

Figure 3. Radar chart for Class III

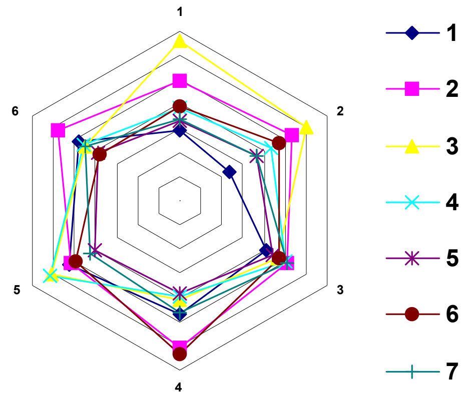

Figure 4. Radar chart for Class IV

4.4. Class IV of test instances

Class IV of DBAP test instances was performed on a set of l=40 vessels in a port with m=5 berths and within time planning horizon of two weeks, with time unit of 3 hours i.e. T=112. Results of computational experiments for the for Class IV is given in the Table 5.

Class IV belongs in a group of a hard DBAP. From the average values of the number of estimation in Table 5. we easily conclude that the best time is for a=5. Similarly from the average values of the duration of estimation we can conclude that the best times are for b=1 and b=2, with a very close result for b=6. Since all these result are stochastic we conclude that it would be the best to take b=3 for optimal value, although that is not the case if we only consider results in the Table 5. Figure 4. is a radar chart visual representation of the Table 5.

Table 5. Class IV test instances times

Class IV	b: Times of estimation executions in seconds						
a: Number of estimations	**1s**	**2s**	**3s**	**4s**	**5s**	**6s**	**Average**
1	57.4539	46.6793	81.0941	93.0682	104.5520	95.8237	**68.5245**
2	98.1492	105.5820	100.4740	120.1100	102.4860	114.9360	**91.9625**
3	131.3060	119.3880	92.9218	80.8790	120.3530	89.5589	**91.0581**
4	75.7295	85.7417	99.4088	78.5750	123.2430	89.9733	**79.5245**
5	65.5721	72.6722	87.7524	75.6014	79.4501	76.8119	**66.1229**
6	77.4737	94.8415	93.6636	125.2800	98.2826	75.5135	**81.5793**
7	66.4313	71.4647	100.3800	91.2035	84.6728	88.4960	**72.8069**
Average	**81.7308**	**85.1956**	**93.6707**	**94.9596**	**101.8628**	**90.1590**	

4.5. Formulas for calculating number and duration of estimations

The best number and duration of estimation of the test instance classes is given in the Table 6, along with the number of vessels, berth and time units of planning horizon.

Table 6. Review of the experimental results

Class	*l*	*m*	*T*	*a*	*b*
I	15	3	56	**1**	**1.5**
II	25	5	56	**6**	**2**
III	30	5	56	**5**	**3**
IV	40	5	112	**5**	**3**

Table 6. shows that for easy DBAP it is enough to shortly estimate optimal solution only once. In the case of a medium difficult DBAP more estimations are needed, but with only slight extension of the estimations. For the difficult cases of DBAP we need less attempts of estimation, but duration should be extended.
Since easy DBAP problems have in general short time of solving we focus on formulas for the number and duration of estimations for medium and difficult cases of DBAP. For the considered test instance classes in this paper we propose *NoEst* function for number of estimation calculation:

$$NoEst(l) = Max\left(1,5+\left\lceil\frac{l}{25}\right\rceil+\left\lceil\left\lceil\frac{l-30}{20}\right\rceil\right\rceil\right), \quad (6)$$

where $\lceil x \rceil$ denotes integer part of x. Function *Duration* for the duration of the estimation (in seconds) for the considered test instance classes is following:

$$Duration(l) = Max\left(1.5,\left\lceil\frac{l}{10}\right\rceil-\left\lceil\frac{l}{40}\right\rceil\right) \quad (7)$$

Proposed functions *NoEst* and *Duration* perfectly matches test class instanced for SA+ERH described in this paper. The usability of proposed function for extra hard cases of DBAP should be examined in future studies.

5. CONCLUSION

In this paper we have analyzed efficiency of SA+ERH algorithm for solving DBAP. Efficiency of the SA+ERH depends on the number of estimations of optimal solution of DBAP and time duration of the estimations. Four classes of DBAP, from moderate difficulty to hard, where analyzed. The result of the analysis are functions for number of estimation and duration of the estimation calculation, for the class instances discussed in the paper.

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SPLITSKA VRATA – MARITIME TRAFFIC AND ACCIDENTS

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ABSTRACT

In this paper we will analyze geographical position, historic and traffic importance and problems related to safety of navigation through the Splitska vrata. The Splitska vrata (the Strait of Split) is narrow passage between the island of Brač and island of Šolta and allows the shortest ship route from the Port of Split to the open sea. Through the Splitska vrata passing many merchant and passenger vessels, on routes that are connecting Port of Split with the islands of the Central Adriatic and with open sea of the Adriatic. Besides large ships, there is intense traffic of small boats and yachts, especially in summer season. Because of that, navigation through the Splitska vrata requires extraordinary precautions and adherence to safety rules of navigation, which is often not the case. The number and characteristics of maritime accidents confirms that violations of navigation rules and recommendations is very frequent, also indicate the need for additional measures regarding marking of waterways and regulation of navigation through the Splitska vrata.

KEYWORDS

Splitska vrata. ship's traffic. ship's accidents. safety of navigation.

1. INTRODUCTION

The main theme of this paper is Splitska vrata, their geographical position and traffic importance. Looking through the history, Splitska vrata had a very important military strategic position and significance as a very important trade route that linked the city of Split with the nearby islands and Italy. This work besides geographical features and historical significance of Splitska vrata is showing marine meteorological conditions that are prevailing in this area and main problems that are concerning the safety of navigation. Also, this paper will show examples of search and rescue operations for ships that have experienced an accident in this area and thereby endanger themselves, other traffic and the environment. The majority of accidents occur during the summer months when there are in some cases a large number of vessels in Splitska vrata. Most of these accidents are the result of non-observance with International Regulations for Preventing Collisions at Sea.

2. GEOGRAPHIC CHARACTERISTICS

Split doors are located between the islands of Brač and Šolta, landing points are:

- on north clip Šolta east Cape (east of Cape Livka) and Cape Zaglav on the island of Brač,
- on south clip Cape Motika on the island of Šolta, Cape Kobila on the island of Brač, Position (φ = 43° 19'43 "N, λ = 016° 24'12" E).

The length of Splitska vrata is approximately one nautical mile (1 NM), and on the narrowest place their width is approximately 800 meters. Objects of Navigation safety marking the passage, and are located:

- On the island of Brač, lighthouse Ražanj 575 E3342, (φ = 4319,2’N ; λ = 16 24,9´ E) (W FI 5s 17 m 13M), (1+4) vid 340-175 (195) (4+2 ; 4+10) reso. 10 M. Large stone tower near the house. This lighthouse was built in the second half of the nineteenth century, dates from the time of the Austro-Hungarian monarchy.
- On the island of Šolta there is coastal light Livka 575 E3338 (φ = 43°19,8´N ; λ = 16°24,0´E), (W Fl 5s 11 M 8 m) (0,5+1;0,5+3) vid 168-058 (250) Red tower with the construction and gallery on the white cottage.
- Navigational safety object that denotes entrance on the north side of Splitska vrata is situated on island Mrduja, white tower with a column and gallery 576 E3340 (φ = 43°20,3´N; λ = 16°24,9´E) (G FI 3s 14m 4M)

Sea depths in Splitska vrata are in the range from 5 to 42 meters. The biggest shallow waters are in front of lighthouse Ražanj and Cape Livka, so it should adapt navigation on these places. It is also important to note that the anchoring and fishing is prohibited in Splitska vrata, which is marked by prohibiting anchoring. Submarine cables and pipelines were laid between islands of Brač and Šolta [3].

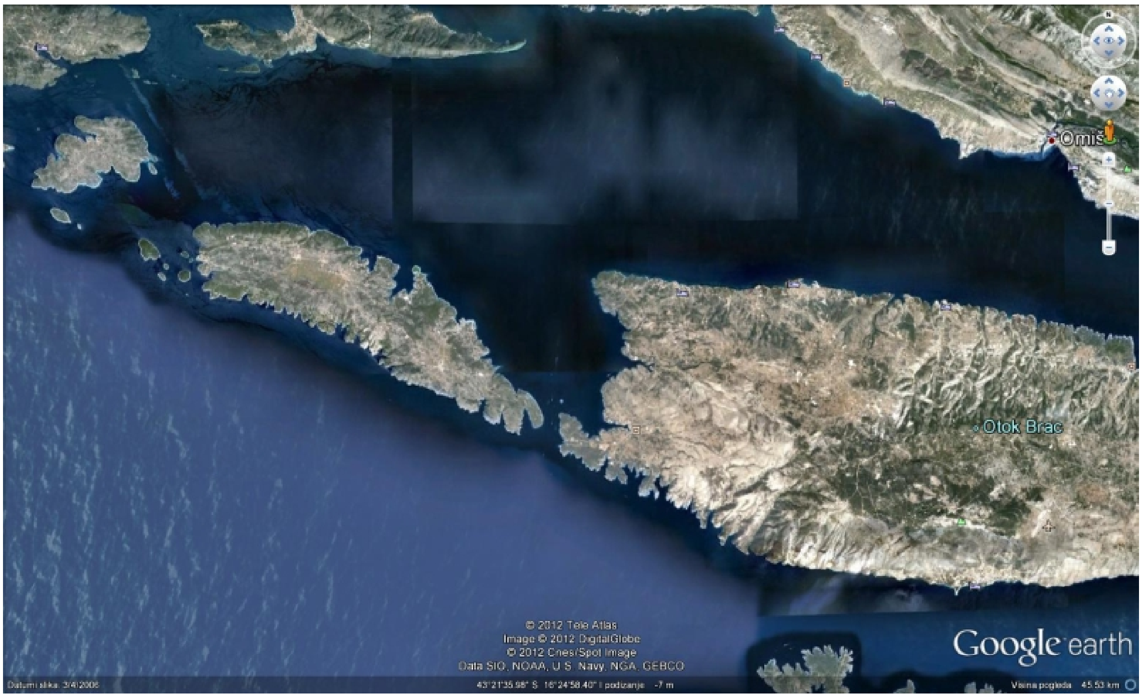

Figure 1. Splitska vrata – between islands: Šolta (left) and Brač (right)
Source: http://www.google.com/earth/index.html

Figure 2. Splitska vrata – maritime traffic in Splitska vrata
Source: http://www.google.com/earth/index.html

	Trogir	Omiš	Makarska	Sumartin	Bol	Supetar	Milna	Rogač	Hvar	Stari grad	Jelsa	Sućuraj	Vis	Komiža	Kaštela	Split	Ukupno
1	7234	566	5682	1264	1688	4209	735	2635	5254	2349	1418	3358	1504	552	621	14487	53556
1.1	6	0	0	0	0	0	0	0	0	5	0	0	0	0	84	197	292
1.2	7228	566	5682	1264	1688	4209	735	2635	5254	2344	1418	3358	1504	552	537	14290	53264
2	53	0	1	0	0	0	0	0	129	112	0	0	23	0	73	949	1340
2.1	14	0	0	0	0	0	0	0	7	44	0	0	0	0	70	698	833
2.2	39	0	1	0	0	0	0	0	122	68	0	0	23	0	3	251	507
3	7298	560	5694	1264	1688	4219	720	2644	5352	2312	1416	3378	1503	552	622	13889	53111
3.1	2	0	0	0	0	0	0	0	0	10	0	0	2	0	90	191	295
3.2	7296	560	5694	1264	1688	4219	720	2644	5352	2302	1416	3378	1501	552	532	13698	52816
4	51	0	1	0	0	0	0	0	126	111	0	0	23	0	72	953	1337
4.1	6	0	0	0	0	0	0	0	15	39	0	0	16	0	69	735	880
4.2	45	0	1	0	0	0	0	0	111	72	0	0	7	0	3	218	457
5	19	0	0	0	0	0	0	0	13	4	0	0	4	0	26	250	316
6	8190	0	14049	2776	0	54940	180	6107	100	19756	0	2175	14108	5	356909	917405	1396700
6.1	0	0	0	0	0	193	30	1214	0	24	0	10	807	0	12068	10299	24645
7	16468	0	5466	1098	0	137642	313	21718	235	93714	0	13227	23384	0	234861	718299	1266425
7.1	0	0	0	0	0	4188	63	2811	0	3882	0	10	1397	0	50	273161	285562
8	136453	13224	237976	34399	84772	744691	22978	171595	208222	364610	81223	144855	109737	10356	34	2008773	4373898
9	148086	13303	235063	33091	85115	724948	21765	164726	212175	353214	86545	149747	112047	10129	32	2053775	4403761
10	7667	0	64781	11824	0	154919	20	26265	0	71718	0	49005	19575	0	1031	315365	722170
11	8380	0	64358	10887	0	155418	16	27186	0	70984	0	50284	19432	0	958	322636	730539

1	*Broj uplovljenja domaćih brodova*	3	*Broj isplovljenja domaćih brodova*	6	*Ukrcano tereta u tonama*
1.1	*Broj uplovljenja domaćih brodova iz strane luke*	3.1	*Broj isplovljenja domaćih brodova za stranu luku*	6.1	*Od toga opasnog tereta*
1.2	*Broj uplovljenja domaćih brodova iz domaće luke*	3.2	*Broj isplovljenja domaćih brodova za domaću luku*	7	*Iskrcano tereta u tonama*
2	*Broj uplovljenja stranih brodova*	4	*Broj isplovljenja stranih brodova*	7.1	*Od toga opasnog tereta*
2.1	*Broj uplovljenja stranih brodova iz strane luke*	4.1	*Broj isplovljenja stranih brodova za stranu luku*	8	*Ukrcano putnika*
2.2	*Broj uplovljenja stranih brodova iz domaće luke*	4.2	*Broj isplovljenja stranih brodova za domaću luku*	9	*Iskrcano putnika*
		5	*Ukupno brodova u prometu s inozemstvom*	10	*Ukrcano automobila*
				11	*Iskrcano automobila*

Figure 3. The amount of maritime traffic in Splitsko-dalmatinska županija
Ministry of maritime affairs, transport and infrastructure
Port authority Split - branch office Milna; 2011

2.1. Effect of currents and winds

In Splitska vrata there is appearance of changing current speeds of 0.5 knots which winds can accelerate up to 2 knots. Splitska vrata are often border of two opposing winds. In fact, it happens that a wind is blowing from two different directions. That means Mistral wind can blow both from Šolta Channel and from the open sea southwest of the island of Šolta. It is not uncommon to see that one sailboat is approaching from the island of Vis through Splitska vrata under spinnaker, and the other sailboat with same sail is approaching from Split. The Splitska vrata are more or less protected from strong winds and waves except in the case of the west wind Lebić which creates rough seas and makes navigation difficult.

3. THE HISTORICAL IMPORTANCE

Split doors were of great importance throughout history. All merchant ships were passing through Splitska vrata with their trade routes from Split or from Milna to islands or to Italy. In Splitska vrata famous battle was occurred in 1806 between the Russians and French. The French are on Rt. Battery near Zaglav build a fort in time of the Napoleonic wars, which in itself speaks about the strategic importance of Splitska vrata throughout history.
In fort there were 10 guns which should prevent the entry of a strong Russian fleet in the waters of Split and Makarska. Russian reconnaissance vessel was anchored near the fort, so the French were told to their command in Split. General Marmont was ordered the ships to sail from the port and to capture the Russian ship, so that five ships went on the attack. But before that people from Split were told to ship Lieutenant Ivan Skolavski about French preparations. When the French vessel sailed from Split, on island of Brač was torched five signal fire for Russians get accurate information on the strength of the French fleet. And Russians attacked them first [2].
In the battle two ships were destroyed, and the Russian ship destroyed the French fort, a battery of four guns. This opens the way for the Russian Navy to the island of Brač. It should be noted that during the Croatia war, battery was set up to coordinate defence of the city of Split from the sea.
Splitska vrata next to a strategic has a sporting character, traditionally the famous regatta Mrduja is organized on that place, and in recent times the manifestation ″Potezanje Mrduje - eng. Pulling Mrduja″ is organized and is based on story whose Mrduja belongs to Brač or Šolta.

4. SEARCH AND RESCUE

One of the most important tasks of Port Authorities Branch Office Milna is search and rescue operations at sea (SAR Operations). In last five years there was 20 search and rescue actions taken with boats 5-ST „MILNA“ and RH 3-ST ″MARJAN″ by Port Authorities Branch Office Milna. Most of the search and rescue operations occurred in the area of Splitska vrata. Statistically speaking (data from MRCC RIJEKA - The National Maritime Rescue Coordination Centre Rijeka) Port Authorities Branch Office Milna is five years among the three branches in the Republic of Croatia with the largest number of actions in the search and rescue operations at sea.
A large number of search and rescue actions are not recorded or shown through statistical reports, because the greater number of actions was routed through the company "EMERGENSEA", which has a base in Milna, and also a large number of actions are coordinated with telephone (coordinated by Port Authorities Branch Office Milna). Such a large number of maritime accidents occurring in the area, talks about the importance and intensity of traffic in Splitska vrata.
Most of the accidents happen during the summer months. Failure to comply with regulations for Preventing Collisions at Sea is the main cause of such accidents.

4.1. Examples of Stranding

In the last three years there have been four stranding: three ships and a yacht, which we can show in the following examples:

Example 1.
M/V: Ivona
Type = ro ro cargo vessel
IMO number: 9345154
Call sign: 9AA2278
LOA (Length Overall): 35 m
Power: 662 kW
Gross tonnage: 197 GT
Draft: 2,2 m
Navigation area: small coastal navigation

On day 3 August 2007, around 04:30 pm cargo vessel ″Ivona″ carrying gas bottle run aground on Cape Livka on the island of Šolta. Insufficient attention of the master near the entrance of the Splitska Vrata, led to the stranding.
The ship sailed in the first quadrant from the island of Vis to Split. Ship was carrying seven crew members, and the investigation proved that they have not respected the rules of navigation. Using tugboats, the ship was successfully moved.

Figure 4. M/V Ivona
Source: Petar Poklepović

Example 2.
M/V: Murat Hacibekiroglu III
Flag: Turkey
IMO number: 8127323
Call sign: TCNZ
LOA (Length Overall): 84,2 m
Power: 1244 kW
Gross tonnage: 1957 GT
Year built: 1983.
Type: general cargo ship

On day 5 February 2011 at 13:35 am the ship ″MURAT HACIBEKIROGLU III″ sailed from the northern port of Split, from berth Silos to the port of Bari loaded with 1429 tons of wheat and 1587 tons of corn. On day 7 February 2011 at 0:10 pm the ship ran aground on the east side of the island Mrduja. The ship was sailing under the Turkish flag, shipping company ″HACI IBRAHIM HACIBEL″, port of registry Istanbul.

On the same day after the pilot disembarked from the ship at 15:00 am, the ship proceeds to the port of Milna Bay anchorage because of bad weather conditions. After leaving the anchorage, in the front of the port of Milna (auxiliary anchorage port of Split) in the direction towards the Splitska vrata there was an error in the estimation of navigation when entering the channel. They did not respect the rules of navigation, which led to the stranding on the eastern side of the islet Mrduja. A total of 13 crew members were on board all Turkish nationality, none of them was hurt, and so far no signs of pollution.

Figure 5. M/V: Murat Hacibekiroglu III
Source: Petar Poklepović

Figure 6. M/V: Murat Hacibekiroglu III – stranded
Source: Petar Poklepović

Figure 7. Rescue actions taken for M/V: Murat Hacibekiroglu III
Source: Petar Poklepović

Example 3.

M/V: Alfa Dragon
Flag: Panama
Year built: 2005
IMO number: 9368637
Call sign: 3EDI8
LOA (Length Overall): 80,6 m
Power: 1323 kW
Gross tonnage: 1997 GT
Type: bulk carrier

On day 18 November 2011 around 06:00 am, there was a stranding of a ship ″Alfa Dragon″ on the island of Brač, when she was passing trough Splitska Vrata. The ship sailed from the Italian port of Porto Empedocle to the port of Split. The ship ran aground on portside and she was tilting about four degrees on the right. At the time of the accident there were fourteen crew members on board and 3150 tons of salt. There was no penetration of seawater into ship's hold.

An obvious example of non-compliance with safety rules of navigation occurred during stranding of a Turkish ship when passing through Splitska vrata. Inspection showed that the error of determining the waypoint caused stranding of a ship on Cape Zaglav. Instead of putting ship’s turning point athwart on Ražanj lighthouse, officer was decided to put ship’s turning point on coastal light Livka (island of Šolta), which led to delay of altering the ship’s course through the strait. There was not enough time to alter the ship’s course in C = 000° to pass through the middle of the strait.

Figure 8. M/V: Alfa Dragon

Figure 9. M/V: Alfa Dragon – stranded on the Cape Zaglav
Source: Petar Poklepović

Example 4:

Yacht name: Maca
Year built: 2005
LOA (Length Overall): 12,83 m
Power: 41 kW
Port of registry: Šibenik

The need for reading and understanding charts and publications to pass through the Splitska vrata is shown in next example of stranding of yacht ″Maca″. The yacht was ran aground on Cape Ražanj because they did not read the depth charts which show that in this place there are shallows to be avoided at sea.

5. PROPOSED MEASURES TO INCREASE SAFETY OF NAVIGATION IN SPLITSKA VRATA

Statistics in the special purpose ports (including marinas), in an environment of Splitska vrata, are confirming an increase in traffic of yachts and smaller boats. Those boats are gravitating to passing through the Splitska vrata. Also, most of the traffic occurs during the summer months, in some weekend days when is an exchange charter boats in marinas (Kaštela-Trogir-Split) and the tourist boats are going on cruise travels, in that moment there can be more than a hundred boats in Splitska vrata. Additional threat presenting navigators that are using sails when passing through the Splitska vrata, because of increased risk of collision. All these vessels are crossing routes of larger ships on the way to Split, or from the Split, and they are preventing their manoeuvrability significantly.
Taking into consideration all the above, it seems necessary to establish appropriate measures to increase the general safety of navigation. Proposed measures include the following:

- establish appropriate measures of navigation guidance,
- prohibit (partially or completely) the passage of the appropriate types of ships (permanently or temporarily) in order to separate the major routes of bigger ships from small boats routes,
- mark the area of lateral markings along the entire channel,
- limit the ship's speed to a maximum of 10 knots (at present the speed limit in force for the fast craft company SNAV is 7 knots),
- introduce a mandatory Pilot Service,
- to improve traffic control, and
- In nearby marinas to establish appropriate information and additional training for yacht masters that have no experience in navigating in this area.

6. CONCLUSION

Number of vessels is increasing every year, thus increasing the number of maritime accidents, especially in traffic narrow passages and straits such as Splitska vrata. Accordingly, it should take appropriate measures to improve supervision and traffic safety in Splitska vrata. Reasonable predictions are that the tendency of traffic in Splitska vrata in the coming years are going to grow, which generates the need for regulation of maritime traffic through this strategic passage, in order to avoid accidents and situations previously mentioned in this paper.
It means primarily to establish an adequate navigation guidance system, combined with active supervision system. Also it must be taken maximum efforts for yacht masters and skippers to comply with the International Regulations for Preventing Collisions at Sea with additional education or with the better supervision of the credibility of the authority.

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SHIP SAFETY FROM THE ASPECT OF STRUCTURE AND NAVIGATION-TECHNICAL ELEMENTS

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ABSTRACT

Ship is an engineering product, capable of floating on water surface and of performing other technical operations. International trade is mostly carried out using waterways besides the development of other forms of transport. Ship safety is an issue which attracts great attention with the purpose of avoiding maritime accidents, the consequences of which are human casualties, loss of material resources and environmental disasters.
Some of the reasons for that are: inadequate vessel strength, or ability of the structure to resist the action of external forces, as well as regular use and knowledge of navigation aids which assist an officer of the watch to steer the vessel in all possible sailing conditions. This paper describes the main factors that affect ship safety from the aspect of the strength of her structure, from the creation of a conceptual design, choice of materials for the construction up to the transfer and subsequent repair and maintenance, as well as from the aspect of the utilization of new contemporary technologies which cannot unconditionally contribute to the increase in the degree of safety, since the fact is that human factor is the one which will ultimately be responsible for the ship safety through senses, assessment and decision.
The data exposed in the papers by Grubišić, regarding ship structure, and Baldauf on the connection between contemporary navigation technology and human factor as the cause of maritime accidents, served as an evidence for the assertions expressed in this paper.

KEY WORDS

ship safety. ship structure. navigation aids. human factor.

1. INTRODUCTION

In the last half century and even more the shipping industry was focused on the improvement of ship's structure in order to reduce accidents and increase efficiency and productivity. We have witnessed major improvements in hull design, system of stability, propulsion systems and navigation equipment. Nowadays ship design and marine systems are upgraded technologically and are of the high reliability. However, maritime accidents continue to occur in large numbers.
One of the basic conditions of seaworthiness is the safety of the structure of the hull which must be safe under all conditions of exploitation of the ship during her useful life, which is confirmed by Grubišić [1-2] and Šuša [3] in their works. Safety and efficiency of marine operations, regardless of whether the ship is under construction or in navigation, are dependent, like all the other "man-machine" systems, on the proper communication between man and the device during fulfillment of the given operation.
In February 2008. the Norwegian Institute of Classification "Det Norske Veritas" (DNV) has released alarming statistics data showing that in the last five years was doubled the number of maritime accidents [4]. In this paper we have analyzed some of factors that significantly affect the safety of the ship.

2. EFFECT OF SHIP CONSTRUCTION ON SAFETY

Ship's construction involves structural composition of the hull, i.e. shape, dimensions, layout and way of connecting building parts of the ship. Hull and other parts of her structure are composed of many small elements that must be combined with one or more elements to build a structure capable of withstanding very heavy loads that the ship is exposed to [1]. The empirical formulas for obtaining the required thickness of the smallest elements of its structure as well as the smallest required moments of inertia i.e. resistance moments for profiles, have led to that nowadays ship has a minimum possible mass and therefore the maximum deadweight. Thus is increased cost effectiveness of the ship, while this does not endanger her safety. The safety of ship's construction is the ability to assume certain forces and the ability to confront these same forces of deformation. Each building part of ship's structure must be constructed so having in mind the cargo that she should carry, either directly or as component part of ship's hull, or both. Maintaining quality in construction of the ship is one of the most important problems of shipbuilding. Reliability and safety of any product including the ship must include not only the product as it is delivered, but also her ability to function through the lifetime for which she is foreseen.

2.1. Control and testing of ship's hull

High-quality performance of all works is an important source of price reduction of ship building and increase of safe operations of all technical means. Requirements for the quality of the structures were determined by technical conditions and the applicable norms and standards, while at the construction of devices and marine equipment are used norms and standards of engineering, electrical engineering, radio and other industries. Standards and norms provide optimal, approved technical solutions on various issues regarding related materials, construction, technology of performed works, conditions of take-over, testing etc. These identified technical solutions are exposed to standards and norms in the form of nominal parameters and properties with stated permissible limits of deviation. By the degree of matching of the real object and its ideal prototype is determined the size of wrongness. If some errors or their sum exceed the limits prescribed by standards, norms and technical requirements such object shall be declared defective. Checking and testing of ship's hull should give a clear picture of the presence or absence of irregularities (defects) i.e. to be a guarantee that there are no unacceptable defects at vital points of the hull and consists of the following stages:

Testing of welded joints to determine that they are free of significant defects of internal and external irregularities of seams. There as a control before welding and consists of: preparation and control of cutting and preparation of grooves, merger control and preparation for welding, which includes control of measures undertaken to prevent deformation and reduce internal stresses (pre-strain and pre-heating etc.), thereafter control during welding, which consists of: the control of welding parameters and control of consumables and control of working techniques (respecting the order of welding, etc.) and control after welding which, in fact is a control of welded joint. It consists of two different main groups of techniques (methods) of control of welded joint.

Control of hull structure and superstructure is accessed after completing the test of joints between ship's sections. Deviation from the form and dimensions of the whole hull, its assemblies and sections consists of errors obtained at single operations. During the construction, the following errors are added: errors in the form of components estimated for assemblage and welding, assemblage errors, errors of welding, errors caused by inaccuracy of measurements, errors of tools and equipment used during installation. The accuracy of technological equipment is an important condition for ensuring quality of products [3].

Testing for tightness of bulkheads, decks and tanks is accessed when the installation of certain parts of the ship is fully completed and testing of joints and sections and other welds on the structure has shown satisfactory results. The installation is considered to be completely finished when all elements are brought into the right position, properly connected, straightened as appropriate, grinded etc. After that, the room i.e. the surface to be checked for tightness should be cleaned, especially joining points that are tested [2].

Checking of main measure of the ship is carried out after the inspection of the whole hull and taking over as a correct. These sizes differ regularly from the projected ones which is understandable since it is impossible to carry out connecting of the whole multitude of elements in such ideal way that during the building period does not come to any discrepancies. These discrepancies are the result of heating during welding, errors during assemblage and so on.

Testing of ship's hull elements i.e. measuring of its thickness is one of the most important diagnostic tests that are performed over the ships in order to assess their further exploitation [5]. The wear of ship's structure elements affects the strength of the ship, and therefore her safety. For a long time thickness measurement of hull structures was not governed by any rules and the range of measurement was different for different classification societies. In recent times are introduced the appropriate rules to govern the scope and structure of those elements of vessel's hull which are subject to measurement.

The basic survey in terms of measurement covers only certain segments of ship's structure that at earlier surveys were registered as parts that should receive special attention.

The scope of measurements during the periodic survey was intended to determine by lower scope of measurements the condition of construction and structure and ship's hull. Given the importance of determining the extension and development of wear of ship design, classification societies have recently strongly tightened the scope of measurements that are required during periodic survey. For example, the scope of periodic surveys at ships with an expected life of more than 15 years is identified with the previous special survey (special survey 3). In addition, periodic survey at its scope is almost identical in all classification societies for ships which age exceeds 12,5 years, while the scope of periodic surveys after 15 years of ship's age is identified with the scope of a special survey 3.

Certainly, the greatest significance during survey of the ship in the part that relates to a diagnostic, have surveys that are conducted every five years of ship's exploitation. These surveys are designed in a way to give a true picture of ship's hull, with a view to determine those elements of ship's structure that will ensure the exploitation of the ship in the next five years.

The first special survey (after 5 years) implies thickness measurement for the following elements: 25% of the main frames in forward and frames in other selected cargo holds, one cross ring with accompanying plates and longitudinal elements of two selected tanks in all zones, two watertight bulkheads in cargo holds and all caps and all hatch covers and sides of hatch covers with corresponding elements.

Elements which thickness is measured at the second special survey (after 10 years) are all main frames in forward and 25% in other cargo holds, one cross ring with accompanying plates and longitudinal elements in each of existing ballast tanks, forward and afterward watertight bulkhead in the upper ballast tanks with associated stiffeners, all watertight bulkheads in cargo holds with associated stiffeners, all deck plates, including plates between holds openings, all hatch covers and sides of hatch covers with corresponding elements, two transversal sections of deck and shell plates at 0,5 length of the ship.

Elements which thickness is measured at the third special survey (after 15 years) are all main frames in forward cargo hold and 25% in other cargo holds, all transversal frames with all corresponding elements in all ballast tanks, all watertight bulkheads in all ballast tanks with associated stiffeners, all watertight bulkheads in cargo holds with all associated stiffeners, all deck plates including plates between hold openings,, all hatch covers and sides of hatch covers with corresponding elements, the internal structure of forepeak (fore - peak tank), two cross-sections with all longitudinal elements of at 0,5 length of the ship and all outer shell plate in the way of cargo holds and selected plates out of cargo area.

Elements which thickness is measured at the fourth special survey (after 20 years) are: all main frames in all cargo holds, all transversal frames with all corresponding elements in all ballast tanks, all watertight bulkheads in all ballast tanks with associated stiffeners, all watertight bulkheads in cargo holds with all corresponding stiffeners, all deck plates, including plates between hold openings, all hatch covers and sides of hatch covers with corresponding elements, all outer shell plates in the way of hold area, selected plates outside cargo area, all decks, including the castle and cassar , the whole bilge strake and additional bottom plates in the way of cofferdams, engine room and peaks, the bottom plate in the way cargo areas, three cross sections at 0,5 ship length, all transversal frames with plates and longitudinal and watertight bulkheads in fore and after peak [6].

Table 1. [5] shows allowable wear of structural elements of the hull according to some of the leading classification societies.

Table 1: Data on allowable wear of structural elements of the hull [5]

	Elements of ship's structure	**ABS**	**LR**	**NKK**	**GL**	**DNV**	**BV**	**RINA**
		%	**%**	**mm & %**	**%**	**%**	**%**	**%**
1	**Deck plates outside hatch line**	20	20	20+1	Up to 11,5 mm wear is 1,5mm	20	20	20
2	**Deck plates in the line of hatches**	30	25	30		20	20	20
3	**Other decks**	30	25	30		20	20	20
4	**Shell plates**	25	20	20+1		20	20	20
5	**Flat bottom plates**	25	20	20+1		20	20	20
6	**Keel plate**	25	20	20+1		20	20	20
7	**Deck longitudinals**	25	25	30		25	20	20
8	**Deck girder**	25	25	25		25	20	20
9	**Topside tank sloping plating**	25	20	20+1		20	20	20
10	**Wing tank longitudinals**	25	25	30		25	20	20
11	**Flat bottom longitudinals**	25	25	30	Above 11,5 wear is tk = 0,09t+	25	20	20
12	**Botom girders**	25	25	25		25	15	15
13	**Shell plate longitudinals**	25	25	30		25	20	20
14	**Inner bottom plating**	30	20	20+1		20	20	20

15	**Inner bottom longitudinal**	25	25	30	+ 0,45 mm	25	20	20
16	**Side tanks sloping plating**	25	20	20+1		20	20	20
17	**Hopper tank longitudinal**	25	25	30		25	20	20
18	**Floor frame**	25	20	25		20	15	15
19	**Wing tank web frames**	25	20	25		20	20	20
20	**Side tank web frames**	25	20	25		20	20	20
21	**Hatchcoaming**	30	30	30		25	20	20
22	**Main frame with stiffeners**	25	20	25		25	20	20
23	**Watertight bulkhead upper and middle strake**	20	20	20+1		25	20	20
24	**Watertight bulkhead lower strake**	25	20	20+1		25	20	20
25	**Watertigh bulkheads in ballast tanks**	20	20	20+1		25	20	20

3. EFFECT OF NAUTICAL - TECHNICAL ELEMENTS ON SHIP'S SAFETY

Until the early eighties of the last century, ships were equipped only with indispensable equipment that they needed to perform navigation. The crew was trained to use properly the given equipment for the purpose of safe steering of the ship. Today, when on board is installed the most modern technology and satellite systems, it is very difficult for crew members to follow their trend of development, thus becoming the weakest link in the chain of safe exploitation of the ship. In addition to the bridge navigation equipment and systems here are as well systems for control of ballast water, inert gas, cargo holds temperature, various types of alarms as well as some new systems that are required by regulatory bodies, such as the: Vessel Traffic Service (VTS), Automatic Identification System (AIS), cameras installed around the deck and superstructure and many others.

According to all stated above, we can say that the command bridge has grown from the navigation to operations center of the ship, regardless of whether the ship is in port or atsea. It is clear that such rapid technological development greatly increases the safety of the ship, providing to a guard officer all necessary information in all ship operations [7]. However, the safety of the ship can easily be compromised by inconsistency of human and electronic navigation devices due to unsuitable design of equipment or ignorance of their work.

The psychological pressure on guard officer, no matter how the ergonomic design of his work space and simplicity of management functions set to the same is an essential factor that affects the safety of navigation. The only fully physically and mentally ready person, with regular training and learning, has the ability to decide and implement decisions and actions related to navigation [8].

3.1. Integrated Navigation Bridge as a factor of safety of the ship

The term integrated navigation bridge includes a number of possible combinations of devices and software designed specifically for needs of each individual vessel, which means that each integrated navigation bridge has its own specific characteristics. However, a number of devices is the same for each integrated navigation bridge and they are: computer processors and software, electronic navigation map with a database, display system, control systems, radar and the station for voyage planning [9]. The fact is that the integrated navigation system designed for the purpose of shortening the time required to fully analyze navigational situations, waiver from individual collecting of navigational information, and connecting all systems into one entity and displaying all necessary navigational information on one display, allowing the navigation situation that can be seen much faster and more accurately. The user must plan all elements of navigation that can be anticipated in advance prior to voyage.

Some integrated navigation systems are supplied with the possibility of automatic monitoring of navigation, that is monitoring of the course and speed according to voyage plan elements i.e. pre-marked route. If the system allows automatic monitoring of navigation, the navigation process is reduced to the intervention by the officers in case of deviation from the scheduled time for any reason, and monitoring of operation of the system itself and compliance with the condition of navigation situation. Therefore, it must be stressed that this modern technological system can not function properly without adequate management of the man even though it increases functionality, reliability, economy and safety. In order to support quality work of guard officers, collected information must be accurate and precise.

The introduction of modern ship automation is closely associated with a reduction in the number of crew members, so that very often on the bridge can be found only one guard officer. This situation is in many cases the causative factor in marine casualties and it is only partially regulated by the law American Institute of Classification American Bureau of Shipping, from ships being integrated into navigation system, requires an annual survey in which are confirmed operating instructions of a person in managing the ship in order to get the class OMBO (One Man Bridge Operation). However, the European classification societies do not support the system of tour on duty on the bridge where it is clearly indicated that the ship is managed by one man. Because of this, Det Norske Veritas has used labels which indicate that the ship is sometimes managed by one person and only in cases where it is not night, low visibility, passing through channels and straits, and in periods of heavy traffic. The guard officer may also be alone on the bridge if the working environment is adapted or designed and shaped for the work of one person, however, DNV is clear in requirements that integrated navigation bridge is to be designed and shaped in such way that if it is necessary, two guard officers manage the ship.

By such a performance of the bridge, are met requirements of International Maritime Organization (IMO) regarding the safety of the ship and integrated navigation bridge. However, as noted above, most ships are not of the same size and have not the same structure of the integrated navigation bridge, and very rarely we have a situation where the navigator is found on the ship on which the device assembly is completely the same as on the ship on which he sailed previously. Therefore some time is necessary for familiarization with devices through technical manuals and through getting instructions from officer from who takes over a shift. In the second case we have a situation where information obtained may not be accurate or are misunderstood, leading to wrong handling of the device and thereby are jeopardizing the safety. Therefore, it can be recommended to shipping companies to perform specific trainings in order to inform their staff on simulators and devices by which sailors will handle at every future employment.

All information and communication systems, which are used nowadays in marine navigation and determination f ship's position are close to perfection. However, it would be a serious mistake *to take* the technology as a perfect! However, it is unacceptable to ignore the human link in electronic navigational chain action-reaction [10].

4. CONCLUSIONS

In this paper is made an overview of factors affecting the safety of the ship, regardless of whether in question is the construction of the ship or the ship in navigation. Structural safety of the ship, regardless of the correct selection of materials and the correct calculation of all elements of her structure, would be very much affected in absence of quality technical monitoring. The monitoring must be present from the start of ship construction, i.e. from her design to the end of lifetime of the ship since the loss of ship 's structure strength would mean the loss of safety.

As much as we are nowadays witnessing the huge progress in all areas of technology, we must be aware no matter how precise it can be, it could not replace human perception as the man is the one who must constantly be on guard and to control the situation.

Knowledge and skills required for the use and maintenance of modern technologies must be large and to follow the technological development of systems. By the combination of modern training and standirzation of equipmency could be achieved higher safety

on board and reduced the risk of maritime accidents. For new generations of seafarers is indespensible the use of computers as for administrative purposes and as well in the performance of more accurate and safer navigation.
Regardless the factors that affect the safety of the ship, the most important link in the safety chain is a man since he by his eligibility should make adequate decisions in order to contribute to safety of the ship.

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BIOGRAPHIE

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RFID TECHNOLOGY USED FOR NUCLEAR CARGO SURVEILLANCE WITHIN SHIP'S STORAGE

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ABSTRACT

Radio Frequency Identification (RFID) is an incredibly fast-growing technology in the conditions of automatic data collection. Although the use of this technology for nuclear cargo management and control is widespread, it is only at its beginning stage. RFID systems have the potential to improve safety, unmanned surveillance reduction, access to real-time data and status of nuclear cargo during the entire transportation circle. The system consists of RFID transmitter powered by the battery, active sensors and stand-alone memory, network browsers, software application, database, internet connection and web page. Tags monitor and record the critical parameters, including the: temperature, humidity, status of the seal, subject movement and environmental conditions of nuclear cargo in real time. They also provide automatic warning or alarm if the nuclear cargo reaches alarming parameters. The information that the reader gets from the transmitter is sent to a special-purpose central database server, which can be accesses by the authorized operator at any time. Memory that is located within the reader stores the data read by sensors during storage, transportation and disposal of nuclear cargo. In the paper this technology has been basically considered in order to draw the attention to its importance to the safety of sea (and land) transportation.

KEY WORDS

RFID, safety, automation, data, sensors, nuclear cargo, monitoring

1. INTRODUCTION

RFID technology allows automatic identification and tracking of objects using radio waves. RFID system generally consists of tags (devices attached to objects that we want to monitor) and readers (devices that detect the presence of RFID tags and read information stored in memory unit via radio waves). Since the tags can operate at a considerable distance from the reader (and over 100 m), this technology differs greatly from the bar-code technology. It is now widely accepted and examples of its application can be seen in the supply chain ie. control and monitoring products, at the airports in tracking luggage, employees in companies, etc.
Over the past ten years a great effort have been put in the development of RFID tags for tracking nuclear cargo during its packaging, storage, transportation and disposal. The Nuclear Regulatory Commission has approved several models of RFID systems for monitoring and tracking of transport of nuclear material.

In the following sections of this paper a brief description of plutonium as hazardous nuclear cargo will be provided , as well as the most important characteristics of RFID tags for tracking and monitoring purposes transport of nuclear cargo, ie.plutonium by sea.

2. PLUTONIM IN BRIEF

Plutonium is a radioactive, metallic transuranic element, produced artificially by neutron bombardment of uranium, heaving 15 isotopes with mass ranging from 232 to 246 and half-lives from 20 minutes to 76 million years. It is a radiological poison, specially absorbed by bone marrow, and it is used, especially the highly fissionable isotope Pu 239, as a reactor fuel and as a key ingredient of nuclear weapons (in American Heritage Dictionary, 2nd edition).

Plutonium is a highly radio-toxic element, but not-existent in nature. It is produced in nuclear reactors as a nuclear reactors uranium fuel becomes irradiated – bombarded by neutrons – some of the uranium is changed into plutonium and it remains contained in the irradiated or "spent" nuclear fuel. In other words, plutonium is produced when uranium fuel is burnt in conventional nuclear reactor. In the case of military production reactors, the process of plutonium production is maximized, but all conventional nuclear power reactors produce it, as well. Thus, by reprocessing the used fuel, uranium (about 96%), plutonium (about 1%) and waste (about 3%) are commonly recycled.

Plutonium is an element that can be easily split to generate quickly large amounts of energy. Though, it is a valuable source of energy. An interesting comparison might be that one gram of plutonium, used in the conventional nuclear reactor, has the same energy value as two tons of coal. Accordingly, the nuclear power generating contributes to improving energy sufficiency and to the stability of energy supply, generally speaking. But, it is to be ensured that nuclear energy is used solely for the peaceful purposes, and under the safest possible conditions. Thus, the highest priority is to be placed on nuclear safety.
The rate of plutonium fission tends to increase with temperature. In other words, when temperature increases, so does the rate of fission, which further increases the temperature, and so one. This property of plutonium makes reaction harder to control and rise the methods of its temperature control to the high level of priorities during its handling and(or) using.
With the end of the Cold War, the real need for plutonium has decreased. However, the need for developing and upgrading plutonium handling techniques has increased. The prospects that the usage and transportation of plutonium irradiated nuclear fuel and radioactive wastes might be expected to continue for the foreseeable future, cause intense scrutiny in this domain during the recent years. Scientists and engineers are today intensively working to find scientific solutions for achieve as safe as possible (re)using, transporting, and(or) stabilizing, cleaning up, and preventing eventual excess and huge waste pollution. Controlling plutonium temperature is one of the most important issues belonging to the respected corpus of scientific and engineering efforts.

3. BRIEF DESCRIPTION OF RFID SYSTEM

RFID tags are designed in order to match any drum type packaging (as they are the most common type of package), ie. modifications of tags can be made considering the number of sensors that are needed for a nuclear cargo tracking and seals, screws, that is. Figure 1. shows the model tag, attached (screw) to a drum packaging. In the picture you can see how the tag is set to drum packaging and placed in a seal with the pressure sensor which is located beneath one of the two screws on the lid of the packaging. When the bolt is loosened, the change of forse affects the electrical resistance by activating the alarm that gives warming to the reader that one of the drum packaging is unsealed.

Figure 1. RFID tag attached to the drum type package of nuclear cargo

Figure 2. shows the inside of a tag wich supports various types of sensors such as: shock, temperature, moisture, seals, radiators, battery sensors, etc.. Figure 2. also shows a part of the batteries that feed the tag up to 10 years from the time of the installation to the desired drum packing.

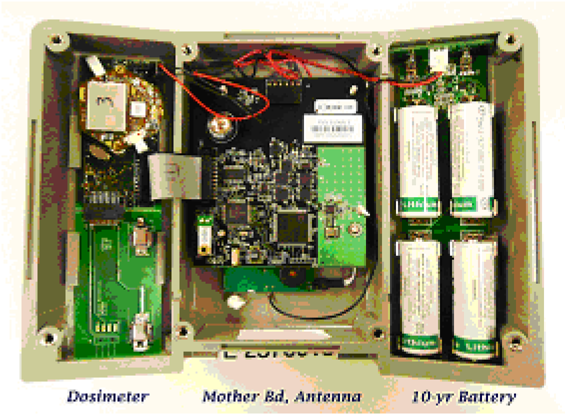

Figure 2. Interior of the tag

When the shock sensor is set to a large sensitivity,it can detect movement.Also, a GPS device that would give the operator information at any time where a certain packaging of nuclear cargo is positioned, can be set within the tag. Temperature sensor sends data to the reader via radio waves in the case of nuclear material exceeding the temperature limit.

Reader is placed inside of a storage vessel for the better range and communication with the tag. Range of the readers is over 100 m with an almost negligible deviation in the case of metal or water barriers.The reader communicates with a tag using UHF radio waves. If there are many packages of nuclear material inside the ship's warehouse, more readers can be set up for the better monitoring and tracking.

Figure 3. Reader with the computer where it is installed the appropriate software

4. SYSTEM OF MONITORING END TRACKING

Combining tags and readers is not enough to meet the requirements of management and monitoring of nuclear cargo. It requires a lot of factors that would complete a system to monitor the operating cycle of packaging for a nuclear cargo. Starting with the packaging, transportation, temporary storage at various locations to long-term storage and / or disposal site. All information gathered in the life cycle of packaging collected by RFID systems are kept in a central database. Data should be presented in a format that is easy for the authorized user to find and they are to provide a high degree of safety information.

Figure 4 shows the concept of RFID systems for tracking and monitoring in practice. This monitoring system is still developing. The ability and potential of this system has proven itself in tests that were carried out on road traffic. His concept of monitoring and supervision does not make much difference when it comes to maritime transport.

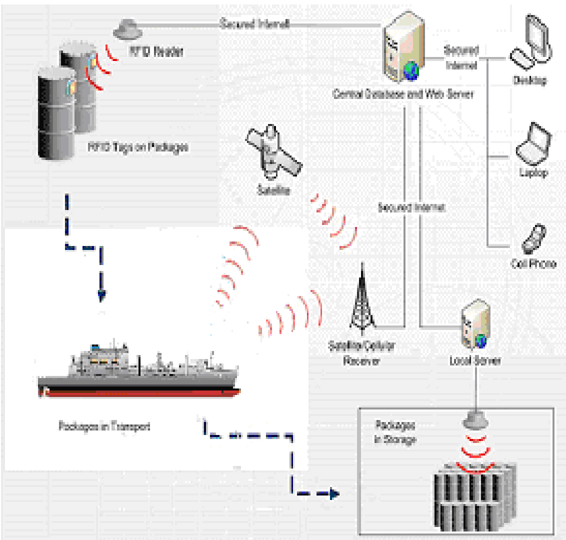

Figure 4. The concept of RFID systems for tracking and monitoring of nuclear cargo during sea transport

As illustrated in Figure 4. information about each package is collected and stored in internal tag memory. Information from the tag are transmitted to the reader via radio waves. The reader is connected to a computer via an ethernet network within the marine system. The computer can serve as a local server that manages multiple readers, and stores information within the network, or to transmit data to a central database server via satelite or cellular networks.
Central database and a dedicated server are located at a safe location, such as the backup server, which is independent of location. Server is used for database management and routine control of the ship's current position, ie. load, for better security and data integrity. Backups are periodically kept in the archives on the backup server, to optimize system reliability.

5. RFID SOFTWARE FOR MONITORING OF NUCLEAR CARGO

The software is a key part of the whole system. The software is installed on the control computer that is connected to the reader, which allows the reader to pull data from the tags. Users can also use the software to remotely change the settings on the tag.
Figure 5 gives an overview of the screen when the software is running. The circles on the screen are packages (top view) with tags.
Tags are programmed to activate the alarm and notify the user using the software in any alarming situations. The software also verifies the integrity of each tag in exatc intervals. The software automatically saves the readings from the tags in a local database computers. Database information can be easily viewed and forwarded further, if necessary.

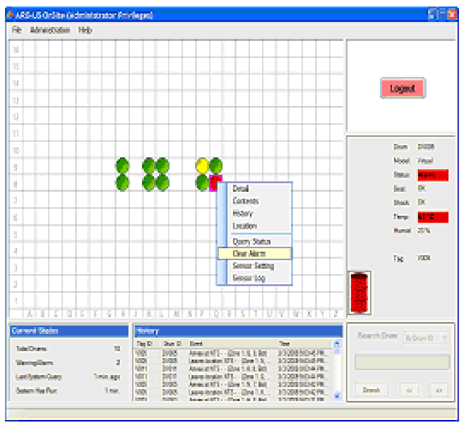

Figure 5. The appearance of the software for control and monitoring of nuclear cargo

Apart from reading data from sensors, by means of software, the user can enter data such as the content of the packages in the tag memory unit. The data stored on the tag are encrypted with 256-bit key (AES-256). User data is also stored in the local database in order to prevent accidental data loss. Software has the ability to send data from a local database to a remote server over the Internet, mobile or satellite network. Server shows all the data associated with each package separately on the website. If the sensors trigger the alarm, the software sends an email or text message to the operator. The operator using the software can access data where the drum package is currently located. This is especially important when transporting dangerous goods by sea. The software is connected to the GPS system within the tag, and during the accession of the software it uploads the last known position of dangerous goods, ie. the ship. With the software you can see the status of each drum package separately. Green colored circles mean that the nuclear material in the package is within normal limits. When the circle is yellow, the nuclear material inside the packaging is beginning to emerge from the limits of normal but not yet reached the critical parameters. If the circle is red, then some of the sensors: temperature, shock, humidity, radiation, etc.. are activated, and this may mean that changes in and / or drum pack reached values which are becoming alarming and may affect the security of cargo.

6. CONCLUSIONS

Although the RFID system for tracking and monitoring of nuclear cargo is still evolving there is no doubt that it will soon find its application in the maritime industry. This paper presents the principle of its potential for improving safety, safeguards, the reduction of human crews, providing information in real time and its overall efficiency.This type of monitoring is now of more interest and over the next few years it will certainly be adopted as standard for the control of nuclear cargo. In the future review articles on this topic, you should pay more attention to each sensor individually as well as methods of acquisition and distribution of relevant data, with the inclusion of an alarm system.

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BIOGRAPHIE

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2010 STCW Manila Amendments

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ABSTRACT

2010 Amendments of STCW Convention have to be implemented until 1st January 2017. New requirements have to be fulfilled by all subjects in maritime education process: administrations, companies, seafarers and educational institutions in line with implementation dates.

KEY WORDS

STCW. amendments. certification. education.

1. INTRODUCTION

STCW Convention (International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978) was adopted on 7th July 1978 and entered in force on 28th April 1984.

Latest amendments to STCW Convention were adopted at the Diplomatic Conference in Manila on 25th June 2010, marking a major revision of the STCW Convention and Code. The 2010 Manila Amendments have entered into force on 1st January 2012.

Unlike the traditional educational systems and standards, based on theoretical knowledge, these amendments further emphasize the competence standards, the specific skills that seafarers should obtain not only in classrooms but also through on-board training and using approved simulators.

2. 2010 STCW MANILA AMENDMENTS IMPLEMENTATION

Transition period for the implementation of 2010 Manila Amendments has commenced on 1st January 2012 and has to be completed by 31st December 2016 by all Member States parties to the convention. That means that by 1st January 2017 all seafarers have to be in possession of the new STCW certificates issued in compliance with new amendments.

For all seafarers, from masters to seamen, that brings new additional education obligations, new examinations, and naturally additional expenses if they intent to continue sailing after 1st January 2017.

Unfortunately, many masters and officers will have to learn more or less the same again, like it was in the case with the ISPS certificates that were not issued according to the STCW Convention.

This time it may be the case of Bridge Team or Bridge Resource Managements and ECDIS training certificates that they have obtained from various institutions, and which could not have been in compliance with the new 2010 Manila Amendment requirements and approved by administrations.

2.1. Amendments

The most significant amendments included in 2010 Manila STCW Amendments, as per IMO web pages, are:

- Improved measures to prevent fraudulent practices associated with certificates of competency and strengthen the evaluation process (monitoring of Parties' compliance with the Convention);
- Revised requirements on hours of work and rest and new requirements for the prevention of drug and alcohol abuse, as well as updated standards relating to medical fitness standards for seafarers;
- New certification requirements for able seafarers;
- New requirements relating to training in modern technology such as electronic charts and information systems (ECDIS);
- New requirements for marine environment awareness training and training in leadership and teamwork;
- New training and certification requirements for electro-technical officers;
- Updating of competence requirements for personnel serving on board all types of tankers, including new requirements for personnel serving on liquefied gas tankers;
- New requirements for security training, as well as provisions to ensure that seafarers are properly trained to cope if their ship comes under attack by pirates;
- Introduction of modern training methodology including distance learning and web-based learning;
- New training guidance for personnel serving on board ships operating in polar waters; and
- New training guidance for personnel operating Dynamic Positioning Systems;
- New regulations concerning near-coastal voyages.

According to revised regulations three types of documents will be issued to seafarers:
1. "Certificate of Competency" - Main Certificates of Masters, Officers and GMDSS Radio Operators in accordance with the provisions of chapters II, III, IV or VII and entitling the lawful holder thereof to serve in the capacity and perform the functions involved at the level of responsibility specified therein;
2. "Certificate of Proficiency" - for other Modular Course Certificates including Ratings and e.g. , Ship Security, Proficiency in Survival Craft and Rescue Boats, Advanced Firefighting, Fast Rescue Boat, Medical Training etc., stating that the relevant requirements of training, competencies or seagoing service in the Convention have been met;
3. "Documentary Evidence" – all other documents that are not the "certificate of competency" or the "certificate of proficiency", used to establish that the relevant requirements of the Convention have been met.

As per regulations I/2 i I/10 of the new STCW Convention, all certificates have to be endorsed by administration. There are two types of the "endorsements":

1. Endorsement by which an Administration recognizes under regulation I/10 a certificate of competency or a certificate of proficiency issued to masters and officers in accordance with the provisions of regulations V/1-1 and V/1-2 to attest its recognition only after ensuring the authenticity and validity of the certificate;
2. Endorsement by which an Administration recognizes "Certificate of Proficiency" issued by another administration according to STCW Convention only after verification.

Certificates of Competency and endorsements may be issued only by Administration - thereby reducing the possibility of fraudulent practices associated with issue of certificates of competency, and all Administrations have to maintain electronic database for verification of authenticity.

The format of certificates is not mandatory defined. The mandatory information that has to be included in the certificate is prescribed allowing the Administrations to use different forms in a more rational manner if they decide to simplify the lives to the seafarers.
The master and the company have to ensure that the crew members are properly rested for duty and watch, and that records of hours of work and rest are properly maintained, and for watch keeping schedules.

2.2. Requirements for Seafarers

All crew members, regardless of their rank and certification, have various requirements to fulfill in order to be properly certified until the full implementation of 2010 Manila Amendments. The requirements can be described as:

- Attending additional education for subjects as Bridge and Engine Recourse Management, Leadership, Teamwork, ECDIS, IAMSAR, VTS, IMSBC, SMCP, High Voltage, etc.;
- Attending additional education for Basic Safety and Ship Security;
- Attending additional education for advanced safety subjects;
- Obtain “Able Seafarer” certificates for “Deck” or “Engine” if and as required;
- Obtain the “Electro-Technical Rating” or “Electro-technical Officer” certificates if and as required;
- Obtain new certificates for different ship types such as passenger ships and tankers, and finally:
- Revalidate certificates in accordance with 2010 Manila Amendments;

2.3. Requirements for Companies

As per Regulation 1/14 of the STCW Convention, which includes a new requirement, all companies must ensure that:
• seafarers have received refresher and updating training as required by the Convention; and
• at all times on board ships operated by them, there shall be effective oral communication in accordance with chapter V, regulation 14, paragraphs 3 and 4 of SOLAS 74, as amended.

2.4. The most important amendments in brief

According to the new regulations from 1st January 2014, all seafarers will have to be trained and certified in security matters which include new anti-piracy elements in three different levels:

- Security-related familiarization training;
- Security-awareness training, and
- Training for seafarers with designated security duties for seafarers having specific duties defined in Ship Security Plans.

The regulations introduce the separate basic training for crew serving on tankers and they will be required to obtain a:

- certificate in basic training for oil and chemical tanker cargo operations (A-V/1-1-1), and
- certificate in basic training for liquefied gas tanker cargo operations (A-V/1-2-1);

Masters, chief engineer officers, chief mates, second engineer officers and any person with immediate responsibility for loading, discharging, care in transit, handling of cargo, tank cleaning or other cargo-related operations on tankers remain the same and they will need to have a:

- certificate in advanced training for oil tanker cargo operations (A-V/1-1-2),
- certificate in advanced training for chemical tanker cargo operations (A-V/1-1-3), or
- Certificate in advanced training for liquefied gas tanker cargo operations (A-V/1-2-2).

As per Regulation V/2 Mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on passenger ships the new certificates will be valid both for passenger and RO-RO passenger ships.

Also new is the requirement for maintaining a Training Record Books not only for officers but for the ratings as well.

Seafarers will be required to undertake appropriate refresher training or be required to provide evidence of having achieved the required standard of competence at intervals not exceeding five years for:

- safety familiarization, basic training and instruction for all seafarers;
- crisis management and human behavior;
- passenger safety, cargo safety and hull integrity;
- crowd management;
- proficiency in survival craft and rescue boats other than fast rescue boats;
- proficiency in fast rescue boats;
- advanced fire fighting

2.5. 2010 STCW Manila Amendments important dates

The transition period of the implementation of the 2010 STCW Manila Amendments started by 1st January 2012 by entering in force of the amendments, but the whole process of implementation has to be completed by 1st January 2017 and by that date seafarers need to obtain all required certificates complying with the new regulations.

The most important dates during this period of transition by which the particular requirements has to implemented are:

01.01.2012. - The new STCW Convention entered in force;
01.07.2013. - From this date all training has to be carried out in accordance with the new requirements;
01.01.2014. - Until this date all seafarers have to obtain certificates for security training;
01.01.2017. - All seafarers on board ships have to have all certificates, including medical, issued in accordance with the 2010 STCW Manila Amendments.

During transition period the administrations may continue to issue certificates in accordance with the regulations in force prior 1st January 2012 but with limited validity until 31st December 2016.

2.6. Port State Control (PSC)

PSC Officers will accept as valid the certificates issued in accordance to the old regulations until 31st December 2016, except Security Certificates that has to be in compliance with new regulations from 1st January 2014.

The only requirement that will be verified according the new regulations from 1st January 2012 by PSCO are the requirements for Hours of Work and Hours of Rest that have been amended in line with MLC 2006 as follows:

- Minimum of 10 hours of rest in any 24 hours period; and
- Minimum of 77 hours of rest in any period of 7 days.

The requirements are related to watch and security personnel, watch keeping schedule and records of hours of rest. When MLC 2006 enters in force similar requirements will be related to all crew members.

The following requirements have to be complied with on PSC inspection:

- The ship has to have valid Minimum Safe Manning Certificate;
- All crew members must have on board valid and original certificates, including medical, in accordance with the statements in the Minimum Safe Manning Certificate;
- The records of hours of rest and work have to be maintained and up to date;
- Muster List has to be up to date and properly posted;
- Watch keeping schedule has to be up to date and properly posted.

PSC Officers have the right to verify the competences and proficiencies of crew members for their ability in fulfilling their duties in relation with the security, environmental protection and safety in cases of clear grounds prescribed by the convention.
In the cases of serious deficiencies the vessels may be detained in port of inspection.

The company and the master are responsible for compliance with the requirements of the new convention, and States, parties to the convention, are obliged to prescribe the penalties.

3. CONCLUSION

STCW convention has standardized education, training and certification of all seafarers in the world regardless of their nationality, and enabling their employment on ships of any flag by the system of recognition of certificates.
New regulations also improve the measures to prevent fraudulent practices associated with certificates of competency and strengthen the evaluation process and monitoring of Parties' compliance with the Convention.
For the seafarers the new requirements mean new training time and expenses.

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BIOGRAPHIE

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MARITIME ACCIDENT INVESTIGATION AND RISK ASSESSMENT DATA WITH THE REVIEW OF THE COSTA CONCORDIA CASE

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ABSTRACT

The use of risk assessment requires availability of maritime accidents reports data, but also "Near-Miss" cases and "Best (Safe) Practices" solutions in order to properly identify the risks, assess their probability and consequences, and determine safeguards. The amount and the quality of the data available should be improved by implementing the "Just Culture" and "Open industry" in the maritime world in order to share information about all such cases that have happened around the world.
The size of ships today makes the accident consequences untolerable due to high number of possible casualties and high costs of salvage, if salvage is possible at all, and clean-up operations, as more and more ships has to be demolished on the site of the accident due to their sizes.
Therefore, it is of great importance to improve the error prevention, and one of the best available sources are the data that should be collected and made available by sharing reports not only about accidents, but also about "Near-Miss" cases and "Best Practices" solutions.

KEY WORDS

Maritime Accident Investigation. Risk assessment. Near-Miss. Best (Safe) Practices.

1. INTRODUCTION

IMO adopted amendments[1] to SOLAS Chapter XI-1, MSC 84th. session in May 2008, in force from 1 January 2010, making mandatory parts I and II of the new Code of International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code). Part III of the Code contains related guidance and explanatory material.

This ammendments expand requirements by International Maritime Conventions for Administrations to undertake to conduct an investigation of any casualty occurring to any of its ships when it judges that such an investigation may assist in determining what changes in the present regulations might be desirable or improving safety at sea, but mandatory in all very serious and serious accidents causing loss of life or serious injury or serious damage to ships or to the marine environment.

The findings of this investigation should be reported to IMO and made public[2].

EU has adopted directive[3] 2009/18/EC on the fundamental principles governing the investigation of accidents in the maritime transport sector and introduced the obligation of the Member States to send a copy of the reports to the European Commission and publish them. IMO and EU have set up a electronic databases, GISIS and EMCIP, containing data from received accident investigation reports.

2. MARITIME ACCIDENT INVESTIGATION

The Flag and Coastal State right and the obligation to investigate the maritime accidents was already included in the most important maritime conventions, like SOLAS, LOAD LINE, MARPOL, and UNCLOS, and the adoption of the above regulations indicate the importance of the availability of accident data to the improvement of the safety at sea and the need to improve the current investigation conduct standard practices by the Administrations[4].

Republic of Croatia has implemented the above regulations by amendments to the Maritime Code Law and new regulations on investigation of maritime accidents. The accident investigations should be carried out by accident investigations agency[5].

Risk assessment has been made mandatory by the amendments[6] to the ISM Code in force from July the 1st 2010.

Formal Safety Assessment[7] (FSA), as part of IMO rule-making process, was adopted in 2002, with the goal to ensure that action is taken before a disaster occurs, unlike the more common practice in the past that the new regulations are adopted as a consequence or answer to the serious accidents. We can remember "Titanic" or "Estonia" only as examples of the reactive regulatory approach.

FSA is used to evaluate proposals for new regulations or to compare proposed changes with existing standards enabling a balance to be found between the various technical and operational issues, including the human element, and between safety and costs of implementation of the new rules, as "a rational and systematic process for assessing the risks associated with shipping activity and for evaluating the costs and benefits of IMO's options for reducing these risks[8]."

FSA consists of five steps:

1. identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes);
2. assessment of risks (evaluation of risk factors);
3. risk control options (devising regulatory measures to control and reduce the identified risks);
4. cost benefit assessment (determining cost effectiveness of each risk control option); and
5. recommendations for decision-making (information about the hazards, their associated risks and the cost

effectiveness of alternative risk control options is provided).

The results of the maritime accident investigations contribute to the effectiveness of FSA in the steps 1, 2, 3, and 5, as it is clearly visible when these steps are reduced in simple terms as on IMO web page:

1. What might go wrong? = identification of hazards (a list of all relevant accident scenarios with potential causes and outcomes):
    a. can be found in accident investigations reports, as causes and consequences of maritime accidents, and Near-Miss reports;
2. How bad and how likely? = assessment of risks (evaluation of risk factors):
    a. can be assessed from statistical data of same or similar risks and by competent analysis of all available data from accident investigations;
3. Can matters be improved? = risk control options (devising regulatory measures to control and reduce the identified risks):
    a. can be found in the safety recommendations in all properly conducted maritime accident investigation report, as well as Best (Safe) Practices and Near-Miss reports;
4. What would it cost and how much better would it be? = cost benefit assessment (determining cost effectiveness of each risk control option);
5. What actions should be taken? = recommendations for decision-making (information about the hazards, their associated risks and the cost effectiveness of alternative risk control options is provided):
    a. can be found in the safety recommendations as well.

Therefore, maritime accident investigation and risk assessment have become the necessary steps for improving safety at sea also contributing to the efforts that action is taken before accidents happen, as a part of proactive regulatory approach, as FSA is based on the analysis of all available and relevant data about maritime accidents, but data from Near-Miss reports and Best Practices can be a valuable source of information and knowledge.

Without speculating into what caused the Costa Concordia case, I have to ask myself what measures could be taken in order to prevent this accident?

2.1. Accident investigation methods

IMO Casualty Investigation Code, (MSC 84/24/Add.1, PART I, 2.12.5) requires that a marine safety investigation contains an analysis and comment on the causal factors including any mechanical, human and organizational factors, not only the active error that triggered the accidents.
Most of the investigation methods are based on The Reason Model[9], also known as Swiss Cheese, and categorization of errors as Active or Latent Errors.

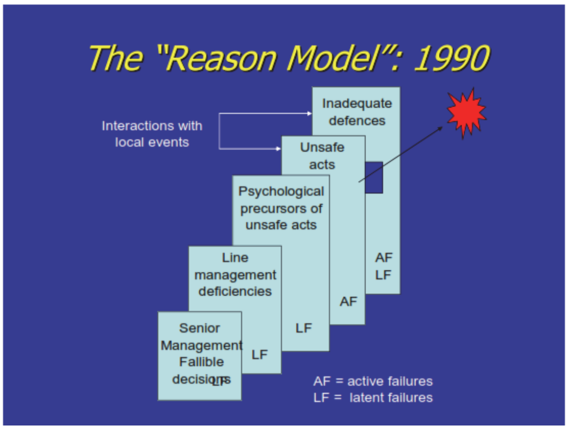

Figure 1: The „Reason Model 1990“

Later version of the “Reason Model”:

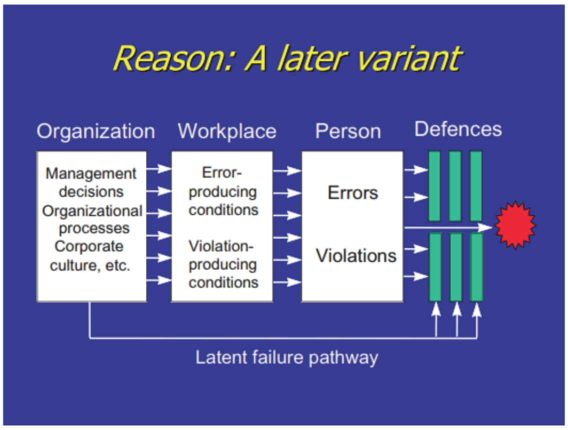

Figure 2: The later variant of the „Reason Model“

The most important conclusion of all worldwide researches into errors and investigation methods is that the active error is not only result of the operator acts, but also the result of accumulated latent errors in the systems, and that the human element is the most important part of the safe work and error prevention.

Every system consist of at least this components:

- Regulatory framework
- Organization and management
- Hardware (Construction and equipment including maintenance)
- Procedures and instructions
- Workplace conditions
- Operator capability (education and training)

Latent errors in any component may remain hidden for years until an active error occurs as an accident waiting to happen.

What could have been the latent errors in case of Costa Concordia?

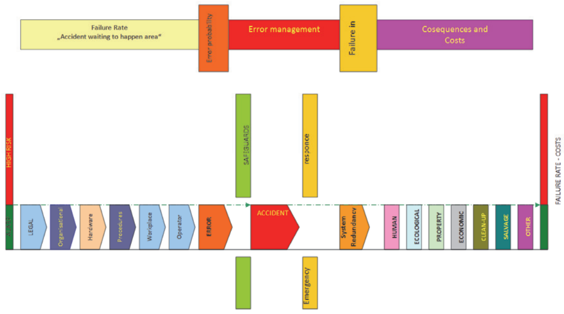

Figure 3: All Errors in ALARP range.

In case that all areas are in ALARP range the possibility of accident is acceptable.

In case of Costa Concordia the above diagram may look like this:

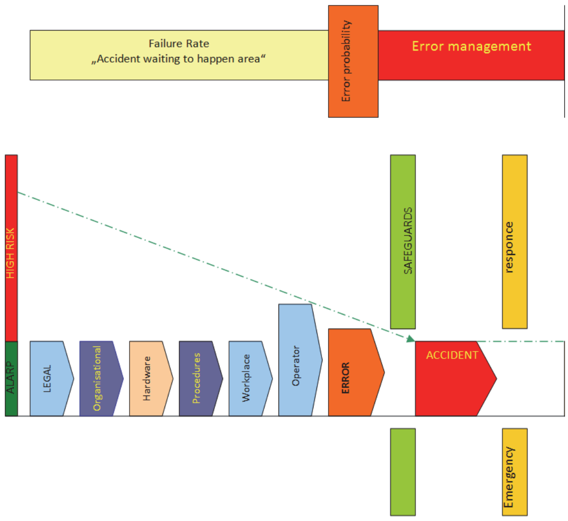

Figure 4: Operator Error over ALARP range.

We can see how the increase in failure rate of any component in the system above the ALARP range makes the increases the probability of error and accident indicated by the angle of the arrow.

Investigation results of the case will, as they always do, determine some latent errors in all areas, at least as possibilities for improvement, so the picture may look like this:

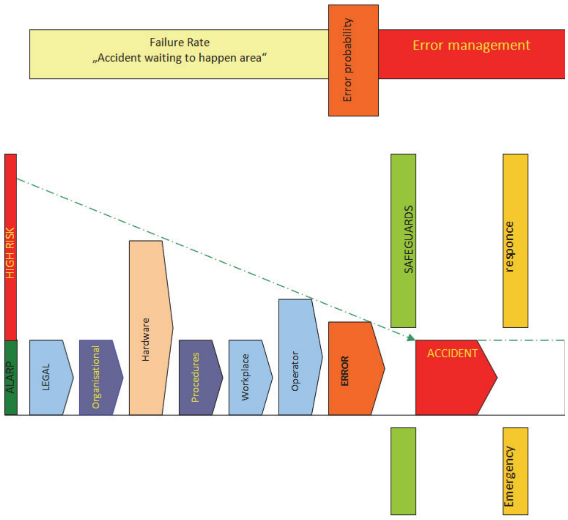

Figure 5: Hardware and Operator Error over the ALARP range.

Following the old saying: “The chain is as strong as its weakest link”, we can conclude that no effort in the lower level component can reduce the risk of accident due to the errors in the higher level component, only the effective barriers of the error prevention.

Using the same tragic case again, if the error was in the hardware, construction of the ship water tightness system, the risk of the damage that have actually occurred could not be reduced by operators actions, but only triggered by operators error. If the vessel could sustain such the damage, she could at least be towed to the port big enough to accommodate the ship of such size.

At this moment we can not speculate on the scope of the damage, as much as it reassembles the Titanic, but it is an accident that should not have happened.

Is the complete loss of power and multiple compartment flooding acceptable?

2.2. Non-Conformities, corrective and preventive actions, Near-Miss and Best (Safe) Practice

Company has to implement the procedures ensuring that non-conformities, accidents and hazardous situations are reported to the Company, investigated and analyzed with the objective of improving safety and pollution prevention, and establish procedures for the implementation of corrective action, including measures intended to prevent recurrence[10].

In so called "Just Culture" organization[11] a large number of such cases will be reported, but in "Blame Culture" organizations, most of these cases will remain unreported, possible corrective or preventive actions will not be implemented, and hazardous occurrence may easily happen again, unnoticed until it becomes an accident that can not be hidden.

Unfortunately, a maritime industry is still a "closed type" industry in which the information are not shared with others. Many cases remain not reported even to the company, companies do not report all such cases to the class, insurer or administration. At the same time the companies, recognized organizations, insurers and administrations do not share information between themselves. Available data is censored, subjective, and almost always un-auditable[12].

The available near-miss data is very often submited anonymously for the fear of consequences by the crew, and as such published on the web. There are very few sources of such reported data to be found (Denmark, US, Mars etc.), that give the cases and solutions, like Safe Practices, although these would be very valuable to all, particularly to the seamen on board when conducting the risk assessments and determining the safeguards to take any task on board, but also to the companies for the improvement of the ISM systems and administrations for proactive regulatory work.

Imo has issued Guidance on Near-Miss reporting to promote a no-blame culture and to encourage reporting of near-misses so that remedial measures can be taken to avoid recurrences[13], trying to initiate not only reporting, but also the continuous improvement in safety management systems by implementing remedial measures and sharing such experiences and findings between all parties in the maritime industry.

It is not possible to conduct proper risk assessment if it is based only on personal experience, or only on cases that have happened within one company, even within one flag fleet.

There was one master that had no cases in all his sailing history, until ..
Was the master of Costa Concordia another?

Importance of Near-Miss reporting can be better understood if we analyze the Heinrich triangle ratio[14]:

Heinrich Ratio

Heinrich Ratio

Fatal Accident	1
Non-Fatal Accident	10
Reportable Incident	30
Unsafe Acts	600

Figure 6: Heinrich Ratio Accident – Near Miss

If we take a Near-Miss as an accident without consequences, there could have been up to 600 missed opportunities to implement the safeguards against the accident occurrence that remained unreported.

This is the area of improvement available at relatively small extra cost, but not yet made mandatory, other then within company. This is the knowledge and experience wasted unless used.

Could the Costa Concordia case be avoided if it was reported as a non-conformity or near-miss:
-Unauthorized deviation from voyage plan?
-Approaching dangerously close to the shore with one of the largest passenger ships in the world?

2.3. Emergency preparedness

The company[15] is obliged by the ISM Code to:
".2 assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards; and
.3 continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection."
Also[16]:
".5 procedures to prepare for and respond to emergency situations;"
And finally:
"8 EMERGENCY PREPAREDNESS
8.1 The Company should identify potential emergency shipboard situations, and establish procedures to respond to them.
8.2 The Company should establish programs for drills and exercises to prepare for emergency actions.
8.3 The safety management system should provide for measures ensuring that the Company's organization can respond at any time to hazards, accidents and emergency situations involving its ships."

On paper, Costa Concordia had all these requirements fulfilled.
Why the response action was not successful?
Can we expect from the man that has just made one of the greatest errors in maritime history to properly command and coordinate the rescue operations?

The main point is that the crew did well even without command and coordination, and that is the best indicator that no technical invention will replace the human element drills and training. Evacuation of 4000 souls has never been tried before. This time there was not so much panic between passengers, they could see the shore, there was no wind or sea. The crew has done theirs duties as well as could be expected, and there was plenty of time, the vessel never sank.

If we divert ourselves from actions of the master, those will be investigated thoroughly by all administrations and the court, one of the main problems was the damage sustained that was greater then it was assumed probable, and the vessel could not be saved as there was no redundancy left.

I don't like to think what could have happened if...., but the problem remains: too much people in too little space in emergency, even if all LSA equipment is in perfect order as it was on Costa Concordia.

After saving people, then next step is saving the ship and environment.

What could be done by coastal state in such a case?

The ship is too big and there is no possibility to even try to do any salvage operations.
Even now when the ship is grounded, there is no ready solution to salvage the ship, and it may eventually prove that it will be more economic to break the ship on site then to try to salvage her.
These extra large ships leave no possibilities of salvage, and even if someone try, like it was the Napoli case, it may prove to be more costly then ship and cargo loss.
So we may ask our self how big is too big?

Emergency preparedness may be the final barrier against the consequences, but in cases like Costa Concordia damage there was no response action available to prevent the catastrophic consequences, other then abandon ship, as all system redundancy has been lost:

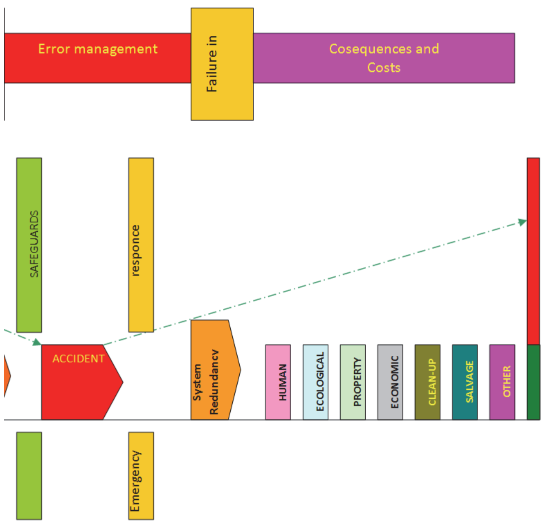

Figure 7: System Redundancy over ALARP range.

Once that the barriers are breached, but also that the system redundancy is lost, all the consequences may fall far beyond ALARP range, actually the costs in lives and damages can be unlimited and catastrophic, as indicated by the angle of arrow.

Organizationally the system had enough redundancy so the crew were able to evacuate the passengers, even if the error occurred in the command system.
But, hardware redundancy was lost completely by the damage sustained.
We don't have enough information to speculate if any of the regulations was not complied with, and how many compartments were flooded, but the ships will never be built strong enough to sustain any damage, only probable damages.

If we look at statistical data only, this damage may be extremely remote, even less likely to occur once in the lifetime (20 years) of a world fleet of 5000 ships, and in the Risk Matrix[17], such risk may be classified as "Negligible" or "As Low As Reasonably Practicable (ALARP)" and no safeguards are normally required.
Unfortunately, in history many kinds of damages were not assumed as probable, and yet they happened.
Titanic, Andrea Doria to name the most famous cases.

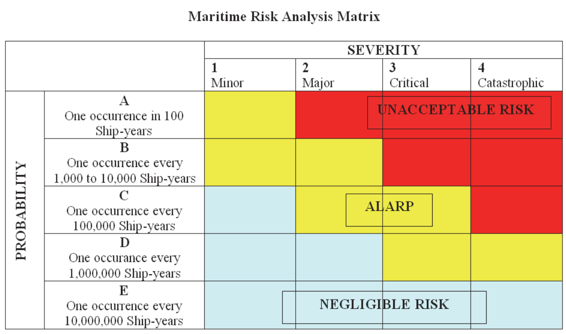

Figure 8: Maritime Risk Analysis Matrix

In cases of the low probability risks we should not ignore catastrophic consequence regardless of the probability, as it is suggested in most of the Maritime Risk Assessment Guidelines[18], such as ABS, GL and others, particularly in case of large passenger ships, and the Risk Acceptance Criteria[19] should be based more on the consequences.
We have new rules for new passenger ships already in place.
Are they effective against such damage?

2.4. Ship size and consequences

There is an old saying between seamen that said it all: "Big ship - Big problem".

When we consider the consequences of an accident with the big ship we can not avoid the size and number of passengers as a factor.
In order to safety evacuate thousands of passengers the emergency preparedness must be almost prefect, and we know that nobody and nothing can be perfect and the value of crew competence in this matter can be achieved only by education, drills and training.
But in order to assist the biggest ships in trouble there is no stand-by arrangements. Even the towing of these extra large ships is not a simple and safe operation.
"Napoli", "Rena" and now "Costa Concordia" size makes re-floating after grounding a mission impossible and extremely costly.
We have already the case of "VALE" bulkers, one suffered damage in loading port, others are denied permission to enter Chinese ports on the ground of the their size.
Every port has its limits and every coastal state has its own limited capabilities to intervene and assist in case of accident, and that is another factor to consider when conducting the risk assessment, because the part of emergency response is the available help in case of error and accident that may significantly reduce the consequences.

Are we close to the day we have to ask ourselves "How big is too big"?

The final diagram of the Costa Concordia case could look like this:

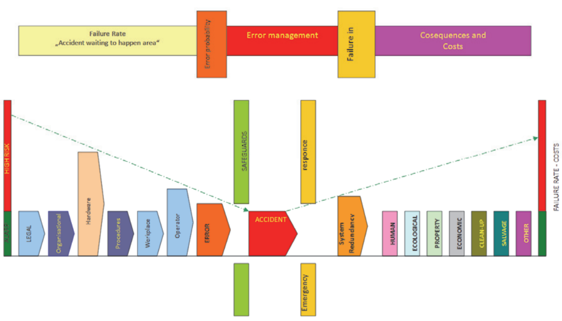

Figure 9: Possible „Costa Concordia“ Errors Range

We can see that all cost may be much higher then ALARP assumed.
Every item can have its own scale, this is only to indicate how the failure in one level can increase the risk of error and accident, and how the failures in emergency preparedness and inadequate redundancy can increase the costs in human lives, in ecological damage, in clean-up and salvage operation, and finally others costs like claims by passengers.

So the Risk Matrix, indicating that the ultimately catastrophic costs should be taken into account, no matter how unlikely to happen, would look like this:

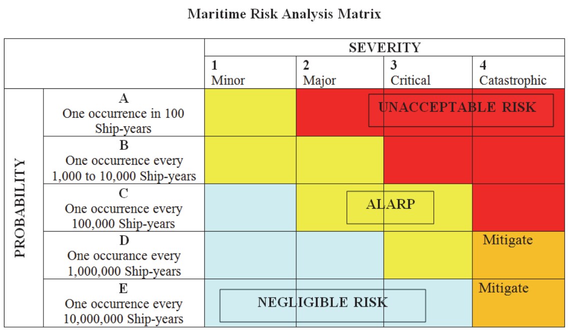

Figure 10: Maritime Risk Analysis Matrix using all Catastrophic Consequences as „Not Acceptable“

When we make the risk assessment we have to look on the other side, what happens after an error occurs, and after an accident happened, in order to estimate the possible consequences of the given risk and determine the measures that could prevent the error at the first place.

If the costs of salvage are to big due to ships size, even if system has enough redundancy there is no way to keep this costs in ALARP zone other then error prevention. The data that could be collected and analyzed from Near-Misses Reports and shared Best Practice solutions is one of the most effective ways of error prevention and the means to improve risk assessment and Safety Culture in maritime industry.

The only way to achieve this is to make the maritime industry an "Open Industry" in which all data, not only from accidents, are published and shared, and "Just Culture" is implemented at all levels.

3. CONCLUSIONS

To improve the Safety Culture in maritime transportation system it is necessary to replace the "Closed Industry System" and "Blame Culture" with an "Open Industry System" in which "Just Culture" is implemented in order to improve reporting at all levels, ensuring that all information about accidents, near-misses and Safe Practices are reported and shared among all interested sides, starting from seamen to Administrations, and then it will be possible to carry out continuous assessment of current practices and risk assessments with more accuracy, resulting in improvement of safety and proactive regulatory process. Such data should be published, categorized and easily searched.

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BIOGRAPHIE

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TRANSPORT OF DANGEROUS SUBSTANCES IN SPECIFIC TERMS SPECIALIZED AGENCIES

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ABSTRACT

Transportation of hazardous substances can be done with various forms of transportation and the quality is determined by appropriate legal regulations. However, the transportation of hazardous cargo specifically, is significantly different from other modes of transportation. This paper aims to present some features in the transport of dangerous goods for this particular specialized service which could be used for the military, police, scientific research institutions, energy and other economic activities. The military component of NATO and all the corresponding parameters, for example, has means of transport, types of hazardous materials (packaging, marking, labeling), safety requirements, organization and control procedures during transport across national borders and more. Similar modes are used in most militaries.

KEYWORDS

dangerous substances, transport, specific conditions, safety, supervision.

1. INTRODUCTION

The purpose of this paper is to contribute to defining standards in operational, procedural, substantive and technical areas. It also proposes measures for their implementation. It would be good to put in writing thorough instructions for internal and international transport of hazardous cargo, military ammunition and explosives in maritime transport. Adherence to certain principles would significantly increase the security of transportation of hazardous cargo, military ammunition and explosives in the maritime and other types of transport. The definitions listed in this paper have been agreed at international level and are used according to the International Maritime Dangerous Goods Code (IMDG Code) for all classes of hazardous substances. Principles of agreement, segregation and transportation of hazardous cargo on board are contained in the IMDG Code of first class substances (ammunition and explosives).

Hazardous substances, during production, transportation, processing, storage or use in technological processing, release or produce infectious, irritant, flammable, explosive, corrosive, suffocating, toxic or other hazardous dust, fumes, gases, mists, or fibers as well as harmful radiation in quantities which could endanger life or human health, material goods and the environment to a greater or lesser distance from buildings where they are located.

A wide range of hazardous and noxious substances are produced daily and are used by different industries. These substances are used in production of medicines, agricultural pesticides, fertilizers, paints, varnishes, polymers, detergents, artificial fibers, propulsion and rocket fuels, in the food industry, electrical industry, metallurgical industry, cosmetic industry, mining, research laboratories and medical industry, to name a few.

There are about eight million different known chemicals, of which about a thousand are used daily. In addition to petroleum, petroleum products, liquefied gases, other hazardous substances encountered in maritime transport such as: explosives, acids (hydrochloric, sulfuric, nitric, phosphoric, hydrofluoric, and others), alkalis (sodium, potassium, ammonium) salts (cyanides, sulfides, hypo chlorides), elements (chlorine, sulfur, zinc, aluminum powder), other inorganic substances (arsenic carbides), alcohols (phenol, methanol, ethanol, propane, butane, glycol), esters (atilacetate, butyl acetate, metilacetate, piralen).

Hazardous substances are cited in various International Maritime Organization (IMO) conventions and codes. This includes oil and other liquid substances defined as hazardous and harmful, liquid substances with a flashpoint below 60º C., threatening and harmful substances, which are packaged and labeled as solid bulk hazardous chemical properties. It also includes the remnants of the previously transported hazardous and noxious substances different from those in packaged form. Hazardous substances may be in bulk and in packaged form, as defined by the International Maritime Dangerous Goods Code (Tadic, 2012.).

Transportation of hazardous substances, in organizational and technological terms, puts at risk persons who come into direct or indirect contact with them. Areas in which dangerous substances are produced, stored, tranship or surface on which they are conveyed or transferred is constantly exposed to the dangers of pollution, contamination, fire, explosion, poisoning and radiation. On the other hand, people who handle hazardous materials or participate in their transport are constantly in danger of injury, damage to health or are in lethal danger.

In each case, hazardous substances in marine traffic represent a risk to humans and the environment. Protection and security of transportation is becoming a serious dilemma to the general public. During handling, loading, transporting and unloading of hazardous substances, there are many potential hazards that could cause an accident (explosion, pollutant and other hazardous chemicals leakage into the sea, various environmental and biological threat, and similar). Therefore, it is very important to inform all participants in transportation and handling hazardous substances of possible causes of accidents and required safety procedures in transporting hazardous substances. Knowing the possible dangers and hazards in improper handling, loading, unloading and transporting, and taking

appropriate safety measures, reduces the possibility of environmental disasters and various other damages. This reduces the possibility of personal injury, personnel fatalities, loss of or damage to property, contamination and pollution onboard ships that transport hazardous and noxious substances.
On 01 April 2009., the Republic of Croatia became a full member of the North Atlantic Treaty Organization (NATO), which has twenty-eight member nations. Membership in NATO changes a nation's independent defense system to a collective defense system and security based on the principles of equality, solidarity and risk sharing as a member nation.
NATO is obligated to participate in conflict prevention, crisis management and crisis response. NATO considers a crisis situation as political, military, or humanitarian, which may be caused by political disputes, armed conflicts, technological incidents or natural disasters (NATO Handbook, 2006.). Support for military forces includes implementation of tasks for Crisis Response Operations (CRO). These forces are only one element in the system with the exception of military skills which includes effective consultation, crisis management and civil emergency planning in terms of response to emergencies.
The Croatian Armed Forces, as well as the military component of NATO's armed forces are proactive in preventing and resolving crises, and protecting the security during participation in humanitarian operations and activities in a disaster.
Transportation of Dangerous Goods by naval vessels of Croatian Armed Forces plan to standardize a regular and indispensable task that involves the timely and safe supply of dangerous goods (fuel, oil, ammunition, and other devices explosive combat load) by the Croatian Armed Forces on home territory and abroad. Therefore, one of the goals of the Croatian Armed Forces is to plan modernization of existing naval vessels with funds allocated for the implementation of tasks for maritime transport of hazardous cargo and to conduct a feasibility study to build a multipurpose logistics vessel.

2. TRANSPORT MEANS FOR NATO ALLIANCE AMMUNITION AND EXPLOSIVES

Logistics draws on the science of planning and execution of movement and maintaining power, which applies to:
- design and development of storage, transportation, distribution, maintenance, removal and disposal of materials,
- transportation of personnel and military equipment,
- construction, maintenance and use of facilities and their disposal,
- providing support services as medical and health.

In any case, this includes logistics and transportation of hazardous substances, first of all ammunition, explosives and explosive devices. These activities are defined in the AASTP-2 manual for the transport of military ammunition and explosives (NATO Manual, 2004.). This publication defines the operational, procedural, financial and technical standards for the transportation of hazardous substances. The manual stresses the importance of documentation required for internal and international transport of munitions and explosives of all types of transportation. The manual states general principles that apply to all modes of transportation and contains simplified requirements for particular types of transport (road, rail, air, sea and inland waterways). Adherence to these principles should increase the security of transportation of dangerous goods.
The AASTP-2 provides basic instructions for national and international transport of military ammunition and explosives in maritime transport. AASTP-2 established the principle of security of transport of dangerous goods by sea in war and peacetime operations. Military ammunition is hazardous and requires special packaging during transport. Some NATO member nations do not have regulations for transporting military ammunition in all aspects of transportation, so I can use this document. Training on transportation of ammunition and explosives are regularly held to help minimize hazards and threats to safety of people and the environment.

Training should be conducted respecting the following procedures:

- Staff training: thorough familiarization with general requirements of transportation of ammunition and other explosive materials,
- Functional training: conducted at a higher level so that staff members are aware of the hazards regarding handling and transporting ammunition and other explosive materials.

2.1. Safety requirements and transfer control

Transportation of military ammunition and other explosive materials should be limited to absolute necessity. The tasks of transporting military munitions and explosives must be planned, prepared and implemented with caution, including safe handling of hazardous cargo and preparation for emergency intervention. Transportation of ammunition and explosives containing explosive or toxic chemical substances is prohibited in all modes of transport other than maritime transport (Tadic, 2012.). The manner, duration and time of transportation of ammunition and explosives must be considered to reduce the risk to an acceptable level.
Considering factors are:

- operational requirements for transportation,
- public safety,
- efficiency,
- stock of ammunition and explosives,
- time available,
- environmental protection.

All participants in the transport of ammunition and explosives are required to take all precautions to prevent accidents and damage to cargo and keep the impact of such accidents to a minimum.
During the transportation of ammunition and explosives, responsible personnel should monitor the following:

- limit the handling of loading and unloading ammunition and explosives only to qualified personnel or authorized representatives. If there are special security requirements, the burden of control over the entire transportation
- ammunition and explosives must be properly packaged and labeled, and properly located in the cargo area to prevent shifting of cargo during transportation,
- prohibit participation of persons who are under the influence of alcohol or drugs in any phase of transportation,
- ammunition and explosives must be protected from adverse weather,
- to prevent leakage, breakage or damage of ammunition and explosives,
- regularly to the state of ammunition and explosives during transportation.

2.2. Packing, marking and labeling military ammunition

2.2.1. Packing

Each type of ammunition and explosives are regulated by standards agreed by all NATO member nations. Packing must be:

- in acceptable condition and not damaged or defective,
- closed to prevent leaks and spills of ammunition or explosives, and
- constructed of a material that prevents deformation.

2.2.2. Marking and labeling

Marking of cargo must be in accordance with NATO STANAG 2023, 2316 and 2322 for transportation purposes, tagged with:

- UN packaging code,
- UN serial number,
- Name of the UN (NATO name)
- Classification of hazards.

3. CARGO SHIPS FOR TRANSPORT OD HAZARDOUS CARGO

According to NATO's Allied doctrine of maritime transport of dangerous goods, to support the smooth and effective implementation of ships in military peacekeeping operations, NATO countries that carry hazardous cargo are required to provide sufficient transportation resources (round-trip), a cargo area, and an operations area. One of the fundamental tasks of NATO member nations is to ensure the availability of military logistics ships for the maritime transportation of ammunition and explosives to the area of NATO led operations. NATO member nations use the “ADAMS” information system for effective planning of military ammunition and explosives transport. ADAMS is a distributed information system developed to plan multinational transport tasks and to coordinate between the various national forces. NATO member nations plan and perform logistical tasks of transport military cargo and the necessary personnel. The main feature of the ADAMS system is the updating and storage of database information with characteristics of military equipment and military forces who are participating in the maritime transport. When planning transportation of hazardous cargo, NATO member nations are required to implement all precautions and ensure availability of capable logistics ships to accomplish transport tasks. For this method of transportation of military ammunition and explosives, NATO member nations comply with prescribed guidelines for stacking and separation of cargo. Ships carrying ammunition and explosives should have special fire extinguishing systems onboard. The hazardous cargo area should have a fire detection system. Ships carrying military ammunition and explosives must be capable of sailing out quickly if needed.

3.1. Loading/unloading hazardous cargo precautions

Loading and unloading of hazardous cargo is approved by the loadmaster or other authorized personnel. Only approved artificial lighting can be used during loading and unloading of hazardous cargo. During heavy weather conditions (storms, lightning, etc.), loading and unloading of hazardous cargo should be suspended, and the hatches closed. Some ammunition and explosives contain electric explosive devices which are extremely sensitive to electromagnetic (EM) radiation from external sources such as radio and radar transmitters. For safety during loading and unloading of hazardous cargo, all marine equipment such as radio transmitters with output power over 25W, in the proximity should be de-energized. Ammunition and explosives that are sensitive to electromagnetic radiation should be moved to a safe distance away from EM radiation of the ship's radio room. In case of a leak or breakage of cargo or cargo facilities, the commander of the ship should immediately stop loading or unloading, and promptly address the damage. Damaged goods will be allowed to board the ship. To ensure the safety of the ship, responsible authorized personnel should supervise the loading and unloading of ammunition and explosives. Unauthorized persons are not permitted access to the cargo area or to handle the cargo. The cargo's warehouse must also be secured against unauthorized entry. Crates containing ammunition and explosives must be sealed.

3.2. Storage and separation of dangerous cargo on board

The separation of hazardous substances in maritime transport is defined by the IMDG Code. Because the code do not apply to military transportation of hazardous substances, separating cargo by NATO member nations are defined as follows:

- distance: cargo type must not volatile interact in the event of an accident, but may be transported in the same area or under the deck,
- separation of cargo stored below deck, provided that the storage area is resistant to fire and liquid,
- separation of cargo holds and on deck both horizontal and vertically
- separation of cargo holds and on deck at the minimum allowable distance.

Stacking of hazardous cargo above the deck of the ship is allowed, and in some cases it is recommended. Some ships have portable warehouses that are water-resistant and protected from the effects of heat. This specific warehouse is located above deck (*Figure 1).* On board ship ammunition and explosives must as follows:

- ammunition and explosives should be left on the deck for quick interventions in case of accidents,
- ammunition and explosives should not be placed at a distance closer than six feet (2 meters) from open flames or other potential ignition sources,
- ammunition and explosives should be so arranged to ensure safe walking on the ship's deck and away from all other ship equipment for safe operation of the ship,
- ammunition and explosives must be stored away from the crew's quarters and rescue equipment area,

- ammunition and explosives of different types must be separated at a distance not less than six meters.

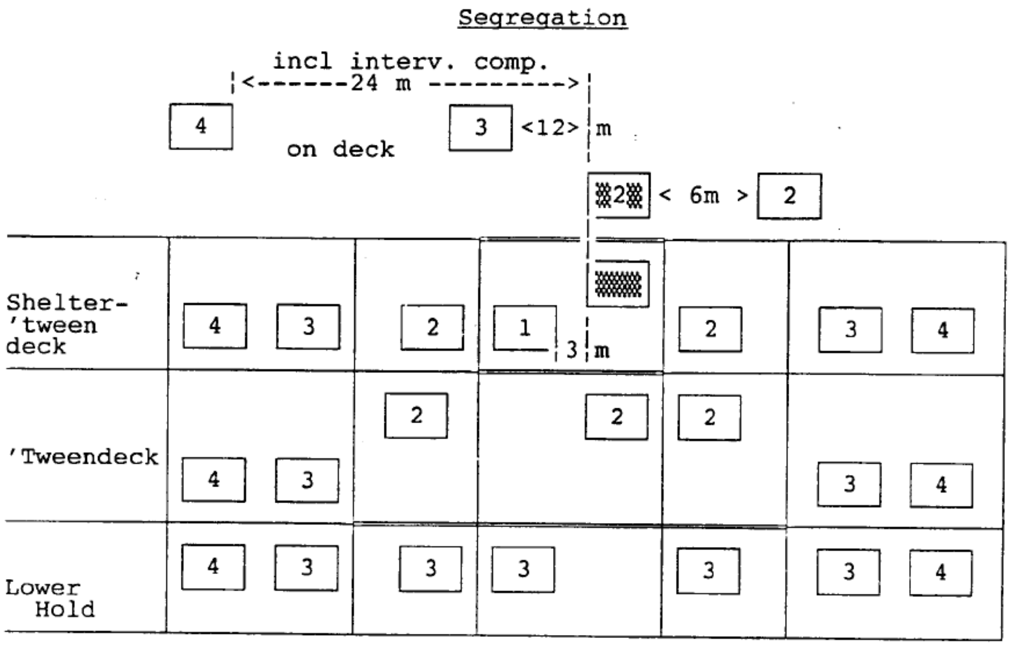

Figure 1. Separation of hazardous cargo

3.3. Transport hazardous cargo containers

Using freight containers significantly reduces the risk of exposure of hazardous goods. Improper packing or lack of proper blocking, tying or fastening may be causing injury or accident when handled or when being transported. Personnel who load the last container must inspect the containers before they are received at their final destination. Military maritime transport should always assume that the weather will not be pleasant or seas calm so securing methods used for land transport only will not be suitable for the sea. These guidelines are important for safe packing and securing of dangerous goods is indicated on the certificate of the containers. The container should be inspected internally and externally before loading hazardous cargo. The structural strength of the container depends largely on the strength of its frame. This refers to the corner posts, corner joints, the main longitudinal and transverse upper and lower elements that make up the final frame. If there is any evidence that the container is weakened, it may not be used. Hazardous goods can be transported only in armored ISO containers.

Although some NATO member nations apply slightly different technical requirements, the International Organization for Standardization (ISO) defines a cargo container as:

- a container for transport equipment is strong enough to be suitable for multiple use and of itself is suitable for storage of materials,
- specially designed to facilitate transport of materials by one or more ways transport and fitted with devices that will allow easy handling, particularly from one mode of transportation to another,
- designed to be easy loaded and unloaded
- minimum internal volume of one cubic meter.

Containers that are commonly used for dangerous goods:

- container type that is commonly used for the carriage of dangerous goods is a closed container with a door on the side, rear access, or the whole side, 20 feet in length and 20 ton capacity. They can be equipped with alarms and they should always be used when required for added security

- explosives and ammunition has complete information in Chapter 7 – Common Publications for transport and storage of ammunition (NATO Handbook for transport military munitions and explosives)
- container of forty feet with a rear door, but it is limited to the IMDG Code 5000 kg explosives that can be transported in any container that exceeds twenty feet and
- an open container (or open with a half-height) for ease of loading, in case the freight will not fit inside a closed container. Such containers should be equipped with fire-resistant tarpaulin, which must be durable, cut-resistant, waterproof and, if possible, fastened in place.

3.4. Procedures for transport across national borders

The NATO Standardization Agency (NSA, 2005.) produced an agreement on the standardization of procedures and forms in NATO maritime transport military equipment and personnel across national and multinational boundaries. The agreement relates to the transportation of dangerous goods in peacetime and wartime. The agreement applies to naval military and civilian vessels, used in maritime transport operations, the development, transfer and withdrawal of support for joint forces. Moving equipment and supplies of NATO military forces is likely to contain dangerous goods. At the entrance of the port or terminal applies restrictions for dangerous goods. In the operational handling of dangerous goods, the rules generally apply:

- the sender's country is responsible for providing vehicles for the transport of dangerous goods by sea. The agency responsible for military movements will plan and execute the transport,
- the host country approves the maritime transport of dangerous goods transportation in its territory and will establish a coordination center of the national movement of the host country,
- the country manages the special tasks of transport of dangerous goods specified by NATO in collaboration with other participating nations who work as teams in ports,
- Coordinating Center Staff, joint strategic transport responsible for the coordination of national transport plans and
- Joint sub-regional headquarters or Transportation headquarters of combined or joint forces. Their task is to submit to Strategic Command changes to the time of arrival, in support transport (supply), withdrawal of forces, and to coordinate the movement and transport within the joint operations of the host country.

All participants in the transport of dangerous goods across national borders must exchange information on transportation (*Figure 2)*. But if some NATO member nations have not entered their data in the M&T data exchange, the host country will not allow passage through their territory.

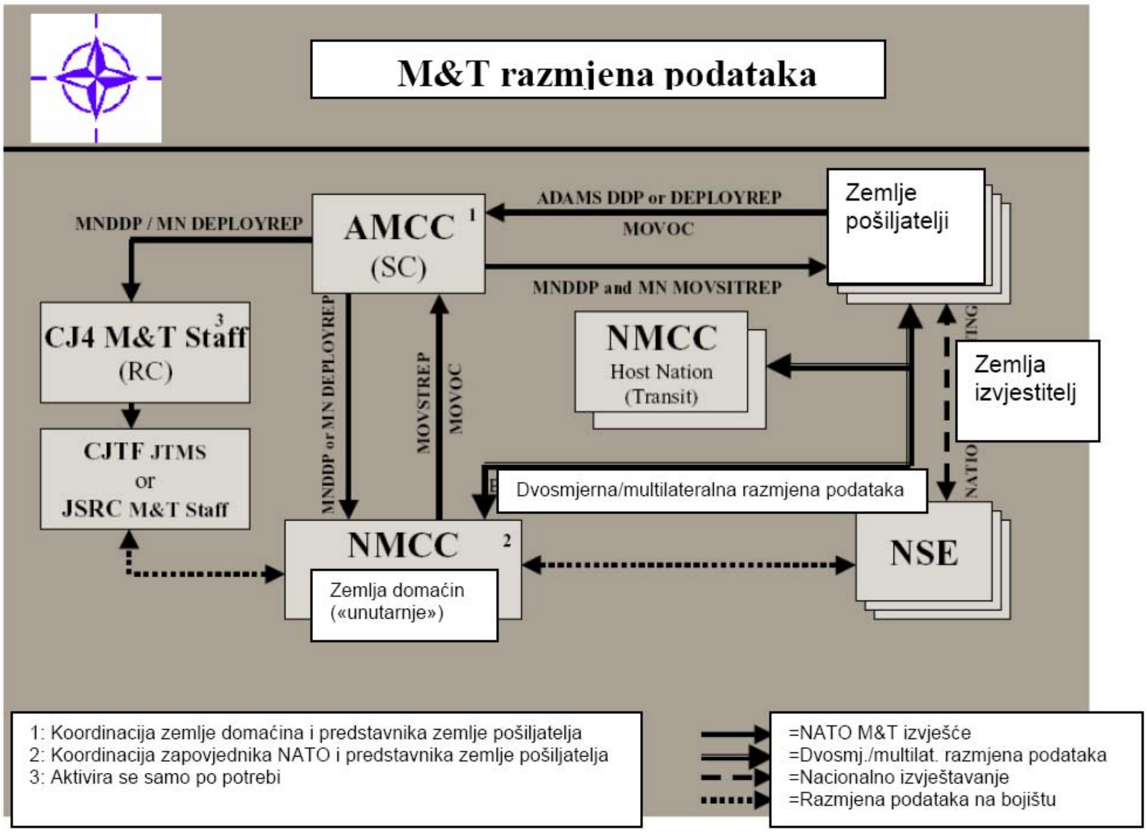

Figure 2 - Flowchart of the data exchange

4. CONCLUSIONS

Since the full range of hazardous and noxious substances produced is used daily in different industries, it is important to standardize the operational, procedural, financial and technical procedures in handling hazardous cargo. It should propose measures for their implementation. It would be good to make thorough instructions for internal and international transport of hazardous cargo, military ammunition and explosives in maritime transport. This way will substantially increase the security of transportation.

Transportation of hazardous substances, in organizational and technological terms, puts at risk all persons who come into direct or indirect contact with them.

The Croatian Armed Forces, as well as the military component of NATO's armed forces are proactive in preventing and resolving crises, and protecting the security during participation in humanitarian operations and activities in a disaster.

Transportation of Dangerous Goods by naval vessels of Croatian Armed Forces will be imposed as a regular and indispensable task that involves the timely and safe supply of dangerous goods

The AASTP-2 is a document which provides basic instructions for national and international transport of military ammunition and explosives in maritime transport. This document established the principle of security of transport of dangerous goods by sea in war and peacetime operations.

Transportation of military ammunition and other explosive materials should be limited to absolute necessity. Tasks transporting military munitions and explosives must be planned, prepared and implemented with great care, including safe handling of hazardous cargo and preparation for emergency intervention.

For effective planning and implementation of the transport of military ammunition and explosives, NATO member states use information system "ADAMS" for transportation planning. The main feature of the ADAMS system is the update and storage of database information about the characteristics of military equipment and military forces that are carrying maritime transport.
The use of freight containers significantly reduces the physical danger they are exposed to dangerous goods. Improper packing or lack of proper blocking, tying or fastening may be causing injury or accident when handled or when being transported. Dangerous goods can be transported only in armored ISO containers. All participants in the transport of dangerous goods across national borders must exchange information on transportation, with all its characteristics.

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THE ROLE OF INFORMATION TECHNOLOGY IN MARITIME EDUCATION

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ABSTRACT

According to ISM, incremental improvements over time are required for the creation and maintenance of a safe and environmental friendly working environment. In this respect, training has gained an increasingly important role in view of the ISM Code requirements, STCW 95 rules and other regulations.
Gradually during the last years, various organizations within the maritime industry have focus on the area of training and developed training services (seminars or by developing computer based training applications) in this respect. IMO STW Sub-Committee STCW (7/Circ.13 – 29/5/2002) has promulgated the issues to be considered by trainers, assessors and maritime administrations when integrating computer-based technologies (CBT) into the training and assessment of seafarers.
CBT is frequently developed for all kinds of business training (its largest market), including skills training for software applications, engineering, sales, and soft skills. CBT is also used widely for industrial, manufacturing, and safety skills training.
With today's faster processor speeds, computer-based training employing rich audio and visual elements is a better experience for the user, than ever before.
Although CBT can't replace the stand-up trainer, especially in learning situations that depend on subjective feedback from the instructor, it is a proven medium for: Increasing retention, as users master learning tasks and review subject matter at their own pace; Lowering turnover, because users experience less on-the-job frustration after training in the private, interactive environment CBT offers; Providing consistency of message, which helps increase standardized.

KEY WORDS

Computer-based technologies (CBT). maritime education. Information technologies (IT).

1. INTRODUCTION

Today the world still faces a shortage of qualified and effective naval officers in the deck and the machine that will seriously affect the future of shipping. The International Maritime Organization (IMO) in collaboration with maritime companies started the initiative "Go to Sea" to overcome the lack of qualified seafarers. Furthermore, with the application of new and advanced technologies, ship crews are kept to minimum levels. By highly qualified seafarers are required to conduct a new generation of ships (more technological level). The International Maritime Organization (IMO) has developed the Vocational Education and Training (VET) programs for merchant navy officers (STCW). This program is based on exchange rates was introduced in 1991. The standard was reviewed in 2003 and several important changes introduced in recent years, and these changes were published in June this year in Manila. IMO has changed the standard of education and training for seafarers and evaluation (STCW) to improve the quality of maritime education and training (MET).

Using previous research has found three main IMO the lack of standards for maritime education and training:

The minimum requirement set by STCW, and this is not the desirable criteria,

That there are disadvantages due to automation on board ships,

And it has been proven that the defects associated with lower English proficiency.

The STCW has been revised in 2010, the amendments, to be known as “The Manila amendments to the STCW Convention and Code” are set to enter into force on 1 January 2012 under the tacit acceptance procedure. It is aimed at bringing the Convention and Code up to date with the developments since they were initially adopted in 1978 and further revised in 1995; and to enable them to address issues that are anticipated to emerge in the foreseeable future. There are a number of important changes to each chapter of the Convention and Code, as follows:

Improved measures to prevent fraudulent practices associated with certifi cates of competency and strengthen the evaluation process

Revised requirements on hours of work and rest and new requirements for the prevention of drug and alcohol abuse, as well as updated standards relating to medical fi tness standards for seafarers; New certifi cation requirements for able seafarers;

New requirements relating to training in modern technology such as electronic charts and information systems (ECDIS);

New requirements for marine environment awareness training and training in leadership and teamwork; New training and certifi cation requirements for electro-technical offi cers;

Updating of competence requirements for personnel serving on board all types of tankers, including new requirements for personnel serving on liquefi ed gas tankers;

New requirements for security training, as well as provisions to ensure that seafarers are properly trained to cope if their ship comes under attack by pirates;

Introduction of modern training methodology including distance learning and web-based learning (IT)

2. WHAT IS UNIMET?

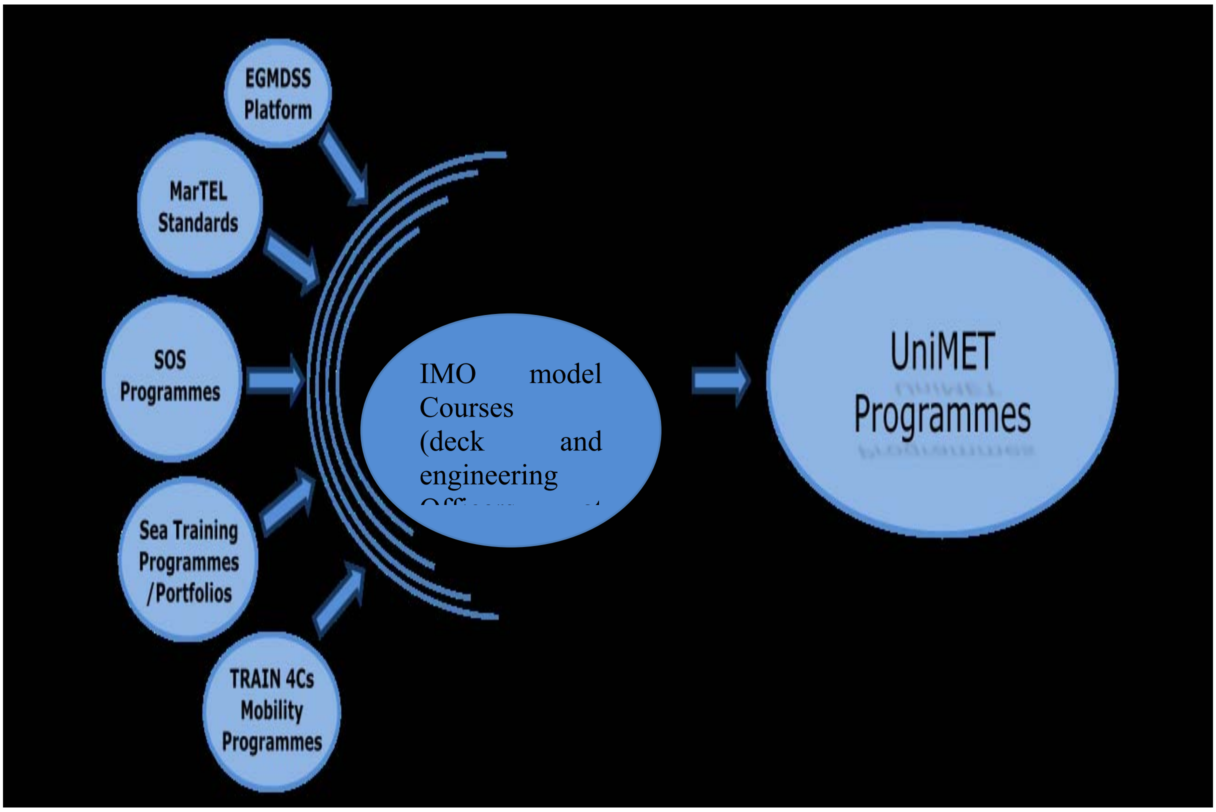
Unimet intends to unify the core of maritime education and training (met) of seafarers based on the stcw and incorporate the good practices in the partner institutions with an aim to disseminate and exploit these programmes across europe and worldwide. The unimet programmes are being cross-referenced with the existing imo model courses to ensure the unimet programmes comply with imo standards. Any new relevant local, national, european and international updates will be incorporated into unimet programmes. Unimet aims to surpass the stcw (which are the minimum standards set by the imo) and promote higher standards and good practices. A quality assurance and control system for partner institutions will be used for the delivery and sustainability of the unimet programmes.

The IMO developed the International Convention on Standards of Training, Certification and Watchkeeping (STCW) which includes the minimum requirements for the education and training of seafarers in 1978.

Major amendments to these standards were adopted in 1995 and 2010. The IMO has passed the responsibility for the application of these standards to national governments and the European Union has established EMSA (European Maritime Safety Agency) to ensure that the STCW standards are implemented in European Union member states and in countries seeking EU support in the implementation of these standards.

The UniMET programmes will be in line with IMO model courses and will incorporate the following elements:

SOS Programmes: Complete and integrated programmes for OOW and senior officers
EGMDSS: E-learning platform for navigators to refresh their knowledge on Global Maritime Distress and Safety System (GMDSS)
MarTEL Standards: International Standards for Maritime English for cadet/OOW/senior officer level
Sea Training Programmes/Portfolios: Occupational standards for OOW sea training and record keeping
TRAIN 4Cs Mobility Programmes: Transfer of cadets from one country to another to improve safety at sea



3. OTHER PROJECTS

EU maritime projects create the perfect platform for networking and cooperation for maritime companies, including shipping companies, training centers for seafarers and other relevant educational centers and institutions. This successful cooperation between European maritime institutions to upgrade the competence of seafarers is a prerequisite for adapting the requirements of today's shipping industry. Expansion of cooperation in the form of student exchange, sharing, development and implementation of joint projects is a key element of the fruitful cooperation. E-learning, electronic learning, including video conferencing is an ideal way for easier access to such courses and knowledge to improve the cheapening of such activities (MariFuture, 2010). The e-learning, e-learning is a very useful tool for students who are not able to reach to educational institutions and centers for working conditions, especially for people who work at sea. Educational institutions and vocational centers by establishing "marine certificate of excellence" (European Agency for Maritime postgraduate courses) can go beyond the requirements of STCW Convention. This will create a good cooperation, and cost savings. (MariFuture 2010)
Partnership maritime industry in the European projects MET will enable competent authorities to achieve the goal and that is better and more efficient certification . The same practice can be achieved in other parts of the world maritime community will have a great benefit to improve "safty at sea."

4. EDUCATION AND INFORMATION TECHNOLOGY (IT)

ICT is defined as a combination of information technology with other technologies.

Information and communication technology (ICT - Information and Communication Technologies) now appear in all the main functions of society and entrepreneurship: research, development, design, production, administration, marketing. ICTs include a wide range of hardware (Eng. hardware) and software (Eng. software) and support of telecommunications systems that use computer systems and serve people who communicate through them. With its capabilities for collecting, storing, transmitting and processing information of all kinds of ICT has improved all sectors of the economy and public services. ICT makes the basis for creative and effective use of knowledge.

ICT in education where students are faced with how new technologies and work through them with the work of the society. When it comes to ICT in education, then uses the acronym ITLET (Eng. Information Technology for Learning, Education and Training), which represents a key element in all shapes and models of distance learning.

The emergence of new communication technologies and media omougućila the changes in education in general. The question is the relationship of form and substance of these changes. In the last twenty years of distance education in the world is becoming very popular due to the rapid development of computer science and information technology. Thus, the computer-aided learning and computer networks replaced, previously known methods of distance education, such as correspondence schools and educational programs on radio and television. The essential innovation in education, however, provides e-learning.

E-learning
IBM is the first company that was a few years ago presented its concept of e-learning, e-learning, to support the process of learning and further education of adults. During the presentation of the first e-learning programs IBM experts predict that it is a technology that will soon become a standard part of life. How their training do not differ much from the students' electronic education (e-education), except for the fact that a greater emphasis on electronic materials, courses are narrowly specialized and must be paid.
Thus, there is a difference in terms of e-Education and e-learning:
- Electronic education (E-Education) is teaching a larger number of cases with the help

of the Internet, Computer and electronic materials,
- Electronic learning (e-learning) includes specialized courses, which can pay for further education and adult employed.

Under the computerized system for distance learning refers to a system in which the user through a computer in real time, interactively, through problem solving (backing, reading and listening to a series of instructions and display), receives a certain amount of knowledge. This allows monitoring of progress on an individual level, and to organize the curriculum according to individual needs. The idea is that e-learning does not eliminate the existing training (classical) methods and technologies, but to serve as a suitable complement to the educational process

Tools for e-learning (Eng. courseware tool) is a computer program (Eng. software) designed exclusively for education. The expression contains two term: Course (course) and software. The tool can be in the form of a CD-ROM, website, floppy disks, digital textbooks, programs for learning, etc.

Courseware tools enable learning and distance teaching using certain system configurations. Today we used two configurations: LCMS (Eng. Learning Content Management System) and LMS (Learning Management System Eng.) systems. LMS and LCMS systems have one thing in common, and that is that the web-oriented to support learning and teaching process. LMS is a software that allows you to fully administer the process of learning and teaching, and LCMS systems to design, cleaning, use and reuse of learning content. The content of learning is structured in the form of granules of knowledge are called learning objects.

LMS consists of a series of functionalities that include the "delivery" (Eng. delivery), monitoring, reporting and administration of the contents of the users, as well as the interaction of students and tutors and students with each other. LMS can be applied to very simple systems, such as school environment, to government departments and large companies. The key standard for the implementation of LMS is SCORM. Common functional features of LMS are: Registration and Billing - processes, authenticates and verifies the application and enforce payment (in case of public portals) for students, Manages the process of training delivery (themes, modules of the seminar) Testing is conducted - the first level of testing consists of quiz questions with each unit. The second level of testing consists of tests after a certain number of lessons or modules, or the entire seminar, Mentoring and monitoring the course and management of the virtual classroom or individual student progress. Supervisor determines the members of the virtual classroom, monitors the progress of each member on the basis of statistic tests, communicate with all members or individual users. Records of monitoring the performance of students are stored in the database. Custom functions allow the student plan and monitor their own development with the supervisor, coordinator or other members of the group. These functions give him insight into the statistics of its work and the use of auxiliary functions such as technical support, online help, glossary and more. Administrator functions include activities such as content control, records, monitoring and reporting, communications, maintenance, inspection modules and seminars, educational chain, back up etc.

Evaluation is an integral part of the educational process which aims to determine to what extent and with what quality of the students adopted curriculum. According to Bloom's taxonomy of learning types are divided into three categories:
- Cognitive (knowledge),
- Affective (attitudes),
- Psycho-motor (skills).

On the Internet you can find online testing mostly for the first three levels of cognitive knowledge. Types of questions that can find the issues in which student reproduces the answer, selects the correct answer among those already mentioned as a possible answer (type, pairs, or an alternative type, multiple choice with one or more correct answers, the type of comparison and sorting). Questions are divided according to their availability: statistical issues (saved as part of the HTML code) for a quiz for self knowledge, dynamic issues (stored in the database) if you need to evaluate and compare the results of all students.

Most tools for distance learning (courseware) has a module for online creation, delivery and processing tests. If the user requires only a function of online test then it is enough to choose an open source (free) tool that has developed this module. There are software packages composed of a number of combinations which give the possibility to create "paper" tests, tests for independent computer tests for the computer in the local network and tests over the Internet (for example Cquest-package).

Tools for the preparation and conduct tests online users can install on your own server (hosting Eng.) or server. The advantages of your own server as security, availability, reliable future and greater ability to adapt to their own needs. Lack of maintenance of the confidentiality of the test. Benefits of hosting a turn ease the startup services and easier to maintain the confidentiality of the test, and the lack of an uncertain future (especially free services) and incompliance own needs.

E-learning as an approach to promoting self-discipline and requires students to take more responsibility for their own learning. Teaching activities may vary from detailed structured tasks through to "open" projects, where students are free to develop their own style of problem solving. The material in electronic form is much easier browsing which allows faster and more efficient learning. Once the material is not appropriate to teach a computer, but such cases are rare. Another feature specific to e-learning is available if it is realized via the internet, what is available to anyone at anytime and almost anywhere, unlike the example classes that must be the exact place and time and requires students to be present. Due to this property E-learning can be used effectively for learning.

5. CONCLUSION

The goal is to improve the system of maritime education and training so that there is a high quality and standards required brodarstrvu World. There are several important issues that still need to be addressed for the successful and timely MET program delivery. One of the important requirements is that the English language which is a maritime country for non-English-speaking world a daunting task. English is the language of maritime and understandably crucial in avoiding collisions at sea (Martel project). Amended STCW will have a profound impact on the successful and profitable way of managing the future development of the maritime industry. Despite these efforts, there are no mechanisms to monitor how these standards apply. The European Maritime Safety Agency (EMSA) has begun to follow the STCW compliance, however, many providers of vocational education and training do not follow these requirements. It is obvious that there is a need to raise awareness of a standardized system of maritime education and training throughout the EU, the ultimate goal is to improve levels of safety at sea in the world. Mareda has developed new projects, SOS II with the support of several large MET institutions in the EU. The main purpose is to provide a unique education and training and to give members an opportunity to enhance the national recognition, but without satisfying the requirements of STCW, assistance in establishing a link between the STCW and SOLAS, the MARPOL, ILO and the Since the IMO and EMSA, using the establishment of partnerships among educational institutions. E-learning, e-learning is an essential tool for part-time students and students who are not able to reach educational institutions and centers for working conditions, especially for people who work at sea, sailors. A partnership of educational institutions and vocational centers by establishing "marine certificate of excellence" (European Agency for Maritime postgraduate courses) can go beyond the requirements of STCW Convention. This will create a good cooperation, and cost savings.

Today, many companies and individuals have realized the potential of distance learning for education and training. In our world becomes increasingly difficult to rely on traditional teaching methods. The maritime industry is increasingly requires adherence to laws and regulations, and the well-trained and educated officers and crew. If distance learning is used effectively, individuals can achieve the required standards in a flexible, convenient. (Maritime online courses) is now possible to study naval courses online, which means that companies and individuals interested in developing skills and careers they can train anywhere they have Internet access. While this is meant to: video, video sequences, audio, interactive narrative, tests and exercises, with the added convenience of online access. Once an individual registers can see your progress through the online course system.

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BIOGRAPHIE

Jelena Krčum was born in Split, Croatia (1983.). She graduated at the Faculty of Science, University of Split, Department of Mathematics - and acquired the academic title of Master of Mathematics and Informatics for Teachers (April 2008). She works at the Nautical High School in Split and she is an external associate on the courses "Mathematics I", "Mathematics II" and "Mathematics III" at the Faculty of Maritime Studies in Split. Her professional research interests include development of education and training especially in marine science. She is the co-author of several research papers in this area.

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SERVICE ORIENTED ARCHITECTURE APPLICATION IN THE MARITIME SYSTEMS

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ABSTRACT

Information communication system as support business activities is extremely important for successful performance of business processes in maritime companies (shipping company, fleet, shipyards and other facilities). The application of modern information communication technology greatly contributes to improving the business. With the introduction of a service-oriented architecture in information systems (Service Oriented Architecture - SOA), and thinking that it gives, offers new possibilities in terms of increased stability of the business, reducing costs, increasing flexibility and adaptability system and increase the quality of service end-user. Furthermore, thinking in the direction of a service-oriented architecture, IT systems it is logical not only as a temporary and short-term objective of marine facilities, but can be seen from the perspective of the overall marine strategy, as well as the organization's total marketing plan of the company. In light of major changes in the information communications market, maritime facilities must focus on using the latest computer technology thus reducing communication costs, giving impetus to innovation and creation of new services, and reducing dissatisfaction with users by constantly exceeding their demands for increased service quality.

KEY WORDS

Service-oriented architecture. software packages. technology. web services. Marine.

1. INTRODUCTION

The organizations in shipping, particularly shippers have traditionally been providers of transportation services of goods and passengers by sea. Recently, organizations in the maritime industry forced the growing competition in the global shipping market as well as increased costs and volatile markets to seek new solutions and services to increase productivity and reduce costs. One solution proposed is the introduction of the service orientated concepts. The very term, service-oriented architecture is a model in which the logic of the system decomposes into smaller separate parts of the process logic.
Service Oriented Architecture represents the best result of the evolution of the software industry the maximum flexibility and expandability. There are different definitions of SOA concepts, but most agree that service-oriented architecture is a style that promotes application weakly coupled services to ensure maximum business flexibility and interoperable technology-independent manner. It is not just about programming and hardware of support, but the whole concept of information technology that allows you to connect different systems and recycling services.
During construction of SOA applications, SOA applies the concept of combining weakly linked and interoperable services. Since weakly connected, applications do not need to understand the technical details of any service call. The result is that SOA provides independence from specific platforms and is not related to a particular technology.
Benefits of SOA technologies have multiple service usability, scalability and manageability. Reusable service routine is a real power of SOA. Development time is significantly reduced, simplified programming logic, and duplication of work efforts generally avoided. In the SOA environment change program interface can be implemented only in one place. A central location allows more consistent and it is easier to manage.
ICT companies must focus on creating configurable service infrastructure thereby reducing shipping costs, increase company profits, fueling innovation and creating new services, and reducing the dissatisfaction of users constantly exceeding their requirements for increasing the quality of services.

2. SERVICE ORIENTED ARCHITECTURE

Nowadays, on the communications market is no single definition of what it is service-oriented architecture? The reason for this lies in the fact that there is no single standardization body that would define the principles to be respected if we want to create a service-oriented system. Instead, various professional organizations, consulting companies and manufacturers have their own visions and definitions of what is SOA.
SOA is a term that is mostly "coined" IBM and today is most commonly used. On the other hand, SAP (System Applications and Products in Data Processing) proclaimed its own platform that is called the ESA (Enterprise Services Architecture) that offers the same: the integration of different IT systems, web services and composite applications. Service-oriented architecture is actually a new view of software architecture that defines the use of services to achieve the requirements set by the user.
SOA allows any logic or data to be used in various ways, depending on who uses them. SOA is primarily originated from the need to rationalize and improve business systems that will reduce costs and increase company profits.

2.1. Business and service orientation

The organization of science is well known that the business system can be divided into two levels: the level of business process and application level. The business process level is the structured design of business applications along with the limitations, mutual relationships and external influences on these requirements. Application level solutions automate business processes across different technologies. The application level contains the solutions needed to successfully master the flow of business processes and is usually realized through the application based on a suitable technology platforms.

SOA introduces a third level, service level interface (Figure 1). It provides the possibility of encapsulation, application and business levels. Applications are separated by platforms (.NET, J2EE, etc.). It provides discovery of the individual components, that services can be used across the interface now. In SOA services architecture is an essential element. SOA system actually provides a service that consists of one or more elementary services, often called the components.

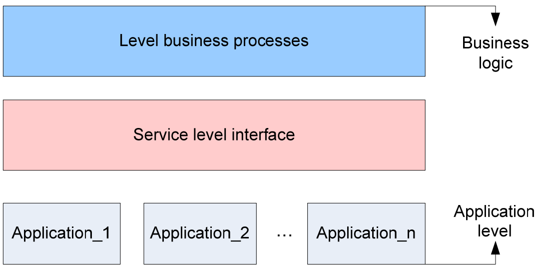

Figure 1 Layer service interface

The components are small logical units that perform an operation. They must ensure the level of abstraction of business logic so that:
the message indicates the information needed to do the work or any part of the work,

- the operation is the logic required to process the message to be carried out units of work,
- the service is a logical set of operations capable perform related work. It allows the interaction of data and applications without human intervention through dynamic and ad hoc connections. These properties make the services attractive, including greater availability of data, dynamic linking of applications to the applications, the relative autonomy and more,
- the process contains the business rules for determination which services are used to perform some task.

Service-oriented architecture is a standardized environment made on the principles of service orientation in which the processes can be executed.

2.2. The basic principles of service orientation

It is difficult to explain the concept of service-oriented architecture because it is not a "piece" of the software or hardware but on the whole concept and philosophy, and information technology that allows connection of different systems and reuse of old applications in combination with the new composite applications. Although there is no official standard, several principles emerged as the most appropriate for systems-oriented service:
the services are re-usable - it is recommended that the design of services is such that they can be used for future needs,

- the services that share a formal contract - a contract in which the service is described and determined by the method and terms of data trade is all you need services that interacted,
- the services are weakly related - must be designed so that there is no need for strong links between different services,
- hide a fundamental logic - is only part of the services contract is visible outside world,
- the services are complex – the services may consist of multiple services, that is obtained by different granularity of logic and encourage re-use of services and the creation of abstract level,
- the services are independent - the logic contained in the service must be kept in clear boundaries, thus ensuring the independence of the other services and retained the ability to change and development services,
- the services do not preserve the state – the service not worry about the information on the states, because it can affect their ability to loose connections. If it is still necessary to have a mechanism for managing the condition, it must be done elsewhere,
- the services can be found – the descriptions of the services must be able to find and be understandable to anyone who requested the service.

From the above principles (the independence, the quickly connections, the abstraction and the need for formal agreements) are fundamental principles the development of service-oriented system.

2.3. Orchestration and choreography

SOA applications are no longer whole monolithic, but consist of a series of modular services. Service can be viewed as a software function that calls the remote system in the case of Web services does not matter what kind of a remote computer running (Win, Unix), since communication is standardized and widely accepted, and in its deepest iteration, all based on XML . In the SOA environment, the server sets new requirements - developed or acquired functionality (services) should be merged into a unified whole and make it possible to simpler and faster way. Primarily it is expected that the obtained Web services connected and bound into a complex whole, which partly or fully implementing a business process company. Of course, this process is obtained by composition of other Web services, and it has to be a new Web service. It is possible to do this in several ways. From ad hoc coding in any programming language with support for Web services, to use for this purpose developed a special higher level languages. There are two basic ways of interconnection services in a more complex process. They are called orchestration and choreography and differ primarily who controls the moment the execution process.

The orchestration is one central process that takes control of all the Web services involved in the work and coordinate their execution. Included Web services are not really "aware" that are more complex in the action / process. The central process coordinates the execution of various operations under the requirements of Web services orchestration. Links to Web services are taking place across the message. They contained the business logic and order of involvement and job execution.

The choreography has no central coordinator. Each Web service knows that is a part of the bigger process, knows that the Web service should call after you have successfully completed the work and what to do if an error occurs. Each Web service involved in the choreography knows exactly when it needs to perform its operations and with whom should cooperate. It allows each Web service possibility to describe their interaction. Choreography courses follow the exchange of messages between multiple parties, not just a business process that is interested in only one participant interaction.

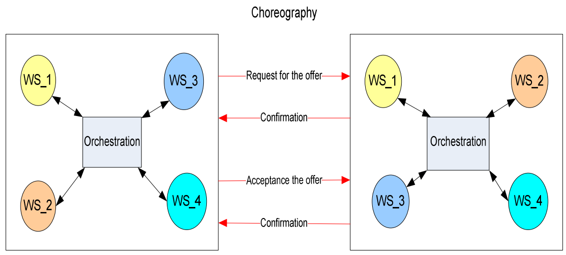

Figure 2 Graphical displays of choreography and orchestration

The Choreography and the orchestration are not concepts that exclude each other. The orchestration is used much more, primarily because it known exactly who is at all times responsible for the execution of the process and it is possible to use existing Web services that do not need to know that part of a larger process. Their implementation should not further modify /adapt because they are used as designed.

A key element of the SOA architecture is the communication between different application services that have communication protocol. Today we are talking mostly about the SOAP (Simple Object Access Protocol) protocol that is based on the exchange of XML files, a successor to XML-RPC (eXtensible Mark-up Language-Remote Procedure Call) standard.

BPEL is the XML-based language for the composition, the orchestration and the coordination of Web services. It contains a rich vocabulary that could describe very well the behavior of business processes. BPEL is the basis of BizTalk Server. BPEL Server provides an excellent environment for the execution of BPEL business processes. BPEL is strongly associated with Web services and modern software development platforms that support Web services (Java Enterprise Edition and Microsoft NET environment). It is achieved security, transaction management, scalability, connectivity with databases with using Web service. Using of components, such as EJB (Enterprise Java Beans) and COM + (Component Object Model), messaging systems such as JMS (Java Message Service) or MSMQ (Microsoft Message Queue) is although achieved.

3. EXAMPLE SYSTEM USING ORIENTED IN MARITIME SERVICES

Application of ICT is support in all maritime activities. Each Maritime Organization (boat, ship, and other institutions) seeks to computerize and automate all business processes, just as these processes are in most cases cheaper, safer and more reliable than one that is based on the activities of people and manual processing. That SOA is a new business concept that allows the implementation of new functionality into the system very quickly and with maximum availability of resources. The system's user gets a completely new opportunities and the perception of service quality.
SOA is a technology for all business entities that in their business has a need for using multiple independent business applications (software), or their business is based on communication with a number of companies over the Internet or communications networks. From this, we will mention a few trends in the development and the implementation of SOA in maritime affairs.
To exploit the possibility of orchestration, and service-oriented architecture is needed to ensure appropriate development environment in all the maritime information and communication systems.

3.1. Shipbuilding

Nowadays, manage a shipyard is complex business condition. In time when the shipping industry operates numerous fixed variable national legislation, when terms and conditions have chronic insufficiency of necessary financial resources, when the Croatian shipyards produced ships almost exclusively for foreign client which in turn means that the shipyard work laws of the world market, it makes management of the shipyard, namely shipbuilding business system, extremely complex. Building the ship takes place through several phases. Each phase consists of a series of processes. Each phase is accompanied by the appropriate software package. In managing business processes applying service-oriented architecture when build the ship is very helpful and can more easily achieve interoperability of applications and data between different business units as well as connect with other companies.
Figure 3 shows an example of using the concept of service orchestrations as web services. A scenario is composed of several parts that present buying parts for new construction when the shipbuilder makes a boat that can be purchased from various suppliers. Purchase shipbuilders to perform an agent who takes care of all of the requirements placed before certain components are met.

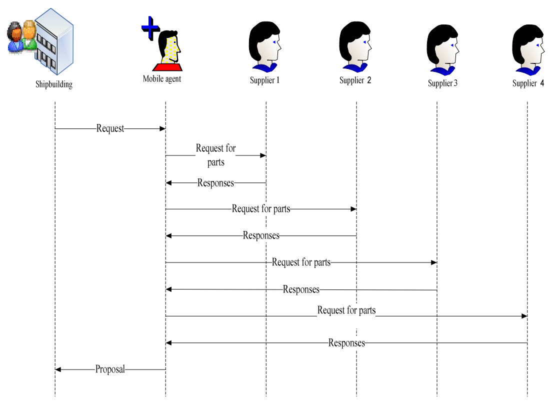

Figure 3 A example of using the concept of orchestration

After the appointed claims, agent communicates with suppliers and negotiating the purchase of the necessary components with the previous list, that is in accordance with the project documentation parts. When you select suppliers for all components, the agent sends an offer for buying to the shipbuilder. The employer may fully/partially accept or reject entirely offer.
From Figure 3 we see that each participant (shipbuilder, its agents and suppliers) have shown the WSDL service input and output interfaces. The mobile agent is a key orchestrator in the case presented; although he has to accept requests from foreign shipbuilders and forwarding requests through an agent to vendors (suppliers), he has to take care of transactional integrity of all described business process.

3.2. Supervision and monitoring of goods in the multimodal transport

In multimodal transports, as contemporary mode of transporting goods, is successfully connect almost all means of transport and modern transport technologies in international transport sectors. For safe, rational and faster operation of all entities in the transport is used integrated information and communication systems, especially those systems that are based on service-oriented architecture. The purpose of this system is that at any time provides information about the condition of the goods, where it is located, the exact time of delivery to destination, etc. Such information is important to all participants in the logistics chain, especially the end user. The end user, via the web at any moment, is able to find a place where goods is commissioned or sent. SOA technology allows integration of applications of all business partners and thus the logistics chain in the business of monitoring goods is simplifies. The implementation of these systems using the Web technology, RFID (Radio Frequency Identification) technology, GSM (Global System for Mobile Communication) technology and GPRS (General Packet Radio Service) technology. These systems allow communications via satellite, terrestrial stations and Internet. An alarm or SMS message comes on your computer or mobile phone network (mobile phone) of shippers, freight forwarders and cargo owners.

3.3. Control of maritime traffic

In the maritime industry, almost all organizations, especially in the ship's organization, are increasingly using new technologies that are based on GIS (Geographic Information System), GPS (Global Positioning System) and AIS (Automatic Identification System). These technologies, supported by the use of communication (GSM / UMTS / GPRS) technology for exchanging data / information over the wireless network, are enabling control and monitoring maritime traffic.

Communication Service Providers, Application Service Providers, Data Centers have their own services. When they are using SOA, they can be implemented directly in their information system. The best examples of using these technologies are the Pan-European Information System and River Information System that provides information services on the rivers. Information system for monitoring maritime traffic (Marine Traffic Project - http://www.marinetraffic.com) provides the static and dynamic data on ships at sea, on the current state of the ports and other data / information. AISLIVE is IT Company that has established a global network of AIS (www.aislive.com). In more than 100 countries and over 2,500 ports and terminals around the world are using web services to monitor and control vessels.

The development of Croatian maritime integrated information systems - CIMIS as part of NSW (National Single Windows) system is based on SOA technology. CIMIS system provides an electronic information exchange between systems that provides an efficient and reliable monitoring, management and control of maritime safety and protection of the sea and marine environment. The main processes in CIMIS are:

- the process of arrival in port,
- the process of leaving the ship in port,
- administrative and supervisory processes in the harbor.

3.4. Marine Organization - cruise lines

Modern shipping company is a dynamic and stochastic business organizational system, the organization that creates new value, and thus the better standard of employed people, their families and narrower and wider environment. Shipping company is most exposed to turbulent changes in the global maritime world market. Therefore, effective management is only possible through application of modern information and communication systems.

A new model of business system entails an organizational structure that is adaptable to changes as they occur within the wider environment and always ready to add new value of knowledge in the processes and activities. Organizational structures based on the integrated information communication system (IICS) are characterized by two fundamentally different characteristics: decision-making is no longer the exclusive privilege of managers and organizations are having a systematic, organic type, adaptable to their environment.

Modern shipping company must have IICS that will support management in modern business. Design IICS-ma is a modular type, and generally can be shared in various ways. This can be for particular areas, so there are:

- sub-office operations,
- subsystem to communicate with ships,
- financial information subsystem,
- the personnel subsystem,
- accounting and information subsystem,
- marketing information subsystem.

Each subsystem has its own applications and services. For this reason, the concept of service-oriented architecture can be implemented and thus different IT systems, applications, devices and services are enabling to work together.
In IICS marine the advantages of introducing the concept of SOA organizations are: increased interaction and better communication with all departments of shipping by boat, faster retrieval and transmission of information, a short course of business processes, faster and efficient delivery of services to the end user.
Almost all shipping organizations have established Web portals. The main content is information and online services. The increasing of portal's popularity is product of including more news and entertainment, opportunity to comment, chat, etc. In addition, it is necessary to upgrade or develop new services, including: transaction services (charging shipping services via a web service where users save time and money), mobile services (customer service providing information and services using wireless communications infrastructure). When creating a mobile service, especially the personalized, it is important the security of account, privacy and accessibility of information and it is necessary to reduce costs.

3.5. Nautical tourism - business nautical tourism

Nautical tourism is part of the marine system and the marine economy. Because of their organizational characteristics, that show the complexity of the objectives, and technical-technological elements have a specific need for the introduction of modern information and communication systems.
In most marine information and communication systems support is available to operators by the following models: a list of crew, vessel data, records bindings, binding's issuance, registration of passengers on board - police and TB, required reports, billing, collection agency, accounts, etc. In most systems the plan berths is used, i.e. the visualization of the situation at marina. The module is designed for the management of accommodation and maximum capacity utilization with the minimum number of moving vessels. With a network for all users which are accessing the same database and they can be on your computer just to see the data entered or changed by other users in the network.
In existing information and communication system, the introduction of SOA technology has a goal to increase safety, reliability and flexibility of business in marina. It is therefore necessary to create new business process that we call "Reservation Services", and it will contain all the elements necessary for the automation of business cover. Newly created business process will support the functionality of existing software (application) information and communication system of the marina. The security of the communication between existing and new applications as well as add automation of business processes are creating by the following Web services:

- Web service that will allow the booking and cancellation link in any marine in the list,
- Web service that will allow the booking as the cancellation and technical services at marina,
- Web service that will allow the booking and the cancellation of general services at marina.

In addition, it is necessary to create new Web applications:

- Web application that will allow easy inspection of existing facilities (berths) in the marines, depending on the size of the vessel, mooring place for boats and organization technical and general services,

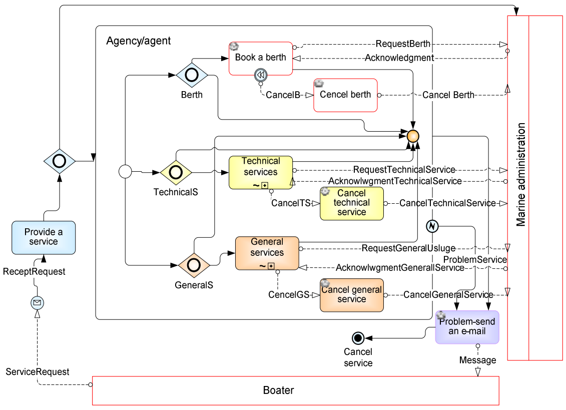

Figure 4 BPMN bus iness process diagram for the connection and provision of technical and general services at marina

- Web application that will enable the operator to select the required marina, the date and time of the service, enter the type of vessel that will be attached, the request for technical or general service, as well as other necessary data,
- Web application that will enable the initiation, or starting a business process,
- Web application that will be accessible only to authorized reception men and agents.

At marina, in a simplified model of the process “Reservation Service”, are included the following participants: Marina Management / reception area, the boaters and the agency or agent. The simplified model contains all the elements necessary for the reservation berth, and technical or general services at marina.
An application’s access requires user’s identification (user name and password) because they are available only to certain users or registered agencies, agents and operators of reception.
Applications are portal type because the main purpose of web portal is centralized location for finding and managing information. The users use the web server to perform different tasks via the Web site. Also, Web portals are a convenient way to collect information from various sources and store them in one place.
The main window of Web site contains elements that allow the operator to select required marine, the date and time of the connection, the desired services and other necessary data.

4. CONCLUSIONS

Number of hardware and software solutions for business support of maritime facilities is increasing every day. Also it increases the total growth of service’s quality and quantity provided by the IMO.
Besides the integration of applications and available resources within the maritime organization, there is a need to integrate business systems of different organizations in the maritime industry. Such integration requires a significant investment of financial and material resources in the planning and construction of new information and communication systems.
Besides the positive impact, the integration of systems and applications is the burning issue of naval designers, system analysts, programmers and other factors in the development process. For this reason, computer experts have realized the benefits of using SOA architecture.
SOA solutions are not closed; they are not depend on one software vendor equipment. SOA solutions can be integrated into different environments, different platforms and it is possible to save a lot of money. It is not necessary to modify existing software, it is possible to exchange data between new and old software.

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BIOGRAPHIE

Pančo Ristov was born on June 23th 1954. Graduated on Faculty of Electrical Engineering in Split as Electronic engineer. PhD student on University of Rijeka, Faculty of Maritime studies. Special interest in the application of computer systems in the maritime systems.

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IMPACT OF VISUALIZATION AND COMMUNICATION TECHNOLOGIES ON THE OCCUPATIONAL HEALTH OF MARINERS

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ABSTRACT

The topic of this paper is the influence of new communication technologies on the psychological health of mariners. In what ways can these technologies change the lives of mariners and their time between embarkation and disembarkation? The paper examines different references from this multidisciplinary area. In marine electronics and communications, the advances in satellite communications have made it possible for mariners to contact home, while new haptic, 3D and virtual-reality technologies make them feel closer to home. However, from the medical perspective, it would be interesting to see if these technologies have any influence on the physical health as well, like the reported headache problems during the use of 3D glasses. The problem area should therefore be investigated by multidisciplinary teams.

KEY WORDS

visualization. virtual reality. hologram. multimedia. 3D technology. psychological health. occupational health.

1. INTRODUCTION

Modern communication systems improved medical care aboard in the last decade of the 20th century. Telemedical care included consultations, counseling, telesurgery, etc. However, all of these dealt with the physical care of mariners although psychological traumas have been observed as well [1, 2]. The benefit of new technologies should be in the reduction of psychological problems due to separation issues. Problems caused by engine vibrations for example, cannot be reduced with communication technologies. However, such vibrations can cause a number of internal and/or occupational health problems, e.g. problems with hearing, the cardiovascular system or dreaming.
It can therefore be said that advances in technology open new possibilities for the prevention of psychological traumas caused by separation of mariners from their families.
The paper is organized as follows. The second section deals with risks mariners are exposed to during extended work aboard. The problems can be occupational (sight, psychology, balance), but more general as well. The third section deals with communications which can be used to improve health. In the final section, conclusions are made about the impact of new communication technologies on the occupational health of mariners.

2. HEALTH RISKS OF EXTENDED WORK ABOARD

Taking into account all the possible effects on the occupational health of mariners is difficult. One typical influence is noise [3]. The typical impacts of noise can be divided into source or physiological impact. Possible sources of noise are:
- ship's engines,
- generators,
- air-conditioning, etc.

The area of impact could be:
- thorax (3 – 7 Hz),
- heart (4 – 8 Hz),
- abdominal and thoracic organs (4 – 9 Hz),
- spine (2 – 6 Hz),
- pelvis (4 – 9 Hz), and
- head (20 – 30 Hz).

The above noises can damage the internal ear (hearing and balance) and thus influence the doctor's decision about the occupational abilities of a mariner.
Different vibrations can have influence as well. Since there are not a lot of physical activities aboard, mariners are at risk of gaining weight. The consequences can be detected in the cardiovascular system. Moisture in the air can cause breathing problems and related diseases.
Long-term stay in lower decks (engineering) can cause eye problems due to long exposure to inadequate and unnatural illumination.
Excessive workload and separation from one's family can cause psychological trauma leading even to accidents. It is important to prevent this sequence of events. So, since psychological health plays a vital role in the prevention of accidents future efforts in marine health should be directed towards improved relaxation and contacts with family and friends at home. The ability of mariners to relax and put aside their fears about the situation at home can have an immense influence on the security and safety of marine transport. The improvement of spare time during extended stays aboard through the application of new communication technologies is therefore of vital importance.

3. HISTORY AND FUTURE OF COMMUNICATIONS IN MARINE

It can be assumed that there were no communications in the early times. However, some form of communication was used. It was possible to use pigeons, flags, light, and leave messages at closes ports that would be carried by the next ship going home. There was also a primitive form of ship-to-ship communication. However, the accessibility of such communication channels was limited to vital information and only limited authorized personnel (captain). Of course, one could put one's message in a bottle hoping that a friendly ship would find it. But, it cannot be considered a serious and reliable way of communication.
The colonization of the world brought about written communication. The invention of the

telegraph increased the speed of communication when ship was in port.

Further advances in communications were the use of telephones and radio receivers. Telephones made possible two-way communication from ports, which improved the psychological stability of crewmen. Radio increased the vessel security. Nowadays, cell phones with satellite links enable communication at almost any time. Modern ships have available not only phone calls, but the Internet as well. In the early stages of the development of the Internet, e-mail communication was possible. Applications like e.g. Skype make possible cheap two-side communication.

Figure 1 illustrates the communication possibilities through history and prediction for the future.

Future trends in communication technology include:

- 3D video conferencing as an improvement of the present day videoconferencing,
- 3D video phone,
- virtual reality with haptic interface,
- holographic visualization in 3D space, etc.

New technologies could allow visual communication with home and family (or other communication end in general) with inclusion of other senses, such as 3D sound and haptic sense.

However, although new technologies seem promising, they should be approached with caution. For example, there are reports of eye-problems when using 3D glasses. A Samsung report [4] states that possible symptoms of watching 3D pictures include:

- altered vision,
- lightheadedness,
- dizziness,
- involuntary movements such as eye or muscle twitching,
- confusion,
- nausea,
- loss of awareness,
- convulsions,
- cramps and/or
- disorientation.

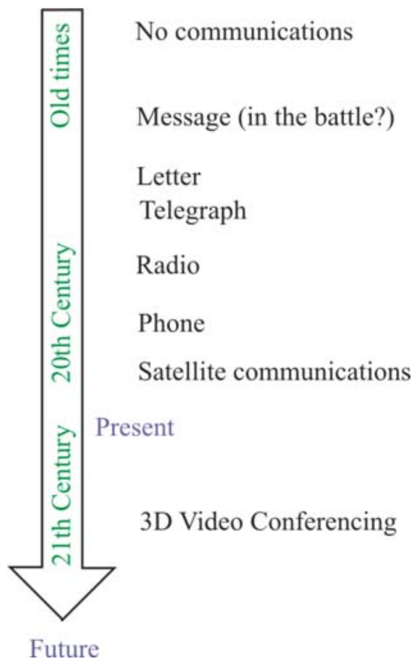

Figure 1. The most significant communication abilities through history.

It is recommended that should any of these symptoms occur, one should consult a physician. The following risk-groups are identified: pregnant women, young children, teens, the elderly, people prone to seizures or stroke, people prone to dizziness or motion sickness, people with eye problems, people who are out of shape, and people who have been drinking. As can be observed, there are no normal, healthy men, a group most mariners belong to, in the risk-group. The problem could rest on the other side of the communication channel – at home.

3D illusions are nowadays a trend in communications. However, new sensing, tele-presence, virtual reality and holographic technologies will be developed in the direction of total inclusion of all the senses. Therefore, new communication will enable sense of touch, not just 3D sound and video surround. In other words, just like you can pay bills over the Internet from any part of the world, in the future you will be able to touch your family. This is well known in the teleoperation [5] technology, which uses force-feedback to create a sense of closeness. A generation of reaction force enables a false sense of touch.

The above can be summarized as in Figure 2.

Crew members can have different medical, economical, family or other problems. They can feel home-sick or just want to feel desired and loved. These are some of the reasons why they should be in touch with home. Furthermore, virtual reality can be used to create a copy of home or some other scene. This could be used to relax mariners. Holography can even help one touch and feel the walls of one's home, which is far away in the real world. The mentioned technologies are not a far cry from present technical capabilities. The problems are the transfer of an enormous quantity of data required for high-resolution over satellite link, and price. As the history of advances in technology has shown us, both are only a matter of time.

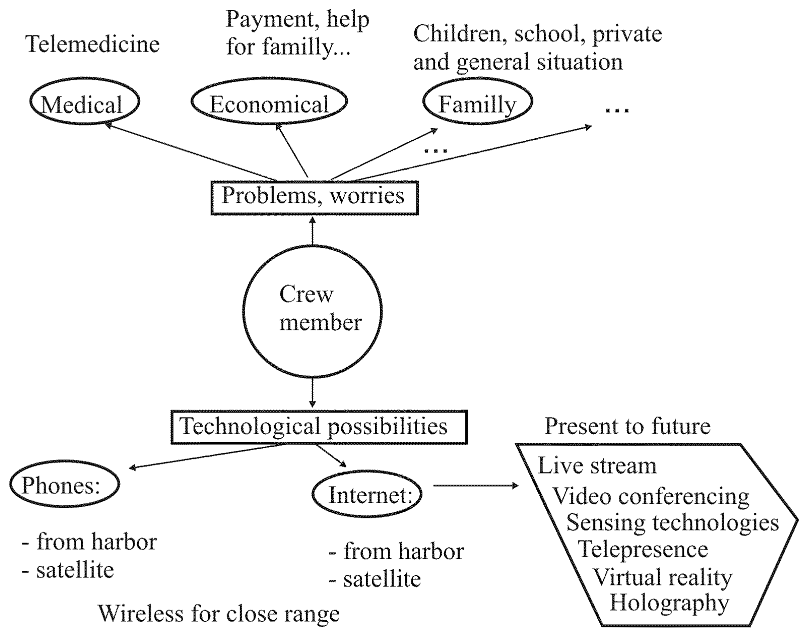

Figure 2. Crew member as a center between problems and technology.

4. CONCLUSIONS

New technologies can make mariners feel closer to home. They can also simulate a relaxing virtual reality environment which can help mariners recharge their batteries for work. However, new technologies must be carefully studied to see if they are causing any undesired health problems, as mentioned in the example of 3D glasses. An influence on health could for example be an inability to meet the occupational criteria for one's job.

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FUZZY LOGIC APPROACH FOR CONTROL NONLINEAR VEHICLE

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ABSTRACT

Fuzzy logic is derived from the theory of fuzzy sets. Fuzzy logic is based on approach in witch term is defined as state between logic value true and false. Fuzzy control is the application of fuzzy logic in faults diagnosis and process control where the mathematical description of the system is not possible or too complex. Fuzzy control enables implementation of human heuristic knowledge for control the system. For the fuzzy control a set of linguistic terms and rules of the experts is used. This paper presents a methodology of fuzzy control based on control of vehicle with inverted pendulum, with simulator Gunt RT 124. Purpose of the simulation is to keeping inverted pendulum in vertical position during acceleration of the vehicle. Display include a selection of input variables, compiling base of rules, defining the terms for fazzification and defazzification which determined control signal for the movement of vehicles. Simulator Gunt RT 124 is located on the Faculty of Maritime Studies, and is used in educating students regarding the application of new technologies in the maritime industry.

KEY WORDS

fuzzy logic. vehicle. inverted pendulum. simulation.

1. INTRODUCTION

Today, computer technologies are presented in almost all areas of human activity. To describe dynamical behaviours of the system, a few methodologies can be used; Conventional control method is based on differential and algebraic equations or graphic approach with structure system graph [1]. In addition to the mathematical description of the system, models based on artificial intelligence are increasingly using. Applying advanced technologies and soft computing methodologies in controls system better possibilities for modelling nonlinear control system is accomplished. It can be done by using artificial intelligence technologies, in witch model could be based on knowledge heuristic, simulation, expert system, fuzzy logic and control, neural network, etc. [5]. In the past few years, there has been rapidly growing interest in fuzzy control of nonlinear systems, and there have been many successful applications. The most important issue for fuzzy control systems is how to get a system design with the guarantee of stability and control performance. In this paper, a fuzzy controller for an inverted pendulum system is presented in two stages. Description of inverted pendulum as one of basics non-linear system, and simulation of fuzzy control modelling approach by using simulator Gunt RT 124 has been done.

2. INVERTED PENDULUM VEHICLE

Carrier vehicle with inverted pendulums is one of the basic nonlinear models. As a nonlinear system, the inverted pendulum is used to analyze inputs signals received from sensors and perform a control signal for stabilization pendulum in vertical position [2,3]. Stabilization control of an inverted pendulum include the position of the vehicle using mid point and limited distance in both directions. Fuzzy simulator Gunt RT 124 is designed for students in educational purposes. The purpose is to create a fuzzy control system, system test and fine tune controller with online debugging interface and analysis of parameters. The simulator Gunt RT 124 is non-linear one-dimensional system with strong coupling, consists of the vehicle model, fuzzy control unit and software program. The task of this simulation is to bring inverted pendulum into centre position, and at the same time, control the position of the vehicle within the limits of the available distance. Motor drives driving wheel, and thus the vehicle. Because of inertial mass, the pendulum is moving in the opposite direction from the direction of the acceleration of the vehicle. Vehicle with inverted pendulum consist of these elements, as shown in figure 2. 1. inverted pendulum, 2. vehicle, 3. vehicle position sensor, 4. drive motor, 5. amplifier, 6. microcontroller, 7. PC with development system, 8. pendulum inclination sensor.

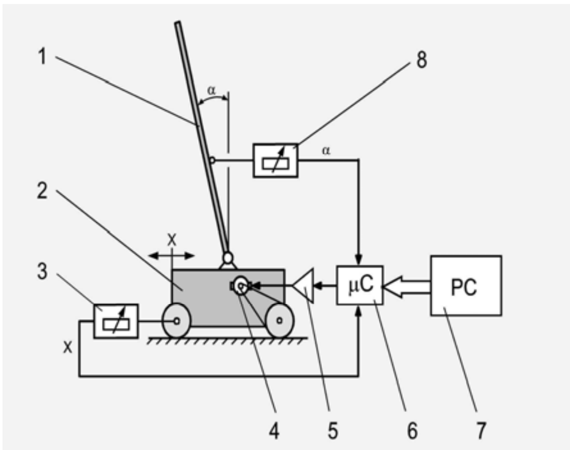

Figure 1. Elements of the vehicle with inverted pendulum

3. FUZZY CONTROL ELEMENTS

Fuzzy system performs transformation from expert knowledge and heuristic base into a suitable signal for processing in computer software in forms of If-Then rules. With this method, it is possible to solve problems in systems that are difficult to be expressed by mathematical or conventional control methods only. Fuzzy system is multi input – single output system [4]. The elements of fuzzy control approach are; input signals in form of membership functions, rule base presented in form of if-then rules, fuzzification and defuzzification process, fuzzy inference for making decisions and output control process signal [5].

3.1. The input element

The fuzzy controller for the inverted pendulum has four input signals: angle between the inverted pendulum and the vertical position, angular velocity of the inverted pendulum, position and velocity of the vehicle. These measured values are provided to the fuzzy controller. For each of four input signal the membership function is added. The element that is located within a set has a certain percentage of membership in that set [7].

3.2. The rule base element

The rule base elements, added by experts, determines the control behaviour of the fuzzy controller. Fuzzy relations are presented in the form of If-Then rules. Some of possible method for determining a knowledge or rule base for fuzzy model is Takagi and Sugeno's method [6].

3.3 Fuzzification process

The fuzzy membership sets are used to define the truthfulness of a variable. Each input variables from sensors turns into fuzzy quantities. The quantities have a descriptive character and form the basis of the data. Each weighted value is assigned to a fuzzy quantity. Fuzzy quantities from the rule base are converting into crisp set values, using one of this method; maximum criterion (MAX), centre of gravity (COA) or mean of maximum method (MOM).

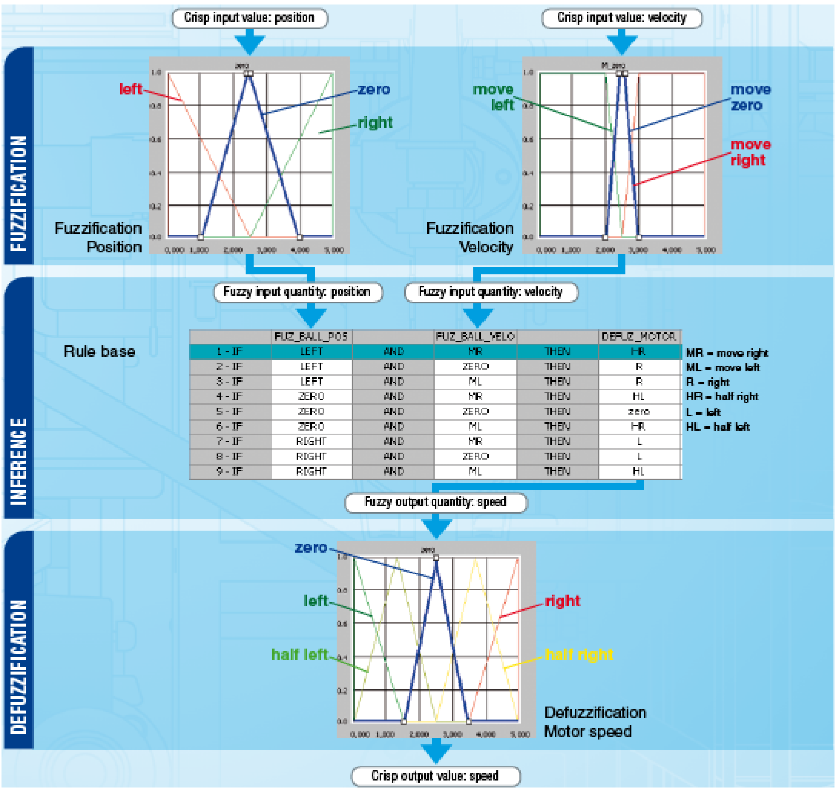

Figure 2. Graphical visualization of simulator Gunt RT 124

3.4. Fuzzy inference

It specifies rules that are applicable are recorded. Each state is described in linguistic expression. It is possible to determine affects for each rule in the behaviour of fuzzy controllers. Every action of the rules is described by the linguistic expression. The degree of application each rule defines the concept of weighted linguistic term in determining the behaviour of fuzzy controllers. The control value for the motion of the vehicle is then determined in defuzzification process. The structure for fuzzy control with its element is shown in figure 2. The project structure is consists of input variables, proportional variables, addition element, fuzzification element, rule base, deffuzification element and outputs signal for vehicle control.

4. CONCLUSIONS

Vehicle with inverted pendulum is one of the basics model for implementation of nonlinear fuzzy control approach. The simulator Gunt RT 124 allows presenting the principle of fuzzy control process with a graphical programming interface for students training. This model enables a fine tuning a nonlinear and unstable system fuzzy control system using debugging interface. It can be easily upgraded by adding new rules to improve performance.

ACKNOWLEDGMENTS

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THE USE OF AUTOMATIC LINpK ESTABLISHMENT TECHNOLOGY IN MARITIME COMMUNICATIONS

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ABSTRACT

Abstract – Global Maritime Distress and Safety System (GMDSS) was implemented on board ships by the 1999 for communication in the case of Distress, Urgency and Safety. These communications aside, the concept of GMDSS implemented new procedures for the establishment of communication with the introduction of the Digital Selective Call (DSC) technology. The idea that a seafarer would use the DSC technology to establish a call with another station (ship or shore) by simply selecting a unique identifier of that station (Maritime Mobile Service Identity - MMSI) and selection of the frequency band on which to establish a call (in the case of the MF/HF frequency range), looked very promising (in some aspects even revolutionary). Seafarers, however, prefer the satellite communication while the terrestrial radio communications are rarely used (DSC included).

Automatic Link Establishment (ALE) Technology is used for military and diplomatic purposes and provides voice communication, data transfer, text messaging, image transfer, e-mail etc. in High Frequency (HF) spectrum by the automatic selection of the optimal working channel and simplifying the process of the link establishment.

This paper is reviewing the main characteristics of the Automatic Link Establishment (ALE) technology and its possible applications as an alternative for satellite communication, as far as the voice, data but also Internet access over HF is concerned, on board ship.

KEY WORDS

Maritime Radio Communication. GMDSS/DSC. High Frequency (HF). Automatic Link Establishment (ALE) Technology.

1. INTRODUCTION

A lot of things changed in maritime communications since the 14. April 1912 when the first CQD message was sent by the White Star Line's Steamship Titanic. The implementation of the DSC technology, with the implementation of the GMDSS did not achieve the desired results. Nowadays the DSC is rarely used for its intended purpose and in reality the officers do the test calls as required, but the actual communication, aside the VHF voice, has almost entirely moved to the satellite network. The HF frequency range is rarely used. Automatic Link Establishment (ALE) technology may prove to be the "next step" in maritime communication, shifting the balance of use between terrestrial and satellite communication that is presently in a large amount on the side of the satellite. This paper will review the main characteristics of the ALE technology and its current and future application in maritime communications.

2. ALE TECHNOLOGY

Development in HF technology in the early 1980's introduced automation in channel selection, unattended operation and interoperability in order to prevent the problems related to the propagation of the sky waves resulted in the Automatic Link Establishment (ALE) systems. As different ALE schemes were incompatible due to different modems and encodings used the United States (US) Government appointed a Mitre Engineer Gene Harrison to make a survey of the current status and development and propose a unique standard taking the best ideas from the available schemes, and with some of his own, come up to one universal standard (US Military Standard MIL-STD-188-141 which eventually led to the US Federal Standard (FED-STD-1045) which, with amendments taking in account the development of the technology, are still in use throughout the world [1]. Currently, there are 3 major standards bodies for tactical HF communications: US Military (MIL-STD series), NATO (STANAG documents) and the US Federal Government (FED-STD series).

2.1. ALE Principle

The principle of Automatic Link Establishment (ALE) is simple: minimize the manual operation during the establishment of a link by enabling the automation of the following procedures: channel selection, channel evaluation and selective (but not only) calling (similarly like the DSC). While receivers scan a list of channels listening for ALE calls, the transmitters select the channel for transmission based on the results of automatic channel evaluation (by measuring the HF energy propagated by the channels of interest using specialized equipment or by measuring the effect of the channel transfer function of the waveform of interest (such as ALE modem). All the stations, when not engaged in a call, actively scan a set of channels. The scanning is done continually and the free stations "spend" some time on a channel "listening" in order to check whether there is a call or not (length of this time (i.e. *dwell time)* depends on the number of channels being scanned). When a call is made, the *dwell time* may increase in order to check whether the station is the designated recipient of the call. On the other hand the transmitter of the call must make sure that the length of the call itself is long enough so that the receiver is able to detect it. It is done automatically by the transmitter. Once the communication is established the transfer of the information over the link is controlled by the operator (for voice communication) or data link modem and protocol for digital communication. [1]

2.1. Types of ALE Calls

There are several types of ALE calls:

1. **Selective call** is achieved by including the station addresses in transmissions that seek to establish links. Establishment of a call is done through the so-called *Three-way handshake procedure*, which is the exchange of standardized data (ALE Frame). The calling station addresses and sends a call frame to the receiver which, after recognising himself as destination, sends a response frame to the calling station, which, after receiving the response knows that bilateral link with the called

station has been established. The calling station confirms to the called station that it has received the response. Now the stations can start the voice or data traffic.

2. **Net call** - addressed to a single address that identifies all members of a collection (*net*) of stations. All appropriate stations send their response frames in prearranged time slots. The calling station completes the *handshake* by sending an acknowledgment frame as usual.
3. **Group call** is similar, but since the stations to which the call is intended do not have a common net address, each must be individually named. They respond in time slots, determining their slot positions by reversing the order in which stations were named in the call. The calling station sends the acknowledgement as usual.
4. **Sound** is only one way communication (broadcast) of ALE signalling by a station to assist other stations in measuring channel quality. The broadcast is not addressed to any station or collection of stations, but merely carries the identification of the station sending the sound.

There are also some special addressing modes:

1. **Allcall** - a general broadcast that does not request responses and does not designate any specific address (used for emergencies, broadcast data exchanges and propagation and connectivity tracking).
2. **Anycall** - a general broadcast that requests responses without designating any specific addressee(s) (used for emergencies, reconstitution of systems, and creation of new networks). Selective *Anycall* is a selective general broadcast that is identical in structure, function, and protocol to the global Anycall, except that it specifies the last single character of the addresses of the desired subset of receiving station.
3. **Wildcard** character ("?") can be used to address multiple stations with a single wildcard address. Responses to a call containing an address with wildcard characters are generated in pseudorandom slots to avoid collisions
4. **Self-Addresses** (used for self-test, maintenance etc).
5. **NullAdress** (self-test maintenance, buffer times, etc.). This signal is not directed to, accepted by, or responded to by any station. [2]

2.3 System structure and hierarchy

An ALE capable station consists of an ALE controller, a controllable single side band (SSB) radio, and transmission equipment such as antennas and couplers. For data transfer the system includes also high speed HF data modems, networking controllers, and so on, as shown in Figure 1.

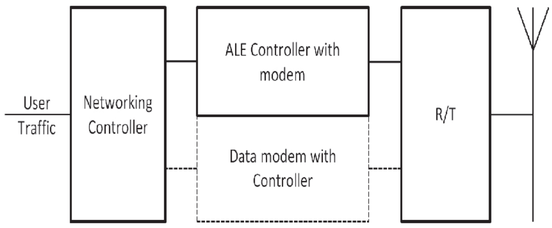

Figure. 1. Structure of an ALE System [1]

Figure 2 shows a functional breakdown of such an automated HF station, where the functions are shown in layers along the lines of the ISO Open System Interconnection Reference Model (OSI-RM). Hierarchical layers:

1. **Medium** - The electromagnetic wave propagation is influenced by the medium through which the waves are travelling and it depends of the several factors (Fig 2.) The ionosphere is a key element of HF sky wave communications. Transmitted HF radio waves hitting the ionosphere are bent or refracted. When they are bent sufficiently, the waves are returned to earth at a distant location. Often at the distant location they are reflected to the sky again, only to be returned to earth yet again, even farther from the transmitter. This HF *sky wave hopping* or *skipping* (i.e., transmitter-

to-ionosphere-and back to receiver on the ground) can increase communication to very long distances (1 hop: <4000 km, 2 hops: 4000 to 7000 km, 3 hops: 7000 to 12000 km). [2]

2. **Physical Layer** is the layer that conveys the physical “bits” over and HF channel. Standards for this layer define the way individual bits are represented in the waveforms being sent over HF channels. The standards fully define the modulation schemes that may be used, and the channel coding methods that can be employed. There are four sets of standards currently available for the physical layer – US Military (MIL-STD-188-110C (09/2011), MIL-STD-188-141C (07/2011)), NATO (STANAG 4285, 4538 and 4539) and US Federal Government (FED-STD-1045(1046/1049/1052)).
3. **Data Link Layer** essentially converts bits from the physical interface into frames and then performs error detection so only the valid bits are passed up to the next layer. In HF communications standards targeted at this layer also provide services such as station identification and link creation. Three standards cover this layer: US Military (MIL-STD-188-141C (07/2011)), NATO (STANAG 4538 and 4539) and US Federal Government (FED-STD-1045A).
4. **Higher Layers** – HF Network (voice, data, images etc.) are covered by: US Military (MIL-STD-188-141C (07/2011)), NATO (STANAG 5066) and US Federal Government (FED-STD-1037).

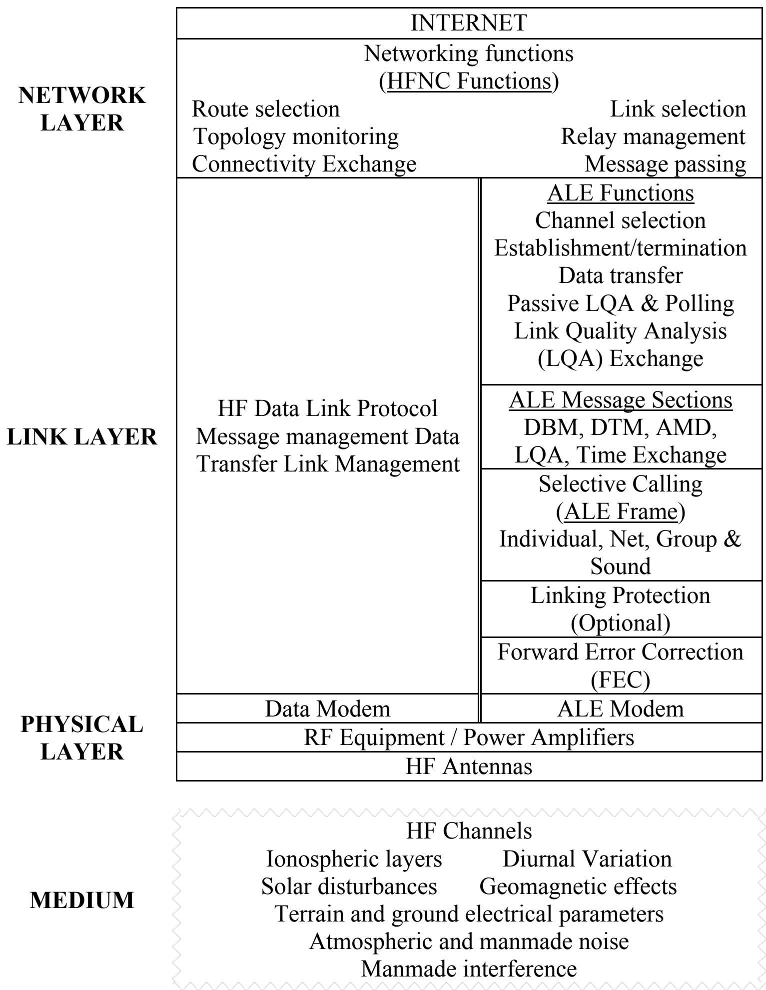

Figure. 2. Hierarchical layers of an HF radio system [1]

3. APPLICATIONS OF THE ALE TECHNOLOGY

ALE technology has already found several fields of application: Governmental and non-governmental agencies, military use and maritime use.

3.1. Established and proposed networks:

1. The United States Air Force - HF Global Communications System Air / Ground / Air Network (**HFGCS**) established by the Air Force Frequency Management Agency (AFFMA) for use by the National Command Authority (NCA), the Department of Defence, Federal Departments, and Allied users equipped with HF ALE radio technology in support of Command and Control (C2) between aircraft / ships and associated ground stations (begun the standardization process became an integral part of the Air Force's communication system).
2. The **SHARES** network - a program sponsored by the National Communication System (NCS) to provide backup capability to the US Federal government to pass/exchange emergency information. SHARES uses existing HF assets, including radio amateurs, to extend HF coverage for all US Federal agencies (backup for vulnerable systems, extended HF coverage, standardized operational procedures and message formatting, etc.).
3. The U.S. Federal Emergency Management Agency (FEMA) has developed the FEMA National Radio System (FNARS) radio network - National Emergency Response Net (in cases of national emergencies uses all residual communicational capacity including radio amateurs and MARS (Military Affiliated Radio System)). FNARS radios include both fixed site and mobile versions, and have ALE capabilities incorporating LQA and preset scanning. Users of the system are able to make selective calls (*i.e.*, individual or group) and broadcasts.
4. U.S. Customs Service's Customs Over-the-Horizon Network (COTHEN) – a network for HF SSB radios possessing ALE and Selective Calling capability allowing hands free operation, proven to be useful in the war on drugs. [2]
5. National Guard Bureau HF E-mail (National Guard Bureau for voice, data and HF e-mail)
6. US Coast Guard Coordination Network
7. US Coast Guard HF Data Exchange Network [3]

3.2. Military use

The ALE Technology has been used in military purposes for several years. The most recent version of the US MIL-STD-188-141C contains requirements to ensure interoperability of new radio equipment with long-haul and tactical application in the MF and HF bands using the “next generation“ALE standards (i.e. 3G ALE).

3.3. Other uses

Additionally, the ALE technology is used for voice and data service as a good alternative for those users for which satellite links are usually necessary because of their position or because they are mobile. HF data channels are also available in special circumstances: as emergency connection to networks damaged due to natural or man-made disasters and for connection to rapid-deployment networks. Good example was the use of this types of equipment in south east US after a series of devastating tornadoes in April 2011. [4]

3.4. Maritime use

The use of ALE technology is still very limited. A positive example is the establishment of the Global Link Network (GLN Network) that uses special modems which, in combination with the existing HF radio allows the ships to establish the communication with the best available station and channel and deliver (e.g.) e-mails using the ALE technology with considerable savings compared to the same data transfer via satellite.

The “ALE box” is installed and interfaced with the ship HF radio set with interfaces to Inmarsat (optionally Iridium and/or Thuraya), GSM, and GPS etc. There is also a Web interface for ship

control and management, to access crew mail, Weather data, etc. [5]
Six different transmission speeds are selected in a highly adaptive manner depending on the particular HF condition. The system operates using automatic selection of the least expensive transmission medium. HF communication is used for the transmission of smaller e-mails or data up to 125 Kbytes. For e-mails with large attachments the system automatically connects using the satellite system or, if within range, using the available GSM network [6]

Applications using this system are: company mail, crew mail, e-mail to SMS, current meteorological data downloaded automatically, transmission of GPS position data for Internet applications, data services (e.g. webcam, online monitoring, FTP), data and voice communication via satellite.
Current status of the GLN Network is shown on the Fig. 3.

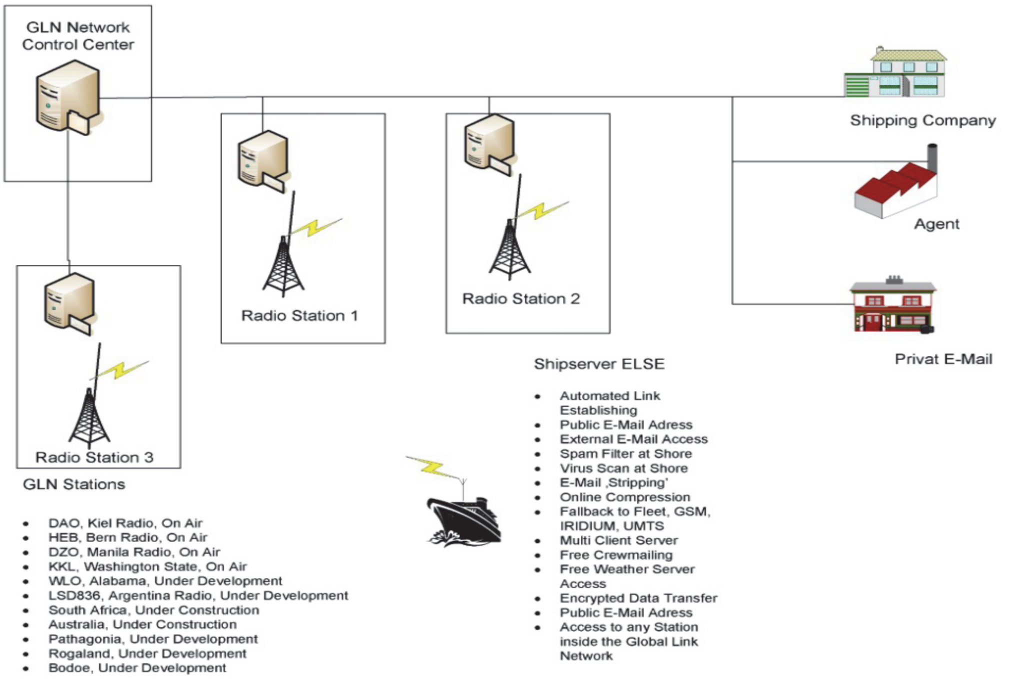

Figure. 3 GLN Network

4. CONCLUSIONS

The wide use of the ALE technology in commercial purposes is still held back by the limitations of the system (maximum speed of the transmitted data). But with the lessons learned in the military application and the introduction of the new standards in 2011 (3G ALE) in military use it is just a matter of time when this new technology will find its way on board ship as an alternative to the satellite communications.
With constant improvements in science, the ALE technology has good potential to enable additional means of communication and solutions for broadband internet over the HF in future.

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TUNING OF PID CONTROLLER FOR AN MARINE AUTOMATIC VOLTAGE REGULATOR SYSTEM

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ABSTRACT

Synchronous generator excitation control system is one of the most important parts of power system control. And as PID control is one of the first developed and the most widely used control schemes in excitation system, its parameters tuning problem has been highly concerned. In this paper contend with the determination of optimal proportional-integral-derivative (PID) controller parameters of an Marine Automatic Voltage Regulator (AVR) system using Chien–Hrones–Reswick (CHR), Cohen–Coon (CC) and Genetic Algorithm (GA) is presented. For results, the classical tuning proposed by Ziegler and Nichols is using compared with all this methods. Also, simulation results obtained using all these methods will be presented and discussed.

KEY WORDS

AVR. CC algorithm. CHR algorithm. GA algorithm. Synchronous generator. ZN method

1. INTRODUCTION

The main difference between the marine and a land-based electrical power system is the fact that the marine power system is an isolated system with short distances from the generated power to the consumers, in contrast to what is normal in land-based systems where there can be hundreds of kilometers between the power generation and the load, with long transmission lines and several voltage transformations between them. On the other hand, the control system in a land-based electrical power system is divided in several separated sub-systems, while in a vessel; there are possibilities for much tighter integration and coordination. Fig. 1. shows a schematic overview of the main electrical and automation components in a typical cruise vessel with diesel-electric podded propulsion [1].

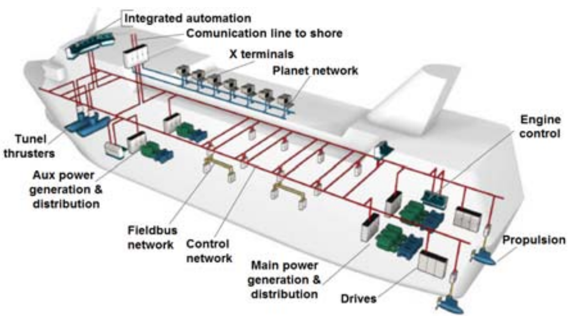

Figure 1. Example of propulsion and control system layout for a cruise vessel

Implemented functionality of a power and propulsion plant system can be described in control hierarchy of Fig. 2. [2].
The user interface is often implemented in operator stations, with a graphical user interface, push buttons etc. The system level controllers are implemented in control stations or PLCs. They can be centralized or distributed computers, depending on design philosophy for the vessel. The main part of the Low level Control are AVR control of synchronous generator and engine protection. The engine protection devices prevent and shut down the engine at over-speed, excessive temperatures, loss of lubrication, etc. The Automatic Voltage Regulator, AVR, controls the voltage by commanding magnetizing current to the field winding of the generator [3].

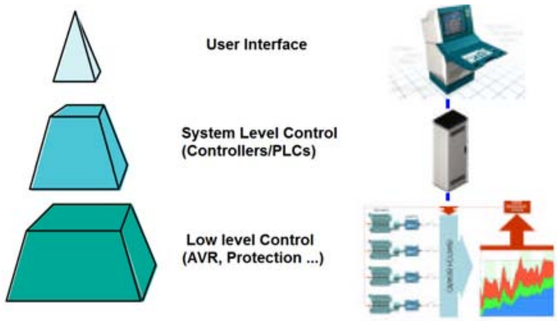

Figure 2. Control Hierarchy for a Power Plant

AVR senses the terminal voltage of the generator and compares it with a reference value. Simplified, the controller has PID characteristics, with stationary limited integration effect that gives a voltage drop depending on the load of the generator [4]. The voltage drop ensures equal distribution of reactive power in parallel-connected generators. According to most applicable regulations, the stationary voltage variation on the generator terminals shall not exceed ±2.5% of nominal voltage. Also, the largest transient load variation shall not give voltage variation exceeding -15% or +20% of the nominal voltage unless other has been specified and accounted for in the overall system design [1].
PID control is the most common one in excitation control. As it has the characteristics of simple structure, convenient debugging, strong adaptability and good robustness, it's one of the most widely used control schemes. However, the complicated process of PID parameters tuning has been plagued with engineers. The parameters' values determine their good or bad control effect. Therefore research on PID parameters tuning techniques has a very important practical significance.
This paper first establishes a mathematical model of generator excitation system. The problem of synchronous generator excitation system PID controller parameters tuning has been concerned using Ziegler and Nichols (ZN) method [5-6], Chien–Hrones–Reswick algorithm (CHR) [6], Cohen–Coon algorithm (CC) [7], and Genetic Algorithm (GA) [8-9]. Simulation results obtained using all these methods, on the some excitation system, will be presented and discussed.

2. MATHEMATICAL MODEL OF GENERATION EXCITATION SYSTEM

As the generator's transfer function is relatively complex, here we just research on the no-load running condition when the current flowing through the stator winding i_G is zero. So only the excitation voltage u_f effect on the generator voltage u_G should be considered [10], [11].

In the linearized model, the transfer function relating the generator terminal voltage to its field voltage can be represented by a gain k_G and a time constant T_G:

$$W_G = \frac{k_G}{1+T_G \cdot s} \tag{1}$$

These constants are load dependent, may vary between 0.7 to 1.0, and between 1.0 and 2.0 s from full load to no load.

Voltage measurement unit is composed of measuring transformer, rectification circuit, filter circuit and other components. Generator's three-phase terminal voltage measured by the voltage transformer first steps down by measuring transformer, and then through rectification circuit and filter circuit is converted to a smooth DC voltage which is in proportion to generator terminal voltage. Therefore, the transfer function of voltage measurement unit can be approximately described as a first order lag element:

$$W_{me} = \frac{k_{me}}{1+T_{me} \cdot s} \tag{2}$$

where T_{me} , the time constant of measurement unit, is about tens of milliseconds.

In self-shunt excitation systems, after the step-down of the excitation transformer and the rectification of the thyristor rectifier, generator terminal voltage supplies the power of field winding.

The amplifier model can be described by a gain K_A and a time constant T_A. The transfer function is:

$$W_A = \frac{k_A}{1+T_A \cdot s}. \tag{3}$$

Usual values of K_A are in the range of 10 to 400. The amplifier time constant T_A is very small ranging from 0.02 to 0.1 s.

A modern exciter transfer function is modeled by a gain K_E and a single time constant T_E:

$$W_E = \frac{k_E}{1+T_E \cdot s}. \tag{4}$$

Typical values of K_E are in the range of 1 to 400. The time constant T_E is in the range of 0.1 to 1.0 s.

The PID controller is used to improve the dynamic response as well as to reduce or eliminate the steady-state error. Every part of PID controller has its function on the control system. (1) The proportion part: Increasing the scale factor can accelerate the response speed and reduce the steady state error, but too large scale factor will effect on system stability. (2) The integral part: Its main function is to eliminate steady state error, but too strong integral action will increase the overshoot of the system and even cause oscillation. (3)The differential part: It can reflect the changing trend of the error so as to bring early correction signals to reduce the overshoot and settling time and increase system stability, but it is very sensitive to the high-frequency interference, prone to excessive oscillation. The PID controller transfer function is:

$$W_{PID} = k_p + \frac{k_i}{s} + k_d \cdot s \tag{5}$$

Block diagram of an excitation control system with PID controller is presented in Fig. 3.

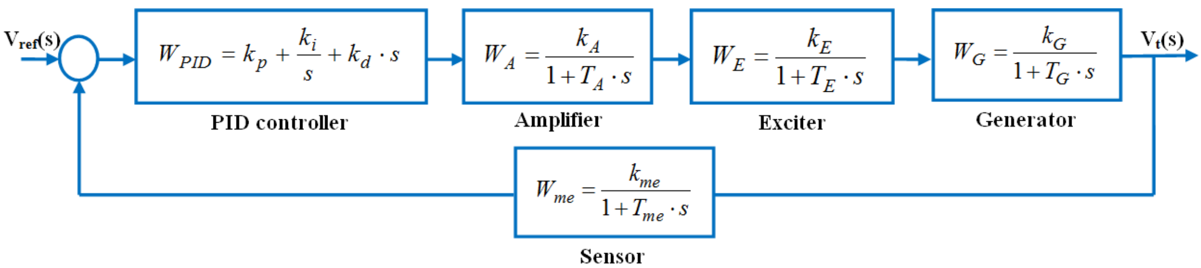

Figure 3. Block diagram of an excitation control system with PID controller.

3. ZEIGLER-NICHOLS METHOD, CC, CHR AND GA ALGORITHM

Currently, more than half of the controllers used in industry are PID controllers. In the past, many of these controllers were analog; however, many of today's controllers use digital signals and computers. When a mathematical model of a system is available, the parameters of the controller can be explicitly determined. However, when a mathematical model is unavailable, the parameters must be determined experimentally. Controller tuning is the process of determining the controller parameters which produce the desired output.

The most common classical controller tuning methods are the Ziegler-Nichols and Cohen-Coon methods. These methods are often used when the mathematical model of the system is not available. The Ziegler-Nichols method can be used for both closed and open loop systems, while Cohen-Coon is typically used for open loop systems.

The Ziegler-Nichols was developed by John G. Ziegler and Nathaniel B. Nichols [5]. Although these methods were presented in the 1940s, they are still widely used. Ziegler-Nichols tuning rule was the first such effort to provide a practical approach to tune a PID controller. This method is useful for plants of which mathematical models are unknown or difficult to obtain. On the other hand, this method guarantees the stability of the system.

Cohen–Coon tuning formula is used a rule table that is obtained empirically as like Ziegler-Nichols rule table.

Very useful PID tuning algorithm is Chien-Hrones-Roswick method. This autotuning method focuses on setpoint response and disturbance response. CHR method provides formulas for 0% and 20% overshoot. Compared with the traditional Ziegler-Nichols tuning formula, the CHR method uses the time constant T of the plant explicitly [6].

Many random search methods, such as genetic algorithm (GA), have recently received much interest for achieving high efficiency and searching global optimal solution in problem space. Due to its high potential for global optimization, GA has received great attention in control systems such as the search of optimal PID controller parameters. Although GAs have widely been applied to many control systems, its natural genetic operations would still result in enormous computational efforts. In this paper will be used MATLAB genetic algorithm toolbox, to optimize PID parameters of synchronous generator excitation control system. This algorithm has the characteristics of strong robustness and efficient optimization.

4. SIMULATION RESULTS

By using Ziegler-Nichols tuning method optimal controller P, PI and PID parameters for system presented on Fig.3 were obtained. The value of coefficients are: k_A=10, T_A=0.1s, k_E=1, T_E=0.4s, K_G=1, T_G=1s, k_{me}=1 T_{me}=0.01s. Fig. 4 show the unit step response of the AVR system with Ziegler Nichols turned controller.

By using Cohen-Coon method and Chien-Hrones-Reswick, for the same system, optimal control parameters were obtained. Fig. 5 and Fig. 6 shows the original terminal voltage step response of the AVR system with CC and CHR turned controller.

Obtained optimal PID controller parameters, using all presented methods, are depicted in Table 1. Fig. 7 show the terminal voltage step response of the AVR system with MATLAB GA turned controller. Compared with the commonly used method ZN method, CC and CHR algorithm, these four system step responses are shown in Fig. 8, and their indicators are shown in Table 2.

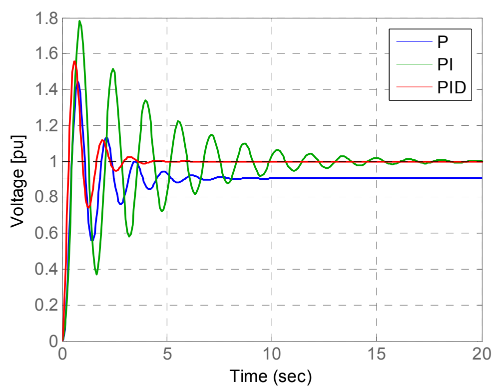

Figure 4. Terminal voltage step response of an AVR system with the ZN-P, PI and PID controller

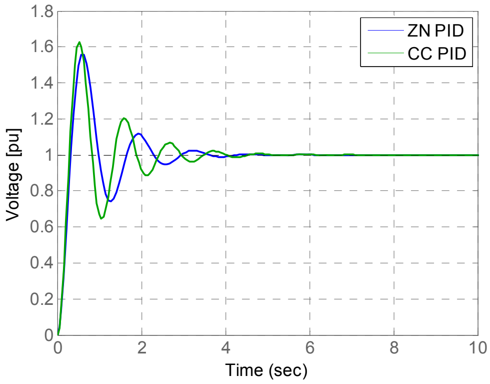

Figure 5. Terminal voltage step response of an AVR system with the CC-PID controller

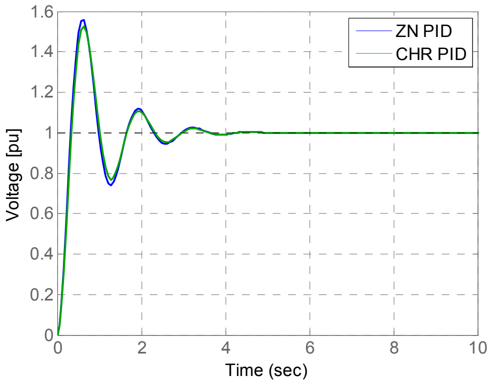

Figure 6. Terminal voltage step response of an AVR system with the CHR-PID controller.

According to the results presented on Figure 5., it can be seen that CC PID control gives smaller rise time, more settling time, and more overshoot than ZN PID control. On the other hand, from Figure 6. is evident that CHR PID control and ZN PID control give approximately the same results.

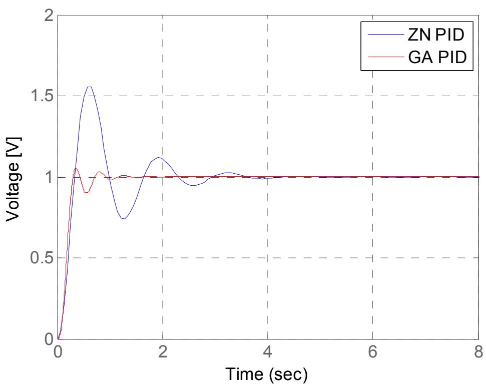

Figure 7. Terminal voltage step response of an AVR system with the GA-PID controller

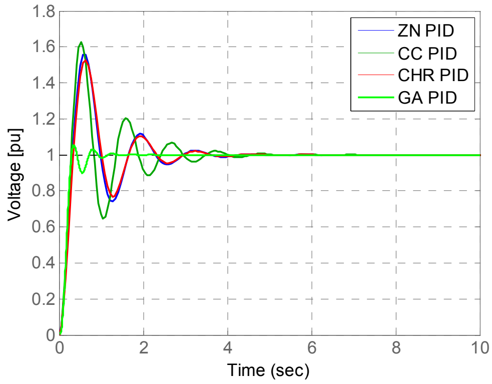

Figure 8. Terminal voltage step response of an AVR system (comparison review)

Table 1. Optimal controller parameters

Method	Controller parameters		
	Kp	**Ki**	**Kd**
ZN	1.1550	2.2514	0.1422
CC	1.6236	2.5341	0.1567
CHR	1.6236	1.7696	0.1263
GA	5	0.548	0.791

Table 2. Response characteristics

Method	Performance		
	r_t (s)*	s_t (s)	Π (%)
ZN	0.217	2.660	55.55
CC	0.228	2.177	62.82
CHR	0.190	2.788	52.83
GA	0.176	0.649	5.49

* *r_t – rise time, s_t- settling time, Π- overshoot*

Simulation results presented on Figures 7. and 8. shows that compared to conventional PID parameters tuning algorithms, PID parameters optimization using MATLAB genetic algorithm toolbox have a smaller overshoot, a better responsiveness and a smaller oscillation number, thus has a better dynamic performance.

As can be seen in Table 2., the GA-PID controller could create very perfect step response of the AVR system, indicating that the GA-PID controller is better than the ZN-PID, CC-PID and CHR-PID controllers.

5. CONCLUSIONS

In this paper PID controllers for a.c. marine-generator power system have been investigated. A linearized model of the generator power system is first obtained. Then the controller parameters have been determined using the ZN, CC, CHR i GA methods. Comparison between the responses of the closed loop PID controllers, for different controller parameters, has been investigated. In additional, computer simulations of terminal voltage step response are presented.
It is shown that GA-PID controller could create very perfect step response of the AVR system, indicating that the GA-PID controller is better than the ZN-PID, CC-PID and CHR-PID controllers.

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BIOGRAPHIE

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ALE MODEM - SUPPLEMENT APPLIANCE FOR HF LINK ESTABLISMENT WITHIN GMDSS

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ABSTRACT

Ease of use satellite communications technology onboard merchant ships rejects HF communications systems. It is inappropriate routine by means of maritime safety since GMDSS satellite communications systems rely on INMARSAT exclusively. Although INMARSAT was originally founded in 1979 as not-for-profit international organization, it is since 1999 privately owned company. HF communicating does not require radio relay link but highly depends on very variable ionospheric condition. Precise MUF assignation, crucial for HF link establishment is not possible without experienced operator. GMDSS equipment does not include HF ALE modem and this paper proposes it as supplement appliance to existing technical solution.

KEY WORDS

GMDSS. HF communications. ALE modem. COMEX expert system.

1. INTRODUCTION

The use of communications beyond of horizon is vital for ship's safety. Apart from satellite space infrastructure, land infrastructure and ship's satellite equipment existence terrestrial communication systems are still irreplaceable in GMDSS and provide direct link, without radio relaying with ship in distress. To communicate over long distances without satellite, an HF radio communication system is used, nowadays and in the past, where there are no artificial satellite installations. HF radio waves use sky waves that refract and then reflect from the Earth's natural satellite - ionosphere. By the first half of the seventies of the last century, only manual techniques to search for working HF frequencies were used. The technique required a very skilled and versatile radio operator. He should have knowledge of global geography, manually monitor one or more frequencies and establish a strict coordination (plan) for working frequencies for a particular time of day. The solar cycle (or solar magnetic activity cycle) has a period of about 11 years. The cycle is observed by counting the frequency and placement of sunspots visible on the Sun. Solar variation causes a periodic change in the amount of irradiation from the Sun that is experienced on Earth. If selected HF frequency is to high for current ionospheric state, it will break through ionosphere in space. If selected frequency is to low for current ionospheric condition it will not reach ionosphere layer of atmosphere. First ALE (Automatic Link Establishment) system device introduced to users in late 1970. ALE devices have expert system built into, which replaces the traditional ways to find the optimum frequency. Modern approach to maritime communications demands integrity. It considers that all communication systems are merged into one unique system rather than individuals segments for communication. The task of modern technology is to enable a comprehensive approach to the problem of communicating through the expert system

2. ALE OVERVIEW

The first ALE systems have developed in early 1980's. The pioneering devices were Rockwell Collins' Selscan™ and Harris' AutoLink™. The goal of the implementation of ALE to HF systems was to simplify the use of HF radio communications such simple as telephony itself. Three-state ALE link establishment states are given in Figure 1. [6]

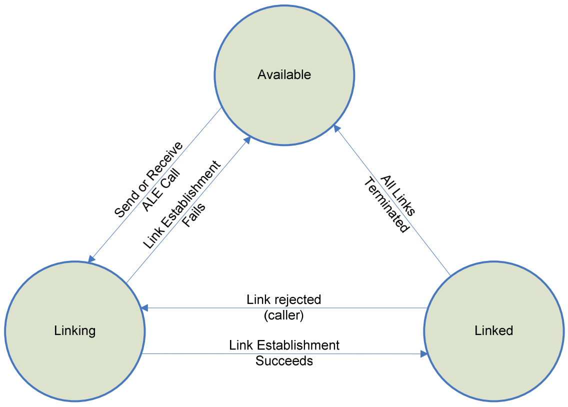

Figure 1. ALE Link Establishment States

When a station wants to send the call, the ALE controller tries to establish a connection with another station and uses the information collected during the ALE sounding. If there is no data on that other station, then the controller will try to establish a connection with another station using all programmed channels. After a successful link establishment, ALE controller terminates the scanning channels process and signals to the operator that the system performed succeed call establishment and the stations will begin to traffic exchange. After completion of the call, the ALE controller will send a request to disconnect the ALE unit returns to the state where it waits for further scanning traffic. Included protection systems back into condition ALE controller scan in case of involuntary termination of a relationship.
ALE devices generate an independent set of signals various frequencies and after the test working frequency is determined. This procedure tests condition of ionosphere using the system without feedback.

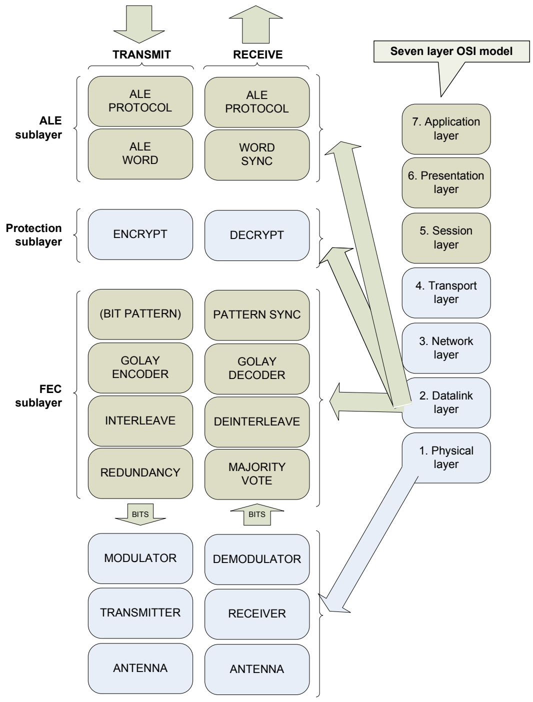

Figure 2. Seven layers ISO OSI model – FEC, protection and ALE sub layer

In the telecommunications and information theory, error correction in the channel decoder (FEC - Forward Error Correction) is a system error checking for data where the sender adds redundancy to the message data, known as the "code" for the elimination of errors. This code allows recipient to perceive and correct the errors (up to certain limits) without having to query the sender for sending additional data. The advantage of FEC is that it avoids the return communication channel or re-sending data at a cost a little wider pass band of the channel required. Seven layers ISO OSI reference model is a brief description of layer design used in communications and computer networks. Network architecture is divided into seven layers. In Figure 2 it is shown that second data layer at ISO OSI seven layers model is important for ALE.[3]

ALE modems 2G to 3G comparison is given in Table 1 with technical specification.

Table 1. 2G / 3G ALE Comparison [2]

Characteristic	2G ALE	3G ALE
Link Time	15.3s – 3 character call sign	8.4s – (Average values)
Link Robustness	0dB(3kHz BW[1])(0dB PAPR[2])	-8dB(3kHz BW)(4dB PAPR)
Waveform	8-FSK - 125 sym/s	8-PSK – 2400 sym/s
Main mode of Operation	Asynchronous	Synchronous Asynchronous Supported
Link Protection	yes – Not widely used	yes – Widely used
Link Evaluation	LQA & Traffic Monitor	LQA & Traffic Monitor
Real Time Channel Evaluation (RTCE)	no	no
Listen Before Transmit	yes	yes
Adaptive / Cognitive	no	no

2G ALE
Employs a fast asynchronous scan coupled with a long link establishment transmission on the desired frequency. The transmission is long enough to capture the scanning receiver and begin the handshake on the desired frequency.

3G ALE
Employs a slower synchronous scan coupled with a short link establishment transmission on the desired frequency. However as the system is synchronous the system must wait for the desired frequency dwell to happen.

Although the 3G ALE more reliable and has significantly increased efficiency, the existence of a large number of 2G ALE radio equipment, availability and prices have made a base standard for global interoperability.
Existing ALE systems should be improved through:

Faster Linking times
- Decrease overhead, increase capacity

Wider bandwidth support from present 3kHz
- 6,12,24 KHz channels being defined in 141B [6]

Channel Selection
- Real Time selection just before use
- Accurate signal quality estimates

[1] BW – Bandwidth
[2] PAPR – Peak-to-Average Power Ratio

Establishment of new standard MIL-STD-188-141C, which describes the wider band channels

Frequency Management

- Dynamically use unused frequencies
- Improved Listen Before Transmit
- Employ cognitive radio concepts as noted after in Ch. 2.

3. COMEX COMMUNICATION SYSTEM

Modern approach to maritime communications demands integrity. It considers that all communication systems are merged into one unique system rather than individuals segments for communication. The task of modern technology is to enable a comprehensive approach to the problem of communicating through the expert system. In this chapter, an autonomous fuzzy expert system for tactical communications networks COMEX is presented. [5] COMEX use various autonomous external sensors to collect and update available channels and network communications parameters COMEX runs on Windows PC, which also acts as the communication station controller. Any operator to achieve expert results in communication can use it. Thus, the expert system would “examine” the network and available equipment that could be used to establish required knowledge and communication in an optimal way. During initial setup, COMEX prompts the operator to provide all the information necessary for an intelligent and expert decision on solving the communication problem at hand. Its intelligence enables it to interface with a variety of channel monitoring sensors, and accept and use the information provided by these autonomous sensors to achieve an optimal solution to the communication problem at hand. COMEX uses three separate Knowledge Bases (KB1, KB2 and KB3) for three different phases in learning process. This architecture has enabled easier and better use of COMEX.

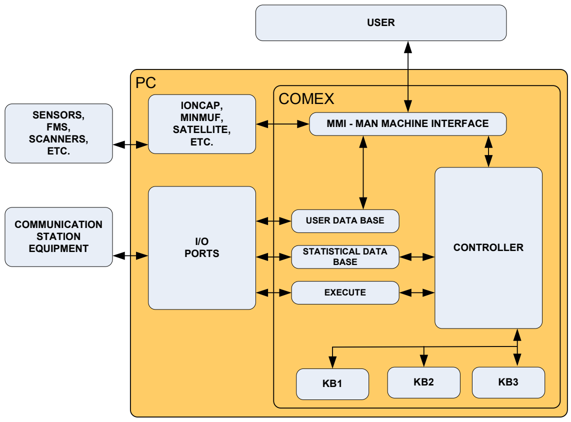

Figure 3. COMEX system architecture

Main part is PC and represents computer that is system’s core. At computer, through appropriate interface various external equipment is attached: communication equipment, frequency management and communication monitoring devices, sensors running various software and scanners as shown in Figure 3.

The MMI is a self-prompted, human-friendly interface, which leads the user through the various steps of operating COMEX. Since COMEX requires information concerning various aspects of the communication network, net members, available communication equipment, traffic type, frequency assignments, topological conditions, system configuration, etc., the MMI interrogates the operator with respect to these and additional aspects. The MMI classifies and stores this information in its data base and transfers pertinent parameters to the CONTROLLER expert system. In addition to the information loaded by the operator, the MMI accepts relevant information from external sensors, such as frequency management systems, and from resident utility programs running on the same processor. Such utility programs include Fresnel zone propagation, IONCAP, MINIMUF, satellite visibility, and BER performance evaluation programs. COMEX contains three knowledge bases (KBs), on which the expert system operates in solving the communication problem. KB1 is used in the CHANNEL TYPE SELECTION — where according to the desired communication task and constraints of the available equipment, range, available channels, etc. - the expert system selects and recommends the use of telephone, MF, HF, VHF, UHF, or satellite communication channels as shown in Figure 4.

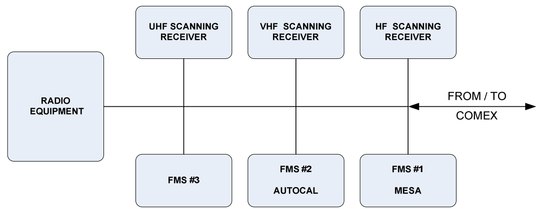

Figure 4. COMEX system architecture

The CONTROLLER then utilizes KB2 in the EQUIPMENT and PATH SELECTION. Thus, according to the size and type of message to be transferred (the range, the antenna coverage, etc.), the expert system selects and recommends the specific antenna, transmitter, receiver(s), modem, and terminal to be used. It also selects and recommends the path and the relay station (if needed) to be used. The CONTROLLER module is in fact an expert system itself, which also manages the various functions performed by COMEX.

The internal structure of the CONTROLLER system employs three distinct knowledge bases and is divided into four main logical parts, as shown in Figure 5:

1. Blackboard
2. The inference engine
3. The question-answer program (QAP)
4. Communication channel for communicating with other modules

The blackboard plays a very important role in the inference process, since without storing the intermediate results on the blackboard the inference engine would not be able to perform its task.

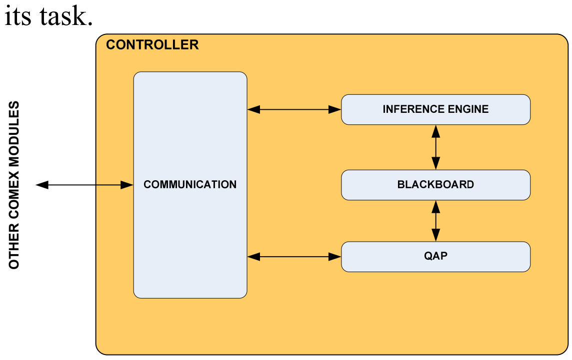

Figure 5. CONTROLLER subsystem architecture

Each line on the blackboard contains:

1. Key words
2. Certainty factor (CF), which is used for the evaluation of the conclusion(s)
3. Rule number (RN), which is the same as the number of the rule that was fired and its conclusion placed on the blackboard

The expert system described here uses production rules as a knowledge representation method.

The general structure of a production rule is

IF P THEN C

where P is the premise of the rule and C is the conclusion.

The general structure of P is

P:: = S | (P) | NOT P | S OR P | S AND P |

S :: = An English phrase in the form: the A of [the] B is [not] [adjective] C. Where A, B, and C are key words. An example to S can be “the range of VHF is 25 miles”. In this case A = “range”, B = “VHF”, and C = “25”.

For example, some of the rules in KB1 are:

120. - - - - - -
121. If range of target is long and satellite is available then type of *ltransmit* is satellite.
122. If range of target is long and not satellite is available and HF is available then type of *ltransmit* is HF.
123. If range of target is short and satellite is available then type of *stransmit* is satellite.
124. If range of target is short and not satellite is available and VHF is available then type of *stransmit* is VHF.
125. If range of target is short and not satellite is available and not VHF is available and HF is available then type of *stransmit* is HF.
126. - - - - - - -

The knowledge base is associated with a special matrix called the bit matrix (BM). BM is an N by N matrix where N represents the number of rules in the knowledge base, so that:

$$BM\left[i,j\right]=\begin{cases}1 \text{ if the conclusion of rule } i \\ \quad \text{is involved in tje evaluation of rule } j \\ 0 \text{ otherwise}\end{cases} \qquad (1)$$

$$\text{if } \sum_{j=1}^{N} BM\left[i,j\right]=0 \text{ then the conclusion of rule } i \text{ is a terminal in the decision tree} \qquad (2)$$

The bit matrix has three functions:

1. It is used by the question-answer program (QAP) to trace the inference path when describing how a conclusion was reached.
2. It helps the inference engine to guide the user to reach a conclusion when the data which was provided by the user is insufficient.
3. As described in Eq. (2), the BM can determine which rule is a concluding rule (i.e., a terminal) and which rule is an intermediate rule.

The bit matrix is created during the initial start-up procedure and updated when a new rule is inserted into the knowledge base or a rule is deleted from the knowledge base. As shown in Eq. (1), an entry BM[i,j] accepts the value 1 if the conclusion of rule i can contribute to the firing of rule j and 0 otherwise. In other words, if the conclusion of rule i is similar to a clause in rule j then 1 is inserted in BM[i,j]. Thus, a matching process takes place to determine the similarity between the conclusion of rule i and a clause in rule j. As was stated earlier, each clause in a production rule is in the form:

THE A of [the] B is [not] [adjective] C

where A and B are key words and C is either a key word or a number or a range of numbers describing B.

This chapter presented the COMEX communications system that should assist operator when selecting a communication device. The expert system should provide inference engine that will effectively lead to efficient conclusions. There occurs confrontation of several expert systems, and this is something that should be considered as production rules would not be in collision.

4. CONCLUSIONS

Before the existence of artificial satellites, the only way to communicate over long distances was to use radio waves that refract and then reflect from the Earth's natural satellite - ionosphere using HF waves. Apart from satellite space infrastructure, land infrastructure and ship’s satellite equipment existence terrestrial communication systems are still irreplaceable in GMDSS and provide direct link, without radio relaying with ship in distress. Implementation of HF technologies is complex because state of ionosphere is constantly changing.

Radio officer as crew member was experienced operator onboard ships in the past, and since GMDSS was fully implemented in February 1999 merchant ships are not obligatory of employing professional radio officer. His functions on boards’ ships are taken over system which includes at least three nautical officers each holding valid radio permit.

Today there are commercially available ALE systems whose are used to test the current state of the ionosphere in order to select the working frequency at the moment. By means of that, the use of prognostic and predictive models maintained by experienced users for test the state of the ionosphere completely avoided. Furthermore, the use of prognostic and predictive models by experienced users for test the state of the ionosphere now is unnecessary.

Modern approach to maritime communications demands integrity. It considers that all communication systems are merged into one unique system rather than individuals segments for communication. The task of modern technology is to enable a comprehensive approach to the problem of communicating through the expert system.

Expert system shown in this paper is COMEX to outline the complexity of the problems of communication and indicate in which direction should be further investigations. It should provide inference engine that will effectively lead to efficient conclusions as one possible and proposed solution of the problem.

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BIOGRAPHIE

Dean Sumić was born on November 29th 1972 in Split, Croatia. Graduated from the Faculty of Maritime Studies Split as Marine Electro-Energetic and Electronic engineer and second diploma as Marine Management graduate engineer. GMDSS GOC instructor at the Faculty of Maritime Studies Split. PhD student on University of Zagreb, Faculty of Transport and Traffic Sciences.

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ACCURACY OF COORDINATE TRANSFORMATIONS IN GIS AND AIS SYSTEMS - EXAMPLE OF THE ADRIATIC SEA

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ABSTRACT

Modern GPS equipment for geodetic coordinates position fixing is based upon worldwide used satellite positioning methods and it gives position on the global WGS datum. In the Republic of Croatia topographic maps and nautical charts have been produced on the local Helmannskoegel datum and Bessel rotational ellipsoid.
The world market offers a large number of software packages which calculate transformations from the local to the global datum, some of them being free and available on the internet.
Reference geodetic coordinates shown on different datums may result in a position error of some hundred metres. Mathematical conversion of a geodetic position from one datum to another is called transformation. Among several models of transformation between the two datums, the following ones are usually used: seven-parameter also called Helmert transformation and three-parameter or Molodensky transformation.
All available GIS and AIS systems mainly used two programs for coordinate transformation: PCTrans developed by Netherlands Hydrographic Service, and Geotrans - Geographic Translator, developed by the US Army Topographic Centre and National Geospatial Intelligence Agency.
In this article we would estimate accuracy and usability of the programs for transformation of geodetic coordinates between local and global datums, used in GIS and AIS systems.

KEY WORDS

geodetic datum. accuracy. GPS. GIS. AIS.

1. INTRODUCTION

To date, in the Republic of Croatia, topographic maps and nautical charts have been produced on the local Helmannskoegel datum (Bessel rotational ellipsoid 1841). However, the modern GPS equipment for position fixing (geodetic coordinates) is based upon worldwide used satellite positioning methods, so that it gives position on the global WGS84 datum. Many instruments and devices have GPS modules which survey data supply with coordinates.
As the satellite navigation is widely applicable nowadays (especially in maritime business), the requirement for the production of a mathematical model of transformation from the global to the local datum and reversely has been arisen. The world market offers a large number of software packages which calculate transformations from the local to the global datum, some of them being free and available on the internet.
Main objective of this paper is to help the spatial data users in the interpretation of their data, and in the selection of high quality software products for the transformation of coordinates.
The paper gives a brief outline of basic terms concerning the Earth's shape and size. Free software packages for the transformation of coordinates are examined and finally, the results of free software packages for calculating transformations are compared to the results of the official T7D program used in Republic of Croatia (Bašić et al., 2006).

2. EARTH'S SHAPE AND GEODETIC DATUMS

The Earth's physical surface has irregular and complex shape (geoid), which should be simplified and defined by means of a physical-mathematical model called rotational ellipsoid. Rotational ellipsoid is defined by two parameters: the length of the semi-major axis a and the flatness of ellipsoid f=(a-b)/a; b is small semi-major axis (Annoni et al., 2001).
The term of geodetic datum defines the shape and size of the Earth, as well as initial point and orientation of the coordinate system used for mapping of the Earth's surface (Dana, 2006). As a rule, it also includes the definition of ellipsoid as mathematical shape of the Earth. The datum helps to define the reference coordinate system in relation to the real world (SGA, 2004).
Ellipsoids of different dimensions and placements in space are used in geodetic practice; those which best fit to the entire Earth are called global ellipsoids, whereas those suitable for particular region or state are called local ellipsoids. Until 2004, the reference ellipsoid used in Croatia was the Bessel ellipsoid 1841, and the associated datum was the Helmannskoegel (HER). The Government of the Republic of Croatia then adopted the decision of establishing new official geodetic datums (European Terrestrial Reference System 1989 - ETRS89 with Geodetic Reference System 1980 – GRS80 as the official mathematical model) and flat cartographic projections (SGA, 2004).
In practice, geodetic datum is divided into the horizontal geodetic datum and the vertical geodetic datum, being the basis for computing the position on the Earth's surface or the height above the Earth's surface. Vertical geodetic datum is not the subject of this paper.

3. COORDINATE TRANSFORMATION

GPS receivers fix the positions of points on the World Geodetic System 1984 (WGS84; NIMA 1990) rotational ellipsoid, centering the Earth through GPS satellite orbital elements. By using GPS technology, it is possible to fix the position in relation to the centre of the Earth mass. That is the reason why local datums are connected (parameterized) with the global WGS84 datum through transformation parameters.
Reference geodetic coordinates shown on different datums may result in a position error of some hundred meters (Fig. 1). Mathematical conversion of a geodetic position from one datum to another is called transformation.
Accuracy and precision of positioning and overlapping objects obtained from different sources depend on: accuracy of transformation parameters and method used for transformation (3 or 7 parameter transformation) and the

quality of the algorithm for conversion and transformation of spatial data. Mean differences of coordinates between the local (Helmannskoegel) and global (ETRS89) datum obtained by T7D (7-parameter transformation) are as follows: for geodetic latitude 0",079815 (3,341 m), and for geodetic longitude 17",193777 (385,846 m).

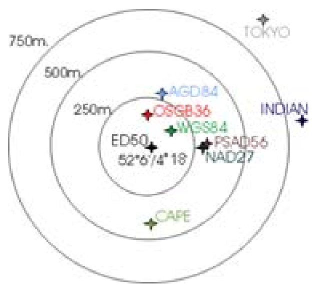


Figure 1. Differences between the same coordinate shown in different datums (according to Dana, 2006).

There is a large number of software on market for spatial data processing and handling, using different program modules for spatial data transformation and conversion. Such software modules are components of many applications, particularly GIS-oriented applications. Most GIS (SAGA, QGIS GRASS GIS, gvSIG, MapServer, PostGIS, TopoCad…), especially free applications, AIS and ECDIS systems used various models and program modules for data transformation and conversion.
Among several models of transformation between the two datums, the following ones are usually used: Helmert (seven-parameter) or Molodensky (three-parameter) transformation (Annoni et al., 2001; URL 1).

3.1. Seven-parameter transformation of coordinates

Helmert transformation is also called the seven-parameter transformation. Parameters for the calculation of coordinate transformation represent a relation between the two datums: the shift of ellipsoid centre towards the centre of the Earth mass, the rotation around three coordinate axes, and the difference in scale between the two systems. The advantage of this method is greater accuracy in calculating transformation as compared with the three-parameter transformation. Helmert transformation obtaining accuracy is 1 m for the area of the Republic of Croatia (Bašić et al., 2006).

3.2. Three-parameter transformation of coordinates

The Molodensky or 3-parameter transformation is commonly used with manual GPS receivers and GIS. The formula is simple, assuming that the transformation between the local and global datums can be represented by a shift of the ellipsoid centre towards the centre of the Earth's masses. In its technical report, the NIMA (1990) gives the formula for the Molodensky parameter transformation between local datums and WGS84.
Standard Molodensky transformation is one of most widely used methods for the transformation of geodetic coordinates from one datum to another. It is less accurate than the Helmert transformation, obtaining accuracy of 5 m for the area of the Republic of Croatia (Bašić et al., 2006). Molodensky transformation has the advantage of a simple computation. It should be pointed out that this method is incorporated within most GIS packages, as well as into most GPS receivers.

4. FREE PROGRAMS FOR TRANSFOR-MATION

Many free programs for computing the transformation of geodetic coordinates between different datums are available on the internet, which is particularly important to a wider circle of GPS data users. Such programs are called free software and they can be used without restrictions. Internet also offers many relatively cheap programs for the transformation of coordinates which allow a free use of program for a restricted period of time (mostly one month). Such software generally supports more than 200 geodetic datums.
Analyzed programs were:
PCTrans developed by the Netherlands Hydrographic Service (www.hydro.nl), suports

different datums, and 3 or 7 parameter transformation model. This program offers most possibilities of all examined programs. Most ECDIS and other applications that deal with the nautical spatial data processing (e.g. dKart) used PCTrans for data transformation.

Geographic Translator – GEOTRANS 2.4.2, developed by the US Army Topographic Centre and National Geospatial Intelligence Agency (http://earth-info.nga.mil/GandG/ geotrans). The program supports 230 datums and 29 projections. Most free GIS applications (e.g. SAGA, QGIS GRASS) used this program for data transformation.

TRANSDAT 10.15 developed by Killet Software, Germany (www.killetsoft.de). The program allows entering reference ellipsoid parameters. It is possible to transform the coordinates obtained from GPS receiver.

TatukGIS 1.2.0.30 developed by TatukGIS Developer Kernel (www.tatukgis.com) supports 24 projections and 225 datums.

EasyTrans 1.27 (http://www.geoima.de) supports 220 ellipsoids. Major disadvantage is the usage of limited duration (30 days).

5. METHODS

Croatian part of the Adriatic Sea occupies an area approximately from 45ºN 13ºE to 41º,5N 19ºE. Sixteen points were selected as check points to calculate the transformation of coordinates, being evenly arranged over the territory of the Croatian part of the Adriatic Sea (Fig. 2) (Bašić et al., 2006).

Transformation model - T7D is unique 7 parameters coordinates transformation model obtained from the State Geodetic Authority SGA and Faculty of Geodesy in Zagreb. T7D is official program for coordinate transformation between Helmannskoegel and WGS84 in Republic of Croatia.

Essential prerequisite for this method of research is that the results of coordinate transformation using T7D is accurate, and it was therefore taken as an etalon.

Furthermore, transformations of coordinates between local datum and WGS84 were calculated for the above mentioned 16 points (Fig. 2) by means of free programs described in Chapter 4, and the obtained values were compared with the coordinates transformed by using T7D.

6. RESULTS

Differences between the coordinates obtained by 7-parameter transformation in T7D and the coordinates obtained by the tested free software using 3-parameter transformation are shown in Fig. 3. The differences are shown on WGS84 in seconds.

Mean differences of geodetic latitude range between 0",066697 or 2m (PCTrans) and 0",110841 or 3.4m (Transdat), while mean differences of geodetic longitudes range from 0",035505 or 1m (Transdat) to -0",106049 or 3.3m (EasyTrans).

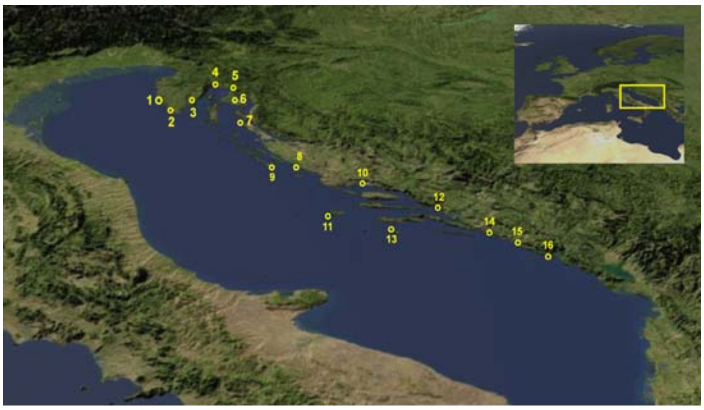
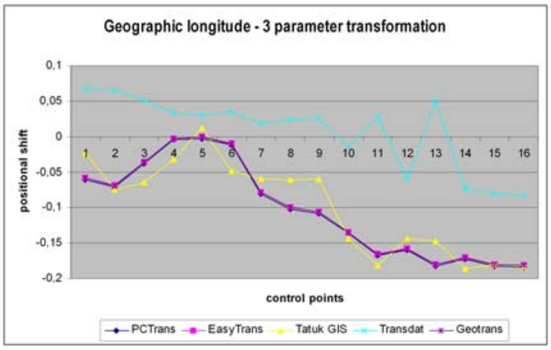


Figure 2. Location of selected 16 points



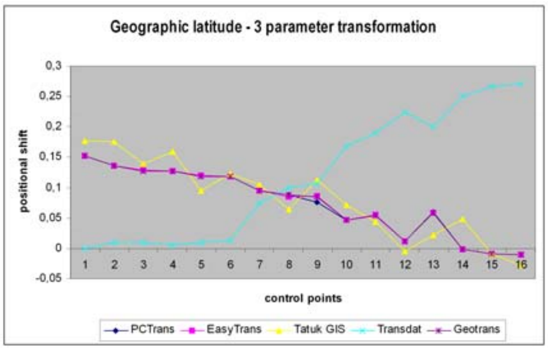


Figure 3. Differences between the coordinates obtained by 7-parameter (T7D) and 3-parameter transformation - φ component in sec. (left) and λ component in sec. (right)

7. CONCLUSIONS

For transformation of coordinates between the local Helmannskoegel Datum and the global ETRS89 or WGS84 Datum, free programs PCtrans, EasyTrans, TatukGIS, Transdat and Geotrans are recommended. It should be pointed out that the results produced by free programs are adequate to meet the needs of most GPS users.

Transformation of coordinates were calculated for a representative sample of 16 points evenly arranged along the Adriatic coast.

Comparing the results of coordinate transformation presented in this paper and official transformation of data, it can be concluded that for accurate positioning during navigation free programs PCtrans, EasyTrans, TatukGIS, Transdat and Geotrans should be used.

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BIOGRAPHIE

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INTEGRATION OF THE LAND AND MARINE SPATIAL DATA ON THE CROATIAN COASTLINE

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ABSTRACT

Every maritime country has its coastal zone, which is differently defined in terms of different professions. As a physical-geographical term, coast is a part of the land in occasional contact with the sea. Coast is therefore not a line but a belt, either wider or narrower, depending on the slope of the land and the range of sea level oscillations.

Because of the sea-land interaction in the coastal belt, the spatial data in that area are interconnected, usually being examined, represented or used together.

Boundary between the sea and land, as shown on nautical charts and topographic maps, is not the coast but the coastline. Land data (State Geodetic Administration) and marine data (Hydrographic offices) are usually represented by means of different coordinate systems, different projections, different datums (horizontal and vertical) and differents scales, to show different contents. As a result, users are not able to refer to the required object in the coastal area in a simple and consistent way. The national spatial data infrastructure (NSDI) should therefore (like in other countries) integrate land data with marine data, defining the marine spatial data infrastructure (MSDI). Integration of the land and marine data is becoming a serious problem for many countries, and just a few of them have solved it , each in its own way.

This paper presents the activities of the Hydrographic Institute of the Republic of Croatia on the integration of the land and marine spatial informations and the possibilities of its implementation in Croatia.

KEY WORDS

nautical charts. topographic maps. coastline. MSDI. Croatia.

1. INTRODUCTION

Development of modern industrial society has enforced the usage of spatial data in many human activities. In last decades rapid application development of information and communication technologies considerably improved tracking of spatial data changes.

Spatial data is defined as the data or information that identifies the geographic location of features and boundaries on Earth, such as natural or constructed features, oceans and more. Spatial data is usually stored by geographic coordinates which is often accesed, manipulated or analysed through Geographic Information System - GIS (IHO, 2011).

A Spatial Data Infrastructure (SDI) is a data infrastructure implementing a framework of geographic data, metadata, users and tools that are interactively connected in order to use spatial data in an efficient and flexible way. Another definition is *the technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain, and preserve spatial data* (GSDI Cookbook, 2009).

The wider use of national Spatial Data Infrastructures (NSDI) has long been held back by difficulties in sharing data between different technologies, different organisations and even between different functions within the same organisation.

The current interoperability capabilities are reflected in the European Unions' (EU) initiative to create a regional SDI – INSPIRE (INfrastructure for SPatial Information in Europe, Directive 2007/2/EC). INSPIRE sets out a framework and timetable that will oblige public sector organisations to publish key spatial data sets in ways that support the discovery of the data and provide access to these resources via product-neutral visualisation and downloading services.

Much has already been written about SDI, but primarily from land-based perspective (IHO, 2011). This statement is valid for Croatia as well. In 2008, Croatian State Geodetic Administration (SGA) published study titled "National infrastructure of spatial data in Croatia" (in Croatian). In this document "the marine dimension" of Croatian NSDI is only mentioned, although the total area of Croatian internal waters, territorial sea and protected ecological and fishery zone (ZERP) is 55 349 km^2, what is 97.9% of Croatian land area (Leder and Filipović, 2007). Moreover, coastline of the Republic of Croatia consists of a mainland part 1880 km in length, and an island part 4398 km in length, amounting to 6278 km (Duplančić Leder et al., 2004). It is the second best indented coast in the Mediterranean. The Republic of Croatia is committed to defining spatially its land and marine territory.

This paper presents the activities of the Hydrographic Institute of the Republic of Croatia on the integration of the land and marine spatial informations and the possibilities of its implementation in Croatia.

2. MARINE SPATIAL DATA INFRASTRUCTURE – MSDI

Marine Spatial Data Infrastructure – MSDI is the component of an SDI that encompasses marine geographic and business information in its widest sense. This would typically include seabed topography (bathymetry), geology, marine infrastructure (e.g. wrecks, offshore installations, pipelines and cables), administrative and legal boundaries, and areas of conservation, marine habitats and oceanography (IHO, 2011).

Schematic presentation of the Marine SDI as "the marine dimension" of SDI is shown in Fig. 1.

According to International Hydrographic Organization an Hydrographic Office (HO) is uniquely placed to play a central role in the development of the marine component of all SDI's. Hydrography, with its subset of data themes, forms the key "base reference" or "core geography" layer for the sea space in each State or region. In this capacity, HO data provides a rich and unparalled resource for users at all levels (IHO, 2011).

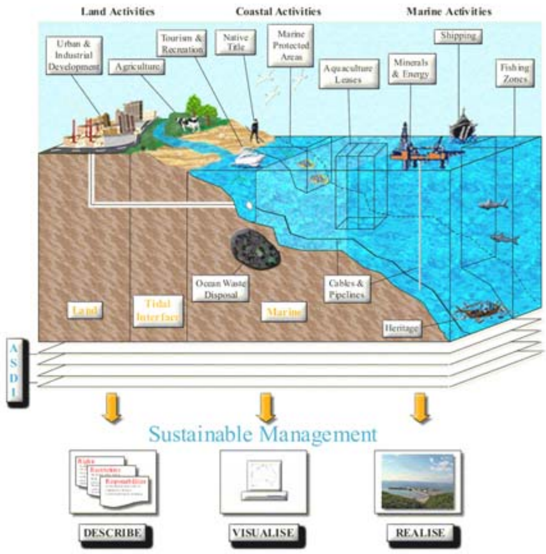

Figure1. Marine SDI as marine dimension of SDI (according to Binns et al., 2003).

Hydrographic Institute of the Republic of Croatia (HHI), as official HO, recognized the importance of the MSDI concept. In article 15 of the "Law on hydrographic activity" (Official Gazzete 68/98, 110/98 i 163/03) it is defined as „Marine Register" as follows:

> „Marine Register shall keep records of the data on the sea, seabed and submarine area, relevant for the safety of navigation, except the data of interest to Defence.
> Marine Register shall include the data on the users, the way and proportions of exploitation of the sea, seabed and submarine area, as well as the records of objects, works and occurrences relevant for the safety of navigation, for each area of local self-governing unit and units of local government and self-government."

Also, in article 5. it is stated that HHI shall carry out, among others:

> „Describing and drawing of a geodetically defined border of sovereignty of the Republic of Croatia on sea, taking into consideration other acts which regulate the border, keeping up to date and managing the database of the official data on sea, in the following fields: navigation, hydrography (objects on sea and in the submarine area), cartography, geology, geophysics and oceanography (sea level oscillations, waves, currents, thermohaline, hydroacoustic and optical properties of the sea, hydrometeorology, etc.), as well as organizing and conducting the Marine Register."

The problem of implementation of MSDI as part of NSDI is consequence of different presentation of spatial data in coastal zone. Land data (State Geodetic Administration) and marine data (Hydrographic offices) are usually represented by means of different coordinate systems, different projections, different datums (horizontal and vertical), and differents scales, to show different contents. As a result, users are not able to refer to the required object in the coastal area in a simple and consistent way (e.g. Duplančić Leder and Leder, 2009).

An example of HHI's activity on implementation Croatian MSDI (legal boundaries) is shown in Fig. 2.

Integration of the land and marine data is becoming a serious problem for many countries, and just a few of them have solved it (Murray, 2007), each in its own way.

It must be pointed out that for every maritime country marine administration has a very important role for implementation of MSDI, especially at highest political level. Marine administration requires definition of MSDI and then access and information about MSDI.

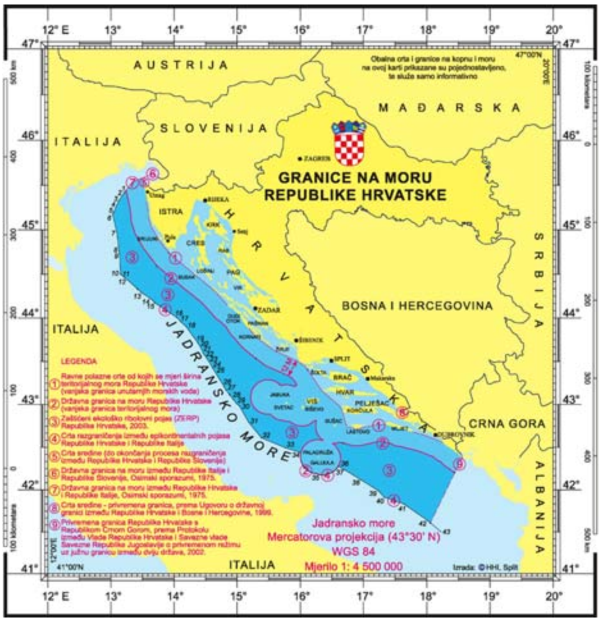

Figure 2. Legal boundaries of the Republic of Croatia in the Adriatic Sea (HHI, 2009).

3. COASTAL ZONE AND COASTLINE

Every maritime country has its coastal zone, which is differently defined in terms of different professions. As a physical-geographical term, coast is a part of the land in occasional contact with the sea. Coast is therefore not a line but a belt, either wider or narrower, depending on the slope of the land and the range of sea level oscillations. As a geographical-economic term, coast has a much wider significance, since the width of the coastal belt depends on land's orography.

Because of the sea-land interaction in the coastal belt, the spatial data in that area are interconnected, usually being examined, represented or used together.

Boundary between the sea and land, as shown on nautical charts and topographic maps, is not the coast but the coastline. According to the recommendation of the International Hydrographic Organization (IHO), most maritime countries define coastline as the intersection of the mean high water with the land (Shalowitz, 1962; Harrington, 1993; IHO, 2005; Quadros and Collier, 2008).

Hydrographic Institute of the Republic of Croatia defines coastline as a surface determined by the mean high water on the tide gauges at Dubrovnik, Split, Bakar, Rovinj and Koper in the epoch 1971.5, being called the Croatian Coastline Reference System for Epoch 1971.5 - HRSOC71 (Domijan et al., 2005).

In practice, the coastline is calculated as the mean high water from the 18.6-year series of hourly values of long-period sea level oscillations obtained from tidal measurements (IHO, 2005; Domijan et al., 2005).

Exact and unique definition of the coastline is very important for gently sloped coast (Fig. 3) to be plotted as consistent feature object on nautical charts and topographic maps.

Geodetic methods of coastline delineation in Croatia are described by Leder and Duplančić Leder (2011).

Figure 3. Oscillations of sea level heights in the coastal belt on a gently sloped coast (Bačvice beach in Split).

4. INTEGRATION OF SPATIAL DATA ON THE CROATIAN COASTLINE

As in the Republic of Croatia there is no continuity of spatial data between the land-sea spatial information, the procedure of locating and referencing the spatial information on the coastline is problematic and complicated, especially for spatial data users.

Different spatial data in the Republic of Croatia use different coastlines as referent baseline. The coastline plotted on the nautical charts produced by the Hydrographic Institute of the Republic of Croatia was defined according to the recommendation of the International Hydrographic Organization as the intersection between the mean high water level and the land. As it is an unambiguous definition, it could be said that the coastline is a consistent feature object on nautical charts.

The coastline plotted on the topographic maps produced by the State Geodetic Administration was derived as the intersection between the land and the sea from aerophotogrammetric recordings at particular time. As the height of the sea level constantly varies in time, such method of determining the coastline is not consistent because it depends on the recording time.

Consequently, topographic maps and nautical charts use differently defined coastlines. Moreover, to represent the land and marine spatial data, different datums (horizontal and vertical), different projections and scales are used (Table 1), and different contents are displayed. The result is that users cannot easily identify their object in the coastal zone.
In order to resolve this problem, it is proposed to define all the vertical cross sections in the marine spatial data infrastructure (MSDI) as an integral part of NSDI, or all the height datums (coastline, geodetic datum and chart datum) using unique and consistent methodology. Users should be enabled effective recalculations between the stored data, as well as easy changeover to new height datums in the future.
Schematic presentation of integration of spatial data on the coastline is shown in Fig. 4.
The best solution would be the unique coastline data for topographic maps and nautical charts.

Table 1. Different reference coordinate systems in Croatia for topographic maps and nautical charts.

	TOPOGRAPHIC MAP	NAUTICAL CHART
COASTLINE	Aerophoto (coastline in exposure moment)	- Croatian reference system of the coastline - HRSOC71
HORIZONTAL DATUM	- Hermanskoegel - ETRS	- Hermanskoegel - ETRS - WGS84
VERTICAL DATUM	- Normalna nula Trsta NNT - Geodetic zero - Croatian vertical reference system - HVRS71	- Mean sea level (MSL) for land data. - Hydrographic zero (Chart datum) - Croatian reference system for depths - HRSDM71
PROJECTION	Universal Transverse Mercator (UTM).	UTM , Mercator
FORMATIS OF DIGITAL DATA	- various formats (DWG, ARC, SHP, Hardcopy)	- Digital nautical chart - Raster (TIFF, BMP) - ENC - S-57 Version 3.1 - Nautical charts: Raster (scan, print) - Bathymetric sheet (hydrographic sheet): ASCII, scan data
SCALE	systematic (1, 5, 25, 50 000…).	unsystematic (various scale range)

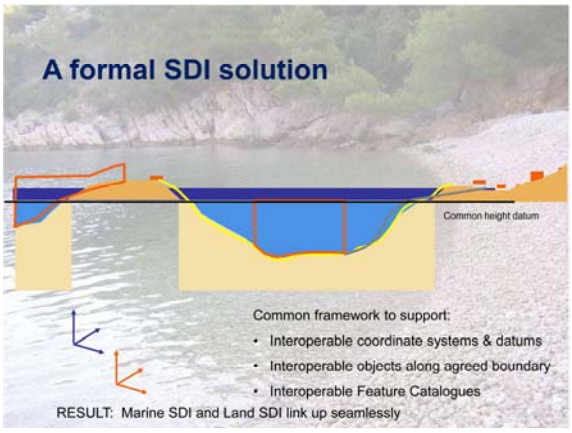

Figure 4. Schematic presentation of integration of spatial data on the coastline (adopted from Murray, 2007).

5. CONCLUSIONS

The European unions' (EU) initiative to create a regional SDI (INSPIRE) was adopted in Croatia. In 2008, Croatian State Geodetic Administration (SGA) published study titled "National infrastructure of spatial data in Croatia". In this document "the marine dimension" (MSDI) of Croatian NSDI is only mentioned.
Hydrographic Institute of the Republic of Croatia (HHI), as official HO, recognized the importance of the MSDI concept.

The problem of implementation of MSDI as part of NSDI is consequence of different presentation of spatial data in coastal zone. Land data (State Geodetic Administration) and marine data (Hydrographic offices) are usually represented by means of different coordinate systems, different projections, different datums (horizontal and vertical), and differents scales, to show different contents.

In order to resolve this problem, it is proposed to define all the vertical cross sections in the marine spatial data infrastructure (MSDI) as an integral part of NSDI, or all the height datums (coastline, geodetic datum and chart datum) using unique and consistent methodology. Users should be enabled effective recalculations between the stored data, as well as easy changeover to new height datums in the future.

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QUALITATIVE METHODS OF FAULT DETECTION AND DIAGNOSIS IN THE ELECTROHYDRAULIC ACTUATOR

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ABSTRACT

Fault diagnosis has essential function in improving the safety of marine systems. This paper gives an especial review on qualitative methods of fault detection and diagnosis for the case of electrohydraulic actuator. The relationships between faults and symptoms are visualized by fault tree and its detailed analysis. Results obtained through simulation point to the importance of fault diagnosis, thereby contributing to the reliability and availability of marine systems.

KEY WORDS

marine systems. electrohydraulic actuator. fault diagnosis. fault tree.

1. INTRODUCTION

Hydraulics is used in every engineering field. It has plenty of advantages over other methods of operation. Its main advantage is, with the application of much less force, a greater work can be done. It is widely used for automation and control engineering fields. Ship has enormous varieties of machineries for propulsion, cargo operation, shipboard safety and maintaining the comfort standards of the crew, therefore hydraulics plays a very vital role [3].

Every hydraulic system must contain a reservoir, a pump, various valves to control oil flow, direction and pressure and a hydraulic cylinder or motor to move the load applied by oil under pressure [15].

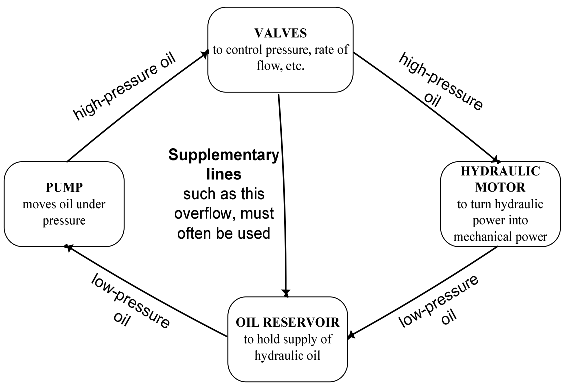


Figure 1. A basic hydraulic system.

Hydraulic system may be very complex and faults need to be detected quickly and correctly to avoid a lot of time and money.

For improving reliability and marine systems safety fault diagnosis methods are more and more important. This paper gives an especial review on qualitative methods of fault detection and diagnosis in the electrohydraulic actuator. Fault tree analysis shows all states of electrohydraulic actuator, therefore it is possible to carry out a better operation condition of a certain system.

2. FAULT DETECTION AND DIAGNOSIS

The main objectives of fault diagnosis are detection, isolation and fault analysis [2], [4], [6], [8], [12].

Security and reliability are generally achieved by combination of different action such as [9]:

- - fault avoidance,
- - fault removal,
- - fault tolerance,
- - fault detection and diagnosis,
- - automatic supervision and protection.

Early detection and diagnosis of process faults can help avoid abnormal event progression and reduce productivity loss. Figure 2 depicts the component of a general fault diagnosis framework. The figure shows a controlled process system and indicates the different sources of failures in it [11].

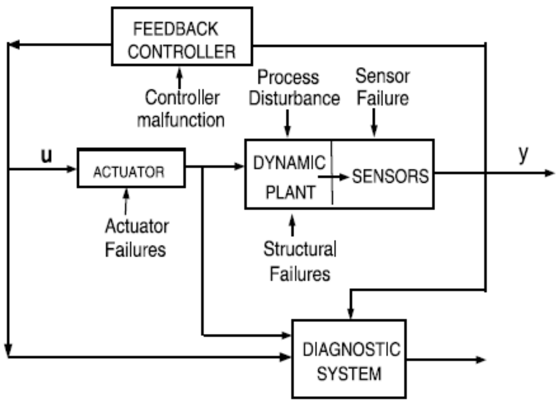


Figure 2. A general diagnostic framework.

To realize the objectives of the fault diagnosis procedure, depicted in figure 3 and consisting of three consecutive steps, shows the order of tasks which should be performed in the automatic diagnosis system [1], [13].

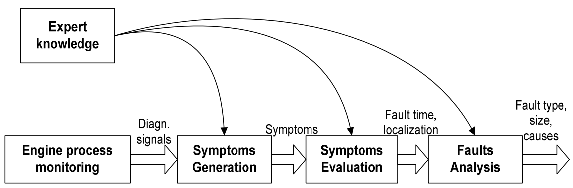
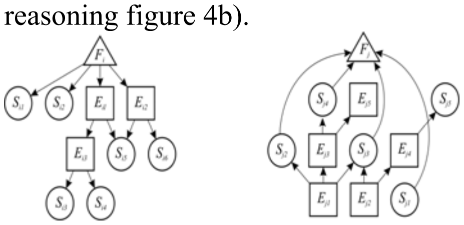


Figure 3. Fault diagnosis procedure.

2.1. Qualitative methods

Qualitative methods use qualitative relationships or knowledge bases to draw

conclusion regarding the state of a system and its components. These methods provide shortcuts, they may represent the most expedient way to meet analytical needs where more processing – intensive approach are time and cost prohibitive [10].
Fault detection and diagnostics based on qualitative modeling techniques represent category that is based on a priori knowledge of the system.
Then this a priori knowledge can be represented in causal relations: fault – event – symptoms. The establishment of these causalities follows the faults tree analysis – FTA, proceeding from faults through intermediate events to symptoms (the physical causalities), figure 4a) [9].
If the analysis is based on observing the fault tree, starting from the symptoms to the faults, it is event tree analysis - ETA or forward chaining reasoning figure 4b).



a) b)

Figure 4. FTA and ETA – the basis of heuristic knowledge.

FTA is the most frequently used in the assessment of the safety protection system design. The design is assessed by predicting the probability that safety system might fail to perform their intended task of either preventing or reducing the consequences of hazardous system [6].
Both methods can be expressed in the form of rules: IF <condition> THEN <conclusions>/<action>. The symptoms are related to each other by means of logical AND/OR operations in binary or fuzzy logic form. Condition part (premise) contains facts in the form of symptoms S as input and the conclusion part includes fault F as a logic cause of the facts. Then, the rules could be given in the form (1):

$$f < \left(\sigma_i \, AND \, \sigma_i + 1 \, AND ... AND \, \sigma\delta\right) OR \begin{pmatrix} \sigma_i' \, AND \, \sigma_i' + 1 \, AND \\ ... AND \, \sigma\delta' \end{pmatrix} ... OR ... > then < \phi_k > \tag{1}$$

where: $\sigma_i \in \left[E_k, S_i\right]$ a set of events, symptoms (inputs i.e. premises), $\phi_k \in \left[E_k, F_j\right]$ a set of events and faults (outputs i.e. conclusions).
In binary logic is: $\sigma_i = 0$ or $\sigma_i = 1$, so ϕ_k can be determined in this way, expression (2):

$$\phi_k = 1 - \prod_{j=1}^{\gamma} \left(1 - \prod_{i=1}^{\delta(j)} \sigma_i\right) \tag{2}$$

where: γ - number of conjunction (union); δ(j) – number of elements by conjunction.
Symptoms, events and faults can present in the form of fuzzy set, which defines the respective functions and affiliation as in expression (3), (often subjective assessment experts, operator):

$0 \le \mu(\sigma_i) \le 1$ for symptoms ;

$$0 \le \mu\left(\varphi_k\right) \le 1 \text{ for faults} \tag{3}$$

where μ is membership function.

3. CASE OF STUDY – ELECTROHYDRAULIC ACTUATOR

In hydrostatic transmission, the exhaust oil from the cylinder or motor is returned directly to the pump inlet. The pump is connected directly to the actuator. The electrohydraulic actuator was designed for high positioning

accuracy, able to complete with conventional closed loop hydraulic system [7].
The electrohydraulic actuator has a high torque to mass ration. The electrohydraulic actuator system offers advantages such as a negligible deadband, high positioning accuracy in the closed loop form, high efficiency due to the absence of control valves and linearity [5].
Control block diagram of the electrohydraulic actuator is depicted in figure 5.

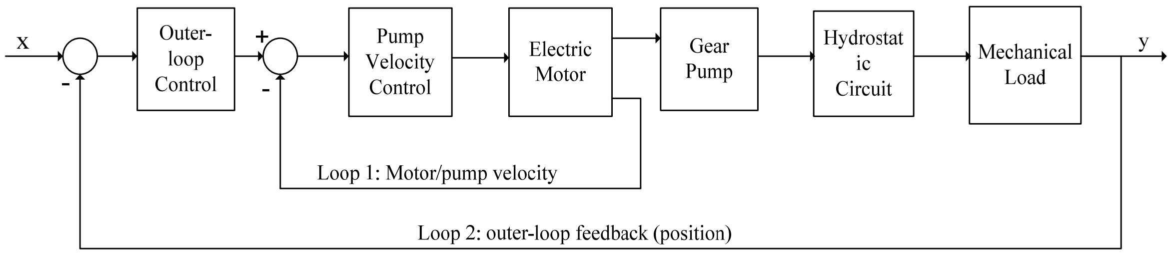


Figure 5. Control block diagram of the EHA.

The main constituent of the electrohydraulic actuator is a bi-directional, fixel displacement gear pump to supply oil to the actuator. In the electrohydraulic actuator, flow rate control is achieved by simply varying the speed of the electric motor. When the flow encounters a resistance such as an actuator, its fluid pressure increases. The pressure difference in the actuator chambers results in exertion of a force on the external load [5].
In this paper, an attempt is made to consider some of the possible faults that may occur when the electrohydraulic actuator is operating. This is crucial when considering implementing a condition monitoring scheme for any machine. Knowing the possible faults and having a better understanding of these faults enable the identification of critical parameters which can be monitored [5].
To check all possible causes of the electrohydraulic actuator malfunction, an analysis by fault tree method has been made, figure 6.
Such diagnostic method of conclusion gives better understanding of functional connections between analyzed system's components and more simple identification of the component that causes eventual fault of a technical system.
Interactive connection of events and symptoms that could lead to given fault has been inferred by Boole's logical expression.
After fault tree construction it is possible to make a quantitative analysis. The probability theory is the basic mathematical technique involved in the quantitative assessment of fault trees. It provides an analytical treatment of symptoms. Symptoms and events are the fundamental components of fault trees.

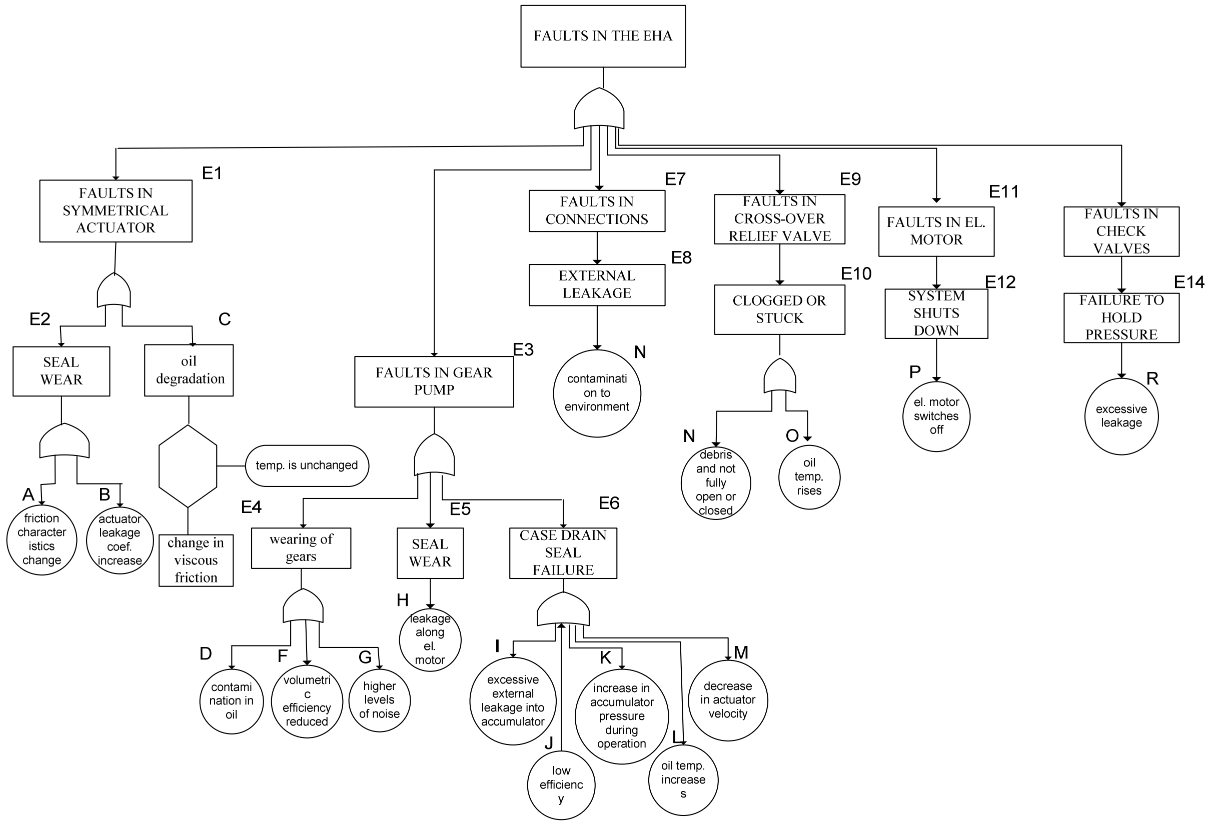


Figure 6. Fault tree of electrohydraulic actuator

Set theory is general approach which allows us to organize the outcome events of an experiment to determine the appropriate probabilities [14]. Using the set theory fault tree concepts of heavy fuel oil separator can be expressed:

P(E)=P(E1)+P(E2)+P(E3)+P(E4)+P(E5)+P(E6)+P(E7)+P(E8)+P(E9)+P(E10)+P(E11)+P(E12)+P(E13)+P(E14)
P(E1)=P(E2)+C
P(E2)=P(A)+P(B)-P(A)P(B)
P(E3)=P(E4)+P(E5)+P(E6)
P(E4)=P(D)+P(F)+P(G)-P(D)P(F)P(G)
P(E5)=P(H)
P(E6)=P(I)+P(J)+P(K)+P(L)+P(M)-P(I)P(J)P(K)P(L)P(M) (4)
P(E7)=P(E8)
P(E8)=P(N)
P(E9)=P(E10)
P(E10)=P(N)+P(O)-P(N)P(O)
P(E11)=P(E12)
P(E12)=P(P)
P(E13)=P(E14)
P(E14)=P(R)

Such analysis shows that, for a succesful system function, it is necessary that all elements of the system are correct. Furthemore, it makes the fault detection easier in case of a single component fault and accelerates the procedure of the fault localization and timely reaction [6].

4. CONCLUSIONS

In a last few years, fault diagnosis methods are rapidly developing. Application of fault diagnosis methods on complex marine systems guaranties high efficiency and long operational lifetime.

It would be ideal to analyze the operation of all marine systems under different faults, but due to the complexity of their interaction that is

practically impossible. This paper analyses the operation of the electrohydraulic actuator as a part of the marine system. By using the fault tree analysis, all serious causes of the faulty operation of the electrohydraulic actuator have been treated.
The qualitative methods contribute to better exploitation possibilities of the vessel and can help the engineer to understand the actual effect of various faults on the vessel performance.

ACKNOWLEDGMENTS

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NEW METHODS IN SUPPRESSION THE RISK OF SHIP'S DIESEL ENGINE CRANKCASE EXPLOSIONS

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ABSTRACT

Marine engine crankcase explosion except engine damage, in extreme cases, often results in serious injuries and deaths of crew members of the ship's engine room and the finaly with total loss of the ship. The biggest disaster of the ship engine crankcase explosion occured in the case of m / b "Reina del Pacifico" on 11th september 1947 when 28 people were killed and 23 wounded (Woodyard, 2009). Fortunately, in most cases the damage is limited to the engine, however, the danger of the big explosion engine crankcase is especially present if, in the case of explosions, oil mist burn out the engine crankcase, which can cause serious damage in the engine room especially at electric installations and devices. This paper describes the causes and consequences of the explosion in the engine crankcase as well as preventive measures for prevention of crankcase explosions that must be carried out during regular maintenance of marine engines. It also describes the safety systems to prevent the engine crankcase explosion, with special reference to research the world's leading marine engine manufacturer MAN B&W in the development of new methods of safety system to prevent crankcase explosion of marine propulsion engines based on water mist injection in supply line of the engine lubricating oil. The application mentioned methods for large two-stroke slow speed marine propulsion engines is described.[1].

KEY WORDS

marine diesel engine. hot spots. fire. explosions in the crankcase. water injecting.

[1] The results presented in the paper have been derived from the scientific research project 250-2502209-2364 „New Technologies in Diagnosis and Control of Marine Propulsion Systems“ supported by the Ministry of Science, Education and Sports of the Republic of Croatia

1. INTRODUCTION

Occasional mechanical failures in ship engine crankcase are inevitable. Minor problems with the bearing surfaces, for example, will cause the occurrence of hotspots and generate a large amount of oil vapor in the engine crankcase. If a high concentration of oil vapor in the crankcase is not detected on the time, further engine operation caused major damage on hot places, and due to increased friction bearing surfaces develop high temperatures which caused ignition of oil vapor and crankcase explosions. Such phenomena other than damage, in extreme cases, often resulting by serious injuries and deaths of engine room crew members and the final loss of the ship. The biggest disastrous explosion of the ship engine crankcase was recorded in the case of m / v "Reina del Pacifico" on 11th September 1947. when 28 people were killed and 23 wounded (Woodyard, 2009). Fortunately in most cases the damage is limited to the engine, however, the risk of major consequence of crankcase explosion especially if oil vapors ignite outside the crankcase, which can cause serious damage in the engine room particularly on electrical installations and devices. According to statistics of maritime accidents and reports of classification societies, every year several of such cases has been recorded with a dramatic and sometimes even fatal consequences. According a report by Lloyd's Registry under whose class is approximately 20% of ships of the world merchant fleet, in period between 1990 and 2001 were recorded 143 cases of the crankcase explosions of which 21 explosions were in low speed two-stroke engines with crosshead and 122 in a four-stroke engines (Woodyard , 2009). If this information is accepted as an orientation factor, can be estimated that in period of 11 years, reported a total of 715 cases of ship engine crankcase explosion in world merchant fleet, or about 65 cases per year (Woodyard, 2009). While this must be borne in mind that only cases that have resulted in greater damage the machinery or injury to the crew has been reported. Less crankcase explosions without major damage generally can not be reported to the classification and insurance association, so there is the probability that the actual number of cases is much greater.This paper describes the causes and consequences of the explosion in the ship’s diesel engine crankcase and preventive measures for the prevention of crankcase explosions that must be carried out during routine maintenance of marine engines. It also describes the safety systems for the prevention engine crankcase explosions, with special emphasis on research and development of new methods of safety system based on the water injection pressurised lubricating oil. The application of these methods for large low-speed two-stroke marine propulsion engines, explores and develops the world's leading marine engine manufacturer MAN B & W.

2. THE CAUSES OF THE EXPLOSION IN THE ENGINE CRANKCASE

For explosion or turbulent combustion process accompanied by fire and the ravages of high pressures must be fulfiled three conditions as follows: source of air (oxygen), fuel and heat. Oxygen and the oil are present in the crankcase, but conditions for explosion could not achieve under normal operating conditions due absence of the heat and stoichiometric ratio between air and lubricating oil. The splash of oil in crankcase during normal engine operation produces a relatively large droplets of oil that can not generate an explosive concentration in contact with the present air. However due to the possible occurrence of mechanical damage to sliding surfaces in the engine crankcase where hydrodynamic lubrication is not present for whatever reason, but eventually dry or mixed friction at these spots are developed extreme amounts of heat energy that results in evaporation of lubricating oil, which covered that hotspots. So when the temperature of hotspots reaches 200oC the oil that cover this surface begins to evaporate. Although the most common cause of local hotspots is extreme high temperature due to dry friction of the bearing surface, this is not the sole cause of the crankcase explosion. The causes of the explosion in the crankcase include situations of piston head cracked. In that case combustion gases pass through mentioned crack and through piston cooling system can get into the crankcase area and cause ignition of the lubricant oil vapor and crankcase explosion (case of the m/v British Valour on 18th March 2001). Furthermore as the reason for cause of the crankcase explosion of the four-stroke engines can be damaged piston ring and excessive weaar of the cylinder liner, in which case the combustion gases blow by from the cylinder, enter in the crankcase and cause oil vapour ignition and crankcase explosion.

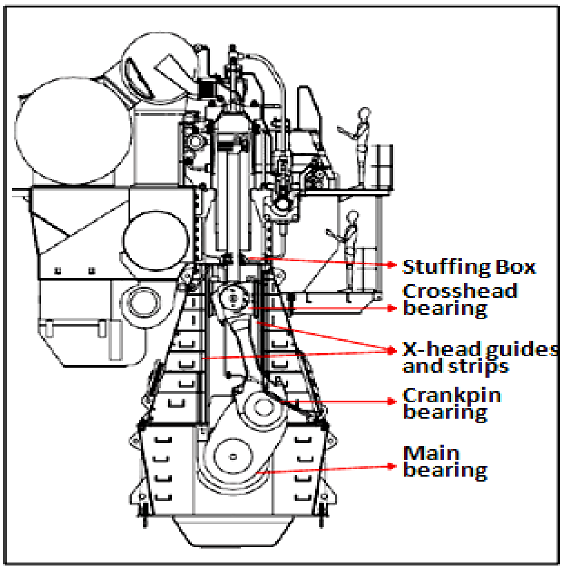

Figure 1. Hot spots in crankcase of two stroke slow speed diesel engine

Figure 1. and 2. shows the possible hot spots caused by insufficient lubrication of bearing surfaces in the low-speed two-stroke crankcase and medium-or high speed four-stroke marine engines. Under normal operating conditions of the engine, the oil vapor generate in the crankcase as a result of oil warming due to lubrication and cooling sliding surfaces in the engine. These oil vapors normaly condense in the crankcase and oil and coolers in concentrations up to 2 mg / l air (Figure 3 – work zone). The concentration of oil vapor can be increased due to increased evaporation caused by excessive heating of the oil due to friction increase at the points where lubrication is insufficient or missing, what resulting with higher concentration of oil vapor of 2-50 mg / l of air.

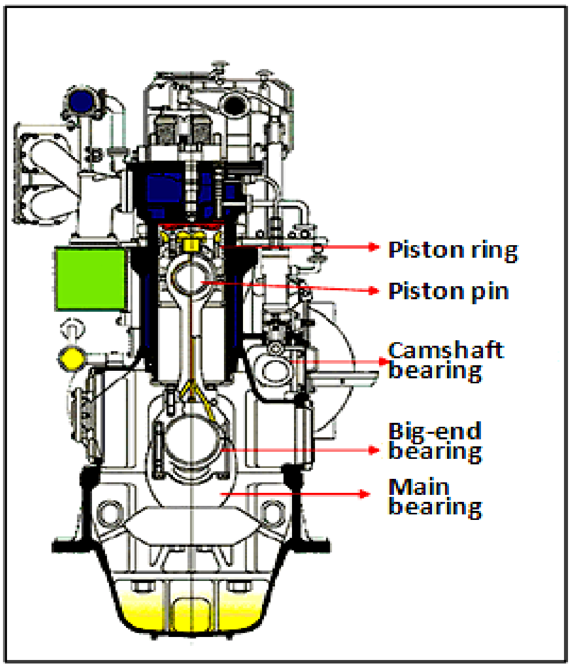

Figure 2. Hot spots in crankcase of four stroke medium speed diesel engine

This area is identifying as dangerous zone in whch explosion may occur. Fig. 3 - a danger zone). Further heating oil on hot spots increases the concentration of oil vapor and when it reaches a value of 50 mg / l or more all the conditions of an explosive mixture in the engine crankcase have been achieved (Figure 3 - explosive level) and leads to the increase of pressure in the crankcase and activating safety valves that opening pressure must not exceed 0.02 N/mm2 (0.2 bar) in accordance with Technical rules of the International Association of Classification societies (IACS, 2008). Tests have shown that the temperature required for ignition of specified concentration is around 850oC, and when all these conditions fulfilled will inevitably come to ignition and explosion in the crankcase. (Smith, 2005)

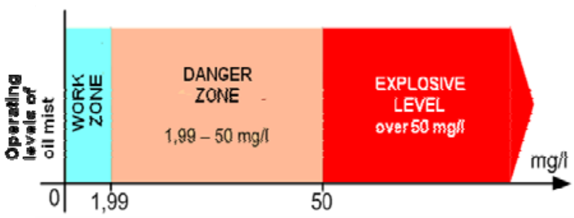

Figure 3. Operating level of the oil mist in engine crankcase (Smith, 2005)

Due to the large metal surfaces of the crankcase in low-speed two-stroke crosshead marine engines a oil mist concentration is significantly lower than those in medium-or high speed four-stroke engines. According to representative samples a diagram has been created that clearly shows the higher working concentration of oil vapor in the crankcase of the four-stroke engines, compared with two-stroke engines and therefore increased risk of crankcase explosion in the four-stroke engines. The upper curve in Figure 4 shows the concentration of oil vapor in the crankcase of the four-stroke medium speed engine type Paxman Valenta 12PR 6L200 measured at 1,500 rpm, at which the engine develops maximum power of 1609 kW. The lower curve represents the concentration of oil vapor in a two-stroke crankcase slow speed engine type MAN B & W 8S80 MC at 76 rpm (Jurjevic, 2007). It is noticeable that the data measured on the four-stroke engine are much higher than those observed in two stroke slow speed engine.

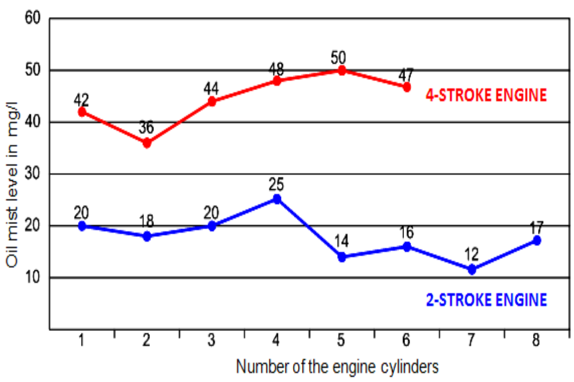

Figure 4. Oil mist level in two stroke and four stroke marine diesel (Jurjević,2007)

3. THE CONSEQUENCES OF CRANKCASE EXPLOSION AND PREVENTIVE MEASURES FOR ITS PREVENTION

Marine engine crankcase explosion, except of the egine damage often result in injuries and deaths of crew members of ship engine room. The biggest disastrous explosion of the ship engine crankcase was recorded in the case of m / v "Reina del Pacifico" 11th September 1947 when 28 people were killed and 23 wounded (Woodyard, 2009). Fortunately in most cases the damage is limited to the engine, however, the risk of major consequence of crankcase explosion especially if there is, in the case of explosions, oil vapors ignite outside the crankcase, which can cause serious damage in the engine room especially on electrical installations and equipment. In some cases, in narrow engine rooms, the pressure wave has caused damage to mechanical items. Doors and lifts have been damaged and, in rare cases, also floor plates have been torn loose and thrown around (MAN B&W Diesel AS, 2002). Proper engine maintenance in accordance with the manufacturer's instructions is an essential prerequisite for preventing the possibility of crankcase explosion. Incorrect tightening bolt assemblies mechanism caused a series of accidents. Particular attention should be paid to the proper adjusting bearings clearance since reduced proper clearance restricts the flow of lubricating oil, which in general leads to overheating and damage the bearing surfaces. Original spare parts should always be used. A number of explosions, some with fatal consequences, have been caused by the use of unauthorised spare parts. In one accident, the piston rod stuffing box was mounted with springs supplied by an unauthorised supplier. Since they were of a wrong dimension, they jammed and caused heating of the piston rod and, finally, a crankcase explosion occurred. In that case, two people lost their lives because of a spare part which might have been believed to be of secondary importance to the functioning of the engine(MAN B&W Diesel AS, 2002).Regular inspection and control of the assemby in the engine crankcase is also essential prerequisites to prevent possible breakdowns and crankcase explosion. Particular attention should be paid to check bearing assemblies with regular measurement of the clearance and detailed checking of all bearings if during examination of the crankcase fragments of white metal found which indicates damage to any of them. Furthermore, it is important to regularly check the safety systems and other components related to safety.

In Table 1 (MAN B & W Diesel AS 2002) presents a numberbof accidents where cause of large two-stroke low-speed marine engines crankcase explosion is known in the period from 1995 to 2002.

Table 1. Cases of explosions where the cause is known (MAN B&W Diesel AS,2002)

Year	Cause of Explosion	Cause of Failure
1995	Bearing in PTO gearbox	
1996	Inlet pipe for piston cooling oil falling off	Incorrect tightening
1997	Incorrect spring mounted in piston rod stuffing box	Unauthorised spare part
1997	Piston rod interference with cylinder frame	
1999	Weight on chain tightener falling off	Incorrect tightening
1999	Fire outside the engine	
2000	Main bearing	
2000	Camshaft bearing	
2000	Incorrect shaft in camshaft drive	Unauthorised spare part
2001	Crankshaft failure	
2001	Piston crown failure	
2001	Main bearing	
2001	Crankpin bearing	
2002	Inlet pipe for piston cooling oil falling off	Incorrect tightening

4. SAFETY EQUIPMENT FOR SUPPRESSION THE DANGER OF EXPLOSION IN THE ENGINE CRANKCASE

IACS Technical rules require mandatory installation of safety valves on the crankcase covers to prevent excessive pressure in the engine crankcase. In accordance with these rules, safety valves shall be designed to allow fast and fully open when the pressure in the engine crankcase exceeds the value of 0.02 N/mm2 or 0.2 bar (IACS, 2008). Installation of safety valves (Fig. 5 and 6) is performed on each crankcase cover for each cylinder as well as on the cover of the camshaft drive mechanism in conventional marine diesel engine if the volume of that space exceeds 0.6 m3 (IACS, 2008). The task of the safety valve is to reduce pressure in the crankcase when the same increases over the limit values. In the case of an explosion in the crankcase, the very rapid expansion pressure wave will cause the opening of the safety valve and admited a large amount of still unignite oil vapor in the engine room. Safety valves are equipped with flame arrestor whose task is to completely extinguish or significantly slow the progression of flame fronts outside the crankcase in the event of an explosion and thereby prevent a fire in the engine room.

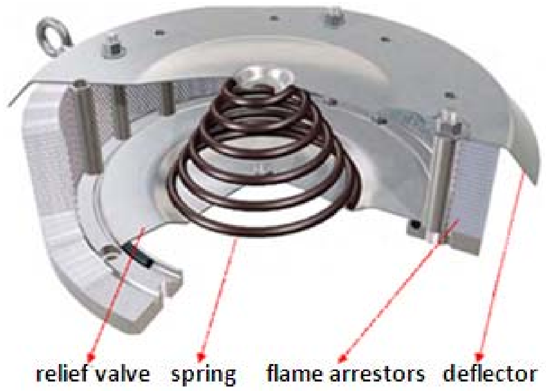

Figure 5. Structure of the „Hoerbiger“ crankcase explosion relief valve

Figure 6. „Hoerbiger“ crankcase explosion relief valve on 2-stroke slow speed marine desel engine

However, in rare cases, in the engine with large crankcase volumes, the explosion of oil vapors can cause extreme pressures that safety valves are not able to compensate, and produce extremely high forces on the crankcase covers that are easy to break out of their rims and causing a fire and the devastating effects in engine room often with fatal consequences for the crew, which in this case located in the engine room. For this reason the SOLAS Convention obliges engine manufacturers to mounting system for the detection of an increased concentration of oil vapor in the engine crankcase in order to improve the safety aspects of marine engines of the crankcase explosion. By the mid-1990s have adopted standards to be met by oil vapor detectors in the engine crankcase, which include: detectors of the oil vapor in the engine crankcase (or equivalent engine bearing temperature control system) that have, at increased concentrations of oil vapor, to activate the alarm system in the engine room and activate engine safety system in a way, that for low speed marine engines with power of 2250 kW and greater and cylinder diameter of 300mm and larger, reduce the load on the engine and reduce the speed of rotation (slow down) to the regime of "very slowly", while for medium and high speed engine with power of 2250 kW and more, and the cylinder diameter of 300 mm and larger with the alarming increased oil vapor concentration in crankcase at the same activate the engine safety system in a way to automatically shut down the engine (IACS, 2008). However for large marine propulsion engines due to the propeller inertia, it is impossible to achieve immediate reduction in speed to the default dead slow value since the propeller will rotate the crankshaft for some time after that. Thus, the risk of a crankcase explosion will still be present during the load reduction process. To avoid this danger, in some engines was installed the inert gas system that would utomatically be activated simultaneously with the activation of the safety system for reducing engine load, and engine crankcase space filled with inert gas to eliminate the explosive atmosphere in the crankcase by reduction of oxygen content to a level where a flame front propagating is not possible. Since in these cases, the engine should stop as soon as possible and check the crankcase after cooling down in order to detect and eliminate the causes of the generation of increased concentrations of oil vapor in the crankcase, the same should be well venting for removal of inert gas before the person can enter the crankcase for inspection and repair of damaged engine assemblies.

5. DEVELOPMENT OF THE NEW METHODS FOR SUPPRESSION THE DANGER OF EXPLOSION IN THE ENGINE CRANKCASE

On large diesel engines, the use of inert gas creates a new risk to the personnel, as venting of the crankcase compartments is rather difficult. Therefore, engine manufacturers approached to the development of systems for suppression the danger of explosion in the crankcase engine based on the use of water vapor which is harmless for the crew and can be easily removed from oil by the normal separation process (MAN B & W Diesel AS, 2002).The world's leading manufacturer of marine diesel engine MAN B & W intensely focused on developing and perfecting this system which is described below. The system is based on the injection of hot water in the lubricating oil to be in contact with the hot places in the engine crankcase and in this way reducing the developed heaton hot spots, thus preventing further generation of explosive vapors in the crankcase. Hot water of 1.5 MPa pressure and 180oC temperature, controlled by control system for detection oil vapor in the crankcase or equivalent engine bearing temperature masuring system is injected using a special nozzle through the pressure pipe of lubricating oil in the crankcase, where it transforms into tiny droplets of diameter less than 10 mm. This system replaces the use of an inert gas, and, thereby, completely removes the risk of choking due to the lack of oxygen. Injected water can not prevent an explosion in the crankcase. However, tests carried out explosions of methane-air mixture showed that the explosion pressure rise substantially reduced by injecting water into a test chamber, thus eliminating the possibility of mechanical damage caused by the action of the explosion pressure wave. The diagram in Figure 7 shows the pressure increase in the tank during the explosion test where for the fuel used a mixture of methane and air. The test is performed in two steps: without the injection of water when the pressure rise in the test tank has reached a value of 3.25 bar (blue curve on diagram in Figure 7) and in the second step with injecting water into an explosive mixture when the maximum pressure during the explosion in test tank was 0.68 bar (red curve on diagram in Figure 7).

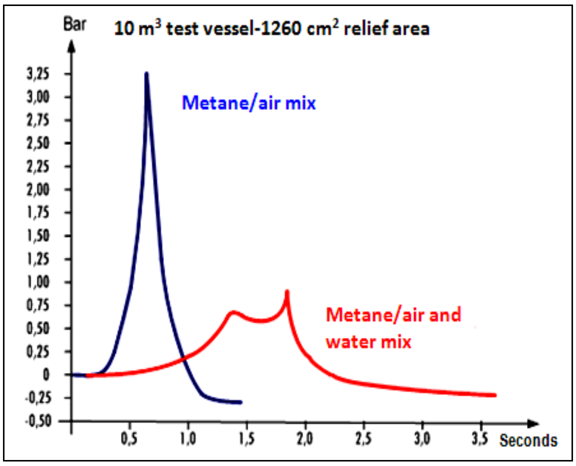

Figure 7. Explosion test in tank with and without injected water mist (MAN B&W Diesel AS,2002)

6. DESCRIPTION OF THE SAFETY CRANKCASE SYSTEM WITH WATER INJECTION

The system for water injecting requires constant supervision because it must maintain a constant pressure and temperature of water in the system. Furthermore, the amount of water mist to be injected must be large enough to ensure that the whole crankcase is covered. The last time they started the research and testing to develop the idea that water vapor is formed in the same way as oil vapors in the engine crankcase. This method can be achieved by direct injection of water in lubricating oil system before entering the engine. In order to be capable of immediately reducing the temperature on the spot affected by hot running when an excessive oil mist level has been measured, hot freshwater is injected into the lube oil at a volume of 1-5% of the amount of oil being delivered to the engine.

Since the boiling point of water is lower than the oil, water will evaporate before evaporation of oil being. Because water has a high specific heat of evaporation, the hot spots in crankcase will be cooled in this manner. This process will reduce or completely eliminate the evaporation of oil in hot spots in the engine crankcase.

Alternatively, on plant with temperature monitoring of the bearings, water injection can be triggered by excessive temperatures in individual bearings, and water injection can be effected in the specific oil supply to the bearing in question, also in this case at a volume of 1-5% of the supplied lube oil amount (MAN B&W Diesel AS,2002).

So injecting water into oil for lubrication can be provided at any time presence and evaporation of the same in hot places in the crankcase, where it can form a oil mist, and subtracting the heat necessary for evaporation to limit or even prevent the evaporation of oil in the crankcase and explosion prevention features.

Figure 8 gives a schematic representation of the system. When the engine running detector (11) continuously measures the level of oil mist at all points in the crankcase. The signal of measured level value is routed to a central monitoring system (12) located in the engine control room (ECR). In case of increase the oil mist level in the crankcase above the permissible value, the control unit will activate the alarm system and engine safety system that will initiate an automatic reduction in engine load, ie to reduce engine speed. However, the engine will not get relief at the moment due to time delays in activating the safety system and inertial effects of the propeller.

To achieve faster response in terms of suppressing explosions in the crankcase, the control unit will simultaneously activating the alarm system and send a signal to the controller (7) to activate the injection of water into the pressure line of lubricating oil is shown in Figure 8.

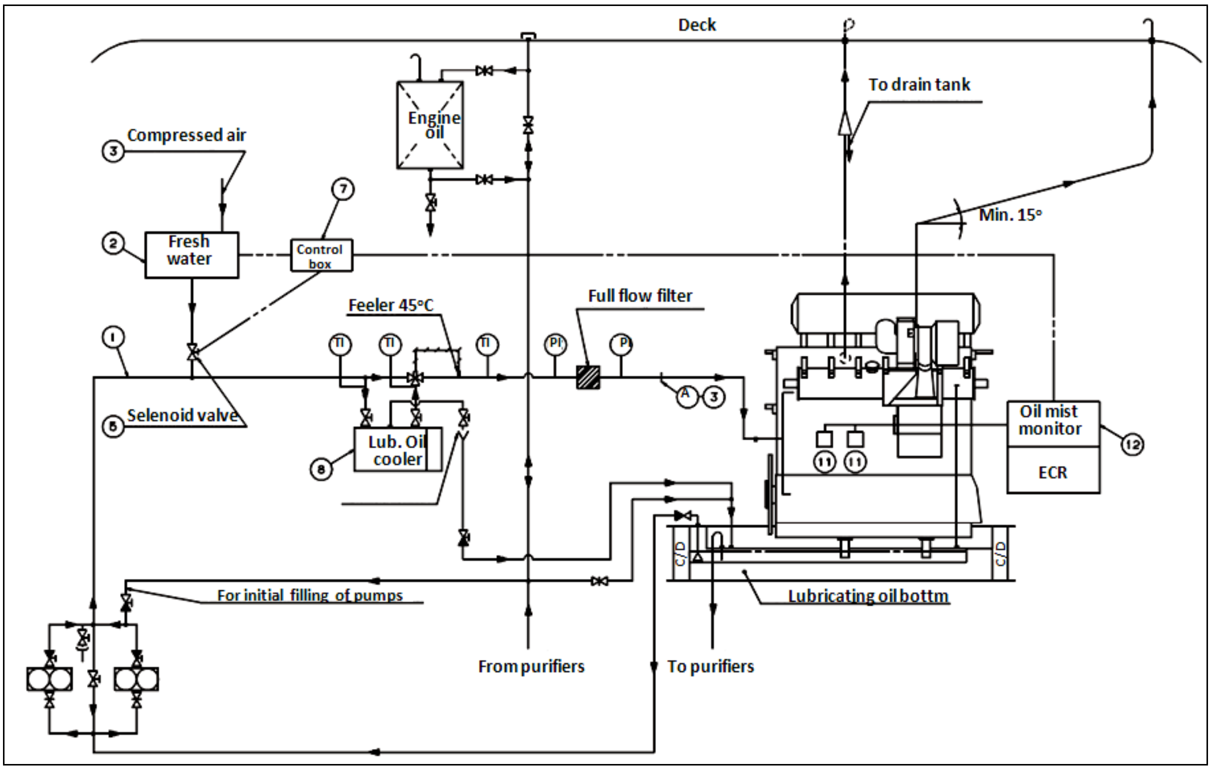

Figure 8. Injection system of water into the lube oil (MAN B&W Diesel AS,2002)

Fresh water tank (2) in Figure 8 is under constant pressure of compressed air, or alternatively is not under pressure until it is activated by a signal from the controller (7). When the controller (7) receives warning signal from the central engine control system about excess permissible level of oil mist in the engine crankcase or alternatively the high temperature of the bearing, following sequence will be activated:

- If the water tank (2) is not under pressure, the signal is passed to the valve (3) that opens the air supply from the ship's compressed air system and puts a water tank (2) under pressure.
- If the water tank (2) is under constant pressure, the signal from the controller (7) opens the solenoid valve (5) and water under pressure enters the oil pipeline (1)

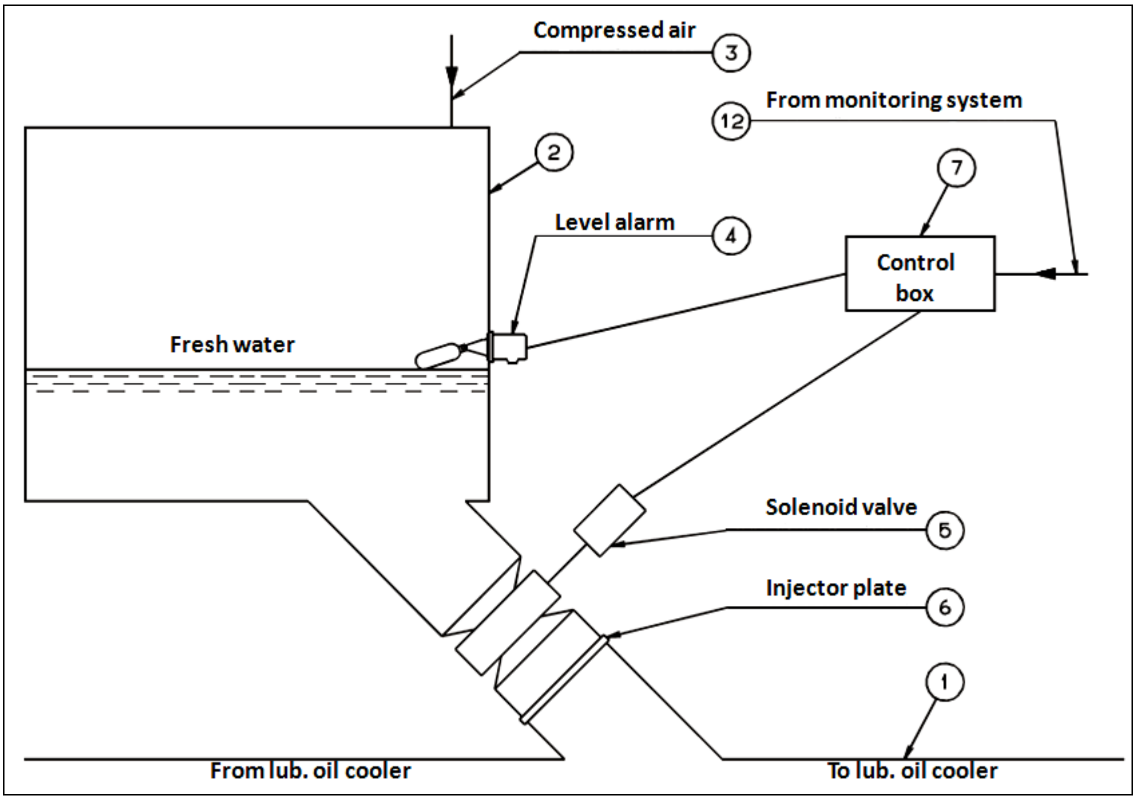

Figure 9. Injection system of water into the lube oil (MAN B&W Diesel AS,2002)

Water is pressed through the nozzle plate injectors (6) where it is dispersed as tiny droplets and directed in to the pressurized oil system. Further mixing occurs with the passage of oil and injected water through the oil cooler (8). A certain proportion of oil and water mixture is controlled by the size and number of nozzles on the injectors plate (6) and the pressure in the water tank (2). In a system in which the tank (2) is under constant pressure, the signal from the controller (7) is sent directly to the valve (5), which was then in the open position until the moment when the water level in the tank (2) reaches the minimum allowable value and activates float (4) to control levels, which then sends a signal to the controller (7), and forwards this to the valve (5) the signal for closing the valve and thus stops injecting water into oil discharge pipe (1). Capacity of tank (2) should be adjusted so as to ensure sufficient supply of water for cooling hotspots in the engine crankcase. On this way will eliminate the danger of crankcase explosion. After such an event, the water is removed from the lubricating oil in the course of the normal cleaning process, using the lube oil centrifuges (MAN B & W Diesel AS, 2002).

7. CONCLUSIONS

The crankcase of marine diesel engine will contain oil mist which is formed by condensation of oil vapour. The generation of oil vapour depends on temperature. Under normal conditions, generation of mist and its re-combination into liquid oil will be in equilibrium and a constant level of oil mist density will be present. Occasional mechanical failures in the crankcase are inevitable. A minor problem with a bearing shell for example, will cause a 'hotspot' and generate large volumes of oil mist. It is this rapid increase in oil mist which must be identified at an early stage, thereby giving warning of the incipient mechanical failure and initiating actions that prevent the oil mist density rising to an explosive level. If not detected quickly, major damage may be caused to the crankshaft and a crankcase explosion may result. Such occurrences may lead to time-charter delay, loss of revenue, salvage claims or even, in extreme cases, serious injuries or fatalities and loss of the ship. In view of the seriousness of the subject, and of the fatal consequences that may be inflicted on personnel and machinery if a crankcase explosion does occur, it has been natural to carry out research work as a matter of priority and with very careful and in-depth tests and experiments.This paper describes the safety systems to prevent the engine crankcase explosion, with special reference to research the world's leading marine engine manufacturer MAN B&W in the development of new methods of safety system to prevent crankcase explosion of marine propulsion engines based on water mist injection in supply line of the engine lubricating oil. The application mentioned methods for large two-stroke slow speed marine propulsion engines is described.

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BIOGRAPHIE

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NEW DESIGN AND TECHNOLOGICAL SOLUTIONS IN NATURAL GAS RELIQUEFACTION ON LNG SHIPS

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ABSTRACT

Gas is a natural resource and can be considered as a gift from the past for meeting the present-day needs of mankind. On the one hand, natural gas provides an enormous source of energy, but on the other, its transport from the source to the consumer is quite a risky one. The transport of liquefied gas requires a great deal of expertise, as well as technical and technological solutions aimed at reducing the risk involved in handling this dangerous cargo.

When a ship is under way in normal conditions, insulated cargo hold walls transfer some of the heat from the environment into the tanks holding Liquefied Natural Gas (LNG), which results in boiling off, i.e. evaporation of certain amount of the cargo. The design solutions and technologies aim to reduce the evaporation rate of methane so that it amounts to less than 0.15% per day at sea, the ship's tanks being initially loaded up to 98.5% of the total capacity.

The purpose of this paper is to explain the newest design and technological solutions in the construction of modern LNG carriers, equipped with on-board reliquefaction facilities and slow-speed diesel propulsion.

KEY WORDS

LNG. boil-off. evaporation. eliquefaction.

1. INTRODUCTION

Since the very beginning of the commercial seaborne transport of liquefied natural gas, LNG carriers have been propelled by steam turbines. Until recently, these prime movers have been the exclusive means of propulsion. In LNG ships, carrying cargo that is liquefied at very low temperatures of about -162°C, certain amount of cargo boils off due to the environment temperature and ship movement. As it is possible to simoultaneously use the boil-off gas (BOG) and the heavy fuel oil (HFO) as fuels for boilers, steam turbine propulsion is a logical preference. Its advantages also include a high level of reliability and a relative cost-effectiveness of maintenance.

The major drawback of the steam turbine as a propulsion unit is a low thermal efficiency, hence high fuel consumption. Moreover, the available amount of naturally evaporated gas to be used as fuel for boilers has been gradually decreasing, owing to the overall development of LNG carriers, achievements in their design and technology regarding gas storage and tank insulation, and due to alternative ways of using boil-off gas which have been developed.
Most of today's merchant ships are propelled by diesel engines – mainly slow-speed two-stroke diesel engines – as a successful and reliable means of propulsion. The main competitive advantage of diesel engines is their efficiency, i.e. high thermal efficiency amounting to approximately 50%, see figure 1., according to [12].

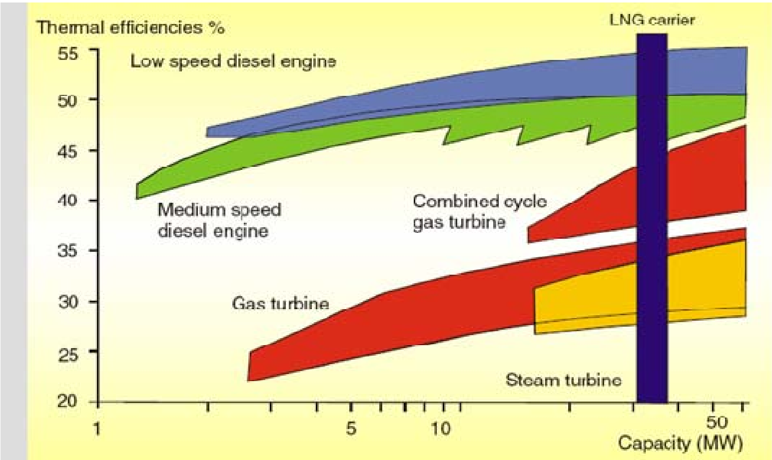

Figure1. Comparative diagram of thermal efficiency levels for various types of propulsion

Electronically controlled slow-speed two-stroke heavy fuel diesel engines fitted with one or two propellers, installed on board ships equipped with BOG reliquefaction facility, present one of the modern options for propelling LNG carriers. In addition to the advantages that have already been mentioned, this design does not use the cargo, or part of it, as fuel for propulsion, which is a sound solution in situations where the cargo loss is unacceptable from the economical point of view.

2. LNG RELIQUEFACTION PLANT

2.1. Principle of LNG reliquefaction plant operation

In an LNG carrier propelled by standard two-stroke slow-speed engine, a reliquefaction unit is used for maintaining normal pressure in cargo tanks. The unit is usually fitted on the ship's deck. The process of reliquefaction includes conducting the boil-off gas from the tanks, compressing it in two-stage BOG

compressors at 4.5 bar, according to [5], cooling it to -160 °C with the aid of nitrogen and condensing the gas through several stages within a heat exchanger, the so-called cold box. After that, the reliquefied gas is separated from non-condensable fractions in a separator.
As the pressure in the separator is higher than the pressure in tanks, the reliquefied BOG is forced back to cargo tanks without the assistance of pumps.
The non-liquefied gas is also returned to tanks or is, if and when necessary, transferred via the gas heater to the gas combustion unit (GCU), according to [11].
The gas reliquefaction plant is based on the Brayton cooling cycle, see figure 2., according to [5].
The cycle involves three main components: C = compressor, T = turbo-expander, R1 = heat exchanger between the cooling gas (nitrogen) and the boil-off gas (BOG) and R2 = heat exchanger between the cooling gas (nitrogen) and the cooling medium (fresh water).

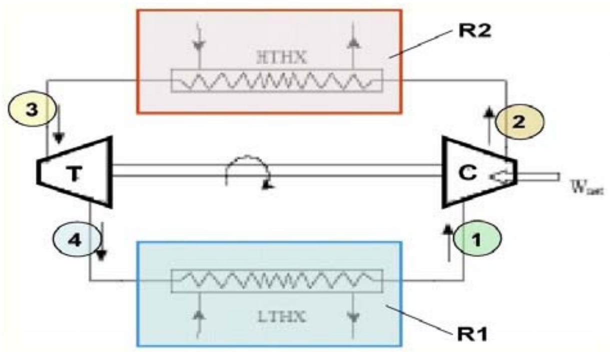

Figure 2. Diagram of the Brayton process

Nitrogen N_2 serves as a refrigerant as this gas remains in gaseous state throughout the cooling cycle, see figure 3., according to [5]. What makes nitrogen additionally suitable for shipboard use is the fact that it is very easily produced by the so-called N_2 generators. Besides, nitrogen does not condense during the process, it is neither toxic nor flammable, its evaporation temperature is -196°C and its molecular mass is high, which facilitates compression.

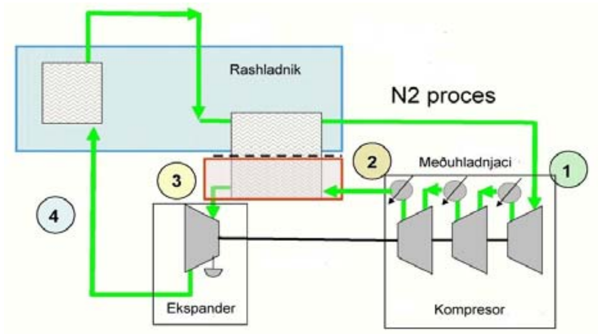

Figure 3. Diagram of the cooling process arrangement
Where the following de note: rashladnik – cold box; kompresor – compressor;
ekspander - expander; međuhladnjaci – intercoolers; N2 proces - process

Process 1-2: adiabatic compression in the compressor, low pressure nitrogen is compressed from state 1 into state 2.

Process 2-3: exchange of heat in the heat exchanger, during the process the nitrogen temperature is reduced at constant pressure.

Process 3-4: adiabatic expansion in the radial turbine; high pressure nitrogen expands in the turbine, the nitrogen temperature is reduced to -165ºC.

Process 4-1: heat is extracted from BOG in the heat exchanger, and the cooling effect is achieved.

2.2. Schematic description of the cooling plant for LNG reliquefaction

The LNG third generation (MARK III) reliquefaction system consists of two primary processes: the nitrogen process and the BOG from the cargo tanks process. Both processes and their components are shown in figure 4., according to [7]. Red colour represents the process of BOG from the cargo tanks, green colour shows the nitrogen process, whereas the reliquefied gas is marked by blue colour. Figure 5. features a diagram of both processes as well as the BOG flow from the cargo tank and back, and the flow of nitrogen as a coolant, according to [7].

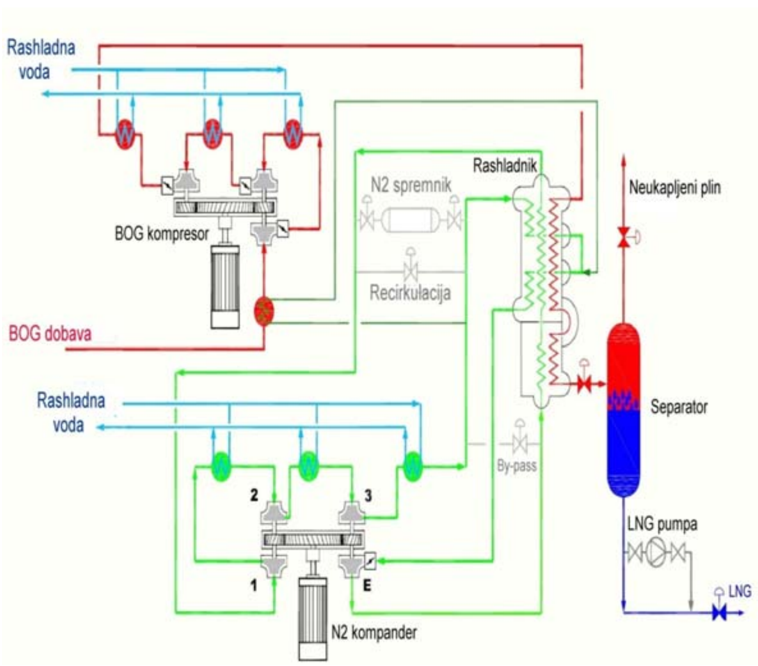

Figure 4. Diagram for the nitrogen process and the BOG process
Where the following de note: *rashladna voda – cooling water; BOG dobava – BOG feed; rashladnik – cold box; BOG kompresor – BOG compressor; BOG kompander – BOG compander; N2 spremnik – N2 reservoir; LNG pumpa – LNG pump; neukapljeni plin – vent; recirkulacija – recycling*

The reliquefaction process is started by carrying BOG via preheater to the three-stage centrifugal compressor with fresh water intercooling. By means of N_2 in the cold box, the temperature of BOG is decreased to the liquefaction temperature of -161.5ºC. Non-condensable fractions are separated in the separator. The pressure in the separator is higher than the pressure in tanks, so that no pumps are needed to transfer the reliquefied BOG back to cargo tanks. A portion of gas that has not been liquefied is returned to tanks or is, according to need, transferred via the non-condensed gas heater to the gas combustion unit (GCU), depending on the pressure in cargo tanks. The reliquefaction plant capacity is 6800 kg/h, whereas the GCU capacity is 5000 kg/h.

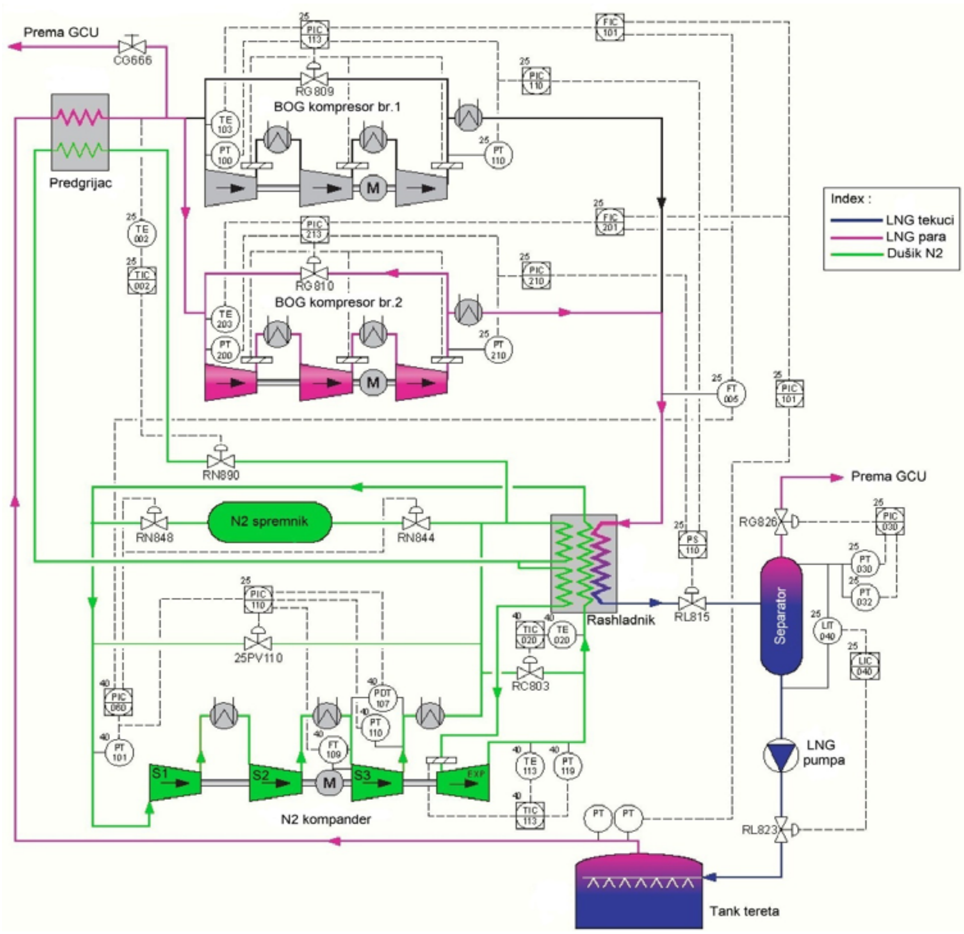

Figure 5. Flow of boil-off gas and the refrigerant N_2
Where the following de note: *rashladna voda – cooling water; prema GCU – to GCU; rashladnik – cold box; BOG kompresor – BOG compressor; BOG kompander – BOG compander; N2 spremnik – N2 reservoir; LNG pumpa – LNG pump; predgrijač – pre-heater; tank tereta – cargo tank; LNG tekući – LNG liquid; LNG para – LNG gas; N2 dušik – N2 nitrogen*

When a ship is under way in normal sailing conditions, the LNG reliquefaction system is sufficient to maintain cargo pressure in tanks. In heavy weather, when rolling and pitching of the ship cause sloshing in cargo tanks and increased evaporation, the GCU is used if the reliquefaction system is unable to maintain the pressure in cargo tanks. The boil-off of 11800 kg/h is partly reliquefied and partly burnt in order to keep the cargo tank pressure within the range of 6-12 kPa.

BOG compressor: The main function of the BOG compressor is to maintain the pressure in cargo tanks at the given value and to increase the pressure before entering the cold box. The increase in pressure leads to an increase in condensation temperature, which results in the overall increase in the entire level of plant efficiency. Once the gas is liquefied, the LNG pump for transferring the liquefied gas back into tanks is not needed due to an increased pressure in the cold box.

N_2 compressor and expander (compander): The compander is an essential component in the refrigeration nitrogen loop; its position within the system is shown in figure 5., according to [7]. The refrigeration process in the nitrogen loop consists of three-stage compression (with inter-stage cooling by cooling water). Gas is compressed from 13.5 bar to 57.0 bar. The nitrogen which is compressed in this way is conducted to the cold box, i.e. the combined plate-fin heat exchanger where it is precooled to -110°C. It then flows into the expander where it is expanded to 14.5 bar at -163°C, and is conducted back to the cold box for reliquefying the BOG. The capacity, i.e. the cooling efficiency is achieved by adjusting the amount of nitrogen in the system, thus changing the pressure and mass flow of this refrigerant through the system.

Heat exchanger (cold box): The basic duty of the cold box is to reliquefy the boil-off gas by means of heat exchange with the cold nitrogen. Also, in order to achieve better efficiency, the cold box extracts heat from nitrogen when leaving the third compressor stage, i.e. prior to entering the expander.

LNG pump: The main function of the LNG pump is to force LNG back into tanks when operating without the BOG compressor, e.g. when under way in ballast, when the pressure in the separator is lower and the pump is needed to force the gas into cargo tanks.

2.3. Arrangement of LNG reliquefaction plant

The LNG reliquefaction plant is located on the starboard deck. It consists of two parts: the compressor motor room (CMR) and the electromotor room (EMR). Owing to the ship design, limited space and stability requirements, the plant has minimal dimensions and is very compact.

The cooling water pumps and coolers, as well as nitrogen generators are situated in the engine room.

The CMR unit houses BOG compressors, nitrogen companders (compressors and expanders), LNG cooler, nitrogen compressors, BOG preheater, gas analyser, LNG pump, separator of liquid LNG, local console for controlling and managing the plant, vacuum cargo pumps, and high duty compressors (HD) which do not make part of the refrigeration system.

The EMR unit contains electromotors for HD compressors and electromotors for vacuum pumps for discharging cargo. The nitrogen reservoir is situated on the ship's deck forward of LNG reliquefaction system room. The GCU unit for non-condensed gas combustion is fitted in the funnel casing. The LNG third generation (Mark III) reliquefaction system is shown in figure 6., according to [11].

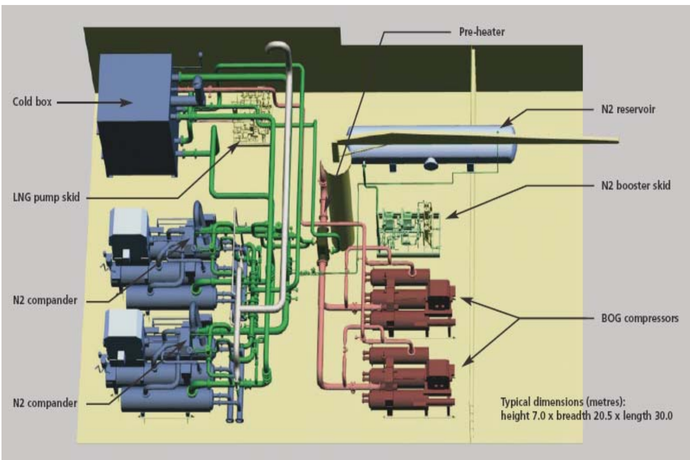

Figure 6. Arrangement of the LNG third generation (MARK III) reliquefaction system

3. CONCLUSIONS

Standard two-stroke diesel engines fitted with the LNG reliquefaction plant have interrupted the predominance of the steam turbine as the exclusive propulsion system in LNG carriers, and are likely to become the prime choice in future commissions of LNG ships in spite of somewhat higher initial costs.
As the price of natural gas is rising much faster than the price of oil, new solutions are being explored for avoiding the loss of natural gas during transport. The transport costs have been reduced by decreasing the consumption of natural gas owing to modernisation and by choosing other types of propulsion on LNG carriers. The expertise acquired by shipbuilders and the continuous education of officers onboard LNG ships are the prerequisites for producing a high quality level of LNG fleet.
Despite certain shortcomings and drawbacks, the vessels equipped with reliquefaction plants are still the most economical types of ships for transporting LNG. The capacity of these vessels ranges from 210,000 m^3 for the Q-Flex LNG ships to 266,000 m^3 for the Q-Max LNG ships.

Although the natural gas seaborne transport is a relatively safe trade in shipping business – there have been few accidents reported in this trade so far – LNG crews will have to be continuously trained to operate new plants coming into practical use and will have to be familiarised with the nature of cargo in order to prevent the risk of accident or minimise harmful consequences in case an accident occurs.

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BIOGRAPHIE

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MALARIA CHEMOPROPHYLAXIS FOR SEAFARERS:YES OR NO?

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ABSTRACT

Around 900 million people world-wide suffer from malaria. The disease occurs in so-called endemic areas, all of which are well-known tropical and sub-tropical areas. There are at least four types of malaria, most life-threatening of which is the tropical type. All malaria types are transmitted by bites of female mosquitos of the Anopheles genus. Croatia used to be a malarious area and mosquitos of the Anopheles genus still exist in one part of the country although their numbers are not significant. Cases of autochthonous malaria have not been recorded in Croatia since 1964. However, there have been so-called "imported" malaria cases, commonly contracted by travellers and workers who have spent time in endemic areas. Therefore, if travelling to endemic areas, seafarers represent a risk group for imported malaria. Death cases among Croatian seafarers suffering from malaria are occasionally recorded. However, and as is the case with other illnesses from which seafarers suffer, due to seafarers' mobility such deaths are not recorded in health statistics since they occurred elsewhere in the world and statistics record only incidents taking place in the state of domicile.
Seafarers generally know little about malaria, unless they sail the tropics. Prejudice and misinformation are wide-spread. Many believe that a vaccine against malaria is available, which unfortunately is not the case. The only way to prevent the disease is to take antimalarial medication preventively, i.e. malaria chemoprophylaxis. There is a lot of resistance and prejudice regarding the application of chemoprophylaxis since it is time consuming and requires that medication be taken one week prior to the stay, during the entire stay and four to six weeks upon return. It is true that medicines used in chemoprophylaxis have side-effects. However, there is practically no medication that is side-effect free. When comparing the side-effects with deaths caused by malaria, chemoprophylaxis is definitely a lesser of the two evils.
This article shows the geographic distribution of malaria, considers the resistance of malaria causative agents to chemoprophylaxis and discusses all prevention measures. Malaria, especially tropical malaria, can very quickly lead to death. Knowledge about how to prevent malaria, how to recognize its symptoms and react properly in case it occurs is therefore essential for each and every seafarer.

KEY WORDS

malaria. chemoprophylaxis. seafarers.

1. INTRODUCTION

Malaria in humans is caused by one or more of four protozoan species of the genus *Plasmodium*: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, or *P. malariae*. All species are transmitted by the bite of an infective female *Anopheles* mosquito. Because of the nocturnal feeding habits of *Anopheles* mosquitoes, malaria transmission occurs primarily between dusk and dawn. Plasmodium falciparum and Plasmodium vivax account for most malaria cases in humans. Falciparum malaria is the commonest type in tropical Africa, the Amazon basin, Papua New Guinea and South East Asia. Most deaths caused by malaria are due to falciparum infections. Broadly, the risk of malaria is greatest in sub-Saharan Africa,

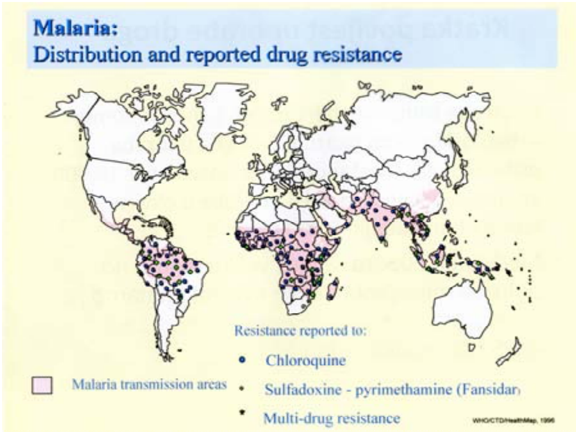
intermediate in India and South-East Asia, and low in Central and South America.[1]
Occasionally, transmission occurs by blood transfusion, organ transplantation, needle sharing, or congenitally from mother to fetus.[1,2,3]
Approximately 40% of the world's population live in countries where the disease is endemic and are at risk of malaria, and 3.2 billion people around the world are at risk of malaria. Malaria is a major international public health problem, causing 350–500 million infections worldwide and approximately 1 million deaths annually. The risk for acquiring malaria differs substantially from region to region and from traveller to traveller, even within a single country.
These absolute case numbers should be considered in the context of the volume of travel to these locations. Seafarers and travellers with the highest estimated relative risk for infection are those going to West Africa and Oceania. Travellers going to other parts of Africa, South Asia, and South America have a moderate estimated relative risk for infection. Persons with lower estimated relative risk are those travelling to Central America and other parts of Asia.[1]
Malaria is a maritime problem for the following reasons:

- unawareness of the fact that malaria is a serious and potentially fatal disease
- insufficient information regarding the clinical picture of malaria
- none or insufficient use of anti-mosquito measures and classical protective medication
- increasing resistance of many new malaria strains to medication
- fluctuating frequency of malaria occurrence in the most dangerous areas, which leads to miscalculations of real risk.[3]

2. MALARIA-ENDEMIC COUNTRIES IN THE WORLD

Malaria transmission occurs in large areas of Africa, Central and South America, parts of the Caribbean, Asia (including South Asia, Southeast Asia, and the Middle East), Eastern Europe, and the South Pacific. The risk for acquiring malaria differs substantially from region to region and from traveller to traveller, even within a single country. This variability is a function of the intensity of transmission within the various regions and the itinerary, duration, season and type of travel.[1-4]

The World Health Organization (WHO) regularly monitors the number of malaria cases world-wide as well as the occurrence of resistance to antimalarials.[5] Malaria endemic areas are more or less the same in the world, but resistance is a variable that tends to change. Recent reports on the current situation and necessary preventive measures are available on the WHO website. Data from one such report are shown in Map 1.



Map 1. Malaria-endemic countries in the World

3. MALARIA IN CROATIA TODAY

According to data of the Croatian National Institute of Public Health, in the period between 1964 when malaria was eradicated and the end of 2010, there were 409 cases of imported malaria.[6,7,8] In the last decade the number dropped to less than 10 imported cases per year. Between 2001 and late 2010, 61 imported malaria cases were recorded, one of which resulted in death. [8] Absolutely predominant among those who contracted the disease are seafarers (some 70%) while workers temporarily employed in tropical countries and tourists in malaria endemic areas account for a much lesser number of patients. [7]
In the period from 1987 to 2006 there were 201 cases of malaria registered in Croatia. The majority were imported from Africa (160; 79.6%), a significantly lower number from Asia

(34; 17.4%), several cases from South America (3; 1.5%) and from unknown locations (3; 1.5%) The causative agents determined are *Plasmodium falciparum* (130; 64.7%), *Plasmodium vivax* (40; 19.9%), *Plasmodium malariae* (4; 2%), *Plasmodium ovale* (1; 0.5%).[7] The causative agents was not discovered in 14 cases (6.9%). Chemoprophylaxis was given to patients in regular intervals and correctly in 23.3% of the cases, in irregular intervals in 8.0% of the cases, incorrectly in 9.5% of the cases, in 9.5% in an unknown manner of application, and the remaining 48.7% did not use chemoprophylaxis.
One death due to malaria was recorded in 2005 in a patient who had received a blood transfusion in a malaria-endemic area due to a traffic accident.[7]

Causes of imported malaria occurrence mostly lie in the non-application or insufficient application of chemoprophylaxis. Data that just under a quarter of all malaria patients were on chemoprophylaxis indicates that either an inadequate antimalarial was prescribed or that resistance of the causative agent is on the rise. The most important piece of data is that most seafarers take chemoprophylaxis unregularly or take none at all, i.e. that they are either uninformed or act irresponsibly. The situation is quite similar in other countries. [1,6,7,9,1]

4. CLINICAL PRESENTATION

Malaria is characterized by fever and influenza like symptoms, including chills, headache, myalgias, and malaise; these symptoms can occur at intervals. Uncomplicated disease may be associated with anemia and jaundice. In severe disease, seizures, mental confusion, kidney failure, acute respiratory disease syndrome (ARDS), coma, and death may occur. Malaria symptoms can develop as early as 7 days (usually ≥14 days) after initial exposure in a malaria-endemic area and as late as several months or more after departure. Suspected or confirmed malaria, especially *P. falciparum*, is a medical emergency, requiring urgent intervention as clinical deterioration can occur rapidly and unpredictably.[1,2,3]

Cerebral malaria is the main complication of falciparum infection and is more common in short-term visitors to malarial areas than in long-term residents who are likely to have some degree of immunity to the malaria parasite. In case of suspicion of malaria treatment should start as soon as possible because delay increases the risk of serious complications and death. If the illness is not malaria, little or no harm will result from the treatment.[3]
In any case medical advice should be sought urgently; if the symptoms are severe or if complications like as blood found in urine, severe breathlessness and jaundice occur, preparations should be made to evacuate the patient to a hospital .[2,3]

5. DIAGNOSING MALARIA

Problems occur when it comes to recognizing malaria in countries that no longer are or never have been malaria-endemic areas. In malaria-endemic countries where the disease is a daily and public health problem, diagnosis is not an issue.
Malaria often starts with symptoms similar to those of influenza so if malaria is not considered as an option, precious time in which adequate therapy should promptly be applied can be wasted.

Malaria should be considered as a possibility if a febrile illness develops after a week of entering a malarious area as well as up to over a year after visiting such an area, although it is more likely within the first 3 months of return.[1,2,3]

Various test kits are available to detect antigens derived from malaria parasites. Such immunologic (immunochromatographic) tests most often use a dipstick or cassette format and provide results in 2–15 minutes. These rapid diagnostic tests (RDTs) offer a useful alternative to microscopy in situations where reliable microscopic diagnosis is not available. Although RDTs can detect malaria parasites within minutes, they cannot determine the species or quantify parasitemia. In addition, positive and negative results must always be confirmed by microscopy. [1,2,3]

In case that a seafarer contracts malaria while at sea, a blood sample should be taken for later examination to confirm the diagnosis.[2]

6. RECOMMENDATIONS ON PROTECTION AGAINST MALARIA

There is no vaccine against malaria. There is also no solid immunity as a result of exposure to malaria. People residing in malaria-endemic areas can show some type of immunity but that type of immunity must not be expected in seafarers from non-endemic countries. It is important to note that even frequent travel to endemic areas does not convey useful immunity against malaria.[3]
The strategy of malaria prevention in ship crews should be based on balancing the actual risk of infection in the visited ports of the tropics with the risk of side effects of antimalarials used for prophylaxis.[3]
Depending on level of risk, it may be appropriate to recommend no specific interventions, mosquito avoidance measures only, or mosquito avoidance measures plus chemoprophylaxis. For areas of intense transmission, such as West Africa, exposure for even short periods of time can result in transmission, so travellers (seafarers) to this area should be considered high risk.[2,3]
Since the *Anopheles* mosquito carrying malaria parasites usually bites between dusk and dawn crew member should be advised to remain indoors at night, in a screened or air-conditioned area.

Crew members who are outdoors between dusk and dawn should be advised to wear long-sleeved shirts and to use insect repellent on exposed skin.

Crew members who do not sleep in air-conditioned areas should be advised to sleep under insecticide-treated bed nets.

For short-term visitors to rural areas of South-East Asia and South America, and for all visitors to Africa and New Guinea before leaving your home port, consider providing the crew with antimalarial drug prophylaxis as recommended by the World Health Organization.[1,3]

7. THE CHEMOPROPHYLAXIS DILEMMA

Use of anti-malarial drugs to prevent the development of malaria is known as chemoprophylaxis. The choice of chemoprophylaxis varies depending on the species and drug resistance prevalent in a country.[3,5]

Antimalarial drug resistance has been defined as the "ability of a parasite strain to survive and/or multiply despite the administration and absorption of a drug given in doses equal to or higher than dose usually recommended but within tolerance of the subject". This definition was later modified to specify that the drug in question must "gain access to the parasite or the infected red blood cell for the duration of the time necessary for its normal action". Most researches interpret this as referring only to persistence of parasites after treatment doses of an antimalarial rather than prophylaxis failure, although the latter is a useful tool for early warning of the presence of drug resistance.[5]

It must be remembered that no chemoprophylaxis regime provides 100% protection. Therefore it is essential to prevent mosquito bites as well as to comply with chemoprophylaxis.[3,5]

The malaria problem is complicated, potentially serious, and present world-wide. Even if the risk seems small, a brief visit to a country where malaria is endemic may be sufficient to contract the disease. It is important to realise that at present 100% protection is not possible. Protective measures, such as appropriate clothing, repellents, impregnated bed nets, aerosolised insecticides, screens and air-conditioning significantly reduce the risk of transmission.[1,3,5]

There is no method available to prevent malaria completely. Even regular administration of chemoprophylaxis can sometimes, if the causative agent is malaria resistant, fail to prevent the disease. Resistance of the parasite against malaria medication exists and is high in several regions.[3]

All measures are aimed at reducing the risk of malaria-attack to a minimum. Hence all measures have to be combined, giving almost 100% risk elimination for severe malaria and malaria death.[3]
Seafarers who reject the advice to take prophylaxis, who choose a suboptimal drug regimen (such as chloroquine in an area with chloroquine-resistant *P. falciparum*), or who require a less-than-optimal drug regimen for medical reasons are at increased risk for acquiring malaria and needing prompt treatment while overseas.[3]
All recommended primary chemoprophylaxis regimens involve taking a medicine before, during, and after travel to an area with malaria. Taking the drug before travel allows the antimalarial agent to be in the blood before the traveller is exposed to malaria parasites.[1, 2,3]
Additional factors to consider are the patient's other medical conditions, medications being taken (to assess potential drug interactions), the cost of the medicines, and the potential side effects.[1,3]

8. CONCLUSIONS

There is a lot of resistance and prejudice regarding the application of chemoprophylaxis since it is time consuming and requires that medication be taken one week prior to the stay, during the entire stay and four to six weeks upon return. The drugs used for antimalarial chemoprophylaxis are generally well tolerated, but side effects can occur. Minor side effects usually do not require stopping the drug. Practically no medication is free of side-effects. When comparing the side-effects with deaths caused by malaria, chemoprophylaxis is definitely a lesser of the two evils. Seafarers should be informed that malaria can be fatal if treatment delayed. Medical help should be provided immediately on-board if malaria is suspected. Blood samples should be taken for later examination to confirm the diagnosis.

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BIOGRAPHIE

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MANAGEMENT OF NOSE BLEEDING (*EPISTAXIS*) ON BOARD SHIPS

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ABSTRACT

Nosebleeds are the most common type of bleeding in the head and neck area and overall one of the most common types of bleeding. Often occurring unexpectedly, especially at night, nosebleeds can cause fear and panic in both patients and those surrounding them. Though often harmless, bleeding from the nose can be serious enough to be considered life-threatening. Nosebleeds should never be treated as harmless occurrences.
About 5-10% of the general population experience a nosebleed on a yearly basis, 10% of whom seek medical assistance and 1% are treated by an ear, nose and throat specialist. There are no data in available literature on whether nosebleeds are more common in seafarers than in the general population, but this has to be taken into account as a possibility.
Nosebleeds can be anterior, or light and immediately visible, and posterior, or heavy and usually noticed only later on. In 90% of all cases, diagnosis is clear due to visible blood dripping from the nose, while in 10% of the cases blood drains down the larynx and is swallowed, therefore making it visible only once it is vomited or, seldom, when the person complains of black stools. This is normally caused by bleeding from only one nostril – in 90% of nosebleeds only one side of the nose is affected.

There are no clinicians on board merchant navy ships. The second mate is usually the one in charge of providing first aid and medical assistance and must know how to stop a bleeding, in this case from the nose. This article provides a description of the management of nose bleeding (*Epistaxis*) on board ships.

Since seafarers lack medical knowledge, medical advice is always an option but it must be sought if bleeding cannot be stopped, if it perseveres for more than 30 minutes, if bleeding is massive, if the patient's blood pressure starts to fall, if the patient is too feeble to sit or if the patient's systolic blood pressure exceeds 160 mm Hg even after the bleeding is stopped.

KEY WORDS

bleeding from the nose. nosebleed. seafarers.

1. INTRODUCTION

Defined as active bleeding from the nose, epistaxis is a commonly occurring phenomenon. Nosebleeds (epistaxis) are the most common type of bleeding in the head and neck area and overall one of the most common types of bleeding. Epistaxis is relatively benign in nature, but can lead to serious, life-threatening situations. In rare cases, this condition may lead to massive bleeding and even death. It has been estimated that up to 60% of the population has had at least 1 episode of epistaxis throughout their lifetime.[1] Fortunately, only 6% of them will require medical treatment to control and stop the haemorrhage. Often a result of traumatic or mechanical causes, epistaxis can progress to uncontrolled, significant haemorrhage, lasting longer than an hour, requiring medical assistance to control.[1]
Often occurring unexpectedly, especially at night, nosebleeds can cause fear and panic in both patients and those surrounding them. Though often harmless, bleeding from the nose can be serious enough to be considered life-threatening. Nosebleeds should never be treated as harmless occurrences.

2. WHAT CAUSES NOSEBLEEDS?

Nosebleeds are most commonly caused by dry, dusty and cold air, nose picking, colds and allergies, blows to the nose and high blood pressure.[2] Less common causes are foreign body, traumatic intubation, orthognathic surgery, oncological surgery, arteriovenous malformations, blood dyscrasias, and medications.[1] Malaria attacks can also cause nosebleeds.[3] Nosebleeds can occur spontaneously when the nasal membranes dry out and crack. This is common in dry climates, or during the winter months when the air is dry and warm from household heaters.[4] People are more susceptible to a bloody nose if they are taking medications which prevent normal blood clotting like aspirin. In this situation, even a minor trauma could result in significant bleeding. [4,5]
Hypertension (high blood pressure) has not been implicated as a cause of epistaxis; however, a hypertensive state can contribute to persistence and worsening of epistaxis. Monitoring of a patient's blood pressure prior to and during treatment is important to determine the need for pharmacological intervention where necessary to assist with control of hypertension.[1]
The incidence of nosebleeds is higher during the colder winter months when upper respiratory infections are more frequent, and the temperature and humidity fluctuate more dramatically. In addition, changes from a bitter cold outside environment to a warm, dry, heated home results in drying and changes in the nose which will make it more susceptible to bleeding. Nosebleeds also occur in hot dry climates with low humidity, or when there is a change in the seasons.

3. EPIDEMIOLOGY

About 5-10% of the general population experience a nosebleed on a yearly basis, 10% of whom seek medical assistance and 1% are treated by an ear, nose and throat (ENT) specialist.[1,4,5] There are no data in available literature on whether nosebleeds are more common in seafarers than in the general population, but this has to be taken into account as a possibility.
In order to perform its functions (breathing, "air conditioning", cleansing), the nose has an extremely rich vascular supply, where blood is provided by the two biggest arteries of the head and neck (the internal and the external carotid artery).

In situations in which nosebleed is able to be adequately controlled with conservative measures, the condition is termed uncomplicated epistaxis.[1]
Nosebleeds can be anterior, or light and immediately visible, and posterior, or heavy and usually noticed only later on.

4. ANATOMICAL CONSIDERATIONS

The nasal cavity is divided into 3 main areas: the anterior nasal cavity, the posterior nasal cavity, and the superior nasal cavity.

The most common site of bleeding is from the plexus of vessels at the anteroinferior aspect of the nasal septum in the anterior nasal cavity. This area, most commonly referred to as the Kiesselbach plexus, is also known as Little's Area and is particularly prone to drying, as well as digital trauma. Collateral circulation in this region is provided by terminal branches of the internal and external carotid arteries. Approximately 90% to 95% of all cases of epistaxis arise from this anterior septal vasculature. Most bleeding from Little's Area is self-limiting, requiring no treatment. Those bleeds requiring treatment are often easily controlled with local, conservative measures.[1] – Figure 1

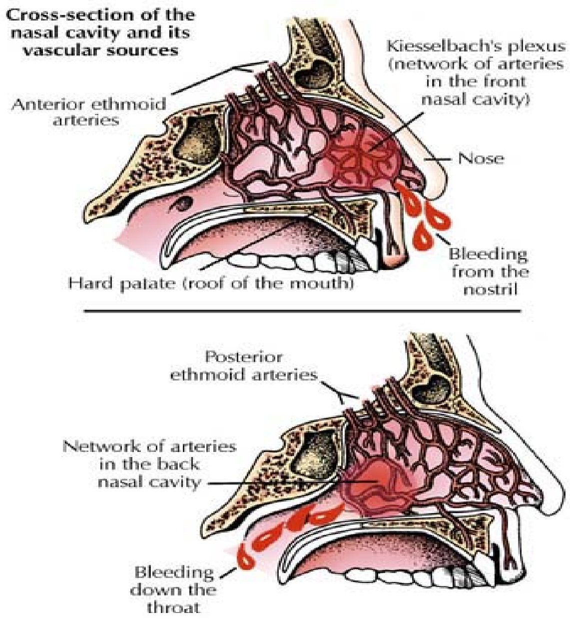

Figure 1. Site of nosebleed: Kiesselbach's plexus (anterior bleeding) and bleeding from posterior nasal cavity (posterior bleeding)

The posterior nasal cavity is the source for roughly 5 to 10% of occurrences of epistaxis. Haemorrhage in the posterior nasal cavity is often more difficult to locate and visualize, leading to increased difficulty to control.

In 90% of all cases, diagnosis is clear due to visible blood dripping from the nose, while in 10% of the cases blood drains down the larynx and is swallowed, therefore making it visible only once it is vomited or, seldom, when the person complains of black stools. This is normally caused by bleeding from only one nostril – in 90% of nosebleeds only one side of the nose is affected. [1,4-7]

Anterior (light) nosebleeds are harmless in 90% of cases. The posterior ones can be life-threatening due to severe blood losses, making localization of the bleeding crucial.

5. DIAGNOSIS

As with any condition, a concise assessment of the history of the present illness is essential. It is important to establish a thorough history from the patient or family members. Information, such as recurrent episodes, frequency, local trauma, and drug or alcohol abuse, is extremely valuable. Family history of bleeding disorders and cardiovascular diseases also help to establish aetiology and help to direct the appropriate course of treatment. Patients taking nonsteroidal anti-inflammatory medications, aspirin, warfarin (Coumadin), or other anticoagulants can present an interesting and challenging problem regarding hemostasis.[1,4,5]

Although epistaxis can have an anterior or posterior source, it most often originates in the anterior nasal cavity.

6. TREATMENT

Nasal bleeding usually responds to first-aid measures such as compression.[1,2,3] When epistaxis does not respond to simple measures, the source of the bleeding should be located and treated appropriately.[1,4,5]

There are no clinicians on board merchant navy ships. The second mate is usually the one in charge of providing first aid and medical assistance and must know how to stop a bleeding, in this case from the nose. In order to prevent them from swallowing their blood, the person bleeding must sit leaning forward and the blood will run down the nostrils. The person bleeding must first apply a nasal spray or drops in the bleeding nostril and then firmly press the nostrils for about 10 minutes. The procedure can be repeated up to three times (30 minutes overall) and if bleeding prevails, a nasal tampon can be inserted. The procedure involves inserting special purpose Vaseline gauze and a

bandage with antibiotic ointment into the bleeding nostril.[2] Antibiotic ointment will help prevent the occurrence of *Staphylococcus aureus* infection.[1] This should be done carefully in order to avoid causing additional damage (scratching) on the mucous membrane with the instrument used to insert the tampon. The purpose of this procedure is to stop the bleeding by exerting pressure on nostril interior with the pressure of the gauze.
Nasal tampons should be carefully extracted 48 hours later. The above procedure should stop anterior (light) bleeding.

However, if after this treatment there is still a lot of fresh blood in the sputum or if the person vomits blood, the bleeding is probably more severe and posterior.

Patients who have sustained significant blood loss, show symptomatic or unstable vital signs, report a complex medical history including coagulopathies and hypertension, and the elderly, should be hospitalized to ensure adequate measures are taken to control and ultimately eliminate hemorrhage.[1,5,6,7]
Since seafarers lack medical knowledge, medical advice is always an option but it must be sought if bleeding cannot be stopped in the above manner, if it perseveres for more than 30 minutes, if bleeding is massive, if the patient's blood pressure starts to fall, if the patient is too feeble to sit or if the patient's systolic blood pressure exceeds 160 mm Hg even after the bleeding is stopped.[2]

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IMPORTANCE OF DETECTION DEFECTIVE COLOR VISION IN PROFESSIONAL TRAFFIC – SEA NAVIGATION (MERCHANT NAVY)

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ABSTRACT

Color vision called the normal thrichromatism has a great importance in modern life on a professional level, especially in traffic, as well as artistic and personal level of each individual. Color vision disorders may be congenital and acquired. Congenital disorders of color vision are excesses in the retinal receptors, and in transport mechanism of vision pathways, while acquired depend on the etiopathogenesis of certain ocular diseases associated with retinal disease, macula and optic nerve. Congenital anomalies of color vision are often present in both eyes in similar anomal quotient (Aq) and show no tendency towards progression. They are recessive and related to gender and more common in male population. Congenital and acquired disorders of color vision are called dyscromatism, and persons with impaired color vision are often called Daltons named after the English physicist John Dalton who was also protanop. The main disorders of color vision are: discromatism, anomalous thrichromatism achromatopsia or monochromatism.

Several diagnostic methods and tests are available for discromatopsy diagnosis. Variety of methods and diagnostic tests improve detection of discromatopsy, by selecting the correct tests, work dynamic - modus operandi and by exact interpretation of the results for each individual discromatopsy.

The results of our research carried out on the Croatian national level are: 8.5% discromatopsy, out of which 2.4% dichromate (1.3% protanopa, deuteranopa 0.9%) and 6.1% anomalous trichromats (protanomals 1.3%, deuteranomals 4.2%, 0.2% protanomals extreme and extreme deuteranomals 0, 4%). The percentage of congenital discromatopsy in Croatia is similar to the European average of 8.0%.

KEY WORDS

dyscromatism. color vision. sense of color. color blindness.

1. INTRODUCTION

For discromatopsy diagnosis several diagnostic methods and tests are available. Variety of methods and diagnostic tests advances detection of discromatopsy, by selecting the correct tests, work dynamic - modus operandi and by exact interpretation of the results for each individual discromatopsy we get new answers on existing differences within the professional circle of discromatopsy researchers. Today it is generally accepted that qualitative and quantitative testing of color vision can be done with the same precision and repeatability as with the testing of the visual field. Clinical practice is late in the new diagnostics implementation, and in this way contributes to the insufficient understanding of color vision testing. In terms of diagnostics the contribution of color vision disorder is rarely properly understood because of the very small number of ophthalmologists who are focused on color vision research. With well-established indications one should take into account the full possibilities of the applied methods and tests. In addition to the four diagnostic methods for testing discromatopsy: denomination, comparison, discrimination and equalization, we also find three types of diagnostic tests: dichotomous, qualitative and quantitative tests divided into two groups, pigment and spectral tests. Color kits resulting from the above diagnostic methods and tests, are adapted to the precise diagnosis of each individual dyscromatism and age (1).

2. DIAGNOSTI METHODS IN COLOR VISION DISORDERS

Four basic methods for diagnosing disorders of color vision, its species, subspecies and levels of damage in other words to determine the anomalous quotient (Aq):

- **a) method of denomination or naming,**
- **b) the method of comparison,**
- **c) method of discrimination or separation and**
- **d) methods of equalization.**

a) Method of denomination or naming colors offered

The method of denomination or naming is done by using special lamps with filters of specific colors, and the respondent determines, names the color offered. A special mechanism can create conditions that exist in real traffic conditions, such as conditions of reduced visibility. Special lamps, so called Lanterns (Martin's lanterns), which are used for testing color vision in the army, navy, railways, aviation, and if necessary in road traffic, therefore are used for testing color vision in harsh conditions.

Their great disadvantage is that they cannot really diagnose the color disorder rather differentiating the candidates according to the ones who cope with colored signaling devices.

Testing can be done in photopic conditions but also in scotopic conditions (2). Numerous authors as Pierce, Sloan and Altman, Wrihgt, Bidovec, Pickford and Lakowski, emphasize the need for appropriate tests and other methods that would allow the correct selection of professionals of different profiles, with satisfactory vision sensor for automatic brightness of certain industries, especially transport, and military and Police (15-20).

b) The method of comparison or matching of the offered colors

The method of comparison or matching of colors offered Holmgren uses wool wraps or colored pieces of paper according to the Seebeck however seldom used today. The doctor extracts a sample roll of a certain color while a respondent from the remaining piles of wool separates the remaining rolls of the same or similar color.

Testing can be done by using different colored tiles or round-pions, which are of different saturation, and the goal is for the subject to rank all the colored pions by ranking them based on the similarity to the previousl pion. Included is one small Farnsworth's panel D-15 test and a large 100 Hue Farnsworth-Munsell test. Based on this principle modifications are made resulting in Lanthony 40 Hue test and Farbtest 28 Hue red test. Order of aligned pions is entered in special diagrams or schemes to determine whether there is a disorder of color vision, and what type (base of the color disorder).

c) Method of discrimination or separation of offered colors

The method of discrimination or separation uses pseudoisochromatic table (PIC). The most commonly used pseudoisochromatic tables by Ishihara and Stilling, as well as tables from other authors such as Polak, Rapkin, Bostrom, Bostrom-Kugelberg, Valhagen, Hardy-Rand-Rittler (HRRAO), Toko Medical College (TMC), etc. These plates are covered in points of various sizes and colors are arranged so that individuals with impaired color vision cannot recognize the default numbers, letters or figures. These tables are extremely suitable for triage and rapid screening of a large number of respondents, and belong to a group of pigment tests. Name pseudoisochromatic table is derived from the fact that these points of various colors are of the same saturation (color traits related to the purity of the color, where color is not mixed with other colors), so that individuals with impaired color vision see different colors as the same color (pseudoisochromia), in other words get the false impression that these are one and the same color and thus offered number, letter or figure cannot be distinguished or named (3, 4).

d) Method of equalization of offered colors

Method of equalization with Nagel's anomaloscope, old type I or newer type II is a spectral test or a test with colored lights. With Nagel's anomaloscope II, that is most used today, is considered the most reliable apparatus for testing color vision, especially when it comes to dyscromatism congenital red-green basis, the newer generation of anomaloscopes like Oculus, Heidelberger, Tomey all color anomaloscoper that can diagnose the blue-yellow color disorder, are also frequently used. Similar old appliances (colorimeters), which are no longer in use due to poor verification of certain color disorders are: Gilles-Archer test, Edrigme-Gren and Beyneu lamp.

3. DIAGNOSTIC TESTS IN COLOR VISION DISORDERS

Tests for the detection and classification of discromatopsy, or color disorders are numerous and classified into two major groups: tests with pigmented inks, so called pigment tests (pseudoisochromatic tables and tests with the colored pions or panel tests) and tests with colored lights, so called spectral tests (anomaloscopes and lanterns) (5, 6). According to the differential diagnostic possibilities are divided into three main groups of tests, which are:

a) **dichotomous diagnostic tests,**
b) **qualitative diagnostic tests and**
c) **quantitative diagnostic tests.**

a) Dichotomous diagnostic tests

These tests are successful and by using the rapid screening method can separate or distinguish normal trichromats from dichromats by doing dichotomous tests for testing color stimuli, ie, color vision, and include:

1) Holmgren Wool Test

In this test there are 125 different colored bunches of wool and 3 rolls of colored standards. Examinee has to determine the similarity of individual standard rolls by pre-set standards while sorting them into three groups according particular color shades.

2) Pseudoisochromatic table by Stilling

These tables have differently colore dots doubled in numbers as backgrounds. People with color vision disorder read one results, and normal trichromates other results. During testing an important role is played by the light brightness and difference in the viewing angle. If the respondent does not distinguish more than four tables, he or she is classified in the group with color vision disorder of the red-green spectrum. Modifications of these tables have the possibility of detecting blue-yellow color vision disorders. Similar principles are used to build pseudoisochromatic tables by Ishihara, Rapkin, Boston-Kugelbergu, Dvorin, the American Optical Company Pseudoisochromatic test, HRRAO test and tables by Volhagenu, TMC tables, Matsubara tables and many others.

3) New London Navy Lantern test (NTL)

Farnsworth perfected this test that is used mostly in the Navy for testing extreme red-green color vision disorders. Respondents sees pairs of colored lights, while he has to recognize them in harsh operating conditions such as conditions of reduced visibility (simulated dusk, darkness, rain, fog, etc.).

b) Qualitative diagnostic tests

In additon to dihotomnic panels some pseudoisochromatic tables have panels for qualitative testing or diagnosis of red-green of color disorders while some moreover can test the blue-yellow color vision disorders. These include:

1) Ishihari's pseudoisochromatic table (PIC)

Ishihara tables are the most used of all the tests. As they are recommended by the International Ophthalmological Congress, thus these tables will be further explained in the following text. They include home plate followed by the four series of plates either larger or smaller where its numerical systematization must be perfectly known (1, 6).
I. (first) plate. Read by all the respondents, normal trichromats and dichromats.
I. (first) series (from second to ninth panels). This series is differently read by normal trichromats and dichromats (protan and deutan answer in the same manner). G. Verriest warns on 4th and 5th plate where even the normal trichromats can make mistakes.

II. series (from 10 to 17 plates). It is only read by normal trichromats, as colored confetti dots together with the background are arranged as to create confusion in the red and green dichromats.

III. series (from 18 to 21 plates). This series includes plates where dichromats differentiate numbers while normal trichromats cannot see the same numbers.

IV. series (from 22 to 25 plates). This series allows accurate differentiation of individual discromatopsy, i.e. whether the color disorder is in red or green color.
Each panel contains two figures of different colors (red and purple) on a gray background. Protan is confused by the redness of the first figures with the gray background. He reads only the second number. Deutan, in reverse reads only the first figure, because he does not distinguish the color purple (color of the second number's confetti). Some editions of the PIC tables are reduced to 14 or increased to 38 plates, while the main characteristics of the plates in the series remain the same. There are also tables tailored for children and analphabetes of the same author or authors.

2) Rodenstock ortoreter R 7 with test plate No. R 173

Quick screening and triage of candidates is today often done on the Rodenstoc's ortoreter R 7 with the test plate No. R 173 especially in the practice of occupational medicine (sea navigators exam). Ortoreter can differentiate dyscromatism quickly and reliably, while its disadvantage is that tritanomaly and tritanophy cannot be tested. Sharpness of the vision, binocular vision, stereovision and other types of vision can be tested on the same Orthoreter except for the color vision that is here not affected by the daylight or artificial light. Respondent can look monocularly and binocularly during the examination. Test panel has opposite so called bipartial fields with identical combination of glass color filters, so that in respondent's consience a fused unique image is created. Panel has six combinations that are shown to the respondents. In five positions, the fileds are in different colors while in one position the fields are of the same color (control panel used to detect simulants). Respondent does not have to name the color rather just give the answers "same" or "different".

c) Quantitative diagnostic tests

Quantitative diagnostic tests include anomaloscopes, expensive diagnostic tools, which are handled by the ophthalmology specialists. They represent the primary diagnostic tool for making the final expert opinion in discromatopsy, especially those related to professional commercial traffic, in accordance with applicable regulations. They use it in larger medical institutions. Another type of test called panels are easier for patients, especially the smaller variants (modifications) such as 40 Lanthony Hue and Panel D-15 test. These tests can be performed quite successfuly by mid and senior medical staff, where ophthalmology specialist evaluates graphic findings (such as readings of the visual field). It is very convenient for everyday work in eye clinics.

Quantitative diagnostic tests are:
Of all tests of color plates, after Ishihari plates, important place belongs to the Nagel II anomaloscope and to the 100-Hue Farnsworth-Munsell test, or to its reduced modifications (7).

1) Anomaloskop Nagel II

There are two types of Nagelov anomaloscopa: type I test stimuli of red and green colors and newer type II, which has broader possibilities for more precise diagnosis. Anomaloscopy can be dichotomous test, qualitative diagnostic, and most importantly, quantitative diagnostic test, and by its type falls under the spectral types. Testing is done by equalizing mixture of green and red polichromatic lights in the upper, with monochromatic yellow light in the lower circular field of the anomaloscope.
From the relationship between upper mix and yellow lower field light it can be precisely determined the type and degree of dyscromatism the red-green area. An optical system of the machine corresponds to the spectral photometer. The two holes release red light (lithium) wavelength 671 millimicrons and a green light (mercury), wavelength 546 millimicrons, near which are located two input gaps S II. and S III. Using the L screw (left screw on anomaloscopeu) one gap may be widened to proportional shrinking of the other. In this way it can change the ratio of red and green lights in the upper half of the field. Above both gaps there is an S gap whose opening is set to the wave length of 589,3 milimicrones. This gap regulates brightness of the lower fields of yellow (sodium), from very light to dark yellow. In "0" position, the gap S III. that releases red light, is closed, while the gap S II. that releases green light, is open. At position 73 the situation is completely reversed. Using the screws gaps can be adjusted so that the result is Rayleigh equation and by setting the L screw (with gaps II. and S III.) a mixture of red and green lights is realized, that in position L screw (L = 40) becomes yellow and by color matches light yellow color corresponding to the lower field, where D screw is in position (D = 15). The eye must be centered to avoid the green-red border around the field or in the horizontal contact line, which divides the circular field of anomaloscope into two equal parts. Aperture must be opened up to the maximum, and respondent must be pre-adapted to light. The latest computers calculate anomaloscopic AQ by setting up Rayleigh equations, which are: Heidelberg anomaloscope of Oculus, Heidelberg anomaloscope multicolor (HMC) of Oculus and Tomey all color anomaloscope.

2) 40 Hue Lanthony test

100-Hue Test Farnsworth-Munsell has 85 colored pions. Some of its modifications, including the most famous panel Lanthony 40 Hue test, are the most accurate tools in determining the ability to detect chromatic discromatopsy. To avoid the difficulty and speed parameters of testing subjects at 100-Hue Farnsworth-Munsell possible replacement is easy modification with 40 Lanthony Hue test (7, 8).
This test includes 4 groups of 10 pions as a scaled down version of the 100-Hue-Farnsworth-Munsell test: pions 1-10 (zone of red and orange), pions 11-20 (yellow and yellowish green zones), pion 21-30 (zone of green and blue) and the pion 31-40 (purple). Test performance: for the accurate test performance there must be daylight. Pion can not be touched with fingers, nor should they be long exposed to light and kept in boxes. Execution time is not set, but it is noted and counts as the element of the ease of test performance. The order of testing: starting from a fixed reference pions, respondent gradually classifies pions according to color similarity of each pawn to previously classified pion. Respondent shall classify four times ten pions. Recording Results: 40 Lanthony Hue test results are graphed. Ishihara tables and anomaloscope Nagel II. are very sensitive for the detection of congenital discromatopsy but are not as sensitive for acquired dyscromatism as the Lanthony 40 Hue test. This test is therefore most suitable for the detection of acquired discromatopsy.

4. ACCESSORIES FOR COLOR VISION DISORDER TESTING

Accessories or the equipment for color vision testing must be chosen for the diagnostic methods and tests to cover all types of dyscromatism and must specify the type of color disorders in order to give a qualitative and quantitative response (AQ). The most appropriate combination of tools for color vision testing of congenital and acquired discromatopsy which should equip ambulance for testing color vision is:

1) Rodenstock ortoreter R 7 to the test plate no. R 173
2) Pseudo isochromatic Ishihara tables and stilling for adults, children and analphabets
3) Nagel II. Oculus or multicolor Heidelberg (HMC) anomaloscope and
4) 40 Lanthony Hue and Panel D-15 test

Of course it should be noted that this combination of tools for color vision test must first be present in large medical centers where the examination of color stimuli in everyday clinical work in study of congenital and acquired discromatopsy takes place. Examination of color vision testing should be done in the time and in appropriate working conditions, according to prescribed instructions for performing each particular clinical test. It is important to reiterate that in contrast to acquired discromatopsy congenital color vision is often found at retesting (same apparatus and the same examiner). The importance of knowing the capabilities of each test, the correct selection of a particular test is necessary for accurate diagnosis of discromatopsy.

5. DISCUSSION

Color vision disorders have been around since the ancient times. The first case was described in 1777. by Huddart, and later on the basis auto-observation he continued testing of color disorders for J. Dalton himself (1766-1844.), and in his honor all dyscromatism is collectively known as color blindness.
Fast development of industry and trade are further developing the practical significance of color vision disorder. A request to create a clinically feasible methods for testing color vision, especially in rail transport occurs after the train accident at Lagerlunda in 1875. Holmgren, three years after the railway accident in 1878. introduced his now classic wool and creates the first test of congenital discromatopsy, and after him, and a whole line of new methods and tests of various authors emerges (9, 10).
Modern high speed traffic by land, by air or by the sea, and its signs and signals, with the participation of a large number of drivers, as well as industries with extensive use of non-ferrous materials and modes of signaling devices, as well as work with computers require normal color vision. In addition to congenital discromatopsy increasing importance is given to acquired dyscromatism, common in professional retinal and visual pathway damage. All this requires a uniform criteria for the assessment of individual cases and the application of such diagnostic methods and tests that provide the most accurate and most complete results. We emphasize the importance of early detection of color disorder in children who need appropriate methods and tests tailored to their age and diagnosed as early as kindergarten, in collaboration with the teachers. Category that should be specifically addressed in the diagnosis of color vision is d transitional forms of discromatopsy between the anomalous trichromats and dichromats, which are: deuteranomalia extreme, extreme protanomalia, anomaly of color pigment and minianomali (11-16).

6. CONCLUSIONS

In our opinion it is necessary to organize subspecialist clinics in major medical centers such as Zagreb, Split, Rijeka and Osijek, that would solve the issues of people with color vision disorders. Association for persons with color vision disorders known as "Arcus Celestis' is therefore organized in Split as the first in Europe, and has the task of early detection of discromatopsy in children and adolescents with a complete color diagnostics in the clinic for color vision testing for all types discromatopsy.

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BIOGRAPHIE

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ANALYSIS OF HUMAN RESOURCES IN SHIPPING COMPANY

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ABSTRACT

Human resources are unique to each company and can not be copied, they are the most important resource for the company and effectively manage human resources is the key to the success of the company. Of all the goods that are available to them, the most precious in the modern business world today is knowledge, intellectual capital, human resources. Competitive ability is assessed in the amount of knowledge, skills and abilities in relation to the turbulent market competition and market competition forces them to better use the resources of the underlying business, which are primarily information and knowledge of their employees. Knowledge exists in people and teams and make a total organizational knowledge and potential that can be measured and is part of the total value of the company. Knowledge of employees, their business experience, ideas, innovation, motivation, teamwork enriches organizational culture and improving processes within the company and to create more new knowledge in relation to costs. The focus of this paper is to show the importance the company attaches maritime human resources. Due to personnel who are an important organizational resource to which attention should be focused companies in this paper will show how maritime company cares about human resources, what is the process of recruitment and selection, on boarding the ship, getting acquainted with the duties and trips, training staff, as it working environment in which it operates, which are the rules, regulations which will be followed. There will also be analysis of the number of employees, with regard to working hours, type of employment and vocational training. You will see the situation within the company, and will propose a better solution if the necessary improvements or changes that would lead to better quality and better management of human resources, and thus the company's business.

KEY WORDS

human resources. recruitment and selection. training. working environment. rules and regulations. the analysis employed.

1. INTRODUCTION

Each company has its own objectives that it has defined and wishes to achieve in its business operating. There are different ways of achievement of objectives, chosen by the company management depending on their own capabilities, the capabilities of the people, i.e. human resources of the company. Human resources are the living factor of organization of the company, whose knowledge, skills, capabilities and creativity are the greatest contributing elements for the successful accomplishment of the company objectives. Human resources are the basis for the building of the company strategy, and all resources including equipment/machines, raw materials, capital and objectives such as productivity and customer satisfaction are derived from the people and their actions. The organizational structure is the foundation of organization of any company, therefore, many theoreticians, because of its importance for the company call it also the anatomy of the company. The purpose of HR management is not to care about people because that would be nice and humane, but because it is useful for the company. However, on the other hand, this is the best way in modern-day situations and modern-day companies to ensure the fully effective use of all the resources and the successful operating of the company, which includes care for the employees and their treatment as complete and highly valuable human individuals.

The management of human resources should encompass all activities that can contribute to the achievement of a higher and viable positive difference in the employee cost and effect ratio. The purpose of HR management is not to care about people because this would be nice and humane but because this is good and useful and because this is indeed the only and the best way for all the resources to be fully and effectively utilized and for the business operating to be successful. Human resources need to be planned, shaped/developed, trained, used in the optimum way, motivated, protected. Human resources as such are not understood only as people, their knowledge and competences, but also as their personality traits, viewpoints, habits, behaviour/attitude at work and work related motivation.

Because of the lack of concern for the company's human resources the issues may emerge in the areas of unfilled vacancies, surplus or shortage of particular jobs, poor organization, higher fluctuations of employees, non-accomplished production plans, losses of operations etc. In the circumstances of increasing and faster changes the method of HR management has become increasingly important, because companies have realized how great its impact is on higher productivity and profit results. The scope of this paper is to examine the way in which human resources are managed at Brodospas d.d. and Plovput d.o.o. The successful use of the tangible and financial assets depends on quality of the people and their dedicated and committed work. The best and the maximum available assets will not give positive results without the appropriate human engagement. Therefore this paper has been written with the intention to present and bring home the importance of human resources, i.e., HR management. The paper in the concrete example of two companies: Brodospas d.d. and Plovput d.o.o., shows all the advantages or drawbacks in the management of human resources and the importance given to this area of management. The human factor is decisive today for the performance of the company and the company's survival and progress depend on the quality of human resources. Therefore, human resources and their use must be viewed as crucial factors and the scope of this study is to give a contribution in that respect. Brodospas d.d. and Plovput d.o.o. have been taken as examples because they are the top two companies with the highest share in the activity/industry in relation to the total revenue and in relation to EBIT in their core activities. BRODOSPAS d.d. has a share of 34.38% in its core activity and it holds the first place with respect to the total revenue. There are in total 93 entities registered under Activity 52.22.

Table 1. Share in the activity in relation to the total revenue (2010)

UDIO U DJELATNOSTI PREMA UKUPNOM PRIHODU (2010)		
Rang Naziv poduzeća	Udio u top 10	Udio u djelatnosti
1. BRODOSPAS d.d.	41,71%	34,38%
2. PLOVPUT d.o.o.	15,69%	12,93%
3. JADRANSKI POMORSKI SERVIS d.d.	12,66%	10,44%
4. JADRANSKA VRATA d.d.	9,12%	7,52%
5. LINIJSKA NACIONALNA PLOVIDBA d.d.	4,99%	4,11%
6. G & V LINE d.o.o.	4,51%	3,72%
7. LUKA DUBROVNIK d.d.	3,64%	3,00%
8. MATADURA d.o.o.	3,47%	2,86%
9. ZOROVIĆ d.o.o.	2,12%	1,75%
10. TRAJEKTNA LUKA SPLIT d.d.	2,09%	1,73%
	Ostali u djelatnosti:	17,56%

Source: www.poslovna.hr (01.04.2012.)

Brodospas d.d. and Plovput are the top two companies in terms of share in the activity in relation to the total revenue and in relation to EBIT. The Brodospas d.d. share in the activity compared to the total revenue in the core activity is 34.38% while Plovput d.o.o. share is 12.93%. The respective share in the activity in relation to Brodospas EBIT is 23.4% and in relation to Plovput EBIT it is 15.06%.

2. HISTORY AND DEVELOPMENT OF ANALYZED COMPANIES

2.1 Brodospas d.d. – History and Development

Brodospas was founded in 1947 in Rijeka, but the registered office was very soon transferred to Split. The original task of Brodospas was to free waterways of the Croatian Adriatic and the Croatian ports of any remains left after World War 2. A number of maritime/technical activities unfolded consequently and thereafter: submarine activities, diving operations, removal of sunk and stranded/wrecked vessels, lifting and moving of heavy cargo, towing operations between Adriatic harbours and then across oceans of the entire globe. Thereafter, it concentrated its activities around specialized technical maritime services provided to drilling rigs at sea and cargo transport operations. Brodospas is the only professional rescuer of the Croatian Adriatic.

For years Brodospas has been the member of the European Tugowners Association and the International Rescue Committee, and it has won many times Vjesnik's Blue Ribbon for the courage shown in rescue and other operations at sea.

The Brodospas mission has been and will be for it to be the shipping/technical company distinguished for its high standard of services, in terms of all requirements set by jobs in which it has been engaged and in all the conditions encountered at sea, in all geographic latitudes. During years of business engagements Brodospas has always been a globally oriented company, especially since 1991 and since its engagement in offshore activities. Brodospases' strategy and intention have been to open itself completely to the global market and the competition in all its ongoing operations, with the principal objective: to expand into foreign markets with its multipurpose tugboats that it launched several years ago through its operations abroad. In the offshore activities Brodospas wants to reinforce its hard earned reputation of a professional, reliable and responsible shipping company, and reaffirm this reputation in new jobs through gradual renewal of the fleet. In the domestic shipping industry it wants to continue implementing further feasibility assessments relating to the keeping of the current operations in terms of safety of transport in ports and at sea, including rescue and submarine operations, and accordingly, to make appropriate business decisions.

In terms of its internal operating policy, Brodospas has already reached to the substantial extent, its direct objective: spending cuts across all levels, including the already started selection of vessels and activities. Old units, which have been found as commercially and technically unprofitable investments, have been discontinued, as well as individual operations, which also have been shown as unprofitable. Through the appropriate restructuring of operating process units the number of employees has been significantly reduced, the process of reduction of the number of employees to the needed figure will be continued with the application of applicable labour laws and regulations. It has been imperative for Brodospas to invest in the technical and technological development for the ongoing engagement in activities for which markets have been found and operations developed. In order to achieve its strategic

objectives Brodospas will develop its competitive competences at international level.
Along these lines it will continue to give special attention to:
• equipment/accessories of the vessels and the selection, professional qualification and training of all human resources needed for the performance of complex tasks,
• active monitoring and the analysis of opportunities on the domestic and foreign markets, by providing mechanisms of fast adjustment to changes in market demands,
• improvement of the management activities through operating processes in the conditions of safety and quality, in compliance with international standards relating to services provided by it,
• potential implementation of the business cooperation with other domestic and foreign partners, for the purpose of achievement of a better position on the market and
• further introduction of modern electronic technology.
Brodospas will continue to pursue such performance of services that will always be satisfactory to customers, with in parallel, the intention for the company to have a modern and capable management, motivated and satisfied employees, with the operating performance results profitable to its shareholders.

2.2. Plovput d.o.o. –History and Development

The first navigation safety services on these territories date back to 1818, with the construction of lighthouses in this part of the Adriatic. Further development of this service may be followed through the office registered in Trieste, Pula and finally starting from 1963 in Split. After the independence of the Republic of Croatia and based on the Decree of the Government of the Republic of Croatia of 21 January 1992 «Plovput» p.o. Split was incorporated as the company owned by the Republic of Croatia. The company was registered at the Commercial Court of Split and entered in the unique register of the Croatian Bureau of Statistics under the activities of «maritime transport services ».Based on the Act on Plovput,1 Split, «Plovput» p.o. Split-based company was then reorganized into the commercial company with limited liability; with the abbreviated company name Plovput d.o.o. The company is the legal successor of «Plovput» p.o. Split incorporated based on the Decree on the incorporation of «Plovput», Split. The company was registered in the Commercial Court Register of Split on 21 May 1998, and the Registration Decision was corrected on 20 October 1998, while changes in the scope of business operating and changes in the provisions of the Articles of Association were entered respectively on 7 July 1999 and 26 April 2000.
Plovput d.o.o. Split is a limited liability company owned entirely(100%) by the Republic of Croatia, whose core activity, in compliance with the Maritime Code and the Act on Plovput, has been the navigation safety and as such it is of the national interest for the Republic of Croatia. It encompasses:2

- Maintenance and development of waterways and domestic sea waters and of the territorial sea of the Republic of Croatia.
- Placing navigation safety structures along waterways in domestic sea waters and in the territorial sea of the Republic of Croatia and making sure they are duly operational and functional.
- Providing radio services along maritime waterways of the Republic of Croatia.
- Research and design/engineering works for the performance of operations within the scope of the company activities.

On behalf of the Republic of Croatia Plovput is a member of IALA (the International Association of Lighthouse Authorities).
The Company activities are, as follows:

- maintenance and development of waterways in domestic sea waters and in the territorial sea of the Republic of Croatia,
- placing navigation safety structures along waterways in domestic sea waters and the territorial sea of the Republic of Croatia and making sure they are duly operational and functional,

[1] «Plovput» d.o.o Annual Report («Official Gazette », No. 73/97)
[2] http://www.plovput.hr/Onama/tabid/368/language/hr-HR/Default.aspx (10.04.2012.)

- providing radio services on maritime waterways of the Republic of Croatia,
- research and design/engineering works for the performance of the activities as defined in Points 1, 2 and 3 of this Paragraph,

There are 619 maritime signalling structures in the territorial and domestic waters of the Republic of Croatia of general relevance for the navigation safety, maintained by Plovput. At the same time, Plovput maintains also 307 maritime signalling structures of local relevance owned by third parties.

3. ANALYSIS OF BRODOSPAS D.D. HUMAN RESOURCES

Figure 1 shows the organizational structure of Brodospas, one can observe that at the top of the Brodospas chart is the Director followed by the Executive Director and the Secretary. The Executive Director is at the head of all organizational units of the company.

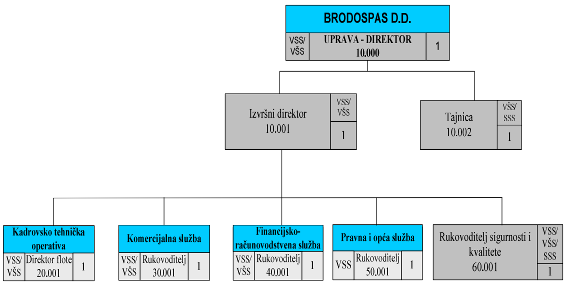


Figure 1. Brodospas d.d. Organization Chart

The organizational culture of the company:
- work environment, in which operations are performed, in compliance with needs of employees and operating processes.
- The company objectives are set based on the participation of, i.e. all the employees are involved in their development.
- Decision-making centralized and within the role of the Executive Director and Director.
- The Management/Managing Board determines safety and quality objectives ensuring these have been defined across all the activities and levels within Brodospas. In the objectives determining process human resources are taken into consideration, which are needed for their accomplishment.
- Direct contact and internal recruiting sources are used in the recruitment process, i.e., HR Manager informs individual employees of their options to be engaged in other jobs. Then it is necessary to hold business interviews with the manager and the Fleet Director to decide on the selection of employees.
- The staff training is conducted in compliance with the annual plan. Managers of services/functions based on internal evaluation results, analyses of exercises, accidents, hazardous situations, customer complaints, incompliance/discrepancy, monitoring of the employee work performance, new regulations and requirements etc are obligated to develop the training plan for the personnel of the function/office under their management, and the uniform plan is then made by the HR Manager.

At regular meetings the Management examines needs for proper functioning of the safety and quality management system and performance of essential operations. The external recruitment source used by the company advertising. The company advertises vacancies in the daily press, in this case in " Slobodna Dalmacija". Direct contact and internal recruitment sources are also used in the recruiting process, i.e., HR Management informs individual employees of their options to be engaged in other jobs, then it is necessary to hold business interviews with the Manager and the Fleet Director, who will decide on the selection of employees.

The work performance of each employee in the head office and aboard ships is monitored while, in addition, the seamen's performance is also evaluated. The scope of the evaluation is to improve Brodospas operating through the monitoring of each individual worker's work performance by determining needs for the additional training, by promoting capable individuals etc. HR Manager is responsible for the making of decisions concerning HR needs, the interviewing of seamen and making decisions on the renewal and signing of seamen contracts of employment.

3.1. Employee Structure

Before the presentation of the employee structure, Chart 1 shows the Brodospas headcount trends through years.
Original scientific paper should report on original theoretical or practical research results. The given data must be sufficient in order to enable the experiment to be repeated with all effects described by the author, measurement results, or theoretical calculations.

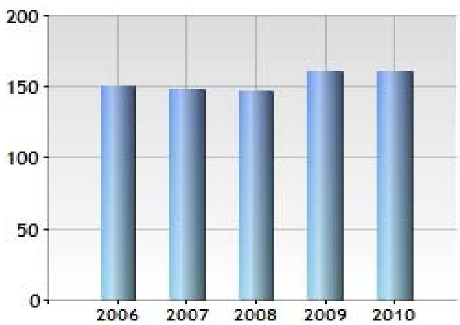


Chart 1. Brodospas d.d. Employees
Source:http://www.poslovna.hr/subjekti.aspx?show=315475&srn=1# (29.03.2012.)

As shown, from 2006 to 2009 the number of employees decreased while 2009 shows a rising number of employees, and the same figure was marked in 2010.

Table 2. Headcount

EMPLOYEES ACCORDING TO HR OFFICE DATA		
	TOTAL	FEMALE
HEADCOUNT 29/02/2010	161	31

Source: Brodospas d.d. documentation

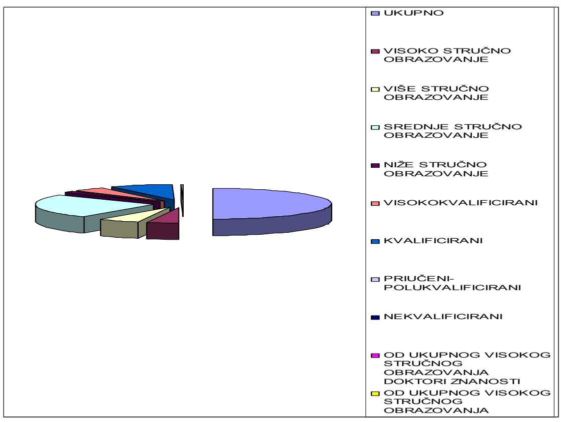
Out of 161 employees only 31 are women, the number of employees remained unchanged in the first months of 2010. In 2009 the number of employees was 161 of which 31 women, same as in 2010.

Table 3. Employees according to professional qualification degrees

EMPLOYEES ACCORDING TO PROFESSIONAL QUALIFICATION DEGREE			
		TOTAL	WOMEN
TOTAL		161	31
UNIVERSITY DEGREE		15	9
COLLEGE DEGREE		20	4
HIGH-SCHOOL QUALIFICATION		80	14
ELEMENTARY SCHOOL QUALIFICATION		4	3
HIGHLY SKILLED		15	0
SKILLED		25	1
TRAINED ON THE JOB SEMISKILLED		1	0
NON-SKILLED		0	0
OUT OF THE TOTAL UNIVERSITY DEGREE QUALIFICATIONS	DOCTORS OF SCIENCE	0	0
	MASTERS OF SCIENCE	1	0

Source: Brodospas d.d. Documentation

Table 3 shows the 2010 status of more than a half of the employees with just high-school qualifications of which 14 women. 15 employees have university degree qualification and of that number more than a half are women, i.e., 9 women. The employee professional qualification diagram is shown also as Pie Chart 2.



Pie Chart 2. Professional Qualification Status of Employees

Table 4. Employees according to types of jobs/work positions

EMPLOYEES ACCORDING TO TYPE OF JOBS/WORK POSITIONS 31/03/2010		
	TOTAL	WOMEN
TOTAL	161	31
FOR AN UNDEFINED TIME PERIOD	158	31
TEMPORARY EMPLOYMENT	3	0
TRAINEES/INTERNS	0	0

Source: Brodospas d.d. Documentation

Out of 161 employees only 3 have been employed on a temporary basis while 158 have been employed on an undefined time period basis. All female employees have been employed for an undefined time period.

Table 5. Employees according to working hours

EMPLOYEES ACCORDING TO WORKING HOURS BASIS 31/03/2010		
	TOTAL	FEMALE
TOTAL	161	31
FULL-TIME	159	29
PART-TIME	0	0
REDUCED TIME BASIS	2	2

Source: Brodospas d.d. documentation

Out of the total of 161 employees, two female employees have been employed on a reduced time basis while the remaining 159 employees have been employed on a full time basis. There are no employees on a part-time basis.

Table 6. Employee indicators

POKAZATELJI ZAPOSLENIH			
Broj zaposlenih (prosječan broj na temelju sati rada)	147	161	161
Prihodi po zaposlenom (u €)	184.784,00	168.582,00	184.537,00
Neto dobit po zaposlenom (u €)	21.409,00	23.110,00	8.637,00
Prosječni troškovi osoblja po zaposlenom (u €)	17.749,00	18.821,00	19.123,00
Prosječni mjesečni troškovi osoblja po zaposlenom (u €)	1.479	1.568	1.594
Prosječne mjesečne neto nadnice i plaće po zap. (u €)	852	892	911
Prosječni mjesečni tr. por. i dopr. na plaće po zap. (u €)	409	446	448
Prosječni mjesečni doprinosi na plaće (u €)	217	231	235
Udio troškova za osoblje u ukupnim rashodima (u %)	10,90	12,90	10,90
Ukupna imovina po zaposlenom (u €)	344.471,00	471.105,00	436.667,00
Ukupni neto radni kapital po zaposlenom (u €)	17.887,00	31.605,00	25.280,00

Source: www.poslovna.hr (30.03.2012.)

Table 6 shows Brodospas d.d. employee indicator trends for 2008, 2009 and 2010, as follows. The number of employees was increased in 2009 to 161 compared to 2008 in which the number of employees was 147. The income per employee was decreased in 2009 compared to 2008, but the income per employee was increased in 2010. It is essential to underline that the sums are shown in Euro. The net profit per employee was increased in 2009, and it was decreased in 2010 by 63% compared to 2009. The average costs per employee were increased year by year just as the average monthly HR costs per employee, average monthly net wages and salaries per employee and average monthly costs of return and contributions on salaries per employee and average monthly contributions on salaries. The share of HR costs in the total expenditure rose in 2009 compared to 2008 and then fell again in 2010 and it was, as in 2008 = 10.90 %. The total assets per employee were also increased in 2009 compared to 2008 to be reduced then in 2010 and the total net operating capital per employee shows the equivalent trend.

3.2. Brodospas d.d. HR Management

The Management determines safety and quality objectives ensuring these are defined for all the activities and across all levels within Brodospas. Human resources needed for the accomplishment of objectives are taken into consideration in the process of determination of such objectives. Brodospas will employ and promote only those individuals that have met the conditions set in its regulations/policies, which in terms of seamen may not be less strict then those prescribed in the provisions of the International Convention on the Standards of Training, Certification and Watch keeping of 1978 as amended in 1995. (STCW Convention 1978, as amended 1995).

Only a person with needed qualifications that, according to the assessment made by Brodospas, is capable of running a specific type of ship and that has been properly acquainted with the safety and quality management system may be engaged as commander. Each commander will be given full assistance by Brodospas in the performance of his/her respective duties.

Each employee must be acquainted with the safety and quality management system to the extent necessary for the successful performance

of respective duties and ship officers and inspectors/auditors must be acquainted with the International Safety Management Code for the safe operation of ships and prevention of pollution (ISM Code).
The work of each employee in the head office and aboard ships is monitored and in addition, the work of seamen is also evaluated. The purpose of evaluations is to monitor the work of each individual in order to improve the Brodospas operating based on the determined additional training needs, promotion of capable individuals etc. Any renewals of contracts of employment with seamen with unsatisfactory evaluations are subject to review by Brodospas.

Ship embarking - The number and qualifications of the ship crew are to satisfy all regulations of the country of the ship's registration and the provisions of international conventions. The embarkation or rotation of crews and support activities such as validation of authorizations and travel documents, travel arrangements etc. are done according to a strictly controlled method.[3]
Orientation training concerning new duties and the ship - Before signing the first contract and before any career advancements, i.e., new assignments, each seaman has to undergo orientation training organized by HR Office to learn of his duties and the Brodospas Safety and Quality Management Policy. For individuals promoted aboard ships orientation training is done aboard ships. In addition to the above said all officers must read the Safety and Quality Management Rules and the Ship Manual – General Operating. If feasible in the process of rotation of crews, Brodospas will endeavour to leave sufficient time for persons taking over duties to receive orientation training from persons surrendering the duties and the ship. All newly embarked crew members, within the shortest possible period after the embarking, under the supervision of the first officer of the deck or the first officer of the engine, must get acquainted with the ship, the equipment and safety measures aboard ship.

Training - The staff training is done in compliance with the annual plan. Office managers based on results of internal evaluations, exercise analyses, accidents, hazardous situations, customer complaints, discrepancies/incompliance, employee work monitoring, new regulations and requirements etc. are obligated to develop a training plan for the managed office staff, and the uniform plan is then made by the HR Manager. The Plan is discussed at meetings relating to the assessment of the Management . The training is attended by persons whose work is directly affected by the safety and quality management system, whereby it must be ensured that the work is done in compliance with the system procedures. Commanders, engine operators and first officers of the deck and the engine, during their leave (R&R), as necessary, are invited to the head office to be engaged in the active work and thereby to get acquainted with work procedures of individual offices and issues encountered in the shipping work. The training aboard ships is primarily conducted as training on the job with senior officers explaining operations in progress.

Infrastructure - Brodospas owns the infrastructure needed for the performance of its services. The infrastructure consists of:[4]
ships of such characteristics that are necessary to meet their needs and client expectations;
support servicing facilities enabling the efficient operation of ships, such as maintenance, supply with needed parts and fuel;
means of communication, providing the communication between ships and the head office, ships and other entities involved in the transport of cargo; rules and regulations applicable in the area of Brodospas activities and applicable to ships.
Brodospas has continually followed market demands, rules and regulations applicable to ships and it has regularly controlled the status of its ships, using results of findings to assess whether the infrastructure meets operating needs, client and market expectations, as well as regulations applicable to the Brodospas operations and ships.

Rules and regulations - All ships have been supplied with all valid regulations, rules,

[3] Safety and Quality Management Rules, Brodospas, 2008

[4] Safety and Quality Management Rules, Brodospas, 2008

instructions and other publications needed for safe navigation and commercial operation processes, such as regulations of the country of the ship's registration, international conventions, navigation manuals, instructions for safe operation, prevention of pollution, personal safety etc. The complete list of issues/volumes that must be aboard any ship has been included in the Manuals and Publications form.

Work environment - Work environment for the performance of operations is in compliance with/has been adjusted to employee needs and operating processes. Ships are in compliance with all safety and environment protection standards, while work areas and crew premises meet modern-day requirements. Safety at work regulations, conventions and resolutions relating to the safety and environment protection are followed in all operating processes, aboard ships and in the head office.

Responsibilities - The Fleet Director has the overall responsibilities for employment, evaluation, embarkation of seamen, orientation training relating to new duties/assignments, organizing and keeping records of the head office employees and seamen training. HR Manager is responsible for the making of decisions relating to staffing needs, interviews with seamen and the making of decisions relating to the signing of seamen contracts of employment. The director is responsible for the making of decisions relating to the signing of contracts of employment with seamen who have no record of previous service aboard Brodospas ships.

Support documentation: [5]

- STCW 1995 Convention (International Conference on Standards of Training Certification and Watchkeeping for Seafarers),
- Regulations on the professions and authorizations of crew members aboard merchant navy ships of the Republic of Croatia,
- National regulations of the country of the ship's flag relating to qualifications of ship crews,
- Ship Manual –General Operating, Organization and Description of Operations Aboard Ships,
- Labour Act,
- Systematic Organization of Jobs/Work Positions,
- Collective Agreement,
- Archive - Personal Files,
- Management Procedures, Crew Rotations,
- Management Procedures, Records of seamen and head office/management employees.

3.2.1. Recruitment and Selection Procedures

Qualifications and experience- Qualifications or professional qualifications/skills and authorizations, experience needed for individual work positions aboard ship have been prescribed in:[6]

- STCW 1995 Conventions,
- Regulations on the professions and authorizations of crew members aboard merchant navy ships of the Republic of Croatia,
- National regulations of the country of the ship's flag.

There are following types of employment aboard Brodospas:

- Employment via Contracts of Employment based on the National Collective Agreement entered into with the Union of the Croatian Seamen,
- Employment via Employment Agreements for defined time periods and Employment Agreements for undefined time periods based on the Labour Act, or the Systematic Organization of Jobs/Work Positions.

The person interested in a specific profile of vocation aboard ship must contact the HR Office directly, by telephone or in writing. Brodospas uses press as the external recruitment source, i.e., daily press and internal recruitment sources, i.e., direct contact. Brodospas, if interested, will request from the candidate to file the application that must include a short CV and navigation details if the

[5] Management Procedures, Manual, Brodospas, 2008

[6] Management Procedures, Manual, Brodospas, 2008

person has any previous service records. Brodospas will invite any prospective applicant to the head office for an interview and HR Manager will conduct the interview. The seaman- candidate must fill out the Employment Questionnaire. During the interview the candidate will be informed of the Brodospas Safety and Quality Management Policies, drugs and alcohol abuse rules and on the work conditions. The resulting information of the interview will be recorded by the interviewer in the Employment Questionnaire: – For Management's Attention box.

The HR office clerk will check, to the possible extent, the credibility of the information given by the seaman- candidate, as necessary, the information on the seaman will be requested from other employers of previous ship assignments. As needed, the candidate may be required to undergo drug tests at the licensed institution. The Decision on the signing of the Contract of Employment is made by the Director.

- HR Office Manager must inform each seaman employed for the first time of, as follows:[7]
- Safety and Quality Policy,
- Brodospas d.d. Drugs and Alcohol Policy,
- Work discipline aboard ships,
- operations and duties of the corresponding work position.

Each officer employed for the first time aboard Brodospas ships, during his visit to the HR Office must read the *Safety and Quality Management Rules and the Ship Manual – General Operating, and, if the time allows it, the Critical Situations (Emergencies) Manual.* The statement confirming that he has read the manuals and the rules will be signed by him in the Orientation Training Record Form. One copy of the Record will be given to the employee and one will be filed in the Personal File. If the officer for any objective reason has not read the manuals, he must read them aboard ship and sign the Orientation Training Record Form that will be sent by the commander to the HR Office.

The Contract of Employment, i.e., the Employment Agreement for a defined or undefined time period is signed immediately before the embarkation. In addition to the employment contract each seaman must sign the Statement confirming that he will respect the Brodospas d.d. Drugs and Alcohol Policy and its provisions. The personal details on the seaman are entered in the computer in the HR Records directory.

Brodospas and seamen contract renewals - For seamen who were already embarked aboard Brodospas ships, before making the decision on the signing of the Employment Contract, the HR Office should:[8]

- Check the evaluation from the previous ship and proceed in accordance with the final evaluation.
- In the event of doubt, the seaman should be required to undergo drug and alcohol tests at the licensed institution.
- The validity of personal documents should be checked (passport, seaman's book).
- Authorizations that are needed should be verified.
- The validity of the medical examination should be verified in the Seaman's Book.

The decision as to the signing of the contract with the seaman is made by the HR Office Manager. The Contract of Employment is signed immediately before the embarkation, and the Statement must be signed in addition to it as confirmation that he will respect Brodospas d.d. Drugs and Alcohol Policy and its provisions.

Records - Employment applications are kept according to the order of arrival. The period of records keeping is 2 years. The seaman's personal details are kept in electronic files, in the PC directory under HR Records. The seamen details are kept in the Personal File archives.

3.2.2.Types of Employment

The types of employment are, as follows:

- Employment via Contracts of Employment based on the National Collective Agreement

[7] Management Procedures, Manual, Brodospas, 2008

[8] Management Procedures, Manual, Brodospas, 2008

entered into with the Union of the Croatian Seamen,

- Employment via Employment Agreements for defined time periods and Employment Agreements for undefined time periods based on the Labour Act, or the Systematic Organization of Jobs/Work Positions.

The selected seamen, candidates must submit certificates/diplomas of the acquired professional qualification/skills, authorizations needed for the performance of specific duties as ship crew members, ID card, passport, Seaman's Book, valid medical examination records entered in the Seaman's Book and the previous navigation experience evidence.
HR Manager must inform each seaman employed for the first time of the following:[9]

- Safety and Quality Policy,
- Drugs and Alcohol Policy,
- Work Discipline aboard ship,
- Operations and duties of the corresponding work position.

Official mechanisms have been provided to ensure that the selection of human resources is in compliance with appropriate quality standards.

4. ANALYSIS OF PLOVPUT D.O.O. HUMAN RESOURCES

4.1. Internal Organization of the Company

The Company's organization has been based on the provisions of Plovput Split Articles of Association – the consolidated version adopted at the General Meeting of the Company on 7 June 1999. On 1 July 1999 the Collective Agreement was signed for Plovput d.o.o. Split employees, regulating the mutual rights and obligations and labour relations of Plovput d.o.o. Split as the Employer and three unions involved within the Company: the Union of the Croatian Seamen, the Union of the Plovput Employees and the Union of Radio Operators and Employees of the Croatian Coastal Radio Stations. On 29 July 1999 the Supervisory Board, with the previous consent of the Employee's Committee, issued the Labour Regulations, in compliance with the Act and the provisions of the Collective Agreement, regulating the rights and obligations of employees and employers, work conditions, salaries and other labour related issues.
The Company activities and other operations of the Company are performed through organizational units:

1. Director's Office (undefined time basis 5, defined time basis 1, 5/1)
2. Navigation Safety Department (23/2)
3. Maintenance Department-Base (71/8)
4. Finance and IT Department (25/1)
5. Commercial and Marketing Department (20/2)
6. Legal and HR Department (15/2)
7. Navigation areas: Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik(96/3)
8. Zagreb Office (2/3)

Based on the powers defined in Articles 9 and 16 of the Plovput Articles of Association the Company Director is to determine in more detail the internal organization of the Company in the Decision on the internal organization of organizational unit work and operating processes.

4.2. Number of Employees and Qualification Structure

With its organizational units the Company covers the entire coastal zone of the sea of the Republic of Croatia. The organizational units consist of in total *236 employees employed on an undefined time basis and 22 employees on a defined time basis*, i.e., in total 258 employees.
The Management Structure of the Company consists of: the General Meeting body, the *Supervisory Board* and the Managing Board. The Government of the Republic of Croatia on behalf of the Company owner appoints three members of the *Company General Meeting body*, the *Supervisory Board* consists of three members, and two members are appointed and recalled at the General Meeting of the Company, one member is elected by the Company employees. The powers and work of the Supervisory Board have been defined in the law. The *Supervisory Board based on Article 17 of the Plovput Act O.G. 73/97 issues the approval of the Annual Operating Plan*. The director is appointed by the Supervisory Board

[9] Management Procedures, Manual, Brodospas, 2008

for the five-year term of office, based on the Public Announcement of the Vacancy under the conditions determined by the Supervisory Board.

Table 7. Plovput d.o.o. Employee Indicators

POKAZATELJI ZAPOSLENIH			
Broj zaposlenih (prosječan broj na temelju sati rada)	280	258	258
Prihodi po zaposlenom (u €)	35.503,00	40.018,00	43.315,00
Neto dobit po zaposlenom (u €)	1.739,00	1.116,00	5.258,00
Prosječni troškovi osoblja po zaposlenom (u €)	17.033,00	19.760,00	18.931,00
Prosječni mjesečni troškovi osoblja po zaposlenom (u €)	1.419	1.647	1.578
Prosječne mjesečne neto nadnice i plaće po zap. (u €)	840	968	927
Prosječni mjesečni tr. por. i dopr. na plaće po zap. (u €)	368	433	415
Prosječni mjesečni doprinosi na plaće (u €)	211	246	236
Udio troškova za osoblje u ukupnim rashodima (u %)	51,20	51,20	51,60
Ukupna imovina po zaposlenom (u €)	69.937,00	76.833,00	80.974,00
Ukupni neto radni kapital po zaposlenom (u €)	11.320,00	15.521,00	19.552,00

Source: www.poslovna.hr (10.04.2012.)

Table 7 shows that the number of Plovput employees was decreased to 258 in 2009 compared to 280 employees in 2008. The income per employee was increased year by year, but the net profit per employee was reduced in 2009 compared to 2008; while the 2010 net profit shows a four times higher figure. The average HR costs per employee were the highest in 2009 while in 2010 they were reduced. The total assets per employee and the total net operating capital per employee were increased year by year from 2008 to 2010.

5. CONCLUSIONS

Companies know how important are human resources and their strengths/qualities that impact directly any company's operating. Therefore, much attention is given to the selection of personnel, but also to their further development, training and advancement. Employees are monitored and evaluated and the purpose of evaluations is to improve the company's operating based on the monitoring of the work of each individual employee and the determination of additional training needs, promotion of capable individuals etc. Brodospas and Plovput will employ and promote only such individuals that meet the conditions prescribed in the respective company regulations, and they are concerned about the safety of the employees, therefore, before embarkations they require from the employees to get acquainted with the Regulations and the Company Policies.

After the determination of the status of the analyzed companies in the area of human resource management processes, one may say that both Brodospas and Plovput operating in these processes has been very professional and of the appropriate quality. Further training and professional development of the employees have been provided by the companies, professionally and in compliance with appropriate quality standards, because of the awareness that human resources are important for the entire business operating. The jobs in the above mentioned companies' industry are in high demand, but compared to other industries it is easier to find candidates. The improvement has been proposed relating to the selection sources: for the Internet to be used as the external selection source. The Internet today has been increasingly used as information/communication tool and in the area of employment services. This is certainly a contributing factor in terms of the level of information available to the company.

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SEAFARERS' CAREER DEVELOPMENT - INFLUENTIAL FACTORS, CHALLENGES AND PERSPECTIVES

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ABSTRACT

The human resource is of paramount importance in every organization, especially in a maritime organization. The ship's crew management process integrates several basic functions: planning, recruiting, selection, education and training, socialization, performance evaluation, communication, motivation, as well as promotion, transfer, termination of work and retirement. All mentioned functions are laid down by international maritime regulations, i.e. respective conventions STCW, SOLAS, MARPOL, MLC, etc. In this sense, subject of research in this paper is defined within the ship's crew management discipline, with special emphasis on very actual topic of successful seafarer's career development. Here will be examined the horizontal and vertical mobility of human resources in the maritime business, the actual state of supply and demand at the labor market (especially the management staff), as well as the "creation" of seafarers all over the world and the role of the educational system in this process. Of special significance in this paper is the systematization of the most important factors that affecting the attractiveness of the seafarer's profession, as well as presenting results of research conducted by the authors during the interval of ten years.

KEY WORDS

management. maritime affairs. career. seafarers.

1. INTRODUCTION

The current situation on maritime market of labour is characterized by seafarer's fluctuation, and that is increasingly present phenomenon of leaving the profession before the retirement. There is an increasing number of seafarers who after a certain period of time disembark in order to work on shore, i.e. there is a decreasing number of seafarers who are ready to spend their whole life at sea. This fact can be applied to the seafarers of every profile.

There are many causes of these changes. Although navigation provides familiarization with many ports and countries, and even the world, the life on-board represents a kind of isolation from the social life. Nowadays, however, the possibility to really see the world is limited, due to the fact that ships spend less time in ports.

On-board monotony, especially on longer routes, appears more often and more seriously than at working places that are situated inland. The resting time on-board is not a real rest for seafarers, because it is spent in the working environment, which is additionally confined space.

Being away from their families for relatively long makes this profession for seafarers even more difficult. All these facts and many other difficulties create frequent conflicts and intolerance among crew members. Due to the above mentioned reasons, a great attention is paid to the on-board living and working environment nowadays. The seafarers' salaries are higher than those at shore. Despite all these facts, seafarers are still quitting their jobs, especially in the countries with high living standards.

The mentioned phenomena resulted in the lack of professional seafarers in the developed countries. The automatization can not solve the problem. Namely, even the highly educated crew on-board automatized ships do not show the intention to stay longer at sea than the seafarers who used to navigate in the recent past. It all boils down to the economical aspect of the fact that management crew members are paid more than junior operating crew members from India, Philippines, Indonesia and East Europe.

2. FLUCTUATION OF HUMAN RESOURCES IN SHIPPING

Technology development and automatization and its application in working process mirrors itself in the fluctuation of seafarers in shipping companies. This influence is evident in the fact that the fluctuation is conditioned, directed and determined by technological requirements of working process. However, the fluctuation does not solely depend on technological processes. It has also a certain degree of autonomity, which is substantially determined by objectives, principles and policy criteria of shipping companies. Human resource policy, in this case, represents both the base and frame for fluctuation process, which comply with material and human aspects.

The fluctuation of employees in each organization, especially in shipping companies, has two basic forms - horizontal and vertical fluctuation. Vertical fluctuation refers to employees' upgrading, while horizontal fluctuation implies transfer, exchange, embarkation and disembarkation. Fluctuation of human resource is an important motivating factor because it provides working places (ships) which comply with seafarers' aspirations and abilities.

In order to optimize the process of fluctuation, it is necessary to comply with certain requirement for each working position on-board at ship (STCW). The possibility of more intensive fluctuation depends on a series of factors which involve: a) organizational conditions which are expressed by the working process requirements, b) seafarers' motivation to fluctuate, c) the company's management potential, which implies different forms of human resource structure, d) inter-human relations in a company and on a ship, e) inclination of shippers to recruit certain human resource - seafarers, f) education policy, etc.

Human resource fluctuation is closely connected to other processes, primarily planning, training, international standards, earnings, analysis and employees' upgrading. Each process affects to some extent the content, direction and dynamics of seafarers' fluctuation.

3. PLANNING OF SEAFARERS ON THE GLOBAL MARITIME MARKET

This paper describes the current situation of the human resource creation on a global scale, with the consideration of the local environment. The approach is based on contrasting different education systems, which are in practice all over the world with the analysis of both advantages and disadvantages of the systems. We also consider the BIMCO (Baltic and International Maritime Council) research, which refers to the demand and supply on the international labour market. A special treatment is given to the upgrading according to the international conventions, which determine the training and education systems.

If we go a few decades back in the past, we will see that the European Union paid great attention to introducing new law and legislative, which apply to seafarers' education and training. This fact also influenced the development of shipping industry. Nowadays, it is impossible to create quality seafarers in case they are not educated in compliance with many conventions, such as SOLAS (Safety of Life at Sea), STCW (Standards of Training, Certification and Watchkeeping) and others. However, seafarers demand is influenced by world's economy situation. Education system planning is of great importance for all transit-countries, which are tackling with radical changes of both educational and economic system aiming at compliance with European Union standards. One of such countries is Montenegro. A great attention should be paid to the future seafarers' education, because during this process we create seafarers who are going to find themselves in an open employment market. It is necessary to follow the world's trends in the maritime education.

If we look into the research of BIMCO which was carried out in the last decade, we will notice that there is a lack of professional (managing officers) seafarers. The difference between demand and supply of human recourse on the global market is in favour of the supply. One part of the managing positions could be covered by seafarers from operating and auxiliary level of hierarchy on board, in order to reduce the difference between supply and demand of human resources in shipping. However, according to the mentioned research, traditional division of professions, as well as great differences in education, indicate that it is not a final solution to resolve the problem of recruiting the professional seafarers. The cause of this problem lies in the education process and interests of potential candidates for this kind of profession. This research aimed at defining the most appropriate measures for increasing interest in this profession. The dynamics of the education process should be primarily determined, so that the main development barriers could be identified.

The survival of the maritime affairs organization, in general, depends on the quality of human resource management. However, over 40% of officers are over 50 years old, and 18% are over 55, so that the question is – why are not young people interested in this profession? It may be that the answer lies in the fact that the maritime education is very demanding and that upgrading and promotion implies a substantial work and practice.

According to the above mentioned facts, the European Union makes efforts to motivate as many young people as possible to make career in maritime affairs. One of the aspects is the fact that only high school education is necessary for on-board senior positions. However, the future officers are required to go through a number of courses in order to improve and upgrade their career. Therefore, we are aware that senior positions do not require graduation from a maritime faculty. This issue is certainly debatable.

4. BECOMING A SEAFARER AND CAREER DEVELOPMENT IN MARITIME AFFAIRS

Shipping is a specific economic branch, so the upgrading and improvement in this business should primarily be mentioned. This results from the fact that each maritime adventure implies a great number of risks threatening to the crew, ship, cargo and environment. Due to that fact, it is necessary that each level and department on board a ship operates faultlessly. The officers are also subject to constant certification on the international market.

The maritime education is divided into three systems: a) traditional system, b) graded system,

and c) comprehensive university system. Traditional system successfully combines theory and practice. The practice provides additional explanation and improvement of theoretical knowledge. This system consists of several phases including on-board work which last 2 to 3 months. The whole system lasts 5 to 7 years, which is its main disadvantage. The Great Britain and some Asian and African countries reduced the time needed in maritime education.
The graded system enjoys a substantially greater popularity and it is applied in the West European countries, USA, Australia, Canada, India, Philippines and Egypt. The system with the 6 to 12 month practice lasts 3 to 4 years, and in that way the undergraduate BSc degree, which is in compliance with STCW convention is obtained. This type of education is carried out at academies, private colleges, faculties and state universities. Montenegro has relatively recently introduced Bologna Declaration and applied this type of the maritime education.
Comprehensive university system is applied in France, Spain, Greece, Japan, China, Poland, Russia, Hungary, Slovenia and Romania. There is a small difference between the comprehensive and graded system. In the comprehensive system the undergrade degree is also obtained with the possibility to continue with post-graduate studies. During the undergraduate studies subjects such as Maritime Law, Economics, Protection of Environment and Human Resource Management prevail.
The common characteristic to these three systems are the following: a) each system comply with standards and minimal terms of the STCW 95, and some even are beyond these conditions, b) each system accents the inseparable aspect of theory and practice (working knowledge), drills, students' projects, programmes for preparing the students for on-board and on-shore jobs. There is a freedom to choose among these systems in some countries.
Besides education, training is obligatory universal form of creating efficient human resources and a basic task of each company management. Through the training the company achieves its objectives and increases the value of the most important capital, and that is human capital. The training is a kind of investment into human resource aiming at qualifying the human resource for certain jobs. In order to improve knowledge and skill of employees, it is necessary to create a suitable system of education and training of maritime human resource. Nowadays, it is of paramount importance to acquire new knowledge and improve existing one, which is dictated both by European Union and many other international organizations which has a regulating role as far as education and qualification of future seafarers are concerned. A great many changes in the field of maritime education and training were contributed by fast technology and technical development in maritime affairs. However, many things remained the same, especially on-board relations, which represent a specific social environment. Therefore, there is an autocratic system on-board vessel, due to the existence of hierarchy.

5. MOTIVATION IN MARITIME AFFAIRS - SURVEY RESULTS

A certain number of young future seafarers finds the life on-board very difficult. This fact causes prejudice when they embark. The surveys prove that future seafarers are mostly not informed well about life on-board a vessel and that could make it difficult for cadets and assistants to adjust when they start with job.
It will be interesting to present the results of the research that was carried out at the Faculty of Maritime Studies in Kotor (nautical department, engine department and maritime science department). The research was carried out in the first, second and third year in December in 2010. Precisely, 362 out of 648 enrolled students were included in the research. They were asked: Who influenced you to become a seafarer? We obtained the following results (Figure 1):

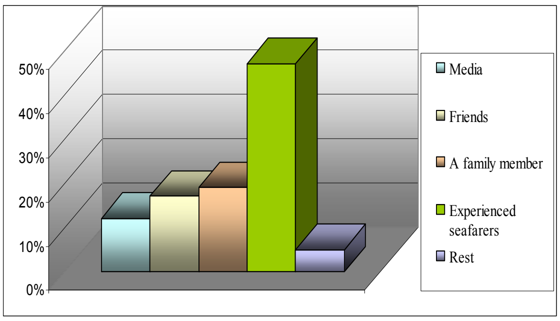

Figure 1. Factors of influence

The results of the survey that include the rest 5% are the following: individual interest, decision made on their own, tradition of the region, personal aspiration, financial situation in the country, etc.

However, the research proved that future seafarers learn most by older colleagues, and that fact has both advantages and disadvantages. The information can be true, but also they can be false, depending on individual experience. Such information makes it difficult for young seafarers to socialize. Once a young seafarer embarks, he familiarizes with the situation, evaluates persons and conditions on-board. Therefore, it is very important that senior officers behave in an adequate way, so that young seafarers can adjust to the ship's environment. That will, certainly, facilitate the socializing.

The objective of the second part of the survey (Figure 2) was to obtain the answer to the following question: What did motivate you to choose the profession?

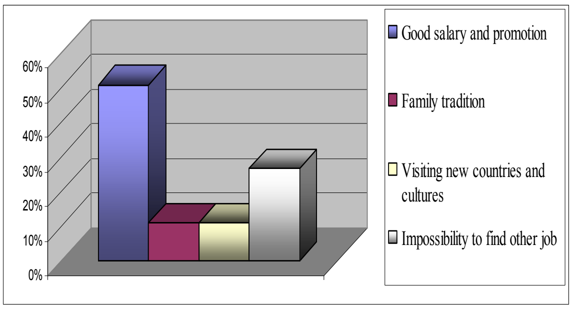

Figure 2. Factors of motivation

In order to compare the results, we are going to present the answers of the students from year 2000 (Figure 3). The question was: What are the reasons for embarkation? The following answers were obtained:

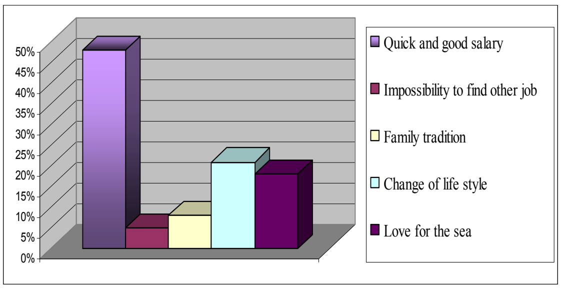

Figure 3. The reasons for embarkation

If we compare the answers from 2000 to the answers from 2010, the conclusion is that quick and good salary is in most cases a motivating factor for embarkation (51% and 48%). It is evident that the number of those who could not find other job increase dramatically in the last decade (5% and 27%). The results of the survey should serve as an indicator for further research in this field, especially economic, political, legal and educational factors should be thoroughly surveyed.

It is necessary to point out some aspects which are crucial and which are psychologically experienced during the first days on-board a vessel. Namely, besides a cordial welcome which results in pleasant feelings there are also some other ways of creating good working environment. Through the survey of adjusting of young seafarers to on-board living and working conditions, the first day's difficulties are graded. In the first place there is the difficulty of being away from the families and homesickness, and in the second place, there is the great distances that seafarers find very difficult. On-board life is essentially difficult, complex, and demands both physical and psychological efforts. There are also a limited communication, rare going ashore, loneliness, lack of free time, and certain limitations that result in frustration.

Various difficult situations in which seafarers find themselves, various limitations and self-sacrifice which are usually related to conflicts, strongly develop the skill to make decisions as well as to accept different opinions. The obstacles in maritime affairs, numerous duties and physical efforts, a great many navigational hazards and many other aspects contribute to creation of positive working environment and characteristics of crew members, such as: determination, courage, endurance, self-control, good decision making and implementing ability. However, these qualities can be created solely in an organized on-board collective, resulted from skilled managing team.

6. CONCLUSIONS

The new economic and social era demands sophisticated methods in human resource management instead of the traditional that characterized the industrial period. The basic preoccupation of science and profession is to find ways of recruiting and selection of competent seafarers whose abilities are source of new and competitive knowledge. It is also necessary to preserve the key competence and to create an ambiance on-board a ship (corporative culture), where knowledge is acquired and shared and trust, cooperation, team-work and commitment to common objectives are essential part of a working environment.

Human resource management is of paramount importance for every branch of economy, due to the fact that even the best plans can not be realized with low quality human resource. Therefore, the objective is creation of qualified seafarers according to the international standards. A successful career in maritime business requires a continuous education and training, as far as technology development, environment protection and safety of life at sea are concerned. Due to the fact that crew members are continuously exposed to a great variety of risks, the managing team should be good at managing human resource in both routine and non-routine operations.

Each seafarer should know his own interests and according to that he or she should plan the career. It could be concluded that the decision is in their hands. Essentially, every individual is responsible for his/her career, and success depends on their will and motivation. Seafarers must be in compliance with all requirements and technical and technological innovations, so that they survive on the world's market. Poor knowledge and irresponsibility cost dearly and sometimes mean the end of a career.

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IMPLEMENTING E-LEARNING MODES TO THE STUDENTS AND SEAFARERS EDUCATION: FACULTY OF MARITIME STUDIES OF KOTOR CASE STUDY

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ABSTRACT

The paper considers in the first line Moodle as a Course Management System (CMS), also known as a Learning Management System (LMS), or as a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online learning sites. The focus of the Moodle implementation into the educational process is always on giving educators the best tools to promote learning, to improve methods of knowledge transfer, and students' efficiency in its acquisition. The motivation and purpose of this system implementation at the Faculty of Maritime Studies of Kotor will be briefly described, as well as the basic tools that are offered by the standard Moodle version, along with some additional aids like hot potatoes and questionnaires (in free editable form) are. The possibilities of extending this e-learning system toward the m-learning one, by the Windows 7 Phone application, for mobile devices, shall be considered, as well. Finally, some examples of the questionnaires on students (seafarers) satisfaction with this new offered distant learning mode in comparison to the previous, more conventional ones, will be conceived and the responds will be analyzed in accordance to a standard statistical method in order to estimate respondents' unanimity or controversy. However, the ultimate goal of the paper is increasing motivation of high school students, especially future seafarers, with regard to the use of on-line learning resources, especially in specific educational domains like those concerning maritime transportation, industry, safety, business, and/or administration are.

KEY WORDS

E-learning. Moodle. M-learning. Seafarers' education.

1. INTRODUCTION

The Faculty of Maritime Studies of Kotor (University of Montenegro) has long lasting tradition being founded even in the medieval times, when captain Marko Martinović's has his own nautical school for Russian feudal lords (17th century), in Perast, a little seaside town near Kotor. Later on, the nautical school continues to exist in Kotor, and it still works as Faculty of Maritime Studies, educating students and seamen for variety of both ship and port vacations. Also, graduated students can find employment in the agencies and firms which are focused on different maritime affairs. Some of graduated students can find jobs abroad on foreign ships, in foreign shipping companies and ports, as well. Although the tradition of nautical and maritime sciences in general is long lasting and rather rich one in Kotor, and along the whole Montenegrin littoral zone, we have to be aware of the requirements of the current moment, i.e. of the actual world living and working flows. Accordingly, we came up to the idea of introducing e-learning environment for the needs of our students, seamen, and all other persons being interested in this mode of education and knowledge transfer.
It is to be mentioned in this context that in 2006 we adapted the curricula to the Bologna system that recommends, among other things, presence of the students at almost all classes during the semester. So, if the students are not present, or if they are usually absent from their classes, there is a real possibility that they will not pass the examinations! – This is particularly case with the students who have to sail, i.e. to work as seamen to earn their salaries, during the semester. Within the past few years we have numerous requirements from their side to organize for them condensed courses several times a year, or to develop and offer them distant learning educational and training modules. Recently, we have decided to meet their needs and to develop and implement an appropriate distant learning module.

2. THE IMPLEMENTED E-LEARNING MODULE

The implemented distant learning module at the Faculty of Maritime Studies of Kotor is composed of three different sets of subjects in the areas of ship's mechanical engineering, nautical sciences, and marine electronics. Through this polytechnic module, it becomes possible to the students (seamen) to refresh and upgrade their knowledge in these three fields of crucial importance for safe and efficient navigation, and other maritime industry and business affairs. All necessary materials (books, handbooks, journal articles, power point presentations, etc.) are available to the students (i.e. seamen in this case) in any time, at any point on the Earth, and on the sea! So, they will be finally, for the first time at our Faculty, in the equal position in comparison to their colleagues who are not prevented to attend the classes in the classical manner.
The on-line tests for evaluation of achieved knowledge are available, as well as, the communication to the lecturers, by forum, chat and/or by e-mail. At the end of the semester, students are to approach the classical exam at the Faculty, like all other students. At this moment there is no plan to organize exams on-line from their home, or working place, since the Internet as *open* network, does not provide satisfying level of security.

3. THE APPLIED METHODOLOGY

In developing and implementing this e-learning module, primarily devoted to the seamen successfully completing maritime high education, we have made some consultations with our colleagues from the Center of information system (CIS) at the University of Montenegro, and with the colleagues from Faculty of Economy (University of Montenegro), who have some experiences with Internet based teaching and learning models. Their mostly positive experiences encourage us to continue with carrying out our idea, as pioneers in this field of, let's say, education method for the next generations.

At the beginning stage of developing this module we decided to use outsourcing technology model in a manner that our University's Center of information system computers (servers) are used as technological platform, while the open-source software package Moodle is employed in the realization of the distant learning module. As the project enters its exploitation phase, some other possibilities related to the hardware and software solutions, along with their improvements, shall be considered. At this moment, this is the cheapest and the most suitable method to realize our idea with rather modest human and technical capacities.

However, we believe the results will be encouraging for continuing to take activities upon improving teaching, training and learning processes at our institution in this direction. Most probably our students, and in the first line seamen among them, will appreciate our efforts and enjoy the benefits of the project. It will be good teaching-learning and vice versa circle for the current and next generations who gravitate toward our Faculty as a place where they can acquire required knowledge for their future vocation(s) within the broad palette of shipping, maritime education, business, industry, and similar posts.

Accordingly, we have defined the mandatory and elective courses for the students and made necessary consultations with the professors in sense how to prepare their classes in electronic formats. Most of them still had some available materials in the electronic format, but, they have to prepare some additional ones in aim to offer more materials and in more appropriate manner to the students', i.e. the consumers of the e-learning contents. These require extra recourses and time, but hopefully we have acquired them in time, and properly. The courses are, for the first iteration, prepared, let's say, in the off-line mode, as textbooks in the form of PDF files. Later on, we shall probably upgrade this module with some new multimedia contents (video, pod-casts, video-conferences, etc).

3.1. Advantages

The distant learning in this context offers seamen opportunity to attain high education even if they are onboard. They became capable to complete the classes at their convenience on the ship. There is no need to attend lectures and they can review assignments and do tests (tasks) during off-hours onboard. They are in position to study whenever they have access to a computer and Internet connection. For slow and quick learners among seamen, this mode of learning is more than convenient through reducing the stress and increasing satisfaction. These are huge advantages in comparison to the classical educational methods which are to be pointed and cherished in the future [1],[4],[10].

3.2. Disadvantages

The disadvantages of distant learning modes are to be taken into consideration, too. Developing distance learning capacities has its costs, requires compromises and developer considerable self-motivation. It does not offer immediate feedback. It requires constant and reliable access to technology. It must be accredited like additional mode of the classical educational program, and within our national high educational and law frames it is indeed time consuming and exhausting process, etc.

4. ABOUT MOODLE IN BRIEF

Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS), or a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online learning sites.

The focus of the Moodle project is always on giving educators the best tools to manage and promote learning, but there are many additional ways to use Moodle:

- Moodle has features that allow it to scale to very large deployments and hundreds of thousands of students, yet it can also be used for a primary school or an education hobbyist;
- Many institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses (known as blended learning); and,
- Many of Moodle users like to use the activity modules (such as forums, databases,

and wikis) to build richly collaborative communities of learning around their subject matter (in the social constructionist tradition), while others prefer to use Moodle as a way to deliver content to students and assess learning using assignments or quizzes (downloaded from: http://moodle.org/, March, 2011).

Moodle within this context has been employed as a software platform for developing and implement polytechnic distance learning module for the students, and particularly seamen among them, at the Faculty of Maritime Studies of Kotor (University of Montenegro), in addition to the existing education and training programs. It is to be expected that it shall offer benefits to both students and professors, and also that it will open perspectives for developing other, larger joint distance learning projects in cooperation with high maritime institutions from abroad.

4.1. On some basic Moodle tools

Among some of the Moodle basic tools are [3],[5],[8],[9]:

Log - in it observations are entered, comments, etc., on the theme set by the educator;
Forum – it enables discussions on the selected topic, with other students and with professor. The discussion takes place synchronous. At any time you can ask a question, and leave contributions. Others can read the texts and leave their comments later;
Choice – it is a tool very similar to Moodle quiz (or, test), contains only one question, but there is no correct and incorrect answers, i.e. it can be used as a small survey;

Lesson – it is an educational content presented in a flexible and interesting way. It contains several pages, which usually ends with the questions, i.e. multiple choices. Depending on the answer to the question, the lesson continues, it returns to the previous page, or remains at the same one. Navigating through the content of lessons can be simple or complex, depending on the structure of the enclosed material;
Workshop – it is a very similar to the task action, which will be described below, with many options. It allows students to evaluate each others projects, and provides examples how to solve some problems;
Talk – allows synchronized discussions via the web in real time. It is a practical tool for collecting different opinions and discussion on various topics;
Glossary – it is used to create and maintain a list of terms and their definitions. The terms can be downloaded in many ways. Also, the terms can be automatically linked through the different courses;
Test - is a classical test with different types of responses: multiple choice, true/false, the short answer, numerical one, etc. The tests provide automatic evaluation;
Wiki – by using this tool, one can write the text together with other participants, but not have to exchange files, similar to the board. It is possible to limit the number of those who have access to, or, allow access to only one group, or create links for subgroups. Wiki is good for group work. A joint project site is the first site of Wiki. Every team gets a new page for their sub-theme, and all pages are linked. Wiki enables discussions, as well.
Assignment – the educator determines the task, which requires students to up-load digital contents on the server. Tasks typically include essays, projects, and reports. There are different types of tasks that may have different functions. The resulting tasks educator can see, but not the other participants. This activity has the option of assessment by the teacher.

4.2. Few additional Moodle tools

Here, hot potatoes and questionnaires shall be briefly described as special Moodle aids.

Hot potatoes - the purpose of the Hot Potatoes application is to enable educators to create interactive Web-based teaching exercises which can be delivered to any Internet-connected computer equipped with a browser. The exercises use HTML and JavaScript to implement their interactivity. All the educator need to employ this aid, is to enter the data for the exercises (questions, answers, responses etc.), and press a button. The program will create the Web pages for the educator, and it can be easily upload to the server. The components of Hot Potatoes (ver. 6) are: JClose, JQuiz, JCross, JMatch, and JMix. Some examples of these exercises can be found on the web site of the considered distant learning courses at URL:

http://moodle.ac.me (Faculty of Maritime Studies).

Questionnaires - The questionnaire allows the examination of the degree of students', or here, seamen's satisfaction by the quality of offered distance learning services. In this sense, below is given an example of the questionnaire, which should indicate the comparative advantages, and disadvantages of distance learning and classic form of learning, and also to range some of the key features of distance learning.

An example of a questionnaire:
(a) Check the benefits of e-learning in relation to the classical form of learning:

- The possibility of learning from home and from the job (during the breaks);
- Reducing the traveling costs and time saving;
- Easier access to instructional materials;
- Possibility of self knowledge evaluation through on-line tests;
- Ability to communicate via the net with teachers and other candidates;
- Faster and easier learning.

(b) Give some advantages of e-learning, which are present in your opinion, and not previously listed (here, students are free to write their own opinions, while the answers will be used for further investigations in this domain).
(c) Check the disadvantages of e-learning in relation to the classical form of learning:

- Lack of direct contact with teachers;
- Inability to “interrupt” the class, put a question, and get an answer when there is some ambiguity in knowledge transfer;
- This is a nonstandard form of learning that requires a strong will, self-discipline, and high level of concentration;
- Some colloquiums are taken on-line, which is sometimes stressful, due to limited time, and present fear if the technique will (or, will not) function properly.

(d) Give some disadvantages of e-learning, which are present in your opinion, and not previously listed (here, students are free to write their own opinions, while the answers, lake in the previous case, will be used for further investigations in this domain).

(e) Estimate, by the marks from 1 to 6, the importance of the following criteria for the distance learning (note: each criterion is to be marked by different score form 1 to 6):

- Stability and speed of Internet connections;
- Availability, at the site, of all necessary materials for preparing the exam in a subject;
- The existence of tests for self evaluation of acquired knowledge;
- Conducting students' surveys;
- Possibility of regular communication with teachers via forum, chat and/or e-mail;
- Possibility of taking tests and final exam on-line.

This survey was carried out on a sample of 45 responders at the Faculty of Maritime Studies of Kotor (April, 2012), and some of the obtained results are given in Table 1, and shown in Figure 1.

Table 1. The students' survey results

E-learning	**Number of <u>Yes</u> answers**
Advantages	
1. The possibility of learning from home and from the job (during the breaks)	**33**
2. Reducing the traveling costs and time saving	**24**
3. Easier access to instructional materials	**29**
4. Possibility of self knowledge evaluation through on-line tests	**28**
5. Ability to communicate via the net with teachers and other candidates	**25**
6. Faster learning	**25**
Disadvantages	
1. Lack of direct contact with teachers	**19**
2. Inability to “interrupt” the class, put a question, and get an answer when there is some ambiguity in knowledge transfer	**23**
3. This is a nonstandard form of learning that requires a strong will, self-discipline, and high level of concentration	**4**
4. Some colloquiums are taken on-line, which is sometimes stressful, due to limited time, and present fear if the technique will (or, will not) function properly	**14**

The Figure 1 shows the importance of some basic distant learning features estimated by surveyed respondents (here students, i.e. seamen among them), expressed in percentages (%). The considered features are evaluated, due to the average values of the respondents' marks, as follows: stability of Internet connection (15%); learning materials availability on the web site (19%); existence of tests for self evaluation of acquired knowledge (20%); conducting students' surveys (14%); regular on-line communication with teachers (16%); and, possibility of taking tests and final exams on-line (16%).

In the part b) and d) of the survey students gave few interesting answers, and some of them are noted below:

Examples of answers on the questions about advantages of distant learning:

- It is easier mode of learning for the students who sail;
- Offer possibility of learning when we are onboard a ship;
- Faster learning and better understanding of the lectures;
- It is possible to access the site at any moment, and find out what is looking for;
- The advantages are huge since almost everything today is Internet based;
- Learning through doing the tests is easier way of acquiring knowledge;
- It is pleasure to access Moodle and test self-knowledge anonymously, etc.

Examples of answers on the questions about disadvantages of distant learning:

- There is no possibility to put a question to the teacher and to receive the answer instantly;
- Tests on-line are not the adequate for testing knowledge, since there is possibility to use Internet as a source of information during the testing;
- The social contacts among the students and the professors are considerably reduced, etc.

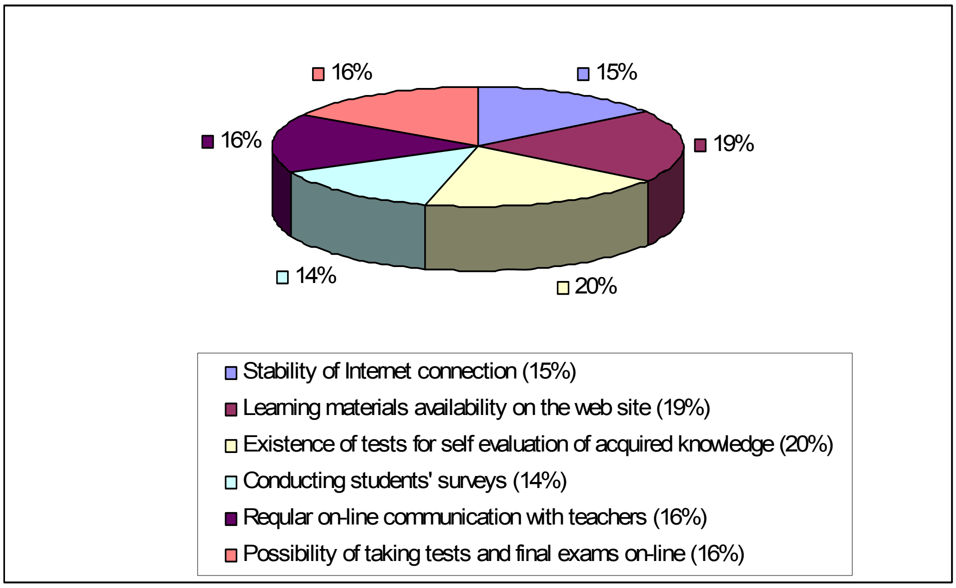

Figure 1. The importance of some distant learning features (expressed in %) obtained through the students' survey

5. MOODLE ON MOBILE: M-LEARNING CONCEPT

In this context, some Moodle features due to the M-learning possibilities it offers are to be considered in brief, as well. Moodle is installed with the My SQL database. As the initial database there are no defined stored procedures for this solution, it was necessary to create one. Web services communicate directly on the database, call procedures, and through the interface allow external applications, in this case the application for mobile phones with Windows 7 Phone to access the database. All users need is that the application obtains a clear structured data with attributes in a place where they should be, where those data come and in no way affect the application development. Some of the functions that the Web service should provide are: posting courses, review the courses, enroll them, posting notices, review notices, etc. This Windows 7 Phone application can be viewed as a proxy for Moodle site, simplifying and adapting user interface for mobile devices. The universal open source solutions offer customers the flexibility and scalability. Integration of different applications is possible only in compliance with certain standards. In the future, strive toward developing software that can be used without major restrictions on the hardware and software shall be present [7].

6. CONCLUSIONS

This paper describes in brief Moodle implementation into the educational and training processes at the Faculty of Maritime Studies of Kotor, due to the requirements of both regular students and seamen who need knowledge and skills refreshments through the adequate training. Basic Moodle features are explained in brief, as well as some additional tools like hot potatoes and questionnaires. What makes the paper original is the statistical analysis of the students/seamen responds to the questionnaire being conceived and presented to them through Moodle itself. The results consider the consistency of the responders in their answers [2],[6], and enable thus making some general conclusions, like: there will be in the front line the great demand for such learning program, mostly among seamen; including more people in the process of getting high education shall be undoubtedly achieved; reducing the costs of commuting shall be gained, as well. Finally, people (in such case seamen) shall be in position to work and earn money, and to study during the off-hours simultaneously. Besides, professors shall be forced to prepare additional materials and to refresh previously made ones, being aware that their handouts and lectures will be available on-line. By making this kind of acquiring knowledge available, the social and pedagogical principle will not be lost, since the students (seamen) may still hang out and exchange their thoughts. On the other hand, they will have direct contact with educators through classical education, which will be organized at the Faculty partly during the hours of consultations, and in that way all quality factors of educational and moral teaching will be fulfilled. Additionally, this pioneer project at the Faculty of Maritime Studies of Kotor should become the sound base for developing greater, joint projects of the similar type, in the Adriatic region, and wider.

ACKNOWLEDGMENTS

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(ii) “Developing an E-learning Module at Faculty of Maritime Studies of Kotor (Montenegro) for the Seamen Educational Needs”, supported by Montenegrin Ministry of Science and developed in collaboration with Academy for New Media and Knowledge Transfer, University of Graz, Austria (2012).

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BIOGRAPHIE

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POTENTIAL ROLE OF CROATIAN ACADEMIC LIBRARIES IN THE PROCESSES OF DISTANCE EDUCATION

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ABSTRACT

The essential goal of the conducted research was to determine a potential role of a librarian in promoting the idea and in carrying out distance education programs at Croatian universities.
The modern librarian, with his/her information, technological and professional knowledge, can make the teaching staff's work easier. Most librarians have high professional and information education, they are engaged in additional training and long-life learning, and their libraries are, at least to some extent, information equipped – are not these the reasons and the opportunities for a better cooperation?

KEY WORDS

academic libraries. distance education. college libraries. high education.

1. INTRODUCTION

1.1. Circumstances in Croatia and abroad

Unfortunately, the librarian's profession in Croatian academic community is still not valued as it should be or as it is the case in Western Europe.

If we take a look at the legislative status of the academic libraries, we shall see that in the Act on Higher Education Institutions in the Republic of Croatia, the status of the academic libraries in the higher education system is not mentioned by a single word.

After a number of years the librarians still have not managed to obtain the well-deserved status for librarianship in higher education. Presently the status of a library is determined within its university or faculty.

Due to the undefined status there are still discussions within the academic community whether the library belongs to the administrative apparatus or it is involved in the teaching and educational aspects of faculties. We know that it is not possible to imagine a higher education institution without a direct cooperation and services provided by library personnel to students or teaching faculty. This is supported by the fact that an academic librarian must have a high education degree equal to the one of the teaching staff. In addition, the continuing education is required. It is therefore clear that librarianship is much more than simple administration. This assertion is supported by the historical development of education, the development of distance education as well as the abundant experience of academic libraries in the western countries.

In Great Britain, higher education libraries have been given new tasks and have been actively involved in teaching processes; in the US and Canada, a number of universities have founded special units to support academic teaching and research, while in Croatia, distance education projects are still skipping libraries in spite of their significant possibilities. New concepts of learning and teaching, which have been increasingly embraced by the very university teachers, are setting huge requirements to libraries but, at the same time, they offer libraries an opportunity to change their standing i.e. to point out the important tasks they can and should carry out within modified academic programs and research methods.

The Association of Research and College Libraries – ARCL, aware of the importance of libraries in advocating and stimulating information literacy projects as an important backing for libraries and librarians dealing with new tasks designed for the improvement of academic schooling, emphasizes in *Information literacy competency standards* the importance of the use of the problem approach method in the education. Namely, such an approach asks teachers and students to acquire all information and communication technologies, but also requires competent librarians who can directly participate in efforts to ensure the use of all available resources of knowledge and information on the one hand, and the adequate level of information literacy of everyone involved in higher education, on the other. In Great Britain this trend is particularly evident in post-secondary education: libraries have been given new tasks and have been actively involved in teaching processes, and in Denmark libraries are intensively included in education even in primary schools. Instead of the common term "library", a new term have been used more and more – "learning resources center" – reflecting the changes that have recently appeared.

1.2. Goals and the methodology of the research

The essential goal of the conducted research was to determine a potential role of a librarian in promoting the idea and in carrying out distance education programs at Croatian universities; another goal was to gather viewpoints, possible doubts and suggestions regarding the potential role of a librarian as a considerable support to teachers, in planning and performing online courses, and to students, in their work and in acquisition of additional skills required when finding, assessing and using information resources and services. In order to reach the goals we relied on the surveying method, using the address book developed within the Scientific Information System (SIS) project. The librarians' answers arrived by e-mail to the address of this research's authors.

1.3. Description of the research

When it comes to surveying librarians in Croatian academic community, this was, as far as we know, the first research on the possibilities of academic libraries in distance education processes. We believe that the achieved results could be interesting for both the librarian and the academic community.

The survey was directed exclusively to the directors of the academic libraries. It had seven questions sorted in several thematic groups. With the first three questions we tried to gather information on the familiarity, the role and the potential participation of the library personnel in the distance education processes. The forth question is divided into four sub-questions. The first one deals with librarians' qualifications for new approaches in education. The second and the third part of the same question offered answers regarding the way the librarians got qualified and regarding the need for organized training for the work with distance education programs. The last part of the fourth question meets the librarians with the dilemma concerning the participation of the librarian profession in the above-mentioned programs. Information equipment in support of distance education is dealt with in the fifth question. The sixth and the seventh question make special thematical groups where the respondents could tell what they think about potential librarians' contribution in improving communication with students and teachers, and about utility of distance education system for librarian profession. It is important to point out that the respondents could give more than one answer to some questions, i.e. to circle one or more of the answers offered.

1.4. Results of the research

The questions were sent to 54 e-mail addresses. There were 41 replies.
38 (92,7%) out of 41 respondents are familiar with the distance education concept; 3 respondents (7,3%) are not familiar with the concept.

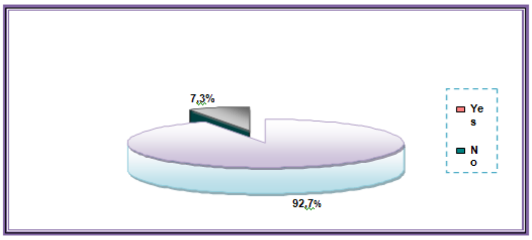

Figure 1. Being familiar with the distance education concept.

Asked if they see librarian profession taking part in distance education, 37 (90,2%) respondents were affirmative, while 4 (9,8%) didn't give their viewpoints.

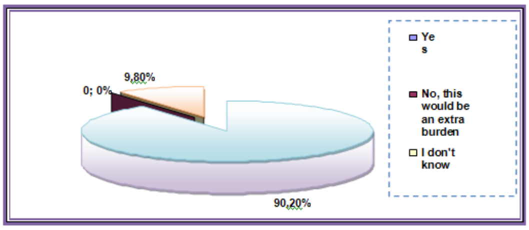

Figure 2. Librarian profession taking part in distance education

So far, 6 librarians (14,6%) have participated in team preparation and realisation of distance education programs; 35 librarians (85,40%) have not been members of such a team.

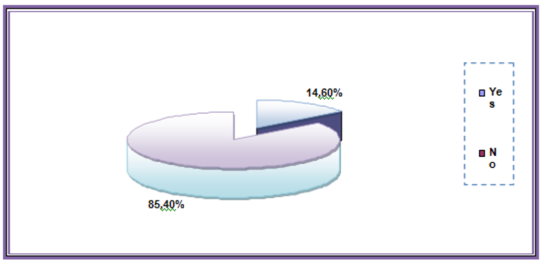

Figure 3. Participation in preparation and realisation of distance education programs

25 respondents (61,0%) consider themselves qualified enough, while 16 (39%) do not consider themselves qualified enough for the new approaches in education.

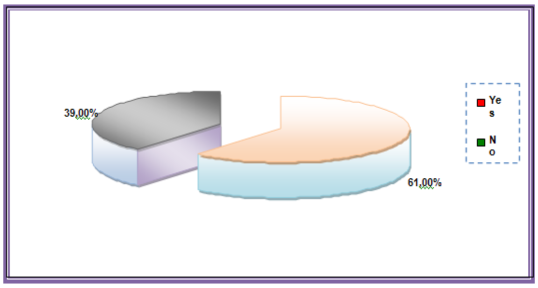

Figure 4. Being qualified for the new approaches in education

They have acquired qualifications through additional training within lifelong learning programs (13 of them, i.e. 52%), through formal education (5 of them, i.e. 20%) or through self-study efforts (7 of them, i.e. 28%).

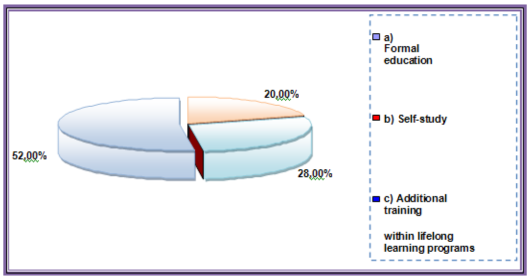

Figure 5. Way of education

The respondents who state that they do not consider themselves qualified enough for the new approaches in education, believe that training of librarians for working on distance education programs should be organized (15 of them, i.e. 93,8%), while one respondent assumes that there is no need for such programs.

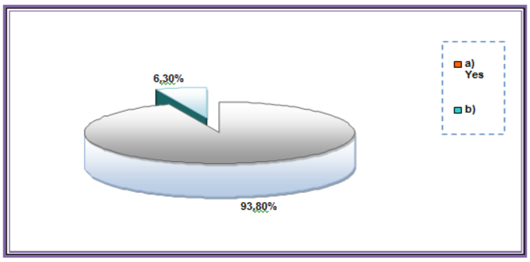

Figure 6. Training of librarians for new programs

33 respondents (80,5%) think that librarians should participate in distance education programs; one respondent (2,4%) believes they should not participate, while 7 respondents (17,1%) did not answer the question.

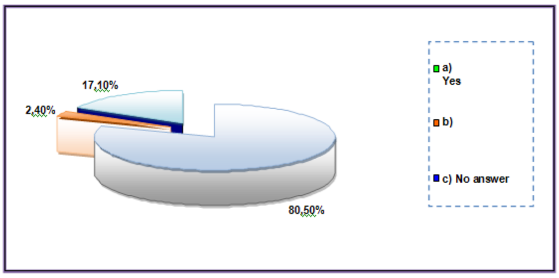

Figure 7. Participation of librarians in distance education programs

10 respondents (24,4%) assume that the library where they work is information equipped for distance education support, while 25 of them (61%) assume it is only partially equipped. Six respondents (14,6%) believe that their library is not sufficiently equipped for distance education support.

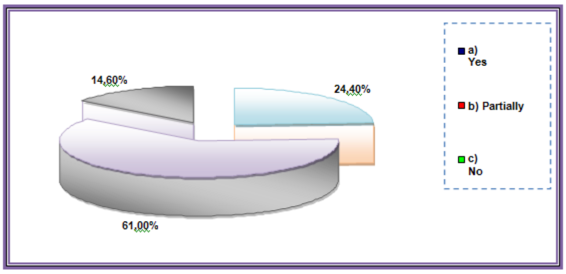

Figure 8. Information equipment

Asked whether they consider they might be useful within student-teacher relationships in the distance education system, 29 respondents (70,7%) assume they could do something for them, 11 respondents (26,8%) believe that they would be a great help, and one respondent (2,4%) answered that he could not help.

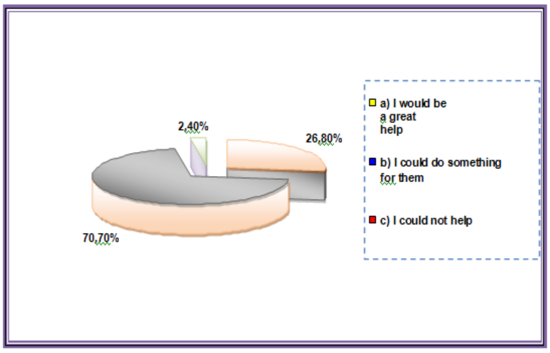

Figure 9. Helpfulness of librarians in student-teacher relationships
in the distance education system

28 respondents (68,3%) assume that involving libraries in the distance education system is useful for the librarian profession, 7 respondents (17,1%) assume that this represents an additional burden for the profession, while 2 respondents (4,9%) assume that students and faculty would not accept the new role of librarians. 4 respondents (9,8%) did not give their viewpoints.

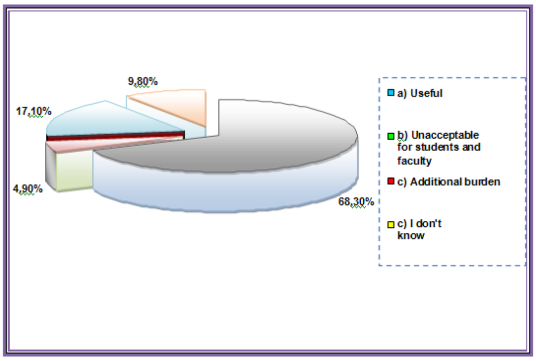

Figure 10. Usefulness of the system for the librarian profession

2. DISCUSSION

We find interesting the fact that most librarians are familiar with the distance education concept and that most of them assume that libraries have a significant place and role in the distance learning processes. Although most librarians have not directly participated in the distance education, they consider themselves qualified enough to the new approaches in education. Most respondents have acquired qualifications related to new technologies through additional training or through self-education.

However, most librarians believe that additional training of librarians for working on distance education programs should be organized. The majority of librarians were affirmative regarding the participation of their profession in the programs. Although seven respondents did not give answers to this question, we believe that this is rather the result of a conceptual way the question was designed.

As far as information equipment of libraries is concerned, most librarians consider them but partially equipped, which indicates that a greater awareness and attention should be given to equipping libraries with new technologies.

We also find interesting the fact that most respondents assume that they could be useful within student-teacher relationships in the distance education system. The same majority believes that involving libraries in the distance education system is useful for the librarian profession.

3. FINAL CONSIDERATIONS

The modern librarian, with his/her information, technological and professional knowledge, can make the teaching staff's work easier. Most librarians have high professional and information education, they are engaged in additional training and long-life learning, and their libraries are, at least to some extent, information equipped – are not these the reasons and the opportunities for a better cooperation?

First of all, most librarians believe that, as far as personnel is concerned, academic libraries are capable of following the work of the academic community. Moreover, librarians have found out that a great deal of students think that, when it comes to information skills, librarians are equally trained, if not even better than very students and teachers. This can lead us to the conclusion that librarians are not supposed to be rivals to students and teachers, but useful colleagues and partners.

4. FIRST ATTEMPTS AND POSSIBLE SOLUTIONS

In order to improve the communication, there are two possibilities: one within the Association of Croatian Librarians – Academic Libraries Committee, the other with universities. The Association could provide data on the academic libraries' informatical, information, technical and other resources regarding the personnel qualifications. The other possibility is that respective universities and faculties state their needs for the support of the librarian profession.

However, in order to enable librarians to accept new tasks, it is necessary to train them for teaching work, especially for the work with new technologies. The Distance education pilot project on a dislocated course of librarianship in Zadar, aimed at the realisation of the idea of overcoming technological and geographic barriers inside Croatia, shows how students can, within a relatively short period of time, acquire necessary knowledge and skills for working with new technologies and learn how to establish new services in their libraries, all thanks to a serious approach, additional commitment and the support of Croatian Academic Research Network (CARNet).

We must as well mention the course of librarianship at Faculty of Arts in Zagreb, founded at Information sciences department, meant for the education of librarians. This fact proves how life-long learning is important for the librarian profession. Here we are specifying only those professional reunions and seminars that are organised by the Center for continuing professional training.

There have been efforts in Croatia to use new technologies in the area of librarian and information sciences. The best example are the web sites of the library of Ruđer Bošković Institute, those of the seminar of the Scientific Information System (SIS) Project and the web sites of Libraries in the Digital Age (LIDA) International Seminar taking place every May since 2000. The intention of the latter has been the dissemination of information related to the area of librarian and information sciences as well as spreading new achievements in the application of new information technologies in libraries to a wider librarian community. The seminar does not address only Croatian librarians – all materials are in English, which is actually the official language of the seminar.
Another professional reunion, international as well, has been traditionally organised by Ministry of Science, Education and Sports, under the auspices of the Scientific Information System. It is held at University of Zagreb, Faculty of Electrical Engineering and Computing (FER). This reunion is for the most part thematically defined – it always deals with new issues that are relevant for the profession and, at the same time, discusses the status of academic libraries and other ongoing problems of the profession.

We can conclude that most Croatian academic librarians are familiar with the distance education system and are, despite certain limitations (information equipment and additional training), very much interested in participating in distance education systems. The overall conclusion that arises from this research is that the librarian profession recognizes the role of academic libraries in the distance education systems. With its professional skills and high education, along with additional training, the librarian profession considers itself capable of playing the potential role of a logistic support to the academic community in distance education.

Generally speaking, we can conclude that distance education is no longer a matter of future. Our education system is slowly but inevitably accepting, partially or entirely, various forms of modern education and we can say without hesitation that in these new systems there is a place for academic libraries.

Given the potentials of the academic libraries on the one hand and the teaching staff on the other, and in view of their cooperation when using modern education and information technologies, this research reveals new questions for further research to be dealing with students and faculty and their viewpoints regarding the potential role libraries in distance education processes.

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BIOGRAPHIE

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I was born on the 3rd January 1964 in Šujica in Bosnia and Herzegovina. After finishing the elementary school in Šujica I attended Šalata Grammar School in Zagreb. I was awarded a BSc degree from the Jesuit Faculty of Philosophy in Zagreb. On passing the exam in librarianship I started to work as a library assistant at Faculty of Maritime Studies – University of Split where I work today as Head of the library. In 2010 I completed the doctoral study in Information Science at Faculty of Arts in Zagreb, acquired a PhD degree and was appointed to Assistant Professor. In addition to being the Head of library I teach socio-psychology at the University of Split. I am the author or co-author of a dozen professional and scientific papers.

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PROCEDURE OF IMPLEMENTATION EU PROGRAMME IPA - COMPONENT II

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ABSTRACT

Through its funds and programmes, *European Union – (EU)* gives support to the development of various types of projects and activities aimed at improving cooperation in various fields. Some programmes are open also to the countries in the accession process. The *Instrument for Pre-Accession Assistance – (IPA*) has been designed for the countries in the status of potential candidates for EU membership in the period 2007 - 2013 and has been established as an EU Council Directive. IPA consists of five different components, of which Component II relates to cross-border cooperation.
Hydrographic Institute of the Republic of Croatia (HHI) in 2011. got EU grant for project from IPA Cross-border Programme Croatia – Montenegro. Project financed through IPA EU grant is named “Joint promotion and increased level of safety of nautical tourism in Dubrovnik-Neretva County and Montenegrin Coast - NauTour" and it is in the phase of implementation.
In the December of 2011. Second call for Proposals for the Cross Border Programme Croatia – Montenegro, 2007-2013 is opened. For Second call HHI prepared Project Application according to the Guidelines for Grant Applicants. HHI prepared Project Application form from Measure 1.1. Joint actions for environment, nature and cultural heritage protection in the cooperation with cross border partners and associates. Project under name “Joint Actions for Sea Pollution Prevention - JASPPer” is in the phase of evaluation.
This paper presents the IPA programme, application procedure, selection and implementation of the project financed by EU funds.

KEY WORDS

EU. IPA. implementation. cross-border cooperation. applicants.

1. THE INSTRUMENT FOR PRE-ACCESSION ASSISTANCE

EU Council Regulation No. 1085/2006 established the IPA programme for the period 2007 - 2013 that replaced the programmes CARDS, PHARE, ISPA and SAPARD. The Commission Regulation 718/2007 determines the implementation of the EU Council Directive for the establishment of the IPA programme. The IPA programme was further amended by the Commission Regulation 80/2010. The IPA programme is a unique financial instrument for financing programmes between EU Member States and candidate countries or potential candidate countries.

The main objectives of the IPA programme include assistance to candidate countries and to potential candidate countries in their harmonisation and implementation of the *acquis communautaire* as well as in preparing for the use of the Structural Funds. [1]
The programme has been designed through joint efforts of participating countries at the principle of partnership, and was adopted by the EU Commission on 12th December 2007. The IPA Programme consists of five components (table 1).

Table 1. IPA Programme Components
(*source: www.cbccro-mne.org*)

1.	IPA I – capacity increase and development of institutions
2.	IPA II – cross-border cooperation
3.	IPA III – regional development
4.	IPA IV – development of human resources
5.	IPA V – rural development

The general aim of the IPA Cross-border Programme Croatia – Montenegro is to increase the quality of living in the cross-border area between the Republic of Croatia and Montenegro. The IPA programme is designed for institutions and non-profit organisations that wish, through cross-border project, to realise cooperation with a minimum of one cross-border partner. [2]
Project activities need to contribute to project objectives and their priorities and need to be performed in eligible areas. Project applicants are liable to co-finance the project by their proper funds. The Programme area consists of "eligible" and "adjacent" areas as determined in Articles 88 and 97 of the IPA Implementation Directive (table 2).

Table 2. Presentation of eligible and adjacent areas (*source: www.cbccro-mne.org*)

Croatia (NUTS III, Counties)		**Crna Gora (Municipalities)**	
Eligible area (art.88.)	Adjacent area (art.97.)	Eligible area (art.88.)	Adjacent area (art.97.)
Dubrovnik-Neretva County	Split-Dalmatia County	Herceg Novi Kotor Tivat Budva Bar Ulcinj Cetinje	Nikšić Podgorica Danilovgrad

The instrument of pre-accession assistance distinguishes two groups of countries: the countries in the status of potential candidates for the EU membership (Albania, Bosnia and Herzegovina, Montenegro and Serbia) and the countries in the status of candidates for the EU membership (Croatia, Macedonia and Turkey). [3]

2. APPLYING FOR THE PROJECTS FROM IPA COMPONENT II

2.1. Applying of the project HHI-a „NauTour“ for measure 1.2. "Joint tourist and cultural area"

The 1st Call for submitting project proposals was open from 12th to 18th August 2009. The Call was published by the Ministry of regional development, forestry and water management and the Delegation of the European Union to Montenegro in cooperation with the Ministry for European integrations of Montenegro.

In the 1st Call, 24 project proposals were submitted, five of which have been selected for funding. The projects were designed on the basis of the cross-border partnership of organisations from Croatia and Montenegro and relate to a set of measures and priorities of the Programme:

- Measure "Joint actions at the protection of living environment,cultural and natural heritage"- 1
- Measure "Joint tourist and cultural area" - 2
- Measure "Small cross-border development projects of communities" - 3.

Operative structures jointly publish the Call for Proposals with Guidelines for Applicants. [4] The Hydrographic Institute of the Republic of Croatia prepared, together with its partners, the Application Form based on the Guidelines for Applicants and submitted the project proposal within the First Call and the Second Call for submitting project proposals within the IPA cross-border programme Croatia - Montenegro, 2007 – 2013. The notification on the positive evaluation was received in June 2010. In September 2010, the Joint Technical Secretariat – (JTS) requested additional documentation that related to the verification of the legality and regularity of the applicants. Having inspected the documentation, the Agency for Regional Development (the Contracting Authority in the Republic of Croatia) started the process of project budget clearing. After the process was completed in November 2010., the Hydrographic Institute of the Republic of Croatia received the final notification on the selection. The project met the criteria and received a positive evaluation. The final decision on the selection of the project that will be financed through the programme will be brought by the Joint Monitoring Committee – (JMC) consisting of the representatives of both countries at national and regional levels.

One of the first approved projects from the IPA cross-border programme Croatia – Montenegro is the project designed by the Hydrographic Institute of the Republic of Croatia and its cross-border partner the Hydrological and Meteorological Institute of Montenegro entitled: "Joint promotion and increased level of safety of nautical tourism in Dubrovnik-Neretva County and Montenegrin coast". The Evaluation Committee proposed the financing of the project, which was accepted by the Contracting Authorities, and the Agreement was signed in Bečići, Montenegro, on 13th December 2010, at the ceremonious conference organised on the occasion of awarding the grants to the selected project proposals.

2.2. Applying of the project HHI-a „Jaspper"for measure 1.1. "Joint actions at the protection of living environment, cultural and natural heritage"

Within the Public Second Call for submitting project proposals within the IPA cross-border programme Croatia - Montenegro, 2007 – 2013 which was opened in December 2011. until March 2012. HHI made and submitted project application under name "Jassper"- "Joint Actions for Sea Pollution Prevention". It's in the evaluation process.

Measure 1.1. supports sustainable cross- border networks for joint environmental, nature and cultural protection. The aim of cooperation under this measure is to stimulate the development of innovative measures and strategies for joint environmental, nature and cultural heritage protection and to educate and raise awareness of the local population and local/regional government units about environmental protection and need for cooperation in that field through public information and participation. Users of the programme concluded the priority of this activity under improvement of the system for environmental, nature and cultural protection in the programme area because environment and natural heritage are outstanding economical resource of the region. This measure is intended for support sustainable cross-border cooperation through the projects related to innovation of the results for the environmental problems. Users of this measure are non-profit legal bodies established by public or private law for the purpose of public interest or specific purpose of meeting needs of general interest (for example local and regional self-government bodies and others).

Implementation of the measure is measured according to the index of the efficiency (for example number of implemented joint programmes, strategies and measures related to environment; number of the studies; number of the joint educational programmes for public and experts and others) and indicator of the results (for example reduction of the financial and ecological damage resulted by sudden pollution; reduction of the sea pollution; increased awareness of the public about cross border issues regarding environment etc.)

3. IMPLEMENTATION OF THE PROJECT “NAUTOUR”

The project “Joint promotion and increased level of safety of nautical tourism in Dubrovnik-Neretva County and Montenegrin coast” started in January 2011. It is planned to be completed in 23 months (by the end of 2012). The total value of the project for both sides is 451,928.36 €. The main objective of the project is to promote tourist and nautical potential of Dubrovnik-Neretva County and Montenegrin coast as a joint tourist area of rich cultural and natural heritage. One of the aims of the project is to improve the quality of service of the cross-border area in terms of nautical and tourist services.

Within the project, the safety level in nautical tourism will be increased, through the cooperation of hydrographic institutions, institutions that provide various tourist services (marinas and other tourist ports, charter companies), institutions for maritime safety and safety in general (harbour master’s offices, port administrations, cross-border maritime police).
In order to realize the planned objectives it is necessary to perform a series of activities, like:

- Collect and systematise data on all major natural and cultural sites and tourist services in cross-border area,
- Collect and systematise information important for the safety of navigation in cross-border area,

From the collected data it is necessary to:

- Design a Web page for leisure mariners that visit the said area,
- Write tourist guide-books of the area for yachts (sailing ships and motor boats) and guide-books for mega yachts,
- Work out cross-border nautical and tourist navigation routes for yachts (sailing ships and motor yachts) and nautical and tourist navigation routes for mega yachts,
- Organise round tables, presentations and promotions of the programme for all activity subjects in tourist and safety segment of nautical tourism and for leisure mariners,
- Organise institutional development and support founding Hydrographic and Oceanographic department within the Hydrological and Meteorological Institute of Montenegro (training for hydrographic survey, hydrographic survey of two marinas on the Montenegrin coast, prepare and publish plans for 3 Montenegrin marinas), etc.

4. PARTNERSHIP IN THE PROJECT “NAUTOUR”

In the project “NauTour” on the Croatian part, the leading partner of the entire project is the Hydrographic Institute of the Republic of Croatia (HHI), with the participation of its partner the University of Dubrovnik (Maritime department). On the Montenegrin part, the leading Montenegrin partner is the Hydrological and Meteorological Institute of Montenegro with the participation of its partner the National Tourist Organisation of Montenegro. Associate partners in the project are the Ministry of the Sea, Transport and Infrastructure from the Croatian side and the Maritime safety department of Montenegro, Harbour Master's Office Kotor and Marina porto Montenegro from the Montenegrin part (diagram 1).

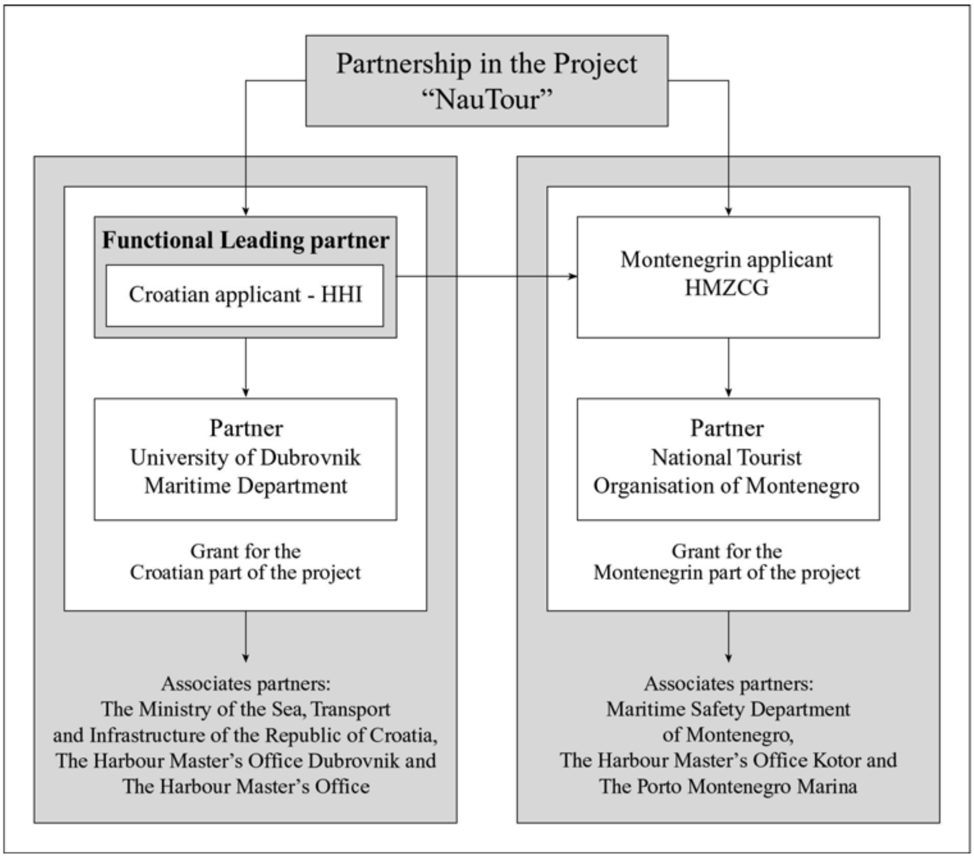

Diagram 1. Partnership in the project

The competent joint institutional structures of the IPA cross-border programme Croatia - Montenegro jointly manage the programme. The IPA competent institutions are:

Programme Operative structure in the Republic of Croatia:

- Ministry of Regional Development and EU Funds– the ministry responsible for management and IPA Component II
- Agency for Regional Development of the Republic of Croatia – Contracting Authority in the Republic of Croatia.

Programme Operative structure in Montenegro:

- Ministry of Foreign Affairs and European Integrations of Montenegro – institution responsible for coordination of IPA
- Delegation of European Union to Montenegro – Contracting Authority in Montenegro.

Joint authorities:

- Joint Technical Secretariat – (JTS), with the head office in Kotor, Montenegro and with its representative office in Croatia is in Dubrovnik (Antena-JTS).

Joint authorities provide support to Operative structures in the programme management, providing advisory services to programme applicants and informing public. The representative office in Dubrovnik provides assistance to potential applicants from the Republic of Croatia. [5]

4.1. Payment mechanisms and reporting

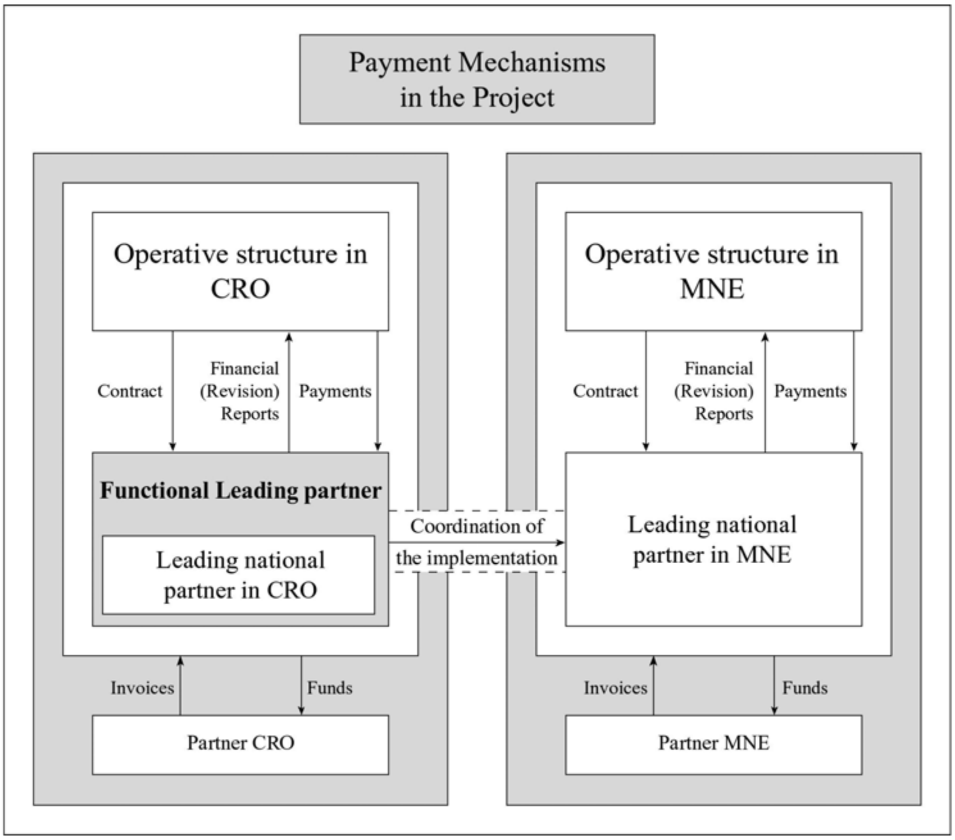

Diagram 2. Payment mechanisms and reporting

Each cross-border partner signs the Grant Agreement with the Contracting Authority of the country. The functional leading partner coordinates project activities on both sides of the border, but partners are individually responsible for finances from the project (diagram 2). The report on the project progress is sent by the functional leading partner to the Joint Technical Secretariat for regional development. The report contains a review of implemented activities for both grant agreements. The interim report relates to the first year of the project and is submitted to the Agency for regional development, and a copy of the interim report is also sent to the Joint Technical Secretariat. The interim report is obligatory in case the project continues over 12 months and is financed by EU funds above 100,000 €.

The final report is sent to the Agency for regional development, with a copy of it to the Joint Technical Secretariat. It is delivered not later than 3 months upon the implementation has been completed. Grant beneficiaries are liable to file all project documentation for 7 years after the final payment, and are subject to auditing from the part of EU institutions during the period (diagram 3). [6]

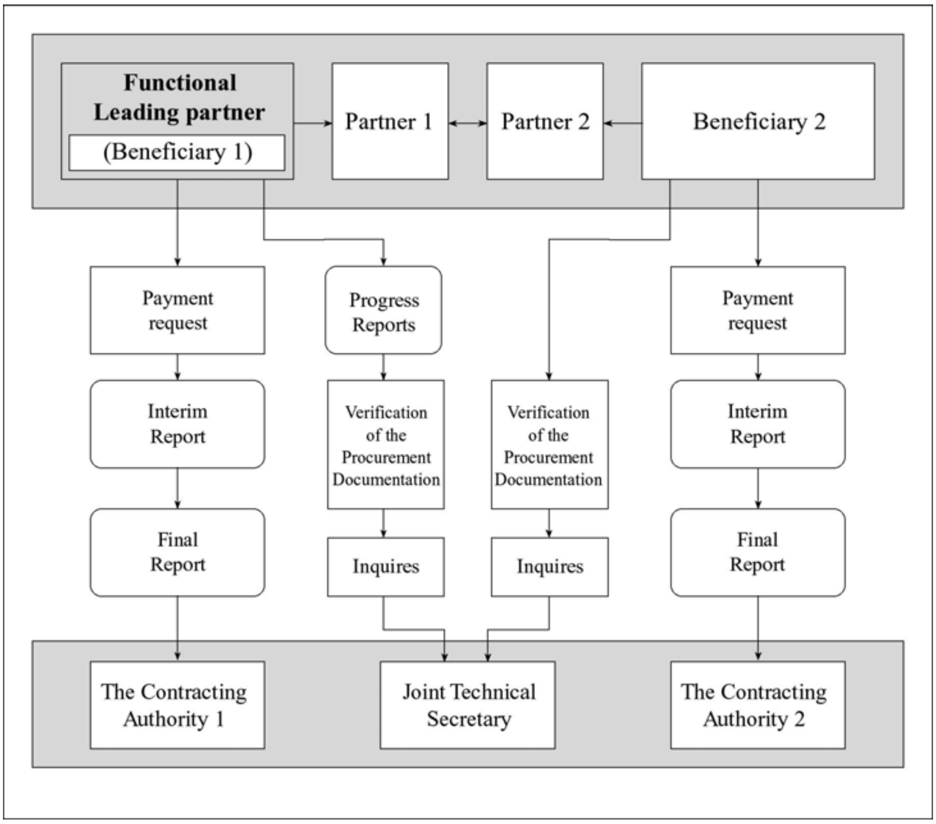

Diagram 3. The process of reporting (Source: Agency for Regional Development)

5. CONCLUSIONS

Through its funds and programmes, the European Union gives support to the development of various types of projects and activities aimed at improving cooperation in various fields. The IPA programme is a unique financial instrument for financing programmes between EU Member States and candidate countries or potential candidate countries in their harmonisation and implementation of the *acquis communautaire* as well as in preparing for the use of the Structural Funds.By means of EU funds, the Hydrographic Institute of the Republic of Croatia intends to establish and improve cooperation with neighboring EU Member States and potential candidate countries aimed at increasing its activities and hydrographic activity. The implementation of the IPA programme, Component II "Joint promotion and increased level of safety of nautical tourism in Dubrovnik-Neretva County and Montenegrin coast - NauTour" promotes cross-border cooperation with Montenegro, aiming to increase the navigational safety in nautical tourism and sustainable development of the environment. In view of the geographic shape of the Republic of Croatia and the exceptional length of its borders, the cross-border cooperation through EU programmes has an important role in the regional development of Croatia. The Republic of Croatia shares its cooperation experience with the EU Member States with potential candidate countries, participating in three cross-border programmes with non-member countries. Moreover, the Republic of Croatia also participates in two transnational programmes, which creates financing opportunities from EU funding.

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BIOGRAPHIE

Vinka Jurić was born in 1980. in Split where she has finished high school. She graduated on the American College of Management and Technology in Dubrovnik in 2000. In 2006. she also graduated on the Faculty of Maritime Studies in Split. At the doctoral programme "Marine" (Hydrographical engineering) in the Faculty of Maritime Studies in Rijeka, she passed all the exams. She works at the Hydrographic Institute of the Republic of Croatia since 2000. Since 2010. she is on the position of the assistant director for EU projects, funds and PR (Department for EU projects and funds). She is actively involved in sports, married.

Prof.dr.sc. Josip Kasum was born in 1961. in Zagreb. He is full professor on the University of Split - Faculty of Maritime Studies in Split. In his work he is actively involved in electronic navigation, nautical tourism and hydrographic engineering.
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ECOLOGICAL ASPECTS OF INTERMODAL TRANSPORT THROUGH THE ADRIATIC

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ABSTRACT

Market globalization and liberalization influences considerably on the formation of the global flow of goods, and thus on the transport system. There is undoubtedly a strong interactive influence between maritime traffic and the process of globalization and liberalization, with a positive effect on the ship transport cost reduction, thus increasing the significance of the flow of goods by sea for transport and economic development on the global, regional and local level. Maritime transport, as the cheapest of all means of transport, is the most important instrument of the globalization process, both for the quantities and the value of the transported goods. Owing to its compatibility with the environment and its least harmful influence to climate, maritime transport gained importance in the intermodal transport system, with a bright future ahead.
The Adriatic represents a significant natural and economic resource, which should be appropriately evaluated and planned, and systematically protected. This article represents an overview of preliminary authors' research results, so far resulting in the proposed model of ecological evaluation of the Adriatic water way (corridor) as a function of intermodal transport. The authors' research is directed towards identification, evaluation and analysis of the possible effects of the Adriatic water way routes on the environment. The implementation of the proposed model, encompassing the intensification of traffic through the Adriatic water way and decreasing the intensity of road traffic in coastal areas, and the integral management of the littoral area could have a more efficient contribution to the protection of this valuable area.

KEY WORDS

intermodal transport. Adriatic water way. maritime transport. model of environment protection. the Adriatic.

1. INTRODUCTION

The interactive influence of the transport system, especially maritime transport, and the processes of globalization and liberalization, is undoubtedly quite strong, as it is precisely these processes that have a positive influence on the reduction of ship transport costs. The cheap and efficient ship transport has constantly been growing and developing its technology, so its significance is thus greater for the growth of transport and economics on the global, regional and local level.

The traffic and transport systems in the region are equally rather under-developed, while EU member countries have a rather developed system, with road transport being dominant in all countries. A series of measures within the traffic and transport system are aimed at implementing an efficient integrated system of intermodal transport by sea, rail and inland waterways, as opposed to the competitive road transport. The tendency of intermodal transport is to achieve such level of organization, financial simplicity and efficiency in the traffic-transportation system that would turn it into a logical choice for transport. Besides the pronounced potential in environment protection, the intermodal transport system is capable of generating and intensifying the economic sustainable development. The Adriatic represents an indispensable spatial, economic, environmental and social resource, a natural privilege of Croatia and its citizens. Besides the positive effects of the developmental, economic, technological and socio-cultural processes, there are negative effects which result in the fact that the Adriatic is becoming one of the most endangered areas.

In the framework of thus determined scientific problem, the subject of research in this paper is to diagnose, on scientific basis, the current environmental aspects and fundamental problems which have to be dealt with, as well as their influence on the Adriatic transport routes in the framework of the EU transport network, and especially the influence of intermodal transport on sustainable growth and environment protection. The goal of the research is to define the prerequisites for advanced resource management of maritime flow of goods in the Adriatic, considering the proposal of the ecological assessment model of the Adriatic, Adriatic conservation model, the significance of intermodal transport in the global trade, ecological aspects of connecting sea and land transport, the development of Adriatic ports, especially the port of Rijeka and the Croatian transport infrastructure, the leading region of maritime transport, general changes in the world economy which influence on the changes in EU economy, and thus on Croatian economy as well.

2. MARITIME TRANSPORT THROUGH THE ADRIATIC AS A FUNCTION OF INTERMODAL TRANSPORT – STRATEGIC GOAL OF CROATIA

The Republic of Croatia, as a country extremely oriented towards the sea, with an already well-built and developed road infrastructure, should intensify and integrate maritime traffic and inland waterways traffic into the sustainable Croatian transport system, by developing rail infrastructure. Transport system, with all its subsystems, represents an important segment of economic growth. The goal of sustainable transport system growth, and intermodal transport as its important constituent, is the establishment of an efficient integrated system which could satisfy the needs of all participants and generate strong economic growth, under the condition of environment safety and sustainability.

As a part of the European Union development strategy, the European Commission has brought and adopted a series of long-term development plans and projects [1], extremely important for the development of Croatian economy. A large number of international projects and strategic documents relates to the research of the flow of goods, as well as transport and industrial routes. Basically, these documents emphasize the key role of a sustainable transport system development, in the context of the European transport policy and logistics, as an important component of the transport system in ensuring a sustainable and competitive mobility in Europe.

The European Commission designed the Freight Transport Logistics Action Plan[1] whereby it determined the support for the development of intermodal transport as one of the main priorities of the European transport policy. Precisely for that reason, after signing the pre-accession agreement in the preparation process of the Croatian entry into the EU, defining the strategic guidelines for integrating comparative advantages of intermodal transport system, and coordinating the organizational concepts of the European transport network, Croatia has an opportunity to achieve a high ranking on the transport market and enable the integration of the Croatian transport system into the European transport network. The realization of the intermodal transport system represents a strategic issue as intermodality is of essential importance for the development of a sustainable transport system. The basic goal of the intermodal transport system is the creation of competitive alternatives to road transport, reducing bottlenecks and jams on roadways, increasing the safety and protection in traffic, and especially reducing the negative influence of transport on the environment.

Besides the pronounced potential in environment protection, intermodal transport system tends to have a high level of organizational and financial simplicity and efficiency in traffic and transport system, as well as the ability to generate and intensify the economic sustainable growth [10, pp.4]. Another important fact is that a form of intercoastal transport connection (SSS – Short Sea Shipping)[2] represents the main form of expanding intermodal transport in Europe. It can easily be concluded that in this way the intermodal transport becomes a logical choice for transport.

The development of an intermodal system, with the main center in the port of Rijeka and a transport-logistic center "Miklavlje" in Matulji near Rijeka, may lead to realization of significant strategic goals for the purpose of economic recovery, progress and possibility of solving the Croatian economic crisis. Possible strategic goals may be summarized as follows [15]:

1. Realizing > € 8.5 billion of new foreign currency annual revenue,
2. Opening > 90,000 of new productive working positions,
3. Reducing imports and increasing exports > 35% in relation to the present,
4. GDP growth by 4.5 - 6% in relation to the present,
5. GDP growth > € 15,000 per capita,
6. Increase of dry cargo traffic by 40 mil. tons per year until 2025,
7. Increasing the profit of the state budget and the budgets of local self-government units situated on the major transport routes > € 3.5 billion per year,
8. Reducing the foreign debt and settlements of the due installments,
9. Various other economic effects.

Croatia and the port of Rijeka may become a strategic transport-industrial corridor and an intermodal centre, as well as a junction of the European Union and great countries of Asia.

The authors would especially like to emphasize the significance of the parameters of the integration of Croatian intermodal sea transport into the international transport, established according to available transport resources and defined transport corridors. For the purpose of increasing compatibility and competitiveness of transport networks, increasing the traffic safety and environment protection, the integration of intermodal sea and inland transport system into the European transport networks represents an important segment for the development of Croatian

[1] Freight Transport Logistics Action – In 2007, the European Commission made a plan proposing a series of measures with the goal of stimulating intermodal transport system competitiveness, raising the level of maritime transport competitiveness, creating a framework for the modernization of European ports, promoting transport logistics and attracting investors, as well as the analysis of progress in the sustainable mobility development.

2 Short Sea Shiping – transport of cargo and passengers between European and nearby non-European ports. It uses waterways that at least in part include the sea or ocean, which is never crossed in its entirety. Geographically, short sea shipping is applied for the area from Iceland, Scandinavia, Baltic region over wetern Europe to the Mediterranean, including northern Africa and the Black Sea.

economy. Owing to all of the above, the authors emphasize the importance of this strategic goal as one of the possible ways of solving the economic crisis in Croatia.

3. APPROACH TO THE ECOLOGICAL ASSESMENT OF THE ADRIATIC TRANSPORT WATERWAY

Geographical, traffic, economic, historical and political factors caused the Adriatic Sea to become an area with a series of economic operations of great significance for the entire Croatia (maritime port and transport activities, petrochemical industry, shipbuilding and processing industry, tourism and trade). The area of the Adriatic has limited resources and limited absorption capabilities. Therefore, a basic task logically suggest itself – preserving the environmental integrity of the Adriatic coastal area ecosystem, or preventing the devastation and degradation of Adriatic coastal and sea area environmental resources by applying and implementing an **environment protection model**, by planning and managing its sustainable development.

A systematic integration of intermodal transport into the sustainable Croatian transport system represents a basic prerequisite for its successful implementation into the trans-European intermodal transport networks. The establishment and management of the Adriatic transport waterway and intermodal transport as a function of sustainable growth demands a synergy of a number of participants, who need to perform their operations in accordance with the legal regulations and concrete regional and other types of planning. The area of the Adriatic is an ecologically very sensitive area, so environmental problems may appear suddenly and quickly reach their peak, while the recovery would be a long-term process requiring considerable material resources. The proposed theoretical model of environment protection, as a holistic approach, reflects a dynamic process of sustainable development and utilization of sea and coastal areas, encompassing all relevant entities in social, economic and ecological interactive relations, who have an influence on the process itself, and in the end, they represent a generator of sustainable growth. A gradual degradation of environmental resources important for the Adriatic may be avoided by "proper" planning and environmental managment as a function of controlled development based on the analysis of environmental condition, social and economic needs, in accordance with the Protocol on Integrated Coastal Zone Management, without at the same time, reducing the potential of national and local economic development in global competitiveness conditions.

4. MODEL OF ASSESSMENT OF THE ADRIATIC TRANSPORT WATERWAY IMPACT ON THE ENVIRONMENT

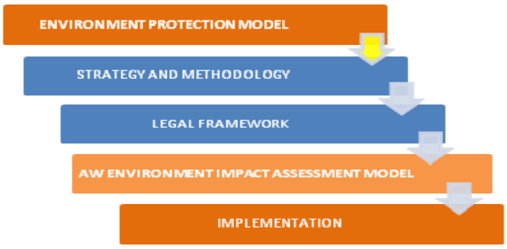
The possibilities of evaluating the Adriatic transport waterway, and the Adriatic in the wider sense, as a source of natural resources, economic and social development, should be considered in the context of the global litoralization process[3]. Sustainability should be based on mutual interdependence of economic development, cultural and social development, environment protection and improved management, all within the framework of natural dynamics and carrying capacity of the Adriatic area.

The Adriatic environment protection model shall contain a strategic ecological evaluation of the Adriatic waterway (corridor) based on the regulations set out by the Annex 1 of the EU Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment. The proposed model should identify the relevant aspects of the current condition of the Adriatic environment, environmental characteristics and main problems that should be solved. The implementation of the proposed Adriatic environment protection model (Graph 1) should disable the multilayered environmental degradation of the sea and coastal areas, and specifically reduce or neutralize the previous

damages incurred owing to the interaction of the processes and subjects in the area.

[3] Litoralization – settlement of population, social and economic activities along the coast.

Graph 1. Theoretical environment protection model (Source: authors)

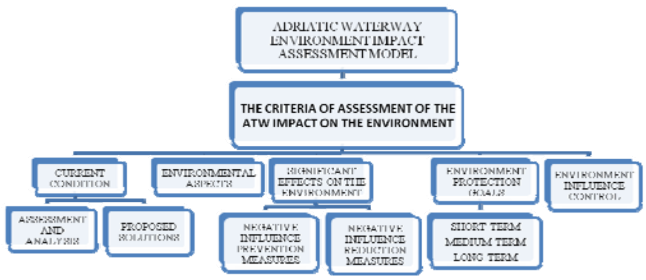


The Adriatic environment protection model, which besides the above mentioned, also contains the suggestion of the key methods of sustainable development technical and technological solutions, based on the environment management system (EMS), in accordance with ISO 14001:2004, and occupational health and safety management system (OHSMS), in accordance with OHSAS 18001:2007, should contribute to the reduction of acidification [4], eutrophication[5], danger to human health, climate change and ozone destruction, as consequences of ship pollution in national and international navigation through the Adriatic. The suggested model encompasses the integration with all integration factors, that is, its structural elements, as well as the demands of all existing partial models integrated today.

5. THE CRITERIA FOR THE ASSESSMENT OF THE ADRIATIC TRANSPORT WATERWAY IMPACT ON THE ENVIRONMENT

The chapter of the model, relating to the criteria of assessing the influence on the environment, should prepare environmental reports that identify, describe and evaluate probable significant influences on the environment and reasonable alternatives, taking into consideration the goals and the geographical scope of the model (plan or program). The Adriatic transport waterway (ATW) aims at creating new integrated transport chains which are supposed to be sustainable and commercially more effective than road transport alone, offering an alternative to the road transport and enabling a change in the means of transport from crowded roads to combined land-sea routes for a significant amount of cargo. The environmental assessment focuses on identification and analysis of the main effects which the routes defined by the Adriatic transport waterway might have on the environment. Owing to the change in the means of transport, in the context of creating new sea routes over the Adriatic, quantitative environmental benefits (probable effects on the environment) should be evaluated on the level of individual corridors. However, qualitative environmental aspects (i.e. overview of environmental aspects of the Adriatic transport waterway, environment protection goals, preventive measures, supervision measures), considering that they are rather general and related to the means of transport, and less to the corridor itself, should be analyzed and evaluated in the framework of the overall maritime traffic over the Adriatic, both on national and regional level.

Graph 2. Theoretical assessment model of the Adriatic transport waterway impact on the environment (Source: authors).



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[4] acidification – drop of pH value caused by CO_2 absorption from the Earth's atmosphere

[5] eutrophication – from the Greek word *eutrophos* = well nourished, from *eu* = well and *trophe* = food. While natural eutrophication has a positive influence on the ecosystem, because it increases its biological resources, with rare negative effects, anthropogenic influence may disturb the ecological balance with harmful consequences.

5.1. Stages of the Assessment Model of the Adriatic Transport Waterway Environment Impact

The Adriatic environment protection model will result in the assessment model of the Adriatic transport waterway (corridor) impact on the environment on the basis of the regulations defined by the Annex 1 of the EU Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment. The mentioned Directive states that member countries are responsible for the implementation of evaluation of certain plans and programs which will probably have a significant influence on the environment. The evaluation must focus on the preparation of environmental reports which identify, describe and evaluate probable significant effects on the environment and reasonable alternatives, taking into consideration the goals and geographical scope of the plan or program. The second important stage in the evaluation is the process of consultation and interaction of all subjects (all coastal countries of the Adriatic region) interested in sustainable ecological development of the entire area. Among other things, that implies that the draft of the plan and/or program and the environmental report have to be available to relevant institutions and the public, and if the plan or program will probably affect the environment in other member countries, they have to be informed and involved in the consultation process. Besides that, the model enables an assessment that also needs to:

- ensure that all interested parties[6] are notified about the acceptance of the plan or program and the measures related to the acceptance and supervising procedures;
- supervise the significant ecological effects of the implementation in order to identify the unforseen harmful effects at an early stage in order to be able to take appropriate preventive measures.

6 Interested parties are the states participating in land and/or intermodal sea transport through the Adriatic: Italy, Slovenia, Croatia, Bosnia and Herzegovina, Montenegor and Albania.

Qualitative ecological aspects (i.e. the overview of ecological aspects of the Adriatic transport waterway, the goals of environmental protection, preventive measures) represent studies on the national or regional level, considering they are more general, related to the means of transport, and less to a particular corridor.

The assessment of Adriatic transport waterway environmental effects will focus on sea waterway analysis in the area, which will evolve through the following stages:

- THE CURRENT CONDITION OF THE ADRIATIC – identifying the specific characteristics, description of the existing and relevant environmental problems;
- ATW ENVIRONMENTAL EFFECT – identifying the main environmental effects on the transport route, identifying the increase in the shipping load of the Adriatic and its effects;
- MAIN ENVIRONMENT PROTECTION GOALS – on international and national level and the assesing how the Adriatic transport waterway will take those goals into consideration;
- INFLUENCE ON THE ENVIRONMENT – probable significant effects of the Adriatic transport waterway on the environment on the basis of main parameters identification;
- PREVENTION MEASURES – measures of prevention and reduction of any significant harmful influences on the environment;
- SUPERVISION MEASURES – principal measures of supervising the environmental effects.

The assessment of Adriatic transport waterway environmental effects has to anticipate the control of significant environmental impacts with the purpose of identifying the unforeseen harmful effects, and their prevention by taking appropriate legal measures, technical procedures and actions.

5.2. Relevant Aspects of the Current Condition of the Environment in the Adriatic (environmental characteristics and main issues to be solved)

The Adriatic is becoming a sensitive area, whose quality is gradually declining as the pressures on the environment keep growing. These pressures include pollution from industry, seafaring, tourism and households, as well as the loss of open areas and the destruction of coastal ecosystems, such as forests, in order to clear an area for construction.

There are more than 7000 ships in international navigation sailing into Croatian ports annually, of which 7000 HAZMAT[7] ships which come into the Adriatic ports, and about 30 000 ships which, besides other types of cargo, transport about 70 million tons of oil annually. The traffic load of the Adriatic is variable in certain areas, while at every moment the radars register from 250 to 300 ships in the Adriatic. This includes about 50 tankers (about 20%), while 10-20% of ships report dangerous cargo to the AIS system [29]. Owing to that, the vessel surveillance through Vessel Traffic Monitoring Service – VTMS[8], provided by the coastal state, is very important because of the direct protection of its interests and because the system provides, first of all, protection of the marine environment, then the ensurance of application of cross-border, customs and health supervision, and the protection of economic activities. The Adriatic, and especially its coast, is a sensitive ecological system which needs to be protected: by implementing the proposed methodology of the protection of the Adriatic and intensifying the traffic through the Adriatic transport waterway, by reducing road transport in coastal areas, which might contribute to the conservation of this valuable region.

According to IUCN [9, pp. 7], the protected areas defined as areas on land and/or sea, specially intended for the protection and maintenance of biological diversity and natural resources associated with them, managed through legal and other appropriate means. EU guidelines[9] are the most important and the most demanding regulations of the EU in the area of environment protection. The establishment of a coherent European ecological network NATURA 2000 of ecologically representative and well-managed areas should be a key element of the approach based on ecosystems, directed towards integrated management and sea environment preservation, including the improvement of fisheries sustainability. Until December 2006, EU-25 set out 4133 entirely land regions under special protection according to the Habitats Directive and 19614 entirely land areas of joint interest according to the Habitats Directive, and only 484 sea areas under special protection and 1248 sea areas of joint interest [5, pp. 5-256.].

The basic national legal framework which represents the foundation regulating the protection of natural heritage of the Republic of Croatia is the Nature Protection Act[10] and the Regulation of Proclamation of the Ecological Network[11]. Besides the Croatian regulations from the area of nature protection, there are two powerful European rules which were the basis for proclaiming the National Ecological Network in the area of Croatia: the European Directive on Habitats (Council Directive 92/43/EEC) and the European Birds Directive (Council Directive 79/409/EEC on the Conservation of Wild Birds) [26].

There is a heavy concentration of national parks and protected areas in the Croatian Adriatic area, which may still be protected owing to the intensification of the environmentally friendly Motorways of the Sea (MoS) network[12]. In June 2008, the protected areas of Croatia, including the areas under preventive protection (a total of 461 protected areas) encompassed 6.78% of the overall Croatian surface, a land area of 7,457.31 km^2 (11.38%) and 1,049.07 km^2 of territorial sea

7 HAZMAT – hazardous material.

8 Basic points of the VTMS are set out in the SOLAS Convention, Chapter V/12 and IMO Resolution A.857(20) Guidelines for Vessel Traffic Services from 1997.

9 Council Directive 92/43/EEC on the Protection of Natural Habitats of Wild Flora and Fauna (Habitats Directive).

10 Law on Environment Protection (Official Gazette 70/05 and 139/08).

11 Direction for Proclaiming an Ecological Network (Official Gazette 109/07) which defines the National Ecological Network (NEM) for the entire area of the Republic of Croatia.

12 MOS – Motorways of the Sea.

(3.38%), or 8.51% of the total surface[13] of the Republic of Croatia [3, pp. 15], of which there are 4.76% of national parks and nature parks, while nine preventively protected areas have a surface of 2,130.00 km^2, or 2.43% of the overall surface of Croatia [19, pp.10]. Croatia has eight national parks and ten nature parks, stretching on nine per cent of its territory [24, pp. 38].
Italy has 22 national parks, while two others are awaiting to be established. They stretch over an area of one and a half million acres, which amounts to 5% of its national territory [5, pp. 5-260]. The Slovenian national park takes 84,000 acres, there are three regional parks and more than 40 protected areas. The Ministry for Environmental Protection and Regional Development is officially responsible for the environment, environmental protection policy, prevention of pollution policy, biotechnology, nature preservation, and overall assessment of the effects on environment and waters [5, pp. 5-260]. The total share of protected areas in Montenegro is 9.21% and it mostly relates to the five national parks. On the basis of the criteria compatible with NATURA 2000, there are 32 Emerald[14] areas identified and proposed for protection. [18, pp. 45].

6. ASSESSMENT OF THE EFFECTS OF INTERMODAL TRANSPORT AND THE ADRIATIC TRANSPORT WATERWAY ON THE ENVIRONMENT

6.1. Anticipated Significant Effects of Intermodal Transport on the Environment

The policy promoting maritime transport, intermodal transport, and among other things, SSS transport includes the main economic, social and environmental issues, which result from the fast development of road transport and the associated road overload, accidents and pollution. Six potential corridors through the Adriatic (MoS corridors) are intended to connect eastern Mediterranean with north Adriatic ports until 2015. It is estimated that there will be a significant increase in the cargo traffic and number of ships (ro-ro, lo-lo, ro-pax) in those corridors according to a few possible scenarios (from 30-70%) [5, pp. 2-27-167]. One of six corridors includes some Croatian ports. Croatia does not have access to the funds in TEN-T program, therefore it is very poorly represented in this project, since it is not a member of the EU.

The proposal of environment protection strategy, arising from the assessment of the effects of the Adriatic waterway on the environment, will enable the protection of the Adriatic and the entire Adriatic area. Ship exhaust gas emissions are not negligible; on the contrary, the increase in the annual number of ships results in the growth of the amount of released combustion gases, thus increasing their harmful effects. Actually, ships are becoming the greatest source of air pollution in the EU, and unless certain measures are taken, it is estimated that until 2020 the ships will release more pollutants into the air than all land sources together [5, pp. 5-262]. Ships emit NO_x, SO_x, CO, PM, NMVOC, N_2O, HFC and other anthropogenic gases which contribute to the local air quality. Nitrogen oxides and sulphur oxide contribute to the regional problems of ecosystem acidification and eutrophication, as well as to the creation of secondary PM particles. Nitrogen oxides and volatile hydrocarbons contribute to the creation of ozone which may travel between continents and is famous as the third most important greenhouse gas [28]. Considering the expected growth trend of the need for this kind of transport and the anticipated grwoth in the number of ships [3], [5], [6] which will be able to satisfy the demands of the global commodity market, the anthropogenic gas emissions from ships will, despite all measures and attempts for their reduction, present a significant factor in the sustainable development process. In 2000, SO_2 and NO_x emissions from international maritime transport in Europe (Graph 3) accounted for about 30% of EU-25 land emissions.

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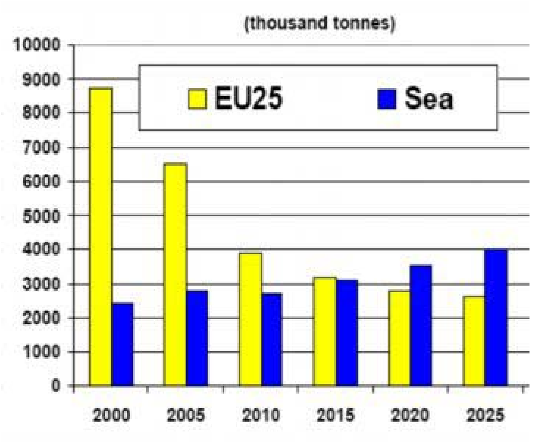
[13] The overall surface of Croatia amounts to 87,661 km^2, of which 56,620 km^2 refers to land, and 31.041 km^2 to sea. The structure of land surface is predominantly agricultural, amounting to 29,557 km^2. Forests take up 26,083 km^2, and water areas (mostly lakes and rivers) take up 534 km^2. The remaining 446 km^2 of land surface is taken up by settlements.

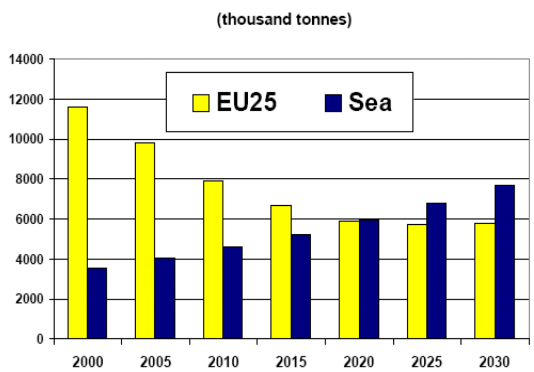
[14] Emerald – networks of areas for the preservation of habitats and species set out in the resolutions 4 and 6 of the Bern Convention.

Graph 3. Comparison of SO_2 and NO_x emissions from land and ships from 2000 –2030 (Source: Susanne Ortmanns - CCB Annual Conference 2007-05-11) [4, pp. 4 i 5.].

SO_2



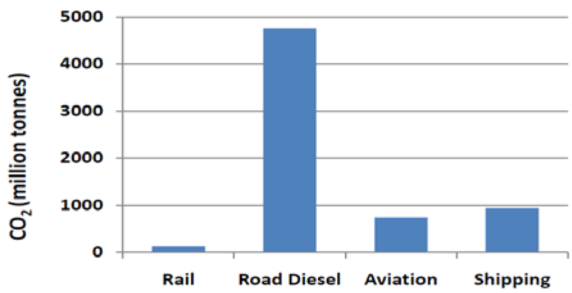
NO_x



Ships emissions currently account for 10 to 20% of sulphur pollution in coastal areas, but this is expected to grow by more than 30% until 2020 in greater European regions, and up to 50% in coastal areas [5, pp. 5-262]. It is estimated that the mortality in Europe resulting from pollution by ship emissions in international traffic will rise, therefore, it is expected that until 2020 the number of deaths will grow to 53,000 [6].

The main effects of the maritime transport route development (MoS) in the Adriatic on environment protection are mostly positive owing to a reduction in external costs created by the transshipment of goods from road to sea. Actually, maritime transport is relatively the least harmful to climate. Greenhouse gas emissions per amount of transport cargo are low in comparison to other types of transport (Graph 4). On the other hand, in absolute values, greenhouse gas emissions from maritime transport are considerable and they keep growing due to the increase of maritime traffic in the trade of goods on the global level. Therefore, maritime transport is an important source of air pollution, and its share in total air pollution, especially in coastal areas and heavy traffic ports, is considerable. Despite that, the developme tof maritime transport, in comparison with other means of transport, may have a positive influence on the control and reduction of negative emissions into the environment.

Graph 4. Comparison of CO_2 emissions from ships and other means of transport (Source: Second IMO GHG Study 2009 International Maritime Organization (IMO) London, UK, April 2009) [22, pp. 136].



These positive effects might be partially annulled owing to the construction of new infrastructure which has to be developed in order to support the intensification of maritime traffic, especially intermodal transport through the Adriatic. The assessment of the effects on the environment of infrastructural interventions included in port authorities development plans have already been made in accordance with the relevant national and EU regulations. Transport activities have consequences on the environment, as they cause accidents and standstills, while the expenses are mostly born by transport users. The methods of external costs assessment and specification, generated by transport activities, mostly relate to:

- air pollution,
- noise,
- standstills and accidents,
- climate changes,

- other external costs.

The supervision of main environmental effects owing to the Adriatic transport waterway and intermodal transport implementation must be carried out through a comparison of an efficient change of the transport means (based on the goods transported on that route). The calculation should be based on the parameters taking into consideration the main categories of external costs of the analyzed means of transport. The calculation of qualitative benefits is based on the change of the transport means. The benefits are calculated as difference between relevant "old route" external costs and external costs of the "new route with the change of transport means" or between relevant external costs for the old and for the new service. Then, the ecological efficiency (€/tkm) of the transport means change is calculated and a proportion between ecological and social benefits expressed in monetary value (€) and the amount of goods and services (tkm) realized through transport means change. The external costs claculations by means of the Marco Polo program (Table 1) may be used as they are comprehensive and offer more detailed values for the main means of transport. The calculation of external costs applied to a specific area of the analyzed route is based on the following values:

Table 1. External costs calculation for different means of transport (Source: Marco Polo Program – Annex 3, II Call 2008) [5, pp. 5-267].

Means of transport	Specific external costs	
	€ per vehicle-kilometer	€ per ton-kilometer
road	0.70	0.035
maritime transport	0.18	0.009
rail	0.30	0.015
inland waters (rivers and lakes)	0.20	0.010

These values result from an internal study by the European Commission based mainly on external research projects UNITE and REALISE, with additional input data by transport associations [3]. As regards maritime transport, the external cost amounts include average quality fuel and emissions from average engine operation.

Ecological benefit from transferring to this model of sea transport (from road to sea) is expressed as a profit of 0.026 €/tkm of transported goods, while at 4.4 billion tkm, the ecological benefit might amount to about 113 billion € [5, pp. 5-267].

6.2. Measures and Goals for the Prevention and Reduction of Significant Harmful Effects on the Environment

The basic goal of the proposed Adriatic environment protection model is defining the prerequisites for the improved resource management, or creating a permanent quality foundation for solving issues whose main characteristic is variability in time and space.

Prevention measures and key goals defined by the proposed model may be summarized as follows:

- Reducing the pollution level – by developing projects for the reduction of most significant pollution sources (by applying the revised MARPOL Annex VI and the Directive 2005/33/EC)[15]; in that sense, the authors suggest:
  - the preparation of national emission inventories,
  - the establishment of Ship Emission Register;
- Promoting sustainable use of sea and coast, which includes assessing which European sea may be proclaimed as ECA/SECA/NECA[16] zone, the availability of suitable fuels and effects on maritime transport [31].
- Coordinating efficient institutions and environmental protection policies with developing partner countries;
- Development of wider knowledge on environment protection issues relevant for the Adriatic by means of calculations for studies, as well as spreading the ideas;

[15] IMO and EMSA as technical assistance to European Commission in the process of ship emission air pollution reduction.

[16] ECA – emission controlled area;
SECA – sulphur emission controlled area;
NECA – nitrogen emission controlled area.

- Including non-governmental organizations and the public into decision making processes on environment protection which have an influence on them;
- Development of indicators to control the results of the protection of the wider Adriatic area.

In accordance with the European Neighbourhood Policy and Euro-Mediterranean partnership, these goals might be achieved through four main means:

- financial assistance from existing and planned EU assistance programs,
- intensive dialogue with regional representatives,
- improved coordination with other organizations and partners,
- sharing EU experiences in solving the problems of the Adriatic and other regions.

The key point of EU strategy is the Horizon 2020, the initiative for preventing the main sources of the pollution of the Mediterranean by 2020, accepted by the leaders of Euro-Mediterranean countries at 10th anniversary of Euro-Med summit in Barcelona in November 2005 [5, 5-262].

Joint interests for the preservation of the sea and sea environment, or specific sub-topics, are defined in seven protocols[17] of the Barcelona Convention [8].

7. CONCLUSIONS

The proposed environment protection model presupposes the possibility of putting all important issues (economic, social, environmental and sustainable development) into a common framework which should find the most efficient ways of achieving ssutainable development of the area/region/local community. The proposed theoretical model should aim to protect the overall Adriatric area and be dynamically adjusted to objective public sector investment possibilities, whereby the conceptional approach should not be limited to a nation, but remain in the context of the protection of the wider region.

The implementation of the suggested model should enable a dynamic ecological economy as a prerequisite for the overall development of a region, and therefore the Republic of Croatia, integrating and reinforcing the characteristics of social and territorial cohesion of scientific and educational communities with a more complete protection of health and environment protection.

On the other hand, the implementation of the model should disable the uncontrolled social and economic activities and uncontrolled urban development, which may result in multi-layered ecological degradations of the sea and coastal areas, and also reduce or neutralize the already incurred damages through the interaction of the processes and subjects in the wider area.

Taking into consideration the fact that the proposed theoretical model is very flexible, with its variability in new social, economic and political conditions as a strong characteristic, it should be accepted that the proposed model is directed towards the integration of mission, vision, strategy, policy, law, operation, resources, programs and activities of all participants. It is especially important to preserve the ecological integrity of the Adriatic coastal area ecosystem, or to prevent the devastation and degradation of the Adriatic sea and coastal area ecological resources, because the area of the Adriatic has limited resources and absorption capabilities. In that sense, the ecological aspects of the transport corridor through the Adriatic implemented by the Adriatic environment protection model, as well as the innovative technical and technological solutions foreseen and proposed by the model, aim at realizing strategic economic development processes of the Republic of Croatia, provided there is a significant contribution to the preservation of the irreplaceable spatial, economic, ecological and social resources, the Adriatic Sea and its coastal area as a natural privilege of Croatia and its citizens.

Based on the mentioned assumptions and evaluation of the proposed model, it is advisable to check and provide improvements

[17] Dumping Protocol, Emergency Protocol, LBS Protocol, SPA and Biodiversity Protocol, Offshore Protocol Hazardous Wastes Protocol, ICZM Protocol

and corrections on the basis of research and data gathering, followed by re-evaluation prior to a wider implementation of the model in practice.

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BIOGRAPHIE

My name is **Igor Kegalj**, I was born in Rijeka in 1962. I graduated from Faculty of Maritime Studies, department of engineering in 1997, and a year after I completed the Pedagogical-Psychological Education at the Faculty of Humanities and Social Sciences. I worked at Dina Petrochemical Industry, after which I transferred to the Shipyard 3. Maj to the position of project head. I am currently working at Maritime School in Bakar. In 2010 I enrolled the postgraduate study (PhD) of environmental engineering and environment protection.

SUSTAINABLE DEVELOPMENT OF CROATIAN NAUTICAL TOURISM AS A FUNCTION OF ECOLOGICAL AND ECONOMIC DEVELOPMENT

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ABSTRACT

Through relevant understanding of nautical tourism as a system it is possible to plan its further development and optimize the measures necessary for sustainable development. Based on that, it is possible to determine the quality and quantity of developing the necessary infrastructure and facilities of nautical service, taking into account the effective protection of the marine environment as one of the most valuable resources of the Republic of Croatia whose management should be based on economic, social and environmental aspects in accordance with principles of sustainable development. To ensure the above, it is necessary to make plans in advance, or to predict potential locations as well as technological solutions for the development of infrastructure, and to analyze the economic and legal parameters, giving special attention to environmental protection during planning, construction, and implementation thereof.

KEY WORDS

nautical tourism. sustainable development. protection of coastal and marine areas. spatial planning.

1. INTRODUCTION

Nautical tourism is one of the most important factors of development of Croatian economy. An important factor of its further development and improvement is certainly a tremendous advantage of the coastal areas of the Croatian Adriatic with respect to natural features, whose jagged coastline and natural beauty of the climatic elements allows for a day at sea and many recreational maritime activities. Accordingly, it can be concluded that the Adriatic coast is the largest Croatian natural wealth in any respect, therefore, its effective protection and conservation is of paramount importance. The importance of sustainable development of nautical tourism is reflected in the fact that only such development can meet the needs of tourists and local population, and thus contribute to the economic development while preserving the ecological value of marine and coastal ecologically acceptable investment in infrastructure in order to prevent the devastation of coastal areas and pollution of the marine environment.

The subject of research is defined in the framework of the above issues and it refers to the definition of nautical tourism as a system and determining its importance for the Croatian economy, as well as exploring the possibilities of its further development. The purpose and objectives of this study are research and analysis, as well as the assessment of the current state of development, and determining the practical procedures with the aim of making a decision on possible options for further optimal development of Croatian nautical tourism, especially the development of necessary infrastructure and facilities, nautical offers, and identifying the necessary measures as a function of sustainable development and environmental protection.

In the context of thus defined scientific problem and the subject of research, the basic scientific hypothesis states: scientifically based insights about the functioning of nautical tourism system, particularly about environmental protection, may predict and analyze the possibilities of more efficient and economical development of these activities. In order to ensure the above, it is necessary to make plans in advance, or to predict potential sites as well as technological solutions for the construction of infrastructure, as well as to analyze the economic and legal parameters, giving special attention to environmental protection during the planning, construction, and implementation thereof. Nautical tourism can significantly contribute to the overall economic growth, raise standards and the quality of life of local inhabitants, provided that it is developed on scientifically-based development factors, established through practice in developed countries. Consistent and relevant knowledge about the factors and infrastructure facilities of nautical tourism, may contribute to planning the further development and optimizing the measures necessary for sustainable development. Based on the above-mentioned, it is possible to determine the quality and quantity of nautical tourism for the purpose of spatial, ecological, technological, economic and normative aspects of development.

2. DEFINITION OF NAUTICAL TOURISM

Nautical tourism is certainly a subset of tourism, so the issue of its definition should be based on defining the issue of tourism. Etymologically explained, nautical tourism is derived from two concepts: nautical and tourism. The term *tourism* is sufficiently explained in the scientific tourism literature, while the term *nautical* originated from the Greek word *naus* meaning ship, or vessel, but also sailing skills. The contemporary meaning of the term nautical or navigation, implies a set of practical and theoretical knowledge and skills necessary to the vessel head for safe and successful management of the vessel at sea, from the port of departure to the destination port [6, pp. 690].

The concept of nautics and nautical, in a broader sense, signify seafaring. This is precisely the reason why the international communication increasingly uses the English term *yachting tourism*, rather than *nautical tourism*, or *maritime tourism*, or the German term *nautischer Tourismus*. The yacht, as a symbol of luxury tourist vacation at sea, strongly associates nautical tourism with tourism operation, and less with seafaring. In this way, the concept of nautical tourism is defined better, making it a part of the tourist, and not maritime activity [6, pp. 691].

Legal regulations of nautical tourism, equally as the definition of tourism, are defined in the Republic of Croatia Law on Tourist Activity, Article 52 which reads [10, no. 08/1996]: *"Nautical tourism is the cruise and stay of tourists - boaters in vessels (yachts, boats, etc.), and stays in ports of nautical tourism for rest and recreation"*. The aforementioned definition should regulate and define nautical tourism as an economic activity. For the purpose of clarification of nautical tourism activities, Article 53 of the Law defines and groups nautical tourism services as:

- space rental on well maintained and partially or completely protected coast for the accommodation of vessels and tourists – boaters who reside in them,
- rental of recreational vessels (charter, cruising, etc.),
- skipper services,
- reception, keeping and maintenance of vessels moored in the sea and on land,
- supply services to boaters (water, fuel, food, spare parts, equipment, etc.),
- servicing and preparation of vessels,
- providing different information to sailors (weather forecast, nautical guides, etc.),
- sailing schools, trainings for skippers and boat head,
- other services for the needs of nautical tourism.

3. EVALUATION OF THE CURRENT STATUS OF NAUTICAL TOURISON THE BASIS OF THE AVAILABLE DATA

In recent years, nautical tourism in Croatia has seen a real expansion. The recommendations of Croatia by the magazines the Lonely Planet [14] and the National Geographic [15] as currently one of the most desirable tourist destinations in the world, and the Croatian forthcoming accession to the European Union, indicate that the increase in tourism demand in Croatia, including nautical, in the coming years, should not be in question, assuming that it continues to offer a competitive tourism product. The problem, therefore, arises from the offer, or with its overall quality, sufficiency and service pricing. The increase in demand affects the growth in offer, and in nautical tourism, this is primarily related to the overall offer of services resulting from the number of available berths in nautical tourism ports, port areas for public traffic intended for mooring and sport ports.

Statistical data by the Croatian Central Bureau of Statistics [11] for 2011 show that there are 98 nautical tourism ports on the Croatian Adriatic coast, of which 61 marinas (of which 11 dry marinas), 19 anchorages, 14 berths, and 4 unclassified nautical tourism ports. The total area of their waters is 3,295,891 m^2, with 17,059 berths, of which there are 5,231 dry berths. Among the total number of berths (17,059, according to the data for the end of 2011), the Istrian County has the highest number of berths - 4,318 or 25.31%, followed by: Zadar County with 3,640 or 21.34%, Primorsko-Goranska County with 3,394 or 19.90%, Šibensko-Kninska County with 3,081 or 18.06%, Splitsko-Dalmatinska County with 1,913 or 11.21%, and Dubrovačko-Neretvanska County with the lowest share of 713 berths, or 4.18%. On December 31, 2011 there were 14,286 vessels at permanent berths in nautical tourism ports, which is 1.0% less than on December 31, 2010. Berths in the sea were used by 85.5% of vessels, while land locations were used by 14.5% of vessels. According to the type of vessel, among the vessels that used a permanent berth in the sea, there were 47.9% of motor yachts, 46.8% sailing yachts, and 5.3% were other vessels. According to the flag, the greatest number of vessels on a permanent berth came from Croatia (33.8%), Austria (18.1%), Germany (16.1%), the USA (6.7%), Slovenia (6.3 %) and Italy (5.5%), accounting for 86.5% of the total number of vessels on permanent berths. The number of vessels in transit in nautical tourism ports in 2011 amounted to 188,457, which is 8.5% less than in 2010.

According to the type of vessels in transit that used berths in the sea, 33.8% were motor yachts, 63.3% were sailing yachts, and 2.9% were other vessels. In this period, most vessels in transit were from Croatia (41.8%), Italy (22.0%), Germany (11.3%), Austria (8.2%) and Slovenia (4.2%), which makes 87.5% of the total number of vessels in transit. The total profit from nautical tourism in 2011 amounted to 600.2 million kunas, whereby 439.4 million kunas was realized from berth rental, which amounted to 73.2% of the overall profit. In relation to the 2010, total revenue increased by 4.5%, while revenue from berth rental increased by 0.8%.

It is also important to mention that, according to the Central Bureau of Statistics, less than half of the vessels sailing along the Croatian coast during the summer use commercial marinas, while the majority of yachts and leisure boats ride at anchor freely in natural bays without any organization, or berth in nearby local ports. There are several reasons for this, the most important being the lack of capacity of nautical ports during the summer period, particularly on islands; in fact, less than a half of nautical-tourist traffic (without the small vessels that do not use nautical ports, especially marinas) is encompassed by an organized reception, which in addition to its economic function, also has an environmental function.

Based on the above mentioned, it can be concluded that the Croatian nautical tourism is faced with high growth and demand rates, which indicates the need for further investment in infrastructure and building new and/or reconstructing the existing capacities. The potential adverse events that may cause the pollution of the marine environment from vessels that cannot berth in marinas or other nautical tourism ports because of the lack of free berths, may have a very large scope in ecological terms, and may exceed many times the cost of investment in infrastructure for the purpose of safety. The capacity of the aquatorium is such that it can bear a significant increase in the number of vessels, which is corroborated by comparison with other Mediterranean countries, such as Greece, Turkey or Spain. Also, the analysis of the situation and plans for development of nautical tourism in the mentioned countries, or the overall rate of recreational boats production, plans for building new marinas and an increase in the existing capacity to accommodate vessels indicates that the number of berths in Croatia can be increased through a balanced and acceptable growth of the total capacity for vessel reception, with the control mechanisms provided.

4. NAUTICAL TOURISM AS A FUNCTION OF ECONOMIC DEVELOPMENT

Tourism is a strategic sector of the Croatian economy, which is particularly true for coastal tourism, and especially nautical tourism. The Adriatic Sea is a very important factor of the internationalization of the Croatian economy and the Adriatic orientation greatly assists to a faster integration into the international economic flows. The development of nautical tourism affects the rapid development of the existing activities of a country or region and encourages the development of new activities that are connected to it horizontally (e.g. excursion tourism, underwater photo-safari, customer service, etc.) or vertically (e.g, small industry, shipbuilding, etc.), which results in employment in different sectors of the population whose direct or indirect purpose is to satisfy boaters thus resulting in economic development, or promoting its rapid growth.

Nautical tourism, seen from a social standpoint, provides its contribution by mixing of nations, transferring information, knowledge, culture and lifestyle. The impact of nautical tourism on the general development of a region or country, in social terms, is particularly reflected in the interest, and then the education of young people. This factor of social, and therefore economic development is immeasurable and large. When viewed from the standpoint of the receptive country, nautical tourism represents an important source of foreign exchange inflows, which is considered as a specific form of exports (the so-called invisible exports). Foreign currency inflow from tourism is very important for developing countries, including Croatia, since nautical tourism is a form of tourist activity in which Croatia can compete on an equal footing in the international market. The influence of nautical tourism on employment is particularly evident today, when the introduction of modern technology increasingly reduces the need for labor in industry and agriculture. In addition, one should not neglect the multiple effects of tourism, which stem from the fact that the funds are not retained at the place of spending, but continue their movement and still influence on economic events. Funds circulate through the economy, running from one company to another, from one branch into another, whereby the economic effects are higher.

Since the development of nautical tourism should be based on the policy of preserving the spatial landscape value of the coast, for the purpose of socio-economic prosperity of locations and premises in which the activity is performed. A particularly important segment of sustainable development is the creatation of economic and social preconditions for the life of the local population employed in services of nautical tourism.

4.1. Nautical Products Design

Nautical tourism product is a set of different products and services such as [9, pp. 525]:

- ability to repair the boats and machinery, use of crane, slipway for launching, forklifts and winches,
- water connections, electricity and gas,
- use of sanitary facilities, parking lots, trailers,
- stores with fuel, spare parts, boats, groceries etc.,
- agencies, exchange offices, banks, etc.,
- hotel facilities, restaurants, sports facilities, etc.,
- excursions, fishing evenings, folklore evenings, etc.

It can be said that the Croatian nautical tourism offers all these products and services, but in many cases, their quality is questionable, including their availability along the entire coast. Specifically, there are a number of marinas where these services are on a high level, which means, for instance, that there are quality services for vessel repair, efficient organization of the system for the use of a variety of machinery (cranes, slipways for launching, forklifts, etc.), parking spaces, access to various shops, travel agencies, money exchange etc., whose working hours follow the needs of yachtsmen. The offer of restaurants, sports facilities, and hotel arrangements at such locations is also on a high level. However, there are places in which this is not the case, which can certainly be changed with minimal financial investment while there may be multiple benefits.

The offer should be focused on the enrichment of nautical tourism with a wide range of facilities that would attract more boaters and extended the stay in a marina which will greatly affect consumation. Also, it is of utmost importance to improve the cooperation between different types of tourism, even within the nautical tourism itself in orer to maximize the development of nautical products, such as the cooperation between the tourist boards of different towns where there are marinas and marinas themselves, through the organization of various forms of entertainment; gastronomy, folklore, recreational work in the fields, vineyards, olive groves, numerous sports events on land or at sea, etc., so the marinas would not be just lodging and shelter from bad weather conditions to boaters, but the key centers of offer and the destination of many boaters.

In order to ensure the feasibility of the proposed measures, it is very important to have the human potential whose competence in Croatian marinas is at a relatively high level. Also, there is enough manpower on the labor market, except on small islands, which can be solved by employing seasonal workers or attracting the workers from the mainland by a variety of benefits such as stimulating income, a relatively large number of holidays per year, etc.

4.2. The Social Impact of Nautical Tourism

With the further development of nautical tourism, the local workforce will certainly get a much better chance of employment (temporary, part-time, seasonal or permanent), which will affect the general increase of living standards in coastal and island areas, the general increase of welfare in families, as well as create opportunities of development and revitalization of various activities that are specific to each area.

Furthermore, it might be also argued that the development of nautical tourism has in the short term affected the specific economic and social conditions of the local and wider community. In the first place, it has encouraged the development of a number of supporting activities shortly after the beginning of the development of nautical tourism (the first services, first employment of local labor force, expanding and opening new restaurants, etc.). Besides the short-term effects, the most significant long-term impacts and consequences of the development of nautical tourism are as follows [1, pp. 77]:

- reorganization and evaluation of (new) developmental options in each county, municipality, village, or even at the country level, some traditional aspects of development (industry, processing industry, shipbuilding) to development based on nautical tourism,
- development of economic activities, directly and indirectly related to nautical tourism, as the main potential for development.

In this respect, the complete Croatian tourist industry began to be perceived as the main economic potential, in which precisely nautical tourism has a very important role. Thus, nautical tourism is increasingly seen as the most propelling development potential and strategically the most significant development direction in the country.

5. NAUTICAL TOURISM AS A FUNCTION OF ECOLOGICAL DEVELOPMENT

Maritime activities may be located and developed exclusively in coastal areas, whose structure and location have a significant effect on the selection and business performance. The area of maritime activities is naturally a sensitive area that is subject to numerous limitations in the use of natural resources. Every new form of economy in the coastal area requires a new evaluation of the area, and therefore its reorganization. Nautical tourism is one of the greatest exploiters of the sea and its shores, and if it is to develop successfully, it must become the biggest promoter of environmental protection. In order to maintain the absolute potential of the basic resources for further development, it is extremely important to preserve the existing natural resources, as well as their utilization as resources (such as ecotourism and organic farming).

Recreation resources at sea and its coast are the key factors of attraction for tourists, therefore it is necessary to emphasize the importance of better understanding the relationship between nautical tourism and ecology, especially with regard to the protection of beaches, bays, marinas, and, generally, the environment as a whole, where attention should be directed towards the physical appearance of the environment, and its population density. Negative consequences of tourism expansion in ecological terms have recently appeared, such as environmental pollution, disturbance of natural and environmental values, misappropriation of cultural goods. It is therefore necessary to monitor and follow the overall state of the sea and coast in order to act in time, for example by reducing anthropogenic impacts on the possible changes in the environment and/or identifying sources of pollution before the occurrence of permanent adverse effects or their dispersal.

5.1. Institutional Aspects of Marine Environmental Protection

Protecting the marine environment is one of the most significant priorities of Croatia. The potential negative impact of nautical tourism on the marine environment suggests the importance of its development in accordance with the principles of sustainable development. When it comes to nautical tourism, sustainability implies the balance between limiting economic development opportunities and permissible reduction of the quality of coastal ecosystems.

The sustainability of natural resources can be defined as the durability or longevity. Coastal ecosystems are the foundation of coastal development. In order to achieve sustainability, the rate of coastal development and use of resources should not exceed the capacity of coastal ecosystems for the support of human activities. This task involves a dynamic balance between limiting the opportunities for economic development and the acceptable reduction of environmental quality [8, pp. 211]. The development of coastal areas should be sustainable in the longterm, because the preserved surroundings is the most important resource. Sustainable development involves meeting our needs, without reducing the opportunities to meet the needs of future generations.

Key legal and strategic documents that deal with environmental issues and clearly set out the priorities are:

- Environmental Protection Act [10, no. 82/1994],
- Strategy and Action Plan for the Protection of Biological and Landscape Diversity of Croatia [10, no. 81/1999],
- National Environmental Strategy [10, no. 46/2002],
- National Environmental Action Plan [10, no. 46/2002].

The coastal area is among the most valuable economic and natural resources of Croatia. This is an area in which the dynamic and interdependent natural processes take place, driven by the interaction of the sea and land, and the area affected by the developmental pressures associated with possible negative impacts that have or could have adverse effects on ecosystems, therefore, the National Environment Strategy, among other things, defines the following tasks:

- the implementation of an integrated coastal zone management,
- the establishment of specially protected marine areas and organization management for the preservation and natural restoration of living communities, fish stocks and biological diversity,
- systematic monitoring of the condition of the marine ecosystems and timely neutralizing the endangering of ecologically and economically most valuable living communities, as well as the implementation of necessary measures for their protection and responsible use thereof,
- fulfilling the obligations under international agreements about the reduction of waste disposal into the sea (strict control).

5.2 Measures for the Protection and Preservation of the Marine Environment - an Incentive for the Development of Nautical Tourism

One of the most important negative impacts of nautical tourism is certainly the pollution of the marine environment arising from the use of various infrastructural and suprastructural systems. Ports and nautical tourism vessels potentially pose the greatest threat to the marine environment, since they involve various activities that may cause the following pollutions:

- pollution of the sea by mineral oil from ships,
- pollution of the sea by wastewater from ships (fecal, sanitary, bilge and ballast),
- pollution of the sea by wastewater generated during cleaning of ships and/or marine engines,
- pollution of the sea by colors used for painting ships (especially by biocides, which are integral parts of antifouling paints),
- pollution of the sea by oily storm water from operative asphalted surfaces, surfaces for the disposal of vessels and vehicles, and internal roads,
- pollution of the sea by land sanitary (waste) water,
- pollution of the environment by small particles of polyester resin that arise when working on plastic parts of vessels.

Based on the above, it can be concluded that the biggest problem in protecting the marine and land environment from nautical tourism is the prevention of pollution resulting from regular work and normal operation of the vessels. The biggest threat is posed by waste motor oil, however, wastewater from a boat (fecal, sanitary, bilge and ballast), and solid waste are also devastating to the marine environment. Waste generated in the area of performing these procedures, should be treated in accordance with the Waste Act [10, no. 178/2004], and the Waste Management Regulation, and Ordinance on Packaging and Packaging Waste of the mentioned Act. This Act prescribes the manner of waste disposal, which, among other things, proscribes its keeping in the designated appropriate locations where it will be transported by authorized institutions to recycling points or permanent placement with keeping the proper documentation of disposal.

In order to prevent the above mentioned pollution, or reduce it to the minimum, it is necessary to effectively implement any sanctioning measures for every (even the smallest) disposal of waste into the sea (solid and/or liquid), and if the pollution occurs, to ensure quick and efficient removal of waste and/or oil both from the sea surface and from the coast, according to a pre-arranged intervention plans in case of contamination. The consequences of possible slowing down of the exchange of water in the marina can be compensated by prohibiting the entry of any particular waste, especially organic (nitrates and phosphates), that may arise as a result of washing the dishes, showering or preparing food on board.

The potential danger to the marine environment is posed by the uncontrolled and badly arranged construction of infrastructural nautical tourism capacities, as well as maritime property evaluation based on awarding the concession and the concession agreements. Inappropriate construction in naturally sensitive areas results in a complete loss and debasement of aesthetic values of landscapes. Concreting the coast causes a complete loss of habitats by dividing larger compact habitats into smaller parts, thus disrupting the life of many species, reducing their overall area and size of the available habitat, causing changes in migration routes, increasing the edge effect and ultimately leading to a disorder in the structure and functions of communities and reducing biodiversity. During the construction of nautical centers, it is particularly important to minimize changes in shoreline by filling or excavating the coast, whereby the new capacities construction should focus on building high-quality supplements to the existing tourist offer.

Granting concessions for various nautical activities is not fully resolved because of vague legal regulations and the lack of an integrated maritime property cadastre. It is therefore very important that the concessions for carrying out certain activities are issued only for the existing tourist sites, and only exceptionally for untouched unconctructed areas. This is important because of the high value of the area as a strategic resource of Croatian tourism, such as conducting inspections over maritime property that, in fact, is not fully established, the same as the control over allocating and spending funds collected from fees for issued concessions on maritime property.

6. CONCLUSIONS

The past development of nautical tourism in Croatia evolved spontaneously, without a comprehensive analysis of necessary facilities and their locations, and potentially harmful impacts on the environment, considering the sensitivity of marine areas and numerous restrictions on the use of natural resources and the lack of spatial alternatives. The choice of nautical tourism ports location in terms of environmental protection is of particular importance, and represents one of the factors which must be comprehensively and qualitatively analyzed. Applying the principles of sustainable development in the planning of spatial positioning of nautical tourism ports is reflected in the need to understand the value and strength of the influence of numerous factors on the living surroundings, particularly on the environment. Mediterranean countries (e.g. Italy, Spain, Greece and Turkey), including the Republic of Croatia, are faced with the problem of surfeit in certain locations on the coast and islands because of tourism, therefore, they seek to harmonize environmental and economic interests of further tourism development, which certainly should be recognized and applied by the Republic of Croatia. Since nautical tourism is the largest exploiter of the sea and coast, it has to become the greatest promoter of environmental protection.

Further development of nautical tourism should be planned with respect to the limitations of the demands for interactivity and the demands of environmental protection in accordance with the policy of sustainable development, and system security requirements including each individual within the system. The guidelines of nautical tourism development should be based on quality, individualism, and humane tourism, which will provide nautical tourism with a new dimension as a user and an active protector of natural and cultural values of the sea and coastal areas, especially on the islands. For nautical tourism, it is particularly significant to preserve natural resources in order to form the original sustainable competitive advantages of a specific area. Therefore, it is important to reconcile the views on the professional and ethical level of nautical tourism development, which should include and connect all participants in the formation of nautical services. Preservation, protection and improvement of the quality of existing natural, environmental and cultural-historical coastal and marine resources is a task for all actors in the system of planning and management of these resources. The above-mentioned measures should stimulate economic development and satisfy the needs of boaters, at the same time contributing to environmental protection and sustainable development of coasts and islands.

The legal infrastructure in the area of nautical tourism is a significant factor in encouraging or limiting of the development. The structure of normative regulations is very complex because many legal decisions, directly or indirectly, affect the development of an activity. The development of nautical tourism requires complex legal regulation because public and private interests, international conventions and national legislature, as well as numerous elements of navigational safety intertwine at different levels. A systematic approach to further development of nautical tourism on the principles of sustainable development in the long-term has to bring benefits, not only to the present, but also to all future generations.

The local government should focus their attention on aspects of regional development and coordination of different interests of many entities and owners, in particular environmental protection and infrastructure construction, as well as other activities that contribute to a better quality of nautical offer. In that sense, rigorous application of standards, regulations and laws in yachting construction and other construction in the context of sustainable development, will enable a coordinated and harmonious development of all activities involved in the formation of nautical products. In that context, the local development policy must not allow tourism to multiply ecological degradation of the natural environment of coastal areas, and should be directed towards the optimally chosen types of tourism in environmentally permissible limits, with the acceptance of principles and strict measures of protection of natural and cultural heritage.

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BIOGRAPHIE

My name is **Igor Kegalj**, I was born in Rijeka in 1962. I graduated from Faculty of Maritime Studies, department of engineering in 1997, and a year after I completed the Pedagogical-Psychological Education at the Faculty of Humanities and Social Sciences. I worked at Dina Petrochemical Industry, after which I transferred to the Shipyard 3. Maj to the position of project head. I am currently working at Maritime School in Bakar. In 2010 I enrolled the postgraduate study (PhD) of environmental engineering and environment protection.

STATISTICS OF TANKER ACCIDENTS BY ITOPF

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ABSTRACT

By sea 80% of the required oil is transported. Only 1% of the transported volume is spilled in the marine environment. Data and analysis in this paper are taken from studies of ITOPF's (Eng. International Tankers Owners Pollution Federation Limited). ITOPF database contains unintentional oil spill of 1970. The data include the type of spill, quantity of oil spilled, cause the accident and the boat that took part in the same. Number of major oil spills (> 700 tonnes) are greatly reduced in recent 41 years that the time within which the collected data. Most oil spills are small type (less than 7 tones). Accuracy of statistics is incomplete due to reporting small incidents around the world. Approximately 5.71 million tons of oil was spilled out as a result of tanker accidents from 1970's to the 2010-year. From tankers oil spills can come as a result of daily operations or accidents.

KEY WORDS

tankers. oil spill. ITOPF. operations. accidents.

1. INTRODUCTION

Data and analysis in this paper are taken from studies of ITOPF's (*International Tankers Owners Pollution Federation Limited*). ITOPF database contains unintentional oil spill since 1970. The analyzed data include the type of spill, quantity of oil spilled, cause and place of accident, the boat that was involved in an accident. Oil spills are generally categorized by size as: small spills (<7tonnes), medium spills (7-700tonnes) and large spills (>700 tonnes) (<50 barrels, 50-5000 barrels, > 5000 barrels).

2. NUMBER AND CATEGORY OF OIL SPILLS

Number of large oil spills (>700 tonnes) has decreased in recent years, i.e. from 1970 when collecting data began. The average number of large oil spills in the 2010s is three (3.3), about eight times less than in the 1970s when the average was 25.3. In the 1970s, there were 253 (55%) large spills (>700tonnes) with a tendency of decreasing every 10 years. In 2000s this number was only 33 (7%) (Figure 1).

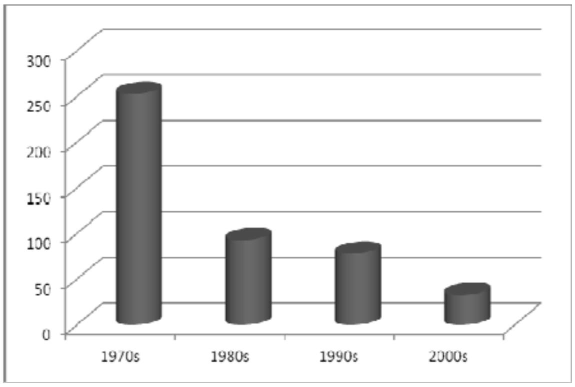

Figure 1. Number of large oil spills (>700tonnes) per decade.

The decline was also recorded in medium spills (7-700 tonnes). In this category the number of spills in the 2000s (149) is twice lower as compared to the 1990s (282), and is almost three times lower in comparison to the 1970s (541) (Figure 2).

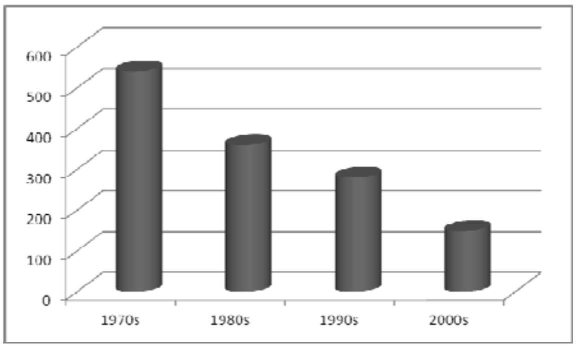

Figure 2. Number of medium oil spills (7-700tonnes) per decade.

Observing the average number of medium spills (7-700tonnes) with the averaged number of large spills (>700 tonnes) per decade (Figure 3) it is evident that through all the observed decades number of medium spills is several times higher. In the 2000s the average number of medium spills was even 4.5 times higher than an average number of large spills. In 2010 four large oil spills were recorded (>700tonnes), which is slightly higher than the average for the decade (3.3) (Figure 3). Unlike large spills (>700tonnes), the lowest number of medium spills (7-700tonnes) since 1970 was recorded in 2010. Together, small and medium spills make up 95%, while the large spills makes only 5% of all recorded spills.

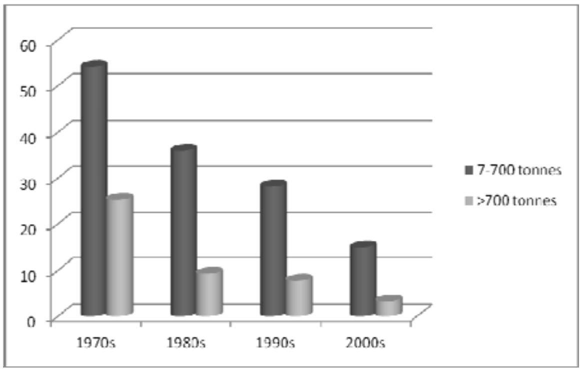

Figure 3. The average number of large (>700tonnes) and medium spills (7-700tonnes) per decade from 1970 to 2010.

Approximately 5.71 million tons of oil was spilt out as a result of tanker accidents from 1970 - 2010. The greatest amount of oil was spilt in 1970s (3.174,000tonnes), while in 2000s only 212,000tonnes of oil spilt were recorded.

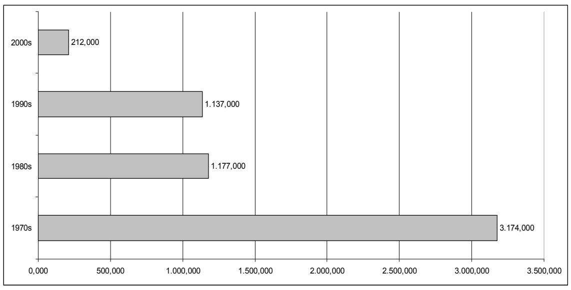

Figure 4. The amount of oil spilled per decade in tonnes.

1990s, there were 360 oil spills over 7 tonnes, resulting in 1.370,000 tonnes of oil spilled. Most of the spilled oil (73%) came from only 10 spills. In 2000-ies there were 182 oil spills over 7 tonnes, resulting in 212,000 tonnes of spilled oil. Two incident contributes to the half (47%) of spilled oil. Figure 4 shows that the amount of oil spilled from the tanker are greatly reduced through the decades as a result of implemented preventive measures.

3. CAUSES OF OIL SPILLS

The circumstances and reasons for oil spills are different, but they can be grouped into operations and accidents. Oil spill for which there is no complete or reliable information about reason is classified under other/ unknown.

A term operation includes loading, discharging, bunkering and other everyday operations (such as ballasting, de-ballasting, tank cleaning). A term accident includes reasons such as collision, groundings, hull failures, equipment failures, fires and explosions. Everyday operations are main causes for the most of small spills (<7tonnes), while accidents are main reason for the largest oil spills (>700tonnes) (Figure 5). In small spills 25% are those with lack of data or reasons.

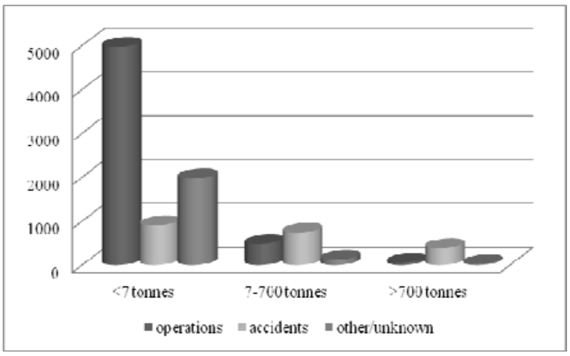

Figure 5. Incidence of spills by grouped causes.

Looking at the overall causes of spills of all sizes (small, medium and large), it is evident that the daily operations (loading / discharging, bunkering and other operations) are more common cause of reaching oil in the marine environment rather than an accident.

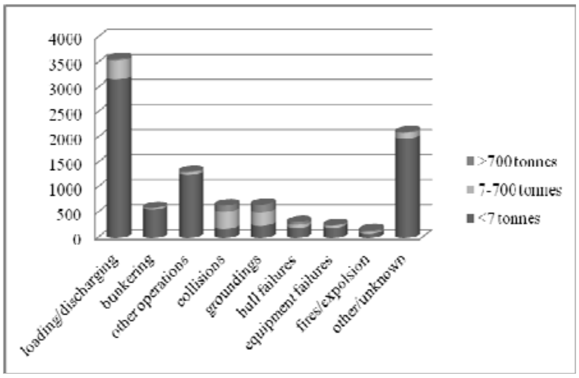

Figure 6. Incidence of spills by cause.

Small and medium spills make up 95% of all recorded spills, the most common cause of these spills are loading and discharging operations in ports and oil terminals, i.e. 40% for small spills and 29% for medium spills. For small spills collision and groundings are very rare cause of spills (2% and 3%), while for the medium spills it is more common cause (26% and 20%).

Unintentional accidents (collision and groundings) are the most common causes of large oil spills, as shown in Figure 7 their share of the major causes of the spills is 64%. Looking at the spills site 50% of large spills occurs at open sea, when a collision and stranding make 58% of the causes of this type of spills. In the inland waters or restricted waters collision and grounding are the main causes of large spills (95%).

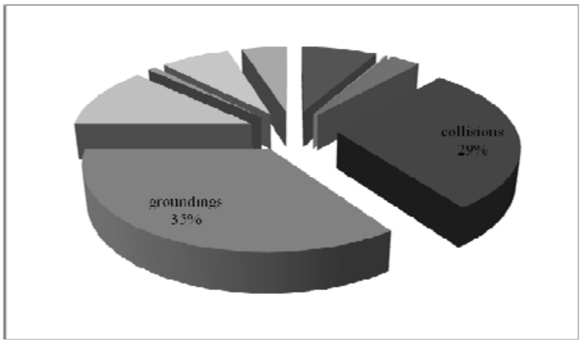

Figure 7. Incidence of large spills (>700tonnes).

4. CONCLUSIONS

Looking at the statistics for four observed decades, the decline of large and medium spills is observed. The lowest number, since the beginning of statistics, of medium spills (7-700tonnes) was recorded in 2010, only 4 spills. Summary, for all types of spills everyday operations (loading/discharging, bunkering and other operations) are more common cause of reaching oil in the marine environment rather than an accident. Everyday operations are main causes for the most of small spills (<7tonnes), while accidents are main reason for the largest oil spills (>700tonnes).

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BIOGRAPHIE

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PROPOSAL ON MEASURES TO REDUCE POLLUTION FROM YACHTS AND RECREATIONAL BOATS

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ABSTRACT

The number of yachts and recreational boats in the Croatian part of the Adriatic Sea has been increasing considerably. Even though the legislative provides legal actions in compliance with conventions and regulations related to marine preservation and prevention of pollution, it is presumed that the measures governing the protection of marine environment from the sewage waters are insufficient.
The design of faecal systems in yachts and recreational boats depends on when a vessel was built. Due to their price, older boats, not fitted with sewage holding tanks, are the ones that are most frequently imported. The number of such vessels is increased in summer months, when older foreign vessels enter Croatian waters making them additionally polluted.
The authors of this paper suggest amendments to the existing regulations and that new compulsory equipment be defined.

KEY WORDS

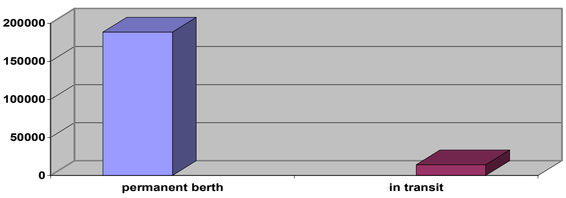
yachts. sewage waters. pollution. pollution prevention.

1. INTRODUCTION

According to the Maritime Code, a sports and recreational vessel is defined as any waterborne craft more than 12 meters in length, carrying fewer than 12 passengers not including the crew, which is intended for extended seagoing navigation and can be employed for private or commercial purposes.[1]

Pollution from yachts and boats implies human-induced entering of matter or energy into the marine environment, directly or indirectly, which has or may have lethal impact on the marine life both in the water column and the seabed. The pollution may threaten marine life conditions and human health, impede maritime activities, decrease the quality of the sea water and reduce the attractiveness of the marine environment. Due to the serious risks of pollution, a relatively high number of national and international regulations have been issued. The *International Maritime Organization* – IMO has had a crucial role in the process of international standardisation.[2]

Graph 1. Ratio of total number of vessels at permanent berth to vessels in transit in the Republic of Croatia in 2011



Source: http://www.dzs.hr/Hrv_Eng/publication/2011/04-04-05_01_2011.htm

The yachts built after 1st January 2006 featuring heads with direct sewage discharge into the sea must be equipped with a tank for holding sewage waters and a discharge connector.

The yachts built before 1st January 2000 featuring heads with direct sewage discharge into the sea can be entirely exempt from the requirements of having a sewage tank installed, provided that there are documents proving the year of construction, technical problems related to the subsequent installation, and the installation costs. These provisions are in line with the European Regulation 59/2000/CE and the consequential obligation of all ports, small ports and marinas to be equipped with adequate systems for collection and treatment of waste waters from boats, yachts and ships.[3]

2. THREATENED AREAS IN THE REPUBLIC OF CROATIA

In the year of 2011 there were 98 ports of nautical tourism along the Croatian coast, including 61 marinas (out of which 11 dry berth marinas) and 37 other ports of nautical tourism. They stretch over 3.295.891 m^2 of the sea surface and comprise 17.059 berths.[4]

Marinas and other ports of nautical tourism are usually constructed in the vicinity of well-known tourist destinations. The Strategy for development of ports of nautical tourism 2009-2019 foresees the extension of the existing marinas and small ports as well as building new ones. Impairing the environmental quality is one of the possible disadvantages of the (excessive) development of nautical tourism, because:

- *marinas are built* in inadequate places with regard to the natural features of the landscape (marinas Žut and Piškera within the Kornati National park – because this is a national park; Marina Šimuni – pollution of the bay due to poor sea water circulation; Marina Punat – due to overcapacity and confined bay; Marina Palmižana – due to deterioration of the natural environment, etc.;
- *excessive anchorage moorings* in the bays with poor water circulation (Telašćica – due to excessive anchorage

1 Article 5, par. 1, alinea 20 of the Maritime Code

2 See the contents of the Convention in: Official Gazette of the Republic of Croatia – International treaties (Narodne novine – Međunarodni ugovori), No. 9/2000. The Convention came into force in 1994, and was amended by Agreement on the application of Part XI of The United Nations Convention on Law of the Sea. See the text of the 1994 Agreement in: International Legal Materials, 1994, vol. 34, No. 6, p. 1301.

3http://www.crs.hr/Portals/0/docs/hrv/brodice_jahte/Pravila%20za%20teh.%20nadzor%20brodica%20i%20jahti,%20Odj.%202.pdf

4 http://www.dzs.hr/Hrv_Eng/publication/2011/04-04-05_01_2011.htm

areas, too many buoys at anchorages and too many vessels throughout the season, etc.);

- *pollution of the sea and coastline* because of excessive boating in particular sea areas (waste, bilge and faecal waters).[5]

It is presumed that an increase in the boating capacity would result in additional pollution in the areas where boating activities are concentrated. The existing marinas have the entire infrastructure that ensures operational functioning and pollution prevention in line with highest international standards. However, the issue is that there are many vessels which were built before 2000 as well as newer vessels whose sewage system is arranged in the way that faecal waters are discharged directly into the sea. There are no obstructions for these vessels to pollute the Croatian side of the Adriatic owing to the insufficient monitoring of remote bays and anchorages, as well as the insufficient monitoring of small ports and marinas, and the vessels moored there.
Certain countries, e.g. New Zealand and Australia, prohibit the discharge of faecal waters in the areas that are closer than 500 meters from the shore. They also prohibit discharging of faecal waters at depths less than 5 meters and in the areas that are closer than 100 meters from fish farms.[6]
Great Britain and Sweden also have strict regulations governing the discharge of faecal waters. It is easy to notice that none of the above mentioned countries lies at a confined sea as does the Republic of Croatia. Therefore it can be concluded that the Republic of Croatia should issue the regulations that are even stricter.

3. PROPOSAL ON SOLVING THE FAECAL DISCHARGE FROM YACHTS AND BOATS

The vessel built after 2000 have to be equipped with a sewage water discharge system. Therefore such vessels are not the subject matter of this discussion. Legislators should introduce an ordinance restricting the import of vessels built before 2000 which are not fitted with the above mentioned systems. In addition, a strict deadline should be set for the existing vessels in the Republic of Croatia, which do not have adequate faecal systems, to install them.
Based on the experience of other maritime countries[7] that have prescribed the faecal water systems onboard boats and yachts, the Ordinance should define what exactly is meant by the term "treated waste waters". The treatment system installed on board should meet those standards. The regulations state that the "treated sewage", sampled 5 times or more within 24 hours, must satisfy the following standards:

- The geometric mean of the faecal coliform count does not exceed 250 faecal coliforms per 100 millilitres; and
- The total content of sampled matter, when the suspended solids are analysed by gravimetric methods, does not exceed - (i) 50 milligrams per litre, when analysed on shore, or (ii) 100 milligrams per litre more than the suspended solids content of the ambient water used for flushing when analysed on board a vessel; and
- A biochemical oxygen demand count where the geometric mean of 5 day biochemical oxygen demand of the samples of sewage does not exceed 50 milligrams per litre.[8]

In order to meet these requirements, owners of yachts or recreational boats must decide which option is best for them. Three available options include fitting a sewage holding tank for storing untreated sewage, fitting an onboard sewage treatment system (Figure 1), or installing on board a portable toilet, which can be taken ashore to be emptied.
The owner will decide which of the available systems is the most cost-efficient, taking into consideration:

5 http://www.hhi.hr/uploads/materials/SRNTH.pdf

6http://www.mfe.govt.nz/publications/water/sewage-systems-for-boats-nov99.pdf

7 Great Britain, Sweden, New Zealand, Australia

8http://www.mfe.govt.nz/publications/water/sewage-systems-for-boats-nov99.pdf

- year of vessel's construction
- size of the vessel, i.e. number of passengers on board
- design of the vessel
- onboard power network.

Figure 1. Example of an onboard sewage treatment device
Source:
http://www.boatersland.com/rarpurasan.html

4. SOLUTIONS TO THE SEWAGE SYSTEMS IN MARINAS AND PORTS OF NAUTICAL TOURISM

Collecting waste waters from large merchant ships in ports is usually carried out by means of suitable vessels (barges), whereas marinas and smaller ports can use portable or stationary units. The system is ideal for such specific needs as it is user-friendly, it entirely meets the requirements of marine environment protection, takes economic criteria into account and, at the same time, enhances the quality and standard of the marinas and ports themselves. It is particularly suitable for marinas and ports of nautical tourism in the Republic of Croatia as they are relatively small and intended for the accommodation of smaller boats and yachts.
However, the systems that have been designed so far for this purpose have a number of constraints. Firstly, the amount of collected water is limited and not exceeding 200-250 l/h (Figure 2). Furthermore, one intake tower is used for only one type of water (bilge or faecal water). The pump units have no permanent vacuum suction, which is a considerable constraint, given the amount of water to be drawn from vessels. As the collected untreated sewage waters are discharged into the public drainage system on the mainland, the latter is affected by bacterial pollution.

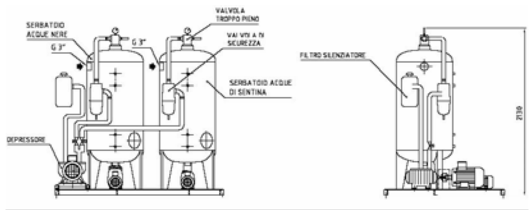


Figure 2. Schematic display of a stationary suction unit for drawing oily – bilge and faecal waters from vessels
Source:
http://www.antea.hr/pdf/usisne_stanice_za_crpljenje_kaljuznih_i_fekalnih_voda_sa_b.pdf

Small ports and marinas in the Republic of Croatia have been constructed according to the standards that were valid in the 1970s. They are now considered undersized for the accommodation of the ever increasing number of vessels in the Adriatic Sea. Moreover, many of them can not accommodate larger yachts (mega yachts). The sewage water collection systems are insufficient, and the service is often too slow or unavailable.

An ordinance on the compulsory equipment for boat sewage systems would imply provisions on the compulsory facilities in marinas and ports of nautical tourism. Given the present capacities and facilities in marinas and ports of nautical tourism, the introduction of the proposed ordinance would give rise to difficulties in nautical tourism. Small ports and marinas providing charter services mostly perform the seven-day booking service. Therefore most of the chartered vessels leave on weekends (on Fridays or Saturdays) and return to their mother ports on Thursdays or Fridays. This schedule makes accesses to small ports, marinas and fuel docks congested due to a large number of vessels coming back to port at the very last moment (mostly around 5 p.m.). The implementation of the compulsory system of discharging sewage waters from all vessels would make the traffic jam even worse. On week-days the berths in most of small ports and marinas are occupied by 5 p.m. and the accommodation of a larger number of vessels intending to discharge their sewage waters would be almost impossible.

Therefore it is recommended that the small ports and marinas are equipped with floating pumpout units in charge of taking sewage waters at anchorages or accesses to small ports or marinas. These craft should be standardised by the Croatian Register of Shipping and the competent Ministry, having prescribed size and capacity. The competent Ministry should determine the number of such vessels with regard to the capacities of respective small ports and marinas. The capacity of these vessels' holding tanks and associated facilities should be sufficient (Figure 3) in order to serve a maximum number of boats and yachts within a minimum period of time.

Figure 3. Example of a sewage treatment device having the capacity of 25-10.000 l/h
Source:
http://www.boatersland.com/rarpurasan.html

5. CONCLUSIONS

There has been a considerable increase in nautical tourism industry in the Republic of Croatia. This growth involves a relatively high number of recreational boats and yachts designed for sailing in a semi-enclosed sea such as the Adriatic. The life of these vessels is very long, especially if they are made of reinforced fibreglass. Therefore it should be borne in mind that there will be few written-off boats and yachts in the future, while the influx of imported ones will be constant.
Vessels built before 2000 do not have to be fitted with a holding tank system or with a sewage treatment device. They are considered as serious polluters given the fact that there are many of them in confined areas in summer season. Those areas are considered particularly threatened.
We propose changes in legislation and the introduction of regulations prescribing compulsory installation of sewage water facilities on board yachts and recreational boats. In addition, new regulations should prescribe compulsory service of special-purpose vessels acting as waterborne pumpout units which would take sewage waters from yachts and recreational boats as they approach marinas and ports of nautical tourism. Finally, it is proposed that these sewage water pumpout vessels should meet the standards specified by the Croatian Register of Shipping and the competent Ministry.

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BIOGRAPHIE

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METEOROLOGICAL WARNINGS IN THE SAFETY OF NAVIGATION SYSTEM

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ABSTRACT

Maritime meteorological service on Adriatic is a part of State hidrometeorological institute, while the center of the service is in Maritime meteorological center in Split since 1947. One of main activities of the service is safety of navigation by issuing meteorological warnings for seamen based on collected data of maritime meteorological stations, ships from VOS system (Voluntary Observing System) and received forecast material. Usually these warnings refer to increased wind, increased state (waviness) of the sea, storm appearance and decreased visibility. For ships and large vessels that sail on open sea, due to WMO criteria (World Meteorological Organization), warnings are issued for state of sea 5 (more waviness) and more. Warnings refer to meteorological reports that broadcast over coastal radio stations Rijeka Radio, Split Radio i Dubrovnik Radio. Issuing of meteorological warnings for seamen is also implementation of obligation that arise from international conventions.
In this paper importance of measuring and collecting meteorological data from maritime meteorological stations is highlited. The need and recommendation for intensification and raising of quality of meteorological warnings is presented, which are sent to CRS (Coastal Radio Station), and review od issued warnings for seamen in 2011. by regions of Adriatic is given.

KEY WORDS

meteorological warnins. wind. sea state. fog, safety.

1. INTRODUCTION

Although navigation of Adriatic east coast, thanks to numerous islands and coves, has always been experienced as relatively safe, compared to outer mediterranean navigation, remains of many ships from shipwrecks along our coast show that safety on sea is doubtful term. Although Adriatic sea is small closed up bay of Mediterranean sea, there are extraordinary and extremely dangerous maritime meteorological phenomena on it.
There is certain amount of meteorological phenomena that directly limit and danger maritime traffic, and so they deserve our attention. Beside wind, there are: storm processes and fronts contected with them, waves (as oceanographic element) and very bad visibility (thick fog).
Commercial marine has significantly decreased dependence of weather conditions, but navigation economy and regularity still depend on it, so it is important to quickly deliver meteorological information. However, at the same time there is increased general - recreational navigation and many other navigable activities, which seek development of marine meteorology in sense of security.
Marine meteorology materially participates in safety, regularity and efficiency of maritime traffic, and studies meteorological elements and phenomena from a point of view of impact on navigational technique and conditions of navigation. It elaborates and perfects ways and forms of meteorological insurance and help for navigation. Weather conditions sometimes make difficult, and with proper and timely assessment, help navigation. Ignoring weather conditions leads to failure of navigation tasks, and sometimes accidents.

2. METEOROLOGICAL NAVIGATION INSURANCE

2.1 Maritime meteorological service

World Meteorological Organization - WMO and International Maritime Organization - IMO under United nations, according to International convention for the Safety of Life at Sea, have set and developed standards and recommendations for work for this branch of meteorology, and gathered them in several documents. WMO demands from their members to satisfy the requirements set in WMO document *Techincal rules*, what primarily means establishment and maintenance of observing stations on land and sea of certain type and structure, marine meteorology service, different communication systems, education of staff, research application and development of technique and technology. WMO and IMO act within the system World Weather Watch - WWW. Assignement of Marine Meteorology Service - MMS is gathering necessary climatological data, analysis, forecasts and warnings for atmosphere and world waters.
Meteorology service for marine is organized by National Meteorological Centre - NMC. It is National Meteorological Institute in Croatia, consisting of Marine meteorological center in Split, meteorological office in Rijeka and meteorological stations. Direct coordination with ships which are included in system of voluntery observation of meteorological elements is held by appropriate serveces (and porth Authority) respectively Port meteorological Officer - PMO.
National meteorological headquarters receives meteorological data (through satellites, computer networks, etc.) and monitors and forecasts meteorological conditions significiant for marine. If it is necessary, they issue special warnings of dangerous meteorological phenomena over great area for which they are in charge, prepares analysis and forecasts of ground and high altitude meteorological maps and forwards them to other meteorological services or offices and coastal radio stations (Rijeka - radio, Split - radio and Dubrovnik - radio.)
For increasing precision and efficiency of forecast for seamen, meteorological service has divided Adriatic on three areas: north, central and south, which is shown on Figure 1.

Figure 1. Map of meteorological distribution of Adriatic[1]

2.2. Meteorological warnings

Warnings of dangerous meteorological phenomena are important for safety of all types of boats. Warnings are part of regular meteorological newsletter which is issued three times a day in Split by Marine meteorological center. Regular warnings are issued in accordance with dangerous meteorological phenomena in regular periods, but emergency warnings can also be issued when dangerous meteorological phenomena are noticed.
Warnings are issued for these meteorological elements:

- strong and stormy winds
- state of the sea
- reduced visibility (fog)
- possible thunderstorms

Flow system and in this regard winds on Adriatic depend, primarily, of distibution of air pressure on European land, Adriatic and Mediterranean sea. Wind speed depends on gradient of air pressure. Gradient is significantly increasing on Adriatic, and in this regard wind speed, because of the orographic effect, insular and coastal canals and slash on mountain (Dinaridi) line along the coast which divides land and Adriatic in two very different and opposite types. Most of the year there are dominant winds of south and north directions on Adriatic (jugo and bora).
In many cases specification of wind waves isn't necessary, since there is general knowledge of wave height which results on certain wind speed. However, wind waves depend on wind direction regarding to coastline, distance from coast, direction change, air masses stability, sea depth, surface currents and changes of sea.
For ships that are sailing through open sea and large boats, in accordance with the WMO (*World Meteorological Organization*) criteria, warnings are issued for the sea state of 5 (more wavy) and more. These warnings refer to meteorological reports that are broadcasted through coast radio stations Rijeka Radio, Split Radio i Dubrovnik Radio.
Wind strength, according to its effects, is determined by Beaufort scale (table 1.), while sea state is by Douglas scale (table 2.).

Table 1. Beaufort scale[2]

Jač (Bf)	Opis	WMO	Brzina (kn)
0	tišina	Calm	< 1
1	lahor	Light Air	1-3
2	povjetarac	Light Breeze	4-6
3	slabi vjetar	Gentle Breeze	7-10
4	umjereni vjetar	Moderate Brezee	11-16
5	jaki vjetar	Fresh Breeze	17-21
6	žestoki vjetar	Strong Breeze	22-27
7	žestoki vjetar	Near Breeze	28-33
8	olujni vjetar	Gale	34-40
9	jaki olujni	Strong Gale	41-47
10	orkanski vjetar	Storm	48-55
11	jaki orkans. vjetar	Violent Storm	56-63
12	orkan	Hurricane	>64

Table 2. Douglas scale[3]

Stanje mora	Opis	WMO	Visina valova (m)
0	mirno (bonaca)	calm (glass)	0
1	mirno (naborano)	calm (rippled)	0-0.1
2	malo valovito	smooth	0.1-0.5
3	umjereno valovito	slight	0.5-1.25

[1] *Source: National hidrometeorological inistute Croatia*

[2] *Source: World Meteorological Organization*
[3] *Source: World Meteorological Organization*

4	valovito	moderate	1.25-2.5
5	jače valovito	rough	2.5-4
6	uzburkano	very rough	4-6
7	teško	high	6-9
8	vrlo teško	very high	9-14
9	izuzetno teško	phenomenal	> 14

3. METEOROLOGICAL ELEMENTS

Among most important elements of meteorological report for boats and seamen on sea, along wind and waves data, there is an information and warning about decreased visibility as critical factor of navigation safety. That particularly comes to the fore when visibility is decreased because of the haze (visibility from 1 to 10 km), fog (visibility < 1 km) and heavy rain with rain curtain. Horizontal (meteorological) visibility is defined as smallest visibility in circle of 360° on altitude of ≈ 10 m above ground.

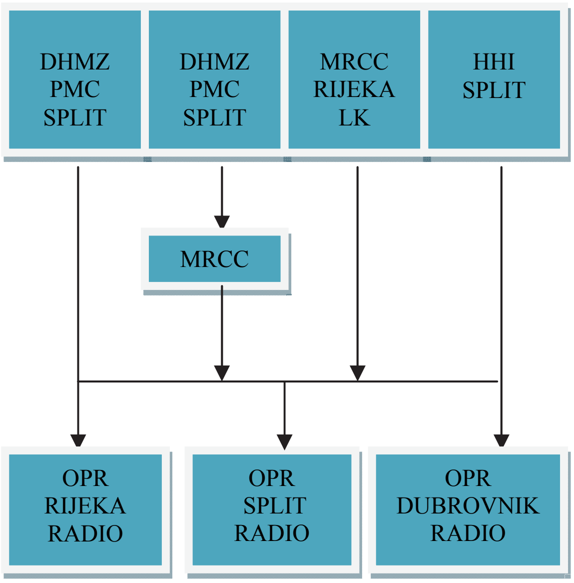

Figure 2. System of maritime safety information[4]

Navigation in fog and in limited visibility is facilitated with turning on proper lights in sense of „being seen" and giving sound signals. Use of the radar also facilitates navigation, which is particulary true for coastal areas and areas with increased traffic. Because of that lighthouses, wether on certain islands, cliffs or harbour lights, facilitate navigation at bad visibility. Significance of poor visibility can be represented with the fact that stopping of larger boat is as far as ½ nautical mile, and sometimes more. Similar stands for changing the direction of navigation.

Thunder and thunderstorms are usually associated with thunder clouds cumulonimbus, which arise and develop in unstable atmosphere due to large vertical flow and temperature gradient above warmer surface, as for example is sea in certain parts of the year. Such clouds on Adriatic occur within the cyclones and flow of the colder air from north and east quadrant to warmer Adriatic.

Regular meteorological warnings are issued in regular newsletters of Maritim meteorological service at 6, 12 i 18 o'clock. Emergency meteorological warnings are issued in accordance with the appearance of extraordinary meteorological conditions on sea, and which were not covered in regular warnings at certain periods of newsletter issuing.

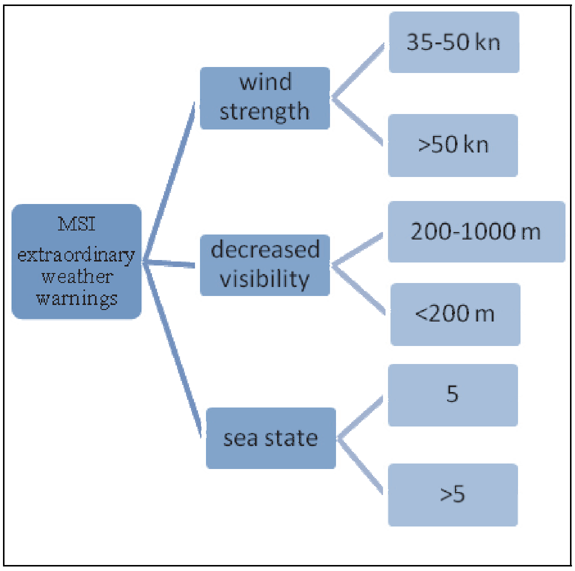

Figure 3. Criteria for broadcasting extraordinary weather warnings[5]

Emergency meteorological warnings are issued immediately after possible meteorological danger is established. They are broadcasted in accordance with established procedures, which are responsibility of local radio stations.

[4] *Source: authors*

[5] *Source: authors*

Warnings are broadcasted on local and english language in areas of responsibility.

It is important to stress out that separate emergency warnings are extremely rare. So during the year 2008. and 2009. total of only eight emergency warning were broadcasted, and that:

- ORP Rijeka Radio total of three (two fog warnings, and one for thunderstorm),
- ORP Split Radio total of three (fog warnings)
- ORP Dubrovnik Radio total of two (fog warning, thunderstorm warning)

Frequency of meteorological warnings in regular weather reports for seamen is significant.

Statistical representation of frequency of meteorological warnings, which are delivered from Marine meteorological center Split to local radio stations in the year 2011. gives insight in relatively large number of days with potential dangerous marine meteorological conditions.

Table 3. Meteorological warnings in the year 2011. issued by PMC Split[6]

Meteorological warnings								
2011	**none**	**bura**	**jugo**	**tramontana**	**sea state**	**storm**	**fog**	**total**
I	3	15	11	2	7	14	13	65
II	3	18	8	7	7	8	9	60
III	5	18	12	8	14	18	4	79
IV	7	22	4	9	2	10	6	60
V	4	25	7	12	5	27	2	82
VI	5	19	5	10	1	24	5	69
VII	11	12	6	7	1	23	0	60
VIII	13	11	2	7	0	16	7	56
IX	9	17	3	6	2	15	1	53
X	7	19	11	5	16	17	4	79
XI	1	15	10	0	7	10	15	58
XII	4	20	16	10	11	18	5	84
ann	72	211	95	83	73	200	71	805

*occurence of pojava one element in any of 3 daily newsletters
*without time and space component

Upon receipt of emergency meteorological warning received from Marine meteorological center Split, MRCC Rijeka delivers it to coastal radio stations: Rijeka, Split and Dubrovnik.

We can see in table 3 that in the year 2011. Marine meteorological center Split sent total of 805 warnings of dangerous meteorological phenomena to local radio stations on east coast of Adriatic. Research is made within these criteria:

- no warnings,
- bura,
- jugo,
- tramontana,
- sea state,
- thunderstorms and
- fog (reduced visibility)

Most warnings are issued for strong, storm and hurricane bura, and for thunderstorms.

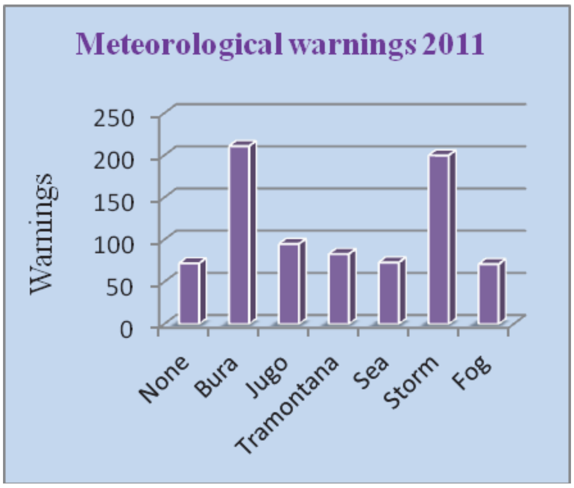

Chart 1. Frequency of issuing meteorological warnings in the year 2011

Chart 2. shows monthly frequency of issuing meteorological warnings in the year 2011., from what we can see that the most warnings from PMC Split has been issued in December (84 warnings) and then May (82 warnings).

[6] *Source: Meteorological newsletter of PMC issued in the year 2011.*

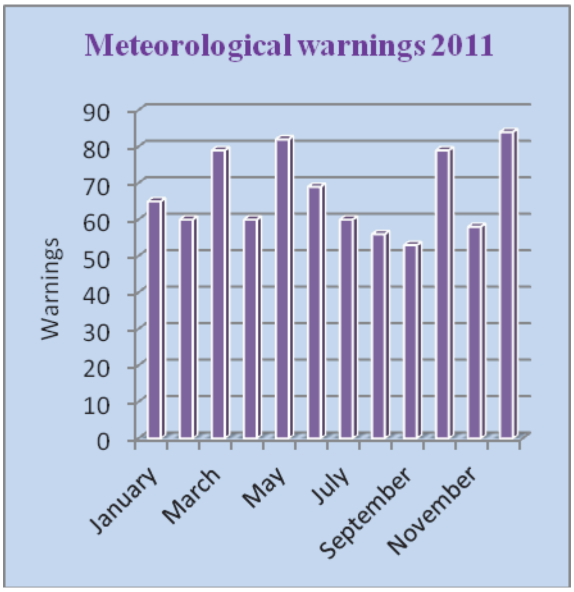

Chart 2. Monthly frequency of issuing meteorological warnings in the year 2011.

It is very important to mention that number of meteorological warnings wasn't less than 53 in any month. It should also be noted that it is about research of date from issued 3 daily newsletters for seamen, in which in one period can be given meteorological warnings for several meteorological parameters (for example: wind and/or sea, etc.).

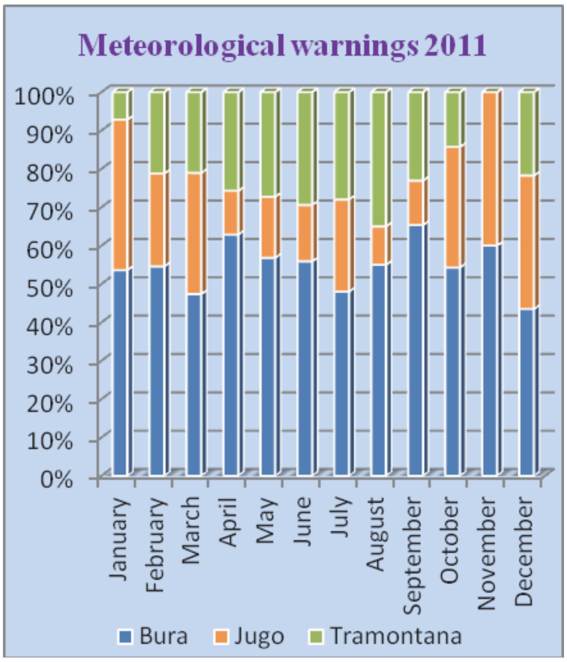

Chart 3. Frequency of issuing meteorological warnings considering wind [7]

Chart 3. (same as chart 1.) shows that the most warnings were for strong, storm and hurricane bura, then for jugo, and also for tramontana. It is interesting that there weren't warnings for tramontana in November of the year 2011.

Giving of weather warnings shows significantly large number of NE wind blows (bura) through whole observed period in all parts of Adriatic.

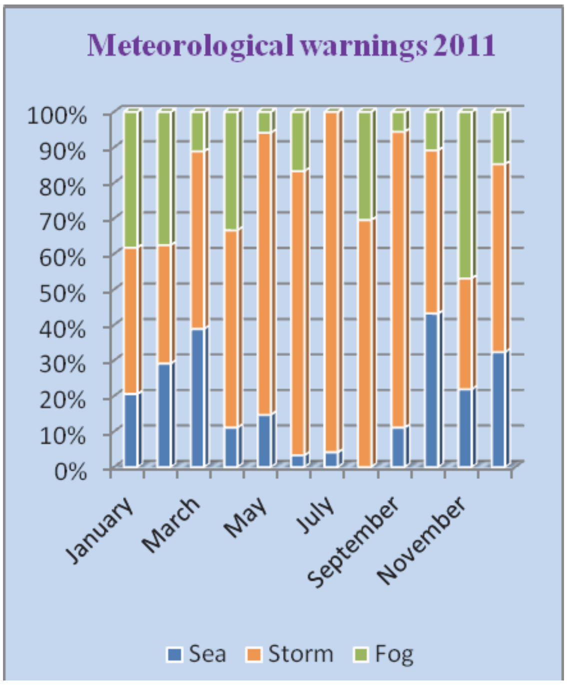

Chart 4. Frequency of issuing meteorological warnings considering sea state, thunderstorms and fog

Frequency of meteorological warnings on thunderstorm phenomena was very large in summer months of the year 2011. No warnings for decreased visibility wasn't issued in July (Chart 4.). In winter and spring months frequency of issuing meteorological warnings for sea state is significant. Through September, there hasn't been issued any warnings for sea state, which is in accordance with general distribution of meteorological parameters annual movement.

[7] *Source: National hidrometeorological institute Croatia*

4. METEOROLOGICAL WARNINGS BROADCASTING

Considering importance of marine meteorology, and particularly importance of meteorological warnings in navigation security system, Work group was formed by MMPI, with representative of companies Plovput, LK Split, MRCC Rijeka, PMC Split, DHMZ Zagreb and the Department of sea.
Criteria and ways for ORP to broadcast important meteorological warnings in the future were agreed at the meeting.
With the change of broadcasting of meteorological warnings croatian ORP, starting December 1st of the year 2009., meteorological warning contained in regular weather report was separated and broadcasted immediately after receiving, not waiting for regular period of MSI broadcast (broadcasting of weather reports and radio navigational announcment). This has undoubtedly increased meteorological navigation safety, particularly for small boats and sailors in summer period on east part of Adriatic.

Table 4. Statistical data of SAR actions in the year 2011. godini[8]

SAR[9] interventions	
action	**number**
stranding	59
inablity for navigation	85
medical transport, intervention, advices	50
divers (bottles)	11
divers (breath)	7
sinking	15
man overboard	15
collision	15
impact	4
flooding	13
delay to destination	15
other (red rockets)	19
fire	9
swimmers	15
surfers	15

In period of January 1st to December 31st on the area of MRCC Rijeka and other 8 MRSC (Pula, Rijeka, Senj, Zadar, Šibenik, Split, Ploče i Dubrovnik) responsibility, for various marine accidents and incidents, there has been total of 341 search and rescue interventions.
Marine meteorological center Split in its basic activity (meteorological navigation safety) besides issuing regular meteorological newsletters, has direct contribution in providing information about local weather conditions at which actions of search and rescue are implemented.
Issuing regular meteorological warnings in time, directly contributes safety of navigation and decreasing of marine accidents.

Table 5. MRCC Rijeka report of results of conducted actions[10]

MRCC Rijeka report		
people rescued		876
people killed		20
people missing		3
people injured		52
vessels rescued	ship	21
	boat	183
	other	22

5. CONCLUSIONS

Safety of life and needs in marine, and other activities related to sea have significantly contributed development of marine meteorology. International scheme under which are boats on all seas and oceans involved from national services to perform measurements and observations of meteorological elements is called Scheme of World meteorological organization of voluntary measurement and observation on ships (VOS).
In summer seasen there are more then 70.000 foreign yachts and over 110.000 domestic vessels on Adriatic. Issuing of meteorological warnings for seamen is fundamental assignment of Marine meteorological center

[8] *Source: Department of marine, transport and infrastructure, National headquarters for coordinating search and rescue on the sea – MRCC Rijeka*
[9] *SAR - Search and rescue*

[10] *Source: Department of marine, transport and infrastructure, National headquarters for coordinating search and rescue on the sea – MRCC Rijeka*

Split, and also is performance of obligations which come from international conventions (SOLAS).

In procedure of issuing meteorological warnings and finding paths to ultimate users, part of coastal radio stations should be stressed, because they broadcast these warnings independently immediately after receiving, and then in regular periods of weather reports broadcasts and if needed, in accordance with agreed criteria, again after two hours. In this way evident lack of separate emergency meteorological warnings has been replaced, when they should be issued and broadcasted only exceptionally, in sudden change of weather, extremely difficult weather on sea or ona tip from the large amount of boats or marine lighthouses. (occurrence of tornados, locally reduced visibility due to fog, etc.) In Department of marine meteorology - PMC Split for needs of MMPI, two times a day there are recordings of meteoreport on croatian, english, italian and german language, and then it is circularly rebroadcasted on VHF Ch 67/Split, Ch 69/Rijeka i Ch 73/Pula, Šibenik and Dubrovnik. It is particularly important to emphasize extremely importance of measurement, gathering and alerts of meteorological data that ships do, because that is necessary for making more accurate weather forecast for open sea, which will be available in the system Meteoalarm (EU) in the future.

For that reason National meteorological institute of Croatia with is Marine meteorological department, and in cooperation with Department of marine is working on insuring as many ships as they can that will deliver meteorological data in PMC Split i real time, which would be as a function of getting quality weather forecast, and would also afterwards serve as database for meteorological routes making.

In the next period, together with establishment of PMS Split as Regional center for Adriatic east coast, plan is to set three radars for early warning to locate thunderstorms more accurately. Warnings of extremely dangerous thunderstroms, particulary in the summer, are generalized because thunderstorms are local character, so place of their formation can be very difficult to prognose.

Also, together with realisation of VTS project, four hidrometeorological buoys will be posted on open seas of Adriatic and they will measure eight parameters which will directly increase quality of input data important for issuing weather forecast for seamen.

Performing marine meteorological service in the future, Marine meteorological center Split with its increased activity, particularly with announcements of weather conditions changing in time, needs to be foundation of navigation safety on Adriatic.

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BIOGRAPHIE

Ružica Popović graduated on Faculty of Maritime Studies. Since 1983. was employed in Marine Meteorological Center in Split, Department Sea Climate. Constant Croatian representative at the WMO as the Port Meteorological Officer since 2011. year. Ms. Popovic is author of more than 15 papers in meteorological safety of navigation. She is a Ph.D student on Faculty of Maritime Studies in Rijeka.

Mirsad Kulović is a full professor and dean of Faculty of Transport and Traffic Engineering at International University of Travnik, Bosnia and Herzegovina. He graduated from University of Belgrade (B.S), University of Zagreb (M.S.) and University of Sarajevo (Ph.D.). He also obtained Transportation Engineering Certificate from University of Tennessee, USA. Dr. Kulovic has over thirty years of experience in traffic engineering and transportation planning ranging from professional consultancy in private companies, teaching at universities and managing transportation projects in government agencies in Bosnia and Herzegovina and in the United States of America. He published two books and over 50 professional and scientific papers in domestic and international magazines and presented it on conferences and symposias. He is active member of many professional organizations.

Željko Šore graduated from the High Nautical College in Split 1983rd year, and passed the exam for master mariner 1986th year. Since 1987. was employed at the Marine Meteorological Centre in Split, as head of ships meteorological services. Since 2009. in the Meteorological and Hydrological Service in Zagreb, Department Sea Climate. Constant Croatian representative at the WMO as the Port Meteorological Officer since 2005. year. As an area of interest can be pointed out the safety of navigation.

THE UNITED NATION CONVENTION FOR THE INTERNATIONAL CARRIAGE OF GOODS WHOLLY OR PARTLY BY SEA – THE ROTTERDAM RULES – THE ANALYSIZIS OF STRUCTURAL CONVENTION AND CONTENTS OF ITS CRUCIAL REGULATIONS

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ABSTRACT

The United Nation Convention for the International Carriage of Goods Wholly or Partly by Sea (known as the Rotterdam Rules) is the newest international convention which unifies and moderates the legal regime governing the international carriage of goods by sea. The Rotterdam Rules accept all elements of the new transportation practice, such as: container carriage, transportation door to door contracts, electronic business (e-business), new and modern approach to transport documents, determining the responsibilities of the performing party and the controlling party, detail development, not only, the obligation and responsibility of the carrier, but also the mandatory rules about the obligations and responsibilities of the shipper. Also, the most important mark of the Rotterdam Rules is to try to enable the use of unified system of responsibilities to carrying contracts and for those carrying branches that precede or subsequent to sea carriage. The integration of the contract of transportation „door to door“ in the scope of application of the Convention is one of the most important, but, at the same time, the most criticized solution.
The Rotterdam Rules are not jet enter into force, but its regulations are the subject of very intensive dispute in scientific and professional circles all around the world. The countries consider and analyze the answer to the question if they would bind themselves with the Rotterdam Rules. If this Convention was put into force and started to be used, it would significantly change the legal regulation of obligations, responsibilities and other important questions connected to the mater of contracts for the international carriage of goods.
In this paper are determined, studied and interpreted the key regulations of the Rotterdam Rules. The authors analyze the structure of Convention and carefully determine the contents and the range of the most important regulations. They particularly emphasize the news in relation to the Hague Rules, which is the most accepted convention that, today, regulates the carriage of goods by sea on the international level.

KEY WORDS

the Rotterdam Rules. carriage of goods by sea. multimodal transport. harmonization and unification of the international transport law.

1. INTRODUCTION

The unification of carriage goods by sea has begun at the beginning of the last century. In the far 1924 The Hague Rules were established with the goal of making mandatory regime of carrier's responsibility and the prescribed limit of the carrier's responsibility. That convention has shown to be a very successful instrument. The Hague Rules, together with their protocols The Hague-Visby Rules (1968) and SDR Protocol (1979) are, even today, the most accepted conventions which determine this topic. The important stage in international unification of marine transportation of goods is also The Hamburg Rules, that have not become widely accepted convention, but its unification efforts are also significant. When we talk about unification efforts in this area, we have to mention also The International Multimodal Transport Convention (1980), which is the most ambitious instrument, but, at the same time, the least successful of all mentioned above because it was never put into effect. The Hague Rules and its Protocols, and The Hamburg Rules are significant contributes to the harmonization of the law governing the carriage of goods by sea.
However, during the past years the pace of dis-unification of the regimes governing the international carriage of goods by sea has increased and caused considerable concern not only to the CMI and UNCITRAL, but to other international organizations. Several states parties to the Hague Rules have amended their domestic legislation with which they have given effect to the Rules by amending some of the terms and adding other terms, in some cases based on provisions of the Hamburg Rules. Other states have enacted domestic legislation incorporating features of both the Hague Rules and Hamburg Rules, as well as making unilateral innovations. In the absence of an internationally acceptable regime being adopted, it is likely that this trend towards further national or regional legislation will continue [1]. The presence itself, of many various systems of responsibility and non-existence of the unique system is the problem that burdens the international marine trading and transport. Also, the technological and commercial developments that have taken place since the adoption of those conventions impose the need to consolidate and modernize them. Changes appeared in the relation of the power of parties in marine transportation contracts (carriers and shippers), containerization, 'internetization', development of electronic communications, and all this changed the way of business in marine transport from its roots. None of the existing conventions adequately solve the existing issues, unification and organization of modern transportation practice is missing. Taking into consideration all mentioned problems, and with the goal of making a better and more modern solution for the 21st century, on 23rd September 2009 The United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea – The Rotterdam Rules, was made and signed in Rotterdam. It is believed that the adoption of uniform rules to govern international contracts of carriage of goods wholly or partly by sea will promote legal certainty, improve the efficiency of international carriage of goods and facilitate new access opportunities for previously remote parties and markets, thus playing a fundamental role in promoting trade and economic development, both domestically and internationally.
This paper displays and interprets the most important conventional rules with the emphasis on those that are new and those legal solutions which are different from the solutions contained in the actual conventions.

2. STRUCTURE OF THE CONVENTION

The Rotterdam Rules, as a whole, represent a very complex codification. The structure is divided into 18 chapters, containing as much as 96 articles. The extensiveness of the convention tells about its comprehensiveness and great precision in regulating all the questions concerning legal regulation of marine transportation contracts. The intention of the convention is to cover much wider scope of application, from the loading and unloading goods to the ship, that is, from port to port, as is regulated by actual conventions on this topic. The Rotterdam Rules has widened its scope to door-to-door, and taken on board a contractual approach, and accepted the challenge of dealing with all the important interfaces between the contract of carriage to the trade transactions, it is clear that the product is comprehensive [6]. Consequently, The Rotterdam Rules, in comparison with the actual conventions from this area, is a unique example of thorough analysis of all obligations and responsibilities of the contracted parties, but also other subjects that appear in the transportation business. Numerous new terms, institutes and legal question, which were not nominated till now in actual conventions from this area, respond to the reality of modern relations in marine transportation contracts. Yet, despite numerous advantages, modern and better solutions in professional and scientific circles, numerous complaints state that The Rotterdam Rules are a too detailed convention, and because of that complexity, extensiveness and number of innovations in its acceptance, usage and interpretation of its regulations, are difficult to understand. [5].

The Rotterdam Rules are divided into eighteen chapters as follows:

1. Chapter 1 - General provisions
2. Chapter 2 - Scope of application
3. Chapter 3 - Electronic transport records
4. Chapter 4 - Obligation of the carrier
5. Chapter 5 - Liability of the carrier for loss, damage or delay
6. Chapter 6 - Additional provisions relating to particular stages of carriage
7. Chapter 7 - Obligations of the shipper to the carrier
8. Chapter 8 - Transport documents and electronic transport records
9. Chapter 9 - Delivery of the goods
10. Chapter 10 - Rights of the controlling party
11. Chapter 11 - Transfer of rights
12. Chapter 12 - Limits of liability
13. Chapter 13 - Time of suit
14. Chapter 14 - Jurisdiction
15. Chapter 15 - Arbitration
16. Chapter 16 - Validity of contractual terms
17. Chapter 17 - Matters not governed by this convention
18. Chapter 18 - Final clauses

3. GENERAL PROVISIONS

The Convention defines 30 terms.[1] Of this number, there are many new terms that enable the usage of modern and innovative system of rules and new institutes in determining transportation contracts.

With contracting parties, carrier and shipper[2], the Convention defines terms and regulates the rights, obligations and responsibilities of other parties as well. On the part of the ship these are: the performing party and the maritime performing party. Performing party is a person other than the carrier that performs or undertakes to perform any of the carrier's obligations under a contract of carriage, to the extent that such person acts, at the carrier's request or under the carrier's right of control. It is important that performing party does not include any person that is retained, by a shipper, by a documentary shipper, by the controlling party or by the consignee instead of by the carrier. Maritime performing party is specially defined and means a performing party to the extent that it performs or undertakes to perform any of the carrier's obligations during the period between the arrival of the goods at the port of loading of a ship and their departure from the port of discharge of a ship. An inland carrier is a maritime performing party only if it performs or undertakes to perform its services exclusively within a port area. On the cargo-owning side The Rotterdam Rules defines: shipper, documentary shipper, holder, consignee, controlling party.

Central and the most important term, which directly limits the field of application of the convention is "contract of carriage". The most

[1] Hague Rules have only 5 definitions of terms.

[2] Definition of the carrier widens the term of the carrier from The Haague Rule. The carrier, according to The Rotteredam Rules, is defined as a person that enters into a contract of carriage with a shipper, independently if they are ship-owner or the charterer from a charter party. This is in accordance with the expanded scope of the application of the Rotterdam Rules that will, under determined conditions, be used to other transport sectors, but with the solution of the Hamburg Rules, which, more contemporary than the Hague Rules determines liability of the carrier and actual carrier. The definition of the shipper did not exist in the Hague Rules, and in the Rotterdam Rules shipper is defined as a person that enters into a contract of carriage with a carrier.

important novelty of the Rotterdam Rules, compared with the present maritime law conventions from this area, is that the contract shall provide for carriage by sea and may provide for carriage by other modes of transport in addition to the sea carriage. Specially defined are liner transportation and non-liner transportation, and the novelty of the Rotterdam Rules is that they apply to the volume contract also. The Rotterdam Rules pay special attention to the transport documents in electronic communication and electronic transport records. They are defined, but the terms "issuance", "transfer", "contract particulars" are also defined.

4. SCOPE OF APPLICATION AND ADDITIONAL PROVISIONS RELATING TO PARTICULAR STAGES OF CARRIAGE

The Rotterdam Rules apply to the contracts of carriage in international carriage of goods between States of which, at leas one is a Contracting State.[3] The Rotterdam Rules apply to the liner transportation, but, from the scope of application and further, as is the case in Hague, The Hague-Visby Rules following contracts in liner transport remain exempt: charter parties and other contracts for the use of a ship or of any space thereon. The Rotterdam Rules do not apply to contracts of carriage in non-liner transportation except when: there is no charter party or other contract between the parties for the use of a ship or of any space thereon, and a transport document or an electronic transport record is issued.

For the application of the Rotterdam Rules, the issuing of transport document is not necessary. That is a big difference in regard to the Hague-Visby Rules that apply only to the bills of lading issued for transport of goods between ports of two different countries. The key novelty of the Rotterdam Rules is that they apply to the electronic transport records and electronic transport documents. The contract for carriage can be concluded in electronic form, too. Widening of the fields of usage to electronic transport documents is a significant achievement of the convention and a very important aspect of it.

Volume contract in linear transport have entered within the fields of usage of the Rotterdam Rules; although, in relation to this kind of contracts, they can be withdrawn from the mandatory regulation of the Rotterdam Rules. This means that, volume contract to which The Rotterdam Rules apply may provide for greater or lesser rights, obligations and liabilities than those imposed by The Rotterdam Rules.

The most important and the most innovative aspect of the Rotterdam Rules is the extension of the scope of application to cover (under certain conditions) carriage preceding or subsequent to sea carriage. One of the important goals of making the new convention was to arrange the modern container door to door transport, meaning, with maritime, cover the segment of multi-modal transport as well. The Hague Rules apply only tackle-to-tackle, while the Hamburg Rules cover port-to-port shipments.

Article 26 of the Rotterdam Rules permits the liability, in some cases, to be resolved by mandatory provisions of international instruments relating to non-maritime transport. When loss of or damage to goods, or an event or circumstance causing a delay in their delivery, occurs during the carrier's period of responsibility but solely before their loading onto the ship or solely after their discharge from the ship, the provisions of Rotterdam Rules do not prevail over those provisions of another international instrument that, at the time of such loss, damage or event or circumstance causing delay:

a) Pursuant to the provisions of such international instrument would have applied to all or any of the carrier's activities if the shipper had made a separate and direct contract with the carrier in respect of the particular stage of carriage where the loss of, or damage to goods, or an event or circumstance causing delay in their delivery occurred;

[3] That is, the place of receipt and the place of delivery in different States, and in Contracting States there has to be any one of the following places: the place of receipt; the port of loading; the place of delivery; or the port of discharge (Article 5). This solution is similar to the Hamburg Rules (Article 2).

b) Specific provide for the carrier's liability, limitation of liability, or time for suit; and
c) Cannot be departed form by contract either at all or to the detriment of the shipper under the instrument.

This mesh system of responsibility is criticized for multiple reasons, and the main objections mentioned are: this does not solve the problem where, at the time of the conclusion of the contract, the mode of transport to be used is not yet known ("unspecified transport") [3], also, it cannot be known in advance on which part of the transport route the damage would appear, so that means that it cannot be predicted in advance which international convention will be used, the mesh system of responsibility is criticized for its complexity and failure of the International Multi-modal Transportation Convention (1980).

5. ELECTRONIC TRANSPORT RECORDS AND TRANSPORT DOCUMENTS AND ELECTRONIC TRANSPORT RECORDS

One of the most important novelties of the Rotterdam Rules, in relation with an existing law of Hague, Hague-Visby Rules and the Hamburg Rules is to provide on effective legal framework for the use of electronic transport records. Anything that is to be in or on a transport document under the Rotterdam Rules may be recorded in an electronic transport record, provided the issuance and subsequent use of an electronic transport record in with the consent of the carrier and the shipper; and the issuance, exclusive control, or transfer of an electronic transport record has the same effect as the issuance, possession, or transfer of a transport document (Article 8). Convention contains precise regulations about the procedures for use of negotiable electronic transport record and replacement of negotiable transport document or negotiable electronic transport record.[4]

These new regulations of the Rotterdam Rules bring us to the new conception and the role of transport documents and electronic transport records. This role is essentially and conceptually very different from the one that the bill of lading has in the Hague Rules. Pursuant to Article 35 of the Rotterdam rules, the shipper or, if the shipper consents, the documentary shipper, is entitled to obtain from the carrier, at the shipper's option issuance of: a non-negotiable transport document or non negotiable electronic transport record; or an appropriate negotiable transport document or, a negotiable electronic transport record. The provisions of the Rotterdam Rules also regulate which contract particulars must be included in the transport documents or electronic transport record.

Pursuant to the Rotterdam Rules carrier has a right to qualify the information relating to the goods in the contract particulars, as furnished by the shipper. Carrier is entitled to enter remarks in the transport documents in order to indicate that he does not assume responsibility for the accuracy of the information furnished by the shipper. Except to the extent that the contract particulars have been qualified by carrier, a transport document or an electronic transport record is prima facie evidence of the carrier's receipt of the goods as stated in the contract particulars. Proof to the contrary by the carrier in respect of any contract particulars shall not be admissible, when such contract particulars are included in a negotiable transport document or electronic transport record that is transferred to a third party acting in good faith or a non-negotiable transport document that indicates that it must be surrendered in order to obtain delivery of the goods and is transferred to the consignee acting in good faith.

The development of electronic commerce in maritime transport and electronic communication is contributed and encouraged by the concepts of the right of control, as well as the transfer of rights, as well as the more

[4] The use of a negotiable electronic transport record shall be subject to procedures that provide for: the method for the issuance and the transfer of the record to on intended holder; an assurance that the negotiable electronic transport record retains its integrity; the manner in which the holder is able to demonstrate that it is the holder; and the manner of providing confirmation that delivery to the holder has been effected, or that, the electronic transport record has ceased to have any effect or validity (Article 9).

contemporary regulations about the delivery of the goods.

6. OBLIGATION OF THE CARRIER

The Rotterdam Rules explicitly mention these obligations of the carrier:

1. Carriage the goods to the place of destination and deliver them to the consignee.

This is general obligation which arises from the nature of the object of the contract obligation.

2. The duty of care for the cargo

This obligation is applicable irrespective of the made of transport. The carrier shall properly and carefully receive, load, handle, stow, carry, keep, care for, unload and deliver the goods. Significant changes made by the Rotterdam Rules to the existing law is that the carrier and the shipper may agree that the loading, handling, stowing or unloading of the goods is to be performed by the shipper, the documentary shipper or the consignee.[5] The period of responsibility of the carrier for the goods under this Convention begins when the carrier or a performing party receives the goods for carriage and ends where the goods are delivered.

3. The duty to exercise due diligence in providing a seaworthy vessel.

The carrier is bound before, at the beginning of, and during the voyage by sea to exercise due diligence to: make and keep the ship seaworthy, properly crew, equip and supply the ship and keep the ship so crewed, equipped and supplied throughout the voyage and make keep the holds and all other parts of the ship fit and safe for their reception, carriage and preservation.

Fundamental novelty and change in relation to the Hague and Hague-Visby Rules is that duty applies throughout the entire sea voyage, not limited the due diligence obligation only to the beginning of the voyage.

4. The new obligation issued in the Rotterdam Rules is "carrier's execution of instructions" (Article 52).

The carrier shall execute the instructions in respect of the goods. The carriers is liable for loss of or damage to the goods, as well as for delay in delivery resulting form its failure to comply with the instructions of the controlling party in breach of its obligation.

7. LIABILITY OF THE CARRIER FOR LOSS, DAMAGE OR DELAY

Basis of liability pursuant the Rotterdam Rules is as well as pursuant the Hague Rules the presumed fault principle. It is considered that it is still not time to adoption of objective responsibility of the maritime carrier, as is in other transport conventions, for example, the Budapest Convention on the Contract for the Carriage of Goods by Inland Waterways, CMR and CIM-COTIF and in marine transport of passengers.
The burden of proof is assigned so that the claimant proves that the loss, damage, or delay, took place during the period of the carrier's responsibility. Claimant does not have to prove what the cause of the damage was, but only that the damage was made. When the claimant proves the damage did occur, the burden of proof is transferred to the carrier. The carrier is relieved of all or part of its liability if proves that the cause or one of the causes of the lost, damage, or delay is not attributable to its fault or to the fault of any other person for whose acts or omissions the carrier is liable pursuant Convention. The carrier is also relieved of all or part of its liability if, alternatively to proving the absence of fault, it proves that one or more "excepted peril" was responsible for the loss, damage or delay.[6] The carrier, for excepted

[5] There is an adjustment made relating to the mandatory nature of the carrier's obligation in those cases where the shipper has negotiated an FIOS shipment in his sales contract. The agreement is that the cargo interest (shipper and consignee) remain responsible for the loading and stowing and, at destination, for the discharging of the cargo. This agreement with the carrier is mirrored in the sales contract, as there – again –the seller and the buyer agree that the loading, stowing and discharging of the vessel will be for them to carry out and that each party is also responsible for demurrage that follows form any delay in those activities [6].

[6] In comparison with the Hague-Visby Rules excepted perils are supplemented and moderly styled. The most important difference is that an error in navigation is deleted from the excepted perils. Fire is put into the list of excepted perils. The

perils, would be responsible for damage on the basis of proved fault. That means that the existence one of the excepted perils creates only a presumption of non existence of the carrier's fault. Despite the fact of the existence of an event which excludes carrier's responsibility, beneficiary[7] can prove that the loss, damage, or delay was or probably caused by or contributed to bay the un-seaworthiness of the ship; the improper crewing, equipping, and supplying of the ship; or the fact that the holds or other parts of the ship in which the goods are carried were into fit and safe for reception, carriage, and preservation of the goods.

The key novelty of the Rotterdam Rules is that they spread the circle of persons for whose acts or omissions the carrier is liable pursuant Convention. The carrier is liable for the breach of its obligations under the Rotterdam Rules caused by the acts or omissions of any performing party, the master or crew of the ship, employees of the carrier or a performing party or any other person that performs or undertakes to perform any of the carrier's obligations under the contract of carriage, to the extent that the person acts, either directly or indirectly, at the carrier's request or under the carrier's right of control. According to the Hague-Visby**,** only the carrier's employees can use rights and limitations of responsibility to which the carrier can refer to. Such servant or an agent is not an independent contractor.

Under the Rotterdam Rules a maritime performing party is subject to the obligations and liabilities imposed on the carrier under the Rotterdam Rules and is entitled to the carrier's defences and limits of liability as provided for in the Rotterdam Rules under for the period while the maritime performing party had custody of the goods or at any other time to the extent that it was participating in the performance of any of the activities contemplated by the contract of carriage. Pursuant the Rotterdam Rules the liability of the carrier and one or more maritime performing parties is joint and several, but only up to the limits provided in the Convention. Their aggregate liability shall not exceed the overall limits of liability under the Convention.

Regulation on liability of the carrier for the delay and calculation of compensation novelties are in relation to the Hague-Visby Rules. The liability for delay is subject to the same scheme of liability and burden of proof as any other cargo damage claim. The liability for delay is, however, limited to two-and-a-half times the value of the freight, payable on the delayed cargo.

8. OBLIGATIONS OF THE SHIPPER TO THE CARRIER

Rotterdam Rules provides for a somewhat more detailed regulation of the obligations of shippers compared with Hague, the Hague-Visby Rules and the Hamburg Rules. It is important to mention that the context of the shipper's liability is a mandatory regime.[8]

The Rotterdam Rules issue these obligations of the shipper:

1. Shall deliver the goods ready for carriage.[9]

intention of composers of the Rotterdam Rules is the strickening of the responsibility for the fire because the carrier is responsible for the acts of his employees, too. In the list of the excepted perils are listed: piracy, terrorism and war (Article 17. paragraph 3 c); act and omission of the documentary shipper, the controlling party, or any other person for whose acts the shipper or the documentary shipper is liable (Article 17. paragraph 3 h); loading, stowing or unloading of the goods performed by the shipper, the documentary shipper or the carriage (Article 17. paragraph 3 i); reasonable measures to avoid or attempt to avoid damage to the environment (Article 17. paragraph 3 m).

[7] Beneficiary is a person having specific rights under a contract for the carriage of goods (charterer, shipper, consignee).

[8] Any term in a contract of carriage is void to the extent that it: directly or indirectly excludes, limits or increases the obligations under this Convention of the shipper, consignee, controlling party, holder or documentary shipper or directly or indirectly excludes, limits or increases the liability of the shipper and other persons for breach of any of its obligations under Rotterdam Rules (Article 79 paragraph 2).

[9] In any event, the shipper shall deliver the goods in such condition that they will withstand the intended carriage, including their loading, handling, stowing, lashing and securing, and unloading, and that they will not cause harm to persons or property (Article 27 paragraph 1)

2. Shall properly and carefully perform any obligation assumed under an agreement.
3. Shall cooperate with carrier in providing information and instructions.[10]
4. Shall provide to the carrier in a timely manner information, instructions and documents relating to the goods.
5. Shall provide to the carrier, in a timely manner, accurate information required for the compilation of contract particulars and the issuance of the transport documents or electronic transport records (Article 31).
6. Shall inform the carrier of the dangerous nature or character of the goods before they are delivered to the carrier or a performing party.
7. Shall mark or label dangerous goods.

If all those obligations are not properly carried out, the shipper will be liable. The shipper is relived of all or a part of its liability if the cause or one of the causes of the loss or damage is not attributable to its fault or to the fault of any person for whose acts or omissions the shipper is liable pursuant Convention. The shipper is liable for the breach of its obligations under Convention caused by the acts or omissions of any person, including employees, agents and subcontractors, to which it has entrusted the performance of any of its obligations.

9. DELIVERY OF THE GOODS

Very often the bill of lading is not in the hands of the consignee when the goods arrive and the consignee claims delivery. If the carrier delivers without the bill of lading, the consequences today are not regulated by international conventions. The consequences are under many national laws strict and unlimited liability, if the goods should have been delivered to somebody else [4]. Chapter 9 of the Rotterdam Rules addresses these issues and contains detailed new rules on delivery of the goods.

Obligation to accept delivery when the goods have arrived at their destination as well as obligation to acknowledge receipt is especially articulated as obligations in the Rotterdam Rules. The delivery of goods is compound action in transport business, and the novelty of the Rotterdam Rules is that it, for the first time, regulates the obligations and rights of both carrier and cargo interest at the destination.

When the goods have arrived at their destination, the consignee that demands delivery of the goods under the contract of carriage shall accept delivery of the goods. Carrier is entitled to request acceptance of the goods by the consignee. On request of the carrier or the performing party that delivers the goods, the consignee shall acknowledge receipt of the goods from the carrier or the performing party. The carrier may refuse delivery if the consignee refuses to acknowledge such receipt (Article 44).

The Rotterdam Rules specifically regulate the rules for delivery of the goods when neither a negotiable transport document nor a negotiable electronic transport record has been issued,[11] delivery when a non-negotiable transport document has been issued that indicates that it shall be surrendered in order to obtain delivery of goods[12] and delivery when a negotiable

[10] It is about the information and instructions which are necessary for proper handling and carriage of the goods if the information is in the requested party's possession or the instructions are within the requested party's reasonable ability to provide an they are not otherwise reasonably available to the requesting party (Article 28).

[11] The carrier shall deliver the goods to the consignee. The carrier may refuse delivery if the person claiming to be the consignee does not properly identify itself as the consignee on the request of the carrier. If the goods are not deliverable, the carrier may so advise controlling party. If, after reasonable effort, the carrier is unable to locate the controlling party, the carrier may so advice the shipper. If, after reasonable effort, the carrier is unable to locate the shipper, the carrier may so advice the documentary shipper and request instructions in respect of the delivery of goods. The carrier that delivers the goods upon instruction of the controlling party, the shipper or the documentary shipper, is discharged from its obligation to deliver the goods under the contract of carriage.

[12] The carrier shall deliver the goods to the consignee upon the consignee properly identifying itself on the request of the carrier and surrender of the non-negotiable document. The carrier may refuse delivery if person claming to be the consignee fails to properly identify itself, and shall refuse delivery if the non-negotiable document is not surrendered. If

transport document or negotiable electronic transport record has been issued.[13] The obligations of the parties and implications of their responsibility for not fulfilling the obligations that are a part of the commitment of handing over the goods are regulated in detail.

The Rotterdam Rules, also clearly prescribe the treatment in cases when the goods remain undelivered. If the goods have remained undelivered, the carrier may, at the risk and expense of the person entitled to the goods, take such action in respect of the goods as circumstances may reasonably require, including to store the goods, to unpack the goods if they are packed in containers or vehicles, or to act otherwise in respect of the goods, including moving them and to cause the goods to be sold or destroyed.

Within the chapter 9 “Delivery of the goods” the right of the carrier or a performing party that may exist pursuant to the contract of carriage or the applicable law to retain the goods to secure the payment of sums due is normalized (Article 49).

10. RIGHTS OF THE CONTROLLING PARTY AND TRANSFER OF RIGHTS

The right of control is for the first time regulated by marine-law convention, meaning, this is an important novelty and a very recent solution of the Rotterdam Rules. In the comparative law some forms of the rights of control are regulated in railway and road transport laws. The Rotterdam Rules precisely define and regulate all relevant questions. Right of control of the goods means the right under the contract of carriage to give the carrier instructions in respect of the goods. Extent of right of control is limited to the right to: a) give or modify instructions in respect of the goods that do not constitute a variation for the contract of carriage; b) obtain delivery of the goods at a scheduled port of call, or, in respect for inland carriage, any place en route; and c) replace the consignee by any other person including the controlling party. Pursuant to the Rotterdam Rules, controlling party means the person that is entitled to exercise the right of control. In fact, in practice, but also according to the text of the convention, the shipper is the controlling party unless the shipper, when the contract of carriage is concluded, designates the consignee, the documentary shipper or another person as the controlling party. The controlling party is entitled to transfer the right of control to another person. The transfer becomes effective with respect to the carrier upon its notification of the transfer by transferor. When a non-negotiable transport document has been issued which indicates that it shall be surrendered in order to obtain delivery of the goods, the shipper is the controlling party and may transfer the right of control to the consignee named in the transport document by transferring the document to that person without endorsement. When a negotiable transport document is issued the holder or, if more than one original of the negotiable transport document is issued, the holder of all originals is the controlling party. The holder may transfer the right of control by transferring the negotiable transport document to another person. When the negotiable electronic transport record is issued the holder is the controlling party and may transfer the right of control by transferring the negotiable electronic transport record.

The Rotterdam Rules, in separate chapter, regulate the methods of transferring rights incorporated in the negotiable transport document or electronic transport record. A holder that is not the shipper and that does not exercise any right under the contract of carriage

more than one original of the non-negotiable document has been issued, the surrender of one original will suffice and the other originals cease to have any effect or validity. If, after reasonable effort, the carrier is unable to locate consignee and shipper the carrier may so advice the documentary shipper and request instructions in respect of the delivery of goods. The carrier that delivers the goods upon instruction of the shipper or the documentary shipper, is discharged from its obligation to deliver the goods under the contract of carriage, irrespective of whether the non-negotiable transport document has been surrounded to it.

[13] The holder of the negotiable transport document or negotiable electronic transport record is entitled to claim delivery of the goods from the carrier after they have arrived at the place of destination, in which event the carrier shall deliver the goods. If more than one original of the negotiable transport document has been issued, and the number of originals is stated in that document, the surrender of one original will suffice and the other originals cease to have any effect or validity.

does not assume any liability under the contract of carriage solely by reason of being a holder. A holder that is not the shipper and that exercises any right under the contract of carriage assumes any liabilities imposed on it under the contract of carriage to the extent that such liabilities are incorporated in or ascertainable from the negotiable transport document or the negotiable electronic transport record.
Regulations about the right of control are very important for international trade of goods and its economic and fast progress. The Rotterdam Rules, with their regulations, enable the sellers, due to the right of control, to control goods during transport and access the goods during transport.

11. LIMITS OF LIABILITY

The Rotterdam Rules, compared with the current conventions in this area, raise the limit of the carriers responsibilities to 875 SDRs per package and 3 SDRs per kilogram.[14] Like the Hamburg Rules, they contain the regulation about the maximum of the responsibility for the delay. As is common, in other transport conventions, the height of limitations for the delay is connected with the amount of the fare. Liability for economic loss due to delay is limited to an amount equivalent to two and one–half times the freight payable on the goods delayed. The total amount payable may not exceed the limit that would be established pursuant Convention in respect of the total loss of the goods concerned.
The carrier's liability for breaches of its obligations under Convention is limited. With the known obligations to the ship and to care for the cargo, there is the responsibility for the obligation of giving information and instructions and the obligation to follow the instructions from the person with the right of control.

In comparison with the Hague-Visby Rules, there is a huge difference in relation to the regulation that says about the loss of the rights to limited responsibility. Pursuant to Article 61 neither the carrier nor any of other person liable under the Convention, is entitled to the benefit of the limitation of liability if the claimant proves that the loss resulting from the breach of the carrier's obligation under this Convention was attributable to a personal act or omission of the person claiming a right to limit, done with the intent to cause such loss or recklessly and with knowledge that such loss would probably result.[15]

12. TIME OF SUIT

Time-bar predicted by the Rotterdam Rules applies to both parties of the contract.[16] This is an important novelty because the Hague-Visby Rules, the right to use the time-bar, assure only to the carrier and the ship. Also, the period of time for suit is lengthened in comparison with the Hague-Visby Rules. Under the Hague-Visby Rules, a cargo claimant has one year in which to file its action against the carrier before such an action would be time-barred. The Rotterdam Rules extended this period to two years. This period commences on the day on which the carrier has delivered the goods or, in cases in which no goods have been delivered or only part of the goods have been delivered, on the last day on which the goods should have been delivered. The day on which the period commences is not included in the period.

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[14] The Hague Rules contain a per package limitation amount of carrier liability £100 sterling. Hague-Visby Rules have a per package limitation 666.67 SDRs and a per kilogram limitation 2 SDRs always applying the higher amount. The Hamburg Rules have a per package limitation amount 835 SDRs and 2,5 SDRs per kilogram.

[15] Also, any of other person entitled to the benefit of the limitation of liability to the Convention lose the right to limit of liability if the claimant proves that the delay in delivery resulted form a personal act or omission of the person claiming a right to limit done with the intent to cause the loss due to delay or recklessly and with knowledge that such loss would probably result. Huybrechts concludes: "It will be difficult to deny the carrier the benefit of limitation of liability as henceforth one will have to prove "personal" intent of the carrier or his "personal" reckless act, i.e., that it is not sufficient to prove intent or gross negligence of the employees or persons acting on his behalf" [2].

[16] "…Claims or disputer arising from a breach of an obligation under this Convention…".

13. JURISDICTION AND ARBITRATION

The Hague-Visby Rules did not determine the question of jurisdiction and Arbitration. The Rotterdam Rules, concurrently to the Hamburg Rules, arrange this question. However, the Rotterdam Rules issue that the Chapter 14 "Jurisdiction" shall bind only Contracting States that declare that they will be bound by them. Unless the contract of carriage contains an exclusive choice of court agreement, the plaintiff has the right to institute judicial proceedings under the Rotterdam Rules against the carrier in a competent court within the jurisdiction of which is situated one of the following places: a) the domicile of the carrier; b) the place of receipt agreed in the contract of carriage; c) the place of delivery agreed in the contract of carriage; or the port where the goods were initially loaded on a ship or the port where the goods were finally discharger from a ship.
Alternatively, the Rotterdam Rules permit that the plaintiff has the right to institute judicial proceedings under the Rotterdam Rules in a competent court or courts designated by an agreement between the shipper and the carrier for the purpose of deciding claims against the carrier that may arise under the Rotterdam Rules. However, such a court will be exclusive for disputes between the parties to the contract only if the parties so agree and the agreements conferring jurisdiction are contained in a volume contract.

14. VALIDITY OF CONTRACTUAL TERMS

Like the Hague and the Hague-Visby Rules, the Rotterdam Rules provide that any term in a contract of carriage is void to the extent that it excludes or limits the obligations of the carrier or a maritime performing party under Convention and excludes or limits the liability of the carrier or a maritime performing party for breach of an obligation under Convention (Article 79). The context of the carrier's liability is a mandatory regime. Parties are not permitted to specify or adopt the rules, as they can under standard contract law. Also, regulations about validity of contractual terms apply against the cargo owner (i.e. shipper, documentary shipper, controlling party, consignee and holder). The Rotterdam Rules provide that any term in a contract of carriage is void to the extent that excludes, limits or increases the liability of the shipper, consignee, controlling party, holder or documentary shipper for breach of any of its obligations under Convention.
The Rotterdam Rules prescribe special rules of the carriage of live animals and other shipments that are not "ordinary commercial shipments". Than, the contract of carriage may exclude or limit the obligations or the liability of both, the carrier and a maritime performing party. Also, a volume contract, to which this Convention applies, may provide for greater or lesser rights, obligations and liabilities than those imposed by Convention. However there are a number of provisions from which a volume contract can never derogate: the carrier's obligation to make and keep the ship seaworthy, properly crew, equip and supply the ship and keep the ship so crewed, equipped and supplied throughout the voyage (Article 14, subparagraphs (a) and (b); the shipper's obligation to provide information, instructions and documents (Article 29); special rules on dangerous goods (Article 32) and the loss of the benefit of the limitation on liability of the carrier (Article 61).

15. MATTERS NOT GOVERNED BY THIS CONVENTION

In a special chapter (chapter 17 – Matters not governed by this convention) the Rotterdam Rules deal with the problem of overlap between the Rotterdam Rules and existing uni-modal international conventions in force. The Rotterdam Rules, providing that nothing in the Rotterdam Rules affects the application of:
a) Any convention governing the carriage of goods by air to the extent that such convention, according to its provisions, applies to any part of the contract of carriage;
b) Any convention governing the carriage of goods by road to the extent that such convention, according to its provisions, applies to the carriage of goods that remain loaded on a road cargo vehicle carried on board a ship;
c) Any convention governing the carriage of goods by rail to the extent that such convention,

according to its provisions, applies to carriage of goods by sea as a supplement to the carriage by rail;

d) Any convention governing the carriage of goods by inland waterways to the extent that such convention, according to its provisions, applies to a carriage of goods without trans-shipment both by inland waterways and sea.

Also, the Rotterdam Rules do not apply to a contract of carriage for passengers and their luggage. Nothing in the Rotterdam Rules affects the application of any international convention or national law regulating the global limitation of liability of vessel owners. Moreover, the Rotterdam Rules do not affect the application of terms in the contract of carriage or provisions of national law regarding the adjustment of general average. No liability arises under the Rotterdam Rules for damage caused by a nuclear incident if the operator of a nuclear installation is liable under any other applicable international or national legal instrument.

16. FINAL CLAUSES

The Rotterdam Rules enters into force on the first day of the month following the expiration of one year after the date of deposit of the twentieth instrument of ratification, acceptance, approval or accession. Until March 22, 2012 the Rotterdam Rules were signed by 24 countries, and only one ratified the Rotterdam Rules, that is Spain.[17] To achieve the higher level of harmonization of legal regime in international carriage of goods, it is prescribed that a State that ratifies, accepts, approves or accedes to the Rotterdam Rules and is a party to the Hague Rules, the Hague-Visby Rules and the Hamburg Rules, shall denounce that Convention and the protocol or protocols thereto which is a party by notifying the Government of Belgium to that effect. Also, the Rotterdam Rules issue that no reservation is permitted to the Rotterdam Rules.

CONCLUSIONS

Today, in the area of legal regulation of maritime transport of goods there are a few conventions and different variations of national law are present too, but many institutes and legal solutions are objected to of being outdated and misfit to the contemporary way of doing business.

The aim of the Rotterdam Rules is to unify and modernize the legal regime governing the international carriage of goods by sea. The Rotterdam Rules take into account modern transactions and the needs of subjects participating in the carriage of goods by sea.

Basic marks of this convention and significant novelties regarding the current Hague-Visby system are: the application of the convention under certain conditions to other transportation branches, the deletion of the nautical fault defence, introduction of new excepted perils (e.g. piracy, terrorism, act and omission of the documentary shipper), continuous duration of the carrier's duty to exercise due diligence in providing a seaworthy vessel, obligation of the carrier to follow instructions of the controlling party, the rights of controlling party and transfer of rights, the innovations regarding the liability of performing parties, increase of the liability limits, the unlimited shipper's liability to the carrier, the provisions on electronic documents, the freedom of contract provisions for volume contracts.

The Rotterdam Rules, until March 22, 2012, has only a single ratification (Spain). That fact does not promise that it will, in foreseeable future, be put into effect. The circumstance which makes the reception more difficult is, in the first place, complicated mesh system of responsibilities and impossibility of prediction where the damage will occur and which convention would be used. The existence of multiple parallel systems of responsibilities and the possibility of using multiple conventions and rules of responsibilities to one multimodal contract of carriage excludes the predictability and equalization and reduces legal security, increases costs and the number of litigations. Failure of Multimodal convention, as an attempt of complete unification of the transport law, broadens the doubt in failure of the Rotterdam Rules. To the sluggishness and absence of wider reception can influence also that the uni-modal conventions in other transportation branches are very efficient and

17 http://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XI-D-8&chapter=11&lang=en, last checked on March 22, 2012.

are regularly modernized with new changes and additions. Also, the attachment of the business subjects to the Hague Rules and long lasting practice in their usage are not the incentive for faster and more comprehensive acceptance of the Rotterdam Rules, which are much more extensive, more descriptive and have very complex and complicated regulations for interpreting, compared to the Hague Rules. The appearance of the Rotterdam Rules on international scene is supposed to additionally violate confidence in the Hamburg Rules, because the Rotterdam Rules are more contemporary and in much more similar to the Hague Rules. If the Rotterdam Rules are not put into effect, it can lead to even larger de-unification, because it will come to the making of regional instruments, and countries will bring their national regulations of different content. EU will establish the regional legal regulation which will be valid in the EU and organize the transport within the EU. The maritime door to door transport needs international and global solutions, and regional and national solutions do not bring the unification of the transport law. Every convention is a result of compromises of different interests of the subject participants in the transport business. The Rotterdam Rules tried, in the best way possible, to reconsolidate different interests and to create new legal regulation of transporting goods adjusted to the contemporary transport door to door. In this moment, there is no answer to the question if the Rotterdam Rules will be put into force. The success of this Convention will depend on big maritime commercial powers, such as USA, EU, China, Japan, Australia and others, to ratify the Rotterdam Rules.

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BIOGRAPHIE

Vesna Skorupan Wolff was born in Zagreb. She has graduated law at the Faculty of Law, University of Zagreb (LL.B.) in 1993. In 1999 she gained her LL.M. She earned her Ph.D. in 2005 at the Faculty of Law, University of Zagreb. Her doctoral thesis was *Liability of the Maritime Carrier*. She passed her Bar exam in 1995. Since 2003 she is employed at the Adriatic Institute of Croatian Academy of Science and Arts. She is currently senior research associate. She held two other posts before starting to work at the Adriatic Institute. She worked in a private attorney office and at the Supreme Court of Republic of Croatia. She has published over 50 scientific and professional papers. She has participated in numerous domestic and several international conferences related to maritime law. Since 2007, she is an associate on the scientific project *Croatian Maritime Legislation and the EU Law*. She won the prize of the Croatian bar association - professional periodical publication *Odvjetnik* for the best paper in the 1995. She is a member of the Editorial Board of the scientific periodical publication *Comparative Maritime Law*. She is a member of the *Croatian Association of Maritime Law*. Her scientific interests include maritime law.

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PROTECTION OF THE RIGHTS OF PASSENGERS TRAVELLING BY SEA

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ABSTRACT

Strengthening the rights of passengers became one of the top priorities of the worldwide shipping community. This paper is aimed an analyzing the level of protection of the rights of maritime passengers. Such analyses aims at helping all parties involved (directly or indirectly) in the maritime passenger transport. It may help carriers toward an effective application of the relevant laws. It may also help national authorities towards a harmonized enforcement of passenger protection. Finally, it may help passengers toward a better understanding of their legal position. Rights of passengers carried by sea are established by various sources of international law, law of the European Union and Croatian domestic law. Such rights are, for example, right to non-discrimination in access to transport, right to mobility (especially important for disabled passengers and passengers with reduced mobility), right to information, right to fulfilment of the transport contract, right to get assistance, right to compensation under certain circumstances, right to an effective system of complaint handling etc. Provisions of the Croatian Maritime Code are compared to the solutions provided by the relevant EU legislation and the 2002 Athens Convention (the newest international convention governing this issue). In the concluding part, the author suggests some amendments to Croatian Maritime Code in order to bring into line Croatian domestic law with the law of European Union on this subject. He also points out the crucial importance of the effective enforcement of the rules dealing with the passenger rights.

KEY WORDS

contract for the carriage of passengers by sea. rights of passengers travelling by sea. 2002 Athens Convention. EU maritime legislation. Croatian Maritime Code. liability of the sea carrier.

1. INTRODUCTION

The adequate protection of passengers on board ships is a key concern of the European transport policy. It is also one of the main concerns of the International Maritime Organization (IMO). Strengthening the rights of sea passengers became one of the top priorities of the worldwide shipping community following the occurrence of a number of tragic shipping accidents in past decades. Significant legislative instruments have been adopted at international and EU level in recent years aiming to ensure that passengers benefit from the high level of protection. New passengers' rights have been established and carriers' obligations imposed. This paper represents an analytic overview of the passengers' rights under the sources of maritime law as well as under the sources of consumer protection law and tourist law. Some conclusions shall be brought regarding the level of alignment between the international, EU and Croatian domestic law governing rights of passengers travelling by sea. Furthermore, some suggestions shall be made in order to bring into line all mentioned sources of law.

2. THE RIGHTS OF PASSENGERS UNDER THE SOURCES OF MARITIME LAW

The primary source of the legal relationship between a passenger and the carrier is the contract of carriage by sea. Contractual provisions may, however, be overridden by the compulsory provisions of international conventions, EU directives and regulations as well as of national statutes.

There are various sources of maritime law which may be applicable to this subject. Many issues relating to the rights of passengers in the event of death of or bodily injury to a passenger are regulated by the Athens Convention Relating to the Carriage of Passengers and their Luggage by sea, 1974 (hereafter - Athens Convention) [1]. The Athens Convention, as amended by its 1976 SDR Protocol, provides an international compensation regime for the death, injury and loss of damage to the passengers' luggage between the states that have accepted the Convention (*infra*, chapter 2.4.)[1]. However, some other maritime conventions may also be applicable, for example the 1976 Convention on Limitation of Liability for Maritime Claims (hereafter - LLMC 1976), as amended by the 1996 Protocol.

Furthermore, there are various applicable sources of the maritime law of European Union. Issues regarding damages in the event of death of or bodily injury to a passenger and in the event of damage to baggage are covered by the Regulation (EC) No 392/2009 of the European Parliament and of the Council of 23 April 2009 on the liability of carriers of passengers by sea in the event of accidents (hereafter - Regulation 392/2009)[2]. This Regulation incorporates in EU law provisions of the Protocol of 2002 to the Athens Convention (Annex I to the Regulation 392/2009). It also makes binding parts of the IMO Reservation and Guidelines for Implementation of the Athens Convention adopted by the Legal Committee of the IMO (Annex II to the Regulation 392/2009).[3]

The protection of other maritime passengers' rights in the EU is based on the Regulation (EU

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[1] The Athens Convention came into force on 28 April 1987. The Republic of Croatia is a State Party to the Athens Convention as well as to the 1976 SDR Protocol, see "Narodne novine - Međunarodni ugovori" (Official Gazette - International Agreements) No. 2/1997. The current list of states which ratified the Athens Convention and its 1976, 1990 and 2002 Protocols may be found at http://www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx.

[2] OJ L 131, 28 May 2009, p. 24. The Regulation shall apply from the date of the entry into force of the Athens Convention for the EU and in any case from no later than 31 December 2012. It shall apply to any international carriage and to carriage by sea within a single Member State onboard ships covered by Class A and B in accordance with Article 4 of Directive 98/18/EC, if the ship is flying the flag of or is registered in a Member State, or the contract of carriage has been made in a Member State, or the place of departure or destination, according to the contract of carriage, is in a Member State. In respect of carriage by sea within a single Member State on board ships of Class A, Member States may choose to defer application of this Regulation until four years after the date of its application. In respect of carriage by sea within a single Member State on board ships of Class B, Member States may choose to defer application of the Regulation until 31 December 2018.

[3] The European Union acceded to the Protocol of 2002 to the Athens Convention, see Council Decisions of 12 December 2011 (2012/2/22/EU and 2012/2/23/EU), OJ L 8, 12.1.2012, p.1-15.

No 1177/2010 of the European Parliament and of the Council of 24 November 2010 concerning the rights of passengers when travelling by sea and inland waterway and amending Regulation (EC) No 2006/2004 (hereafter - Regulation 1177/2010)[4]. The Regulation 1177/2010 imposes various obligations on maritime carriers, terminal operators, travel agents and tour operators, especially in the event of interrupted travel as well as in the case of carriage of disabled persons and persons with reduced mobility[5]. It also imposes some obligations on EU Member States. Each Member State must designate a new or existing body or bodies responsible for the enforcement of the Regulation 1177/2010 as regards passenger services and cruises from ports situated on its territory and passenger services from a third country to such ports[6]. The Regulation 1177/2010 shall apply from 18 December 2012 in respect of passengers travelling

- on passenger services where the port of embarkation is situated in the territory of a Member State;
- on passenger services where the port of embarkation is situated outside the territory of a Member State and the port of disembarkation is situated in the territory of a Member State, provided that the service is operated by an EU carrier;
- on a cruise where the port of embarkation is situated in the territory of a Member State[7].

The Regulation 1177/2010 in Article 21 explicitly prescribes that its provisions shall not preclude passengers from seeking damages in accordance with national law in respect of loss resulting from cancellation or delay of transport services before national courts, including under so-called Package Directive 90/314/EC (*infra*, chapter 3.). Therefore, the Regulation 1177/2010 does not preclude passengers from seeking further damages, in addition to claims prescribed by the Regulation itself, if these further damages are recoverable under the applicable national law or EU legislation.

As far as the Croatian maritime and transport legislation is concerned, the provisions of the Maritime Code[8] may be applicable, as well as

[4] OJ L 334, 17.12.2020, p. 1

[5] Beside the specific passengers' rights which are more precisely described in this paper (*infra,* 2.1.-2.3.), the Regulation 1177/2010 establishes the general right on travel information available to the passenger. Carriers, terminal operators and, when applicable, port authorities shall, within their respective areas of competence, ensure that information on the rights of passengers is publicly available on board ships, in ports, if possible, and in port terminals. The information must be provided as far as possible in accessible formats and in the same languages as those in which information is generally made available to all passengers. Carriers and terminal operators shall set up an accessible complaint-handling mechanism for rights and obligations prescribed by the Regulation 1177/2010. When a passenger wants to make a complaint to the carrier or terminal operator, he shall submit it within 2 months from the date on which the service was performed or when a service should have been performed. Within 1 month of receiving the complaint, the carrier or terminal operator shall give notice to the passenger that his complaint has been substantiated, rejected or is still being considered. The time taken to provide the final reply shall not be longer than 2 months from the receipt of a complaint.

[6] Each body has to be independent of any commercial interest. The passenger may submit a complaint, in accordance with national law, to the designated body, about an alleged infringement of the Regulation 1177/2010. A Member State may decide that a passenger as a first step shall submit the complaint to the carrier or terminal operator; and/or that the national enforcement body or any other competent body shall act as an appeal body. National enforcement body shall every 2 years publish a report on its activities. National enforcement bodies of different Member States must cooperate. Finally, each Member State shall lay down rules on penalties applicable to infringements of the provisions of the Regulation 1177/2010.

[7] By contrast, the Regulation 1177/2010 shall not apply in respect of passengers travelling on ships certified to carry up to 12 passengers; on ships which have a crew responsible for the operation of the ship composed of no more than three persons or where the distance of the overall passenger service is less than 500 metres, one way; on excursion and sightseeing tours other than cruises; or on ships propelled by mechanical means as well as original, and individual replicas of, historical passenger ships designed before 1965, built predominantly with the original materials, certified to carry up to 36 passengers. Member States may, for a period of 2 years from 18 December 2012, exempt from the application of the Regulation 1177/2010 seagoing ships of less than 300 tons operated in domestic transport, provided that the rights of passengers under the Regulation 1177/2010 are adequately ensured under national law. Member States may exempt from the application of the Regulation 1177/2010 passenger services covered by public service obligations, public service contracts or integrated services provided that the rights of passengers under the Regulation 1177/2010 are comparably guaranteed under national law.

[8] See „Narodne novine“(Official Gazette) No. 181/2004, 76/2007, 146/08, 61/2011. Relevant provisions of the

the provisions of the Act on Compulsory Traffic Insurance (hereafter - ACTI)[9].

2.1. Rights in cases of cancelled or delayed departures

Under the provisions of Regulation 1177/2010, in the case of a cancellation or a delay in departure, passengers shall be informed by the carrier or by the terminal operator, of the situation (and of the estimated departure time and estimated arrival time) as soon as possible and in any event no later than 30 minutes after the scheduled time of departure.

Where a carrier reasonably expects the departure of a passenger service to be cancelled or delayed for more than 90 minutes beyond the scheduled time of departure, passengers shall be offered free of charge meal and refreshment, provided they are available or can reasonably be supplied. In the case of a cancellation or a delay in departure where a stay of one or more nights becomes necessary, the carrier shall offer passengers free of charge adequate accommodation on board, or ashore. For each passenger, the carrier may limit the total cost of accommodation, not including transport to and from the port terminal and place of accommodation, to EUR 80 per night, for a maximum of three nights. [10] Moreover, the passenger shall immediately be offered the choice between:

- re-routing to the final destination, under comparable conditions, as set out in the transport contract, at the earliest opportunity and at no additional cost;
- reimbursement of the ticket price and a return service free of charge to the first point of departure, at the earliest opportunity.

The payment of the reimbursement shall be made within 7 days, in cash, by electronic bank transfer, bank order or bank cheque. Where the passenger agrees, the reimbursement may also be paid in the form of vouchers and/or other services.

The Maritime Code contains different provisions regarding passengers' rights in these cases. Under the Article 606, in the case of voyages limited to the internal waters of the Republic of Croatia, a passenger may cancel the contract if the ship does not commence the voyage within one hour after the time stated in the contract or in the ship's timetable, or within 12 hours in the case of voyages beyond the said limits. Moreover, the passenger shall have the right to reimbursement of the ticket price.

If the delayed departure is caused by the act of the carrier or persons in his service, committed with the intent or gross negligence, the carrier shall be bound to compensate the passenger for damages.

Under the Article 610 of Maritime Code, if a voyage limited to the internal waters of the Republic of Croatia is interrupted for more than 12 hours after commencement for reasons not caused by the passenger, or in case of a voyage beyond the said limits which is interrupted for more than three days, the passenger shall have the right:

- to request the carrier to carry him and his luggage to his destination by the carrier's own means of transportation or by other adequate means;
- to request the carrier to return him and his luggage to the port of departure within a reasonable period of time and to reimburse him for the ticket price;
- to cancel the contract and request the carrier to reimburse him for the ticket price.

If the voyage has been interrupted with the intent or the gross negligence of the carrier, or of persons in his service, the carrier shall be bound to compensate the passenger for damages[11].

2.2. Rights in the event of delay in arrival

According to Regulation 1177/2010, in the event of delay in arrival at the final destination,

Maritime Code are quite similar to provisions of the Athens Convention as amended by the 1990 Protocol.

[9] See „Narodne novine"(Official Gazette) No. 151/2005, 36/2009, 75/2009.

[10] However, if the carrier proves that the cancellation or delay is caused by weather conditions, endangering the safe operation of the ship, he shall not be obliged to offer accommodation.

[11] The Maritime Code prescribes certain formalities regarding enforcement of abovementioned passenger's rights (Article 611). Furthermore, the Maritime Code separately regulates the passenger's right to cancel the contract before its commencement even if the carrier fulfils his obligations. Depending on the circumstances prescribed by Articles 608-611, the passenger shall have the right to reimburse at least 90% of the ticket price.

the passenger is entitled to the minimum amount of compensation (25% of the ticket price) for a delay of at least:

- 1 hour in the case of a scheduled journey of up to 4 hours;
- 2 hours in the case of a scheduled journey of more than 4 hours, but not exceeding 8 hours;
- 3 hours in the case of a scheduled journey of more than 8 hours, but not exceeding 24 hours; or
- 6 hours in the case of a scheduled journey of more than 24 hours.

If the delay exceeds double the abovementioned time, the compensation shall be 50% of the ticket price. It shall be paid in vouchers and/or other services, or in money, but only at the request of the passenger.[12]

However, the passenger shall not be entitled to compensation if the carrier proves that the cancellation or delay is caused by weather conditions endangering the safe operation of the ship or by extraordinary circumstances hindering the performance of the passenger service which could not have been avoided even if all reasonable measures had been taken. Furthermore, the passenger shall not be entitled to such compensation in cases when he was informed of the cancellation or delay before the purchase of the ticket or if the cancellation or delay is caused by the fault of the passenger.

The Athens Convention does not regulate passenger's rights (or carrier's obligations) in the case of delay in arrival. Similarly, this topic is not regulated under the Maritime Code. In the context of Croatian domestic legislation, this issue may be solved by application of the Law on Obligations (Article 696)[13]. This provision prescribes that the carrier is liable for the damages arising from delayed carriage, except in cases where the cause of delay could not be avoided even with the use of carrier's professional diligence.

2.3. Rights of disabled passengers and passengers with reduced mobility

The Regulation 1177/2010 addresses the issue of non-discrimination and assistance for disabled persons and persons with reduced mobility (Articles 7-15). Carriers must not refuse to accept reservations, issue tickets or embark persons on the grounds of disability or of reduced mobility, and nor must tickets be offered at an additional cost. However, reservations and tickets may be refused to disabled persons or persons with reduced mobility in order to meet applicable safety requirements and where the design of the passenger ship or port infrastructure and equipment makes the safe embarkation, disembarkation or carriage of disabled persons impossible. In such cases, carrier (as well as travel agents and tour operators) shall take all reasonable efforts to find the alternative means of transport for the person concerned.

Furthermore, carriers and terminal operators shall be liable for loss suffered as a result of the loss of or damage to mobility equipment or other specific equipment, used by a disabled person or person with reduced mobility, if the incident which caused the loss was due to the fault of neglect of the carrier or the terminal operator. The fault or neglect of the carrier shall be presumed for loss caused by a shipping incident. This compensation shall correspond to the replacement value of the equipment concerned or, where applicable, to the costs relating to repairs. However, these rules shall not apply if the relevant provisions of the Regulation 392/2009 applies (*infra*, chapter 2.4.).

2.4. Rights in the event of death or personal injury to a passenger and in the event of damage to baggage

2.4.1. Current status

At the moment, the Athens Convention, as amended by the 1976 SDR Protocol, provides an international compensation regime in force for the death of or personal injury to a passenger, as well as for the loss of or damage to the passengers' luggage between the states that have accepted the Convention. The Athens Convention applies to international carriage (carriage in which the place of departure and the place of destination are situated in two different states, or in a single state if there is an

[12] Carriers may introduce a minimum threshold under which payments for compensation will not be paid. This threshold shall not exceed EUR 6.

[13] See Narodne novine (Official Gazette), No. 35/2005, 41/2008.

intermediate port of call in another state) if at least one of the further conditions are met:

- the ship is flying the flag of, or is registered in, a convention state;
- the contract of carriage was made in a convention state;
- the carriage commences or terminates in a convention state.

A passenger is defined as “any person carried in a ship under a contract of carriage or a person which, with the consent of the carrier, is accompanying a vehicle or live animals which are covered by a contract for the carriage of goods not governed by the convention. The carrier is the party with whom the passenger concludes the contract of carriage, whether or not that party actually performs all or any part of the contract of carriage himself. The carrier may arrange for another carrier (the performing carrier) to perform part (or all) of the contract. However, in this situation the contracting carrier still remains liable for the whole of the carriage to the passenger. The performing carrier will also be liable to the passenger for the part of the contract carried out by them.

The carrier (which in this context includes both the contracting and performing carrier) is liable if the death of or personal injury to a passenger is caused through their fault or neglect. The carrier will be liable for the acts and omissions of their employees or agents acting in the scope of their employment.

In cases of shipwreck, collision, stranding, explosion, fire or defect in a ship, fault or neglect will be presumed to exist and it will be up to the carrier to prove the contrary. In all other cases the passenger must prove fault or neglect. The passenger must always prove the fact that the accident took place during the carriage. The term carriage covers not only the period during which passengers are carried onboard the ship, but also the period of embarkation and disembarkation. The transfer of passengers from land to ship and *vice versa* is covered where such transfer is either included in the fare or is put at the disposal of the passenger.

The passenger must prove the extent of loss or damage, irrespective of the cause. The liability of the carrier can be reduced, in whole or in part, if the carrier can prove contributory fault on the part of a passenger.

The Athens Convention permits the carrier to limit his liability. Following the 1976 Protocol, all limits are expressed in the Special Drawing Rights (SDR) as defined by the International Monetary Fund (IMF). The liability of the carrier for the death of or personal injury to the passenger cannot exceed 46,666 SDR per passenger[14]. The Athens Convention permits individual contracting states to increase (but not decrease) the death and personal injury limits in respect of carriers who are their nationals. The Athens Convention limits will be applicable unless the claimant proves that the death or injury resulted from the carrier’s intentional act or omission or that the carrier acted recklessly and with the conscious knowledge that such damage would be a probable result. [1].

Any action for the death or personal injury to passengers must be taken within two years from the date of disembarkation or when disembarkation should have taken place. Passengers can institute proceedings in the courts of any convention state that is:

- the principal place of business of the carrier;
- the place or departure or destination;
- the claimant’s domicile or permanent residence state, if the defendant has a place of business and is subject to the jurisdiction of that state;
- the state where the contract of carriage was made, if the defendant has a place of business and is subject to the jurisdiction of that state.

After the occurrence of the incident which was the cause of the damage, the parties may agree

[14] The Athens Convention also provides for compensation in respect of damage to or loss to passenger’s luggage, which is defined as cabin luggage (in passenger’s possession or control), vehicles and other luggage. In respect of loss to cabin luggage, the principles of the carrier’s liability correspond to the liability principles which apply in the case of the death of or personal injury to a passenger. In regards to liability for luggage other than cabin luggage, carrier fault or neglect will be presumed to exist. Carrier liability for cabin luggage cannot exceed 833 SDR per passenger; liability for vehicles cannot exceed 3,333 SDR per passenger; liability for other luggage cannot exceed 1,200 SDR per passenger. Passenger valuables (money, gold, jewellery) are generally not covered by the Athens Convention compensation system, unless entrusted to the carrier for safekeeping. In such cases, limits of liability may be set out by contractual provisions.

that the claim for damages shall be submitted to any jurisdiction or to arbitration.

On 25 May 1990, another Protocol to the Athens Convention was adopted increasing the liability limits approximately threefold, from SDR 46,666 to SDR 175,000 per passenger. However, this Protocol has not been ratified by the required number of states and is therefore not yet in force.[15]

In the event of a major casualty the provisions of the Athens Convention will operate together with those of any other applicable limitation of liability convention, such as the LLMC 1976. The LLMC 1976 gives the shipowner (who may be the same person as the carrier or performing carrier as defined in the Athens Convention) the right to limit his liability in respect to the total amount of claims for all passengers. This global limitation of liability is separate from and in addition to the *per passenger* limitation prescribed by the Athens Convention. The limitation of liability under LLMC 1976 is SDR 46,666 multiplied by the number of passengers which the ship is authorised to carry, but not exceeding SDR 25 million irrespective of such a number of passengers. Where the sums of liability to individual passengers exceed that "overall" limit, individual claims would then be reduced on a pro rata basis[16].

LLMC 1976 was amended by the 1996 Protocol. The limitation for passenger claims under this Protocol is SDR 175,000 multiplied by the number of passengers that the ship is authorised to carry, without any ceiling figure[17].

As far as the EU legislation is concerned, the Directive 2009/20/EC of the European Parliament and of the Council of 23 April 2009 on the insurance of shipowners for maritime claims (hereafter - the Insurance Directive) is of a significant importance[18]. It requires shipowners of ships having a gross tonnage 300 or greater to maintain insurance to cover maritime claims subject to limitation under the 1996 Protocol[19]. The Insurance Directive requires that this cover is evidenced by a certificate or certificates of insurance in respect of a ship entering EU port, or flying the flag of a Member State. All EU Member States were obliged to bring into force laws, regulations and administrative provisions necessary to comply with the Insurance Directive before 1 January 2012.

Provisions of the Maritime Code covering these issues are aligned to the Athens Convention as amended to the 1990 Protocol (which is not in force at the international level) as well as to the 1996 Protocol to the LLMC 1976.

Therefore, the present situation concerning the limits of carrier's liability for the death of or personal injury to a passenger is as follows:

- if the carriage is international (carriage between a Croatian port and a port in another state), the Athens Convention as amended by 1976 Protocol is applicable which means that the liability of the carrier cannot exceed 46,666 SDR;
- if the carriage is domestic (carriage between two ports located in Croatia), the Maritime Code is applicable, meaning that the liability of the carrier cannot exceed 175,000 SDR.

In addition to the compensation available on the grounds of carrier liability, passengers in public transport are often entitled to compensation under the contract of compulsory insurance of passengers in public transport against accidents. This compulsory insurance is regulated by the rules of Croatian domestic law. The

[15] The required number is ten. As of 31 March 2012, only six states (including Croatia) have accepted the 1990 Protocol.

[16] The LLMC 1976 entered into force on 1 December 1986. The Republic of Croatia is bound by the LLMC 1976. The list of states bound by the LLMC 1976 may be found on http://www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx.

[17] The Republic of Croatia is bound by the 1996 Protocol to the LLMC 1976. Amendments to increase the "non-passengers limits of liability" in the 1996 Protocol were adopted by the Legal Committee of the IMO, on its 99th session in London. The new limits are expected to enter into force 36 months from the date of adoption, therefore on 19 April 2015, under the tacit acceptance procedure. However, the "passenger liability limits" have not been increased by these newest amendments.

[18] On 9 October 2008, the Member States adopted a statement in which they unanimously recognised the importance of the application of the 1996 Protocol to the LLMC 1976 by all Member States.

[19] All Member States shall lay down a system of penalties for the breach of national provisions adopted pursuant to the Insurance Directive and shall take all the measures necessary to ensure that those penalties are applied. The penalties provided for shall be effective, proportionate and dissuasive (Article 7 of the Insurance Directive).

compensation is available to passengers in public maritime transport irrespective of carrier liability for the accident which caused the damage.

In Croatia, this type of insurance is regulated by the ACTI [2]. Each undertaking which is entitled to perform the public transportation of passengers is obliged to conclude this type of insurance contract with the insurer. The beneficiary of this insurance is the passenger. The insurance covers the period whilst the passenger is onboard and the period of embarkation and disembarkation (including the period while the passenger is at the quay waiting for embarkation or disembarkation).

This insurance covers damages for death or permanent disability of the passenger caused by an accident in public transport. When this damage is raised, the minimum compensation amounts (insurance amounts available to the passenger or other beneficiaries) prescribed by the ACTI are as follows:

- 40,000 HRK (approximately 5,300 EUR) per passenger in the case of his death , and
- 80,000 HRK (approximately 10,700 EUR) per passenger in the case of permanent disability and according to the degree of disability.

2.4.2. Changes in the future

Since 1996, the Legal Committee of IMO has discussed proposals to further amend the Athens Convention [3]. As a result of these efforts, the new 2002 Protocol to the Athens Convention has been adopted (hereafter – the 2002 Athens Convention [4].

The 2002 Athens Protocol introduces compulsory insurance to cover carrier's liability for passengers on ships and raises the limits of liability. It also introduces other mechanisms to assist passengers in obtaining compensation, based on well-accepted principles applied in existing liability and compensation regimes dealing with environmental pollution. These include replacing the fault-based liability system with a limited strict liability system for shipping related incidents (shipwreck, collision or stranding of the ship, explosion or fire on the ship, capsizing of the ship or defect of the ship) backed by the requirement that the carrier take out compulsory liability insurance to cover these potential claims as well as by the passenger's right to direct action against the insurer [5].

The 2002 Athens Protocol establishes a two tier liability system in cases where death of or personal injury to a passenger is caused by a shipping incident. The carrier is liable for the death of or personal injury to the passenger up to the limit of SDR 250,000 per passenger on any individual occasion, unless the carrier proves that the incident resulted from an act of war, hostilities, civil war, insurrection or a natural phenomenon of an exceptional, inevitable and unavoidable character; or was wholly caused by an act or omission performed by a third party with the intent of causing the incident. Therefore, the 2002 Protocol introduces strict liability of the carrier for the death of or personal injury to a passenger up to the abovementioned limit (the first tier of liability).

If the loss caused by the shipping incident exceeds the limit of SDR 250,000 per passenger on any distinct occasion, the carrier is further liable - up to a limit of 400,000 SDR per passenger on each distinct occasion - unless the carrier proves that the incident which caused the loss occurred without the fault or neglect of the carrier (the second tier of liability).

For the loss suffered as a result of the death of or personal injury to a passenger not caused by a shipping incident, the carrier is liable if the incident which caused the loss was due to the fault or neglect of the carrier. The burden of proving fault or neglect lies with the claimant. The carrier liability cannot exceed SDR 400,000.

The limits contained in the 2002 Athens Protocol set a maximum limit, empowering - but not obliging - national courts to compensate for death, injury or damage up to these limits. The 2002 Athens Protocol also includes an "opt-out" clause, enabling State Parties to retain or introduce higher limits of liability (or unlimited liability) in the case of carriers who are subject to the jurisdiction of their courts. A State Party, which makes use of this option, is obliged to inform the IMO Secretary General of the limit of liability adopted or of the fact that there is none.

The 2002 Athens Protocol requires performing carriers to maintain insurance or other financial security, such as the guarantee of a bank or similar financial institution, to cover the limits for strict liability under the 2002 Athens Protocol regarding the death of and personal injury to passengers. The limit of the compulsory insurance or other financial security shall not be less than 250,000 SDR per passenger on each distinct occasion. A certificate attesting that insurance or other financial security is in force always has to be onboard a ship. A model certificate is attached to the 2002 Athens Protocol.

For the first time in an IMO international agreement, a regional economic integration organization (for example the European Union) may sign the 2002 Athens Protocol[20].

States that ratify the 2002 Athens Protocol are required to denounce the 1974 Convention and its 1976 and 1990 Protocols, if they are obligated by those international agreements.

The objective of the 2002 Protocol is to enhance passenger remedy protection. Together, compulsory insurance and significantly increased liability limits could lead to very significant liability on the part of the insurer. The Protection and Indemnity Clubs (P&I Clubs) were strongly opposed to the amounts of liability prescribed in the 2002 Athens Protocol. They particularly pointed out that the prescribed limits are too high, taking into consideration the situation on the insurance market and the danger of catastrophic incidents caused by acts of terrorism or other “acts of war”. The problem arises from the fact that 2002 Athens Protocol does not contain explicit provisions reducing carriers’ (as well as insurers’) liability in cases where death of or personal injury to a passenger is caused by terrorism. Finally, P&I Clubs expressed their unwillingness to cover carriers’ liability as set out in the 2002 Athens Protocol. The consequence is that only few states acceded to the 2002 Athens Protocol[21].

In order to solve the problem, new and lengthy discussions took place under the auspices of IMO, resulting in a new instrument - IMO Reservation and Guidelines for Implementation of the Athens Convention (hereafter - IMO Guidelines) adopted in October, 2006. This document is considered as a non-mandatory *lex specialis* in relation to the 2002 Athens Protocol. IMO Guidelines recommend that States which ratify or accede to the 2002 Athens Protocol should include a reservation concerning a limitation of liability for carriers and a limitation for compulsory insurance for acts of terrorism, taking into account the current state of the insurance market. IMO Guidelines set out new provisions in respect to limits for carrier’s liability in respect to the death of or personal injury to a passenger caused by any war risks[22]. Under these provisions, carrier’s liability for the death of or personal injury to a passenger caused by war risks (terrorism included) cannot exceed lower of the following amounts:

- 250,000 SDR in respect of each passenger on each distinct occasion; or
- 340 million SDR overall per ship on each distinct occasion.

Under the IMO Guidelines, separate insurance cover is required covering liability for the death of or personal injury to a passengers caused by war risks limited to the abovementioned figures.

Additional insurance is required for covering carriers’ liability for the death of or personal injury to passengers caused by non-war risks. This insurance cover must be provided in accordance with the 2002 Athens Protocol.

[20] The European Union acceded to the 2002 Protocol and urged its Member States to do the same, (*supra,* fn. 3). At the same time, the European Union made a reservation in accordance with IMO Guidelines.

[21] Current number and the list of states which acceded to the 2002 Athens Protocol may be found at http://www.imo.org/About/Conventions/StatusOfConventions/Pages/Default.aspx

[22] War risks include war, civil war, revolution, rebellion, insurrection or civil strife arising there from, or any hostile act by or against a belligerent power, capture, seizure, arrest, restraint or detainment, and the consequences thereof or any attempt thereat, derelict mines, torpedoes, bombs or other derelict weapons of war, acts of any terrorist or any person acting maliciously or from a political motive and any action taken to prevent or counter any such risk, confiscation and expropriation. Under IMO Guidelines, both war and non-war insurance may be excluded subject to the Institute Radioactive Contamination, Chemical, Biological, Bio-chemical and Electromagnetic Weapons Exclusion Clause as well as to the Institute Cyber Attack Exclusion Clause. Furthermore, insurance cover is subject to automatic termination upon the outbreak of war between any of the “Five Power States” (UK, USA, France, the Russian Federation, and the People’s Republic of China).

As already has been mentioned[23], the Regulation 392/2009 incorporates in EU law all passengers' rights prescribed by the 2002 Athens Protocol. It also prescribes mandatory application of the substantial parts of IMO Guidelines. In addition, under the Regulation 392/2009 the carrier who actually performed the carriage when the shipping incident occurred shall make an advance payment sufficient to cover the immediate economic requirements proportional to the damage suffered, within 15 days from the identification of the person entitled to damages. In the event of death, this payment shall not be less than EUR 21,000. The provision in respect of advance payment shall apply if the incident occurred within the territory of a Member State, or occurred onboard a ship flying the flag of a Member State or is registered in a Member State. It will also apply if the carrier is established within the EU[24].
In respect of compensation for lost or damaged baggage, the Regulation 392/2009 also adopts relevant provisions contained in the 2002 Athens Protocol[25].
As far as Croatian position regarding this issue is concerned, it should be noted that some legislative actions are scheduled for the end of this year (2012) with the purpose of accession of the Republic of Croatia to the 2002 Athens Protocol.

3. THE RIGHTS OF PASSENGERS UNDER THE SOURCES OF TOURIST LAW

Various sources of tourist law may also be applicable with the purpose of (additional) protection of the rights of passengers travelling by sea. Passengers shall have this protection in cases when they are at the same time “the travellers” as defined by those applicable sources of tourist law. They can also be “the consumers” as defined by some other applicable instruments of the EU law governing specific tourist contracts[26].
Furthermore, it is possible that the “carrier” as defined by the applicable maritime sources is at the same time “the travel organizer” as defined by applicable sources of tourist law.
At the international level, the International Convention on Travel Contracts, 1970 (hereafter – CCV) has been adopted[27]. CCV shall apply to any travel contract concluded by a travel organizer or intermediary, where his principal place of business or, failing any such place of business, his habitual residence, or the place of business through which the travel contract has been concluded, is located in a CCV Contracting State. Travel Contract means either an organized travel contract or an intermediary travel contract. Organized travel contract means any contract whereby a person undertakes in his own name to provide for another, for an inclusive price, a combination of services comprising transportation, accommodation separate from the transportation or any other service relating thereto. Intermediary travel contract means any contract whereby a person undertakes to provide for another, for a price, either an organized travel contract or one or more separate services rendering possible a journey or sojourn. "Interline" or other similar operations between carriers shall not be considered as intermediary travel contracts.

[23] See *supra,* chapter 2.
[24] This provision is inspired by the similar provision contained in the 1999 Convention for the Unification of Certain Rules for International Carriage by Air (Montreal Convention). The European Union is a Party to the Montreal Convention. This Convention is implemented in the EU law by the Regulation (EC) No 889/2002 of the European Parliament and of the Council of 13 May 2002 amending Council Regulation (EC) No 2927/97 on air carrier liability in the event of accidents, (2002), OJ L 140, 30.5.2002, p. 2.
[25] For the cabin baggage, the carrier shall be liable if the incident which caused the loss was due to the fault or neglect of the carrier. The fault or neglect shall be presumed for loss caused by a shipping incident. In respect of other baggage, the carrier shall be liable unless the carrier proves that the incident which caused the loss occurred without the fault or neglect of the carrier. His liability is limited as follows: 2,250 SDR for cabin baggage; 12,700 SDR per vehicle and 3,375 SDR in respect of other baggage, all per passenger and per carriage.
[26] As a consequence, under the circumstances, the passengers may be protected by other applicable sources of consumer protection law.
[27] CCV has entered into force on 21 February 1976. State Parties to the CCV are: Argentina, Belgium, Cameroon, Italy, China, San Marino and Togo. Current status is available at: http://www.unidroit.org/english/implement/i-70.pdf (15 April 2012).

In principle, under the CCV liability is imposed to the travel organizer and/or travel intermediary. In the performance of the obligations resulting from abovementioned contracts, they have to protect the rights and interests of the traveller according to general principles of law and good usages in this field.
This paper focuses on the liabilities imposed to the travel organizer[28]. He shall be liable for any loss or damage caused to the traveller as a result of non-performance, in whole or in part, of his obligations resulting from the contract or the CCV, unless he proves that he acted as a diligent travel organizer. Therefore, his liability is based on presumed fault. Without prejudice to the questions as to which persons have the right to institute proceedings and what are their respective rights, compensation payable by the travel organizer shall be limited for each traveller to:

- 50.000 francs for personal injury;
- 2.000 francs for damage to property;
- 5.000 francs for any other damage[29].

However, a Contracting State may set a higher limit for contracts concluded through a place of business located in its territory.
Furthermore, where the travel organizer himself provides transportation, accommodation or other services connected with the performance of the journey or sojourn, he shall be liable for any loss or damage caused to the traveller in accordance with the rules governing such services.
Therefore, in the context of the carriage of passengers by sea, travel organizer shall be liable as the (performing) carrier under applicable maritime legislation.
Where the travel organizer entrusts to a third party the provision of transportation, accommodation or other services connected with the performance of the journey or sojourn, he shall be liable for any loss or damage caused to the traveller as a result of total or partial failure to perform such services, in accordance with the rules governing such services. The travel organizer shall be liable in accordance with the same rules for any loss or damage caused to the traveller during the performance of the services, unless the travel organizer proves that he has acted as a diligent travel organizer in the choice of the person or persons performing the service. In cases when such applicable rules do not provide for a limitation of liability, compensation payable by the travel organizer shall be set in accordance with the abovementioned CCV limits.
In so far as the travel organizer has paid compensation for loss or damage caused to the traveller, he shall be subrogated in any rights and actions the traveller may have against a third party responsible for such loss or damage. The traveller shall facilitate the recourse of the travel organizer by providing him with the documents and information in his possession and, as the case may be, by assigning his rights to him. The traveller shall have a right of direct action against a responsible third party, for total or complementary compensation of the loss or damage caused to him.
Any contract concluded by a travel intermediary with a travel organizer or with persons providing separate services, shall be deemed to have been concluded by the traveller. The travel intermediary shall not be liable for non-performance, in whole or in part, of journeys, sojourns or other services governed by the contract.
A travel organizer shall not be entitled to avail himself of the provisions of the CCV which exclude his liability or set or limit the compensation payable by him if the traveller proves that the loss or damage was caused by a wrongful act or default committed by the travel organizer or intermediary or by one of the persons for whom he is responsible with the intention of causing the loss or damage or in a manner implying either a deliberate disregard or inexcusable lack of awareness of the prejudicial consequences which might result from such conduct. Where special rules are prescribed by law, abovementioned wrongful acts or default shall be assessed in accordance with those rules.
The provisions of the CCV shall not prejudice the traveller's rights and actions against third parties.

[28] Although there are some obligations and liabilities imposed by the CCV to the intermediary toward the traveller, but they are not related to the liability arising from non-performance of the travel contract. See CCV, Article 22.

[29] The franc referred to in the CCV is the gold franc weighing 10/31 of a gramme and of a millesimal fineness of 0.900.

At the EU level, the Council Directive 90/314/EEC of 13 June 1990 on package travel, package holidays and package tours (hereafter – the Package Travel Directive) may be applicable[30][6]. The Package Travel Directive applies to “the package” which means each travel which is part of a pre-arranged set of services sold or offered for sale at an inclusive price covering a period of more than 24 hours or including an overnight stay and which combines at least two of:

- transport;
- accommodation;
- any other tourist services not related to transport or accommodation which account for a significant proportion of the package price.

The Package Travel Directive covers agreements which links consumer with the organizer and/or the retailer. Organizer is the person who, other than occasionally, organizes packages and sells or offers them for sale, whether directly or through a retailer. Retailer is the person who sells or offers for sale the package put together by the organizer.

Numerous rights of the consumer are protected by the Package Travel Directive.

In case where the organizer finds that before the departure he is constrained to alter significantly any of the essential terms of the package contract, such as the price, he shall notify the consumer as quickly as possible in order to enable him to take appropriate decisions and in particular:

- either to withdraw from the contract without penalty, or
- to accept a rider to the contract specifying the alterations made and their impact on the price.

The consumer shall inform the organizer or the retailer of his decision as soon as possible. If the consumer uses the option of withdrawal from the contract or if, for whatever cause, other than the fault of the consumer, the organizer cancels the package before the agreed date of departure, the consumer shall be entitled:

- either to take a substitute package of equivalent or higher quality where the organizer and/or retailer is able to offer him such a substitute. If the replacement package offered is of lower quality, the organizer shall refund the difference in price to the consumer; or
- or to be repaid as soon as possible all sums paid by him under the contract.

In such a case, he shall be entitled, if appropriate, to be compensated by either the organizer or the retailer, whichever the relevant Member State's law requires, for non-performance of the contract[31].

Where, after departure, a significant proportion of the services contracted for is not provided or the organizer perceives that he will be unable to procure a significant proportion of the services to be provided, the organizer shall make suitable alternative arrangements, at no extra cost to the consumer, for the continuation of the package, and where appropriate compensate the consumer for the difference between the services offered and those supplied.

If it is impossible to make such arrangements or these are not accepted by the consumer for good reasons, the organizer shall, where appropriate, provide the consumer, at no extra cost, with equivalent transport back to the place of departure, or to another return-point to which the consumer has agreed and shall, where appropriate, compensate the consumer

Organizer and/or retailer party to the contract is/are liable to the consumer for the proper performance of the obligations arising from the contract, irrespective of whether such obligations are to be performed by that organizer and/or retailer or by other suppliers of services without prejudice to the right of the organizer and/or retailer to pursue those other suppliers of services.

With regard to the damage resulting for the consumer from the failure to perform or the improper performance of the contract, the Package Travel Directive imposes some rules which are implemented in all EU Member

[30] OJ L 158, 23. June 1990, p. 59. As far as the Croatian domestic law is concerned, it should be noted that the Articles 881-903 of the Law on Obligations (regulating the Travel Organizing Contract) have been created in accordance with the Package Travel Directive.

[31] However, there are some exceptions from this organizer's (retailer’s) obligation, see Article 4(6) of the Package Travel Directive.

States. Under these rules, organizer and/or retailer is/are liable unless such failure to perform or improper performance is attributable neither to any fault of theirs nor to that of another supplier of services, because:

- the failures which occur in the performance of the contract are attributable to the consumer,
- such failures are attributable to a third party unconnected with the provision of the services contracted for, and are unforeseeable or unavoidable,
- such failures are due to a case of force majeure or to an event which the organizer and/or retailer or the supplier of services, even with all due care, could not foresee or forestall.

In the matter of damages arising from the non-performance or improper performance of the services involved in the package, the Member States may provide that the compensation may be limited in accordance with the international conventions governing such services. Therefore, such compensation may be limited by the provisions of applicable international maritime conventions (for example Athens Convention).

Regarding damage other than personal injury resulting from the non-performance or improper performance of the services involved in the package, compensation may be limited under the contract if such contractual limitation is allowed by the law of a Member State. Such limitation shall not be unreasonable.

It is obvious that there is a certain level of interaction between the sources of tourist (consumer protection) law and the sources of maritime law. Unfortunately, such situation may cause certain confusion regarding the rules which should be applied in a specific case. For example, Article 14 of the Athens Convention prescribes that no action for damages for the death of or personal injury to a passenger, or for the loss of or damage to luggage shall be brought against a carrier or performing carrier otherwise than in accordance with the provisions contained in this Convention. But, what happens in cases when the carrier as defined in Athens Convention is at the same time the organizer as defined in the Package Travel Directive?

This issue has been the subject of two legal decisions in UK Country Court. In the first case, *Lee and Another v Airtours Holidays Ltd and Another*[32], decided in 2002, the court held that the provisions of the Package Directive were part of the UK national law and should be applied unless the provisions of the Athens Convention were specifically referred to in the contract, which they were not on the facts of that case[33]. However, in *Norfolk v My Travel Group plc*[34] decided in August 2003, the court held that the Athens Convention was given the force of law in the UK and that the Athens Convention therefore applied even where there was not express reference to it in the contract[35] [7].

4. CONCLUSIONS

Passengers travelling by sea enjoy high level of legal protection. Their rights are basically regulated by maritime (transport) legal instruments. However, it should be kept in mind that legal sources of tourist and consumer law are also applicable. Some of these rights are: the right on minimum information to be provided, the right in cases of cancellation or delay of transport (including re-routing and/or compensation), the non-discrimination between passengers with regard to transport conditions offered by carriers, rights in respect of compensation in the event of death of or personal injury to a passenger as well as in the event of damage to baggage.

Relevant legal instruments contain provisions imposing on carriers and other relevant persons and public bodies the obligation to ensure that passengers are provided with precise

[32] (2004) 1 Lloyd's Rep. 683.

[33] Under the Article 15 of the Package Travel, Package Holidays and Package Tours Regulations, 1992, which incorporated the provisions of the Package Travel Directive into English Law, the contract may provide for compensation to be limited in accordance with the international conventions which govern such services.

[34] (2004) 1 Lloyd's Rep 106.

[35] Considering the facts of the case, the consequence of this decision was that the claim, which was brought pursuant to the Package Travel, Package Holidays and Package Tours Regulations 1992, was time barred pursuant to the Article 16 of the Athens Convention (the action was brought more than two years after the disembarkation of the passenger).

instructions regarding enforcement of their rights. Relevant sources of EU law impose on each Member State a duty to designate a special body responsible for the enforcement of passengers' rights.
However, some issues are still waiting to be solved. There is a certain degree of legal uncertainty regarding the interaction between the international conventions ad applicable EU legislation. This situation has to be clarified as soon as possible because it brings confusion regarding the obligation of the EU Member States to implement EU law and their obligations pursuant to international conventions. Consequently, it brings confusion regarding enforcement of passengers' rights.
As far as the Croatian law is concerned, some amendments to the Maritime Code shall be necessary in order to implement relevant EU legislation. Furthermore, appropriate steps should be taken toward accession the Republic of Croatia to the 2002 Athens Protocol. The European Union has already acceded to this Protocol. Regardless of the "international success" of the 2002 Athens Protocol, its substantial rules, as implemented in the EU law by the Regulation 392/2009, shall enter into force at the EU level at the beginning of the 2013. All parties involved (passengers, carriers, the State) must be prepared for upcoming changes.

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BIOGRAPHIE

Jasenko Marin was born in 1970. He gained his LL.M. in 2001 and his Ph.D. in 2003 at the Zagreb Faculty of Law. His field of scientific interest covers maritime law, transport law an insurance law. Since 1996 to 2002 he worked as a researcher at the Adriatic Institute of Croatian Academy of Sciences and Arts. Since 2003 he is employed at the Faculty of Law in Zagreb where he became Associate Professor of Maritime and Transport Law. He teaches

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THE NEW BLOCK EXEMPTION REGULATION FOR LINER SHIPPING CONSORTIA

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ABSTRACT

Liner shipping involves the transport of cargo, chiefly by container, on regular basis to ports on a particular geographic route, known as a "trade". Consortia are forms of operational cooperation between liner shipping companies with the view to providing a joint maritime cargo transport service. The cooperation within consortium must be limited to operational cooperation, notably sharing space (capacity) on their vessels, so the members of a consortium market their services and fix their prices individually. Consortia are generally found to restrict competition because capacity is the key competition parameter that influences on prices of the transport service. However, consortia enable more efficient use of vessel capacity thus helping to improve the service that would be offered by each of the members individually. Customers receive benefit from such cooperation as long as the consortium is subject to effective competition. Article 101/1 of the Treaty of the Functioning of the European Union (TFEU) regulates the prohibited agreements, agreements which aren't subject to effective competition. Those agreements can be exempted from the prohibition prescribed in Article 101/1 TFEU if they fulfil four conditions laid down in Article 101/3 of the TFEU. The new Consortia block exemption Regulation No 906/2009 sets out different conditions compared to former Regulation No 823/2000 that consortia agreements need to fulfil in order to benefit from an exemption from the prohibition enshrined in Article 101/1 TFEU. These conditions are being analysed in this paper.

KEY WORDS

liner shipping. consortia. block exemption regulation. market share.

1. INTRODUCTION

Consortia are forms of operational cooperation between liner shipping companies with the view to providing a joint maritime cargo transport service. Consortia generally help to improve productivity and quality of available liner shipping services by reason of the rationalisation they bring to the activities of member companies and through economies of scale they allow in the operation of vessels and utilisation of port facilities. Members of liner shipping consortia are sharing space (capacity) on their vessels and jointly use one container terminal in a given port, which in many cases is controlled by one of the members of the consortium. Sharing capacity is generally found to restrict competition because capacity is the key competition parameter that influences on prices of the transport service. However, consortia enable more efficient use of vessel capacity. Customers receive benefit from such cooperation as long as the consortium is subject to effective competition. Article 101(1) of the Treaty of the Functioning of the European Union (TFEU) regulates the prohibited agreements, agreements which aren't subject to effective competition. Those agreements can be exempted from the prohibition prescribed in Article 101(1) TFEU if they fulfil four conditions laid down in Article 101(3) of the TFEU. These four cumulative conditions are: (a) The agreement must contribute to improving the production or distribution of goods or contribute to promoting technical or economic progress, (b) Consumers must receive a fair share of the resulting benefits, (c) The restrictions must be indispensable to the attainment of these objectives, and finally (d) The agreement must not afford the parties the possibility of eliminating competition in respect of a substantial part of the products in question.

There is a presumption that consortium agreements that comply with the conditions of the consortia block exemption regulation, in particular remain below the market share threshold prescribed by that regulation, fulfil the four conditions laid down in Article 101 (3) TFEU. This does not mean that agreements that fall outside the scope of the consortia block exemption regulation are by nature prohibited. It simply means that they are not automatically exempted, but an individual assessment need to be made as to establish their compatibility with Article 101 TFEU. That assessment need to be done by the members of consortium themselves (self-assessment). That rule is introduced by Council Regulation (EC) No 1/2003 on the implementation of the rules on competition laid down in Article 81 and 82 of the EC Treaty.[2] Before that Regulation consortium agreements that did not meet the market share thresholds or other conditions laid down in consortia block exemption regulation could be notified to the European Commission for individual exemption. The Commission would than assess if the agreement fulfilled the four cumulative conditions of Article 101 (3) of the TFEU. With the entry into force Regulation 1/2003 that notification procedure was abandoned. As a result, all undertakings in every economic sector, including maritime transport, have to self-assess their behaviour in the light of changing market conditions, to establish whether it falls under Article 101 (1) of the TFEU and in that case whether it fulfils the conditions of Article 101 (3) of the TFEU.

In this paper we are also analysing market conditions in liner shipping sector. Changes of those conditions are the main reason for introducing new rules of the European Union on liner shipping consortia.

2. INDUSTRY CHARACTERISTICS

Shipping is the most important mode of transporting commodities, because today more than 90 % of world trade is carried wholly or partly by sea. Liner shipping services run on a set schedule and combined with intermodal services can carry any commodities between any two given points in the world. The most important customers of carriers which provide liner shipping services are manufacturing companies, but their customers can also be private individuals moving their belongings.

To run an efficient and successful liner shipping service it is necessary to: 1. Cover all pertinent ports in the trade routes or focus. 2. Run a regular and reliable schedule to enable just-in-time delivery. 3. Operate one or several strings of vessels per trade route in order to ensure at least a weekly service and acceptable transit times. 4. Have access to efficient and reliable transhipment services. 5. Invest in high-capacity vessels so as to achieve the economies of scale necessary to operate a fuel-efficient and low-cost service. 6. Balance supply and demand and position containers in order to offer sufficient supply while keeping utilisation high, despite considerable trade imbalances and unpredictable and sharp fluctuations in demand. So, it is very difficult for a liner shipping carrier to offer efficient and quality services without cooperation with other carriers. Since on 13 September 2006 the Council repealed the liner conference agreements, consortia are the only remaining way of cooperation between liner shipping carriers.

3. LINER SHIPING CONSORTIA TODAY

In summer 2007, Directorate-General for Competition of the European Commission opened a market investigation with a view to obtaining factual information for the review of Regulation 823/2000 on the application of Article 81 (3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia). Questionnaires were sent to major liner shipping carriers and number of shippers and freight forwarders. They were asked to provide detailed information on all agreements they entered into with competitors which they consider constituting consortium. The objective was to identify which activities are currently being carried out jointly by consortia members and how these activities relate to exempted activities as defined in Article 3 of Regulation 823/2000. The answers received from carriers, shippers and freight forwarders represent a good sample of supply and demand.

They show that liner shipping carriers enter into various forms of cooperative agreements. The market investigation identified the following categories of agreements: 1. A vessel sharing agreement is a contract between two or more vessel operators agreeing to provide a certain number of vessels for common use of all parties in order to set up a joint liner service. 2. A swap agreement is a reciprocal contract between two or more parties that agree to exchange space on the ships they operate. 3. A slot charter agreement is a contract between two or more parties whereby the vessel-operating party sells slots on its vessels to the other party. These categories of agreements are also often linked with one another, e. g. a vessel sharing agreement can also include several slot charter agreements between the parties to the agreement.

3.1. Trades on which liner shipping consortia operate

Liner shipping is not a concentrated industry on a global scale, as today the market leader holds only an 18% share of world-wide capacity and remaining carriers hold less than 10% of world capacity. However, liner carriers do not compete on a global scale but on particular geographic routes generally known as trades. So, the competitive situation has to be examined on the relevant market. Competitive levels vary from trade to trade. The number of carriers active on Europe trades varies from 6 (Europe-Australasian trade) to 26 (Transatlantic trade). Some carriers are parties to various agreements on one and the same trade. Such cross-participation have to be taken into account when analysing the competitive situation on the relevant market.

The most important Europe trades are 4 East-West trades: North Europe-Far East, Mediterranean-Far East, North Europe-North America (Transatlantic trade), Mediterranean-North America. These trades are served by 20 or more carriers and the number of consortia operating on that trades ranges from 6 to 9 and at least five carriers are operating individually on each trade. Fifteen or less carriers (10 on average) operate on each of the six thinner North-South trades. These trades are: Europe-East Coast South America, Europe-West Coast South America, Europe-West Africa, Europe-South Africa, Europe-Australasian Trade, Europe-Indian Sub Continent. The number of consortia operating on them varies between 1 and 5. On average only 3 carriers operate individually on each of the North-South trades.

Table 1. Overview of Europe Trades

Europe Trades	Number of Vessels	Average Capacity of Vessels (TEU)	Operational Capacity (1000 TEU)	Total number of Carriers	Carriers operating only individually	Carriers in consortia	Number of Consortia and other agreements	Cross Participation in consortia and other agreements
North Europe - Far East	290	6.358	11.810	21	5	16	6	3
Mediterranean -Far East	377	4.007	11.633	20	6	14	7	9
North Europe-North America	149	3.644	3.825	26	10	16	7	3
Mediterranean - North America	171	2.966	3.969	23	6	17	9	8
Europe-East Coast South America	75	2.725	2.047	14	3	11	5	2
Europe-West Coast South America	38	1.880	539	7	2	5	2	2
Europe-South Africa	33	2.149	653	7	4	3	1	0
Europe-West Africa	137	1.450	2.125	16	10	5	3	2
Europe-Australasian Trade	50	2.596	554	6	3	3	2	1
Europe-Indian Sub Continent	37	3.860	591	11	3	8	2	0

Source: Dynaliner 05/2008

4. REGULATION OF LINER SHIPING CONSORTIA IN THE EUROPEAN LAW

In the European competition law liner shipping consortia are regulated by block exemption regulation. The objective of block exemption regulation is to provide legal certainty; there is presumption that consortium agreements that comply with the conditions of consortia block exemption regulation, in particular remain below the market share threshold, fulfil the four conditions laid down in Article 101(3) TFEU, so those agreements are not considered forbidden within the meaning of Article 101 (1) TFEU. The first consortia block exemption regulation was brought in 1995. It was Commission Regulation (EC) No 870/95 of April 1995 on the application of Article 81 (3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia). Situation in liner shipping market changes constantly, therefore consortia block exemption regulation have to be reviewed periodically. The Council set a period of validity of 5 years for consortia block exemption regulations. After this period, a consortia block exemption regulation can be renewed if it still reflect the current market environment and practice. So in year 2000 the European Commission decided to renew the block exemption regulation for liner shipping consortia through the adoption of Regulation (EC) No 823/2000. Regulation (EC) No 823/2000, as last amended by Regulation (EC) No 611/2005, expired on 25 April 2010. Because of that in summer 2007, Directorate-General for Competition of the European Commission started a process of revisiting Regulation No 823/2000 by launching a comprehensive market investigation. The result of that process is the new Consortia block exemption Regulation (EC) No 906/2009 on the application of Article 81 (3) of the Treaty to certain categories of agreements, decisions and concerted practices between liner shipping companies (consortia).

5. REGULATION 906/2009

Regulation 906/2009 comprises significant changes compared to the Regulation 823/2000. The most important changes are: 1. Revision of definition of a consortium. 2. Revision of the market share condition. 3. Revision of list of exempted activities.

5.1. Revision of definition of a consortium

Regulation 906/2009 changes the definition of a consortium in two ways. First, according to that Regulation consortium can consist of either one agreement or a set of interlinked agreement. This amendment better reflects market reality. Second, the definition of a consortium now extends to all international liner shipping services of cargo, whether or not are those services provided "chiefly by container". As in practice most liner shipping services concern containerised cargo, the impact will be limited to some exceptional non-containerised services.

5.2. Revision of the market share condition

The new Consortia block exemption Regulation (EC) No 906/2009, as is commonly the case in block exemption regulations, only applies to consortia which do not exceed a given market share threshold in the relevant market where they operate. Regulation 823/2000 set a threshold of 30% for consortia that operate within a liner conference and 35% for all other consortia. After the end of the liner conference system on trades to end from Europe, the new, uniform market threshold introduced by Regulation 906/2009 is 30% for all consortia. However, in practice this reduction will not affect the majority of existing consortia, as most consortia have already been subject to lower 30% market share threshold in the past, since their members operated until recently within a liner conference.

When assessing the market share condition, liner carriers must first define the relevant product and geographic market or markets where the consortium operates. The Guidelines on the application of Article 81 of the EC Treaty to maritime transport services (Maritime Guidelines) provide carriers guidance in this respect.

5.3. Revision of list of exempted activities

The Regulation 906/2009 provides for a list of exempted activities which are considered indispensable for provision of a joint liner shipping service. The revised list of exempted activities in Article 3 of Regulation 906/2009 is shorter. It contains the following activities:

1. the joint operation of liner shipping services including any of the following activities:
   - (a) the coordination and/or joint fixing of sailing timetables and the determination of ports of call;
   - (b) the exchange, sale or cross-chartering of space or slots on vessels;
   - (c) the pooling of vessels and/or port installations;
   - (d) the use of one or more joint operations offices;
   - (e) the provision of containers, chassis and other equipment and/or the rental, leasing or purchase contracts for such equipment;
2. capacity adjustments in response to fluctuations in supply and demand;
3. the joint operation or use of port terminals and related services (such as lighterage or stevedoring services);
4. any other activity ancillary to those referred to in points 1, 2 and 3 which is necessary for their implementation, such as:
   - (a) the use of a computerised data exchange system;
   - (b) an obligation on members of a consortium to use in the relevant market or markets vessels allocated to the consortium and to refrain from chartering space on vessels belonging to third parties;
   - (c) an obligation on members of a consortium not to assign or charter space to other vessel-operating carriers in the relevant market or markets

except with the prior consent of the other members of the consortium.

The following activities are removed from the list: a) activities that are not carried out in practice, b) activities related to price fixing conferences, c) activities which are not indispensable for the provision of a joint service. Such is the case with use of joint documentation system, as well as joint marketing structures and issuance of a joint bill of lading. In addition to that, we emphasize that no new activities were added to the list during the revision.

As other block exemption regulations, Regulation 906/2009 does not apply where the consortium contains hardcore restrictions. Such hard core restrictions include the restrictions usually found in block exemptions on horizontal cooperation: price fixing, capacity or sale limitations, or market or customer allocation.

6. CONCLUSIONS

The EU competition rules applicable to the maritime transport sector has been revised and modernised in recent years. The first step was the repeal of the block exemption for liner shipping conferences which allowed price fixing and capacity arrangements of their members in 2006, which entered into force in October 2008, after two years transitional period. The second step was adoption of Guidelines on the application of Article 81 of the EC Treaty to maritime transport services (Maritime Guidelines) providing guidance on the application of Article 101 TFEU in the maritime sector, and the last step in this review process was the adoption of the Consortia block exemption Regulation 906/2009.

That Regulation is the last existing block exemption Regulation in the transport sector and it will apply for five years starting from 25 April 2010. It provides safe harbour for the operation of liner shipping consortia which meet the new reduced market share condition of 30% and do not contain any hardcore restrictions (price fixing, capacity or sale limitations, or market or customer allocation).

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1. With effect from 1 December 2009, Articles 81 and 82 of the EC Treaty have become Articles 101 and 102 of the Treaty on the Functioning of the European Union (TFEU).
2. OJ, L 1, 4.1.2003, p.1.
3. It takes on average 6 similar sized container ships to set up a liner shipping service.
4. Due to the step increase in oil prices in recent years, the cost of bunker is the single most important cost item for the provision of liner shipping services. Increased fuel efficiency due to the larger vessels with modern engines is to the benefit of consumers and the environment alike. Another means of reducing bunker cot is to reduce speed.
5. The repeal entered into force on 18 October 2008, after two-year transitional period. As a result, after that date liner carriers operating services to end/or from one or more ports in the European Union must cease all liner conference activity contrary to Article 101 of the Treaty.
6. OJ L 100, 20.4.2000, p.24.
7. OJ L 89, 21.4.1995, p.7.
8. See, supra section 3.
9. OJ L 256, 29.9.2009, p.31.
10. OJ C 245, 26.9.2008, p.2.

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CONDITIONS FOR COMPENSATION FOR DAMAGE UNDER THE CONTRACT OF MARINE INSURANCE

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ABSTRACT

Marine insurance is an important factor of successful operation in maritime transport. Like other types of insurance, marine insurance, as an activity, is focused on the restoration of unsettled material values in the society. It prevents, due to unpredictable circumstances, disorders that would significantly disrupt the adopted mechanisms of value creation and operations of its holders. It is used to achieve the primary task which is a complete indemnity of damage of the insured item. This fully applies whether it is possible to repair the damaged object insured by bringing it to its original condition, repairing it (restitutio in integrum), or by providing monetary compensation. In addition, compensation of damage may not exceed the damage occurred by emergence of adverse events suffered by the insured, i.e. the biggest payout from the insurance must match the value of the insurance subject. In order to compensate damages arose from the contract of marine insurance it is necessary to achieve certain conditions. It could be argued that the request for realization of the conditions placed upon the contracting parties, in some way represents a defense against abuse of the institute of maritime insurance and insurance in general, at least when it comes to all types of property insurance. In this paper, we try to point out the essential characteristics of conditions whose fulfillment is inevitable for realization of the right to compensate the damage under the contract of marine insurance. A special emphasis is given to the legislative provisions governing this issue in both the Montenegrin and English laws.

KEY WORDS

Contract of marine insurance. compensation of damage. insurance interest. risks and excluded damages.

1. INTRODUCTION

The primary obligation of the insurer is, on the occasion of occurrence of the insured event, and on the basis of submitted data and documentation from the insured, to pay an adequate compensation and liquidate damage to the insured. Liquidation of damage shall be conducted through the procedure known as the liquidation process, which consists of several actions and measures that need to be taken by the contracting parties, including the fulfillment of certain conditions that must be taken into account. Although a small number of laws contain provisions to regulate the term within which the insurer should fulfill its obligation, our law envisages the terms for fulfillment of the most important obligation of the insurer. According to the Law on Maritime and Inland Navigation[1], still in force in Montenegro, in the matter of maritime security, Article 764, stipulates that the insurer is obligated to pay the insurance benefit within the period of one month following the date the insured person submitted the claim, with all data and documentation for establishing its obligation arising from the insurance contract. The same provision is contained in the Maritime Code of the Republic of Slovenia ("Official Gazette of the Republic of Slovenia", nos. 26/01, 21/02, 110/02, 2/04 and 49/06) Article 716 and in the Maritime Code of the Republic of Croatia ("Official Gazette of the Republic of Croatia", nos. 181/04, 76/07, 146/08 and 61/11) Article 121.[2] However, in order to exercise the right for compensation under the contract of marine insurance, the previous three conditions need to be cumulatively achieved, as follows: there should be a causal relationship between the insured and the incurred damage, that an insured person has an interest in the insured object and that damages are not excluded from insurance contract.

2. EXISTENCE OF CAUSAL CONNECTION BETWEEN RISK AND DAMAGE

Existence of causal link between an adverse event and incurred damage is the basic principle of liability for compensation of damage in the Civil Law (Law on Obligations). It is about a requirement that cannot be excluded in all cases of responsibility for damage, regardless of whether it is a responsibility based on the fault or objective responsibility. A request for existence of a causal link between the insured risk and incurred damage arising from insurance contract, is also indispensable for the exercise of the right to compensation of damage in insurance. If there is no causal link between damage and the insured risk, there is no obligation of the insurer.
Due to the achieved insured risk, a number of different consequences and damages to the insured may occur. The question that inevitably arises is whether the insurance covers all damages resulting due to realization of the insured risk or only some of them. The

[1] "Official Gazette of the Federal Republic of Yugoslavia“, Nos. 12/98, 44/99 and 73/00. In Montenegro, at this moment, maritime legislation is still based on the Law on Maritime and Inland Navigation of SRY of 1998. Ministry of Transport of Maritime Affairs of Montenegro has acceded to preparation of a comprehensive legal framework, in the manner to separate specific areas of the Law on Maritime and Inland Navigation and regulate them by special laws. In this sense, the following laws have been adopted: the Law of the Sea and the Law on Yachts (2007), the Law on Ports and Coastal Zone Management Act (2008), the Law on Marine Fisheries and Marine culture (2009) and the Law on Protection of the Sea from Pollution against Vessels was adopted on March 22, 2011A Draft Law on the Safety of Maritime Navigation 2012 was created, and the creation of the Law of Obligations in Maritime Affairs is being expected.

[2] Application of provisions that specify the deadline for payment of compensation has proven to be positive, since many insurers have tendency to delay the payment of compensation thus creating unnecessary difficulties for policyholders and inflicted damage to them. One-month envisaged deadline is quite sufficient period of time for bringing of the decision, after the insured provides all information and evidence necessary to determine the liability insurance. A shorter period would not be justified especially in large and complex claims where the insurer, normally, should pre-advise with its reinsures, and eventually require them to pay a share of the damage.

situation is simple if all risks are covered by the insurance, because then the damage is also covered and as such will be compensated. However, if only one of risks is covered by insurance, and the other is not, then the question is whether in given situation the damage is covered by insurance or not. There are various theories providing different criteria for determining damages covered by the insurance. The theory of a direct cause (lat.causa proxima, eng. proximate cause) is the most frequently applied theory, under which the insurer is obliged to compensate only damages which represents an immediate consequence of the insured risk, while not being obliged to pay the damage occurred as an indirect consequence of the insured risk if it is not insure. It can be argued that the theory of the immediate cause is fair and practical and that it served as a signpost aimed to better solutions of specific cases. However, over time the practice has shown that the strict application of this theory does not lead to satisfactory solutions but it must be departed from it. Deviation from this theory appears in several cases: when the damage occurred as the direct result of an event which is in turn an inevitable consequence of the insured risk, when the damage was the result of maritime and war risks, and when the damage occurred due to risks in which, because of their nature, the theory of direct cause (proximate cause) cannot be strictly applied. [3]

For a long time, in England, the insurer owed a compensation of damage form the insurance contract to the insured, only if the damage resulted from the cause covered by the insurance (the Principle of Causa Proxima). Nowadays there is deviation from this. Compensation of damages is owed also in case when the insured risk, or one of the insured risks, decisively contributed to realization of the insured event, i.e. that damage to the insured item occurs. In the English literature, for the immediate cause is often said to be "the most dominant and effective cause of the loss" that may not be the closest cause in time. English Marine Insurance Act of 1906[4] in its Article 55, paragraph 1, emphasizes that “the insurer is liable for any loss proximately caused by a peril insured against, but, subject as aforesaid, he is not liable for any loss which is not proximately caused by a peril insured against.” To make the insurer liable, the perils insured against must have proximately caused the loss.

The Law on Maritime and Inland Navigation, Article 750 stipulates that: “unless otherwise agreed, the insurance shall cover damage due to the insured risks, as follows: 1. total loss of the insured object; 2. partial loss of or damage to the insured object; 3. salvage costs and costs caused directly by the occurrence of an insured loss; 4. general average 5. salvage reward; 6. costs of establishing and liquidating the damage covered by the insurance.”

The same provision is contained in both in the Maritime Code of the Republic of Croatia, Article 706, and the Maritime Code of the Republic of Slovenia, Article 702.

From the Article formulated like this, it is clear that legal provisions shall not mention closely what should be a causal relationship between risk and damage like, except for costs caused by the occurrence of the insured event. Namely, the explicit prediction of the causal relationships at all categories of claims would lead to a rather rigid element that could be more harmful than useful. Therefore, the starting point was the medium solution. Thus, if there was a misunderstanding in this regard, it would be much better if they are dealt appreciating each individual on case by case basis and according to theories, rather than taking decisions which often cannot be met in certain situations. However, this does not mean that the insurance covers all direct and indirect damages caused by insured risks. Insurance covers primarily the direct damage, but also indirect ones in those cases when it is usual in marine insurance, and when such damages have been decisively influenced by insured risks. In addition, according to stylization referred to in Article750, when enumerating certain categories of damages, it can be seen

[3] B.Ivošević, Udžbenik transportnog osiguranja (Transportation insurance textbook), Tivat, 2010, p. 89; V.Tomašić, Ugovor o plovidbenom osiguranju (Agreement on Navigation Insurance), Belgrade, 1990, p. 139.

[4] Ivamy, E.R.H. Chalmers', Marine Insurance Act,1906, p.195. Available at the website: www.jus.uio.no/lm/england.marine.insurance.act.1906/

that only losses and material damages of the insured subject matter are covered which excludes benefits from the insurance, primarily for commercial damages that the insured had suffered. The same goes for the costs of salvage, general average, salvage reward and costs of establishing and liquidating the damage that are covered as such, but solely if they occurred in relation to insured risks. Therefore, subsequent damages that the insured had in connection with salvage, general average, and the like, are not covered by the insurance, regardless of what they ultimately resulted as the consequence of realization of the insured risk.

The law, as we have already stated, gives closer qualifications of the causal relationship between insured risks and damages incurred only regarding costs caused by occurrence of the insured event. Such costs are covered by insurance only if they incurred as a direct consequence of an insured event. Other costs incurred by the insured, which were only an indirect consequence of the insured event are not therefore covered by the insurance. Closer determination of the causal relationship at these costs was necessary in order to avoid that costs caused by occurrence of the insured event also include numerous costs that the insured may have had, but that can, only to a lesser extent, be considered to have arisen as a consequence of the insured event.

There is a frequent practice to put wordings from which it can be concluded that the insurance covers both direct and indirect damages in terms of insurance regarding specified risks. Thus, for example, in terms of insurance is sometimes stated that the insurance covers damages that can be reasonably attributed to certain risks, as opposed to damages that are covered only if incurred as a result of the insured risks. The first expression indicates that consequences covered are not only direct but also indirect consequences of certain risks, if those consequences can be reasonably attributed to these risks, while the other term implies only damages caused as a direct consequence of insured risks.

3. INTEREST OF THE INSURED IN THE SUBJECT-MATTER INSURED

In order to preserve the indemnificatory character of the marine insurance as a condition for the validity of contract and exercise the right to compensation for damage from the insurance, the obligation has been imposed on the insured to prove that he has a certain material interest on an subject-matter insured, the so-called insured or insurable interest. As in insurance in general, it is about the issue of necessary existence and establishment of a certain relationship of the insured against the subject-matter insured, which indicates that the subject-matter will be materially damaged or destroyed in any material way due to impact of the insured risk. This relationship is called the interest in insurance. It can be and often is the relationship of ownership over the subject-matter insured, and any other material interest, for example, interests of holders of real rights on the subject-matter insured, the interest of the persons who claim subject-matter insured or interest of the carrier that the goods are not damaged while in transport, etc.

Interests in maritime insurance are specific in relation to interest in insurance generally. However, we believe that there are three main features of interest in this type of insurance. The first consists in the fact that conclusion of insurance contracts occurred and occurs without requests for proof of interests. Another specificity is reflected in the existence of more different, specific subjects of interest and more subjects as holders of such interests. Cargo insurance contracts are particular for their specific interests, which leads to double and multiple insurance. The third characteristic consists in very frequent cases of impossibility to determine interest at the time of conclusion of the contract, therefore it is done subsequently. Insurable interest in the law is related to the person who may suffer the damage, and this person is called the insured. In any case, he should be distinguished from a person who concludes a contract of marine insurance with the insurer that is from a policyholder. This is the legal name for the person who concludes a contract,5 but also for the person who is entitled under the contract to the payment of the sum insured. According to the Article 729 paragraph 1 of the Law on Maritime and Inland Navigation: »The insured can only be a person who has or may expect to have a justifiable material interest in the non-occurrence of the event insured.«

English Marine Insurance Act of 1906 defines the term of insurable interest in marine insurance by general formulation in Section 5 (paragraph 1) which stipulates that »every person has an insurable interest who is interested in a marine adventure« and in the same section, under paragraph 2 stipulates more precisely that: »In particular a person is interested in a marine adventure where he stands in any legal or equitable relation to the adventure or to any insurable property at risk therein, in consequence of which he may benefit by the safety or due arrival of insurable property, or may be prejudiced by its loss, or by damage thereto, or by the detention thereof, or may incur liability in respect thereof«.

Subject to provisions of the Law on Maritime and Inland Navigation, Article 729 paragraph 2, the interest on a subject-matter insured does not have to exist at the time of signing the contract, but it is necessary for the insured to have an interest on a subject-matter insured at the moment when the insured event occurs, or after occurrence of an insured event but in the course of the insurance period duration. Despite the necessity of existence of interests in insurance, the practice of maritime insurance knows issuance of the PPI (»Policy proof of interest«). Origin of issuing policies without the existence of interests should be sought in such practice which existed in medieval England, but the law that declared illegal issuance of such policies was soon adopted.6 Today's so-called PPI policies are the result of certain insurance practices respected by the contracting parties, which regulates material relationships between the parties at which it is difficult to determine insurance interest in terms of rules on compensation.7 PPI policy is such a policy in which, in case of the insured event, the insured is entitled to charge the sum insured only on the basis of the submission of the policy, and with no obligation to prove the existence of interest. In accordance with English Marine Insurance Act of 1906, PPI policies are null and void and have no legal effect. A Marine Insurance (Gambling Policies) Act 1909 additionally prescribes sanctions against those who operate based on such policies. However, despite everything, issuance of PPI policies still exists in certain cases. Those are policies with no interest and are therefore known as "honor" policies. These policies cannot enjoy legal protection, but since they usually do not come to courts, the courts do not express the opinion on their validity. That is exactly the main specificity in the marine insurance, because generally speaking, in the insurance law such insurance policies must be considered null and void. Regarding Marine and Insurance Act, it identically refers to policies where there is an interest, but the insurer has waived the right to request proof of interest, as in policies with no interest. It considers both of them null and void. However, Marine Insurance (Gambling) Act of 1909, prescribes, in addition to nullity, sanction in the form of penalty only for policies where there is no interest.

The Law on Maritime and Inland Navigation does not explicitly prescribe the nullity of the contract, if it was concluded without an interest, but it can be inferred from the general rules of the Contract Law, as well as from the provisions of the above mentioned Article 729,

[5] The Law on Maritime and Inland Navigation contains provisions, that is Article 730 paragraph 1, according to which the policy holder may conclude the insurance contract for its own account, for the account of a third party or for the account of a non-specified person (the so-called “ For whom it may concern ” insurance). The same provisions are contained in the Maritime Code of the Republic of Croatia (“Official Gazette of the Republic of Croatia ”, No.181/2004) Article 686, paragraph 1.

[6] See: Arnould, Law of Marine Insurance and Average, Book II, British Shipping Laws, Vol.10, London, 1961, p. 277.

[7] It is about the recognition of certain additional costs in the hull insurance, which might not be recognized within the framework of ordinary hull policies, because they exceed the full value insurance. Gilmore & Black, The Law of Admirality, second edition, The Fondation Press, 1975. p. 61.

according to which only a person who has or may expect to have a justifiable material interest in the insured loss not occurring may become an insured person. The same conclusion can be inferred from Article 685 of the Maritime Code of the Republic of Croatia and Article 681 of the Maritime Code of the Republic of Slovenia.

The Law on Maritime and Inland Navigation, in Article 729 paragraph 2, regulates the issue of when an insured must have an interest in the subject-matter insured in order to claim compensation for suffered damage.8 According to provision of that paragraph, “An insured person may request compensation for the damage covered by the insurance (insurance benefit) only in the event that he has an interest in the insured object at the time of the occurrence of the insured loss or if he acquired it subsequently”. In principle, the insured has the right for compensation for damage only if the insured had an interest on the subject-matter insured at the moment of occurrence of the insured event. However, the law in the same paragraph also foresees an exception to this principle, in favor of the insured who had no interest on the subject-matter insured at the moment of occurrence of the insured event, but gained it after such an event. Such an insured person can claim compensation for damage incurred prior to his acquisition of the interest on the subject-matter insured, but only if he acquired such interest during insurance period. This is where the specificity of interest is in marine insurance, since the future interest can be insured and that future interest may be the expected profit. It has already been said that the insured may be a person who may expect to have a justified material interest in case that the insured event does not occur. The right to insurance of the expected profit is regulated by Article 728, paragraph 1, item 2, of the Law on Maritime and Inland Navigation. In comparative legal theory it is emphasized and such a provision is contained in our Law on Obligations 9 Article1021, that property insurance may be contracted by any person having an interest that the insured event does not take place since otherwise such person would suffer a material loss. However, as far as our law and property insurance are concerned, the same Article, paragraph 2 of the above mentioned Law, as in navigation laws, the insurance right may pertain only to persons having material interest that the insured event does not take place at the moment of occurrence of damage.

For the above mentioned reasons, and because of a large number of interests and their holders, the practice of conclusion of contracts for the account of persons unknown is widespread at the time of conclusion of the so-called "For whom it may concern" insurance contracts.

4. EXEMPTION FOR DAMAGE FROM THE INSURANCE

Damages exempted from insurance form special category of damages in marine insurance. According to Article 752 the Law on Maritime and Inland Navigation the following damages, occurred directly or indirectly, are exempted from the insurance contracts: intentional action of the insured person, gross negligence of the insured person, intentional action or gross negligence of those persons for whose actions the insured person is responsible for by the Law and the emergence of war risks. Almost the same provision is contained in the Maritime Code of the Republic of Croatia (Article 708) and the Maritime Code of the Republic of Slovenia (Article 704), given the fact that the Maritime Code of the Republic of Croatia foresees in Article 708, paragraph 2, item 4, that damages incurred due to realization of nuclear risks are also exempted from the insurance contract.

Damages incurred by an intentional action of the insured are exempted from insurance and cannot be covered by insurance by an explicit contract concluded between the insured and the insurer. This is understandable, since otherwise the occurrence of an insured event, and therefore entitlement to compensation for damages, depended solely on the will of the insured which is contrary to one of the basic principles of the insurance, which aims to compensate the damage suffered by the insured due to occurrence of an extraordinary

[8] This issue is regulated by the Maritime Code of the Republic of Croatia, Article 685, paragraph 2 and the Maritime Code of the Republic of Slovenia, Article 681, paragraph 2.

[9] „Official Gazette of RMNE“,No.47/08.

event, not because of his intentional action. Otherwise, if it was also allowed, the insurance would lose its practical significance because it would become a source of various speculations and unjustified enrichment.
Damages caused by gross negligence of the insured are exempted from the insurance but may be, if the parties wish to agree so, covered by an explicit provision in the insurance contract. In the practice of marine insurance, damages caused by gross negligence of the insured are usually covered solely in liability insurance of the insured for damages caused to third parties. Such insurance is intended to secure not only the insured, but also third parties which would have suffered material damage due to gross negligence of the insured.
Damage caused by an intentional action or gross negligence of persons for whose acts the insured is answerable, according to the law are (for example, persons under the employment contract), in principle, excluded from insurance, except when it comes to damages caused by an intentional action or gross negligence of the shipmaster and the crew, which includes also damages caused by nautical fault, where insurance of such damages is allowed, according to Article 752 paragraph 2 of the Law on Maritime and Inland Navigation.
Damages caused due to occurrence of the war and political risks are exempted from regular insurance contracts. However, war risks are insured in terms of naval ships, boats and aircrafts, as well as goods being transported by naval ships, aircrafts or by mail.
According to Article 772 of the Law on Maritime and Inland Navigation, Article 729 of the Maritime Code of the Republic of Croatia and Article 724 the Maritime Code of the Republic of Slovenia, in addition to the above mentioned damages that are exempted from the insurance, the following damages are also exempted from the insurance regarding the hull insurance:
In fixed term insurance or voyage charter insurance: the damage created directly or indirectly because of a fault on the ship or because the ship was not seaworthy shall be exempt 10 from hull insurance if the insured person knew of it or could have known and prevented its consequences with the due care and attention of good ship-owner.
The provision of the preceding paragraph shall not apply to the damage caused due to a fault on the ship or because the ship was not seaworthy and the insurance company was informed of this or learnt of it in any other manner when concluding the insurance contract.
In fixed-term insurance, the damage caused directly or indirectly due to risks created outside the limits of the navigation as foreseen in the contract shall also be excluded from the insurance.
Regarding cargo insurance, Article 777 of the Law on Maritime and Inland Navigation, Article733 of the Maritime Code of the Republic of Croatia and Article 729 of the Maritime Code of the Republic of Slovenia emphasize that the following damages shall be exempt from the insurance: "Damages created as a result of a fault or of the natural properties of the goods shall be exempt from insurance, and in those cases where the damage was caused by a delay to the means of transport due to an insured risk".
In addition to the above-mentioned damages that are excluded from insurance under the law, the other risks and damages that are otherwise covered by the law may be excluded from the insurance, which is often agreed upon in practice. This can be done either to agree upon specific clauses in the contract containing also clauses on damages excluded from insurance contract, or by single stating of risks in the contract, i.e. damages excluded from insurance contracts.

5. CONCLUSIONS

In order to remove any doubt about the eventual possibility of marine insurance to be turned into another relationship contrary to its essence, that is to lose its main goal and task

[10] The non-seaworthy condition of the ship shall mean non-seaworthiness in general and the inability to carry out a specific voyage and transport with the ship, either because of technical deficiencies or insufficient equipment, unsuitable crew, an excess or incorrect load, an excess number of passengers on board, or for other reasons.

directed to repair damage caused by extraordinary events (risks), it is inevitable to fulfill conditions presented to contracting parties. In this paper, we have tried to point out the most important conditions, whose fulfillment is inevitable for realization of the right to compensation for damage under the contract of marine insurance. The obligation of proof of interest is not only a specificity of marine insurance contract, but also of other insurance contracts, primarily property insurance contracts. However, interest in maritime insurance has its own specificities that also constitute the specificity of this contract as a whole.

The issue of coverage of damages caused by insured risks and their causal relationship to realized risks certainly cannot be left to practice entirely, because it would allow controversial opinions regarding the scope of coverage. Namely, such a solution would allow that damages which should not be covered by insurance may also be taken as insured damages. Our law started from an average solution according to which damages covered by insurance arose due to insured risks, provided that the causal relationship between risks and damages is listed only at those categories of damages where, without explicit limitation, a very broad interpretation could appear. These include costs directly caused by the realization of an insured event. These costs necessary require limitation of coverage to the costs directly caused by an insured event, which exclude all other costs indirectly incurred due to insured risks from the insurance. The issue of damages excluded from insurance takes a special place. Exclusion from insurance of just a damage caused by deliberate action of the insured would not be justified, because in this way the insured loses interest to take care of an insured subject, which would increase the damages that would otherwise be avoided. Therefore, our law excludes other damage categories.

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BIOGRAPHIE

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Jelena Nikčević Grdinić was born in Niksic, Montenegro, in 1972. She received the D.Sc. degree in Faculty of Law at the University of Belgrade, Serbia, in 2004. Since 1994 she has been employed at the University of Montenegro, where is currently at the position of an associate professor. Her area of interests includes: maritime law, marine insurance, maritime average, business law, etc.

THE MARITIME DELIMITATION AT PREVLAKA IN THE LIGHT OF INTERNATIONAL AND MARITIME LAW

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ABSTRACT

This paper is aimed at presenting the Prevlaka issue in a concise way. First, it is necessary to explain the historical development of this area up to the present time. Since the parties in dispute are Montenegro and Croatia it will be important to present the views of both Montenegrin and Croatian experts on the issue.
Since the dissolution of Yugoslavia the international community has taken a lively interest in the Prevlaka issue. It has not been resolved as yet, but the outbreak of violent conflicts between the interested states has been prevented. A significant portion of this paper is devoted to the nature of this problem and its possible solutions. We will try to explain a possible court proceeding by providing examples from the existing court practice on which the International Court of Justice has expressed its views. We find these views useful in the adjudication of the dispute.
The methods used are: a content analysis of theoretical and experts' views presented in domestic and foreign literature, the comparative and historical methods as well as political standpoints obtained through the media and internet. We have tried to present at least the outlines of a complex problem that possesses an international legal character and is extremely important for a peaceful development of the countries in dispute and beyond. The work is structured in such a way that it points to possible directions in solving the issue in question.

KEY WORDS

Prevlaka Peninsula. border issue. Croatia Montenegro. international community. equidistance. jurisprudence.

1. THE HISTORY OF PREVLAKA

It is difficult to find anywhere in the world such a small piece of land presenting such a complex property rights, interstate and international issue as does Prevlaka.

The very term Prevlaka can in archival sources be found in as different spelling variants as *Prielaqua* and *Privilaqua*. Privilaqua could have meant water or harbor - a privileged, preferred, and primary one. How the term has transformed through time can be seen through the following names - *Preblacha, Preulaca, Prevlaca, Prevlaka.*[1]

The prefix *pre* denotes primacy and priority. If something is valuable (valis) then Prevalis is even more valuable. The name of Prevlaka appears in certain documents in various forms. The Archives of the Kotor District Court offers the name as *Privilaqua*, *Previlacha*, while also preserving the other, older name, which appears simultaneously with the former until the fifteenth century. It is *Tombe, Tumba*, *Tomba*, *and derives from the Greek word tumulus or the Latin tumbos meaning a mound or a hillock*.[2] The Prevlaka Peninsula is otherwise called Cape Oštro, The Entrance to the Bay of Kotor, and since the adoption of the UN Security Council Resolution No. 779, dated October 6, 1992, while waiting for a peaceful and just solution to the border dispute to be reached it has been commonly referred to as No Man's Land.

Although, strictly speaking, Prevlaka could be considered to be only a small islet, there are plenty of indications that this term covers a wider area because a small island could not be home to all that that gave the peninsula the grandeur and importance attributed to it. Numerous authors claim that both in historical and geographical terms Prevlaka is by all means more than an islet. In geographical terms, it is located opposite the Cape Oštro, more precisely in the eastern part of Tivat Bay - at the end of the famous Soliosko field and in the hinterland of the Luštica peninsula. Prevlaka and its surroundings, that is, all of today's Boka Kotorska Bay, was under the Njemanjići family rule between 1186 and 1371, then under the sovereignty of the Hungarian king (1371-1385) and King Tvrtko (1385-1395). By 1420 it managed to preserve independence, but since then it was under Venetian rule until 1797.

The Turks conquered the Herceg Novi area in 1438 only to be supplanted by the Venetians in 1687 when Bocca di Cattaro was declared a province of Venice. After the fall of the Venetian Republic Prevlaka came under the Austrian (1797- 1805), and then the French rule (1805-1806). With the international recognition of the Kingdom of Serbs, Croats and Slovenes in 1919 and 1920 Boka came under the sovereignty of the newly formed kingdom. This fact was not changed by the Italian conquest and rule of Prevlaka between April 17, 1941 and September 8, 1943, as well as the German military presence at Prevlaka. Historians report that traces of the fortresses in the Bay of Kotor date back to Illyrian times. The entire area of the Bay, including this small peninsula of Prevlaka used to be called Prevlaka.

It was observed long ago that the environment of Prevlaka *is a very rich although still nascent, ancient archaeological site. One could only image what would be found only if one could explore the underwater world around Prevlaka? It is even possible that this was where the written language was developed and disseminated from.*[3] Many of the architectural remains of decorative stone sculpture at Prevlaka originate from the time of early Christianity, from the third and the fourth centuries. Boka Kotorska is the largest bay of the Adriatic Sea covering an area of 87 334 km2. The Adriatic Sea is one of the closed or half-closed seas.[4] It consists of four bays: Kotor (29 km2), Risan (25 km2), Tivat (8km2) and Hercegnovi Bays (16 km2). The Bay Islands are Mamula, Isle of Flowers, Island of

[1] Vasko Kostić , *Zapretana prošlost Prevlake*, Beograd ,1989. p.14
[2] Ivo Stjepčević , *Arhivska istraživanja Boke Kotorske*, Perast, 2003.god.p.111
[3] Vasko Kostić, Zapretana prošlost Prevlake, Beograd 1989 p. 10
[4] D. Rudolf, Međunarodno pravo mora, Zagreb,1985.p.231

St. Mark, St. George's Island, Our Lady of the Rock, Our Lady of Mercy, and the peninsulas: Vrmac Devesinjsko, Luštica and Prevlaka.

2. MONTENEGRIN THEORETICAL. VIEWPOINTS ON MARITIME DELIMITATION AT PREVLAKA

The main criterion for determining the status of a bay is the sovereignty over the coastline. It belongs to *the state which holds sovereignty over the bay coastline, and in case the coastline is shared between two or more countries the belt of territorial waters is established, and the rest of the bay falls under the regime of the high seas.*[5] Therefore, the inland sea waters are under the complete sovereignty of the coastal state and are equaled in this respect with the mainland. Yugoslavia exercised its legal rights over all its inland waters which were not denied, and were based on international law.

According to the International Sea Law, the waters of the Bay of Kotor had the status of inland sea waters. In the Bay of Kotor the west and east coasts are jagged in different ways. The west coast covering the area from Cape Oštro to Cape Kobila is relatively non-jagged, particularly with regard to the very Prevlaka Peninsula. Greater is the jaggedness of the east coastline. On this side of the coastline should the straight baselines be determined. These would be suitable only for normal baselines and the internal sea waters, as required by international law. Such a solution would be adequate when assuming that the entrance basin is divided, which could be accepted as a temporary solution for Prevlaka.

It is noteworthy to emphasize that Prevlaka *is linked to sea waters which, since belonging to it, are added to it and cover about 250 km2 of the territorial waters.*[6] The adjacent epi-continental shelf extends to further 4500 km2 along the Cape Oštro and Prevlaka, and, in the opinion of some scholars and experts abounds in natural resources of the sea and seabed. From the standpoint of maritime law, if states, international organizations or private individuals and legal entities want to conduct scientific research in *inland sea waters* they must obtain the *express permission of the coastal State,*[7] which is issued under the conditions and procedures specified by the internal law. The technology of exploitation and the nutrition needs of the population highlight the importance of this area. The current state of the marine basin next to Prevlaka is impossible to maintain because its legal status is changing. The waters lose the status of inland sea waters and are about to gain the status of the territorial sea waters.

The coastal state has sovereign rights, and, naturally, it is not without significance where the borderline between Montenegro and Croatia will be drawn. Professor Perazić is of the opinion that in our case Prevlaka determines the lateral boundary, i.e, it is going to start from the middle of the base line at the exit from the Bay of Kotor, or from some other point north to Prevlaka. The exploitation of oil from the seabed began in the years of World War II and shortly after the first coastal states' claims to jurisdiction over these areas appeared. *Every coastal state is entitled to its epicontinental shelf, even if it does not declare its exclusive economic zone.*[8] Professor of International Law and Head of the Expert Team of the Government of Montenegro in the Prevlaka dispute, Prof. Nebojša Vučinić is of the opinion that both the issues of the land and maritime boundaries are contentious. Montenegro was able to base its claims for equitable delimitation in the Prevlaka region on a range of arguments. Some of them that stand out are the historical reasons, the geographical configuration of the coast and the proportionate length of the coastline and marine areas, a very narrow area in which they need to redraw the borders, the vital interests

[5] dr Milenko Kreća,Pravo mora- naučno istraživanje mora i prenos pomorske tehnologije, Beograd, 1990, str 11

[6] dr Gavro Perazić, Bokokotorska Prevlaka, Beograd, 1995, p. 49.

[7] dr Milenko Kreća, Pravo mora- naučno istraživanje mora i prenos pomorske tehnologije, Beograd,1990, p.96

[8] V. Đ. Degan, Međunarodno pravo , Rijeka, 2000, p. 696, gospodarski pojas = isključiva ekonomska zona

of navigation and security, economic, commercial touristic and fishing aspects.

The interests of Montenegro shall also apply to the smooth sailing, especially because of the hydro-geographical properties and the sea depth at the western entrance to the Bay. The control over the Cape Oštro and adjacent waters is an essential prerequisite for the smooth sailing, that is, an entry and exit to and from the Bay, particularly along the west coast, which is more suitable for sailing and, therefore, has always been used for the purpose.

3. CROATIAN VIEWPOINTS ON MARITIME DELIMITATION AT PREVLAKA

Professor of International Law Dr. Davorin Rudolf believes that the best solution to resolve this dispute is before the International Court of Justice because otherwise the politics would render a judgment in the dispute. In this case, as he says, the Court would take into account the arguments of both countries. He stressed that "nobody in Croatia not even in their secretest thoughts thinks of Prevlaka as a training ground for security threats to Montenegro"
The opinions of Croatian scholars on disputed maritime delimitation Prevlaka are opposite to ours. Professor Josip Pecarić claims the Bay of Kotor to be one of the Croatian lands. In his opinion it was one of the targets of the Greater Serbia policy and it is, according to him, fair to conclude that more than fifty percent of today's monumental treasures of Montenegro belongs to the Croatian people of Boka, i.e, that the Croats of Boka are rightfully entitled to the treasure. Some Croatian authors begin from the fact that Prevlaka is among their essential interests. This is explained by the fact that *they consider the cultural heritage of the Bay to be Croatian*, and the very Bay to be the *Bay of the Croatian saints*.[9] Thus, Croatia could not accept Boka to be part of Montenego. The International Law Professor Vladimir Đuro Degan *hoped that based on the signed Protocol on Interim Regime at Prevlaka, FRY would finally abandon any claims to the Prevlaka hinterland.*

Professor Stijepo Obad believes that since the Middle Ages onwards Prevlaka, in geographical, cadastral, administrative, judicial, ecclesiastical, religious and national terms has belonged to Dubrovnik, Dalmatia and Croatia. He emphasizes that the dissolution of the former Yugoslavia has left this region encountering two new realities in terms of the two newly formed states - the Republic of Croatia and the Republic of Montenegro, and it would be best that this area on both sides continue to be an oasis of peace and not a potential battlefield.

Mutual recognition of the international borders of Croatia and FRY means that both countries have no territorial claims towards each other, *therefore Oštra is no more a territorial but rather only a security issue that will be resolved in the future negotiations and by a separate agreement in the spirit of the UN Charter and good neighborliness, particularly in terms of demilitarization of demarcation.*[10]

4. THE INTERNATIONAL COMMUNITY ROLE IN SOLVING THE PREVLAKA MARITIME DELIMITATION DISPUTE

Upon the dissolution of Yugoslavia, it was essential to mark the republican borders as state borders, thus providing them with all the protection of international law. The Badinter Arbitration Commission was in favour of international recognition of those republics that wanted independence within their existing boundaries, unless a different agreement was reached. The first criterion was that the external borders had to be respected in all cases. Then, the second criterion was that the demarcation line between the neighboring independent states could be changed by means of unfettered mutual agreement. However, based on the third criterion, the Committee

[9] dr Josip Pecarić, *Hrvati Boke Kotorske od 1918. godine do danas,* Međunarodni znavstveni skup *Jugoistočna Europa* 1918- 1995

[10] Tripimir Macan, Rt Oštra u povijesti i politici,Matica Hrvatska Zagreb, 1998, p.109

suggests that *if not agreed otherwise, the former boundaries assume the character of the boundaries protected by international law*. That is the conclusion led to by the principle of respect for the territorial *status quo*, and in particular the principle of *uti posidetis juris*, it being the principle that has a universal character. The Commission took a general statement of the ICJ over the border dispute Burkina Faso - Republic of Mali as a precedent. The case is at rest as of December 22, 1986. This case confirms the respect of inherited borders after independence stemming no doubt from one of the general rules of international law that is or is not expressed in the formula *uti possidetis*.

On October 7, 1991, Montenegro submitted to the Republic of Croatia an initiative to solve the border issue at Prevlaka. An important document after the Vance Plan was the Joint Declaration Ćosić - Tuđman signed in Geneva on September 30, 1992. In the third paragraph of the Declaration it is pointed out that the two presidents agreed *the Yugoslav Army was to leave Prevlaka on October 20, 1992, in accordance with the Vance Plan. The security issues in this area were to be solved by deploying the UN observers to the area and demilitarization. The issue of the general safety of the Bay of Kotor was to be settled through further negotiations*. They also agreed to establish an interstate mixed committee to review all outstanding issues, and to normalize relations, which had to be resolved peacefully. Therefore, the security in this area was to be established through demilitarization of the area and deploying the United Nations observers. After this the Security Council Resolution 779 of October 6, 1992 ensued. The status of Prevlaka was confirmed by Resolution No. 981 of the UN Security Council of March 31, 1995. An important event in the Prevlaka dispute solving was the Dayton Agreement. According to this Agreement the Prevlaka border dispute was to be settled by triple exchange of territories.

5. MARITIME DELIMITATION AT PREVLAKA AS A BORDER ISSUE

Upon dissolution of Yugoslavia new states emerged on the Adriatic coast as new subjects of international law (the former republics): Slovenia, Croatia, Bosnia and Herzegovina and Montenegro (Serbia and Macedonia are countries with no coastline). Land borders between former Yugoslav republics have become international borders protected by international law.[11]

For more detailed information and discussion on islands and especially on the delimitation issues of certain marine areas and Croatia, it is necessary to consult comprehensive works on the topic by Baric-Punda and Grabovac, professors at the Faculty of Law in Split.[12] Professor Vesna Buric Punda, who was a member of the negotiating team on this issue, as a co-author of the book "Resolving Disputes in International Maritime Law - documents, case law, opinions of scientists" analyzes the major issues concerning the delimitation. The book presents a review of the dispute and the corresponding maps. Prof. Buric Punda also co-authored the paper "New Contributions on Delimitation of Marine and Submarine Areas between Croatia and Montenegro," where she analyzed the Protocol signed between the Government of the Republic of Croatia and the Federal Republic of Yugoslavia on the interim regime along the southern border between the two countries, which established the interim regime in the area along the southern border.One of the Protocol parties today is Montenegro which declared its independence in 2006. Although the Protocol parties agreed that the provisions of the Protocol and the Annex of the Protocol would not in any way prejudge the final delimitation between the two states (Article 2 of Protocol), the authors perform a

[11] This is indicated by the Badinter Commission Opinion (On the International Borders of New States) of January 11, 1992. See the article: V. Baric Punda, D. Rudolf., o.c, p. 225-227.
[12] Barić- Punda, Grabovac, Pojam otoka u međunarodnom pravu s posebnim osvrtom na Palagružu i razgraničenje morskih i podmorskih prostora republike Hrvatske, Zbornik radova Pravnog fakulteta u Splitu, 1- 2, 1995.

cartographic analysis of the achieved solutions unfavorable for Croatia.

The boundaries of Boka Kotorska were determined and modified several times, mainly as a result of wars, conquests and rebellions. Montenegro did not perceive the former administrative, inter-republic border as recognized by international law. This clearly indicates that there is a border and territorial dispute. This is explicitly recognized by the international community by establishing a UN Observer Mission at Prevlaka to assist the parties in dispute in finding a peaceful and mutually acceptable solution. The opinion of the Badinter Commission on the transformation of the inter-republic borders into the interstate ones is a general and principled stand, which is mandatory, but which in the opinion of our scholars must be further concretized through the bilateral agreement on border demarcation and delimitation between Montenegro and Croatia.

By its hydrographic and geographic location as a land surface Prevlaka is linked to several categories of marine spaces that have different legal statuses.[13] It is necessary to pay attention to them so that the Prevlaka issue as a boundary problem may be better understood. The outer side of Prevlaka faces the open sea, thus binding itself to all legally recognized institutes of international marine law, including the epicontinental shelf which is very important.

However, in the entrance basin it is not the case; this can only be about the inland sea waters and the territorial sea, which is now temporarily divided between the two countries. The territorial sea in our case appears to be the most controversial part of the sea area, since its boundaries represent, in fact, the state sea border. It is necessary first to point out the legal content related to this sea area that will undoubtedly prove its importance for the coastal state. This issue has historically been dealt with in various different ways. In the case of Prevlaka, the sea in the external basin does not reach anywhere near this latitude within this basin, so that the contact between the two territorial seas would occur.

6. A POSSIBLE SOLUTION TO THE PREVLAKA MARITIME DELIMITATION DISPUTE

Croatia and Montenegro have a temporary border regime because the Interim Agreement on maritime delimitation (Prevlaka), which the Croatian government signed with the then Federal Republic of Yugoslavia in December 2002, is still in force.

As for Croatia, the most contentious is the presence of the police forces of Montenegro in the blue zone, i.e. in the small area of territorial waters around Prevlaka. Croatia will insist on the equidistance as under the Interim Agreement of 2002 the median line was nor drawn, which does not suit Croatia.

Since it is common practice in the world, Croatia will want to draw the median line between the Montenegrin and Croatian coast. It should be noted that the median line applies if there are no special circumstances that Montenegro will certainly seek to be entered. Certainly the smallest problem is the entrance to the Bay which is a small strip, while the line to be drawn between Montenegrin and Croatian coastline seaward is what is important.

Member of the Croatian group of experts on delimitation between Croatia and Montenegro Vesna Barić Punda said that "there are no compelling and valid reasons for abandoning the median line in the Bay of Kotor. So, there is no mutually agreed upon line of demarcation between the two countries, the sea border is the median line. "

In the case of the disputed maritime delimitation Prevlaka, a compromise reached through establishing a joint functional exercise of limited sovereignty might be a solution in the mutual interest. The sovereignty should belong to both neighboring states with or without supervision and control by the organs of the international community.

[13] Dr Milenko Kreća, Međunarodno javno pravo, Beograd 2007.god, str 127

Thus, in the Convention on the Law of the Sea an agreement remains the first tool for the delimitation of territorial waters. Article 15 proves that the rule contained in the first sentence is of the dispositive nature; therefore the states are free to agree upon solutions different from those provided by applicable rules of international law. Sovereign states are always free to conclude or not conclude agreements and may freely determine the content of the agreement within the limits set by the cogent norm (jus cogens). If there is no contrary agreement, states are authorized to extend their territorial sea up to the median line. Due to the wide acceptance of the median line, it seems appropriate to give more details about this delimitation method.

It is a line every point of which is equidistant from the nearest points on the baselines from which the breadth of the territorial seas of each of the two States is measured. The theory distinguishes between three main types of the median line: strict, simplified and modified median line. The strict median line can be most simply defined as a line that is created by strictly applying the definition in Article 15 of the 1982 Convention on the Law of the Sea.

It consists of a large number of connected straight lines (segments). In order to avoid such a complex line of demarcation between two countries, they often simplify the median line so as to reduce the number of points where the boundary line changes direction. Finally, a modified median line is also based on equidistance, but consists of segments that connect points whose position is not strictly equidistant from the baselines, since certain forms are only partially taken into account.

In the case of demarcation with the country - party in dispute, the point of land on which now the state border reaches the coastline, would be significant in this regard because it would serve as an endpoint in the north wherefrom the median line would be drawn at an angle to the exit door that would be marked by a straight line Cape Oštro – Cape Marište. In addition to this method, there is also a method of drawing the boundary line at a right angle at the point where the land border reaches the coast. With a curving coastline this method is inapplicable.

Therefore, since the line of demarcation at sea which would be determined by agreement between Croatia and Montenegro, is still non-existent the median line should be presented as the boundary between the two countries at sea.[14]

States are left a free choice with regard to the method which will determine the boundaries. An analysis of state practice shows that the use of the median line, as a method of delimitation, has dominated over the last 70 years. From a total of 45 agreements concluded, the equidistance method was employed in 33 agreements, 15 of which were concluded between states with opposite, and 18 among states with adjacent shores. From the standpoint of states practice in the delimitation of the territorial sea, it can be concluded that the median line is the most commonly used demarcation method. The emergence of the equidistance rule, a special circumstance in early contract law, can be explained by the fact that this formula reached a balance between a certain kind of predictability and flexibility, objectivity and discretion.

The resolution of the dispute should first be sought in direct diplomatic negotiations. If no results are achieved in that way, than the dispute on the basis of the agreement should be brought before the International Court of Justice in The Hague. In case an international trial was excluded, Montenegro could make a request for an advisory opinion from the International Court of Justice. In such a case we would have to address the Security Council. The opinion given by the Court would have no legal significance of a verdict, but rather that of a legal justification, so that the dispute in question be resolved in accordance with law.

Deciding on the delimitation of the territorial sea has been the subject of a court settlement in a matter of only a few disputes, but, when passing judgments on delimiting other sea areas the Court, also often commented the issues that are important for the delimitation of territorial waters. Thus, the International Court

[14] Ibler,V., Međunarodno pravo mora i Hrvatska, Zagreb, 2001. p.187

in a fishing dispute (Fisheries Case) between the UK and Norway exposed their understanding of some basic questions arising from the nature of the territorial sea. It referred to the close connection of the territorial sea to the land area, and concluded that *the land is what confirms the right of coastal states over the waters in front of its coast.*[15] In 1983 Guinea and Guinea-Bissau presented a dispute on the maritime border to arbitration, demanding one delimitation line for the territorial sea, an exclusive economic zone and the epicontinental shelf. By its 1986 verdict the Arbitration Tribunal once again confirmed the fundamental principle that the land dominates the sea, and its relevance for the very delimitation. The verdict stated that *each delimitation should be conducted fairly and on objective ground: it is important to ensure that, as far as possible, each State controls the maritime area against its shores and in its vicinity*.[16] In this case the Arbitration Tribunal began the process of delimitation by examining the justification for the lines proposed by the parties. Since it first rated the justification of the equidistance proposed by Guinea-Bissau, one might say that the Arbitration Tribunal in this dispute also in a way started from equidistance. What might be considered strange in the further court treatment of the matter is the Tribunal's acting after its his rejection of the boundary lines proposed by the parties in dispute. Namely, the Arbitration Tribunal simply drew the line without having examined the relevant circumstances. These were not thoroughly addressed until after drawing of the specific delimitation line stating that the circumstances were not such as to be able to affect its decision on delimitation. In such a way the Tribunal departed from the usual treatment which provides that a decision on delimitation is adopted after taking into account all relevant circumstances.

In the case law an important case is that of delimitation of the epicontinental shelf in the North Sea in 1967. This was a dispute between the Federal Republic of Germany - Denmark and Germany – the Netherlands. In this case a request was filed with the Court to decide which principles and rules were applicable to the delimitation of the epicontinental shelf between the parties in the area of the continental plateau of in the North Sea. The Government of the Federal Republic of Germany demanded the Court to declare that *each coastal State was entitled to a fair continental part of the plateau and that the method of equidistance is not a rule of customary international law.*[17]

They considered this method not applicable in this case unless it is by agreement, arbitration or otherwise established that an equitable division of the continental plateau could be achieved by applying the method. The Court in this case, however, pointed out that the method of equidistance is not mandatory between the parties in dispute and that there is no single method of delimitation that must apply in all circumstances. It refers the parties to resolve this dispute by agreement, based on *equitable principles* taking into account all the relevant circumstances so that each state obtains the highest possible share of the epicontinental shelf. The Court suggested to the parties to take into account the general configuration of the coast and all the specific unusual phenomena while negotiating. It is necessary to take into account the natural resources of the epicontinental shelf as well.

7. CONCLUSION

A proper delimitation between adjacent, coastal states in the region should be made on the basis of existing rules on marine and submarine boundaries, that is, their delimitation, through direct negotiations with Croatia and international arbitration before the International Court of Justice in The Hague. The rules of international law and maritime law on delimitation of the sea and the waters

[15] Reports of Judgments, Advisory Opinions and Order, ISSN 0074- 4441,The International Court of Justice p. 116

[16] Juraj Andrassy- Međunarodno pravo, Zagreb, 1990, p.162.

[17] Juraj Andrassy- Međunarodno pravo, Zagreb, 1990, p.162., p.124

are very general, vague and undeveloped. Therefore, today we can speak about the process of formulation and development of these rules through the practice of the ICJ. Every delimitation should be seen as unique and original case on its own, whereby on the basis of the broadest geographic, political, historical, economic and other arguments we are striving towards a fair solution. Before the Court arbitration it is necessary to develop further certain methods.

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BIOGRAPHIE

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2008. Finished the Summer school of "Human rights for future decision makers" in Dubrobnik
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SOME CONTRACTS IN MARITIME AFFAIRS

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ABSTRACT

The authors in the text dealt with some unnamed maritime contracts, namely contracts that are not specifically regulated by the Maritime Code, nor any other regulation, but their characteristics and particularities arise from the practice and from taking over of certain parts of any other named or unnamed contracts. Specifically, it is a set of contracts which have as their object the various services that a ship or boat or yacht needs, with the particularity that there is a foreign element in the sense of a ship, boat or yacht owner. This is especially important considering the certain tax consequences and customs that exist in the case of determining a person's illegal conduct. Among other things, here comes into consideration the application of international contracts that have legal power beyond the Croatian law, a subject of special interest is the effect of determined illegality on a Proprietary status of a ship, boat or a yacht in terms on which subject the enforcement for payment of tax and customs duties for violating these regulations is possible.

KEY WORDS

contract. maritime affairs. duties. legal effects.

1. INTRODUCTION

"The sea changes everything" or "all matter changes with or by the sea". This phrase or saying may be interpreted as a figure of speech, suitable for poetry and/or prose, yet the fact is that the meaning of the phrase has, impartially, a much wider range. In this text, the saying shall be limited to the analysis of legal aspects of a contract that combines the elements of material and procedural law, as well as the elements of commercial, maritime, civil, customs and tax laws.

This paper specifically deals with the contract law and the factual substrate requiring a connection with the aforementioned branches of law. Consequently, this paper also deals with maritime, commercial, customs and tax laws. A yacht charter may be a contract whose matter is an available yacht or boat which is leased (in case of demand) and which certainly has to be maintained even if, for any reason, there is no demand. In case the vessel is leased, this contract will likely (and almost certainly) lead to making a number of other associated contracts whose *ratio* is the use and maintenance of the yacht or boat.

The essential assumption of this paper is that the area of yacht and boat charter party is sub-standardised to a large extent[1], which is not good and should be changed, unless there are relevant reasons preventing the changes and making the existing situation justified. There is no doubt that this is a service area that has been expanding considerably on both domestic and international markets. A long time ago, the prevailing standpoints and views were that services were neither independent nor important economic categories, regardless of their character. Such views were dominant in the times of Adam Smith who considered services as economic processes which produced services incorporated in the product (1776) and John Stuart Mill who believed that the implementation of services was conditioned by and dependent on things, i.e. goods (1848). In 1930s Colin Clark started a systematic research but concluded that services were "secondary goods", used only once the primary needs (for goods) were satisfied.[2] On the domestic market, the potential of nautical tourism has directly and positively affected a number of complementary activities, including boatbuilding (making and maintaining of vessels), construction of moorings, anchorages and modern marinas, food production and catering, i.e. shops and restaurants where the value-added food is treated, prepared and sold. In addition, it is certainly necessary to point out that the development of nautical tourism gives rise to the demand of legal services, e.g. lawyers, to be provided when making various contracts and claiming contractual and extra-contractual rights, for instance, in case of various damages which occur quite often in maritime affairs.

2. LEGAL SOURCES

The essential legal source with regard to any legal issue, including this paper's matter, is the Constitution of the Republic of Croatia[3]. As this paper's issue involves the yacht charter (contracts related to exploitation and maintenance of yachts and the associated contracts), the legal sources also include the Maritime Code[4] and the Civil Obligations Act[5], but also the Ownership and Other Proprietary

[1] The term "yacht" is hereinafter used without restrictions which means that it also refers to boats.

[2] See in: Deša Mlikotin Tomić, Dominik Vuletić, *Prvi model Zakona ugovora o uslugama u Načelima europskog ugovornog prava* (First model of the Law on service contracts in Principles of European Contract Law), in: Pravo i porezi, No. 12/10, p. 78.

[3] Ustav Republike Hrvatske (The Constitution of the Republic of Croatia), Narodne novine (Official Gazette of the Republic of Croatia – hereinafter Official Gazette) No. 56/90, 135/97, 8/98 - consolidated text, 113/00, 124/00 – consolidated text, 28/01, 41/01 - consolidated text, 55/01, 76/10 – Revision of the Constitution - hereinafter: The Constitution.

[4] Pomorski zakonik (Maritime Code), Official Gazette 181/04, 76/07, 146/08, 61/11.

[5] Zakon o obveznim odnosima (Civil Obligations Act), Official Gazette 35/905, 41/08.

Rights Act[6] which is *sedes materiae* for the issues of ownership, and the Consumer Protection Act[7] given the fact that charterers are consumers as well, and finally the Leasing Act[8], with regard to great analogies with yacht charter contracts. As the tax and customs status of yachts is very important for their import and exploitation, legal resources also include the Customs Act[9], the Regulation Implementing Customs Act[10], the Law on General Administrative Procedure[11], the General Tax Act[12], the Convention on temporary admission[13], the Regulation on requirements for arrival and stay of foreign yachts and boats intended for sport and recreation purposes in internal waters and territorial sea of the Republic of Croatia[14], the Ordinance on boats and yachts[15], the Regulation on conditions that water craft and physical person or corporation carrying out charter craft activities must satisfy[16], as well as any other legal code at law or sub-law level governing this issue.

According to the Constitution[17], international treaties are, with regard to legal power, above law.

Judicial practice and administrative practice, together with legal science, represent legal sources *sui generis*. They do not act as legal codes; they act – exclusively or to a great extent – using the power of persuasiveness (legal science exclusively in this way, whereas judicial and administrative practice also in this way).

The Republic of Croatia has not yet become a member of the European Union; however, the EU guidelines and various acts representing the European community acquis or *acquis communautaire* have been adopted and make an important part of the Croatian legal practice. In this regard, the role of The Constitutional Court of the Republic of Croatia is of paramount importance as it adopts and implements various standards from the *acquis*

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6 Zakon o vlasništvu i drugim stvarnim pravima (Ownership and Other Proprietary Rights Act), Official Gazette 91/96, 68/98, 137/99, 22/00, 73/00, 114/01, 79/06, 141/06, 146/08, 38/09 and 153/09.

7 Zakon o zaštiti potrošača (Consumer Protection Act), Official Gazette 79/07, 125/07 – amended, 79/09, 89/09 -amended.

8 Zakon o leasingu (The Leasing Act), Official Gazette 135/06.

9 Carinski zakon (Customs Act), Official Gazette No. 78/99, 117/99, 73/00, 92/01, 47/03, 140/05, 138/06, 60/08, 45/09, and 56/10.

10 Uredba za provedbu Carinskog zakona (Regulation Implementing Customs Act), Official Gazette 161/03, 79/06, 05/07.

11 Zakon o općem upravnom postupku (Law on General Administrative Procedure). The 2009 Law on General Administrative Procedure was published in Official Gazette 47/09 whereby the former version of the law, published in Official Gazette 53/91 and 103/96 ceased to be effective.

12 Opći porezni zakon (General Tax Act), Official Gazette 127/00, 86/01 and 150/02. This Act has been in force as of 1 January 2009 whereby the former version of the Act, published in Official Gazette 147/08, ceased to be effective.

13 Uredba o pristupanju Konvenciji o privremenom uvozu (Convention on temporary admission), adopted in Istanbul, 26th June 1990 in English and French, Official Gazette MU 16/98. Pursuant to Articles 26 and 30, alinea 3, of the Law on the procedures for the conclusion and implementation of international agreements, (Official Gazette 28/96), the Ministry of Foreign and European Affairs published in Official Gazette MU 8/99 that the Convention came into force on 1st June 1999.

14 Uredba o uvjetima za dolazak i boravak stranih jahti i brodica namijenjenih športu i razonodi u unutarnjim morskim vodama i teritorijalnom moru Republike Hrvatske (Regulation on requirements for arrival and stay of foreign yachts and boats intended for sport and recreation purposes in internal waters and territorial sea of the Republic of Croatia), Official Gazette 40/06.

15 Pravilnik o brodicama i jahtama (Ordinance on boats and yachts), Official Gazette 27/05, 57/06, 80/07, 3/08, 18/09 and 56/10.

16 Pravilnik o uvjetima koje mora zadovoljavati plovni objekt, te fizička ili pravna osoba koja obavlja djelatnost iznajmljivanja plovila (Regulation on conditions that water craft and physical person or corporation carrying out charter craft activities must satisfy), Official Gazette 41/06, 62/09, hereinafter: Charter Regulation.

17 Article 140 of the Constitution states: International Treaties which are made and confirmed in accordance with the Constitution and which are published and in force, make part of the internal rule of law of the Republic of Croatia and are, with regard to legal power, above law. Their provisions can be altered or cancelled only in line with requirements and procedures stipulated in these Treaties, or in compliance with general rules of the international law.

communautaire, including the standards and views of the European Court of Human Rights.

As we focus on the contract law matter, specific legal sources *sui generis* include the so-called Lando Principles[18] or the PECL initiative (*Principles of European Contract Law*), aimed at designing a law model for service contracts under the title PEL SC (*Principles of European Law; Service Contracts*). These sources are specific because the Republic of Croatia is still not a member state and also owing to the fact that, for the EU member states, this is a source which is certainly not a legal source in its classical sense.

3. ANALYSIS

3.1. Initial assumptions

The fact is that being a maritime state is an essential attribute of the Republic of Croatia, which means that all activities based, conditioned or related to the sea are exceptionally important for Croatia's economy. The tourism industry includes a specific tourist sector (nautical tourism) which has been increasingly growing, and the latter include an equally growing activity related to renting of yachts, the business which is colloquially and most commonly called the charter[19]. One of Croatia's sub-law regulations, the Charter Regulation[20], uses the term *charter company* as a synonym for a *craft owner/operator*. In addition, literature and other references use the term *charterer* for the transport customer[21]. According to one or more criteria, there is often an emphasised international aspect in this area (craft ownership, ensign a vessel is flying, crew's nationality…)

If we take into consideration that more than 4000[22] vessels are available on the market (including yachts, ranging from the smallest ones, that hardly meet the qualification, to the most luxurious yachts manned by a large crew) and that a yacht is actively employed for a minimum of 5 weeks (peak season, from 10th July to 15th August, when there are almost no available vessels[23]), the number of yacht charter contracts amount to 20,000[24] per year, which is approximately 10 times more than the amount of apartment sale contracts in 2011.[25]

With regard to everything that has been set forth, one may expect that a yacht charter contract would be a designated contract featuring detailed and precise regulations, in line with its importance. Unfortunately, this is not the case, at least for the time being. The Maritime Code, in spite of the fact that it is, regarding the number of articles, one of the most comprehensive laws in Croatian positive

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[18] See more in: Selma Sakić, *Landovi principi kao oblik harmonizacije komunitarnog prava*, master thesis, Sarajevo, March 2009, (unpublished); Deša Mikotin Tomić, Dominik Vuletić, op. cit.

[19] See at www.wikipedia.org the various meanings (accessed: 15/04/2012):
The term is used for a special case (or as an exception) to an institutional ***charter****. A charter school, for example, is one that has different rules, regulations, and statutes from a state school.*
Charter *is sometimes used as a synonym for 'tool' or 'lease', as in the 'charter' of a bus or boat by an organization, intended for a similar group destination.*
A ***charter member*** *of an organization is an original member; that is, one who became a member when the organization received its charter.*

[20] Regulation on conditions that water craft and physical person or corporation carrying out charter craft activities must satisfy, Official Gazette 41/06, 62/09.

[21] Drago Pavić, *Pomorsko pravo* (Maritime law), Volume II, Visoka pomorska škola (Higher Maritime School), Split, 2002, p. 86.

[22] For example, see www.miramoclub.hr which offers over 2000 vessels (access: 08/04/2012). If this number is at least doubled, it turns out that there are 4000 vessels available.

[23] Another question is whether it is possible to make any profit from the 5 weeks of charter, in particular regarding the existing tax regulations – this is essential for those who plan or invest in this business. Unfortunately, the situation is entirely different for those who had already invested in charter business and subsequently faced the market changes (which is a normal business risk), but also the legislative changes affecting the vested rights.

[24] This number is considerably higher if it includes the contracts made on a day basis and the business deals which are not registered.

[25] 2169 apartments (flats) were sold in 2011, out of which 1352 in Zagreb and 817 elsewhere in Croatia – source: *www.business.hr* (accessed: 08/04/2012).

law[26], does not contain the provisions specifically addressing the craft charter contracts. Consequently, there are no provisions regulating yacht charter contracts. It is true that a number of provisions of the Charter Regulation feature the terms such as "a hired yacht", yet it does not imply that the Charter Regulation contains provisions on contracts of chartering yachts or other vessels (although the issue is not the same when discussing a sub-law regulation or an act).

3.2. On contracts in the maritime code in general

Even though the Civil Obligations Act is the *sedes materiae* of the contract law, the Maritime Code pays a great deal of attention to the matter in a total of 318 articles which directly deal with maritime law contracts (Articles 430-747), and within other provisions that, in addition to other matter, address maritime law contracts (general provisions, penalty provisions, transitional and final provisions). Given these facts, the question is how such a situation could have occurred, especially in view of the fact that the Maritime Code was issued in 2004, i.e. in the time of great expansion of nautical tourism without any recession in sight, and also in view of the fact that some other parts of what is usually called the "state" easily recognised the trend and, in our opinion, even excessively insisted on recognising the potential, which lead to damages resulting from changes within the legal framework, which have not been entirely settled to date[27].

Despite a great number of articles, there are really but a few designated or nominate contracts[28]. As for regulating contracts for the employment of ships, the Maritime Code differs a) maritime contracts, and b) charters by demise / contracts of affreightment (Article 442), where Maritime contracts are aa) contracts of carriage of goods by sea, ab) contracts of the carriage of passengers by sea, ac) contracts of towage or of pushing of ships on sea, and ad) contracts relating to other maritime services (Article 443 of the Maritime Code).

In order to facilitate the implementation, it is prescribed that the provisions of the Maritime Code referring to particular maritime contracts also apply, in appropriate manner, to other maritime contracts, unless stipulated otherwise by the Maritime Code (Article 444).[29] Some contracts are specifically regulated, e.g. the contract of maritime agency (Articles 674-683), the contract of marine insurance (Articles 684-747), the contract of salvage (including the raising of

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[26] Over a thousand articles, far more than in the Companies Act which contains 647 articles (Official Gazette 111/93 and its amendments published in Official Gazette 34/99, 121/99 – authoritative interpretation, 52/00. – The decision of the Constitutional Court of the Republic of Croatia, 118/03, 107/07, 146/08, 137/09, 152/11 - consolidated text).

[27] The changes and damages refer, above all, to excise duties and other charges that have practically almost destroyed the boatbuilding industry – fortunately, following the severe criticism, the state has largely restrained from additional charges. The similar situation occurred in the area of charter profits, regarding the value added tax – although all those engaged in this activity strongly objected, the normative framework unfortunately has not changed.

[28] The designated contract are the contracts that have been in force long enough and/or have been applied enough frequently, so that the rights and liabilities of the parties to the contract have been profiled and standardised, enabling the legislator to describe them under a specific name within legislation. On the other hand, there are innominate contracts lacking a detailed description of liabilities due to the fact that such contracts have been effective for a shorter period of time and have been applied less frequently – see in: Zvonimir Slakoper – Hrvoje Kačer - Axel Luttenberger, *Osnove prava trgovačkih ugovora i vrijednosnih papira*, Mikrorad d.o.o., Zagreb, 2009, p. 50. In addition, when observing the case which is discussed in this paper, there is a third category – the contracts which are neither new nor rare in practice, but are nevertheless unrecognised by the legislator. There is also an opinion that the designated contracts involve the contracts whose content and legal-technical designation has not become stable, see e.g. Petar Klarić – Martin Vedriš, *Građansko pravo* (*Civil right*), Official Gazette, Zagreb, August 2008, p. 110.

[29] Unless otherwise provided by this Law, the provisions governing particular maritime contracts shall also apply in appropriate manner to other maritime contracts.

sunken objects, Articles 760-788[30]). The theory clearly emphasises the diverse legal nature of a maritime contract (as it represents a piecework agreement – *locatio conductio operis*) with regard to a contract of affreightment (as it is a contract of exploitation of objects – *locatio rei*)[31].

By applying a number of general legal principles (in particular *lex posterior derogat legi priori, lex superior derogat legi inferiori, lex specialis derogat legi generali)* to the existing range of legal codes at law, sub-law and super-law[32] levels, a legal solution can be found to any problem occurring in practice. This is not disputable – however, the level of quality of the solution and its closeness to the ideal result are frequently disputable. Nevertheless, it should be always pointed out that legal safety is not equally achieved when there is a clear legal provision in the regulation directly addressing a subject (this applies to the Maritime Code as well) and when extensive efforts are made fulfilling a legal void in order to find a solution. In other words, when it is prescribed, for example, that a legal solution is to be applied, in appropriate manner, to another situation, this only apparently or just *prima facie* looks simple, but may be very complex (if it was not the case, there would be few laws). In addition, the very Maritime Code is not persistent. For example, Article 208 clearly refers to the Ownership and Other Proprietary Rights Act regarding the proprietary rights of the ship and yacht, whereas later on, in the section dealing with contracts, there is no similar provision which would refer to the Civil Obligations Act. It is clear that contracts will be regulated by the general provisions of the Civil Obligations Act which is a substitute for a Civil code which presently does not exist, in all cases when an issue is not settled by a particular or special regulation (in this case the Maritime Code), but this is not at the same level of legal safety. Moreover, at least as far as this matter is concerned, there is no justified reason for using different criteria in the same law (referring clearly to the Ownership and Other Proprietary Rights Act, and not referring to the Civil Obligations Act).

3.3. Yacht charter contract

3.3.1. General remarks

As it has been already pointed out, the Maritime Code does not contain provisions which would govern the yacht charter contract in a particular and clear manner. It is true that Article 2 alinea 1 of the Maritime Code states that the provisions referring to craft also refer to yachts[33] unless stipulated otherwise, but the Maritime Code does not regulate the contract of craft charter, so that, consequently, it does not regulate the contract of yacht charter either. It is very important to point out that the contract of affreightment and charter party are not the same. In spite of similarities, there is a clear and important difference which has been recognised even by the Civil Obligations Act (unlike the earlier version of the same Act which described only the contract of affreightment, but in such a way that it practically referred to both contracts[34]). The essential difference is between the terms *usus* and *ususfructus*: *usus* (as well as yacht charter) authorises the usage, whereas

[30] Not all articles apply to the contract. These are article references governing the salvage in general and including the contract of salvage.

[31] Drago Pavić, Pomorsko pravo (*Maritime law*), Volume II, Visoka pomorska škola (*Higher maritime school*), Split, 2002, p. 59.

[32] We are referring to international treaties.

[33] However, there is no reference to boats. On the other hand, a provision in Article 446 alinea 1 states that:
(1) Provisions of the Articles 442 – 674 (**authors' note:** provisions referring to Contracts for the employment of ships) of this Law shall also apply to: 1) warships, 2) boats.

[34] See Articles 567-599 of the 1991 Civil Obligations Act (Official Gazette 53/91, 73/91, 111/93, 3/94, 7/96, 91/96, 112/99 and 88/01. It should be noted that the Act was acquired from the former Yugoslav legislation; it came into force in 1978 (Official Gazette of the Socialist Federal Republic of Yugoslavia 29/78, 39/85, 46/85 and 57/89). See short explanation of the amendments after acquiring in: Tanja Tumbri, *Zakon o obveznim odnosima*, Informator, Zagreb, 1997, pp. V-VI. Cf. Ivica Crnić, *Zakon o obveznim odnosima*, *napomene, komentari, sudska praksa i prilozi*, drugo bitno izmijenjeno i dopunjeno izdanje (*Civil Obligations Act, notes, comments, judicial practice and appendices*), second and thoroughly amended edition, Organizator, Zagreb, 2006, p. 475.

ususfructus (as well as affreightment / ship charter) authorises both the usage and exploitation, which implies gathering fruits (including the civil ones)[35]. This means that there is a considerable difference between a situation where a lessee charters a craft in order to transport cargo from one place to another, and a situation where a client charters a yacht in order to reach, as best as he can, the destinations where there are no regular shipping lines[36] (e.g. Palmižana near the town of Hvar, as one of the worldwide famous destinations[37]). The Civil Obligations Act differs and separately regulates the contract of affreightment and the charter party[38]. It should be noted that, in business practice, the contract of carriage of goods by sea is also called the charter party[39], although there are no justified reasons. As it has been already mentioned, the Charter Regulation contains the formulation about hiring a yacht / yacht charter, but offers no specific details.

Therefore, the only solution is to apply, in appropriate manner, the provisions of the Civil Obligations Act which refer to the charter. Basically, this is possible but it should be borne in mind that, differences being so significant, the safety phrase "in appropriate manner" will often present an obstacle when applying the solutions from the Civil Obligations Act. If it is so, the courts are not authorised to *non liquet* - restrain from procedure in case of lacking lawful solution[40] and there is a risk that the application of interpretation turn the interpreter into a new legislator, which is bad for legal safety as it strongly encourages arbitrariness and legal violence.

Another possible solution is to apply, in appropriate manner, the provisions of the charter by demise / contract of affreightment from the Maritime Code. In order to make it feasible, it is necessary to clarify the distinction between the charter by demise / contract of affreightment and the yacht charter, and bear in mind that the Maritime Code provides a legal definition saying that "Under a charter by demise as prescribed by this Law, the lessor gives the lessee,[41] against payment of hire, a ship to perform navigation activities" (Article 658). Under the contract of affreightment/ charter by demise the shipper ceases to be a navigation entrepreneur while the lessee becomes a navigation entrepreneur[42]. Taking this into consideration and comparing to the common charter of a boat (not including a single crew member) or a yacht (where a skipper is commonly hired while additional crew is hired only onboard really large yachts) which typically involves only tourism and no entrepreneurial elements, the essential and specific differences are clear and require specific legal regulations. As long as such specific provisions do not exist, the only possible solution is to apply general provisions "in appropriate manner", which certainly implies delegating a specific responsibility to the one who applies the law due to the procedure of interpretation. Such a person will have to take into consideration all that has been set forth above, and will likely have to go out of the framework of meaning provided by the linguistic interpretation. Although this is enabled by the target or teleological interpretation, there is a general opinion that this is a very sensitive and legally unsafe and

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[35] See also: Petar Klarić – Martin Vedriš, *Građansko pravo* (*Civil law*), Narodne novine, Zagreb, August 2008, p. 524.

[36] We are referring to transport links maintained and guaranteed by the state or at least by local self-government; not referring to the market-oriented, hence profit and weather-dependent lines.

[37] Particularly owing to the Meneghello family unique park.

[38] Which is also the case in the General civil code (Österreich Allgemeines Bürgerliches Gesetzbuch - ABGB) or the Austrian civil code.

[39] Drago Pavić, *Pomorsko pravo*, Volume II, Visoka pomorska škola, Split, 2002, p. 77.

[40] "not clear", a legal formula used by a Roman court to indicate that the factual situation engaged in a case has no answer from the governing system of law and therefore can not be judged – such a legal construction in the Croatian positive law does not exist.

[41] It should be noted that the Civil Obligations Act, as a regulation which is the *sedes materiae*, uses the term "zakupnik" ("holder"), whereas the Maritime Code uses the term "zakupoprimatelj" ("lessee"). Although the Maritime Code was issued earlier, the terminology should have been harmonised when the documents were amended.

[42] Drago Pavić, *Pomorsko pravo*, Volume II, Visoka pomorska škola, Split, 2002, p. 78.

risky area where the procedure of interpretation could likely do more harm than good[43].

When claiming that the yacht (and boat) charter contract is very specific (and inherently requiring specific legal regulations), in addition to the above mentioned arguments there is a number of other facts supporting the hypothesis. Here is but a selection of them:

a) in the yacht charter without hired crew, it is essential that the charterer has basic handling qualifications; typically, he/she rarely applies seamanship (in most cases from one annual leave to another); if this is true (and we are positive about that), the legislator must take it into consideration;
b) regardless of whether a skipper and/or other crew members are included in the contract, the charterer on his/her behalf and on his/her own account purchases fuel (potentially breaching the law by purchasing and using the subsidised, so-called "blue" diesel), makes arrangements for the anchorage or mooring, buys provisions. In all these situations the third parties are not familiar (or are partially familiar) with the status of the person they are dealing with, often considering him/her the owner or holder of some other (proprietary) rights regarding the yacht and ensuring him/her the legitimacy;
c) the number of craft theft during the charter indicates a phenomenon which must not be (at least not entirely) relinquished neither to the insurer's practice nor to the general insurance provisions;
d) the abuse of the craft during the charter regarding the breach of customs regulations (especially if the vessel flies a foreign ensign) and tax regulations (especially regarding the distinction between the so-called representation and classical charter) also indicates the phenomena requiring specific provisions;
e) given the common structure of the persons on board (in terms of professional qualifications, knowledge and skills), the legislator should determine useful specific provisions, at least in the area of environmental protection (from dumping waste into the sea to oil leaks and other threats to the marine environment);
f) current tax regulations imply that all those who used entrepreneurial import subsidies must achieve the prescribed minimum of the capacity booking and the minimum of financial collection for the services provided on the market. Given the ongoing recession, there are few entrepreneurs who could make it. When discussing the issue of the charter contract satisfying such provisions, it is essential to find out whether the contract is formally legal if the owner makes a deal with himself/herself and pays for the charter[44]?;
g) there are a number of other specific aspects, but the above mentioned is enough to prove that this business activity requires special legal regulations which, unfortunately, do not exist at the moment.

3.3.2. Legal attributes of the yacht charter contract

3.3.2.1. General remarks and the contract matter

It is particularly necessary to point out that it is hard to determine legal attributes of the yacht charter contract, owing to the missing legal regulations. This, at the same time,

[43] This is possible, it is risky and represents a threat to legal safety. See more about it in: Nikola Visković, *Teorija države i prava*, Birotehnika, Zagreb, 2001, p. 243 onwards; Oleg Mandić, *Sistem i interpretacija prava*, Narodne novine, Zagreb, 1971, p. 201 onwards; Norberto Bobbio, "O kriterijima za razrješavanje antinomija", in: *Eseji iz teorije prava*, Logos, Split, 1988, pp. 123-135.

[44] Tax authorities examine the validity of such contracts. In order to achieve the same effect, entrepreneurs lease vessels one to another (this is a fictive and simulated legal business resulting directly from the tax provisions – but it does not represent a classical tax abuse since the hire is actually paid and the vessels are used).

represents a strong argument that the present situation should be changed.

On the one hand, the contract matter is the price or a hire, while on the other the contract matter is the vessel itself (yacht or boat), whose sailing purpose is designated as "recreational" and not intended for transport[45], with a remark that the contract matter is, by legal definition, a movable property (Article 208 of the Maritime Code). Article 3 of the Charter Regulation is very important as it states:

(1) A charter company can lease their own vessels or the vessels owned by another domestic physical person or corporation.

(2) A charter company can lease a vessel owned by another domestic physical person or corporation under condition:

– that the vessel is entered into the register of boats for commercial purposes or is entered in the register of yachts for commercial purposes, and

– that the charter company proves that all tax and customs liabilities regarding the vessel have been fulfilled.

3.3.2.2. With regard to the form or the type of contract

According to their form or type, contracts can be formal and informal. Pursuant to the Civil Obligations Act, the charter contract is an informal contract, unless it involves a real estate. In this case, written form is prescribed (Article 552 of the Civil Obligations Act). The requirements include the signature certification with *clausula intabulandi* as a requirement for the land-registry feasibility (not for legal validity) given the fact that the charter is but one of the four compulsory rights suitable for entering into the land register (pre-emption, buyback, charter and affreightment)[46].

However, according to Article 659 of the Maritime Code, the charter by demise / contract of affreightment must be made in written form, to avoid the threat of nullity (as the following paragraph states that the charter by demise / contract of affreightment which is not made in writing has no legal effect). The problem of implementing this provision lies in the fact that the definition of charter by demise / contract of affreightment, according to the Maritime Code (unlike, for example, the 1991 Civil Obligations Act), significantly differs from the essence of the yacht charter contract. The question is whether it is justified to equalise the two quite different contracts, especially given the fact that the consequences of failing to meet the form are exceptionally serious (if equalisation is accepted).

In practise, problems related to the forms or the types of contract do not exist. A yacht charter contract is almost always made in written form (always, when a charter company is a legal entity engaged in a registered activity involving leasing the vessels and fulfilling all the so-called public liabilities). This makes sense for many reasons. The parties to the contract have agreed on a written form, regardless of the fact that this may not be required and stipulated by law[47]. In addition to legal safety, needed by charter companies that are always particularly concerned about the profit, the written form is equally needed by charterers to show their legitimacy to the third parties (especially to police and customs authorities, and all other entities who provide any sort of services related to the yacht).

Nevertheless it is possible to make a yacht charter contract as a verbal agreement and it is necessary to determine whether such an agreement is legally valid (although verbal agreements are rather rare and are most often associated with illegal, the so-called "black" charter). Here it is necessary to find out whether a contract is fulfilled or not, as according to Article 294 of the Civil Obligations Act, a contract requiring a written form is considered valid, even though it has not been made in writing, if the parties to the contract have fulfilled the contractual liabilities, entirely or to a great extent, unless there are other consequences resulting from the fact that the contract has not been made in the prescribed form.

The very existence of the aforementioned doubts leads to the conclusion

[45] This implies that the vessel is not engaged in transport business, but chartering a yacht does not obstruct the charterer to be transported from one place to another.

[46] See Article 31 alinea 1 of the Land Registration Act (Official Gazette 91/96, 68/98, 137/99, 114/01, 100/04, 107/07 and 152/08).

[47] Article 289 of the Civil Obligations Act.

that there should be a clear legal provision which would resolve these doubts.

3.3.2.3. With regard to payment

According to the payment, the contracts can be contracts against payment or contracts without payment. The yacht charter contract is a contract against payment; if there was no payment involved, it would be a lending agreement, not a yacht charter contract. Here it should be borne in mind that the parties to the contract may, for various reasons (most frequently in attempt to avoid certain liabilities towards the state), simulate to make a lending agreement (simulated business) and not a charter contract (dissimulated business). As a rule, a simulated business is considered void, whereas a dissimulated business is considered valid (if it also meets the other prerequisites of validity)[48].

3.3.2.4. With regard to the performance of the contractual obligations and party stakes

According to the performance of the contractual obligations and party stakes at the time of making a contract, the latter may be commutative (where the data are known) and aleatory (regulating the effects of the occurrence of an uncertain event). As far as the yacht charter contract is concerned, everything seems to be clear and leading to the conclusion that this type of contract is a commutative contract. However, some believe that the aleatory elements are introduced into the contract by the fact that weather conditions significantly determine not only the quality of exploitation of the vessel, but can also raise doubts whether there has been any exploitation at all. For example, it may occur, especially in short-term charters, that leaving port is not possible or allowed (primarily by authorities such as harbourmasters and police).

In legal theory and legislation there are serious doubts when attempting to make a distinction between a *fortuitous case* and *force majeure*. According to the objective theory, a fact constitutes a case of force majeure when it is unavoidable *per se*. That is to say, for an event, an act etc. to be considered as a case of force majeure, it must be objectively out of the area of the debtor's control. On the other hand, the subjective theory considers as cases of force majeure events which were unforeseen and would be unavoidable even if the debtor had acted with extreme diligence and care, i.e. if he had demonstrated diligence and care exceeding those of the non-negligent debtor whose attitude constitutes the criterion of the distinction between negligence and fortuitous cases in general. The shortcoming of this theory is that it almost erases the difference between a fortuitous case and force majeure[49]. Some believe that a fortuitous case is an event which could have been prevented if it had been foreseen, whereas force majeure is an event that could not have been avoided even if it had been foreseen[50]. As weather conditions are not events that can be avoided (Article 1067 of the Civil Obligations Act contains a formulation defining a force majeure, although not using the very term, in a way that such an event requires the accumulation of all conditions[51]) it turns out that, in Croatian positive law, according to the Civil Obligations Act, and applying to all contracts unless a special regulation stipulates otherwise, weather conditions qualify neither as force majeure (as they are neither foreseeable nor avoidable) nor as a fortuitous case (even if the bad weather has been foreseen, it can not be avoided).

It can be concluded that apparently simple distinctions, such as the categorisation of commutative and aleatory contracts, may give rise to serious doubts. For this reason and for all the previously described reasons, it should be pointed out once again that specific and precise legal regulations should be

[48] See in: Petar Klarić – Martin Vedriš, *Građansko pravo*, Narodne novine (Official Gazette), Zagreb, August 2008, p. 142. See also Article 295 of the Civil Obligations Act (the use of the term "prividni" ("apparent") for a simulated contract, and "neki drugi ugovor" for a dissimulated contract.)

[49] See in: Petar Klarić – Martin Vedriš, *Građansko pravo*, op. cit., p. 602.

[50] See in: Zlatko Ćesić, Vilim Gorenc, Hrvoje Kačer, Hrvoje Momčinović, Drago Pavić, Ante Perkušić, Andrea Pešutić, Zvonimir Slakoper, Ante Vidović, Branko Vukmir, *Comments on the Civil Obligations Act*, RRIF plus d.o.o., Zagreb, 2005, p. 1654.

[51] "...for an unforeseeable reason, out of the area of control, which could not be prevented, avoided or eliminated".

designed (to govern, for example, distinct standards for the so-called *first minute* arrangements and distinct standards for other contracts, in particular the *last minute* arrangements).

3.3.2.5. With regard to other associated contracts

It is almost impossible to imagine a yacht charter contract which is not resulting in other associated contracts. Potentially there are countless contracts, but the most relevant, or the most frequent, are the ones arranging the berth, anchorage or mooring, contracts of maintenance (e.g. cleaning), contracts of supplying food, beverages and the so-called industrial water, but also the contracts of sub-charter and sub-affreightment.

It should be emphasised that, according to the Civil Obligations Act, the sub-charter is allowed (Article 567), whereas the sub-affreightment is forbidden (Article 537) - unless otherwise stipulated by contract. The distinction results from the fact that the affreightment involves business aspects (includes exploitation), which is not the case in the charter. However, having the yacht charter in view, the distinction does not necessarily seem to be logical and safe as a legal conclusion, which represents yet another argument for designing additional legal regulations.

A whole set of associated contracts (as we call them) are mutually diverse but have a strong common feature – their *ratio* is the best and the most prosperous implementation of the yacht charter contract. Some of them may contain privileges (as a rule, at marinas, anchorages and moorings), while in some of them any specific feature of the charterer is entirely irrelevant from the legal point of view (e.g. when purchasing food and drinks). It should be added that there is also a possibility (which should be strengthen by a clear contractual provision) for a contract depending on the implementation of the yacht charter contract, to be legally bound with the latter (e.g. the berth, perhaps a hotel accommodation on a remote island).

3.3.2.6. A customs specificity related to the yacht charter contract

Customs tariff preferences, considering the amount of duties (both absolute and relative), have always encouraged serious attempts of abuse but, on the other hand, have also given rise to permanent suspicion as for whether the abuse of customs regulations really occurred. In everyday life there are countless possible abuses, but one case deserves a particular attention: the suspicion of a simulated yacht charter contract connected with the residence status of a Croatian citizen. Namely, a Croatian citizen residing abroad has a right to use the privileges otherwise entitled to foreigners, with regard to using a craft flying a foreign ensign, in case of temporary admission of the craft. Here it is exceptionally important to quote the key part of the Annex C of the 1990 Istanbul Convention:

Article 5
For the facilities granted by this Annex to apply:
(a) means of transport for commercial use must be registered in a territory other than that of temporary admission, in the name of a person established or resident in a territory other than that of temporary admission, and ***be imported and used by persons operating from such a territory****;*
(b) means of transport for private use must be registered in a territory other than that of temporary admission, in the name of a person established or resident in a territory other than that of temporary admission, and ***be imported and used by persons resident in such a territory****.*

In order to use these provisions efficiently and safely in a legal way, it is important that there are no obstacles in the implementation of the key institutes, as it is hard enough to accurately determine the factual situation. It should be assumed that the Convention has a super-law legal power, which implies the harmonisation of the national laws and sub-law regulations. Having this in mind, one may ask how to even interpret the key term ***persons resident in such a territory*** if the laws and sub-law regulations do not specify anything about it. Croatian regulations involve the terms of residence and temporary residence as well as their sub-divisions, but do not say anything about living in a territory.

The above mentioned implies a considerable area for would-be abuses and damage to the state and the parties. It is clear that the ambiguity has to be solved urgently, but meanwhile life goes on and decisions need to be made. We believe that *de lege lata* the only option is, in case of doubt, to act *in favorem* of the party, certainly not the other way round. In this area there is always a risk of court disputes at international tribunals, the disputes Croatia is already involved in and will be involved even more once it becomes a member state of the European Union.

3.3.2.7. A tax specificity related to the yacht charter contract

Croatian tax system often experiences changes and suspicion of abuse. Regarding the vessels and their charter, the practice proves that the persons, owning vessels for commercial purposes and leasing them, are required to lease the vessel for a number of weeks; if they fail to fulfil the minimum requirements, it shall be considered that the vessel "*was not used for entrepreneurial purposes, or it was used for entrepreneurial purposes to a negligible extent…*". In a specific case, a very expensive yacht was leased for 43 days over the season and it was decided that the case matches the above mentioned qualification. The decision was followed by a tax sanction. It should be added that in practice there is a frequent confusion between the tax prepayment (earlier rates were 22% and 23%, now 25%) and the preferential VAT rate of 10% for the craft charter, resulting in the conclusion that, proportionally, far too little was "returned" into the budget. In this context a change introduced by a novelty in the Corporate Income Tax Act should be mentioned[52]: according to Article 12 alinea 16 of this Act[53], during the tax period a vessel should make an income amounting to at least 7% of the purchase value. Many vessel owners simply can not meet this provision and failing to do so, they lose all tax preferences, which is a certain way towards bankruptcy or liquidation.

When discussing the yacht charter contract, it is important to note that a withdrawal or the termination of the contract may have civil law and legal-tax consequences. Being familiar with real-life situations, it would be wise to introduce a sort of protective clause into the contract. However, if a charter

[52] Corporate Income Tax Act (Official Gazette 177/04, 90/05, 57/06, 146/08, 80/10 and 22/12). It is interesting that this law also uses the term "craft charter".

[53] 16) The taxpayer whose long-term assets include vessels, aircraft, apartments and summer houses, is entitled to use the amortisation of the fixed assets as expenditure under the following conditions:
1. that the taxpayer is registered for the activities of **lease and transport using his vessels** and aircraft, i.e. for the activities of renting apartments and summer houses, and
2. that the taxpayer, using vessels and aircraft during the tax period, makes income amounting to **at least 7% of the purchase value of such assets**, and
3. that the taxpayer, using apartments and summer houses during the tax period, makes income amounting to **at least 5% of the purchase value of such assets**.
(17) If the taxpayer, during the tax period, fails to fulfil the obligations from alinea 16 of this Article, he must raise the basis of tax assessment by the expenditure of amortisation of such assets, and by all associated expenses resulting from the use of these assets.
(18) The taxpayer, whose assets from alinea 16 of this Article was amortised in the previous tax periods, is considered to have had expenses related to the use of such assets in accordance with this Act, if the taxpayer, during the tax period, meets the requirements from alinea 16 of this Article. If the taxpayer fails to fulfil the obligations from alinea 16 of this Article, his basis for tax assessment will be increased by all associated expenses resulting from the use of such assets.
(19) The taxpayer using the assets described in alinea 16 of this Article for leasing, the costs of leasing and usage of these assets shall be recognised in accordance to this Act, providing that the taxpayer, during the tax period, made an income amounting to at least the costs of leasing. If the taxpayer fails to fulfil the aforementioned obligation, his basis for tax assessment will be increased by the cost of leasing and all associated expenses resulting from the use of such assets.
(20) The vessel mentioned on alinea 16 of this Article is a boat or yacht in the internal waters serving for pleasure, sports, recreation, or charter activities.

company decides to do so, the clients may choose the company that does not use protective clauses, so that it can be concluded that the introduction of protective clauses into the contract should be a measure taken by the legislator (providing that the afore mentioned attitude of tax authorities is legal at all).

It is important that the Charter Regulation stipulates that the *charter company*[54] is liable "*...to prove that all tax and customs liabilities have been fulfilled regarding that vessel.*" Regretfully, this has not resulted in an appropriate definition of the yacht charter contract (at least at a sub-law regulation level) where provisions would explain, for example, how to prove that the tax and customs liabilities have been fulfilled, and what happens if they have not been fulfilled.

4. CONCLUSIONS

Although the yacht and boat charter contracts are very common in practice, there are no clear and accurate legal regulations that would govern that type of contract exclusively and make it a classical designated contract. The yacht charter contract is indisputably a contract against payment and an informal contract. The problems (at least benign ones) arise from questioning its commutative or aleatory nature, and these minor problems may lead to major troubles when one must decide where to look for legal sources for filling in the legal voids – in the charter by demise / contract of affreightment, in the general lease contract, or elsewhere.

We consider that it is not only useful but also necessary to introduce changes into the legal framework (even though there may have been few major problems in practice, this is not an argument to remain passive; on the contrary). The changes would not result in any costs or harmful consequences, while all sides would benefit from the increased legal safety and reduced number of court disputes which is inversely proportional to the quality legal framework. The fact that the judicial practice and administrative practice manage to cope with the issue is only the proof of their quality, but by no means an argument for keeping the legal framework unchanged. If the changes are made (we hope and believe they will), then a *modus operandi* would require gathering as much experience and suggestions from the "field"[55], and then prepare a legal proposal of an act for a thorough public discussion (as a primarily seasonal activity is discussed, the forthcoming nautical season is already lost, but there is time to start legislative activities for designing new regulations for the next one), We therefore hope that the parliament will not adopt a legal proposal of the new act in express procedure (which is, unfortunately, a common practice), but rather after two or three perusals.

On the other hand, certain mitigating circumstances exist. The Maritime Code is a comprehensive act which can easily withstand the regulation of one more contract, in addition to the others that are already defined. Further detailed legal regulations will considerably increase the level of legal safety, which is already a sufficient reason for our initiative to be thoroughly examined and adopted (as we are, without prejudicing anything, absolutely confident our arguments are sound). We would like to point out that we do not mean that any regulation of the Maritime Code is superfluous and that it should be changed by articles on yacht charter contract, but we suggest that it should be possible for the Maritime Code to introduce novelties comprising new elements, both at formal and substance levels. Naturally, from the technical point of view, it should be considered whether the necessary changes would be introduced to the Maritime Code

[54] It should be noted that the Companies Act (Official Gazette No. 111/93 and its amendments published in Official Gazette, No. 34/99, 121/99 – authoritative interpretation, 52/00 – The decision of the Constitutional Court of the Republic of Croatia, 118/03, 107/07, 146/08, 137/09, 152/11 - consolidated text) provides a considerably different definition of the term *company*. The company or a firm is a trade name, i.e. the name used by a tradesman in doing business with the third parties. – see in: Vilim, Gorenc, Zlatko Ćesić, Vesna Buljan, Vlado Brkanić, *Comments on the Companies Act*, IV amended edition, RRIF, Zagreb, 2008, p. 30.

[55] Foreign experience may be very useful, in particular the experience of countries developing nautical tourism (Italy, Greece, Spain…).

alone, or to some other regulations, e.g. customs and tax regulations, as well.

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BIOGRAPHIE

Blanka Ivančić-Kačer was born at 15. of July 1979. in Split, married and mother of two children. She enrolled at The Faculty of Law in Split in the academic year 1998/1999., and has graduated at 28. February 2002., namely before the term. She has received for the academic year 2000./2001. a reward from the Dean and from the Head Provost, and as a best student of the 4. year she has received a reward Konstruktor- engineering d.d. Split.
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THE CONCESSION AGREEMENT AS AN INSTRUMENT FOR THE DEVELOPMENT AND MANAGEMENT OF SEAPORTS

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ABSTRACT

Under processes of globalization and liberalization in the last twenty years exists trend of increasing investments of private capital in seaport sector by applying concession agreements. Seaports have developed as an answer to economical demands of their hinterlands and markets. Their appearance and development are under strong influence of historical, geographical, political and economic factors, which are transferred to different models of management, ownership structures and legal arrangements. In many countries round the world, governments and public institutions have withdrawn from direct performing of port activities because of the belief that involvement of private entrepreneurs will provide better flexibility and efficiency on the market. Because of the need to reduce public spending there is a request for active involvement of the private sector, not only in providing port services but also in the construction and development of the new port objects and installations. In the new environment concession granting of the port activities to the private operators has become regular practice and very efficient tool for management of the seaports, particularly in the development of the new port capacities. In the eighties many seaports around the globe were in dire straits: particularly in financial problems, under state control, over manned, without market orientation, often without possibilities to provide simplest port services. These situations were usual not only for the seaports in the developing world but also in many other developed countries. Concession agreements have provided timely solutions; private investors secured funds for modernization of the port capacities, what have released state funds for investments in other economy sectors.

KEY WORDS

concession agreement. seaports. port development. port management.

1. INTRODUCTION

In most countries throughout the world, practically all imports and exports are performed by sea. Maritime transport needs the port facilities to facilitate the interconnection with road transport and inland navigation. Efficient ports are required for this purpose, to provide assistance to the economy in terms of internal supply and external distribution. Seaports were developed as a response to the economic requirements of their hinterland[1] or market. Their emergence and development were influenced by historical, geographical, political and economic factors, which were "translated" into different management models, ownership structures and regulations throughout the world. In many countries throughout the world, the government and governmental authorities have withdrawn from the direct performance of port operations, convinced that the involvement of private entrepreneurs in the performance of port operations and the provision of port services will provide for increased flexibility and efficiency on the market (by means of a higher competitiveness), as well as a better response to the requirements of port users. The ports that were traditionally managed as governmental divisions are faced with a private capital inflow, which promises higher competitiveness, increased efficiency and lower operating costs. This usually includes the transfer of the provision of port services from governmental authorities to private companies[2]. Today, in view of the need to cut down public consumption, the active participation of the private sector turns out to be necessary in many countries, not only in the field of the provision of port services, but also in the fields of construction and development of new port buildings and facilities.

Over the last decade, maritime transport has undergone major technological innovations, which increased the need for port facilities that would be in a position to accommodate new generations of ships and different forms of packed cargo. This has triggered competition among the ports in order to attract modern ships and higher cargo volumes; in addition, intermodality increased the competitiveness forcing the ports to expand their operations outside the usual port boundaries.

The traditional role of the ports with respect to the storage of goods is therefore becoming less significant paving the way for a better and more integrated logistical and physical distribution. These trends have also produced an impact on the organization and regulation of ports: they have enabled a growth in private capital inflow in the development of the ports, the deregulation of the operations and sometimes the full privatization of the ports.

Technological changes also emphasize the importance of specialized terminals in the ports (for instance, multipurpose, container, liquid, bulk cargo, and the like). The facilities in the terminals require major capital investments and depend on the size of the port; they are becoming more specialized and play a key role in the selection of the port. The private sector is becoming more and more interested in this type of operations, which has shifted the focus of competitive strategies from the ports in a wider sense to specialized terminals, whereby terminals are becoming the most important elements within the port industry. This change of focus is the main explanation for the increase in competitiveness in the port sector.

As it results to be very difficult and methodologically risky to compare ports and terminals, it is also equally questionable to use terms such as "facilities owned by the State", "privatization" and "national interest" in all cases of deregulation, change in ownership of ports and terminals, lease and concessions. Most ports and terminals are still owned by the State or under governmental management and supervision. The evolution of the ports through the processes of privatization (concessions or listing on the Stock Exchange) or lease of port

1 The hinterland of a port can be defined as a space for which the overall costs of port operations are lower than the same costs when using an alternative port.

2 See: Braddon, D., & Foster, D., Privatisation: Social science themes and perspectives, 1996, Alderschot, UK, Dartmouth Publishing Company, Everett, S., Corporatisation strategies in Australian ports: Emerging issues, 1996, IAME Conference-Shipping, ports and logistic services: solution for global issue, Vancouver.

facilities has reached its peak over the last decade. Although they are fundamentally and financially different, concessions and sales of terminals were regarded as privatization; this shows that there is no accurate and widely accepted definition of the privatization of port buildings and facilities. The reasons for the privatization of terminals or ports differ significantly from one case to another, as well as the objectives that one wants to achieve. There are cases when the objective is to get an inflow of fresh private capital for the development of the infrastructure, while in other cases the objective is to attract new port users and to increase the efficiency of the existing facilities. There is no doubt that the boundaries set by the port policy-makers vary significantly and that they define the level of freedom of the operative management in terms of setting the port tariff, operative and marketing policies.

A port can be defined as "part of the land with a maritime and road access, which developed into a logistical and industrial hub, and plays a significant role in global industrial and logistical networks".[3] The dual character of the ports should not be forgotten thereby: they constitute the links in the commercial and logistical chains, reason why they are of a significant value as assets that are at the same time the property of the State or serve the interest of the State. They also fulfill a series of other non-financial tasks, such as the enforcement of supervision of the ports by the State, the enforcement of the national tax and customs regulations, social cohesion, employment and acts related to national security and defense. In view of the aforesaid, the analysis of ports is both very interesting and complex, and the relations between private and public interests are interlaced in a particular way compared to other fields of the transport infrastructure.

In this new environment, granting concessions for the performance of port operations to private port operators has become the usual practice and a very efficient port management tool, in particular in the development of new port facilities. A concession means an authorization granted by the government or the port authority to a private operator to provide specific port services, such as cargo handling or storage of goods or cargoes, management of terminals or provision of nautical services (for instance, pilotage and towage). With the concessions, the port authorities can retain a significant share of control over the organization and structure of the offer on the port market. This paper researches the role of concessions as an important port management tool. The field of interest has been reduced to the grant of port land concessions to private operators in the scope of the *Landlord* port organizational model[4] .

According to this model, the port authority is usually a special entity under public administration established by a special law, which is authorized to enter into agreements (including the concession agreements), to set standards and pass the rules and regulations to be applied in the port area. Port operations (cargo handling in particular) are mainly performed by private operators. Today, *Landlord* is the prevailing port model in large and medium-sized ports throughout the world.

Various theorists have been dealing with port infrastructure management and funding issues. While orientating the field of interest towards seaports, Psaraftis[5] presents his position with the emphasis on European ports and raises questions with respect to port management, which arise out of the institutional framework. After the failure with the draft Guidelines on the Provision of Port Services[6] which were rejected twice, and the adoption of the Document on the Communication of the European Commission to the European

3 See: Notteboom T. and W. Winkelmans, Structural changes in logistics: how will port authorities face the challenge?, 2001, Maritime policy and Management, vol. 28, p.71-78.

4 The Landlord model of port management is a model in which the port authority, as landlord, grants a concession for port areas to private port operators.

5 For further details, see: Psaraftis, H.N., EU Ports Policy: Where do we Go from Here?, 2005, Maritime Economics and Logistics, No. 7, p. 73-82, Psaraftis, H.N., Europe port "patchwork" needs to be redesigned, 2004, Lloyd's list.

6 Directive on Reinforcing Quality service in Sea Ports: A Key for European Transport, the so-called First Port Package (European Commission, 2001b), Market access to port services, Second Port Package (European Commission, 2004c).

Parliament and Council on Reinforcing the Quality of Services in Seaports[7], Psaraftis emphasizes the need for the adoption of a unified port policy on a supranational level instead of the partial solutions now prevailing. The so-called "port package" was the proposal made by the European Commission for a market approach to the regulation of the provision of port services. This proposal was intended to increase transparency in public and private financial flows to the ports, and to regulate competitiveness in the provision of various port services. The basic idea was to ensure that a potential service provider, either public or private, receives a fair and equal treatment on the market, as a result of which sound competition should increase efficiency in the ports in terms of lower prices and higher quality of service, including port security, safety and intermodal agility.

The expected monumental effect of the "port package" on the port sector resulted in individual strategies to pave their own way by standing for various interests, very frequently even contradictory, which finally resulted in the rejection of the proposal in the scope of the procedure before the European Parliament.

A significant contribution in this field was made by the authors De Langen and Pallis[8], who directed their research towards an analysis of market barriers. Pursuant to the definition provided by Carlton et. al[9], which defines the entry barrier as "anything that prevents an entrepreneur from instantly establishing a new company on the market, while a long-term entry barrier means a cost to be borne by a new entrant in contrast to the existing companies on the market, which do not have this cost or did not have to bear it in the past", De Langen and Pallis discuss the impact of deregulation on market barriers. While evaluating different port management models, Brooks and Pallis[10] have developed a conceptual framework, which integrates different relevant design components. Everret[11] discusses on the basis of a survey of the Australian experience in the objectives of reforms and the problems related to the deregulation of a monopoly in the public sector, where there is the problem of the regulation of the formerly State-owned monopolies, which have grown into private monopolies after their privatization. In his paper, Everrett investigates the impact of regulation on the performance of port operations and export supply chains. Baird[12], however, researches the objectives of the privatization of ports, while Brooks and Cullinane[13] write about port efficiency and port management. The research conducted by the authors Gomez-Ibanez and Meyer[14] in the field of the privatization of the infrastructure is also of importance and presents the considerations with respect to the privatization of the infrastructure in a wider sense.

2. SEAPORT MANAGEMENT MODELS

The essential characteristic of the ports from the aspect of a given economic organization is that a port cannot be regarded as an entity in which one service only is being provided. Different operations are being performed in the port area. It is important to take into consideration that various aspects of each particular service provided within a port can be regulated under different regulations. Bearing in mind that all port services must be provided within a limited port area, it is essential to research the modalities and instruments of coordination and

7 Directive on Reinforcing Quality service in Sea Ports: A Key for European Transport, the so-called First Port Package (European Commission, 2001b), Market access to port services, Second Port Package (European Commission, 2004c).

8 For more details, see: De Langen P.W. i Pallis A.A., Analysis of Entry Barriers in Seaports, 2007, Maritime Policy and Management, 34(5), p. 424 - 440.

9 See: Carlton, D. and Perloff, J., Modern Industrial Organisation, 1994, New York, Harper Collins College Publishers, p. 110.

10 See: Brooks, Mary R. and Pallis Athanasios, A., Assessing port governance models: process and performance components, 2008, Maritime Policy & Management 35:4, p. 411-432.

11 See: Everett, S. Public sector deregulation: a paradigm in conflict, 2008, Maritime policy & Management, 35:4, p. 341-351.

12 See: Baird, A.J., Port privatisation: objectives, extent, process and the UK Experience, 2000, International Journal of Maritime Economics, 2(2), p. 177-194.

13 See: Brooks, M.R. and Cullinane, K. (eds.), Devolution, Port Governance and Port Performance, 2007, London, Elsevier.

14 See: Gomez - Ibanez, J., Meyer, J., Going Private; The International Experience with Transport Privatization, 1993, Washington, The Brookings Institution.

to identify the role of the port authority as the institution in charge of the performance of port operations, construction, maintenance of the facilities and infrastructure in the port area. As a general rule, port authorities are local, regional or national public entities, although there are also some examples of private port authorities. Public port management is present in different forms throughout the world. In some countries, the management and planning of the port capacity are rather centralized such as, for instance, in Singapore, while port authorities are quite autonomous in other countries, which is the case in the USA. There are also intermediate cases, where regional and national authorities are involved in port administration such as, for instance, in Australia. It is important to emphasize that the public character of a port authority does not necessarily imply that port services are also provided by the public sector.

There are different models of port organization throughout the world. They differ by the level of direct intervention of the port authorities in the provision of port services. On the one hand, there is the case where the port authority acts as a landlord, leaving as many port operations as possible in the hands of the private sector. In this model, the port authority is the owner of the port land and infrastructure that it leases to private operators or grants to them under a concession. Examples of such a model may be found in the USA, in Canada, Australia and Europe. On the other hand, there are comprehensive[15] port authorities, where the port authorities are in charge of all (or almost all) operations within the port, from cargo handling to pilotage. This is the way to achieve a monopoly in the management of port activities. Examples of this kind may be found in Singapore and in many African ports.[16] The analysis of investments in port infrastructure points to different examples throughout the world. There is a model of local (municipal) funding, which is usual in Northern Europe (the Netherlands, Belgium, Germany), where the responsibility for the port policy lies directly with local administrative bodies (the so-called Hanseatic tradition). There is also another model, where the State plans and funds all investments in the core port infrastructure (dredging of access channels, railways, roads, jetty, pier, etc.), although the general trend is towards the self-financing of the port system; such examples may be found in countries of Southern Europe and Latin America (the so-called Latin tradition). The third model is self-funding, where the funds to finance investments are provided by private entrepreneurs or out of the private resources of the port authorities, which originate from the collection of port fees. This model prevails in countries of the Anglo-Saxon tradition (Great Britain, the USA).

In the scope of the Landlord model, the port authority grants the rights and enforces the regulations related to the development, management and supervision of the port area, the maintenance and supervision of nautical access to ports, the care for the port infrastructure, environmental protection, and enforces the regulations in the fields of safety at work and security. This could be a simplified definition: “In a Landlord port, the port authority builds piers and moles that it grants to terminal operators under a concession (to stevedores in most of the cases). Operators invest in cargo handling equipment (cranes, handling facilities, forklifts, and the like), hire the labor required for the performance of port operations and contract the handling of cargo from the ships with shipping companies”. In the scope of this port organization model, private entrepreneurs invest in the development of the operative port infrastructure, cargo handling equipment and the provision of cargo handling services, which are the basic tasks of daily port operations. On the other hand, this model makes it possible for a public authority to perform the supervision and manage the development of the port, which is usually connected with national interest and financial needs, which are beyond the bounds of possibility for private investors. Efficient and successful ports that apply this organizational model are Rotterdam and Hamburg.

15 Two subgroups are usually distinguished in this category: service ports and tool ports. In both cases, the port authority is the owner of the port assets, while private companies provide services only in the second case.

16 See: Goss, R., Economic policies and seaports – Part 3: Are port authorities necessary?, 1990, Maritime Policy and Management, 17, p. 257-271, Heaver, T., Meersman, H., Moglia, F., & Van de Voorde, E., Do mergers and alliances influence European shipping and port competition?, 2000, Maritime Policy and Management, 27, p. 363-373.

The so-called “tool” model is an alternative to the above-mentioned organizational port model, where the port infrastructure and superstructure are in public ownership and used by private entrepreneurs, under a concession or lease, as a “tool” for the provision of port services. Although the differences in comparison with the previous model are minor, the consequences in terms of port development and planning are significant. Examples of this type of ports are Marseille and Houston.

In contrast to these two previously mentioned models, in private ports the development and management of the infrastructure and superstructure, and cargo handling are directly under the control of the private sector. Examples of this kind may be found in Great Britain.

The provision of other port services such as towage, ship waste collection, mooring, unmooring, and the like, is ensured by different service providers in a majority of ports throughout the world regardless of the port management model. In addition, in most of the cases the provision of these services is regulated as the provision of public services, with the exception of private ports.

The previous analysis was mainly directed towards the performance of operations and the development of ports; from a legal point of view, the critical question is “who is the owner of the port land”? Although it is difficult to generalize, the land is most frequently the property of the State, while port authorities have the power to manage the land and care for it. The interest of the State is served through the intermediary of specialized agencies, most frequently ministries or special independent bodies. Agencies grant rights under concessions for the purpose of the development and management of ports and terminals. The construction of nautical access to ports, the construction of jetties, the dredging of access channels and similar major infrastructural projects are mainly the duty of the State, although there are also cases of joint funding with the private sector in case of investments of mutual interest. It is necessary to emphasize that in contrast to public ports, purpose terminals are reserved to specific port users such as, for instance, the container terminals, which have been serving a particular user over a relatively large number of years because the same terminal was built by such a user. At this time, the mode of management of such a terminal is irrelevant since it arises out of a particular concession agreement.

In practice, there are also certain interim solutions, where certain port users enjoy certain privileges and a special treatment, which is also the result of special contractual relations. The difference arises out of related characteristics in view of the capacity of the terminal and the cargo handling capacity requested by the shipping companies. In the event that the offer greatly exceeds the demand, then the terminal can also be used by other port users, whereby certain users continue to enjoy a privileged status.

It is essential to point out that it is practically impossible to exclude the State from the discussion about the development and management of ports. In the scope of the international common law, there is no general access right for ships in a port, except in case of a ship in distress. In accordance with the international Convention on the Law of the Sea[17] and the existence of sovereignty in internal seawaters, as well as the absence of any general right of undisturbed way, it is also implied that foreign ships do not automatically have the right to enter a port located in the inland waters of a particular country. Although the opinions expressed in arbitration suggest that the ports of each country must be open to foreign ships, other than in case of protection of the national interest, the courts do not support this position. National ports are assumed to be open for international trade. From the point of view of international law, the State is entitled to determine which ports in its inland waters will be open for international trade. This question is also of an organizational nature due to the fact that trading operations assume the presence of a customs office, an immigration service and various other facilities.
The State can also close its ports for the purpose of protecting some vital interests for security reasons, preventing pollution or even

17 Convention on the Law of the Sea, 1982, (UNCLOS 82).

expressing a political disagreement. In addition, the State can also specify the rules and conditions for access to its ports, which is the case for tankers without a double plating, which are forbidden to enter the ports of the European Union and the United States.[18] In spite of that, other intergovernmental agreements support the right of entry, as it is the case with the Treaty Establishing the European Community with respect to the principles of non-discrimination and free movement of goods, where the Member States enjoy a reciprocal right of access to the ports of the other Member States. In accordance with the provisions laid down in the International Convention on the Law of the Sea[19], the States are entitled to perform the governmental supervision of the ports, and in this sense all the governmental services required to receive and forward the ships can be located in the ports. Each State can define the level of openness of a port for international trade, and the State is the one to exercise an influence on the whole service and treatment of ships and cargo in a particular port.[20]

The ports constitute key links in the logistics chain and play a significant role in the international economy. Natural resources are important for the concentration of employment, the performance of operations, and both local and regional development. In many cases, the ports form an integral part of the urban area so that the development of a port is frequently a driving force for the development of the cities and regions. Lately, the term “port cluster” or maritime cluster has been used quite frequently; it describes the effect of the ports as an economic multiplier on the creation of value added and employment in their environment. In the sense of the competitiveness of logistics chains, efficient ports can serve the development of their narrower and wider hinterland, and their influence on economic growth can be significant both on the regional and international level. The ports are an instrument for the efficient planning of the regional and national economy, and accordingly the question of employment is essential; this does not refer only to the staff working directly on the provision of port services, but also to the influence of indirect employment in the port environment. For the purpose of serving different objectives of development of national economies, free trade zones have been developed in many ports throughout the world.

The port authorities, as the organizations in charge of the management of the port area, are responsible for the whole functioning of the port, from the enforcement of order, the grant of concessions, the development and maintenance of port buildings and facilities, the performance of port operations, the provision of nautical services, and environmental protection to the questions of security and defense. This set of different activities is generally placed in the context of the term “public port”. In a public port, different governmental institutions enforce the national laws and regulations related to the governmental supervision of the port, security, defense, safety at work, safety of navigation, customs and tax policy. Employment, tariff policy, marketing, finance, infrastructural development and practically all major managerial decisions are supervised by governmental bodies.
The market strength of the port authorities has been drastically altered over the last decades. The ports constitute significant links of the traffic and logistics chains. However, their role is more defined by big shipping companies and powerful terminal operators operating in their area, than by the port authorities that manage them. The port authorities can influence the structure of the offer on the market of port services with their concession policy.

It is generally accepted that the ports play a significant role in modern logistics, where they act as key links in the supply chains and as an interlink between different transport models, which requires high quality standards for the provision of services. The concessions, in an economic sense, constitute a very efficient instrument for the management of natural monopolies, such as the port infrastructure.

In view of the fact that ports are trying to be more competitive, there is a trend towards increasing the role of the private sector in the

18 OPA 90 in the USA and Erika Package in the European Union.

19 UNCLOS III, 1982.

20 See: Churchill, R.R., Lowe, A.V., The law of the sea, 3rd Edition, 1999, Melland Schill Studies in International Law, p. 61-64.

ports. Due to the overall unsatisfactory efficiency of public ports in terms of their adaptability to speedy changes in their environment and the requirement for them to become more competitive on the international market and financially more independent from the State Treasury, the involvement of the private sector in the ports has increased not only in the performance of port operations, but also in the construction of the port infrastructure. It is a fact that today concessions are being used very frequently in the port sector, due to the fact that they relieve the public authorities from a significant operating risk and financial burden, while at the same time they allow the bodies of the public authorities to retain the ownership of the port land and the responsibility for the grant of authorizations for the purpose of the performance of port operations and the construction of port buildings and facilities. The bodies of the public authorities can, in such a way, remain in a position favorable to the protection of the public interest.

3. PRIVATIZATION OF PORT OPERATIONS

As shown in the previous part, different types of port organization clearly point to the fact that the public sector and private initiative are usually coexisting. In the essence, the overall trend is towards a port organization of the Landlord type, which implies an increased influence of private initiative on the development of seaports. As it is the case with all economic activities, private entrepreneurs are trying to make maximum profits. The public sector, on the other hand, tries in general to maximize the measures that are of general benefit. As a general rule, it is considered that the public role is mainly expressed though the establishment of an environmental, economic and social structure that facilitates the development of the ports, not necessarily through a direct involvement in the performance of port operations. Goss[21] studied the boundaries between the public and the private sector in port operations and he found many different practices, which shows that the boundaries between the public and the private sector are very unclear or even inexistent. As an example from the past, one could use the UNCTAD (1975) report[22] on the international level, which revealed the existence of significant differences between the port management models in developed countries and developing countries, although a trend towards an increased autonomy in port management was already noticed at that time.

There are major theoretical reasons that are being mentioned for the purpose of justifying the involvement of the public sector in port development and management, and most of them are based on the characteristics of a natural monopoly of certain services that are being provided, on the imperfections of the market, or a protection against the potentially harmful environmental impact. On the other hand, some port operations are regarded as "public services" in certain countries, which is the case of cargo handling, pilotage and towage in Spain, which does not imply that such services must exclusively be provided by public organizations. Nevertheless, after his research of the role of the public and private sector, Juhel[23] concluded that, subject to many factors, their role can significantly vary. For the public sector, it can range from the setting of operating standards to the direct performance of port operations, or the provision of the physical and financial resources for the purpose of fulfilling the conditions required for the performance of port operations. Therefore, the conclusion that can be drawn is that there is no universally accepted distribution of responsibility, although, as mentioned above, an increase in the involvement of private companies in the development of new port facilities has been noticed. The involvement of the private sector in the development of port facilities is conditioned by different factors: the need for new sources of finance for the port infrastructure and equipment, a decrease in public deficit, the endeavors to increase

21 See: Goss, R., : "Competition is key to wellbeing of ports", 2006, Lloyd's List.

22 UNCTAD (1975): Port Pricing, United Nations Conference on Trade and Development, New York.

23 See: Juhel, M.C., "Globalisation, privatization and restructuring of ports", 1998, 10th Australasian Summit Ports, Shipping and Waterfront Reform.

efficiency in the performance of port operations.[24] Other important factors are to contribute to the growth of trade and gain managerial experience.[25] In many countries, the government decided to perform a deregulation and privatization in the field of the performance of the port operations. Although there are several examples of full privatization of ports (Malaysia, Great Britain, New Zealand), there have been many examples over the last few years of private companies building new port terminals pursuant to a concession agreement. The full privatization of a port is not the only way to increase the efficiency, so that it is important to allow a particular organization to exploit the port resources on a commercial basis, while leaving the sufficient flexibility and the resources required for a successful action.[26]
On the other hand, the ports under governmental governance are generally regarded as expensive and less efficient. This thesis, however, has never been supported by specific empirical evidence.[27]
Bearing in mind that the ports are now facing a relatively high circulation of cargo and huge investments in their development, as well as their important role for the regional and national economy, it is necessary to investigate the reasons for the privatization of the port operations instead of the retention of public control. The answer to this question is simple: either due to the fact that the ports are of great importance for the national economy, reason why it is necessary to ensure the efficient and flexible functioning of the port in accordance with the market requirements, or by granting special rights to private entrepreneurs, which should result in attracting new port users, achieving a better usage of the existing infrastructure and a speedier development of the regional and national economy.

According to Cullinane[28], the empirical evidence does not allow to easily draw a conclusion with respect to the relation between the ownership of the port area and the efficiency of the port. The international practice, however, suggests that private initiative in the performance of certain port operations has actually improved the quality of the provided services.[29] Generally speaking, the worldwide trend is towards the organization of ports on the principles of the Landlord model, which means that the port authorities manage the port infrastructure for the purpose of preventing a private monopoly over a common good (port land, seawater area, and the like), allowing private companies to perform port operations and invest in the construction of port buildings and cargo handling equipment. In a majority of countries throughout the world, the public sector plays a key role in port planning, investments, development and regulation.[30]
It should be emphasized that the involvement of private initiative in port development is feasible and desirable as a way in which this economic sector can adapt to a new and more competitive environment, in which the ports need a modern management and equipment in order to satisfy the needs of maritime transport. The cooperation between public and private sector is appropriate, so that the public sector is withdrawing from the direct performance of port operations and taking a more regulatory role, while the private sector is using the benefits of the adaptation to market conditions, increasing the efficiency arising out competitiveness.

There are several alternatives for the selection of the most favorable way to introduce the private sector in the performance of port

24 For further details see: Hall, K.G., “Port Privatization”, 1997, May, The Journal of Commerce.

25 See: Baird, A.J., Port privatisation: objectives, extent, process and the UK Experience, 2000, International Journal of Maritime Economics, 2(2), p. 177-194.

26 For further details see: Bennet, M., “Trade or treasury: who benefits from port privatization?”, 1992, Portus Vol. 7. N1 1, p. 10-15.

27 See: Liu, Z., “The comparative performance of public and private enterprises”, 1995, Journal of transport economics and Policy, September, p. 263-274.

28 For further details see: Cullinnane, K., Song, D-W. and Gray, R. : “ A stochastic frontier model of the efficiency of major container terminals in Asia: assessing the influence of administrative ownership structure”, 2001, Transportation research Part A: Policy and practice.

29 See: Estache, A., Carbajo, J. and De Rus, G.: “Deregulation and Privatisation: The Argentina Case”, 1998, Washington DC, World Bank.

30 For further details see: Baird, A.J., 2000, Port privatisation: objectives, extent, process and the UK Experience. International Journal o Maritime Economics, 2(2), p. 177-194, Baird, A., “Privatization trends at the world's top -100 container ports“, 2002, Maritime policy and Management, Vol. 29, p. 271-284.

operations, and they depend on the size of the port, the existing conditions and the type of services to be provided. Among many possibilities, we will only mention some of the most important ones:

- *Full sale of the port in its entirety* (full privatization). When using this form of privatization, all assets and liabilities pass onto the private sector, which can be justified by the serious budgetary deficit of the public sector.

- *Transfer of parts of the port to the private sector on a Build-Own-Operate basis* (BOO).[31] Short-term budgetary deficiencies justify the use of this form of privatization.

- *Share of the private sector in ports for the purpose of building or rehabilitating the port buildings and facilities required for the provision of port services* (BOT or ROT).[32] Under this form of concession (lat. *Stricto sensu*), the private operator is responsible for the construction and funding of port buildings and facilities. Upon termination of the concession, the port infrastructure and superstructure are returned to the grantor.

- *Emergence of new independent companies through a combination of efforts invested by two or several organizations*: joint venture. This type of partnership arises when two or several organizations with the same objective join their forces. Such partnerships are not exclusively entered into by private parties, which are the case of Shangai (China), Kelang (Malaysia) and other Asian ports with major investment projects, where the port authorities have undertaken a joint venture for the purpose of building and resuming the activity in new terminals. In other cases, there is cooperation between several public institutions, such as in the example where the port authority of Singapore and the port authority of Daliana have jointly built and manage the container terminal in Dayaowan (China).

- *Lease* (French: affermage). In some cases, the port authorities lease out the port property to private companies for a limited period of time; in exchange, the port authorities collect a certain fee. In contrast to concession agreements (*stricto sensu*), in such cases private companies do not usually have the obligation to invest, and they only bear the commercial risk. The port facilities or buildings, like port cranes or storehouses, are leased out in such a way to port operators.

- *Licenses*. In this case, the port authority allows an operator to provide certain services in the port area, which usually require relatively simple equipment; therefore, the assets are usually owned by the private operators.

- The *Management Agreement* is a simple form of participation of the private sector in the performance of port operations in such a way that an agreement is entered into for the management of a port or terminal. With this form, the port authority is the owner of the port infrastructure and facilities, but these are managed pursuant to an agreement by a private operator who is able to apply all the advantages of a private initiative. This form vests the investment risk and the commercial risk with the public sector, due to the fact that the managers do not invest their own capital in the port. The port of Bristol in Great Britain is an example of such a practice, where the infrastructure and the port facilities are owned by the local authorities, while the port is managed by the private sector.

When selecting one of the above-mentioned options for the purpose of defining the best alternatives for a particular port, the objectives of the port policy must be defined as well as the defects with which the port authorities are faced. The type of port services to be provided can determine the possible level of privatization. The crucial factor that needs to be taken into consideration is whether the provision of a particular port service requires the exclusive use of stable port assets:

a) *Port services that do not require the exclusive use of the port infrastructure or superstructure*

This group consists of services such as pilotage, towage, forwarding agency and other auxiliary services that are provided for a ship or cargo. In

31 BOO - Build, Operate and Own.

32 BOT - Build, Operate and Transfer; ROT - Rehabilitate, Operate and Transfer.

many ports, for the sake of the safety of navigation, the tradition is that some of these services are provided by the public sector. Practically, in most cases ship mooring and unmooring services are regarded as "public services" since each port user is entitled to be provided these services. This is the reason why they are directly provided by the port authority in order to avoid any disturbance in their provision. Pilotage is a typical example of a mandatory service, which is of a monopolistic character in many ports. Pilotage is mandatory for ships beyond a specific size, as well as for ships carrying dangerous substances. The level of public intervention in the provision of this service varies from one country to another. In some countries, the pilots are civil servants, while in other countries they are independent agents, more or less regulated by their professional associations. There are also different towage solutions in the ports. As a general rule, towage is regarded as a "public service", and in practice towage services are provided by the port authorities or indirectly by private operators.

b) *Port services that require the exclusive use of the port infrastructure or superstructure*

The provision of these services assumes the use of one of the most limited port resources: space. Therefore, this group consists of the cargo handling terminals, the storage facilities, stable facilities, and the like. It is very complex to involve private operators in this group of services since they should be using assets in public ownership, which are expected to be optimally used. Therefore, the concession agreements need to be carefully structured in order to mitigate the interests of private operators and port authorities. These agreements must at the same time provide an incentive to private operators so that they properly maintain and improve the assets granted to them under a concession.

An organization based upon the concession model is appropriate for the privatization of a sector with monopolistic features.[33] In the scope of this approach, the State (city or any other public entity) transfers the right to provide certain services to the private sector, while retaining thereby a certain control over the performance of the business operations, by incorporating in the concession agreement the deadlines and conditions, and the rights and duties of the service provider. The private sector assumes the operative responsibility and part of the commercial risk at least during the provision of the services. The concessionaire is responsible for the achievement of certain standards in the provision of the services, and has a certain amount of freedom in the selection of the instruments and modalities for their achievement. In spite of many features common to all concessions, there are significant differences between different types of concession. These variations can result in significant operative implications. Although the duties of the private sector in the scope of a concession always assume the performance of the business operations and the maintenance of the systems or facilities during the provision of services, these duties can, but do not have to, include the elaboration of projects, the construction and funding of new infrastructure.

In all forms of concession, the public entity, usually the State or city, grants the rights and obligations to private companies (concessionaires) for the purpose of the provision of certain port services.[34] Van Niekerk[35] considers that the privatization of port terminals by means of a concession agreement is an appropriate option where the port competitiveness is efficient, but not necessarily in the cases in which competitiveness needs to be achieved through regulation.

33 Concessions are less appropriate in circumstances when competition can and should be present on the market. This differs from a competition for the market via tender procedures to obtain the exclusive right of provision of services, where many companies can compete with each other for the provision of services. A competitive discipline aims at reducing the need for economic regulations. Such companies need to operate on equal terms within a unique legal framework, and not under the circumstances of individual regulatory arrangements, which are of a discriminating nature. Therefore, under normal circumstances, the State should not have the possibility any more to abolish the right of an operator to provide services.

34 Concessions are also granted to autonomous public organizations. The example of France, where companies owned by the State are the concessionaires for the management of highways; furthermore, companies owned by the State have a monopoly in the fields of gas supply, power supply and railways.

35 See: Van Niekerk, H.C., Port reform and concessioning in developing countries, 2005, Maritime Economics and Logistics, vol. 7, p. 141-155.

4. REGULATION OF THE PERFORMANCE OF PORT OPERATIONS

The active involvement of private companies in the performance of port operations requires a legal regulation of the provision of certain port services for the purpose of preventing any potential inefficiencies that might arise as a result of the local monopolies. The probability that such a scenario will happen is higher in smaller ports with relatively low volumes, due to a lack of competition within the port, as well as among competitive ports. Therefore, the regulation of the performance of port operations is a key aspect in the new strategic concept, which does not necessarily have to be under the auspices of the port authorities themselves.

The usual way to get private companies involved in the performance of port operations is by means of an agreement between public and private entities. The substance and the form of the agreement will greatly depend on the initial conditions prevailing in the port, its size and the specific features of the operations performed. The agreements present different features, from the concessions, where private companies are temporarily granted for use part of the port land for the purpose of building and operating, while returning the concession area to the granting authority upon the expiry of the concession, up to the licenses for the provision of particular port services.[36] The selection of the most favorable alternative will depend on the objectives that the regulator wishes to achieve, as well as on the restrictions set in a particular port. Another important element that needs to be taken into consideration is the status of asymmetric information of the contracting parties in view of the fact that private companies are better acquainted with the conditions related to their costs and the demand than a public regulator.

The regulatory system most frequently used to prevent abuses of a dominant position is the application of the maximum allowed port tariff and the limitation of the profits of private companies by limiting the rate of return on the invested capital. A mixed regulatory system contains elements of a pricing policy as well as profits limitations. The advantage of using a price cap is the stimulation of efficiency due to the fact that a cost reduction allows for a growth in profits under the set prices. In contrast thereto, it is not a good thing to have a limited demand, in combination with a price cap, that creates the preconditions for a decrease in the quality of the provided services as well as an increase in the detrimental environmental impact, as a result of the pseudo-strategy to reduce the costs. Limiting the rate of return of the invested capital decreases the risks and costs of capital due to a guaranteed rate of return, but on the other hand there is no incentive to increase efficiency. A hybrid system attempts to combine the advantages of both systems, while preserving at the same time the environment and the quality of the provided services.

The conclusion that can be drawn is that the substance of the agreement and the regulation of the prices of the provided services constitute an appropriate instrument to introduce private capital in the performance of port operations, while preserving quality and stimulating efficiency.[37]

There are also cases when regulation is not necessary or plays a less significant role. This is the case when there are competitors due to the fact that it is generally accepted that competitiveness is an essential element to induce discipline on the economic agents when intervening on a particular market. Whether competitiveness is feasible and desirable will depend on the traffic volumes handled in a particular port. Kent and Hochstein[38] have established the traffic thresholds to determine the type of competitiveness that can be achieved in a particular port. Even when there

36 For further details see: Trujillo, L. and Nombela, G.: „Privatization and regulation of the seaport industry“, 2000, Universidad de Las Palmas de Gran Canaria.

37 For further details see: Guasch, J.L.: Granting and renegotiating infrastructure concessions: Doing it right, 2004, Washington, World Bank Institute Development studies.

38 Kent, P.E. and Hochstein, A., "Port reform and privatization in conditions of limited competition: the experience in Colombia, Costa Rica and Nicaragua", 1998, Journal of Maritime Policy Management, vol. 25, No. 4, p. 313-333.

is no competitiveness in a particular port, there is a need to regulate the prices of the provided services in order to achieve competitiveness in relation to other ports. In such a case, the role of the regulator can be limited to a periodical control of prices for the purpose of preventing any potentially detrimental arrangements between competitors providing the same services in the port or in any other alternative port. It should be emphasized that, in general, competitiveness has increased in the port industry as a whole, but this has not the same impact on all ports or all port operations. This depends on many aspects such as the location of the port, the volumes and structure of cargo, and the like. An extensive open debate is being held in the European Union on the public subsidies to the ports since it is considered that subsidies can have a detrimental effect on competition.

The economic activities performed in a port are very complex. Their successful performance requires a set of different agents and activities that can be classified under the same denomination as port services. They include from the port administration performed by the port authority, to pilotage, towage, water and power supply, cargo handling, ship supplies, repairs, and the like. These services cover all the operations in connection with the relations between port users and the port from the moment when the ship enters the port up to the completion of its cargo handling operations when it leaves the port. During that time, there are services that are provided to the ship, the passengers, the crew and the cargo.[39]

Firstly, there is a group of services related to the entry of a ship in a port, which include pilotage, towage and mooring. All these services can be provided directly by the port authority, or be outsourced to private companies. Pilotage is regarded as an activity that is necessary and frequently mandatory so that a ship could safely enter a port, and it usually assumes the presence of an expert on the commanding bridge with a good knowledge of the situation in the seawater area of the port. Private companies can perform pilotage subject to a license granted by the port authority, and pilotage activities can also be performed by employees of entities of the public administration. Towage assumes moving a ship within a port area with smaller ships having a higher installed power, so that the ships performing cargo handling operations could maneuver more easily and safer. These activities are frequently outsourced to private companies, and it is not excluded that they are also under the direct governance of the public sector.
Cargo handling services are the most important port services provided to cargo ships. They include all the activities related to the transshipment of cargo from a ship or onboard a ship, as well as through different port buildings and facilities. Cargo handling services are provided by organizations subject to public governance or by private companies in the framework of a concession agreement. The large investments that are usually required for this type of service are frequently used as an argument to justify private investments in port buildings. This is the reason why port terminals are being built today in many ports throughout the world by private companies on public land.

In view of the fact that we are dealing with a provision of services by private companies, they operate under the supervision of entities of the public authorities, in particular in terms of prices of port services and achieved profits. As stated earlier, the regulations are stricter and they depend on the level of competition in a port or between the ports. The size of the port and the type of services provided are the two key elements when deciding whether competition is feasible and how to promote it. In order to be able to analyze it, it is necessary to have a good knowledge of the cost structure of the particular port operations. Cargo handling usually includes moving different goods or cargoes (containers, liquid and solid bulk cargo, general cargo, and the like). It is not easy to determine whether it is necessary to have one terminal for all needs or several specialized, i.e. multipurpose terminals. This is a question that remains to be answered by the relevant port policy.

39 For further information about port services, see: De Rus, G., C. Roman, and L. Trujillo: Actividad Economica y Estructura de Costes del Puerto de La Luz y de Las Palmas, 1994, Madrid, Ed. Civitas.

The cargo handling process varies subject to the cargo being handled. There is a trend towards the specialization of companies depending on the type of cargo, due to the fact that the handling equipment is highly specialized and very expensive. This is why specialization leads to the formation of terminals that are defined as specialized berths in the ports where mainly all operations related to the relevant type of cargo are being performed. Container terminals are the best example of such a practice since handling containers assumes big gantry cranes, large storage facilities and the use of various cargos handling equipment (forklifts, tugs, and the like). These factors influence the companies to rather use more efficiently the terminals specially designed to handle particular types of cargo than the terminals designed for various types of cargo.

Out of the total costs related to the movements of cargo in a port, 70% to 90% thereof are cargo handling costs, subject to the type of cargo being handled. This is the reason why cargo handling is one of the most important port services that the regulator must permanently supervise in order to ensure efficient port operations in terms of pricing.

When providing cargo handling services, the following three groups of productive factors are required: infrastructure and superstructure, facilities and mobile equipment, and labor. The availability of these factors of production depends to a great extent on the type of cargo handling organization prevailing in a particular port. An interesting characterization of the ports has been provided by the European Parliament (EP 1993), where the port area is defined as a complex of a land area and seawater area where services are provided to ships and cargo. In order to reach this area it is necessary to ensure maritime access, maritime structures[40] and land access.[41] The above-mentioned structures are necessary in order to provide the required services to the cargo and ships entering the port, and they include the piers and moles, the road and railway network within the port, the power supply facilities, and the like. There are two types of users using the port infrastructure: the ships that moor or enter a port and the companies operating in the port area and providing different services to the ships (pilotage, towage, cargo handling, management of terminals, and the like.). Terminal operators usually operate on the basis of a concession agreement that sets the contractual obligations of the concessionaire and regulates the payment of the concession fee.

Above the port infrastructure there is the port superstructure, which includes the buildings (storage facilities, cargo handling facilities, offices, and the like). Infrastructure and superstructure are complemented by fixed and mobile equipment, information systems and automated systems.

Labor in the ports can be roughly classified in two groups: the workers directly involved in cargo handling operations (stevedores or port workers), and those who are not (administrative and maintenance staff). Traditionally, the first group is strongly regulated, although significant changes have occurred throughout the world over the last years. The reasons for the protection of port workers can be found in the characteristics of their jobs and in particular in the temporary demand and the low level of specialization. Cargo handling was almost entirely reserved to registered workers. The protection of port workers seems to have been frequently excessive, allowing the port workers to maintain some kind of monopoly in the performance of port operations. This is the reason why many countries have carried out a legal reform to increase the efficiency of labor and reduce the costs; this process is ongoing throughout Europe. Amendments to the labor law in the ports of Great Britain have resulted in an increased competitiveness in the ports and between the ports, and caused a decrease in salaries. As a result and in response to the increased pressure exerted by port users with respect to the price and quality of the provided services, the port operators consider that their efficiency has improved, in particular in terms of a reduction of the duration of the stay of ships in the ports, as well as of a decrease in

40 Access channels, jetties, structures for the safety of navigation, and the like.

41 Road and railway networks connecting the port to the local and national networks.

direct costs and an increase in the quality of the provided services.[42]

Other types of port services that the port users need refer to administrative tasks and various approvals (health certificates, import/export licenses, payment of port fees, and the like). These services are usually provided by specialized agents or forwarding agents whose services are hired by the shipping companies to prepare in advance on their behalf the documents and everything required for the stay of the ship in the port. Before the ship enters the port, they undertake the acts required so that upon the entry of the ship in the port all necessary services (pilotage, towage, cargo handling, supplies, and the like) in a timely manner as soon as possible.

Finally, there are also many accessory services that are provided by various agents and companies operating within or outside the port area. This group of services includes all types of supplies that a ship might need, including, as the most important, food, water, fuel and spare parts. There are also services that are used by members of the crew, like medical services, laundry, recreation, and the like. It results from all of the aforesaid that various services are being provided in the ports by either the private or public sector, and that there are several different models of port organization. From a regulatory point of view, infrastructure and cargo handling are the most important port components due to the fact that the efficiency of the port greatly depends on them. Other port services are somewhat less important and too much regulation is therefore not necessary.

5. FEATURES OF THE CONCESSION AGREEMENT FOR THE CONSTRUCTION OF BUILDINGS AND THE PERFORMANCE OF PORT OPERATIONS

The different types of port services that are provided by private operators are subject to different kinds of possible contractual arrangements between the contracting parties. The port size is one of the key variables when determining the appropriate level of involvement of the private sector in a particular port. For those ports with an insufficient demand for the existence of several terminals, the best solution is probably to leave the port in its entirety to the private sector. It is possible to retain the public ownership of the infrastructure, while the port can be managed by a private operator who will provide the necessary port services (cargo handling, storage, cargo stacking, and the like) to the port users.
In case of major ports of the Landlord type, it is possible to involve private operators in the performance of port operations in a number of more complex ways. In this type of ports, the port area can be divided into special terminals, which creates competitiveness within the port itself. As a general rule, in these ports some of the port services are provided by private companies operating on the basis of a license, for those types of services of a simpler nature that do not require the use of significant parts of the port infrastructure. In contrast thereto, the private operators who provide port services requiring the exclusive use of the port infrastructure or superstructure must enter into a concession agreement, which will specify in detail the conditions under which a private operator will be using the assets, as well as his obligations.

Licenses to operate a business are relatively simple since the equipment to be used for the provision of services is the property of the operator. The role of the port authority or any other regulatory institution is limited to setting certain minimum standards (for instance, professional qualifications for pilots, number of available tugs, and the like), and to passing the rules for the provision of port services.
By definition, the concession agreement is a lot more complex than the license since it encompasses not only the questions related to the provision of port services, but also the provisions related to the maintenance of assets, the investments required to be made, the distribution of risks between the granting authority and the concessionaire. The concession agreement can be regarded as an

42 For further details see: Thurnbull, P. Weston, S. : „The British port transport industry: employment, working practice and productivity“, 1993, Maritime Policy and Management, vol. 20, p. 181-195.

interim solution between public ownership and full privatization of the port area.

The objective of the privatization of port operations is to increase the efficiency in the port industry, while it aims at the same time, from a political aspect, at preventing that the society remains deprived of the ownership of major assets.[43] The concession agreements have also been used to a large extent in other industries that cover a valuable infrastructure (energy, water supply, gas, transport, and the like), as a form of cooperation between the public and private sector. When drafting the concession agreement, there are a number of aspects that need to be carefully regulated°: the purpose of the concession, exclusivity in the exploitation of assets, the obligations and fees for the concessionaire, the term of the concession, fines and penalties, the distribution of risks. The problem of overstaffing manifests itself in a majority of ports worldwide and it constitutes one of the essential contractual elements that needs to be regulated.

The application of the concession agreement is relatively new in the port practice. There are diverging opinions on the legal nature of the concession agreement as well as on its configuration. Certain forms of concession agreement look more like privatization models, while others have more features of a lease agreement. In view of the fact that a comprehensive privatization represents an unlimited and irrevocable transfer of ownership of the port land from the public sector to the hands of the private sector, the concession agreements cannot, regardless of whether they contain obligations as to the development of the port infrastructure, be regarded as a full privatization of the port, but rather as instruments that present the features of a partial privatization, in particular in the sense of the performance of port operations. Over the last decades, the application of the concession agreement has become the most accepted method to develop public-private partnerships in the seaports throughout the world.

The concession agreements were initially designed for those ports in which the port authority was fully responsible for the port administration and the provision of cargo handling services (Service Port model). In ports of the Landlord type, lease agreements are usually used in addition to the concession agreements. Both types of agreements have many features in common, and it is generally believed that the lease agreement is actually a variant of the concession agreement. The lease agreements (leasehold) usually assume the exploitation of the existing port infrastructure and equipment, with the obligation to make minor capital investments, and they are entered into for a term of 10 to 25 years, while a full concession agreement, which assumes the construction of entirely new port facilities (terminals), requires significant financial investments and is usually entered into for a longer period of time, most frequently for 25 to 50 years, which depends on the amount of investments (full concession). This type of agreements has most frequently the features of the so-called Greenfield investments.[44]

For the avoidance of doubt, the term “full concession agreement” is used to describe a concession in the wider sense of the word; it represents a set of agreements that regulate the relations between the public authorities and the private sector with respect to the right of exploitation of the port land and facilities, as well as the obligations with respect to the development of the port infrastructure and superstructure. The main reason for the application of full concession agreements is actually of a fiscal nature. As a matter of fact, in the 80’s many ports throughout the world were faced with a difficult financial situation: they were controlled by the State, overstaffed, without any market orientation, and frequently unable to provide even the basic port services. This kind of situation was not usual for the ports in the developing countries only; it was

43 For further details see: Crampes, C. and Estache, A., “Regulatory Tradeoffs in Designing Concession Contracts for Infrastructure Networks“, 1997, World Bank/Economic Development Institute. Policy Research Working Paper, 1854, Washington DC, Thompson, L.S. and Budin, K.J. (1997): “Global Trend to Railway Concessions Delivering Positive Results“, Public Policy for the Private Sector, Note No. 134, December, World Bank, Washington DC.

44 Term used for a completely new development, where the investor, frequently on a completely unprepared infrastructure, builds a structure from the foundations to its full operational state.

also the case in many developed countries. The concession agreements have provided a timely solution: private investors have provided the funds for the modernization of the port facilities, which has freed up some State funds for investing in other sectors of the economy. In addition to their advantages, the concession agreements also have a price, which is the full or partial surrender of the State control over the development of the ports.

5.1. Procedure for the Selection of a Concessionaire

A concession agreement can be granted by applying several different methods: by direct selection of the concessionaire, private negotiations or launch of a public invitation for bids. The concession policy has been considerably changing over the last few years in many ports throughout the world. Since the time when no formal conditions were frequently not required at all, until now, when the concession grant procedure is very demanding in terms of selection of the potential concessionaires. The national and supranational legislation (the *Acquis* of the European Union), the privatization of port operations and legal disputes with respect to irregularities in the grant of concessions have resulted in the fact public tender procedures for the grant of concessions are the most frequently used method today for the grant of concessions in seaports.

Each tender procedure for the grant of a concession must satisfy the principles of equality, which means that each applicant shall receive equal treatment and there may be no favoritism whatsoever in the concession grant procedure nor any significant limitations to competition. The tender procedure for the grant of port concessions mainly consists of two phases: determining the qualifications and selecting the most suitable candidate. The first phase of the selection includes determining the qualifications of the candidate, and it is also based upon the financial standing. The experience of the candidates can be proven by performing operations with similar cargoes in the same port or any other port. The candidate needs to prove his competence in activities related to the project by providing evidence of his prior experience in the performance of operations or the management of port terminals.

The tender procedure usually contains financial standing thresholds that the candidate must satisfy. For the purpose of providing evidence of his financial standing, the candidate is required to submit the balance sheets and the audit reports for a given number of years. The first phase of the tender procedure usually reduces the number of potential candidates, but also diminishes the risk of unreliable applicants who do not satisfy the conditions. The second phase of the tender procedure includes the technical and financial proposals, and the bid price. Each applicant submits one bid only, with no variants or alternatives. Pursuant to the technical and financial proposal and the bid price, the most favorable bid is selected among the bids of those applicants who passed the prequalification procedure. The negotiations start upon completion of the selection, and after that a concession agreement is entered into for the construction of the port buildings and/or the performance of the port operations being the subject matter of the agreement.

5.2. Structure of the Concession Agreement

While the main framework of the relations between the granting authority and the concessionaire is specified in the main concession agreement, there are also many other document that form part of the concession. The concession agreement and the related documents can be used under various circumstances, including the following:

- a private operator enters into a concession agreement for the existing public port building (terminal),

- a private operator enters into an agreement subject to the obligation to perform a significant further development of the existing port infrastructure and superstructure, including also the purchase of cargo handling equipment,
- a private operator enters into a concession agreement subject to the obligation to build a completely new port terminal.

In view of the different circumstances mentioned above, the concession agreement, in a wider sense, usually contains the following provisions: the recitals, the definitions, the preconditions for the agreement to become effective, the term of the agreement, the contracting parties, the general rights and obligations of the concessionaire, the transfer of rights, obligations and assets, the scales to measure performance, the provisions on the occurrence of events of Force Majeure, access to the concession area, governing law, setting the port tariff, concession fee, termination and renewal of the concession, indemnities upon termination of the concession, return of the concession area to the granting authority, arbitration, and the like. If a concession has been granted for the use or construction of port terminals, the private operator (concessionaire) is entitled to exploit a particular terminal during a particular period of time. The content of the concession agreement usually starts with a definition of the rights and obligations of the concessionaire, which constitutes a key element of the agreement. Table 1 illustrates the usual structure of the concession agreement in the scope of the Landlord model of port organization.

Table 1. Structure of the concession agreement for the Landlord model of port organization

1.	**Recitals, definitions, preconditions for the agreement to become effective**
2.	**Business plan of the concession** Economic and financial aspects of the concession Promotion of the business operations Mode of exploitation of the terminal (public use, special purpose)
3.	**Scope and concession area** (length and number of operative berths, storage facility, cargo handling equipment, description of the facilities that need to be built, and the like)
4.	**General provisions** Description of the services provided by the concessionaire Provisions on ownership and obligations to maintain the infrastructure and superstructure Rights and obligations of the granting authority and the concessionaire
5.	**Term of the Concession Agreement**
6.	**Setting the port tariff** Setting the fees by the concessionaire Regulation and supervision of fees Adjustment of prices
7.	**General commercial conditions** Fixed concession fee Variable concession fee (for instance, by unit of handled cargo) Scale to measure performance (for instance, minimum daily cargo handling capacity)
8.	**Provisions on the termination of the concession**
9.	**General provisions** Confidentiality, Force Majeure, governing law, arbitration, and the like

The structure of the concession agreement, its regulatory scheme, the modalities to set the port tariff as well as the modalities for the grant of the concession itself point to the priorities of the port authority and other concession grantors, and as such the concession agreement plays an important rule in the management of seaports.

6. CONCLUSIONS

In many countries worldwide, the government and governmental authorities have withdrawn from the direct performance of port operations, convinced that the involvement of private entrepreneurs in the performance of port operations and the provision of port services will provide for increased flexibility and efficiency on the market (by means of a higher competitiveness), as well as a better response to the requirements of port users. The ports that were traditionally managed as governmental divisions are faced with a private capital inflow, which promises higher competitiveness, increased efficiency and lower operating costs. This usually includes the transfer of the provision of port services from governmental authorities to private companies. Today, for the purpose of cutting down public consumption, the active participation of the private sector turns out to be necessary in many countries, not only in the field of the provision of port services, but also in the fields of construction and development of new port buildings and facilities.

In this new environment, granting concessions for the performance of port operations to private port operators has become the usual practice and a very efficient port management tool, in particular in the development of new port facilities. A concession means an authorization granted by the government or the port authority to a private operator for the provision of specific port services, such as transsshipment or storage of goods or cargoes, management of terminals or provision of nautical services (for instance, pilotage and towage). With the concessions, the port authorities can retain a significant share of control over the organization and structure of the offer on the port market.

In the 80's many ports throughout the world were faced with a difficult financial situation: they were controlled by the State, overstaffed, without any market orientation, and frequently unable to provide even the basic port services. This kind of situation was not usual for the ports in the developing countries only; it was also the case in many developed countries. The concession agreements have provided a timely solution: private investors have provided the funds for the modernization of the port facilities, which has freed up some State funds for investing in other sectors of the economy. In addition to their advantages, the concession agreements also have a price, which is the full or partial surrender of the State control over the development of the ports.
The concession agreements are relatively new in the port practice. There are diverging opinions on the legal nature of the concession agreement as well as on its configuration. Some concession agreements look more like privatization models, while others have more features of a lease agreement. The structure of the concession agreement, its regulatory scheme, the modalities to set the port tariff as well as the modalities for the grant of the concession itself point to the priorities of the port authority and other concessionaires, and as such the concession agreement plays an important rule in the management of seaports. Over the last decades, the application of the concession agreement has become the precondition for the sustainable growth and development of seaports on the global market worldwide.

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BIOGRAPHIE

Dr. **Tomislav Batur** was born in 1967. in Split. In 1994. graduated from the Faculty of Maritime Studies in Split (Department of Marine Engineering) and acquired the title of maritime traffic engineer. On Faculty of Economics in Split 2004. he completed his postgraduate professional study, "Finance and Accounting" course "Financial Management", developed and defended his master thesis titled *Intellectual capital as a measure of value and efficiency of enterprises.* On the Faculty of Law at the University of Mostar 2009. he defended his master's research paper entitled *Maritime clustering and legal aspects of the port policy of the European Union.* On the Faculty of Law in Split 2012th he defended his doctoral research work under the *Concession Agreement as a function of development of seaports*, and earned an academic degree of Doctor of Science from the scientific field of social sciences, the field of law, a branch of administrative law and administration. The author has also completed the Maritime Executive MBA in 2007th in London, organized by Falconbury Business Seminars. In addition to numerous professional examinations in the marine field, is also a leading auditor for ISO 9001-2000 (Quality Assurance Lloyd Center). He is the author throughout his professional and scientific effort associated with various aspects of maritime areas, from technical through to economic and legal issues. His professional career began as an engineering officer in the merchant navy ships. (1988 - 1994)., Worked in state administration (Ministry of Transport and Infrastructure) on maritime inspection operations (1994.-2005.), And since 2005. on the position of Director of the Port of Ploče Authority. He is the Director of the Trade and Transport Integration Project in the port of Ploce since 2005. year. Participants in the project are the World Bank (IBRD), European Bank for Reconstruction and Development (EBRD), the Croatian government and the Port of Ploce. The project includes among others the conclusion of concession agreements, construction of new port terminals, port infrastructure and port Information Systems as well. As an external lecturer at times he was engaged in postgraduate professional study "Economics of Human Resources" at the Faculty of Economics in Split. He is the author of several scientific and professional papers in the field of shipping and maritime law.

QUANTIFICATION OF INFORMATION MODELS OF TRAFFIC VARIABLES AS A FUNCTION OF SUSTAINABLE DEVELOPMENT OF TOURISM OF SPLIT DALMATIAN COUNTY FOR 2012

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ABSTRACT

In this paper is given the quantification of the main variables of traffic information model in terms of sustainable development of tourism in the Split-Dalmatian County for 2012 year.
In transition countries like Croatia the transport activity has been often viewed as dilemma: is the transport factor that makes or defines economic development, as well as tourism was analyzed only through the balance of payments of the state, and later on it became economic development engine. State without good road and rail networks, modern air and sea ports, modern urban transport and supporting facilities cannot significantly develop tourism.

KEY WORDS

information model. transport. infrastructure. sustainable development. tourism. nautical tourism.

1. INTRODUCTION

Services become more present in the global, regional and national economic structure. It follows that the importance of transport and tourism is growing from year to year. These two branches have a positive impact on the current balance of payments and for years significantly reduce the level of negative current balance of Croatia. In both services the quality of human resources is a very important factor for their successful expansion and function. It is unforgivable that we for decades irrationally treat such great potential offered by the Adriatic and which should affirm the Adriatic orientation of the country.

Europe is today a major tourist region in the world. Tourism is also one of the five most important export sectors for 83% of countries in the world. In the European Union, the total effect of tourism (direct and indirect) reflects in the creation of 12.6% of GDP and 13% of employees.

All modes of transport (road, rail, air and sea) are in function of tourist arrivals in Croatia. Considering transport infrastructure used by tourists to arrive at chosen destination, one should note 9 airports- three of the island (Krk, Brac and Mali Lošinj), seven major seaports (Dubrovnik, Ploče, Split, Šibenik, Zadar, Rijeka and Pula) and few smaller ones along the coast and islands.

2. SYNERGISTIC RELATIONSHIP BETWEEN TRANSPORT AND TOURISM

The majority of passenger ports is located in the city harbors. As passenger traffic is closely connected with the road one and as Croatia is highly seasonal tourist receptive country, the streets of major passenger ports in the summer are often in a deadlock. Then it is very difficult to respond in an appropriate manner to these ports and their primary function which is reflected in the loading, unloading and transhipment of passengers and cars [5]. In the past two decades many, to us competetive passanger ferries, have substantially modernized. A modern ports with modern passenger terminals and access roads are built. As an example are the tourist ports of France, Italy, Spain, Greece and Turkey. In Barcelona is in the commercial port invested one billion euros. Therefore, in almost all Croatian passenger port serious reconstruction of access roads and traffic moving on the new location are required. In Split, the relocation of the port out of the city is becoming necessity, while hundreds of thousands of trucks, buses and cars block the traffic in the summer to great extent which is a threat to transport services of public interest such as ambulances, firefighters, public transport etc . Possible location of the new port is now derelict and unused space between the coastal areas of the hotel Zagreb and Duilovo Stobreč.

As a factor in the development of tourism, transport has an initial role and is prerequisite of the tourist traffic in general and mass tourism is most directly determined by the state transport system [7].

In Croatia, foreign tourists come mainly by personal cars or some other road vehicles (92.6%); other vehicles are much less frequent (0.4%, railways, aircraft 5.5% 1.5% vessel) [1].

Croatia is among the top twenty countries of the world by the quality of the natural environment, openness to tourism, access to safe drinking water, the presence of rent-a-car company, but is positioned very low in relation to the regulations connected to foreign investment, financial aids in tourism and international air travel network [4].

To achieve necessary investments and high-quality effects that should be generated by synergy development of transport and tourism, it must ensure conditions to exclude motor vehicles, trucks, in remote locations of about 50 km. European Commission with grants finances development of the intermodal traffic, which consists in the use of freight road vehicles only on short spatial distances up to 50 km and on longer terms functions marine or rail transportation. In this way Croatia does nothing to benefit from EU funds.

Last year in Croatian tourism almost all types of commercial tourist facilities registered a rise in tourist arrivals and nights, with an increase of 9.3 percent in arrivals and 8.7

percent in overnight stays in private accommodation compared with the year before. It has achieved the highest total of last year's rates, 35 percent or 21.1 million. In private accommodation last year of overnights generated nearly 3 million tourists. In the camps last year there was 2.2 million tourists or 8 percent more than the year before and with 14.7 million nights this type of accommodation had an increase of 7.6 percent. Between the camps on the third and private accommodation in the first place according to the last year's physical tourist traffic, are the hotels which recorded the highest tourist arrivals among all types of housing, 4.5 million or 9 percent more than in 2010. Overnight stays in hotels were almost 16 million or 7 percent [3].

In Dalmatia was recorded 4,497,049 tourist arrivals and 25,481,565 overnight stays. Most arrivals in that area made the Split-dalmatian county, 1.777.700 (8.6 percent more), with 10,250,215 (9.5 percent) overnight stays. Out of 11,455,677 tourists, 4,499,231 of them stayed in hotels (8.9 percent), 2,934,727 in private accommodation (9.3 percent), and 2,204,921 in the camps (8 percent more) [3].

In the period from January to December 2011, there was 830 cruises in Croatia. On these ships was 1,141,454 passengers, who resided in Croatia and stayed there about 1659 days, which is an average of two days. In the structure of the cruises, most foreign cruise ships register its first entry into the Croatian territorial waters in the Dubrovnik-neretvanska county (71.3 percent) and the Split-dalmatia County (14.1 percent), which is total of 85,4 percent [3].

In Croatian airports during 2011, there were 5,554,026 passengers or 7.20 percent more than in 2010. Last year all our airports recorded growth in passenger numbers. In the first place remained Zagreb Airport with 2.224,01 million passanger in 2011, which is an increase of 7.56 than a year ago. The Dubrovnik airport is still in second place with 1,332,733 (+5.96 percent) of passengers and Split with 1,272,317 passengers (+7.10 percent) came very close [2].

Croatian camps in 2011 with a record of 15.1 million overnight stays or 7 percent more than last year, ranked itself at the 8th place in European camping; with capacity stayed at 10th place and wih the price of camping at the 5th place. The most overnights, 8.1 million, was recorded in the Istrian camps. The second and third place had camping Kvarner and Zadar with 3.1 and 1.6 million overnight stays [3].

3. DEVELOPMENTAL PROBLEMS AND NEEDS OF TRANSPORT IN SPLIT-DALMATIA COUNTY

The highway link within tourist destinations is very poor. It is therefore necessary to proceed with the construction or reconstruction of roads connecting the constructed or planned facilities on the highway to the cities in SDcounty. Poor quality of roads is also on the islands and the hinterland [6].

Inadequate road infrastructure is in the suburban and urban transport links. It is necessary to restore the road network in all parts of SDcounty, especially neglected local roads and fire trails.

The current bus station in Split, Solin, Kaštela and Trogir do not meet the needs of the handling of passengers on domestic and international road traffic and itis neccessary to reconstruct or build a new bus station on existing or new locations.

In all towns and villages presented is a continuing lack of infrastructure for transport at a standstill, especially in summer, and it is absolutely necessary to address these issues. In larger cities the construction of more public garage on the model of public-private partnerships is needed.

Ferry ports are insufficient capacity for the main traffic routes and need to be built or reconstructed to increase capacity of ferry ports on the main directions of the project. Split has to take an action on planning relocation of the port in a similar way as it was done in Zadar, by moving ferry traffic from the Peninsula on the area of Gaženica.

The county has a lack of berths for yachts and mega yachts and connections to accommodate all types and sizes of cruise ships. There is also a lack of organized anchorages with buoys for boaters to anchor. One should increase the capacity of the ports of nautical tourism and create an integrated study for vessels of nautical tourism.

The current state of rail infrastructure is not satisfactory and it is necessary to align it with the development of other track network in Croatia and throughout Europe. Required are investments in railway infrastructure and modernization of the main traffic route Split-Knin.A study on the possibilities of building gateway Split-Sinj-Livno, as a continuation of the construction project Jadranko-Ionic railroad should also be planned.

The present railway station in Split is outdated and does not correspond to modern standards of passenger handling and it is therefore necessary to build a new modern railway terminal (Terminal), (location Kopilica).

The conditions for handling passengers at other railway stations in the county should be improved.

Problematic is the use of airports (Split and Brač) due to seasonal fluctuations.

The problem is the lack of supporting services (warehouses, cargo services, etc.) at the airports and the need is to continue expanding the capacity of services, as is necessary to expand the passenger terminal in Split.

4. DEVELOPMENTAL PROBLEMS AND NEEDS OF TOURIST ECONOMY OF SPLIT-DALMATIA COUNTY

The biggest problem of the tourist economy of the county is not enough good organized private accommodation, which occupies over 60% of total capacity and unfinished privatization of hotels. With above mentioned is in relation a low proportion of hotel capacity. It is therefore necessary to develop a program improvement, organization and increase the competitiveness of private accommodation and accelerate the process of privatization of state-owned hotels. It also important to attract investment in the construction of new accommodation, especially hotels with 4 or 5 stars.

Insufficiently are developed selective forms of tourism (cultural, rural, conference, etc.), so it is necessary to develop them (and related infrastructure) that will extend the tourist season and create competitive advantages (proceed with ethno-eco-villages, the program of thematic trails and other programs), all in accordance with the principle of sustainability. It is necessary to increase investment in additional tourist activities throughout the year and not just in coastal areas and islands.

The county has also a lack of awareness of the need for a common destination management and the need to develop programs, destination management, in particular through lifelong education. Slowly happens adjusting to new trends and awareness of the need for continuing education of the staff is relatively low. Particularly low are levels of education and knowledge in market research and application of marketing principles in business. It is necessary to devise a program to educate tourism workers in accordance with the latest global trends and attract young people into vocational and high schools for tourism occupations.

There has been relying mainly on the comparative (natural) advantages in the development of tourism rather than the creation of competitive advantages, while the application of modern technologies is very slow, especially in small accommodation facilities. It is also present insufficient number of specialized facilities that serve specific market niches.

The big problem of the county's tourism is seasonality in connection with shortness of tourist season, so it is necessary to increase investment in additional tourist activities throughout the year across the county and not just in coastal areas and islands.

The county's present lack of extra-board spending, especially on the additional elements of the proposal.

Unused are the possibilities of development of rural tourism, especially in the hinterland of the county and in the interior of the island;

There is also a small number of high quality of nautical bindings and underdeveloped is maritime logistics due to the growing demand. It is necessary to increase investment in the development of maritime ports and equipment so as to promote the development of high quality tourism.

5. QUANTIFICATION OF VARIABLES OF INFORMATION MODEL

To address the quantification of variables in the traffic information model of sustainable tourism development of Split Dalmatian county one should first determine the most important variables of the model. The most important variable of this model are: road traffic, railway transport, air transport, marine transport, hospitality, private sector, nautical tourism and cruises.

From all this follows quantification of these variables in a way to determine the value of these variables for the year 2012. The current value of each variable on the index scale of zero to 100 for the Split-Dalmatia County will be determined. It starts from the assumption that the value of the variable is zero in the underdeveloped countries of the world and that 100 is the value of variables in the most developed countries in the world [4].

Now follows variables quantification of traffic information model in terms of sustainable tourism development of Split Dalmatian County for 2012:

1. Road traffic: 70,
2. Rail traffic: 40,
3. Air Transport: 70,
4. Sea traffic: 50,
5. Environmental Protection: 60,
6. Hospitality: 50,
7. Private sector: 60,
8. Nautical tourism: 65 and
9. Cruisings: 70.

6. CONCLUSIONS

In the Split Dalmatian county, as well as in other Croatian regions, it is important to attract investments aimed at improving the quality of tourism and the creation of higher added value, since profitability of the tourism sector is low.

This county must develop in the direction of high-value destination and preserve the national, cultural and natural values. The strategic goal should be that Split-Dalmatia county becomes one of Europe's leading destination specialised for the "tourism experience" and to make further efforts and investment to raise the attractiveness of the area of business travel and convention tourism.

Insufficiently is developed tourist destinations and the tourism cluster and there is no joint appearance and presentation of modernized offers on foreign markets. It is therefore necessary to develop tourism based on tourist and recreation destination cluster. It is necessary to promote sustainable tourism development in accordance with environmental protection, support actions to protect the environment and enhance environmental awareness among local residents and tourists.

Quantification of variableof traffic information model in terms of sustainable tourism development of Split Dalmatian County for 2012 indicates that the highest values of variables on the index scale from zero to 100 are road transport, air transport and cruising (70), nautical tourism (65) and the protection of the environment and the private sector (60).

Quantification of model variables at the same time gave the lowest values of the following variables: rail transport (40), sea transport (50) and hospitality (50).

It is obvious that the strongest arguments of synergistic relationship between transport and tourism are road transport, air transport, cruisings, nautical tourism and environmental protection and the private sector.

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THE IMPACT OF ECONOMY CRISIS AS INDICATORS OF LIQUIDITY OF SHIPPINIG COMPANIES

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ABSTRACT

The impact of the global financial crisis is felt in the Croatian economy, which is why they expressed problems in billing and claims payment obligations. Last year's Croatia marked decline in economic activity, which is accompanied by high external indebtedness and internal liquidity. The current economic situation affects the company's business, its liquidity and its development and survival. Especially because of the situation that prevails in the economy not only Croatian but also the world, we are witnessing the devastating levels of liquidity in many businesses. In times of economic crisis, financial planning is an increasingly important role since it allows a precise understanding of the financial impact of negative factors from the environment. Special attention will be paid to the liquidity of companies which have paid great attention, because without money the company difficult business to the extent that it threatened the termination of business. The subject of this paper is to examine and determine how the economic crisis has impacted on the liquidity indicators of shipping companies. Will observed the period since 2008 to 2010 year. Will analyze the liquidity ratio is a sample of 5 companies in the field of shipping activities and will be based on the analysis to make conclusions about the impact of the economic crisis on business and liquidity indicators shipping companies. It is important to notice and to recognize which factors had the greatest impact on liquidity and operations in the previous period, which are essential for the present study. The final contribution is the understanding the importance of liquidity analysis and interpretation of results**.**

KEY WORDS

economic crisis. shipping companies. liquidity indicators.

1. INTRODUCTION

The liquidity, like as the company's ability to satisfy due obligations, represents an important assumption of good business, even the survival of businesses. It is not surprising given the importance of an analytical approach to liquidity through the liquidity indicators. The quality of business is measured and assessed by using indicators. In this context, the basic criteria of a good business are safety and success. The liquidity indicators are used to assess the ability of companies to satisfy short-term liabilities to short-term assets **Error! Reference source not found.**. Fundamental analysis of financial indicators can be accurately located the causes of financial crises businesses subject.

It is unquestionable importance of liquidity for the company as an economic subject, but also for the overall national economic system and it is a prerequisite for their success, but also for the survival. It should be noted that any industry, activity is specific and a liquidity problem is specific. When financial managers have to final select alternatives, there is the need of immediate evaluation economic trends in the market supply of raw materials, market sales of goods and services, as they are imposed and estimates of future macroeconomic measure of economics **Error! Reference source not found.**. Liquid company is a company in which assets are freely flowing in a circular way and converted from cash to non-monetary forms, and from non-cash forms to monetary **Error! Reference source not found.**. The economy's liquidity if it runs unhindered goods and cash flows **Error! Reference source not found.**.

The causes of non-liquidity can be found within the company, but also the influences, risks that exist in a business environment. The most common internal causes of non-liquidity of the company are billing disputes and uncollectible receivables, excess and slow moving and obsolete inventories, investments financed by inadequate resources and insufficient financial results. Non-payment of state-owned enterprises to other businesses subject is like a generator of non- liquidity. External causes of non-liquidity are resulting from the ineffectiveness of monetary-credit and banking system, the underdevelopment of money markets and capital and non-functioning of the judiciary. The internal causes of illiquidity can be influenced by good and adequate measures and business management decisions. The external causes can be influenced with the help of government monetary policy. Analysis of liquidity provides a picture of the overall liquidity of the company, it allows detecting problems and takes appropriate measures to eliminate the resulting difficulties and avoid possible non-liquidity. The influence global financial crisis is felt in the Croatian economy, which is why they expressed problems in billing and claims payment obligations.

As we go through a period of crisis, particular importance will be given to the movement of liquidity in recent years, and show that the situation in the Croatian economy affected the liquidity of the company. The analysis of liquidity observe of the company and liquidity the Croatian economy will bring a final conclusion about the existence of a relationship of economic crisis and the liquidity of companies in the shipping companies.

2. THE IMPACT OF THE ECONOMIC CRISIS

It is important to mention the very beginning of the economic crisis that has greatly affected the operations of companies and their liquidity. In early summer 2007, by real estate market crisis in the United States the financial crisis has begun. The crisis has led to liquidity and reducing leverage used by financial institutions, particularly in the U.S. and Europe. Large uncertainty in the actual movement is the result of pronounced global financial imbalances where, on the one hand, there is a huge U.S. balance of payments deficit, while on the other hand appear balance of payments surpluses of Asian countries and oil exporting countries. More and more borrowers unable to settle credit obligations: partly due to rising interest rates and partly due to revenue shortfalls. With regard to the resale of credit to banks around the world, the crisis has spread into a global financial crisis.

Central and Eastern Europe (CEE) region is an emerging market that is now most strongly affected by the spillover of the financial crisis of the economically developed countries. The reason is the fact that this region its long expansion largely funded by foreign borrowing, and during this process in many countries, including Croatia, significantly deepened its internal and external imbalances. External sources of funding in the second half of 2008 began to dry up, and it was only a matter of time before the start adaptation of private consumption and investment. Adaptation was accelerated in late 2008 and early 2009, when Western European countries sank deeper into recession and significantly reduced demand for imported goods from SIE. The main policy concern was inflation, which is rapidly growing due to increasing food and oil prices and excess vacancies in the labor market. Since October 2008, CEE region has been sinking into a vortex of the global financial and economic crisis.

Because of the serious deterioration of the real sector of the economy, most market analysts still expected in mid-February that the central bank will continue to lower interest rates and implement other measures to improve liquidity. Croatian economy is struggling with nearly 40 billion of unpaid bills. Although this is an old debt, which, due to legal regulations exist only in books and statistics, in them are 14 billion of unpaid taxes and contributions, which the state could pay the annual budget deficit. Even 33 billion HRK(Croatian Kuna) should be written off, said Matko Bolanca, in the name of the Croatian Employers' Association, where they are aware that most non-liquidity wear fictitious' debts that will never be collected because debtors are dead businesses without employees. Therefore, 13.555 companies should be deleted from the records, and their 8.6 billion commitment and over 12.400 companies need to spend a short bankruptcy process to write off another 10 billion HRK debt **Error! Reference source not found.**. The Tax Administration has launched a rapid bankruptcies 2600, the Commercial Court 2255, the State Attorney's Office filed 142 criminal charges **Error! Reference source not found.**. The law limit of payment is mechanism that should prevent further accumulation of arrears. By this law the Croatia would be familiar with the law of the European Union directive, which requires payment of obligations within 30 days, with the exception of the 60 days deadline to pay for the health sector and in cases where a short term compromise the operations of the company. "Duly settle newly created liability after the application of this law could bring in question the collection of pre-existing debts, but keeping busyness subject in contracting a new business and creating new financial obligations, and the consequent slowdown in economic activity," the opinion of the Chamber, which is classified in the suspicious group under the law.

Most analysts are sure only in the fact that the public sector will bring the law in order. For public companies it will not mean a lot of pressure, because they the payment down to a period of 42 days, from 72 last year and they have less liability because of falling orders **Error! Reference source not found.**. For the state it can cause problems, because it will increase pressure on the borrowing, the increase in interest rates and the further destruction of credit ratings. Otherwise, the most recent statistics of Financial Agency (FINA) show that in the end of July the number of businesses which are blockade long up to 60 days is reduced for about 38.9% and the amount of their unpaid obligations is reduced about 18 %. The third monthly consecutively is recorded decline and the number of insolvent businesses in the blockade long of 360 days to more than 1000. These 75 percent of the total 68 400 blocked citizens and companies, and their heavy debts were 83.5 percent or 33.5 billion HRK **Error! Reference source not found.**. This reduction is based on the collection of receivables from individuals applying Enforcement Act. The total amount of unpaid bills in two months is reduced by 54 million HRK, and considering the number of subjects, Croatian Chamber of Economy (HGK) analysts calculated that the average debt were amounted to 2000 HRK **Error! Reference source not found.**. On the other hand, there are no drastic changes in the legal persons. Number of blocked companies grew to 35.975, and their other obligations stayed at almost on the same level.

Although the sector of "classical" industry and agriculture loudly and most persistently warns on the problem of non-liquidity, business reports for the first quarter that the company submitted the Zagreb Stock Exchange revealed that many companies are crying out for capital, even when the report states that liquidity is good. In most companies, like as a rule stay notice that they had increased funding costs due to rising interest rates and exchange rates, and some show growth stocks due to growth. This is an increase in total outstanding incoming obligations and the number of insolvent businesses in relation to the state in late October last year, since, according to previously published data, the total value of unexecuted basis for payment of 68.489 business entities (legal and natural persons, and artisans) at the end of October amounted to 40.19 billion HRK. The Fine notes that the data shows a slight increase in total outstanding basis for payment in relation to the state in late October last year to 60 in those days, and those for 360 days or more. The number of insolvent businesses in the blockade 360 days longer than in October is increased by 1.4 %. More than 75 percent of businesses in the long-term blockade and the amount of their blockade make 83.1 % of total debt. The blockade longer than a year in late November, there were 53175 enterprises and on them refers 33.97 billion for the execution of the payment. For business subjects that have been blocked for more than a year, they are still dominated those who have blocked five or more years, 35.8 percent of them. From a total of 70 061 blocked business, more than half, or 52.1 percent, are legal entity.

At 36 532 legal entities, which employ a total of 41 532 workers, concerns most of the total amount of uncommitted basis for payment, 83.7 percent or 34.2 billion HRK. It is a short-term blockade, long of 30 days, were 1650 legal persons, which is 321 legal entities more than in October. But the amount of their uncommitted basis of 10.8 million HRK less than the month before.

Faced with rising borrowing costs, the economic activity in Croatia began to slow down mid-2008 year. Economic activities are further slowed by the end of the year but beginning of 2009 starts the period of great recession. In 2010 year, Croatian entrepreneurs were operated in the harshest conditions in the last ten years and made a net loss. Negative trends from 2009 year, which is in Croatia, as well as the world marked the spillover effects of the global financial crisis started in 2008 year on the real sector of the economy, continued in 2010 year and are more expressive than in 2009 year.

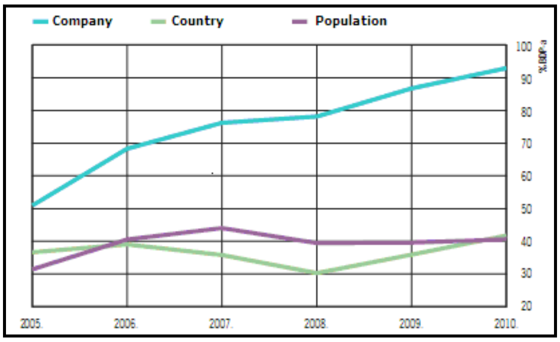

Figure 1. Total debt per sectors

Source:http://www.hnb.hr/publikac/financijska%20stabilnost/h-fs-7-2011.pdf (Last visited: 21.01.2012.)

From Fig. 1 can be concluded that the largest share of total company debt in total debt is still growing. While the indebtedness of the population is stagnant, government debt has a slight tendency to increase.

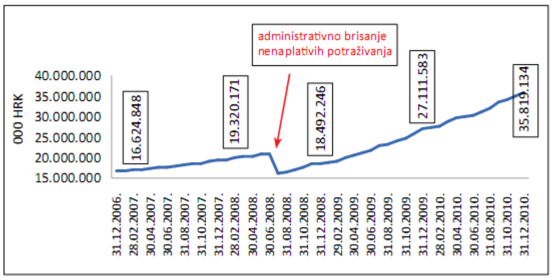

Figure 2. The value of delayed orders of legal entities and tradesmen

Source:http://www2.hgk.hr/en/depts/makroek/Hrvatsko%20gospodarstvo%202010%20godine.pdf

Sharper increase in outstanding orders during crisis 2009 and 2010 years shows that most businesses did not timely adjust the reduction of economic activity and is not aligned with the that and value of your order (first signs of crisis, but could be felt in 2008 year). There is a failed state and government that is too long assured the public that there is no the economic crisis in Croatia.

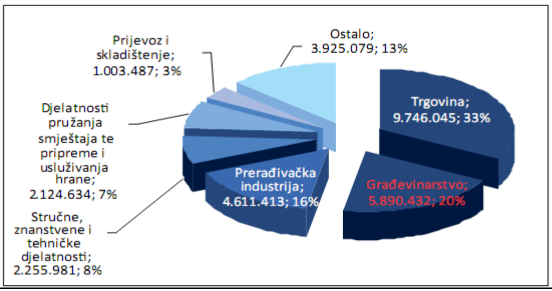

Figure 3. Outstanding accounts of legal entities 31.12.2010.
Source:http://www2.hgk.hr/en/depts/makroek/Hrvatsko%20gospodarstvo%202010%20godine.pdf (Last visited: 10.4.2012.)

From the Fig. 3 might be seen that the biggest share of any outstanding orders are legal persons in trade and 33% of the total outstanding orders. Then the construction industry follows with 20% and manufacturing with 16%. While transport and storage has 3% share of outstanding orders. For different from Croatia, economic growth marked business 2010 year in the world. But the increased economic activities in our major trading partners causes to an increase in demand for our goods and thus increase exports, which had a positive impact on slowing economic growth in Croatia. What could be seen on the liquidity indicators and their mild recovery in 2010 was observed for certain observe businesses.

3. ANALYSIS ECONOMIC CRISIS AS INDICATORS OF LIQUIDITY SHIPPING COMPANIES

Comparison of financial information, financial indicators will show the importance of liquidity for the business, the risks that entails and connections with the economic crisis of liquidity. The research will be based on our own calculations of the all indicators of liquidity through the period since 2008 to 2010 year for companies in the shipping industry. In the review will take an additional five companies and will be reviewed changes within a period from 2008 to 2010. Analysis of liquidity points to the critical factors that may decide the future of the company. In order to analyze the interconnection, with the help of analytical and mathematical methods will present the results and conclusions. Results will be presented in the following tables. Today situation in the economy affects the company's business, on his liquidity and his development and survival.

Table 1. The sample of research

No.	SHIPPING INDUSTRY	SECTOR
1.	Atlantska plovidba d.d.	Transport and storage
2.	Jadroplov d.d.	Transport and storage
3.	Tankerska plovidba d.d.	Transport and storage
4.	Lošinjska plovidba-brodarstvo d.o.o.	Transport and storage
5.	Uljanik plovidba d.d.	Transport and storage

From Table 1 can be seen which companies are taken as a sample research interconnection of economic crisis and the liquidity indicators in the shipping industry.

Table 2. The share in activities to total income (2010)

No.	SHIPPING INDUSTRY	Share in top 10	Share in activities
1.	**Tankerska plovidba d.d.**	**44.64%**	**43.40%**
2.	Atlantska plovidba d.d.	23.99%	23.33%
3.	Jadroplov d.d.	13.95%	13.56%
4.	Lošinjska plovidba-broda-rstvo d.o.o.	7.03%	6.83%
5.	Uljanik plovidba d.d.	3.98%	3.87%
6.	Dinamarin d.o.o.	2.30%	2,24%
7.	Splitska plovidba d.d.	1.94%	1.88%
8.	Mediteranska plovidba d.d.	1.12%	1.09%
9.	Medservis d.o.o.	0.54%	0.53%
10.	Plavetnilo d.o.o.	0.50%	0.49%
	Others in activities		2.78%

Source: www.poslovna.hr (Last visited: 05.04.2012.)

Companies that are taken as samples of work are among the top five companies that have the largest share of activity in the total revenue in 2010 year. For example, Tankerska plovidba has a share in the activities of the total revenue of 43.4%, Atlantska plovidba 23.33%, 13.56%

Jadroplov, Lošinjska Plovidba-brodarstvo 6.83% and 3.87% Uljanik-plovidba.

Table 3. Share in activities to EBIT (2010)

Rang	Naziv poduzeća	Udio u top 10	Udio u djelatnosti
1.	TANKERSKA PLOVIDBA d.d.	36,28%	35,68%
2.	ULJANIK PLOVIDBA d.d.	28,48%	28,00%
3.	ATLANTSKA PLOVIDBA d.d.	17,55%	17,26%
4.	LOŠINJSKA PLOVIDBA - BRODARSTVO d.o.o.	13,13%	12,91%
5.	DINAMARIN d.o.o.	1,33%	1,31%
6.	ŠANGULIN d.o.o.	1,10%	1,08%
7.	MEDSERVIS d.o.o.	0,74%	0,73%
8.	SPLITSKA PLOVIDBA d.d.	0,53%	0,52%
9.	CMA CGM CROATIA d.o.o.	0,51%	0,50%
10.	CROATIA LINE d.d.	0,36%	0,35%
		Ostali u djelatnosti:	1,66%

Source: www.poslovna.hr (Last visited: 05.04.2012.)

As in table 3 the sample of work belongs among of companies that have the largest share of EBIT in the activity, all except Jadroplov. So Tankerska plovidba has an interest in the activities under an EBIT of 35.68%, Uljanik plovidba 28%, 17.26% Atlantska plovidba and Lošinjska plovidba-brodarstvo d.o.o.
As in table 3 the sample of work belongs among of companies that have the largest share of EBIT in the activity, all except Jadroplov. So Tankerska plovidba has an interest in the activities under an EBIT of 35.68%, Uljanik plovidba 28%, 17.26% Atlantska plovidba and Lošinjska plovidba-brodarstvo 12.91%. The spillover of the global economic and financial crisis in Croatia took place somewhat later than in the EU, while signs of recovery of the Croatian economy followed much later. Namely, in Croatia annually 2008th was still recorded growth in GVA of industry, a negative trend started (in August) a few months after he started in the EU. It can be concluded that of non -liquidity issue did not arise suddenly, but is constantly present in the Croatian economic system, but it is slowing in economic activity during the economic crisis has pushed to the surface. Non liquidity has become bigger over time and general economic crisis has only made an extra boost.

Based on table 4 it will be able to make conclusions about the existence of the interdependence of the economic crisis and the liquidity of companies in the shipping industry. Each company will be considered separately. It will be taken with the analysis of indicators of Atlantske plovidbe d.d. Before the results should be interpreted, it is important to say something about themselves indicators of liquidity. To better understand the results of indicators it is important to explain their theoretical significance. Coefficient of current liquidity is an indicator of security operations that the empirical norms favorable if its value is two or more than two, which means that short duration should be at least twice the short – dated obligations. Coefficient of accelerate liquidity is a indicator of the relationship that tells us about the possibility of firms to respond quickly and efficiently and that very quickly gather funds for the settlement of arrears. This indicator should be at least 1 or more, or current obligations should not be greater than the sum of cash and receivables, although there are exceptions, depending on the industry.

Table 4. Indicators of liquidity observed company

YEAR	2008.	2009.	2010.
	ATLANTSKA PLOVIDBA d.d.		
Coefficient of curent liquidity	2,97	0,35	0,28
Coefficient of accelerate liquidity	2,88	0,34	0,27
	ULJANIK PLOVIDBA d.d.		
Coefficient of current liquidity	13,59	2,04	1,30
Coefficient of accelerate liquidity	13,59	2,04	1,30
	JADROPLOV d.d.		
Coefficient of current liquidity	0,83	3,19	1,06
Coefficient of accelerate liquidity	0,83	2,61	1,04
	LOŠINJSKA PLOVIDBA-BRODARSTVO d.o.o.		
Coefficient of current liquidity	0,67	0,56	0,36
Coefficient of accelerate liquidity	0,67	0,56	0,36
	TANKERSKA PLOVIDBA d.d.		
Coefficient of current liquidity	1,98	1,40	1,58
Coefficient of accelerate liquidity	1,92	1,28	1,47

Looking at the indicators through the period 2008-2010 year it can be seen that at the first analyzed company in the Atlantic voyage Inc. the current indicator of liquidity declined in 2009 year compared to 2008 and equals 0.35

which is significantly less than the established norm, and it can be concluded that the company became insolvent in 2009 year. 2009 years is just year when in Croatia it can began to feel the impact and consequences of global economic and financial crisis. Current coefficient of liquidity is further decreased in 2010 year and amounted to 0.28. Just like as coefficient of current liquidity is also an indicator of accelerate liquidity declined in 2009 year and amounted to 0.34, and is also based on the amount of liquidity indicators can be said that the company has a problem with the liquidity. The indicator of current liquidity as the indicator of accurate liquidity is further decreased in 2010. For Atlantska plovidba d.d. the indicators of current and accurate liquidities are shown in Fig 4.

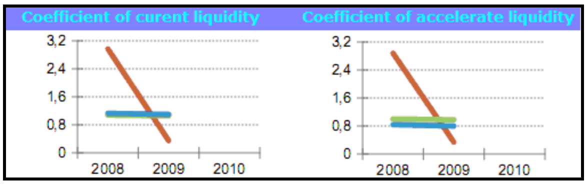

Figure 4. Indicators of liquidity of Atlantska plovidba d.d.

On the chart from Fig. 4 red lines represents subject, the green color represents the sector, while blue colors represent all entities. Based on the graph it can see the current decline in indicators of accelerate liquidity and that the downward trajectory of is the red line.

After having analyzed the company Atlantska plovidba d.d., the company Uljanik plovidba will be analyzed. As with Atlantska plovidba indicators of current and accelerate of liquidity and declined in 2009 year compared to 2008 year and continued to decline and in 2010. The fall of indicators has been extremely high, even with the 13.59. Indicators of current and accelerate of the liquidity in 2009 was lowered to 2.04, while in 2010 year to just 1.30. Uljanik plovidba d.d. is also faced with the problem of liquidity in 2009 and even more in 2010 year. The movement of indicators will also be shown with the help of graphs. Based on the analysis of these two companies, suggest that the economic crisis had a strong impact on the liquidity of the company, ie the impact of the economic crisis has affected the current and reduction of indicators of liquidity, particularly that seen in 2009 year that is just the beginning of a year of economic crisis in Croatia.

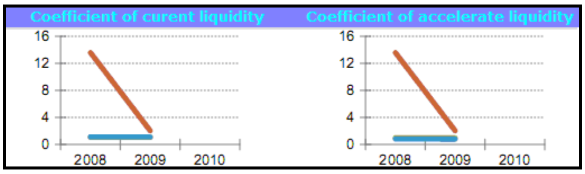

Figure 5. Indicators of liquidity Uljanik plovidba d.d.

Based on the Fig. 5 it can be seen a large drop of indicators of current and accelerate liquidity for the company Uljanik plovidba d.d. It is evident from the steep slope, falling red line that represents an entity that is in this case Uljanik plovidba. In contrast with two previous observed companies, in 2009 Jadroplov didn't notice the decrees of indicators of liquidity. Indeed it noticed increased, while decreased indicators of liquidity recorded in 2010 year. Indicators of liquidity are presented with the help of graphs (Fig. 6).

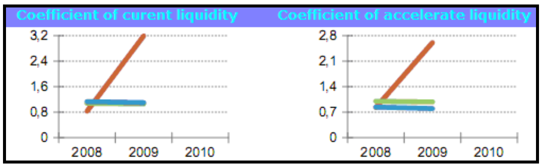

Figure 6. Indicators of liquidity Jadroplov d.d.

Unlike from the two previous observed companies, for the company Jadroplov it can be seen positive growth of the red line that represents liquidity indicators for Jadroplov. It may be noted the growth indicators and the current liquidity and accelerated in 2009 year compared to 2008 year. The economic crisis has different impact on the company's business, not every industry or company acting at the same time, Jadroplov consequences of the economic crisis is felt only in 2010 year.

The following analyzed company is the company Lošinjska plovidba-brodarstvo d.o.o. For this company it can be seen that there has been a decline and indicators of current liquidity and accelerated in 2009 year compared to 2008 year. Further decline in the indicators was also in 2010 year. It can be concluded from this sample of the economic crisis had an impact on the movement of a decrease in the liquidity indicators of enterprises in the shipping industry. It still remains to analyze a company and then will make the final conclusion. For Lošinjska plovidba-brodarstvo d.o.o. the movement of indicators for observed period is shown on Fig. 7.

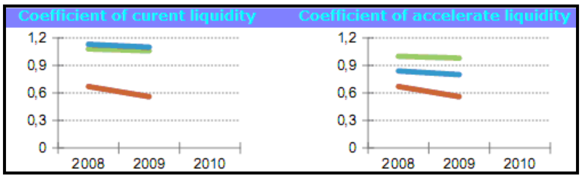

Figure 7. Indicators of liquidity Lošinjska plovidba-brodarstvo d.o.o.

Unlike from the previous analyzed companies can be seen as Lošinjska plovidba-brodarstvo d.o.o. has fewer indicators such as lower liquidity of the sector and other entities, the red curve shows itself subject (Lošinjska plovidba-brodarstvo) is below the blue curve, which represents all subjects and the green curve representing the sector. From the graph one can see a slight drop in current and indicators of liquidity, ie the slope of the red curve is gentle.
The last company that will be analyzed is Tankerska plovidba d.d. In the year 2009, which represents just one crisis year and also at Tankerska plovidba d.d. can be observed decline in liquidity indicators, but unlike other analyzed companies it can be see that Tankerska plovidba d.d. registered the increasing of indicators of current and accurate liquidity in 2010 year. The company has apparently managed to find a good way, the strategy out of the crisis, or at least have found a way to alleviate the effects of the economic crisis.

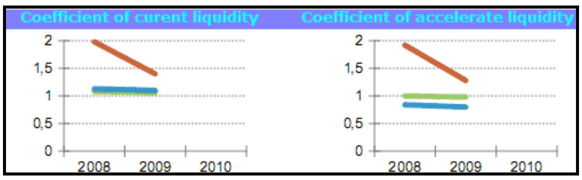

Figure 8. Indicators of liquidity Tankerska plovidba d.d.

From Fig. 8 it can be seen, for Tankerska plovidba d.d., a slight decline in 2009 year when it is not show growth in 2010 year and this can be seen from Table 4.

Especially because of the situation that prevails in the economy not only Croatian but also in the world, we are witnessing the devastating levels of liquidity in many businesses. Causes of non-liquidity can be found within the company, but also influences, risks that exist in the business of surrounding. Negative trends from 2009 year, which is in Croatia, as well as the world, marked the spillover effects of the global financial crisis started in 2008 year on the real sector of the economy, continued in 2010 year and are more expressive than in 2009 year.
Based on the analysis of the observed five companies during the period from 2008-2010 year it can be concluded that there is a mutual relationship of economic crisis and the indicators of liquidity, ie the economic crisis has affected the reduction of liquidity ratio during the period from 2008 to 2010 year. 2008 is the year of reversal of deterioration and results of operations which continued until 2010 year. Business analysis 2011 year indicates that the effects of the crisis experience in 2011 year until the beginning of 2012 year. The only brings optimism and hope begins to end the crisis and improve business results.

4. CONCLUSION

After a serious disturbance in the global market in 2008 and 2009 years, caused by the financial and economic crisis and in 2010 there was a favorable conjuncture in the international market. Trends of the Croatian economy in 2008 and 2009 year were global convergence.
Unlike most countries, Croatia has denied the occurrence of crises, and then late started a few minor measures that could not give the desired results for economic recovery.
By observing and analyzing the amount of the liquidity of the observed 5 companies are finding that the economic crisis affected the company's business and the decline in liquidity. Connection between economic crisis and liquidity indicators is shows on the graphs from which will also be able to see decline in liquidity during economic crisis. In time of

economic crisis, financial planning is an increasingly important role since it allows a precise understanding of the financial impact of negative factors from the environment.
Economic recovery program which launched by the Government in April 2010 is the comprehensive and widely accepted, but is slowly being realized. The crisis is not possible without severe interventions that will be painful in equal measure where necessary

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BIOGRAPHIE

Marina Brodarić was born in Split, Croatia (1987.) She graduated at the Faculty of Economics, Business Economics-Financial Management and acquired an academic title of Bachelor (baccalaurea) economy. After that she enrolled in graduate university study, the orientation of Financial Management, 28.09.2010. and acquired the academic title of Master of Economics. She went to seminars „How to trade securities. (2009.) and 2010. Student business academy, Enterpreneurship Competition (first place). She is subcontractor on the items "Financing of maritime", "Management of shipping and ports" and “Quality management”. Also she works in the shipping company as a independent officer. She is also co-author of some research papers in these areas. Her professional goal is further education and training.

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INTERDEPENDENCE OF PRICES BETWEEN SECOND-HAND AND NEWBUILDING SHIPS

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ABSTRACT

In this paper we have looked at two shipping markets; the sale and purchase and the newbuilding market. We have examined interdependence of second-hand and newbuilding prices. The analysis encompasses the monthly prices over the period of eight years, from January 2004 to December 2011. Considered markets are segmented by type of ships and their size. In the analysis are selected Capesize, Panamax and Handymax bulk-carriers and VLCC, Suezmax and Aframax tankers. For both shipping sectors the ratio (SHP/NBP) second-hand price over the newbuilding price and its movement is examined. Corresponding statistical analysis was carried out for each type of ship and linear correlation coefficients were calculated ranging from 0.68 up to 0.96 depending on type and size of ship.

KEY WORDS

Shipping market cycles. second-hand prices. newbuilding prices. SHP/NBP ratio. linear correlation coefficients.

1. INTRODUCTION

There are four closely related markets in the international shipping industry: the freight, the second-hand, the newbuilding and the demolition market. The freight market is a service market in which ship-owners can rent vessels for sea transport services while the newbuilding, second-hand and demolition markets are all dealing with ships and can be viewed as ship markets [1].

It is well known that these markets are not independent but related to each other. The world shipping is an economic activity directly dependent on global seaborne trade. Seaborne transport activities can cause the demand for ships by the cargo-owners. In this circumstance, the cargo-owners will enter into a special contract with the ship-owners for the hire of their ships. For the ship-owners, they have two ways to get ships: purchase an old ship immediately in the second-hand market or order a new one in the newbuilding market. Ship-owners can hire out their ships in the freight market for just operating the ships for a period of time or they can also sell them to take the advantage of the value increase for speculation purpose in the second-hand market. Any decision made by the ship-owners on how to get the ships will influence the ship markets (newbuilding and second-hand markets) immediately. On the other hand, ship-owners have three ways to deal with the ships when the freight market is in recession - to sell them in the second-hand market or demolition market, or to lay them up for a period of time.

In this paper, the demolition market is not considered. The paper is focused on the timing of obtaining the ships and on the temporal relationships that can provide insight into the directions of information to be used in the investment decision of the entrepreneur (purchase a second hand ship or build a new one), ship-owners, charterers, cargo-owners and investors in their decision making activities. Accordingly, the ship markets here mean the second-hand and newbuilding markets.

Therefore, our aim is to investigate the possible relationship between these two markets. In order to study this issue, we choose a typical variable to represent each market. It has been established in previous work (see later in literature review) that these variables are second-hand price (SHP) and newbuilding price (NBP) and linear or non-linear relationship between variables underlying assumption of his model. In addition, to examine timing of the obtaining the ship we included temporal relationships of the ratio (SHP/NBP) for two shipping sectors (dry bulk and tankers). Although the exact function between the variables in not known, at least the existence of some linear relationship between them is plausible. Furthermore, in shipping industry, since the movable capital assets (ships and cargo) are traded, ship prices over time are of great importance to investors taking decisions.

2. LITERATURE REVIEW

There exist a significant number of studies in the literature investigating the determinants of the SHP and NBP of ships. Some authors argue that the supply and demand framework is not appropriate for determining ship prices, since a ship is a real asset with long life [2]. They state that the value of ships shares in total world wealth varies proportionally with the expected return on ships as capital assets and is inversely related to alternative investment. Others consider SHP as a weighted average of short and long term profits. The SHP is assumed to depend on the expectations about the future of the shipping industry worldwide and examined is the correlation between second-hand and newbuilding markets [3]. In an interesting study [4], author established the SHP for various types and ship sizes which is then explained in terms of a time charter rate, newbuilding and scrap prices. In addition, some authors test the hypothesis whether the market for ships is efficient through a dynamic framework of second-hand tanker and dry bulk prices. They conclude that there is long run market efficiency in the shipping industry [5, 6]. When examining the dynamics of volatilities in the tanker and dry bulk sector one author finds through ARCH modelling that the prices of small ships are less volatile than larger ones and the nature of this volatility varies according to size [7, 8]. In another study [9], a group of authors analysed the cyclical nature of SHP aiming to describe and forecast cycles and to evaluate policies. They found that NBP variable has a higher impact on SHP that the time charter one. Having in mind this short literature review the contribution of this paper can be seen as threefold.

First, we study a functional relationship of the SHP and NBP, the ratio SHP/NBP and its temporal movement, thus examining the variability and level of the asset value (ship) with respect to the measurable factors. The temporal behaviour of SHP/NBP ratio in the examined shipping sectors is important in the decision making of the ship-owner. However note that it is not necessarily only related to trading activities but to a number of other not here examined variables (for example freight market and demolition market).

Second, the results of our linear model are compared for the different ship sizes in the dry bulk and tanker sectors and useful comparisons or contrasts can be made.

Third, this paper presents an attempt to model the investment decision of the entrepreneur in the dry bulk and tanker sector having in mind question whether to purchase a second-hand or new building.

3. DATA AND METHODS

Monthly time series data was collected for the years 2004 to 2011 from N. Cotzias shipping group and RS Platou shipbrokers [10]. Specifically we collected SHP for 5 year old ships and NBP for different ship types and sizes as shown in Table 1.

Table 1. Shipping sectors, ship types and sizes used in this investigation.

Shipping sector	Ship type	Ship size DWT
Dry Bulk	Capesize	170 000
	Panamax	70 000
	Handymax	50 000
Tankers	VLCC	300 000
	Suezmax	150 000
	Aframax	110 000

For our purposes we used as time dependent variable the ratio of SHP/NBP according to the ship type and size in order to create a decision making tool for the ship-owner or others in shipping business like charterers, cargo-owners investors and entrepreneur in the dry bulk and tanker sector.

4. RESULTS AND DISCUSION

The ratio's volatility across dry bulk shipping sector is shown in Figure 1. The ratio's volatility across tanker shipping sector is shown in Figure 2.

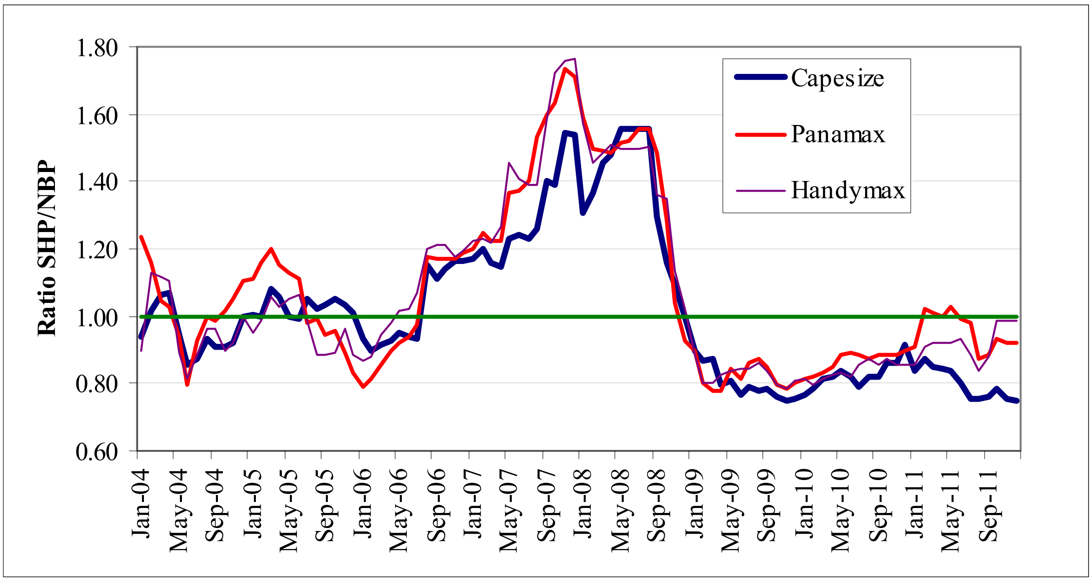

Figure 1. Ratio second-hand price to newbuilding price for each dry bulk size.

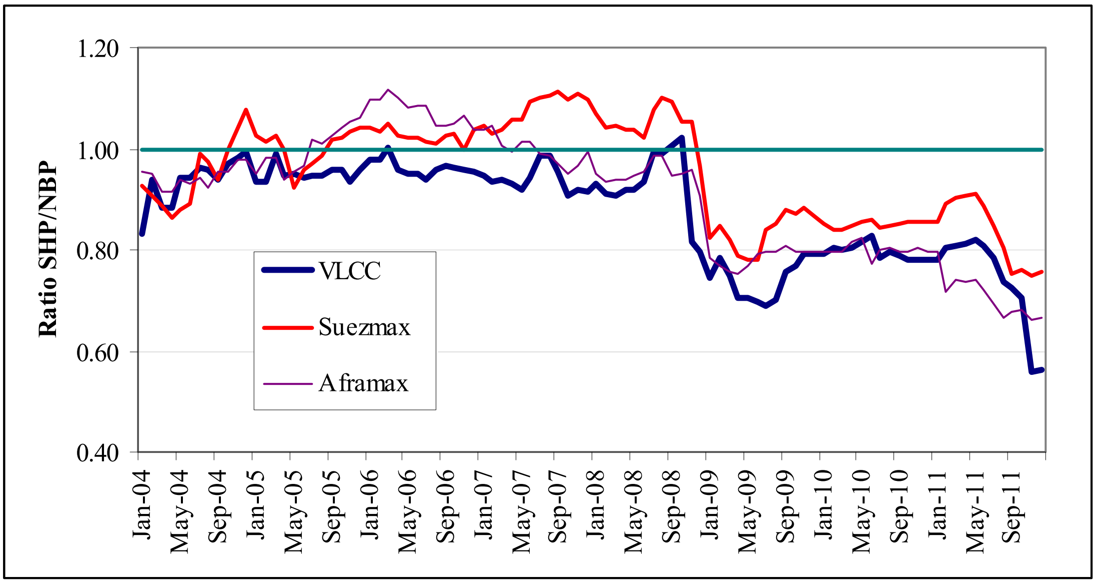

Figure 2. Ratio second-hand price to newbuilding price for each tanker size.

Figure 1 shows that the ratio SHP/NBP is subject to a positive trend and increased volatility, especially from January 2006 to January 2008 which can be explained by the variability of second hand prices for all ship types. From July 2006 to November 2008 ratio SHP/NBP > 1 is related to peaks in the freight market and conversely, from December 2008 to almost December 2011, the ratio SHP/NBP < 1 is related to trough. For the timeframe corresponding to SHP/NBP > 1, linear correlation coefficients between SHP and NBP are high, thus indicating a strong linear relationship, they vary negligibly across ship types: Capesize 0.96, Panamax 0.96 and Handymax 0.94. At the time when SHP/NBP < 1, linear correlation coefficients between SHP and NBP are somewhat lower implying a weaker linear relationship and there is some variation according to ship type: Capesize 0.79, Panamax 0.86 and Handymax 0.75.

A low SHP/NPB < 1 ratio implies that ship-owners expect in the future a strong market and can afford to wait for another two or three years until the delivery of the newbuilding as current freight market is not in its peak. This assumption is supported by linear correlation coefficients calculated.

A high SHP/NPB > 1 ratio implies that ship-owners are in a strong market and the purchase of second-hand ships is worthwhile even though calculated linear correlation coefficients are generally higher then in previously considered time period.

On the other hand, the ratio's volatility across tanker shipping sector shown in Figure 2 is quite different than in Figure 1 for dry bulk shipping sector. It illustrates generally accepted knowledge that shipping industry comprises of the dry bulk and tanker sectors each with its own distinct market structure. Comparing these two sectors, in addition to the different shipping routes, the shipped cargoes and ship sizes the links between the freight and ship markets for these sectors may also be different.

In Figure 2, it is interesting to note that the ratio SHP/NBP < 1 is subject to a negative trend especially for VLCC ships from January 2004 to December 2011 with linear correlation coefficient 0.91 between SHP and NBP. It seems that ship-owners have been more interested in ordering newbuilding as well influenced by new regulations and quality standards for tankers (single and double hull). For Suezmax tankers there are two distinct periods when the ratio SHP/NBP > 1 (September 2005 to November 2008) so ship-owners were more interested in buying second-hand ships and SHP/NBP < 1 (December 2008 to December 2011) when ship-owners were more interested in waiting for newbuilding. Consequently, linear correlation coefficients calculated range from 0.89 to 0.96. For Aframax tankers there is very short period of two years (from July 2005 to July 2007) when the ratio SHP/NBP > 1 and ship-owners prefer to buy second-hand ships despite of low linear correlation coefficient 0.68.

3. CONCLUSIONS

In this paper we reported on one functional relationship of the SHP and NBP, the ratio SHP/NBP and its temporal movement. This way, the variability and level of the asset value (ship) was examined with respect to factors that are measurable (ship price), which are important considerations for the decision maker to take into account when choosing between the second-hand purchase or new building.

Furthermore, the ratio SHP/NBP has been quantified for the different types and sizes of ships in dry bulk and tanker sector. The cyclicality of the shipping sector together with expectations formed by the entrepreneur, the ship-owner and the broker determine the movement of the ratio and hence the decision of the entrepreneur.

Variables which influence international shipping industry based on the freight and the demolition markets were not considered in this study. The inclusion of the relevant covariates in the model would supplement the finding presented in this study and merits further investigation.

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COST SYSTEMS VS MANAGEMENT DECISION MAKING IN SHIPPING

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ABSTRACT

This paper presents the results of a field study about the domestic shipping companies, in conditions of globalization, in terms of business complexity and of quality of cost systems. The most important is to explore their impact on the quality of managerial decision making.
In the eighties, many companies experienced that their traditional cost systems were unable to provide the relevant cost information in the business decision-making process. Traditional cost systems, in terms of business complexity, were unable to estimate the effect of strategic choices based on costs and profits.

KEY WORDS

shipping companies. business complexity. cost systems. management decision.

1. INTRODUCTION

This paper presents the results of a field study about the domestic shipping companies (hereinafter: Company), in conditions of globalization process, in terms of business complexity and of cost systems quality. The most important is to explore their impact on the quality of managerial decision making.

In the eighties, many companies realized that their traditional cost systems were unable to provide the relevant cost information in the business decision-making process. Traditional cost systems, in terms of business complexity, were unable to estimate the effect of strategic choices based on costs and profits, all because of numerous changes in business environment such as: direct labor being reduced drastically, indirect costs getting increasingly higher, inventories being reduced, life expectancy of products also reduced, development of new products is increasingly faster and more frequent, production lines becoming much more complex, distribution is expensive, selling is increasingly expensive (Stevenson and Barnes, Stevenson, 1996). Consequently, each company should have a cost system designed to provide managers with information needed for their current operation (Horngren, DATAR, Foster, 2003). Companies can use contemporary cost models (Activity Based Costing-ABC), Time- Driven Activiy Based Costing-TDABC) for allocating office department costs and the costs of service departments based on actual activity in these units; then, managers can directly evaluate the resources required for each transaction, product or customer.

Performance Structure. This paper comprises three basic sections, including the introduction and conclusion. The introductory paragraph defines the research issue and explains the purpose and objectives to be achieved and which result from applying cabinet scientific methods in this study. In the second section, after conducting an empirical research,the following questions are responded:

- Do local shipping companies have adequate information on the costs that will help them to form the operating cost structure?
- Can local comapnies influence the quality of management decision making by applying well-designed model of indirect-costs allocation model?

The third and final section sets forth conclusive considerations derived from the empirical study.

The scientific contribution of this paper is based on the study, analysis and impact of company cost system on management decision-making in the same units. It is intended to suggest possible improvements in management decision-making (quality).

2. EXAMPLE MODEL TESTING

The empirical research has been conducted by surveying 17 shipping companies. The survey questionnaire contained 17 questions to which 68 responses were obtained and used for creating a non-financial database. The questions related to three factors:

1. Business complexity
2. Quality of existing cost model
3. Quality of management decision making

and to the familiarity of companies with the contemporary ABC cost model.

Using the database, relevant variables were computed for each company and statistical analysis performed with the SPSS software. The linkage between quality variable of cost model - VKM and quality variable of management decision making – VKMO was tested using the method of linear correlation.

2.1. Analysis of research results Complexity of company business (KK)

The average business complexity was computed on the basis of four indicators that are summarized in table 1.

Table 1. Average complexity

Question No.	Indicators	Intensity (%)
1.	Number of services KK1	86,8
2.	Organizational structure KK 2	86,8
3.	Number of customers KK 3	100

4.	Structure of responsibility centres KK4	79,4
Average complexity PKK		88,3

The average complexity of 88.3% leads us to a conclusion that companies have a complex business operation in terms of number of customers and services and in organizational structure is not sufficiently adapted to the compexity of companies.

2.2. Cost model quality (KM)

The assumption for the quality of company cost model are defined through five indicators. They are summarized in Table 2.
According to the data from Table and average KM of 83.8%, it can be concluded that companies have high-quality cost model, particularly with regard to:

1. allocations of indirect costs to responsibility centers (KM 4), and
2. employees that have necessary experience and skills for taking responsibility in decision making (KM 2).

The system for managing and coordinating the activities of decentralized decision-makers (KM3) was evaluated favourably. However, the ones evaluated as substandard are:

1. decision-making rights granted to employees and their acceptance of rights and responsibilities for decision making (KM 1) of 73.5%, and
2. model quality in terms of using outsourcing (KM 5) at the level of 69.1%.

Table 2. Average cost model quality

Question No.	Indicators	Intensity (%)
5.	Decision-making rights granted to employees KM 1	73,5
6.	Required experience and skills for employees KM 2	94,1
7.	System for indirect cost management and activity coordination KM 3	86,8
8.	Allocation of indirect costs to responsibility centres KM 4	95,6
9.	Use of outsourcing KM 5	69,1
Average cost model quality KM		83,8

2.3. Quality of management decision making (KMO)

The assumptions for the quality of management decision making in companies are defined through seven indicators. The computed average quality of management decision making in companies figures out at 90.9%. It is at the turn of a quality and high-quality model as shown in Exhibit 3.

Table 3. Average quality of management decision making

Question No.	Indicators	Intensity (%)
10.	Use of cost information for allocating indirect costs to services KMO 1	91,1
11.	Use of cost information for setting service selling prices KMO 2	82,3
12.	Use of cost information for reducing the costs KMO 3	94,1
13.	Rate of collecting cost information for decision making purposes KMO 4	98,5
14.	Use of cost information for identification of profitable customers KMO 5	79,4
15.	Use of cost information for ship capacity management KMO 6	95,5
16.	Use of cost information for strategic decision making KMO 7	95,6
Average quality of management decision KMO		90,9

2.4. Company's familiarity with ABC method of cost management

Contemporary allocation cost model is familiar only to 38% companies. Given the stated operation complexity, there is an objective need for it and we should work on adoption of a contemporary CO-based cost model.

Acceptance of set-up hypothesis

To prove the correlation between the complexity of company and cost model quality, the linkage between the complexity of company VKK and the quality of indirect cost allocation model VKM was tested by using the chi-square test. Chi-square was 3.90, which means that the relationship is statistically significant at the level of 0.0483 ($p = 0.0483$). Thus, the linkage between the company complexity and quality of indirect cost allocation model (cost model) has been proved and, hence, it can be concluded that:

Greater complexity of company requires a higher quality indirect cost allocation model.
To prove the hypothesis that a well designed cost model have positive impact on the quality of management decision making, the linkage between the quality of cost model and quality of management decision making has been examined by using the method of linear correlation. It was 0.576 which is statistically significant at the 0.0012 level.
It proved that a company with better designed cost model has also a better management decision making model.

Suggestions for improvement

Given the importance of applying contemporary cost models in shipping, the following improvements would be desirable to:
- align company organizational structure with its operation complexity,
- give employees greater rights of decision making,
- use more extensive outsourcing (outside the company and outside its country of domicile),
- use more intensive cost information for:
- a) allocation of indirect costs to services
- b) setting/defining its selling prices, and for
- c) identifying profitable customers,
- develop an awareness in companies of the power of contemporary cost models, create assumptions for the implementation of contemporary cost model by installing adequate ERP system.

3. CONCLUSIONS

The research results show that companies have poor knowledge of contemporary cost management models and are mainly using traditional cost models (with contemporary elements), and yet prepare cost information for decision making purposes at an enviable speed. It is therefore realistic to assume that shippers/companies could easily get proper informatical training to be able to use modern tools for quick and inexpensive calculations of the profitability of responsibility centers, maritime transport services and of customers as well. Companies with complex operations would then dispose of such calculations that would help them to understand properly and in detail its economy, and find out what is bringing/making them profit and what is losing them money. Given the stated complexity of their operation, there is a need for it.

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BIOGRAPHIE

Milica Krstulović, born in Ogorje, Croatia (1956.) **Education**: Received a graduate degree MSc at the Faculty of Economics, University of Split in 2009; the masters thesis was about the responsibility centers and activity-based costing in Croatian shipping. Graduated from the Faculty of Economics, University of Split in 1979. **Professional experience:** A rich experience in organizing, controlling, invest planning and managing in variety of companies, including running the family business (since2009.), retail (2004.-08.), shipping (1991.-2004.), telecom (2005.- 07.), port of cargo (1979.-91.), and teaching/lecturing in High School (2000.-03.) **Conferences:** IMSC 2009. “Defining responsibility centers and results in shipping”. **Foreign languages:** Italian and French: basic knowledge, English: good working knowledge **Aim**: To use skills in management, science and teaching. Leisure activities include nature photography, painting and swimming.

Maja Krčum was born in Split, Croatia (on March 1958.). She graduates from the Faculty of Electrical, Mechanical Engineering and Naval Architecture, University of Split on March 1981. She received a graduate degree (M Sc.) at the Faculty of Electrical Engineering, University of Zagreb in 1996. Her master's thesis was entitled “Simulation on Model of Shipboard Electrical System”. In 1997. she was appointed Head of Department, also working as a tutor and counselor. Now, she is quality manager at the Faculty. She was participated in a number of both national and international conferences where her papers and lectures were generally acknowledged as an active and valuable contribution towards the development of her profession. Her primary interest lies in the field of shipboard propulsion systems, with a special emphasis on electrical propulsion and its numerous applications (simulation methods).

Jelena Krčum was born in Split, Croatia (1983.). She graduated at the Faculty of Science, University of Split, Department of Mathematics - and acquired the academic title of Master of Mathematics and Informatics for Teachers (April 2008). She works at the Nautical High School in Split and she is an external associate on the courses “Mathematics I”, “Mathematics II” and “Mathematics III” at the Faculty of Maritime Studies in Split. Her professional research interests include development of education and training especially in marine science. She is the co-author of several research papers in this area.

NAUTICAL TOURISM AND EUROPEAN PROGRAMME FOR CRITICAL INFRASTRUCTURE PROTECTION

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ABSTRACT

In this paper the authors examined nautical tourism and European Programme for Critical Infrastructure Protection - EPCIP [2]. In countries with strong economic activity in nautical tourism, it takes the characteristics of critical infrastructures. Therefore, it is reasonable to expect that the Republic of Croatia as a part of the European Union (EU) will conduct the expected activity in this field.

KEY WORDS

nautical tourism. critical infrastructure. the Republic of Croatia. European Union. activity.

1. NAUTICAL TOURISM

Nautical tourism is expressed through its connections with maritime nautical science, market, supply, demand, consumers and gaining profit. From the aspect of maritime industry, nautical science is the skill of conducting a vessel from its departure position to its destination position. Accordingly, in nautical tourism, nautical science would be the skill of conducting a nautical tourism vessel from its departure position to its destination position. In this economic sector, there is also the concept of nautical market, a meeting point of supply and demand of goods and/or services. Nautical supply is considered to be a volume of good or goods that boaters wish to buy at a certain price. The profit realised in nautical market is the revenue, i.e. the positive difference between the invested amount and the yielded amount. Nautical market may be determined by a model (Figure 1). The model also contains offshore and onshore technological subsystems [1]. Offshore subsystem includes technical and technological systems used in nautical market in water and/or in the sea. This refers to non-Convention vessels, i.e. recreational ships such as yachts, sailing boats, speed boats, small boats, rafts and other vessels.

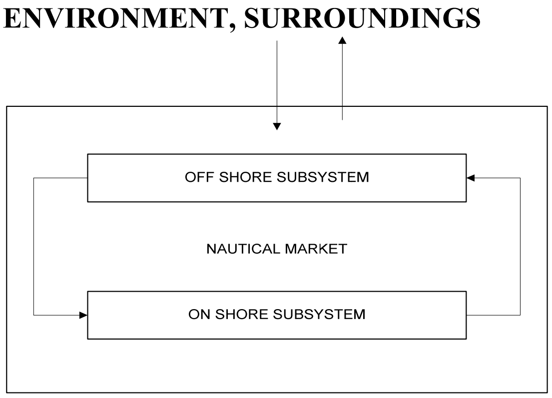

Figure 1. Nautical market system

Source: [3]

Onshore subsystem refers also to nautical tourism ports. According to legal regulations in effect in the Republic of Croatia, a nautical tourism port is a tourist object. In terms of business, space, construction and function, tourist objects are units that provide opportunity for meeting conditions of nautical tourism and tourists, i.e. boaters. Nautical tourism ports allow for the use of various services, such as, for instance, servicing, tourist and commercial services and catering.

The management of nautical tourism ports is carried out by legal or physical persons in the status of concessionaires. According to services offered, nautical tourism ports in the Republic of Croatia are classified as anchorages, berthing places, dry marinas and marinas. An anchorage includes a part of the water area suitable for anchoring vessels. A berthing place relates to parts of water area and coast. Berthing places are arranged for berthing various vessels. A dry marina is a part of the coast or land, enclosed and arranged for providing the custody service of vessels. A marina includes a part of the water area and the coast. Its operations include providing berthing and custody services for vessels and accommodation services for boaters. Marinas also provide other services like, for instance, management of vessels, servicing and maintenance of vessels. The number of boaters in the market of the Republic of Croatia has a significant increasing trend. Last year there were about 250,000 recreational vessels in the eastern part of the Adriatic [7]. Under the assumption that there are about four members of the crew on each vessel, we can assume that there were about 1,000,000 people. In conclusion, nautical tourism, as a part of maritime affairs, and consequently as a part of traffic of a country, assumes the characteristics of critical infrastructure (CI).

2. EUROPEAN PROGRAMME OF CRITICAL INFRASTRUCTURE PROTECTION

In 2004, *European Council (EC)* started preparing an inclusive strategy of critical infrastructure strategy [4]. The Commission accepted proposals listed in the Statement on the critical infrastructure protection with the aim to increase prevention, promptness and response to possible terrorist attacks. Thus, for instance, terrorist attacks in Madrid and London indicated the risks of such attacks oriented towards the infrastructure of the *European Union (EU*) [8]. Conclusions of the EU Council adopted in 2004 in relation to prevention, promptness and response to terrorist attacks led to the development of the proposal for *European Programme for Critical Infrastructure Protection (EPCIP)*. This issue was also analysed by the *Commission of a Critical Infrastructure Warning Information Network (CIWIN).* Consequently, the Commission adopted the Green Book on European Programme for Critical Infrastructure Protection in November 2005. This allowed for political opportunities to the Commission to establish EPCIP and CIWIN. In 2005, the Commission was liable to design a draft of the European Programme for Critical Infrastructure Protection. The general objective of EPCIP is the improvement of critical infrastructure protection in EU. It is expected that the goal will be achieved by creating an EU framework of the critical infrastructure protection. It is considered that a priority activity is the protection from terrorism threats. Critical infrastructure protection will be based on all recognised types of threats. Security and economy of EU depend on the infrastructure of various kinds of services. It is logical that any destruction, damage or threat to a vital infrastructure may cause loss of lives, property and decline of public contentment and moral of EU citizens. Even if a threat occurs, it has to be short, manageable, infrequent, geographically isolated and minimally detrimental to the welfare of member states, citizens and the European Union. Since 2004, a relatively significant stage has been reached in the matter in EU.

It included for instance: organisation of seminars, publication of *Green Paper* and discussions with public and private parties. It is of extreme importance that member states continually analyse potential threats and undertake adequate protection measures.

3. FINANCING AND IMPLEMENTATION OF EPCIP

EU planned financial measures aimed at development [5]. The measures are transferable within EU and especially proposed in the EU programme *Prevention, Preparedness and Consequence Management of Terrorism and other Security Related Risks*. It is expected that the measures will provide for sufficient funding for the critical infrastructure protection in the period 2007-2013. A part of EPCIP is also the proposal of the European Council Directive on Identification and Designation of European Critical Infrastructure to particular entities and a help in the improvement of their protection. In 2008, the European Union Council adopted the Directive 2008/114/EC that is considered a turning point in the development and completeness of European Programme of Critical Infrastructure Protection (EPCIP) [6]. The Directive is the first movement towards systematic recognising and designation of European critical infrastructure. It also allows for assessing the necessity for improvement of European critical infrastructure protection. The Directive defines the necessary procedures for recognising and designating European critical infrastructure. It allows for joint approach to the assistance aimed at improving the protection of such infrastructure. Taking account of subsidiary and proportion principles at EU level, the actions have to be oriented towards the critical infrastructure important for EU. Such actions and the development of special measures of protection will relate to European critical infrastructure of EU member states. Within their internal activities, they are preparing their own approaches in critical infrastructure protection while waiting for the Commission activities and for the European CIP Programme. It may be concluded that a delay in adopting the joint framework will increase the number of possibly uncoordinated approaches in critical infrastructure protection. The main objective of the Directive on ECI is the procedure of recognising and designating an entity as critical infrastructure. The Commission and an EU member state and relevant participants are developing a comprehensive sector approach of ECI identification of a particular entity. The starting points for practical implementation of the procedure of designating an entity as a European critical infrastructure are:

1. Public effect and potential number of threatened people,

2. Economic effect or significance of economic loss and/or damage of a product or a service,
3. Environment effect,
4. Political effect, and
5. Psychological effect.

After practical implementation, an EU member state recognises an infrastructure according to the met criteria and reports to the Commission about the critical infrastructure. According to the recognising procedure, the Commission prepares a Draft of European critical infrastructure. The Draft is based on the information received from member states and on other relevant information.

After the above procedure the Draft is adopted. The Commission measures will be directed towards the European critical infrastructure for which it is justifiably expected that a threat to it would significantly disturb the security of two or more member states or one member state, in case the critical infrastructure is located in another member state [9]. Should the member state request so, the Commission will certainly support it in its efforts to protect the national infrastructure.

4. CONNECTIVITY OF NAUTICAL TOURISM AND CRITICAL INFRASTRUCTURES

Starting from the entirety of outer volumes of nautical tourism observed systematically in connectivity with critical infrastructures, some special features may be indicated. They are evident through technical and technological processes related to maritime nautical science, market, supply, demand, consumers, profit realisation etc. For instance, the following processes may be listed:

- planning of navigation,
- navigation,
- supply,
- safety of navigation,
- protection,
- sales,
- purchase,
- revenue,
- consumption,
- suppliers,
- optimal planning,
- shopping centres,
- service centres,
- hotel accommodation,
- catering,
- education,
- specialisation, etc.

In order to adopt an optimal strategy for the critical infrastructure protection, each of the listed processes should be systematically studied and other processes recognised. In nautical tourism there are numerous processes relating to technical and technological processes. Technical processes in nautical tourism range from relatively low complexity to high complexity level. Technological processes are also numerous [10], including boaters and other subjects present in the nautical market of the Republic of Croatia. Taking into account the figure of 250,000 recreational vessels in the eastern Adriatic in 2011 with four members of the crew aboard each of the vessel, the number of 1,000,000 people indicates the reason for concern and necessity to undertake certain steps aimed at increasing security. Undoubtedly, nautical tourism assumes the elements of critical infrastructure and as such requires a special systematic and comprehensive approach in determining an adequate, i.e. optimal level of security.

This will significantly contribute to the stability of the country and to the increased welfare in this economic sector of our country.

5. CONCLUSIONS

Nautical market of the Republic of Croatia is continually expanding. Last year, there were about 250,000 recreational vessels staying in the eastern part of the Adriatic Sea. The assumption that there are four crew members on each vessels leads to the conclusion that there were 1,000,000 tourist boaters. All EU member states are exposed to various threats. In 2004, European Council initiated preparations in designing a strategy of critical infrastructure protection. It is of significant importance that member states permanently analyse possible threats and undertake actions aimed at protection. In certain circumstances, nautical tourism assumes elements important for determining critical infrastructure. Therefore a special, systematic and comprehensive approach in determining its security level is required. Such activities will contribute to the stability of the Republic of Croatia and to the increase of the profit. Practically, the Republic of Croatia is already a member state of EU and it should meet the requirements in this sector as well.

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BIOGRAPHIE

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NAUTICAL MOORING PLACES AS A POTENTIAL OF NAUTICAL TOURISM

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ABSTRACT

Nautical mooring places as a small size organized way for acceptance of boaters, with existing tourism facilities, may contribute to the development of nautical tourism (but only with the already constructed waterfront).
As a kind of port of nautical tourism, mooring places states from year 1999., from the Ordinance on the classification and categorization of ports of nautical tourism. Subsequently, the Regulation on the classification of ports open to public traffic and special purpose ports of 2004. introduced a limit number of berths per mooring place (max. 10). Amendments to the Regulation on the classification of ports open to public traffic and special purpose ports of 2007. mooring places are released. Thus, in the current Ordinance on the classification and categorization of ports of nautical tourism of 2008., mooring places as the term, exist no more. Draft of new Maritime demesne and seaports act of July 2011. re-introduced so called "Tourist mooring places". This confirms the complexity of the problem of wandering about the legal status of mooring places in maritime law.

KEY WORDS

Mooring places. nautical tourism. ports of nautical tourism.

1. INTRODUCTION

The backbone of the Croatian nautical infrastructure makes nautical berths in marinas. However, aside from legally concessed berths in the marinas, there are a number of nautical/maritime facilities that are located in front of various tourist facilities (small hotels, apartments, restaurants, etc.) that are also in use by boaters in summer. These mooring places, regardless of the method of construction and fitting into the space, almost as a rule, are not legally categorized as nautical facilities, although they have to accept the sailors that use tourist facilities on the coast. As the constructions acts on shore (for mooring places) are already done, we should see which of these objects might fit into the space and be legally concessed, and which should be removed in order to introduce order in the maritime demesne and to prevent further devastation of the coast of uncontrolled illegal construction of nautical mooring places.

2. MOORING PLACES IN THE PRIOR REGULATION

Earlier legislation had recognized a need for an area smaller and more easily organized space for reception of nautical boats and yachts than the marina. Mooring places during the previous ***Ordinance on the classification and categorization of ports of nautical tourism*** (from 30.12.1999. to 01.07.2008.)[1] were a kind of port of nautical tourism, beside the anchorages, marinas and dry marinas (Article 4.).

Mooring place is a part of water area and coastal region, arranged for the berthing of vessels and equipped with a mooring system. If the possibility of mooring space permits, in the water area of the mooring places, can be identified a place where anchoring is allowed (Article 6.).

This allowed less complex forms of business in nautical tourism, which are anchorages and mooring places compared to marina. However, in practice, a simpler form of organization types of ports of nautical tourism (such as mooring places), was proved to be able to abuse. Because of undefined maximum number of berths in the mooring places, as well as the lack of detailed definitions and basic criteria that differ mooring places from the marina, possibility of concessions of mooring places as a kind of ports of nautical tourism was abused in a manner that a large nautical objects that did not meet the requirements and standards for marinas, acted as mooring places with significantly lower concession fee which was not their original purpose.

The criteria for determining the amount of concession fee in the ***Regulation on the procedure for granting concessions on maritime property*** (Article 16., B1), with respect to the determination of a concession fee of ports of nautical tourism, are divided into two groups: anchorages and mooring places, marinas. Concession fees cover for marinas are substantially greater.

[1] See „Official Gazette“ 142/99, 47/00, 121/00, 45/01, 108/01 and 106/04.

Table 1. The initial amount of fixed and variable part of the concession fee

<table>
<tr><td rowspan="2" colspan="2">Type the port special-purpose</td><td colspan="3">Fixed initial amount of concession fees (kn/m^2)</td><td rowspan="2">The variable part of concession fees</td></tr>
<tr><td>Mainland and II. group of islands</td><td>Mainland and I. group of islands</td><td>Mainland and III. group of islands</td></tr>
<tr><td rowspan="2">MARINAS</td><td>Existing and built</td><td>10</td><td>8</td><td>/</td><td>min. 2 % of income</td></tr>
<tr><td>Unbuilt (new)</td><td>2</td><td>1,6</td><td>/</td><td>min. 4 % of income</td></tr>
<tr><td colspan="2">ANCHORAGES AND MOORING PLACES</td><td>5</td><td>4</td><td>6</td><td>min. 2 % of income</td></tr>
</table>

Manipulations with the mooring places were somewhat tried to prevent with the ***Regulation on the classification of ports open to public traffic and special purpose ports***[2] that was first introduced limit the number of berths in mooring places in the highest of 10 berths.

Mooring place is a part of the coast built for temporary mooring of vessels outside the port area, with a maximum of 10 berths (Article 2., par. 1., point 2.).

Then, the restriction of the number of berths in mooring places, as well as mooring places, were abolished in amendments of the ***Regulation on the classification of ports open to public traffic and special purpose ports*** (the Ministry of Maritime Affairs prepared a decree).[3]

At the end, the term mooring places was deleted as a kind of ports of nautical tourism in the current ***Ordinance on the classification and categorization of ports of nautical tourism*** (issued by the Ministry of Tourism).[4] Mooring places as a term and as a type of ports of nautical tourism exist no more, and new category was added instead (disposal of vessel objects).

Nautical ports are classified into the following types: Anchorages, disposal of vessel objects, dry marinas, marinas (Article 5.).

Because of discrepancies in the various divisions of ports of nautical tourism, it becomes questionable interpretation of the height of the concession fee, considering the ***Regulation on the procedure for granting concessions on Maritime demesne***[5], that doesn't know such division of ports of nautical tourism, nor the concept of disposal of vessels or dry marina, so it is necessary to harmonize the method of determining the amount of the concession fees with a new categorization of ports of nautical tourism, respectively harmonize regulations that come from the Ministry of tourism with those who come from Ministry of Maritime Affairs, which concern the same issues.

This confirms the complexity of the problem of categorization of types of ports of nautical tourism, and concessions for ports of nautical tourism. Misuse of mooring places has led to the repeal of this category of ports of nautical tourism witch would be helpful to many restaurants and other tourist facilities on the coast and islands (only if the organization relies on the coastline already built). This, we should certainly consider further in the future, and we should provide a similar form of organized mooring places, because, despite the deletion of mooring places from the regulations, they still exist in practice.

3. MOORING PLACES - NEGATIVE CASE STUDY

The former Ministry of Sea, Tourism, Transport and Development is 05.06.2006. performed the inspection and administrative supervision over the implementation of the ***Maritime demesne and seaports act***[6] under a concession for the special purpose port, sport port Bunarina, port in Pula. Then, they found that the concessionaire 1999. was obtained on shore concession for the special purpose port, the sport port, but after that, despite the concession

[2] See „Official Gazette“ 110/04.
[3] See „Official Gazette“ 82/07.
[4] See „Official Gazette“ 72/08
[5] See „Official Gazette“ 23/04, 101/04, 39/06, 63/08, 125/10 and 102/11.

[6] See „Official Gazette“ 158/03., 141/06, 38/09. and 123/11.

reads the sport port, requested and obtained a decision of the competent government authority on meeting the minimum requirements for the provision of tourist services of the port of nautical tourism, type of mooring places. It was also determined, that at the time of inspection, in the port hosted 226 vessels of foreign nationality.[7]

In this case, it is important to emphasize that the solution of the state administration has allowed a berth in the sport harbor where 226 foreign vessels were found. Whether it is a distorted view, a deliberate search for bypass or holes in the regulations, this behavior does not contribute to the legal right on the maritime demesne. Mourning the fact that breaking the law is justified by document decision issued by the state administration, which shows that in these different segments alignment, should be better.

It is interesting that the Assembly of Split-Dalmatia County made a concession in which refers to "port of nautical tourism (mooring place) on the part Pučišća, bay area Luke and in Makarska, area outside the hotel Dalmacija 01.06.2011. although there is no more such types of port of nautical tourism as mooring place.

4. MOORING PLACES - CURRENT SITUATION

The analysis of current legislation in the ***Maritime demesne and seaports act*** shows us a term of mooring places.

Amendments to ***Maritime demesne and seaports act***[8], among other things, intervened in the port area of ports of county and local significance open to public traffic. Article 74. got a new paragraph 3. and 4., by which the port area, of ports open to the public traffic of the county and local importance, include:

- the area intended for the liner shipping,
- municipal berths - including mooring a vessel whose owner resides in the local government unit, or a craft predominantly reside in the area and entered in the register of ships by Port Authority, or is registered in the register of vessels authorized harbor master's office or branch offices,
- nautical berths for nautical vessels,
- berths for fishing boat and
- mooring places.

Definition of moorings is listed in the ***Ordinance on the criteria for determining the purpose of each part of the port open to public traffic of the county and local importance, method of berth payment, terms of use, calculation of the maximum amount of fees and revenue sharing***.[9] There would be a new definition of moorings (which is no longer port of nautical tourism) well-placed in ***Maritime demesne and seaports act*** or return to the ***Regulation on the classification of ports open to public traffic and special purpose ports*** (Article 2. paragraph. 2.) in order to know what it says when it uses the term mooring.

5. MOORING PLACES AND PROPOSALS OF THE NEW MARITIME DEMESNE AND SEAPORTS ACT (2011.)

The new ***Maritime demesne and seaports act*** has been announced for years ago. This regulation has seen at least 6 drafts of final proposals and public representation, but its adoption is postponed because of the constant changes of individual solutions in act.

Here we analyzed the last proposal of ***Maritime demesne and seaports act***, officially released version of the new law in July 2011. (Posted on the official site of the Ministry of Sea, Transport and Infrastructure). This proposal (like others before) introduces term of "touristic mooring place."

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[7] Data from administrative records on the conducted inspection of Ministry of Sea, Tourism, Transport in the sport harbor „Bunarina", Class: 342-01/06-01/122; Reg. no: 530-04-06-03, from 07.06.2006.

[8] See „Official Gazette" 141/06. čl. 10., that adds to Article 74. new paragraph 3. and 4.

[9] See „Official Gazette" 94/07 and 79/08.
Article 2. point. 7. „Mooring place is a separate port area which is equipped for safe mooring of boats."
Article 3.: "Port area of port open to the public traffic includes all port basin, port anchorages and mooring places that form a functional port unit. The port area, port anchorages and mooring places are divided into operational part of the port, municipal part of the port, and if there is space nautical par of the port."

Draft proposals of the Maritime demesne and seaports act with the final draft law introduces the concept of so called again "touristic mooring places."

In this proposal, we are not talking about a new division of ports of nautical tourism, but "touristic mooring places" and nautical anchorages are introduced as the new institutes, which are given to the economic exploitation by granting concessions (Article 27., paragraph 1., point 2.), or as an exception provided for use by applications, in case when there is a physical and infrastructure connection between the "touristic mooring places" and nautical anchorages and restaurant/accommodation facility (Article 57., paragraph 3.).

"Touristic mooring places" is defined as an *independent infrastructure facility (pontoon, jetty, pier, mooring) in function catering and tourist zones and/or individual tourist facilities on maritime demesne* (Article 2., paragraph 1., point 15.).

In accordance with Article 57. and 58., which regulate the "touristic mooring places" and nautical anchorages, "touristic mooring places" serves for acceptance of bats and other crafts. It is equipped with means for mooring, and can be equipped with the means for providing a supply of water and electricity.

Typically, a tourist berth gets concession for exploitation (according to the procedure for granting concessions on maritime demesne for commercial use), it follows that "touristic mooring places" enable concessionaire partial exclusion of maritime demesne from the public use.

Exceptionally, oppose to the ordinary process of concussing "touristic mooring places" as a commercial concession on the maritime demesne, in case where an existing infrastructure facility meets by its appearance the definition of "touristic mooring places" and makes functional, infrastructure and spatial entity with a single touristic accommodation facility, potential user of maritime demesne may submit a request to obtain approval for special use, when he proves infrastructure, spatial and functional connectivity, and when he proves that a tourist berth, which is intended to get for the specific use, is not contrary to the spatial planning documents.

Then the county assembly or big city council, can issue a special use permit for the "touristic mooring places".

On the "touristic mooring places" witch is the exception in terms of ways of obtaining a specific use, berth can not be guaranteed (mooring places with a special use permit instead concession). (Article 57., paragraph 7.).

Authorized of approval is required to maintain the constructed or installed, infrastructure facility and pay a fee for use of the maritime demesne. The fee, which will be determined by the competent minister, is the income of the state, county and city/municipality budget.

6. CONCLUSION

Mooring place is needed as a lower level, i.e., a simpler form (compared to the marina) of legally organized tourist facilities for boaters. It can be legally re-introduced as a subspecies of ports of nautical tourism (as has already been in the regulations) or as a new institute of concessions (exceptionally specific use, but then no charge), such as it has been proposed in last draft of the ***Maritime demesne and seaports act***.

Regardless of the manner in which the mooring places may return to the practice of nautical operations, it is important to respect the principles on which they will be awarded only in the already constructed and decorated seashore in addition to the existing pontoon. If we re-introduce, moorings, it will be a test for the efficiency of state administration that had to, due to an inability to control and regulation, and because of abuse in the past, abolished the mooring places. It is essential to determine the conditions of mooring, the difference in relation to the marina and control mechanisms. If we assume that there is no power and instruments to prevent that the reactivation of nautical mooring places will mean an abuse of them, in a way of uncontrolled shore concreting, and/or substitution of marinas by mooring places, then we need to postpone their reactivation.

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BIOGRAPHIE

Tonći Panžić was born in 1975. in Split where he had finished high school (Mathematics-IT education centre) and graduated on the Faculty of Maritime Studies. He became Master of Science in 2009. (Faculty of Law, "Maritime Law and Law of the Sea", waits for the assessment and defence of doctoral dissertation). At the doctoral program "Marine" in Faculty of Maritime Studies-Rijeka he passed all the exams. He works for the Hydrographic Institute of the Republic of Croatia since 2005. (now in Department for EU projects and funds). He is Voluntary blood donor, actively involved in sports, unmarried.

DISBURSEMENT OF CRUISE SHIPS WHILE CALLING PORT OF DUBROVNIK - GRUŽ

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ABSTRACT

The aim of this paper is based on determining the expenditure of the cruise ship for the purpose of settling the total of all costs related to mandatory fees when calling at port of Dubrovnik – Gruž. This is one of the crucial factors for Dubrovnik Port Authority in order to position itself and adapt to developments in the international cruise tourism, changes in its cycle, and daily increasing competition. Besides the already investigated and published studies related to passenger expenditure in the destination, revenue from the ship itself remained an open question, and its contribution to the destination and development of the port Dubrovnik - Gruž. We were particularly interested in the ship mandatory fees per passenger prior to its disembarkation at the destination since we had the opportunity to meet with different opinions about the feasibility of this type of tourism, due to the assumption that guests from the cruise ships are poor consumers, neglecting the fact of revenue gained by each cruise ship call. Our terms of reference are based on the number of cruise ships calling in the port of Dubrovnik - Gruž in the year 2011 and tariffs applicable mandatory fees and services with the aim of determining the total cost, regardless of the products whose characteristics are not entirely equal.

KEY WORDS

cruise ship. expenditure. Dubrovnik. revenue. mandatory fees.

1. INTRODUCTION

Provoked by the general opinion, somewhat unfounded views about cruise tourism bringing to destinations like Dubrovnik only harmful consequences and effects, without the direct benefit to the local community, we decided to investigate what is the guaranteed minimum income this kind of tourism brings to port Dubrovnik -Gruž. The main reason for limiting our study to the port of Gruž is precisely in order to accurately determine the minimum guaranteed income received from cruise ships. In the purpose of determining above mentioned income we have used data collected by Dubrovnik Port Authority, tariff regulations and orders: Tariff of port charges and fees in the port Dubrovnik - Gruž, Tariff regulations for charging light dues in internal and territorial waters of the Republic of Croatia, Order of pilot services charges in internal and territorial waters of the Republic of Croatia. We believe and by this research we would like to prove that cruise tourism is of great importance for Dubrovnik and that income received from it can't be negligible. There is much more space to improve and disperse trend of cruise tourism through all year around what will consequently increase income and still remain in the frame of sustainable development.

2. CRUISE TRAFFIC IN PORT DUBROVNIK - GRUŽ

Port Dubrovnik – Gruž is mainly cruise port with 484 cruise ship calls and 704 725 cruise passengers in 2011. Cruise industry reports high growth rates especially in the last ten years. In order to explain this unexpected fast grows that are affecting port Dubrovnik – Gruž we should search among trend features. First of all lower prices of the cruise are making it more accessible and affordable for more different social groups. Bigger demand for cruise trips and growing number of passengers are producing more and more new cruise destinations, producing pressure to destinations in order to improve, reconstruct and build ports infrastructure and suprastructure that will fulfill this demanding market.

Total number of passengers from cruise ships in port Dubrovnik – Gruž shows continuous growth (Figure 1.) with slightly reduced annual rates in ship calls (Figure 2.). In the year 2009 number of calls was reduced about 9 percent from 2008. As we can witness the rapid growth of the average size of the ship, it can be said that the number of passengers in 2009 still shows some increase. Already in the year 2010 we have a continued growth of around 8 percent over the previous years. According to the announcements for the year 2012 we are expecting increase in passenger number by 7 percent.
While making the traffic estimates we are taking into account the carrying capacity of Dubrovnik as a cruise destination and developmental framework that imposes spatial limitations. On the other hand, the Croatian market is part of the Mediterranean Cruise market in constant growth stage with so many possibilities for improvement that will consequently lead to future growth of cruise industry.

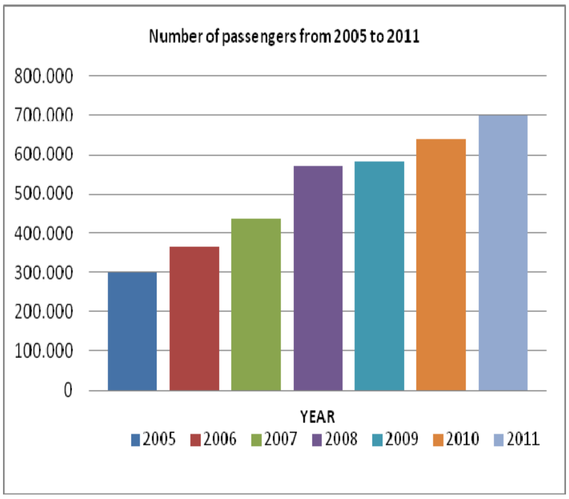

Figure 1. Number of passengers in port Dubrovnik – Gruž from the year 2005 to 2011.

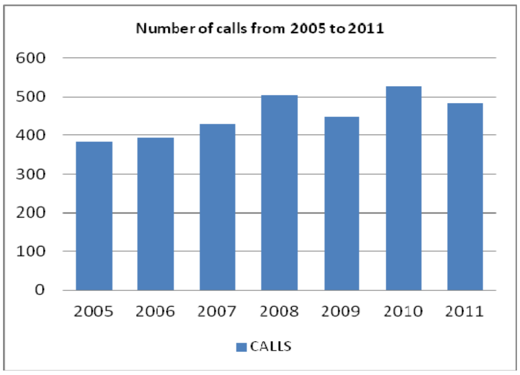

Figure 2. Number of calls in port Dubrovnik – Gruž from the year 2005 to 2011.

Average vessel capacity is constantly growing. Thus, in the year 2008 average capacity of the ship in port of Gruž was 40 956 BT, while in the year 2009 capacity has become to 44 733 BT, so the number of passengers remained at the previous year despite the reduction in the number of calls. Average ship capacity in the year 2010 was 45 030 BT, and in the year 2011 it came to 53 260 BT. (Figure 3.)

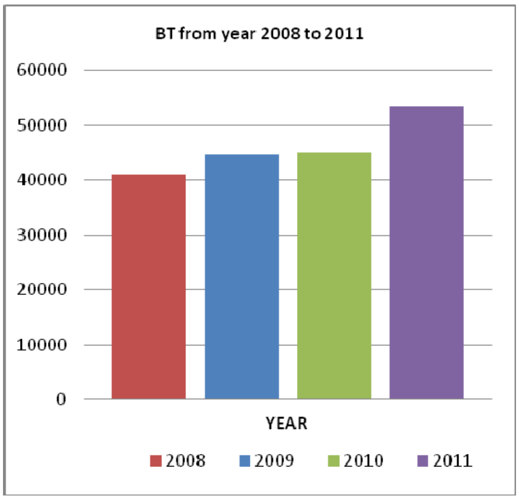

Figure 3. Increase of ship BT in the port Dubrovnik – Gruž from the year 2008 to 2011.

One of the significant development opportunities is influence on the seasonality. Favorable climatic conditions represent one of the most important factors influencing seasonality with application of appropriate marketing strategies. With traffic dispersion through the whole year and week it is possible to achieve, on annual basis a lot of more calls and passengers, while still maintain the framework of sustainable development.

In the Mediterranean ports / destinations for cruise ships an average share of passengers in the period from May to October in the year 2009 was 78 percent, indicating that the seasonality in Dubrovnik is somewhat more expressed than in other Mediterranean destinations. (Figure 4.)

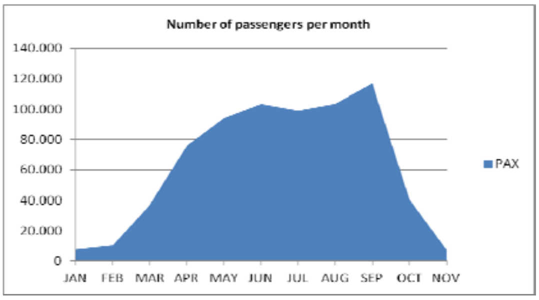

Figure 4. Number of passengers in port Dubrovnik – Gruž per months in the year 2011.

Arrivals are also unevenly distributed through the days of the week. In 2011 concentration of passengers at weekends is still very high, with a share of 67 percent in three weekend days. Unexpected concentration of passengers on Wednesday is nearly 18 percent of all passengers and 19 percent of all calls. Representation of the traffic is weakest on Mondays, Tuesdays and Thursdays (Figure 5). Analyzing the number of passengers on weekdays since the year 2008 to 2011 shows that this issue has been improved, and that the trend tends to equalize the share by all days of the week, but this trend is still poorly defined, and it will be necessary to make considerable efforts to achieve acceptable outcomes.

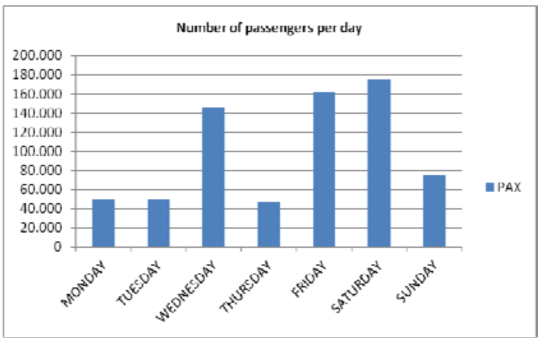

Figure 5. Number of passengers in port Dubrovnik – Gruž per days in the year 2011.

Seasonality in Dubrovnik is one of the main factors that arises difficulties related to the excessive concentration of passengers and traffic congestion. The analysis of seasonality in the world has shown that the least seasonal effects are, almost eliminated on the U.S. cruise market, which indicates the high degree of market development and a very positive marketing effect.

In Europe seasonality is more prominent, showing somewhat less-developed market and less favorable geographical conditions of the northern part of the continent. Since there is huge relationship between seasonality and cruise market development, especially with expected growth rates in some markets in the future, we can conclude that reducing seasonality in Dubrovnik is also one of the possibilities for development. This is confirmed by the average seasonality in the Mediterranean ports, which is less prominent compared to Dubrovnik (Figure 6.)

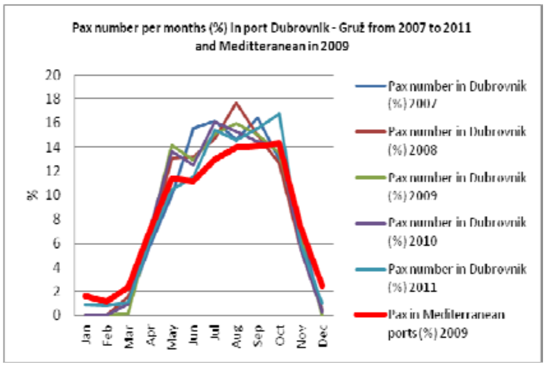

Figure 6. Pax number per months (%) in port Dubrovnik - Gruž from 2007 to 2011 and Mediterranean in 2009

Comparing with other Mediterranean ports climatic conditions as a basic seasonality factor in Dubrovnik can be eliminated, because Dubrovnik area is area with mild Mediterranean climate, which points to the possibility of reducing seasonality in Dubrovnik, in order to reach a similar situation as in other Mediterranean ports.

2.1. Tariff schedule of port services and charges

The Dubrovnik Port Authority intends to approach the problem of the organization of the tariff policy very seriously. Since the amount of the port fees in competitive Mediterranean ports are significantly higher than those at the port Dubrovnik – Gruž and investment in infra/supra structure will significantly increase the level of provided services, Dubrovnik Port Authority intends to bring the average fee per passenger from the level of 3.3 EUR to 4.5 EUR per passenger in next few years. Since Dubrovnik as a destination wants to attract cruise ships through the whole year and during underrepresented days in the week, while lower their interest in the high season and weekends, attempts will be made to favor desirable periods via the tariff system.

The Dubrovnik Port Authority plans to organize the tariff system in such a manner that it will serve as one of the mechanisms for achieving market goals, depending on the development of marketing strategy. Therefore, increase of prices will not be linear, but will favor certain target groups.

The model for calculating the price of the fee for cruise ships has been changed in 2009. While the former model took in to account BT and passengers, the new model has only one parameter – BT. The part that was calculated on the bases of the passenger number is now compensated by the constant (independent amount), and the classes for the categorization of the price on BT basses have been avoided. In this way, we gained almost the same distribution of prices and simplified the calculation (Table 1).

Table 1. Basic harbor dues of Dubrovnik Port Authority

No.	**item**	**eur**
1.	Basic price	**370 + 0,09167 X GT**

Table 2. Other provisions of Dubrovnik Port Authority

No.	**Item**	**eur**
1.	Over 24 hours stay	S*/24 X 0,09167 x GT
2.	Cancellation fee	
2.1.	Cancellation 0 – 21	100% paragraph 1, article 2.2.1.
2.2.	Cancellation 21 - 120	50% paragraph 1, article 2.2.1.
2.3.	Cancellation 120 - 180	30% paragraph 1, article 2.2.1.
3.	Discounts as per	
3.1.	From 01. November to	30% total price
*S – no of hours over 24		

The tariff policy refers to devising a tariff model of the port fees and adjusting the level of the fees, taking into account the competitive ports, investment in improving the state of the infrastructure and superstructure, target market, possibilities of the Dubrovnik region in

connection with the accommodation of cruise ships, and the most frequent problems that occur. Prototype of an ideal ship call should have the following characteristics: medium-sized ship, high economic category (Deluxe or Super Deluxe), a call on an ordinary working day, outside the high season (July–October). Through various tariff discounts, an attempt will be made to favor the described categories. Numerous analyses have been performed in order to adjust the fee level to achieve the desired results. Since the situation on the market is unstable, the possibility is provided by new tariff that Dubrovnik Port Authority general manager applies the discount up to 30%, when consider necessary. The regular discount is in the off – season period.
Beside above mentioned harbor dues charges in the port Dubrovnik – Gruž there are two more obligatory charges as mooring and unmooring of the ship and solid waste disposal charged by Dubrovnik Port Authority primary concessionary Luka Dubrovnik d.d.

Table 3. Mooring and unmooring*

Table 3.1. charge for vessels up to 500BT

no	Basis for calculation – vessel	EUR
1.	0 – 25	20,00
2.	25 – 50	25,00
3.	over 50	30,00

Table 3.2. charge for vessels over 500BT

no	Basis for calculation – BT	EUR
1.	501 – 1500	64,88
2.	1501 – 2500	100,15
3.	2501 – 5000	119,51
4.	5001 – 7000	159,34
5.	7001 – 10000	198,03
6.	10001 – 13000	216,25
7.	13001 – 16000	236,73
8.	16001 – 20000	266,32
9.	20001 – 25000	341,43
10.	25001 – 30000	425,57
11.	30001 – 35000	512,16
12.	additional 1000BT – over 35000	8,90

**Notes:*
Quayage is charged separately for mooring and unmooring.

Transfer from one berth to another is charged as mooring and unmooring allowing the discount of 50%. Transfer of the vessel from one berth to another is not charged for when the ship has to be moved due to safety reasons or in case of a mechanical breakdown.

Table 4. Solid waste – obligatory fee

Table 4.1. charge for vessels up to 500BT

no	Basis for calculation – vessel length -	EUR
1.	0 - 25	25,00
2.	25 - 50	30,00
3.	over 50	35,00

Table 4.2. charge for vessels over 500BT

no	Basis for calculation - BT	EUR
1.	501 – 1000	40,00
2.	1001 – 5000	52,00
3.	5001 – 10000	68,00
4.	10001 – 20000	95,00
5.	20001 – 40000	116,00
6.	over 40001	157,00
7.	If the amount of disposed waste exceeds 3m³, each other m³ will be charged EUR 35,00	

2.2. Regulations for charging light dues in internal and territorial waters of the Republic of Croatia

As one of the mayor parts of ship calling Dubrovnik port – Gruž disbursement goes on lightning dues, exactly 33% (Figure 5.) what is around 12 mill HRK. We consider this extremely high as tariff of regulations for charging light dues in internal and territorial waters of the Republic of Croatia predicts only monthly and yearly payments even dough more than 50% of cruise ships are calling Dubrovnik port – Gruž only once per month.

Table 5. Light dues in internal and territorial waters of the Republic of Croatia

Monthly tariff	
BT	price in EUR per BT
to 10000 BT	0,19
10001 – 20000	0,19
20001 – 50000	0,14
50001	0,12
Yearly tariff	
BT	price in EUR per BT
10000 BT	0,64
10001 – 20000	0,64
20001 – 30000	0,64
30001 - 50000	0,48
50001 - 80000	0,40
80001	0,35

2.3. Order of pilot services charges in internal and territorial waters of the Republic of Croatia

Last but not least part of disbursement is compulsory pilot dues taking 8% out of total ship disbursement calling port Dubrovnik – Gruž (Figure 7.).

Table 6. Order of pilot services charges in internal and territorial waters of the Republic of Croatia*

BT	Basic price in HRK
to 1000	588,29
1001 – 2000	756,37
2001 – 3000	882,43
3001 – 4000	10050,51
4001 – 5000	1176,57
5001 – 10000	1323,64
10001 – 20000	2206,07
20001 – 30000	2647,81
30001 – 50000	3088,50
50001 – 70000	3529,71
70001 – 100000	4059,16

**Notes:*
- *Pilot is charged separately for entering and leaving a port Dubrovnik – Gruž.*

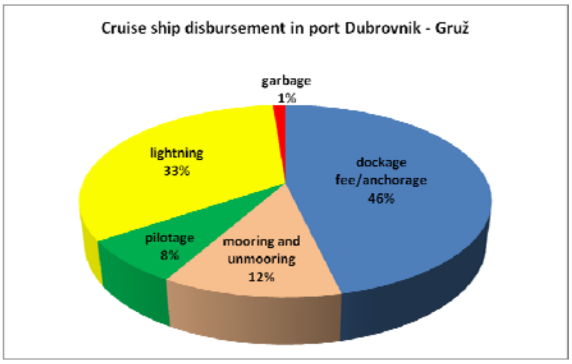

Figure 7. Income achieved (in percentage) per services in port Dubrovnik – Gruž in 2011.

Table 7. Income achieved (in HRK) per services in port Dubrovnik – Gruž in 2011.

Service	Income (HRK)
Dockage fee	16.880.730,81
Mooring and unmooring	4.374.857,24
Anchorage	283.794,23
Pilotage	2.724.619,00
Lightning	12.332.363,85
Garbage	429.108,88
Total	37.025.474.01

3. CONCLUSION

Taking in to analysis all mentioned parts of ship disbursement while calling port Dubrovnik Gruž we are coming to a conclusion that minimum guaranteed income from cruise ship call excluding all additional charges as overtime, work during weekend and holydays, and extra expenses is 7,13 EUR per passenger. Speaking about port Dubrovnik –Gruž and total number of cruise passengers in 2011 (704 725) total disbursement income is over 5 mill EUR (Table 7.). Our leading research idea is proven to be right. Different branch of services generate significant income out of cruise tourism that as we have mentioned before can't be neglected.

There are needs, possibilities and obligations to be followed during next few years in order to increase number of cruise passengers in port Dubrovnik – Gruž taking care about sustainable development. There is still a plenty of room to be negotiated about spreading cruise calls through off season months same as through underrepresented days of the week.

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BIOGRAPHIE

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I was born on January 12, 1976 in Dubrovnik, where I have finished University of Maritime Studies, maritime management; holder of B.S. degree and numerous certificates from short courses and seminars at various Croatian and European academic institutions. After completed studies, worked for Carnival Cruise line as a chief electronic officer for over 5 years until 2004 when I got an employment in Dubrovnik Port Authority as a general manager. Currently I am finishing postgraduate program at University of Business Economics in Split and I am actively involved in various Croatian university studies financed by ports or government itself.

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AN ANALYSIS OF MANEUVERING PROCEDURES IN FOUR-POINT ANCHORING AND DEFINING THE MARITIME SAFETY MEASURES

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ABSTRACT

Maneuvering the ships during positioning in the oil fields and other specific locations using four anchors with winches (Four Point Mooring Ships) is considered a demanding and responsible job of the captain. Ships of this type are fitted with more than 1000 m of wire rope on every winch drum, and the work area, i.e. the seabed, involves quite a lot of various obstructions such as oil wells, underwater gas and oil pipelines, and the like. If the tasks are performed in the tropics, additional difficulties include volatile and changing meteorological and oceanographic conditions. Findings produced by statistical analyses show that these ships' anchors cause severe damage to underwater installations, amounting to millions of U.S. dollars. Experience and training of the master and the deck crew are exceptionally significant for damage prevention, particularly when anchors should be hoisted fast and the position left quickly due to impending bad weather. When carrying out these maneuvers, the master must act in accordance with the regulations of the oilfield concessionaire and has to be familiar with his ship's maneuverability and anchor system, in order to minimize the risk of damaging underwater installations. The basic objective of this paper is the analysis of complex procedures performed when handling anchors and maneuvering the ships of this type, and defining safety measures when carrying out these operations. Insights and findings produced by this research can be also used for education and training of deck officers and masters taking part in this kind of maritime venture.

KEY WORDS

maneuvering, positioning, anchor handling, analysis of maneuvering and anchoring procedures, defining safety measures

1. INTRODUCTION

Four Point Mooring Ships are multipurpose vessels engaged in operations on anticorrosive protection and maintenance of platforms as well as diving operations. They provide accommodation for up to fifty workers at a certain location and therefore function as floating mini hotels which perform various offshore operations.

Lying to four or two anchors and stern mooring lines, they stay at a given location regardless of waves, tides or changes in wind direction.

Before performing the anchoring operation, the Master of the ship must design an *Anchor Pattern Planning Chart – APPC* which is to be approved by the Marine Department. Its validity is usually 30 days from the day of approval. In case that the vessel is going to stay at the location for more than 30 days, the Master should then request for a reapproval. The Master is responsible for all operations of the vessel including stability, watertight integrity, securing of the vessel's equipment comprising the mooring and anchoring equipment. Navigational warnings are to be broadcast during the anchoring operations. A vessel is usually positioned with two anchors, of *DELTA FLIPPER* type, weighing approximately 5 tons. They are are dropped at a distance of nearly 600 m from the bow, the stern being made fast to the platform by means of the vessel mooring lines. Anchoring operations are not permitted in darkness. During anchoring deployment all other vessels must keep clear of the ship being anchored including those in access to the platform.

In the process of extremely complex anchoring operations which employ almost the entire deck crew at the same time, a special problem arises in the communication between the Master (who while handling the ship, must give orders to the crew) and the crew members who are usually multinational and who do not always have sufficient working knowledge of English language. Additional distortions in communication are made by noise either from the anchor winch engines, rain, thunderstorms or wind. The deck officers assist the Master in transmitting the orders to the crew at the winches. The team work is essential and the crew experience in such specific operations is of extreme importance. Beside his theoretical knowledge of the ship manoeuvring abilities, the Master's experience in performing such a complex manoeuvre is also very important. Certain companies when employing new masters require, beside other qualifications, three or four years of experience in these operations. The theoretical knowledge of the new Master has to be verified by means of appropriate computer programmes in offshore operations, vessel handling techniques and regulations for avoiding collisions at sea (*COLREG*). Then, the new Master has a four to five hour interview with the Master adept at these operations. During the interview the problems with the vessel manoeuvring are theoretically explained and the new Master's knowledge is verified in the process. After that, the practical test follows – the performance of the vessel manoeuvres, the operations of lowering four or two anchors and making the vessel fast to a platform.

In practice the quickest and the safest way to execute this manoeuvre should be found, but surely the Master's experience in these operations is of crucial importance as well as the analysis of the mistakes which might have happened during the previously executed operations. From the safety point of view, the team work represents especially important factor. Each manoeuvre is different and unique; for that reason this paper will only del with the typical manoeuvres of these types of ships.

2. MOORING PLAN

Before relocating the vessel, the Master has to make preliminary anchor pattern planning chart in agreement with the contract holder and in consultation with the company site representative.

2.1. ANCHOR PATTERN

When designing anchor patterns, the following should be taken in consideration:

- heading in relation to the prevailing weather (wind and sea),
- the presence of underwater structures (pipelines, risers and wells) which

might foul the anchors on the laying ground,

- anchor patterns for other vessels and barges employed in the immediate vicinity,
- limiting strength of the wind and seas under which the vessel must be put at "long stay"[1] or leave the location and
- when setting the stern mooring lines, attention should be paid to the pipeline location, the position of the mooring bollards and access for gangway deployment on the platform.

After the anchor patterns are prepared, the Master must present them to the *Company Site Representative* who is responsible for interests of the owner company or the oilfield concession holder. If there are no objections, anchor pattern planning charts should be sent to the *Marine Department* for approval. In case that the anchor patterns do not meet the requirements, they will be rejected. The new anchor pattern planning chart must then be designed taking into account the recommendations in order to satisfy the requirements. The following equipment is to be used for mooring and anchorage:

- anchor wire lengths of at least 1000 metres, and minimally of 32mm size in diameter,
- tension and lineout meters for all the anchor winches,
- stern mooring set of capstans and
- electronic charts which must be updated and corrected.

2.2 SOFT MOORING PLAN

When planning for securing of soft lines to platforms, the Master must consult CSR-company site representative. In designing the plan, attention should be paid so as to keep all mooring lines clear of obstructions at the stern and to keep the pipelines and risers out of way from the stern lines, i.e. away from the area between the stern and the platform, while taking into consideration the prevailing weather conditions (wind and sea) at the site. The plan has to be designed so that if the weather conditions deteriorate, it will still be possible to put the vessel at "long stay" or leave the site without incurring any problems.

The ropes are to be tied to bollards, if these are mounted on the platform, if not; they are to be tied around the legs of the platform with regard to the maximum permissible working tension. Soft mooring plan must be approved and validated by the Marine Department, and always kept on board. When handling the mooring lines the attention should be paid so that the total hypothetical force, made by the common actions of sea tides, wind and waves, does not exceed 55 % of the mooring line breaking strain. Before putting the ropes in use, they are visually examined, and they must prove to be in good state. Usually it is not allowed to use ropes with more than two splices (some companies allow not even a single rope splice). An additional supply of three completely new ropes should always be carried on board. Each mooring rope is marked with a number on a rubber plate sewn into the rope for keeping the record in the process of rope control. Synthetic mooring ropes, when out of use, must be protected from the direct influence of the sunlight.

Three legged platforms (*tripods*) can be maximally exposed to strain of 300kN. An anchor pattern design should include the limiting factors; e.g. the height of the waves should not exceed 1 m, the wind speed should not be greater than 15 knots, and vessel should not remain under those conditions for more than two hours in daylight period.

2.3. MINIMUM ANCHORING DITANCE FROM PIPELINES AND OTHER UNDERWATER STRUCTURES

Where operations require a distance of less than 1 nautical mile from a pipeline or underwater structures, when designing the anchor patterns the following minimum distances should apply: the anchoring distance should remain as far as practicable from the underwater structures, but never less than 100m from a pipeline and also never less than 200m if the steel anchor wire crosses the pipeline in the

[1] In case that wind blows with the speed more than 20 kn, the vessel is moved further from the platform (25-30m) by veering out the stern lines and heaving in the bower lines of both bow anchors. In this case we say that the vessel is *at long stay.*

direction of pull at any stage of the mooring process.

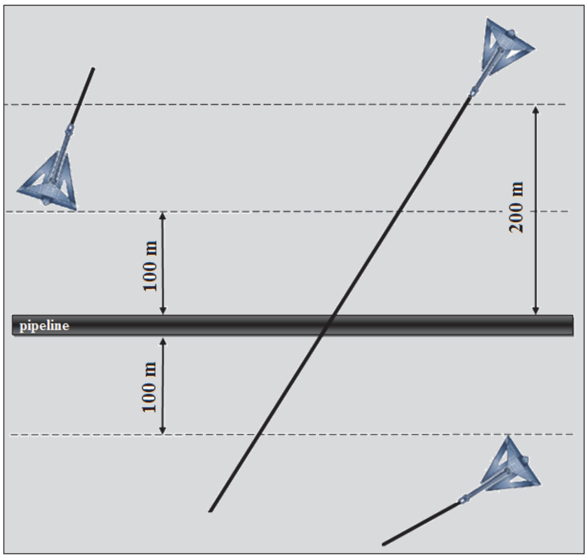

Figure 1. Minimum Anchoring Distance from Pipelines and Other Underwater Structures

2.4. ANCHOR OPERATION PLANNING

Prior to the performance of the anchor operation, the Master has to check the weather forecast and the time of high and low water (due to the set and strength of the sea tide) in order to select the most favourable period to commence the operation. He must estimate the influence of the external forces which will act upon the vessel during the manoeuvre and mooring operations, as well as during the stay at birth. The sea tides under the influence of the gravity pull of the closest celestial bodies change their direction and speed more or less in the same way in which the water level changes, therefore it is possible to distinguish diurnal, semi-diurnal and mixed tides. In confined areas tidal currents assume two mutually opposite directions, the incoming flood tide and the outgoing ebb tide with shorter periods of slack water. The speed of the tidal current reaches far greater values in shallow waters.

Before starting any anchor deployment operations, it is important to organize a crew briefing and inform the crew on the anchor handling details, explain each stage of the anchorage process as well as the duties of each crew member employed in the operation emphasizing the possible dangers which may arise during their work and warn them about the obligatory use of the personal protective equipment making sure that:

- the layout meter is reset to zero,
- the check list is filled in,
- the operations are planned together with the company site representative and
- the preparations are made in case of possible difficulties and sudden emergences, such as: man over board – *MOB*, the loss of signal on remote positioning system, anchor dragging, anchor wire fouling on the seabed (structures and coral reefs), main engine breakdown etc.

3. ANCHOR DEPLOYMENT OPERATION

Prior to the commencement of the anchor deployment operations, the Master must check the following: main engine, bow and stern thrusters, winches, loose gear and all electronic devices on the navigating bridge, all the watertight doors must be closed, and if everything is in working order the operations may commence.

The riggers are to be transferred to the platform, and it is to be checked that the engines, thrusters and steering gear are able to maintain the position of the ship regardless of the influences of the wind, currents or waves. Moreover, the direction and the strength of the external forces which influence the underbody must be determined. After establishing that everything is in accordance with the standard requirements, remote electronic positioning department is contacted in order to obtain the signal of the first anchor position on the electronic chart for remote positioning, which is represented as a target of ten meters in diameter with the bullseye in the centre (see Fig 4). The Master has the responsibility to drop the anchor at the precisely fixed anchorage point which is plotted into the electronic chart by means of remote positioning system. The manoeuvring method will depend on the anchorage position and on prevailing weather conditions. These factors influence the duration of the mooring process which commonly lasts up to two hours.

The vessel proceeds from the platform toward the signal of the first anchor position. At a fair distance the vessel turns to reciprocal course and proceeds under the covered signal centre - platform course gradually decreasing the speed until it almost stops above the anchor drop location. Immediately before the arrival to the anchorage location, the anchor is lowered to the depth of 10 to 20 m, depending on the depth of the sea at the anchorage location.

Figure 2. Anchor DELTA FLIPPER

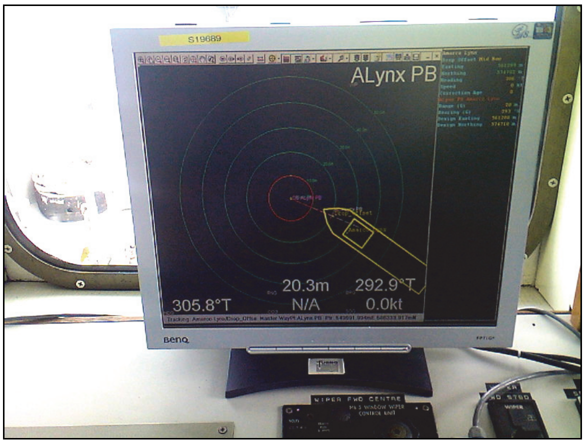

Figure 3. Vessel coming to anchor position (current distance: 20.3m)

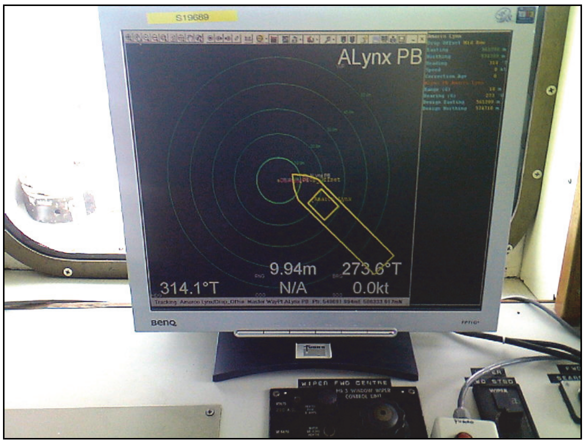

Figure 4. Vessel coming to anchor position (current distance: 9.94m)

When the vessel is within the 10m tolerance centre, the red circle changes its colour to green, and the crew receives the order to release the hydraulic brake and to drop the first anchor. When the anchor reaches the bottom the signal button, which records the position of the first anchor in the remote positioning system device, must be pressed. “First anchor on bottom” is displayed, and the Supervisor responds to the Master that the first position is either accepted or rejected. In case of the rejected position, the anchor must be recovered and dropped in precisely required position.

Then, the vessel proceeds to the second anchor drop location. The vessel runs slow ahead approximately 300m towards the platform (minimum distance allowed before the vessel turns is 200m), at the same time paying out the steel anchor wire of the starboard anchor. The tension meter than displays the tension force of approximately 10 kN. After that the ship makes a wide turn towards the second anchor position. The second anchor must be double secured with the stopper and lashed while the vessel proceeds above the underwater structures.

Immediately before the arrival to the second anchor location, the speed of the vessel is reduced, the anchor unlashed and made ready for lowering. When the vessel is within the 10m tolerance circle, the circle changes its colour to green, the vessel is hove to and the order to drop the second anchor is released. When the anchor touches the bottom, the signal button is pressed and the position of the second anchor is recorded in the remote system of electronic anchor positioning. The message "Second anchor on bottom" is displayed, and the Surveyor responds to the master whether the position is accepted or rejected. In case of the rejected position, the anchor must be recovered and dropped in precisely required position. Which anchor will be dropped first (the portside or starboardside) will depend on weather conditions (direction and strength of the wind, sea tides and waves).

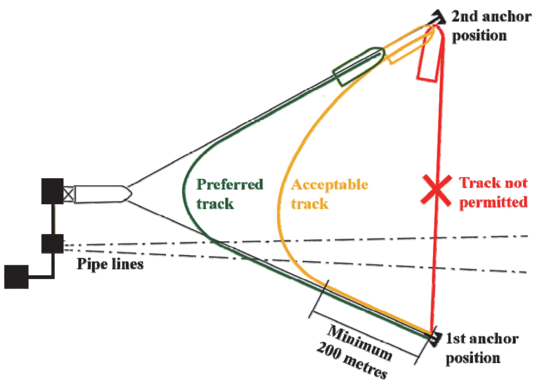

Figure 5. Second anchor deployment operation

When the second anchor is dropped, the Master transfers the commands for handling the ship to the stern control station where he continues the manoeuvre of the stern approach to the platform. The vessel runs astern towards the platform heaving in the first anchor line and paying out the second anchor line at the same time. After approximately 300m the first anchor line will be spread abeam, and tension in that rope will begin to grow. The crew at the first winch will receive the order to unlock the winch. By contemporary release of both winches the ship will slowly approach the platform stern to. When the vessel is at 50 m distance from the platform, the order is given to the crew of the second winch to lock it, because then the anchor begins to dig in with the force of 150 kN for about twenty minutes. The force which is three to four times greater than the anchor weight is usually used at the distance of 30 to 50 meters from the platform. In the process of approaching the platform stern to, the manoeuvring operations are highly restricted due to the influence of the anchor lines at the bow and the influence of wind, sea currents and waves coming from abeam. For this reason, both engines and the steering gear, as well as bow thrusters are used at the same time for better deployment of the anchor lines. When the first anchor has dug in, the brake of that winch is released. In the same way the second anchor pretensioning (diggining in) is achieved in twenty minutes time. When both anchors are dug in, the vessel runs slowly astern and is hove to about twenty meters from the platform. One of the specific purpose vessels then passes the stern lines to the platform and secures them according to the anchor pattern plan.

Usually two ropes are passed out at each side of the stern and two doubled lines are passed out on cross. When the stern is made fast to the platform according to the anchor pattern plan, the pretensioning of the first and the second anchors is performed again for 10 to 15 minutes. If the force on the tension meter in the meantime does not drop, this means that the anchor dug in well and that it holds tight. After that, for each anchor, working pretension is set to approximately 50 kN, and is kept under constant control by the deck officer of the watch. The reading values are written in a special log at all times during the vessel's berth along the platform. The manoeuvre is over after the vessel has been securely moored stern to the platform.

During this complex manoeuvre in which two main engines, bow thrusters and steering gear are handled, the Master is checking the position and course of the vessel on the electronic chart, the anchor bearings, and is keeping the watch on devices which display the length, the bearing and the tension force on the anchor lines, and is coordinating, by means of the VHF, the crew operations on the deck and at each windlass as well as the riggers on the platform.

If in the manoeuvring process, the Master estimates that the anchor or its line struck a pipeline or any other structure on the seabed, the operation is instantly suspended and the incident is immediately reported to the Marine Department, which will send the divers or a remote operated vehicle – ROV hurriedly to the place of the incident in order to make underwater inspection. If smaller gas pipelines are struck, the tension meter will not be able to read them.

Possible dangers in case of a gas pipeline damage are: fire break-outs, explosions and temporary buoyancy loss which can lead to sinking if greater amount of gas running under water reduces the seawater density. Damages to the gas pipelines or underwater oil wells can cause pollution of the marine environment or ecological disaster of great dimensions. Therefore, the Master has a huge responsibility when performing manoeuvring operations of this type.

If the Master suspects that something strange happened in the process of performing this complex manoeuvre, he should always account for the worst possible sequence of events in order to avoid possible damages.

Anchor dragging should be avoided if possible, and when designing the anchor pattern plan the positions with least underwater structures and coral reefs should be searched for. The anchors are usually dropped at 600 m distance from the bow because shorter distances increase the risk of anchor drag. Lines are set in direction in which they will be tensioned during the stay at berth.

On certain locations with many underwater structures, the anchoring procedures are performed by the special purpose vessels – *Anchor Handlers (AH)*[2] in order to reduce to minimum the possible damages to the underwater structures.

Figure 6. Display of the underwater structures below anchored and moored vessel

4. FOUR POINT MOOR

[2] Anchor Hanndlers are special purpose vessels for anchor handling

As with two point mooring ships, variables such as wind, sea tides, sea depth, anchorage location and the disposable length of the anchor line, obstructions on seabed, pipelines, waves and swell, all represent factors which have to be taken into consideration when performing this manoeuvre.

Presented diagrams can serve only as a sample in ideal weather conditions. Bearing of the fore-and-aft line can vary considerably depending on the actions of wind, sea tides and waves. The manoeuvre is performed as previously explained, paying attention that the anchor does not drag, since it may foul and damage the anchor line and underwater structures.

Usually, the bower anchors are dropped first. Then the vessel, his stem on to tide, drifts downwind or down the tide toward the position of the third anchor so as to avoid the possible risk of fouling the anchor line with the rudder or the screw. If wind and tide come from different directions, the vessel should stem the resultant of the two actions.

After the first anchor S1 has been dropped, the brake on the windlass is released and the vessel proceeds to the working position at the speed of one to two knots. The vessel then takes a wide turn toward the position of the second anchor P1. The tension meter of the first anchor displays about 10 kN. When in position for the second anchor drop, the vessel will be hove to, the second anchor will be dropped, the windlass brake released and the vessel will run astern toward the working position, at the same time turning the first anchor line on the winch.

When the vessel approaches the working position, the second anchor windlass will be checked and the force on the tension meter will slowly begin to increase. When the vessel reaches the working position, both bow winches will be released, the tension meter will display minimum tension and the vessel will proceed astern to the position of the third anchor drop. Coming to the position, the third anchor S2, i.e. the starboard stern anchor will be dropped. By heaving in two bower anchor lines, and paying out the starboard stern anchor line S2, the vessel will run toward the working position. When in the working position, the brakes of the three windlasses will be released and the vessel will proceed astern toward the position of the fourth anchor drop P2. In this process, a constant watch has to be kept over the bearing of the starboard stern anchor line in order not to foul the rudder or the screw. Before the arrival to the position of the fourth anchor drop, the tension on the third anchor line should be slightly increased to check the bearing of that anchor line. If the bearings of all the anchor lines correspond, after the vessel is hove to in position of the fourth anchor P2, the anchor can be dropped. The procedure of the precise anchor drop position fix is the identical to the previously described.

The vessel then proceeds to the working position heaving in both bow anchor lines, and slowly hauling in the line of the third (starboard stern) anchor S2, while veering out the port stern line of the fourth anchor P2. On arrival to the working position, one by one anchor is being dug in, as previously explained.

Since the prevailing conditions at sea are rarely ideal and due to the complexity of the four point anchoring operations and obstructions on the seabed, and in order to reduce the risks to minimum, very often in these kind of operations AH vessels are used. The ship usually drops the two bow anchors or two anchors on the weather side (first the bow, then the stern anchor), and the remaining two are dropped in the intended position by means of the mentioned vessel.

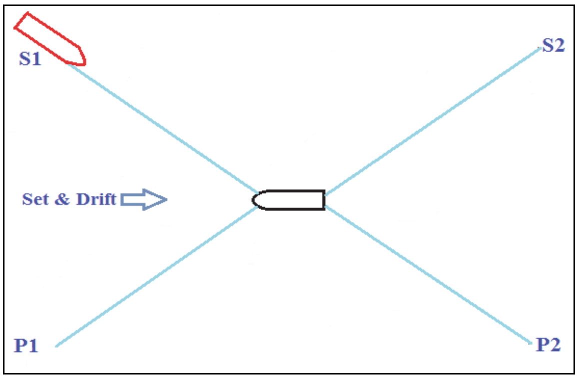

Figure 7. Dropping the port bower anchor (S1)

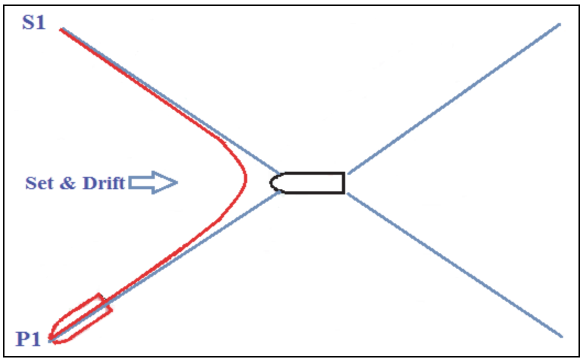

Figure 8. Proceeding to the position and dropping the port bower anchor (P1)

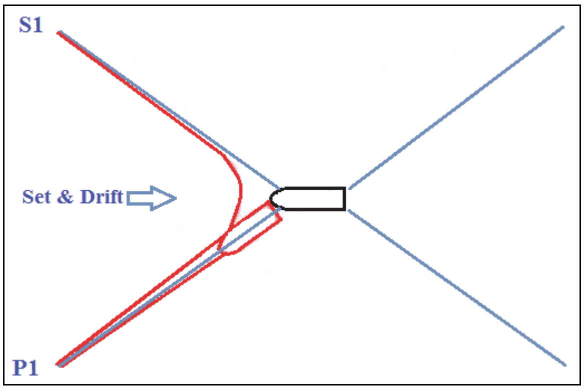

Figure 9. Proceeding toward the working position, and then toward the starboard stern anchor drop position

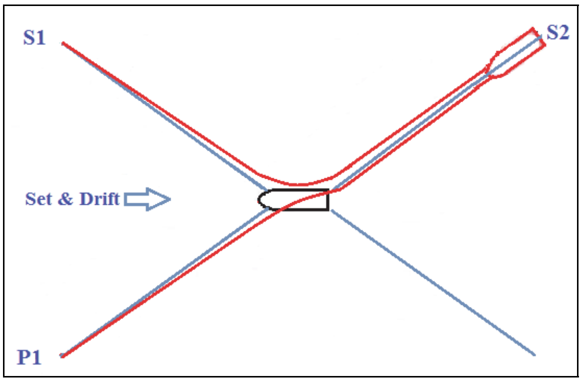

Figure 10. Proceeding toward the drop position and starboard stern anchor drop (S2)

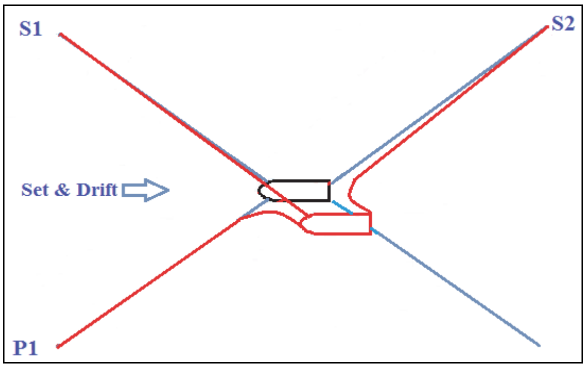

Figure 11. Proceeding toward working position, and then toward the position of the port stern anchor drop

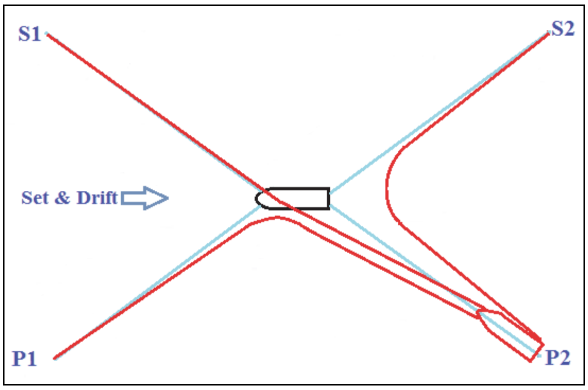

Figure 12. Proceeding to the drop position and the port stern anchor (P2) drop

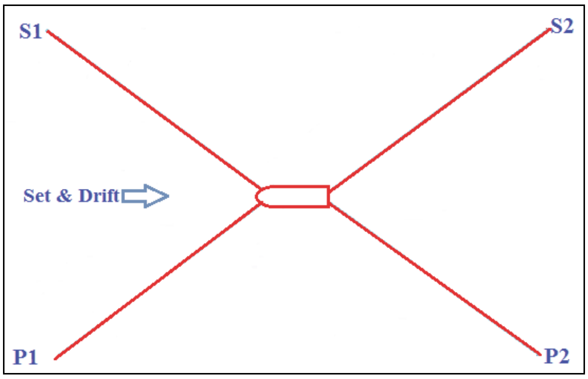

Figure 13. Four point anchored vessel on the working position

5. ANCHOR RECOVERING OPERATION

When relocating the vessel, all the stern mooring lines are cast off and picked up and the steel wires can be heaved in to approximately half length to the anchor, about 300m. Then the brake on the first windlass is released and the second anchor line is heaved in up to the anchor position. When performing these operations a constant watch should be kept on the interface of the electronic positioning system where the distance and bearing to the position of the dropped anchor are displayed. These values are to be compared to those on the lineout meter. When the anchor is weighed-broken from the ground, the tension meter will show only the weight of the anchor and anchor line, which will result in a bit more than 50 kN. The button on the remote electronic anchor positioning system is then pressed in order to cancel the electronic position of the anchor. The anchor is then heaved up and put in the hawse pipe and is secured with the stopper and lashed. The vessel then turns to the reciprocal course and continues heaving in the remaining anchor line while running astern to about 200m from the platform. Then it slowly turns in the direction of the second anchor. When it reaches the position of the second anchor, the position is cancelled on the remote electronic positioning system, the anchor is stowed in the holder and secured with the stopper and lashed.

If the vessel has been staying at a location for too long, and if the anchor dug in deeply into the mud on the sea ground, and cannot be weighed-broken, after bringing the vessel up to the anchor position, the windlass has to be put under tension (the maximum tension of the windlass on these types of ships is 200 kN). This value must not be exceeded because it can lead to the partition of the line and anchor loss. When the anchor line is set as tight, it will take some time for the anchor to let go by itself. This usually takes 15 minutes or half an hour depending on the type of the seabed and on the period of the stay at anchor.

In case of an accident of any kind, the Marine Department should be notified, and especially in the following situations:

- in case that the anchor or anchor line fouls any structure on the seabed,
- at any time when there is a suspicion of anchor dragging,
- when the anchor line has been fouled on the sea bottom, and
- in case of an anchor, anchor wire or chain loss

If he Master takes notice of any unusual state, he must suspend the manoeuvre and consult the Marine Department.

6. MARITIME SAFETY MEASURES DURING THE STAY AT ANCHOR

The mooring gear must in all conditions meet the requirements of the safe stay at anchor, foremost in case of the strain of the wind against the freeboard which represents the basic stress to the mooring gear of the vessel. Other influences such as waves and currents should not be neglected either.

In general, working vessels are equipped with anchors weighing four to five tons with wire lines of 32 mm in diameter, and tension force on the line usually figures to 50kN.

Maximum permitted work load of the anchor wire must never exceed one third of the breaking strain of the wire line. When the tension force in anchor wire reaches 80% x 1/3 of the breaking strain, the preparations for the suspension of the operation must begin. The preparations include the starting of the main engine, bow and stern thrusters and windlasses and the crew must be ready to perform all the operations. Before the tension force in the anchor wires exceeds the permitted maximum, the vessel must be put to other ropes or leave the location.

The ropes which are used for the stay at anchor are made of synthetic fibres of ordinary breaking strain for each type and size of a ship. They must be positioned so that the total wind force gets distributed evenly to the bollards, which will be achieved by setting the right number of the mooring lines of the same characteristics to keep their actions equal. The mooring lines must be distributed in order to meet the requirements in the view of horizontal angles of action. In doing so, the number of required mooring lines must be determined bearing in mind that the total force to which a rope may be exposed to must not exceed 55% of the breaking strain of the line.

During the stay at anchor in fair weather conditions, the vessel must be made fast with eight stern mooring ropes. The recommendation is to distribute the mooring lines in the following way:

- one doubled rope to enable easier unbending, on the starboard side of the stern,
- one doubled rope to enable easier unbending, on the port side of the stern and
- two ropes passed out on the cross from the port and the starboard side of the stern.

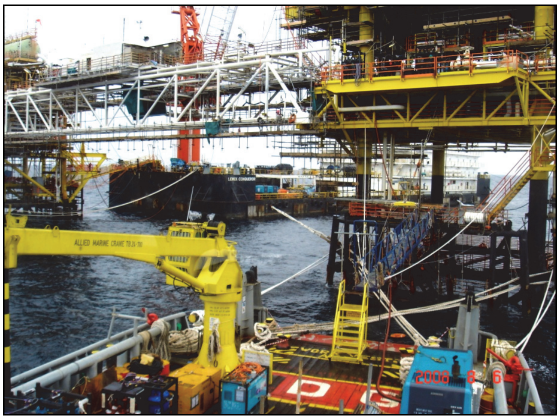

Figure 14. Stern mooring lines

The mooring lines must be set according to the soft mooring plan.

7. WATCHKEEPING

While the vessel is berthed along the platform, the regular watchkeeping duties are performed by competent, trained and qualified officers on the navigating bridge. Among other things, this includes:

- watchkeeping in accordance with the Master’s standing orders,
- permanent control and registration of the tension force readings from the anchor lines into a special log,
- listening to the radio transmissions,
- observation and radar plotting of the sudden incoming changes and deterioration in weather conditions (rain, wind and storms),
- observation of the waves and wind (direction and force), visual lookouts as well as observations of the disposable instruments (anemometer), if the value readings exceed given limits the Master must be notified at once and
- listening to the weather forecast.

Figure 15. Tension and lineout meters for port and starboard bower anchor lines

If the weather conditions deteriorate and tension force on the anchor lines begins to increase, the engine crew must be ready to immediately start the main engine, bow thrusters and winches. In that case, the vessel is immediately put to other ropes (minimum 30m from the platform), the main engine and the winching gear are started. If due to the actions of the wind, sea tides or waves coming from abeam, the tension on the anchor lines starts to increase; it can be reduced by the action of bow thrusters driven in direction of prevailing heavy weather. The weather in the tropical regions is often unstable, and sudden changes are often. Local storms do not last very long, an hour or two, after which they settle down. If the Master estimates that the heavy weather will last longer and that the safety of the moored vessel is in danger, he organizes the crew and gives order for the anchor recovery manoeuvre. The vessel leaves the mooring proceeding toward the outer anchorage, where she drops the anchor and waits for the weather to settle down.

8. CONCLUSION

The conclusion is based on the author's years-long experience with performing offshore operations and manoeuvres.

The most important conclusions are as follow:

- before anchoring operations start, the vessel manoeuvrability must be checked with regard to the external factors (sea tides and wind). The weather forecast and the time of the high and low water must be observed,
- crew briefing must be held in order to explain the anchor pattern, the duties of the crew members and to warn them about possible dangers,
- communication with the multinational crew presents a special problem, since their working knowledge of English language is not always at satisfactory level, and additional difficulties appear as a result of meteorological conditions at sea, such as wind, rain and the sound of waves. Therefore, the communication must be short, simple and clear,
- in case of contingency during anchoring operations, the consultations are to be held with the Marine Department help desk where experienced masters keep a 24 hour watch. The worst possible sequence of events which can happen to the vessel or the crew is to be considered,
- if the Master suspects that in the process of manoeuvring a pipeline or any other underwater subject has been fouled with the anchor or anchor line, all operations are immediately suspended and notification is immediately sent to the Marine Department waiting for their instructions,
- anchoring operations are to be performed in daylight only,
- during manoeuvring operations, the tension and lineout meter are to be constantly under supervision, as well as the current position of the vessel on the electronic chart,
- the anchor dragging should be avoided if possible, and when making the anchor pattern plan the lying ground with the least underwater structures and coral reefs is to be found. The mooring lines are to be set in direction in which they will be tensioned during the stay at the moor,

- before the new Master takes over the con, he is to check the vessel's manoeuvrability,
- possible dangers in case of gas pipeline damage are: fire break-outs, explosions, temporary buoyancy loss which can lead to sinking if greater amount of gas running under water reduces the seawater density. Damages to the gas pipelines or underwater oil wells can cause pollution of the marine environment or ecological disaster of great dimensions,
- at certain locations with many underwater structures, the anchoring procedures are executed by the special purpose vessels – *Anchor Handlers* in order to reduce to minimum possible damages to the underwater structures.
- when the vessel is berthed along the platform, the regular watchkeeping duties are performed by competent, trained and qualified officers on the navigating bridge. Among other things, watchkeeping duties include: observation of tension forces on the anchor lines, radar plotting of the sudden incoming changes and deterioration in weather conditions (rain, wind and storms), observation of the waves and wind (direction and force),
- if the weather conditions deteriorate, the vessel must be put at *long stay* (minimum 30m from the platform), the main engine and windlass engines must be started. If due to the actions of the wind, sea tides or waves coming from abeam, the tension on the anchor lines starts to increase, it can be reduced by the action of bow thrusters driven in direction of the prevailing heavy weather. If the Master estimates that the heavy weather will last longer and that the safety of the moored vessel is in danger, he should organize the crew and give order for the anchor recovery manoeuvre. The vessel should leave the moor and proceed toward the outer anchorage, where she should come to anchor and wait for the weather to settle down.

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FUTURE PROJECTS FOR CNG SHIPPING

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ABSTRACT

The compressed natural gas (CNG) shipping concept aims to offer savings in the transportation of natural gas by eliminating the need for the expensive onshore refrigeration trains that are required in the liquefied natural gas (LNG) method. This paper's purpose is to explain the variety of proposed CNG concepts and to provide information intended to facilitate guidance in understanding the key differences between the different CNG concepts and their practical impact on ship design and construction. The paper discusses the key competitive concepts for CNG transport with regard to the monohull ship design. The technology of storing compressed gas in pipelines is used to find out solutions to the problem of storing compressed gas onboard ships. The concept of CNG transport joins the aspects of these two technologies together, according to [5].

KEY WORDS

LNG gas. CNG concept. construction. structure.

1. INTRODUCTION

In recent decades there has been a rapid increase in natural gas consumption and consequently, in ship transportation of liquefied natural gas overseas.
Gas is a natural resource and can be considered as a gift from the past for meeting the present-day needs of mankind. However, when making an overall gas evaluation, both advantages and shortcomings must be taken into consideration. On the one hand, natural gas provides an enormous source of energy, but on the other, its transport from the source to the consumer is quite a risky one.
The advantages of gas include its extraordinary purity, low ecological consumption risk and increased potential for industrial consumption. For these reasons the energy industry experts have declared it the fuel of the 21st century and the fight for predominance over this valuable natural resource is yet to begin.

The transport of liquefied gas requires a great deal of expertise, as well as technical and technological solutions aimed at reducing the risk involved in handling this dangerous cargo.
LNG carriers, currently the only ships capable of transporting natural gas, are efficient in carrying huge amounts of gas in deep-sea trade, but the costs of pumping units and auxiliary facilities make them too expensive for the exploitation of smaller gas reserves. Therefore a number of smaller gas fields remain isolated, unexploited and inappropriate for exploitation by means of LNG ships. This could be changed by introducing a less expensive alternative, i.e. the CNG concept.
Experts claim that the market potential for this type of ship is considerable due to the fact that more than half of the world's gas reserves are isolated or connected to oil fields. Actually, 30% of the discovered gas is considered isolated and is defined as a gas reserve.

2. CNG (Compressed Natural Gas) TECHNOLOGY

In addition to the *conventional* steel technology, there are some novel concepts for marine CNG transportation systems which seek to reduce the cargo storage system weight by reducing the storage pressure in conjunction with refrigeration and/or by using lighter, e.g. composite, materials.
Composites have the advantage over steel of better corrosion resistance and low temperature characteristics. There are CNG concepts based on the use of composite glass or carbon fibre pressure vessels, and also steel pressure vessels reinforced with fibre glass which, from the standpoint of weight, have significant advantages over pure steel vessels. These factors strongly affect the weight of the storage system. As the ship design must balance both weight and volume, any improvements in volumetric efficiency are of particular interest, according to [5].
This is principally important when comparing the concept with LNG carriers, where the liquefaction process reduces the gas volume by a factor of 600. The CNG concepts reduce the natural gas volume by a factor ranging from 250 to 400. Depending on the concept, there are differences in the volume of the storage system required to accommodate a given volume of sales gas. The required containment system is not simply a matter of geometry, but also the pressure and temperature at which the cargo is stored.
For each of the main storage methods, the required onboard storage volume was calculated, together with the weight and volume of the storage system. A ship design capable of meeting these requirements was then developed using parametric estimating methods. The conventional monohull bulk carrier type was used as the basis of the ship design.

3. COMPETING CNG SYSTEMS

There are at least six principal systems currently proposed for the storage of the CNG aboard ship. General characteristics of these systems are presented in table 1., according to [5]. When discussing the CNG concepts, the terms "lean" and "rich" natural gas will be encountered. Lean or dry gas is natural gas that contains few or no liquefiable liquid hydrocarbons.
Rich gas is natural gas containing heavier hydrocarbons than lean gas. Its liquid content has an important economic value. The volume of cargo containment required for CNG is not as straightforward to calculate as is the volume

of cargo containment required for normal liquid or solid cargoes. For example, by chilling the gas (as in the Enersea system) it is possible to compress increased quantities of gas into the same volume for a given pressure. Table 2., according to [5], shows the tank storage volume (in m^3) required for three different standard volumes of natural gas (in MMSCF – million standard cubic feet) at these temperatures. A 20% increase in storage pressure (from 200 to 250 bar) reduces the required volume by about 6%. A reduction in temperature from 17.8°C to 16.7°C reduces the required storage volume by a similar amount, about 5%.

The CNG systems which operate in the 200-250 bar range do not generally tend to refrigerate the cargo.

They achieve compression factors in the range of 270 to 350. The partially refrigerated concept (Enersea) operates at lower pressures (concept 90 bar for rich gas and concept 130 bar for lean gas), and achieves compression factors up to 370.

Table 1. – CNG storage methods

Method	**Partially refrigerated**		**Non-refrigerated**			
	Steel cylinders	Fully composite cylinders	Steel cylinders		Partially composite cylinders	Reeled steel pipe
	VOTRANS™	**Composite material**	**PNG™**	**CE Tech**	**Part composite GTM**	**Coselle**
Proposer	Enersea	TransOcean Gas, Canada	Knutsen	Høegh, Teekay & Statoil	TransCanada Pipelines	Williams (Cran & Stenning)
Storage temperature (°C)	-29	From amb. temperature to -80	Ambient temperature	Ambient temperature	Ambient temperature	Ambient temperature
Pressure (bar)	90 to 130	250	250	250	207	250 to 275
Pressure (psig)	1300 to 1900	3600	3600	3600	3000	3600 to 4000
Storage unit	Insulated vertical pipes	Vertical composite cylinders	Vertical steel cylinders	Horizontal steel cylinders	Steel cylinders reinforced by composite	Cassettes of coiled small diameter pipe
Characteristic dimensions	1 m to 1.2 m diameter and 12.16 m or 18.29 m high	1 m to 1.1 m diameter, 12.2 m high	diameter 1.067 m	diameter 1.2 m	1.066 m, up to 24.4 m long	0.17 OD, 10 miles long

Wall thickness	19 mm	Thickness will depend on the type of fibre used for reinforcement; E-glass and carbon fibre are the current alternatives	33.5 mm	33.5 mm	Overall wall thickness 38 mm	6.35 mm

Table 2. – Effect of varying temperature and pressure on required storage volume

Pressure (Psig)/bar		3000/207				3600/250			
Temperature (°C)		+20	-17	-28	-40	+20	-17	-28	-40
Compression factor		295	355	375	410	322	381	401	431
Tank volume (m^3)	300 MMSCF	28,810	23,930	22,620	20,710	26,390	22,280	21,140	19,670
	600 MMSCF	57,620	47,870	45,240	41,410	52,790	44,570	42,280	39,340
	900 MMSCF	86,430	71,800	67,870	62,120	79,180	66,850	63,420	59,010

3.1. Knutsen PNG (Pressurised Natural Gas) carriers

The pressurised natural gas (PNG) system, developed by Knutsen, is based on the use of vertical steel cylinders, storing gas at ambient temperature but at high operating pressures around 250 bar(g).

The gas is stored in 1.0668 m diameter pipes with hemispherical end caps, with a length ranging from 19 to 38 m. Tests have been conducted on units fabricated from X-80 grade steel and with a wall thickness of 33.5 mm, according to [5].

Together with DNV, OAS company has been studying a PNG ship capable of loading and discharging cargo ashore, along with a CNG carrier (terminal-to-terminal carrier) handling cargo at sea. Capable of transporting from 70 to 1060 MMSCF, this version of a PNG ship would be 290 m in length, around 54 m wide, with speeds ranging from 15.5 to 18 knots, carrying 2600 cylinders for transporting the cargo, see figure 1., according to [8].

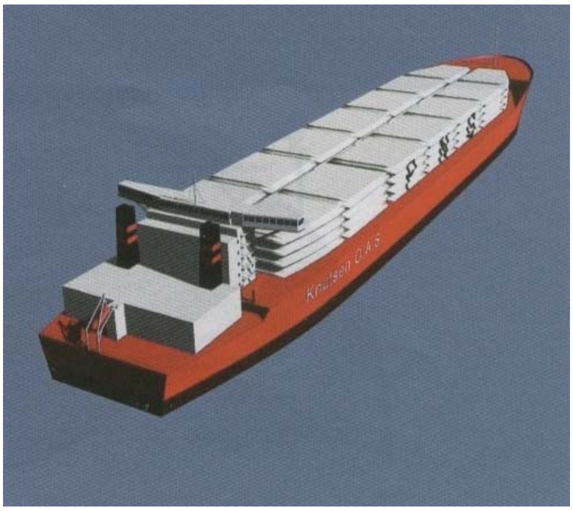

Figure 1. Schematic image of a Knutsen PNG ship

3.2. VoTrans technology

In the meantime, the consortium of Kawasaki, EnerSea, and Hyundai companies that is developing the concept named VoTrans (Volume Optimised Transport and Storage) has announced that ABS granted them permission to design a new class of ship.

In this concept the natural gas is compressed and cooled to lower temperatures. The gas is stored in vertical carbon steel pipes that are insulated and kept refrigerated at - 29°C.

Compared to other CNG methods, the lower storage pressure from 90 to 130 implies that 19 mm thick walls can be used for steel pipes, API 5L X80, which are 1.0668 m in diameter.
This results in a significantly lower weight of the storage system compared to other steel or steel composite systems. Enersea is also considering the use of higher strength steel (e.g. X100) of a 1.2 m diameter pipe, according to [5].
In the first development stages of this concept horizontal pipes were used.
This method was soon abandoned for a vertical arrangement of the cargo modules. Individual pipes are arranged in modules of up to 36 pipes that are fitted together with top and bottom manifolds. The modules are arranged in tiers for loading and unloading purposes. A tier may consist of as many as 164 bottles.
The upper part of the pipes projects above the main deck. Therefore, a superstructure is fitted above the main deck to provide a nitrogen filled cold box in which the pipe modules are located, see figure 2., according to [8].
Unloading of the gas is achieved using a fluid displacement technique. The displacement fluid is a mixture of ethylene glycol and water. The glycol requires a storage space on board a ship. The amount of displacement fluid to be carried on board depends on the internal volume of a tier (usually about 1.5 times the maximum tier volume). This ship would be 191 to 290 m long, 34 to 47 m wide, with speeds ranging from 14 to 18 knots, having a capacity of 220 to 520 MMSCF.

Figure 2. An example of a CNG carrier

3.3. Coselle concept

This technology has been developed by Cran & Stenning Technology of Calgary. The rights were purchased by Williams Energy from Oklahoma, but the technology is now back as an independent venture under the name Sea-NG Management Corporation.
The Coselle concept also uses steel pipes for safety, whereas the high pressure gas storage system is a long reeled pipe of a smaller diameter, which makes part of the steel pipe. The pipes are reeled around a 5 m diameter core to an outside diameter of 16 m and a height of 3.3 m. Each Coselle weighs approximately 448 tonnes containing approximately 17.7 km of pipe. The pipe itself weighs around 408 tonnes, and the Coselle container the remaining 40 tonnes, according to [5].
A CNG ship would store several such Coselles in its holds beneath the main deck. For safety reasons, the holds would be inerted with nitrogen to eliminate the danger posed by gas leaks. All valves and fittings would be installed above the main deck to facilitate maintenance.
A design was developed in 1996 with a storage pressure of 200 bar, but in 2003 a new design with an assumed storage temperature of 10°C and a pressure of 250 bar was developed, and reported to be capable of storing approximately 82 tonnes of gas in each Coselle.
The 1996 ship design had a nominal capacity of 330 MMSCF while the 2003 design has a nominal capacity of 600 MMSCF. The 1996 design was based on a 60,000 dwt bulk carrier hull carrying 108 Coselles in 18 stacks six high, whereas the 2003 design carries 144 Coselles in 18 stacks eight high.

3.4. Transocean Gas – fully composite systems

The Transocean Gas system is based on lightweight fibre reinforced plastic (FRP) pressure vessels. Carbon fibre is not used (it may be a possibility in the future), but nevertheless the e-glass filament fibre composite is claimed to allow a weight 1/3rd that of comparable high strength steel pressure vessels (carbon fibre would be 1/6th the weight). Stainless steel bossings would be used at the end of each tank, according to [5].
Up to 24 pressure vessels would be stowed vertically in cassettes based on the dimensions

of 40 ft containers. The cassettes would isolate the CNG containment and manifolds from ship deflections and vibrations. The cassettes could be stacked several tiers high as with cargo containers. The isolation and control valves would be located on the main deck for safety reasons and easy access, see figure 3.

Figure 3. An example of a CNG carrier – Transocean Gas concept (Source: www.transcanada.com)

Storage temperatures that are considered range from ambient down to - 40°C or even - 80°C in an attempt to get compression ratios much closer to LNG. It is not clear whether the natural gas in this form (pressurised LNG) will be in liquid or gaseous state.
This concept should result in a significantly lighter ship. Such a ship should permit a relatively small hull with conventional proportions.
When fully loaded, a standard cassette weighs around 200 tonnes. The cassette modules isolate the gas from forces that drive the ship forward and the design also performs regular cargo and safety system inspections. Moreover, once the cassette system is installed, it will considerably facilitate the protection of CNG carriers from accidents.

3.5. Compressed energy technology (CETEH)

In 2004, Statoil, Teekay Shipping and Leif Høegh established Compressed Energy Technology AS (CETEH) for the commercialisation of new systems for CNG transport, according to [5].

This concept's characteristics are as follows:

- tank volume – 30,000 to 100,000 m^3;
- gas cargo from 6,000 to 20,000 t (7 to 25 million standard m^3) or 247 to 882 MMSCF;
- pressure 200 to 250 bar.

One of the designs is reported to contain 510 horizontal steel cylinders of 1.2 m in diameter at 250 bar, giving a cargo capacity of 25,000 tonnes, which is equivalent to 1.2 billion cubic feet of natural gas. These horizontal cylinders and their support arrangements will present significant challenges in the design and construction of the appropriate ships.

3.6. TransCanada pipelines GTM – partially composite materials

The Gas Transport Module (GTM) is based on conventional high strength low alloy (HSLA) steel pressure vessels, but with a reduced wall thickness. The steel cylinder is reinforced externally by woven GRP. It is claimed that this offers 40% weight savings over other concepts.
This technology has been used since 1970s to reduce weight in small pressure vessels such as breathing apparatus for firemen and high altitude climbers. Sections of conventional pipeline using this technology are in operation in Alberta, Canada.
The standard pressure vessel has a diameter of 1.066 m and a length of 24.38 m. Such a unit would store 0.172 MMSCF of gas at 207 bar. Higher pressure designs of 250 bar and larger lengths and diameters (up to 1.524 m) are possible, according to [5].
For marine use, the individual cylinders are manifolded together to achieve a larger cargo capacity. Most publications show the tubes being stowed horizontally in the ship, and not projecting above the main deck level.
In addition to the weight saving, it is claimed that the GTM cylinders could also be built more easily to a larger diameter than a steel vessel, thus reducing the amount of manifolding required.

4. CONCLUSIONS

The growth of the industry closely related to natural gas transportation has resulted from the worldwide crisis arising from a decrease in production of crude oil despite an ever increasing demand. Even nuclear power plants are gradually being converted or replaced by power plants using natural gas as fuel.
These economic reasons provide the framework for today's rapid and creative development of ships designed for carrying liquefied gas. In order to meet market demands, the new costs of effective solutions in transporting natural gas from the production site to the user have to be adjusted. It is assumed that the CNG concept would be more cost-effective than the LNG transport or the pipelines as the only present alternative.

In addition to the possibility of exploiting smaller and/or isolated gas reserves, CNG carriers also feature a number of other advantages.
When observing the overall transport chain, from the gas exploitation to the delivery to the users, CNG developers point out that there is a great potential for reducing infrastructural costs. They also claim that CNG carriers can serve both for storage and transport of the cargo, and are capable of directly disposing waste into the ground, either via shore-based or marine-based waste terminals or platforms.
Despite the shipping industry's considerable interest and the preliminary approval of the CNG class, CNG vessels are still huge and demanding projects. Given the fact that no such ship has been actually built so far, the first construction will in fact have to justify the cost-effectiveness of building such ships.
The first builder of a CNG ship will have to be granted certain subsidies and incentives in order to justify the development of an entire fleet. Designing all major marine systems in CNG carriers will require the authorisation of all competent services and institutions.
The application of the existing standards and regulations, such as The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) allows for usage of very small cargo transport capacities on board expensive vessels. The solution is to use more economic and cost-effective CNG ships whose cutting-edge design ensures an entirely identical level of safety with lower nominal safety factors.

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BIOGRAPHIE

Srđan Dvornik
He was born in Split in 1966. He completed undergraduate studies at Faculty of Maritime Studies in Split in 1990 and was awarded the BSc degree – graduated engineer in Maritime transport, marine engineer. From 1990 to 2005 he sailed as an engineer officer on domestic and foreign merchant ships. He passed the exam for Chief engineer officer on a ship powered by the main propulsion machinery of 3,000 kW or more in 1995 in Split. Since 2005 he has been an assistant and 2011 lecturer at the Department of marine engineering of Faculty of Maritime Studies in Split in the area of Technical sciences, the field of Traffic and transport technology.

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Higher education of seafarers in Split began with the establishment of the Maritime College in 1959.

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The Faculty employs teachers with high research and teaching titles as well as highest ranks in merchant shipping. Lectures take place on the Faculty premises and in the nautical and mechanical engineering simulators, GMDSS simulator as well as in the electrical engineering laboratory, The practical part of the teaching process takes place on board training and research vessel “Naše more“, training vessel “Kraljica mora” as well as Jadrolinija vessels. Professional practice is carried out in “Brodosplit” shipyard workshops, while navigational practice is carried out by going sailing with students.
Education meets the requirements of STCW convention and The Regulation on Requirements for the Award of Ranks and Certification of Seafarers on Board Merchant Ships of the Republic of Croatia.

The Faculty of Maritime Studies is a partner institution of the postgraduate doctoral study “Maritime Affairs” organised by and carried out at the Faculty of Maritime Studies in Rijeka.
The Faculty cooperates with many other faculties of Croatia and Europe as well as many shipping companies and companies involved in sea-related activities. The Faculty of Maritime Studies in Split has founded a professional and scientific journal “Transactions on Maritime Science” - ToMS and International Maritime Science Conference - IMSC.

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Organized hydrographic activities in the Adriatic date back to 1860, when Hydrographic Office was established in Trieste. In the years to come, it changed locations a number of times: Pula (1866), Tivat (1922), Dubrovnik (1923), Split (1929), Hvar (1943), Vis (1944), Monopoli (1944), Split (1944). From 1937 the Office continued its activity under the name of the Hydrographic Institute of the Navy.
After the recognition of Croatia as an independent state, Croatian Parliament established the National Hydrographic Institute on 10 April 1992, later renamed the State Hydrographic Institute.
Under the Hydrographic Activity Act (Official Gazette No. 68/98), the Institute was reorganized as a public institution named the Hydrographic Institute of the Republic of Croatia (HHI), carrying out the hydrographic activity of interest to the Republic of Croatia.

The mission of the Institute is to carry out scientific-research, development and professional works related to the safety of navigation, hydrographic-geodetic survey of the Adriatic, marine geodesy, design and production of charts and nautical publications, oceanographic research, submarine geology research and finally publishing and printing activities.
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