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office@toms.com.hr

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ToMS

Transactions on Maritime Science (ToMS) is a scientific journal with international peer review which publishes scientific papers in the following areas:

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~ Safety Systems
~ Marine Ecology,
~ Hydrography,
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~ Transportation and Modes of Transport,
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ToMS aims to present best maritime research from South East Europe, particularly the Mediterranean area. Articles will be double-blind reviewed by three reviewers. With the intention of providing an international perspective at least one of the reviewers will be from abroad. ToMS also promotes scientific collaboration with students and has a section titled Students' ToMS. These papers also undergo strict peer reviews. Furthermore, the Journal publishes short reviews on significant papers, books and workshops in the fields of maritime science.

The views and opinions expressed in the papers are those of individual authors, and not necessarily those of the ToMS editors. Therefore, each author will take responsibility for his or her contribution as presented in the paper.

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Contents

From Editor-in-Chief

Ivica Kuzmanić

Dear Readers,

You have before you the fifth issue of the internationally reviewed scientific journal "Transactions on Maritime Science", published by the Maritime Faculty of the University of Split. The Journal is published in an electronic, open access and printed form. Our desire is for our readers to have an easy access at minimum expense.

In this issue we publish papers from the scientific areas of nautical science, meteorology, marine engineering, maritime traffic surveillance, maritime law, along with a paper investigating the relationship between maritime skills in various generations of seafarers. In four out of the total of seven papers the authors and co-authors are scientists from abroad.

We have remained faithful to our decision of publishing in each issue a paper aiming at improving our readers' knowledge of the English language. There is no need to emphasize how important it is to anyone in the seafaring business.

We have also remained faithful to another area we wish to promote: the Croatian cultural heritage. Again a poem, this time written in the dialect spoken by the inhabitants of the southern coast of the island of Brač. And once again, this is the only contribution presented in bilingual form: the vernacular of the author Ivica Jakšić and accompanied by the inspired English translation by Mirna Čudić. This versatile artist was born in Bol on the island of Brač. And, as a special treat, in the electronic version of course, we have a unique opportunity to hear the author recite his own poem.

Our esteemed and most valuable London collaborator Tatjana Krilić brings us first-hand news from the International Maritime Organization (IMO). We bring you all the news from the last six months: since the previous issue of our Journal.

This issue also brings a paper of our renowned publicist Marijan Žuvić. Once again, it is a story concerning our maritime heritage – the 'Veli Jože', the floating crane that has secured its place in history.

Apart from the above, we bring you short overviews of the Indian Maritime Development , A New Maritime Crane Concept, First Triple-E (vessel), New Ship Water Treatment System, etc.

We still hope that the papers we publish will urge you to cooperate.

Manoeuvring Simulation Methods Applied to Determine the Shape and Operational Condition of New Ports – Mielno Port Case Study

Lucjan Gucma, Maciej Gucma, Rafał Gralak

This paper presents a complex method of establishment of optimum design of sea ports with regard to navigational safety. Real-time simulation method was implemented in the presented study. The limited task real-time simulation model was created together with characteristic ship models and environment. The paper presents several stages of the research, such as the designing of the model, planning of simulation experiments and statistical analysis of results, The results are used as design guidelines for the small Polish sea port of Mielno which is currently under development.

KEY WORDS
~ Ship manoeuvring simulation
~ Safety of navigation
~ Port design
~ Breakwater optimization

Maritime University of Szczecin, Szczecin, Poland
e-mail: l.gucma@am.szczecin.pl

1. INTRODUCTION

The Marine Traffic Engineering (MTE) research team from the Maritime University of Szczecin (MUS) has been doing research in port design and optimization of water areas (Gucma, 2012; Gucma, 2009) since the 1970-ties. The study described in this paper focuses on the planning and design of the new Port of Mielno. It is one of several research studies conducted by the MTE team dealing with complex sea port planning and design (Computer simulation for new port design in Mielno, 2012). The main goals of the research studies were (PIANC, 2014):

1. The establishment of the optimum parameters of:
   - the new sea port in the Mielno area with respect to shape, width and depth,
   - the outer and inner port breakwaters with respect to their shape, taking into consideration wave height in the port;
   - the turning points with respect to their shape and optimum depth;
   - the berthing places in the inner port with respect to their shape, length, depth, maximum energy of ship contact, maximum speed of ship propeller and bow thruster streams on the bottom.
2. The establishment of the safe port operation requirements with respect to:
   - admissible meteorological conditions for given kinds of ships and manoeuvres;
   - other navigational conditions and limitations, like the presence of other ships at berths, the use of position fixing systems on approach, navigational markings, vessel traffic service.

3. The establishment of manoeuvring procedures during berthing and unberthing for different kinds of ships and propulsion systems.
4. The establishment of under-keel clearance in keeping with the Monte Carlo method.
5. The establishment of ship's distance from the most dangerous objects.
6. Carrying out the most typical emergency runs (typical failures on entrance) and describing the necessary emergency action for captains.

Mielno Port is a small beach fishing port on the west coast of Poland, situated between the Baltic Sea and the sea lake of Jamno (Figure 1).

Figure 1.
Planned location of Mielno Port.

The typical Baltic sea small passenger ship, having the length of L = 60 m (Figure 2), was chosen as a characteristic ship (m/f Design) in the design stage of the new Mielno Port in the presented study, after the investors' economic analysis and based on their needs. The most important parameters of the design ship are presented in Table 1.

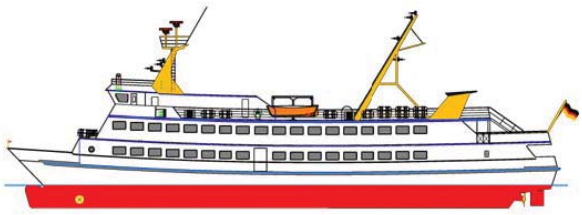


Figure 2.
General arrangement of m/f Design (based on plans of m/f Adler Dania).

Table 1.
Main parameters of design passenger ship (L= 60 m) operated in the Baltic Sea area.

Parameter	m/f Design
Length - LOA	60 m
Breadth	12 m
Draft	2.5 m
Machinery	total 2x1.200 kW at 900 rpm
Propeller	1 variable pitch propeller
Propeller	diameter=1.83 m at rpm 360
Speed	approx. 18 kn. (at 90 %)
Rudder	1x35 deg. / area=2.7 m^2 / conventional
Bow thruster	150 kW
Lateral wind area	approx. 500 m^2

2. THE ASSUMPTIONS BEHIND MIELNO PORT DESIGN

The most important goal of Mielno Port design is to provide access to passenger ships up to 60 m in length and enable future port development to accommodate cargo and fishing vessels (Computer simulation for new port design in Mielno, 2012). The most important design restrictions are as follows (Figure 3):
1. to design a sea port with two breakwaters, inner and outer (entrance) port, well-sheltered from typical weather conditions,
2. to design at least one turning point inside the new port,
3. to create at least 4 berthing places for design ships,
4. to test and validate at least TWO alternative port designs made by two independent design teams (S and B team).

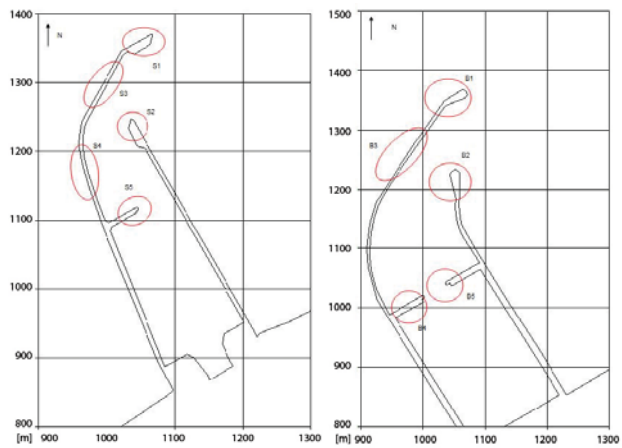


Figure 3.
Two design alternatives for Mielno Port (S Design – upper and B Design – lower) with critical points.

doi: 10.7225/toms.v03.n01.001

3. METHODS APPLIED

The real-time simulation interactive method with captains and pilots engaged in ship manoeuvring trials was applied. This method is thought to be most reliable and suitable for this kind of research studies (Gucma, 2005). MTE research team possess several kinds of manoeuvring simulators: from limited task simulator with 2D display to modern full-mission simulator with 3D display and real control systems.

3.1 Real-time simulation method – limited task simulator

Two classes of hydrodynamic models used by the MTE team had limited task simulators. While first class models were used when only limited parameters were known (usually when non-existing ships or a general class of ships were modelled), second class models were used when detailed and exact characteristics of hulls, propellers and steering devices were known. Additionally, real manoeuvring characteristics were used for the validation of models. The model of m/f Design used in the research was based on modular methodology in which all influences, like hull hydrodynamic forces, propeller drag and steering equipment forces, as well as given external influences, are modelled as separate forces, subsequently summed up as perpendicular, parallel and rotational forces.

The model is operating in a loop in which input variables are calculated instantly (settings and disturbances) as forces and moments acting on the hull, while momentary accelerations and speeds of movement surge, sway and yaw are evaluated. The most important forces acting on the model are:

- thrust of propellers;
- side force of propellers;
- sway and resistant force of propellers;
- bow and stern thruster forces;
- current;
- wind;
- ice effects (neglected);
- moment and force of bank effect (neglected);
- shallow water forces;

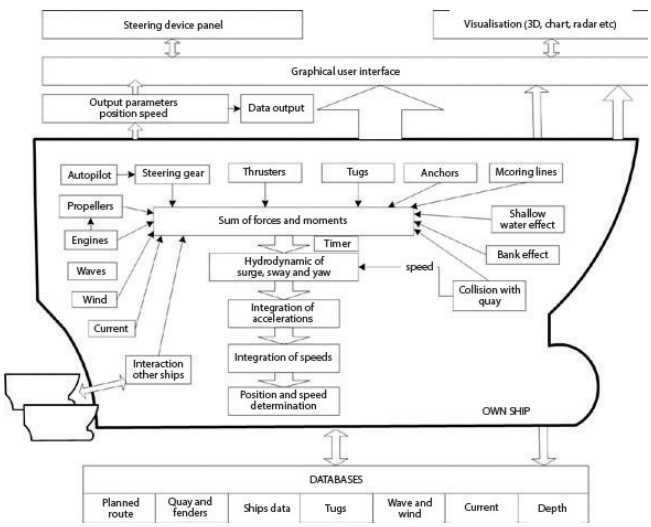


Figure 4.
The main functional diagram of the simulation model.

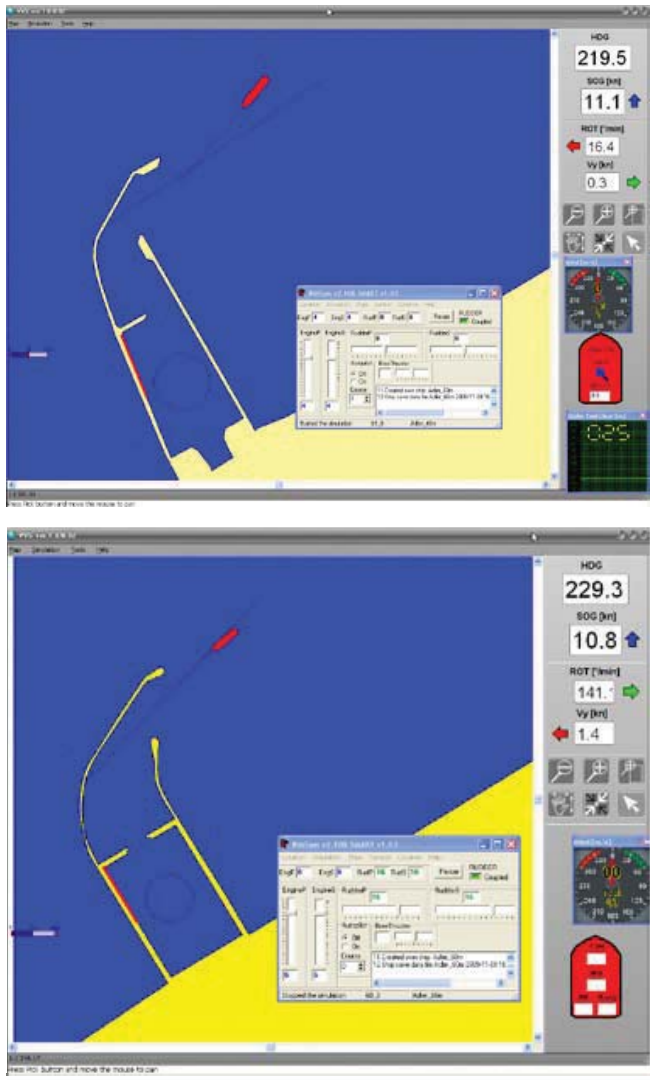


Figure 5.
Interface depicting simulation model Design turning at outer turning points S (left) and B (right) in Mielno port (limited task simulator).

- mooring and anchor forces (neglected);
- reaction of the fenders and friction between fender and ship hull;
- tug forces (neglected);
- other, depending on the special characteristics of a ship's power and steering equipment.

The functional idea of the ship manoeuvring simulation model is presented in (Figure 4).

Interface of the model is typical 2D nautical chart – like interface in (Figure 5). The interface covers information on the ship's state (position, course-speed, yaw etc), quay and shoreline location, navigational markings, soundings, external conditions, tug and line control and control elements of the model. The model is implemented in Object Pascal with the use of the Delphi™ environment and Visual C™ with the use of the C++ language.

Limited to the usual 3DOFs (the horizontal planar motion), the ship's movement over the ground (thus the so-called dynamic effect of the water current is introduced) is given by (Artyszuk, 2005):

$$\begin{cases} (m+m_{11})\dfrac{dv_x^g}{dt} = (m+c_m m_{22})\,v_y^g\omega_z + (m_{11}-c_m m_{22})\,v_y^c\omega_z + F_x \\ (m+m_{22})\dfrac{dv_y^g}{dt} = -(m+m_{11})\,v_x^g\omega_z + (m_{11}-m_{22})\,v_x^c\omega_z + F_y \\ (J_z+m_{66})\dfrac{d\omega_z}{dt} = -(m_{22}-m_{11})\,(v_x^g-v_x^c)\,(v_y^g-v_y^c) + M_z \end{cases} \quad (1)$$

$$\frac{dx_0}{dt} = v_{NS}^g \quad , \quad \frac{dy_0}{dt} = v_{EW}^g \quad , \quad \frac{d\Psi_0}{dt} = \omega_z$$

$$\begin{bmatrix} V_{NS}^g \\ V_{EW}^g \end{bmatrix} = \begin{bmatrix} \cos\Psi & -\sin\Psi \\ \sin\Psi & \cos\Psi \end{bmatrix} \cdot \begin{bmatrix} V_x^g \\ V_y^g \end{bmatrix} \quad (2)$$

where:

V_x^g, V_y^g, ω_z – represent ship surge, sway and yaw velocity over ground, x_0, y_0, Ψ – the position of Cartesian coordinates and heading, m – ship mass, m_{11}, m_{22}, m_{66} – added masses, c_m – empirical factor, F_x, F_y, M_z – external excitations (resultant/total surge, sway force and yaw moment), generally consisting of the following items (denoted by additional subscripts) and generally representing the functions of ship speed through water ('V_w'):

$$\begin{cases} F_x = F_x(v_x^w, v_y^w, \omega_z) \\ F_y = F_y(v_x^w, v_y^w, \omega_z) \\ M_z = M_z(v_x^w, v_y^w, \omega_z) \end{cases} \quad (3)$$

$$v_x^w = v_x^g - v_x^c,\; v_y^w = v_y^g - v_y^c \quad (4)$$

$$\begin{bmatrix} V_x^c \\ V_y^c \end{bmatrix} = \begin{bmatrix} \cos\Psi & \sin\Psi \\ -\sin\Psi & \cos\Psi \end{bmatrix} \cdot \begin{bmatrix} |\vec{V}^c| & \cos\Upsilon_c \\ |\vec{V}^c| & \sin\Upsilon_c \end{bmatrix} \quad (5)$$

where:

$|\vec{V}^c|$ and Υ_c represent the velocity and geographical direction of the water current (a uniform current by default).

The model is described in details by Artyszuk in (Gucma, 2013).

3.2 Verification of the model

The verification of a mathematical model, i.e. the quantitative assessment of its adequacy, is always carried out after the model is built and based on the conformity indicators of a ship's manoeuvring characteristics. The verification compares ship's manoeuvres by using comparative parameters:

- acceleration - distance and time for various operating modes of the main engine;
- stopping - distance, time, deviation from the original course for various ME working modes;
- turning ability (turning circle tests) - diameter, linear

velocity and rate of the turn during turning;

- course stability (zigzag tests) - rudder response speed, maximum angle of deviation, yaw time, non-dimensional yaw period;
- turning ability with thrusters or engines, time to alter course by a specific value.

The validation of the model was carried out by using acceleration, breaking and circulation trials bearing in mind the influence of shallow water (Figure 6).

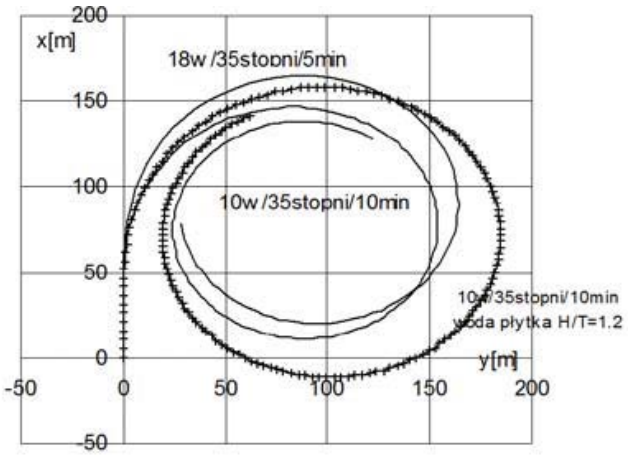


Figure 6.
Validation of the model (turning circles at different speeds compared with influence of shallow water) (Computer simulation for new port design in Mielno, 2012).

4. STATISTICAL METHODS OF SIMULATION DATA PROCESSING

Simulators are very widely used today. Hydrodynamic models are becoming more and more reliable. However, it should be made clear that conclusions cannot be drawn from the experiments conducted without efficient statistical data processing (Gucma, 2013). Usually a different kind of data processing analysis is applied when horizontal and vertical ship movement is considered.

4.1 Safe manoeuvring areas –simulation result data processing method

The safety horizontal area needed by navigators to perform manoeuvres is the most important factor [Gucma 2005, Irribaren 1999]. The assumption behind models of this type is that a ship is moving along predefined route x (Figure 7.a) with the following probability of accident:

$$P_{AW} = P_{SA/A} P(Y \geq y_{MAX}) = P_{SA/A} \int_{y_{MAX}}^{+\infty} f(y)\, dy \quad (6)$$

where: $P_{SA/A}$ – the conditional probability of serious accident, $f(y)$ – the distribution of ship's position, y_{MAX} – distance from the centre of the waterway (route) to waterway edge.

The probability of serious accident $P_{SA/A}$ could be defined with the Heinrich ratio or a more detailed consequence analysis. One of the most important stages of accident probability evaluation is the statistical analysis of results. The probabilistic concept of a safe manoeuvring area is presented in Figure 7.a. The distribution is strongly dependant on waterway area arrangement, could be evaluated in simulations and validated in real-space experiments.

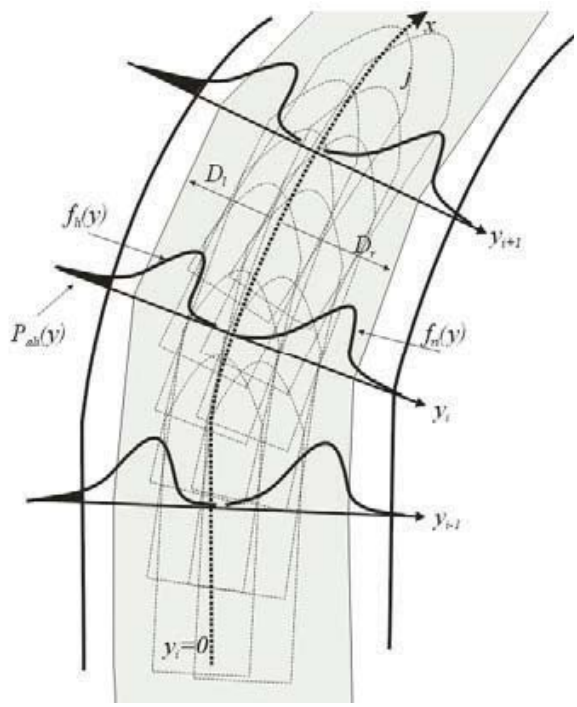
5. RESEARCH PLAN

The following conditions of manoeuvring have been considered:

- zero conditions (for validation and comparison of manoeuvring areas);
- wind 11 m/s (lower limit of 6°B);
- wind 17 m

Two directions of wind have been considered:

a)



b)

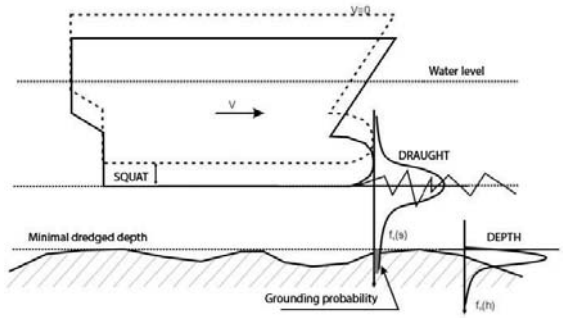


Figure 7.
The probabilistic concept of establishment of a safe manoeuvring area on the waterway (a) and the calculation of under-keel clearance (b).

- NW as the most difficult for entering the port.
- NNE as a problematic wind for stern directions, capable of causing entry problems due to the ship's stern moment of inertia.

The height of a significant wave depends on the wind and typical wind-wave conditions on the Baltic, presented in Table 2.

5.1 Simulation series

10 simulation series have been conducted, each for 13 to 14 ship passages (entrances only). A detailed plan of simulation passages is presented in Table 2. and the technique of manoeuvres is presented in (Figure 8).

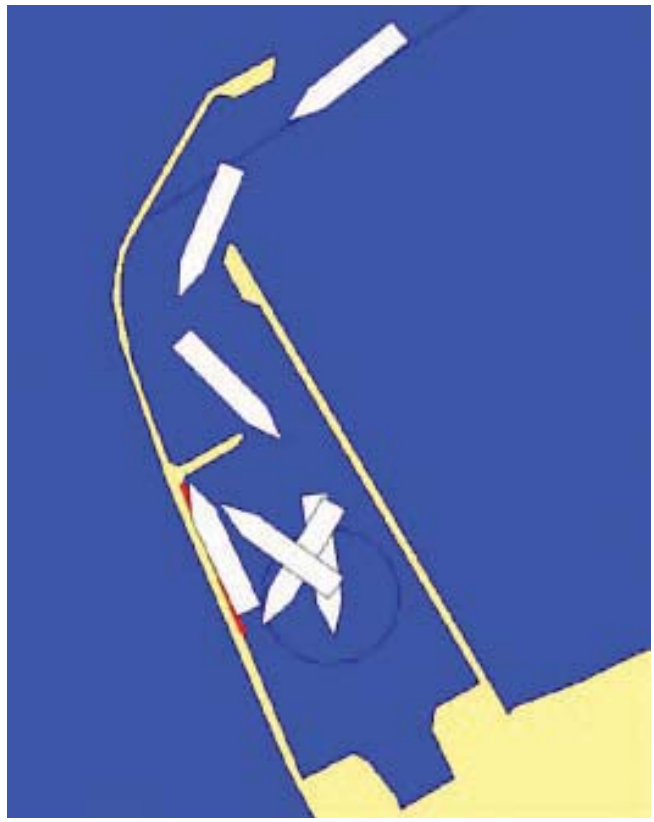


Figure 8.
Ship manoeuvre technique for the S and B design alternatives (entrance, immediate turning and mooring).

Table 2.
Detailed plan of simulations.

No.	Port design alternative	Manoeuvre	Wind	Wave	No. of simulation passages
1	S	Entrance and port turn	0	0	14
2			NW 11 m/s (6B)	0.9 m	14
3			NW 17 m/s (8B)	1.8 m	14
4			NNE 11 m/s	0.9 m	13
5			NNE 17 m/s	1.8 m	13
6	B		0	0	14
7			NW 11 m/s (6B)	0.9 m	14
8			NW 17 m/s (8B)	1.8 m	13
9			NNE 11 m/s	0.9 m	13
10			NNE 17 m/s	1.8 m	13

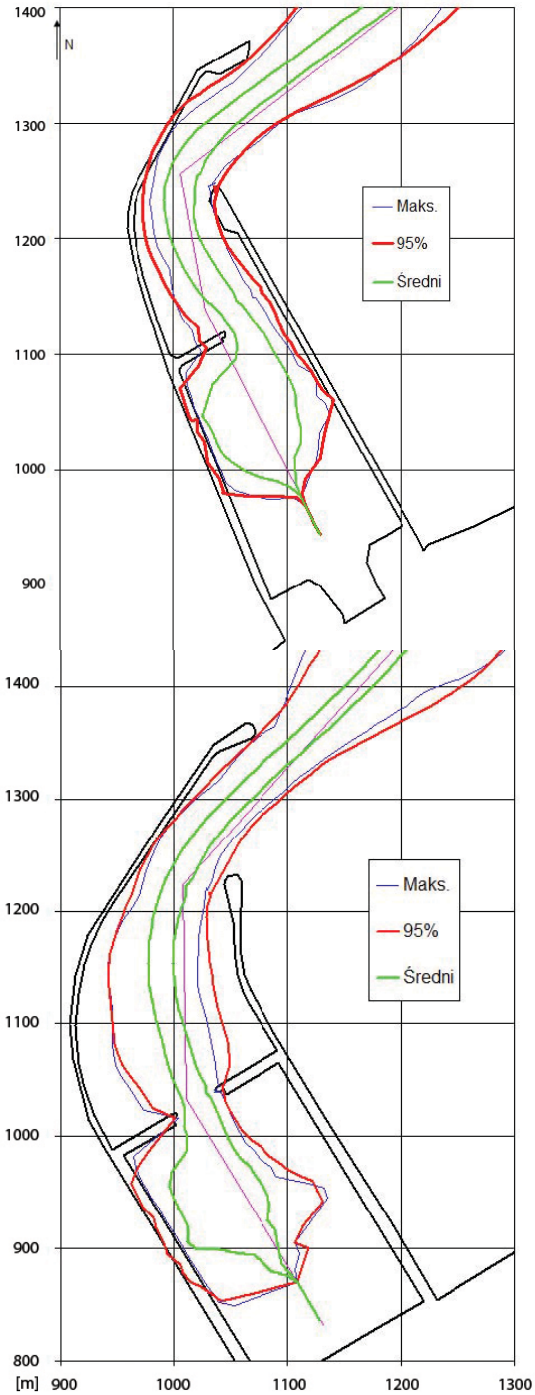


Figure 9.
Manoeuvring areas of Design ferry during entry with NNE 17 m/s wind – comparing simulation series 5 and 10. The 95% confidence level presented in red (mean and maximum areas are blue and green) for S (upper) and B (lower) alternatives.

6. RESULTS OF THE RESEARCH

All simulation trials were conducted by skilled captains and pilots having experience with this kind of ships and manoeuvres. The simulation data were recorded and analyzed. Simulation results were analyzed on the basis of the following criteria:

- ship manoeuvring lane widths (horizontal safe manoeuvring area dimension),
- under-keel clearance (the Monte Carlo method);
- energy generated at the point of contact with berth structures,
- velocities of the propeller bottom stream,
- engine and rudder settings,
- probabilities of collision with given points,
- manoeuvre duration,
- emergency manoeuvres.

Only the results for the first criterion have been presented in this paper. The safe manoeuvring areas calculated with a 95% certainty are widely used in analysis. The results of one series, with the eastern wind of 20 m/s, are presented in Figure 9. Additionally, the maximum area, as the area of all ferry passages in a given simulation series, is presented.

The wave simulation analysis was made for alternative B only. The results for significant wave height of 2m from direction NNE are shown in (Figure 10).

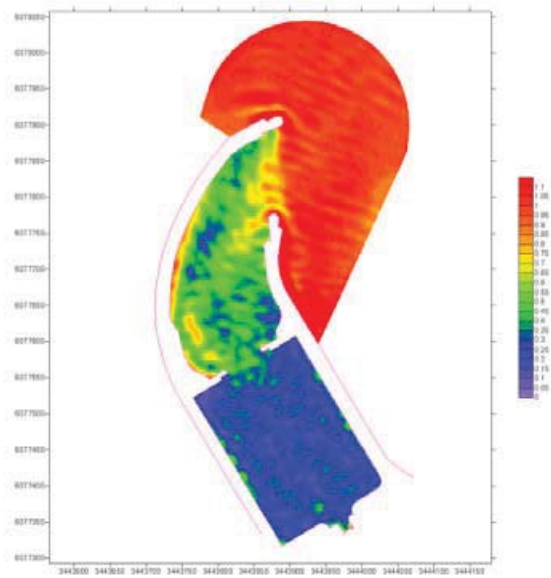


Figure 10.
Numerical wave analysis for alternative B (wave system in the port, significant wave height outside the breakwaters NNE 2 m and period of 7 s) (Study 2012, 2012).

7. CONCLUSIONS

The presented complex study could be used for the development of guidelines for port design, operational limitations and risk assessment of new port and breakwater designs.

The efficient use of statistical data analysis for data processing and proper planning of simulation experiments, combined with good collaboration with designers and wave simulation specialists, are crucial for successful port design.

The conclusions pertaining to specific conditions required for the safe manoeuvring of passenger ship m/f Design in Mielno Port are as follows:

- Since alternative S is not acceptable in comparison with alternative B, only alternative B is under consideration for further development (Table 3 shows differences between alternatives and necessary changes in given critical parts of the breakwaters – see Figure 3),
- Some minor modifications of alternative B (up to 5m changes in the shape of the breakwater) are required (Table 3).
- Alternative B could be used as the final stage of Mielno Port design in the sense of navigational safety, when taking wave height inside the port into account.
- Acceptable wind conditions for safe entry of a L = 60 m long ferry are NNE 17 m/s wind with wave height of 1.8 m outside the port.

Table 3.
Comparison of the required modifications of breakwaters in S and B alternative designs.

Simulation series	**Alternative**	**Additional width at critical points (see Figure 3) [m]**				
		S1	S2	S3	S4	S5
1	S	0	5	0	0	10
2		0	10	10	5	25
3		0	5	0	10	40
4		0	5	10	0	35
5		5	0	0	0	40
mean		1	5	4	3	30
max.		5	10	10	10	40
S alternative – additional width of min. 5 m required at the turning point						
Simulation series	**Alternative**	**Additional width at critical points (see Figure 3) [m]**				
		B1	B2	B3	B4	B5
6	B	0	0	0	2	0
7		0	5	0	2	0
8		0	2	0	0	0
9		0	0	0	5	5
10		0	0	5	5	5
mean		0	1.4	1	2.8	2
max.		0	5	5	5	5

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Seafarer Cross-Generational Competence Skills

Olena Tyron

It was mentioned that the ability to establish a positive relationship between the members of international crews is an urgent issue. This ability influences not only the safety of navigation, but the mental health of seafarers as well. Foreign language competence is essential for the resolution of this problem. Successful everyday communication of seafarers depends on a number of factors: the awareness of cross-cultural, religious and cross-generational differences will help establish a friendly communication onboard a ship with an international crew. This paper presents a study on cross-generational communication of future seafarers. Our study empirically proved that the ability of mutual communication between different age groups facilitates the establishment of friendly relationships onboard a ship. A psychological insight into the peculiarities of different generations helped us see the process of communication of seafarers in a new light. We outlined the main values of different generations, allowing the students to learn the preferred topics of everyday communication. In our opinion, the results of this study may be used by lecturers of maritime educational establishments in the scope of the course Psychology and English language.

KEY WORDS

~ Cross-generational communication
~ Cross-cultural values
~ Age perception
~ Everyday communication

Kyiv State Maritime Academy, Kyiv, Ukraine

E-mail: ollena22@hotmail.com

1. INTRODUCTION

The issue of foreign language competence of seafarers is widely studied nowadays. In our earlier research we defined the factors required for the development of foreign language competence in future seafarers (Tyron, 2013). One of the determinants of successful daily communication onboard a ship with an international crew is the skill of communication with sailors of different age groups.

Let us analyze the term competence. Competence is generally defined as skills, qualifications and knowledge giving a person the ability to work as a part of a professional team or, when it comes to maritime activities, a crew. According to a study conducted by the Seafarer's International Research Centre (SIRC) in the late 1990's, the lack of crew competence is a growing problem. Proficiency in English is one clear example. The Seafarer's International Research Centre defines crew competence as "a uniform standard of the provision of high quality training and educational opportunities at least as important as professional training". It emphasizes the importance of the so called "silent knowledge comprising unwritten roles and attitudes of the seafaring culture. Further, competence is a mixture of technical and social skills and a place where terminology and vocabulary are taken for granted" (Lane 1999). In conclusion, one could say that competence is a sum of education and experience. According to Ding & Liang (2005), competence includes knowledge, skills and understanding in terms of communication, with emphasis on issues such as fluency in English. Competence also includes physical and psychological attitudes, including attitudes towards maritime safety and health standards (Berg et al., 2013).

The theoretical bases of research on cross-generational international communication in an international crew were:

- Ukrainian theory of generations (L.S Vygotsky);
- Western scholars (Giambattista Vico and Jean Condorcet);
- American theory of generations (Neil Howe and William Straus).

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- the theory of communicative accommodation and the model of stereotypes implemented in cross-generational communication (Williams and Giles, 1996; Giles et al., 2001; Williams & Garrett 2002).

2. DESCRIPTION OF THE RESEARCH

1. Program and basic methods of empirical research.

The goal of the research was to analyze the influence of cross-generational communication skills on the establishment of friendly relationships onboard a ship, especially in international crews. In order to fulfil the tasks, achieve the goals and confirm our hypothesis, a number of methods were used:

- theoretical – the analysis of psychopedagogic, psycholinguistic literature, reports and other information resources of offshore international organizations in order to determine the theoretical and methodological principles of research, open its conceptual-categorical apparatus, clarify the status of the problem and generalize and systematize major theoretical positions to determine the psychological and pedagogical factors relevant for the development of foreign language communicative competence of future seafarers;
- empirical methods - questionnaires, interviews, teacher observations, testing and expert evaluation to determine the level of development of foreign language communicative competence of future sailors, psycho-pedagogical experiment to test the hypothesis of the research, mathematical statistics to determine the statistical significance of obtained results.

2. Conditions and purpose of research.

Experimental research work was carried out at the Kyiv State Maritime Academy with full-time and part-time students of the 2nd, 3rd and 4 year of the Faculty of Navigation, specializing in "ship navigation and control" and "operation of ship power plants". The practical implementation of the tasks was carried out in two stages: forming and stating experiments. The objective of the first stage was to test the hypothesis that cross-generational skills are relevant for the establishment of successful communication onboard a ship with an international crew. 60 students of the Navigation and Engineering Department were interviewed. The first test was "The test of defining the need in communication by Ryakhovskyi", which is widely used by Ukrainian psychologists.

The results were:

- 60% of the respondents scored 14-18 points. That means normal sociability. They are curious, willing to listen to their interlocutor, patient in communication, defend their point of view. They accept contact with strangers but do not like noisy groups of people.
- 30% of the respondents scored 9-13 points. They are very sociable, fond of expressing their own ideas on different topics. They are keen on meeting new people, quick tempered, show lack of patience.
- 10 % are overcommunicative. They take up any cause, although they do not always bring it to completion.

So, none of the students surveyed had any problems with communication in their native language, but when it came to communication in English onboard a ship, they mentioned difficulties, mostly psychological in character (Tyron, 2013). We paid special attention to the students' answers to the following test question: "Do you think that people of different generations have difficulties understanding each other?" In spite of the results of the test which proved high communicative abilities of the students in general, 85 % of respondents answered "yes" and 15 % - answered "no". This goes to show that the development of ability to communicate with people of different age groups must be made one of the goals of training of future seafarers. For further research of this subject matter we designed a test for the students of the academy who took part in the experiment. Inter alia, it contains the following questions:

- "What was the age composition of the crew you had your shipboard training with?"
- "Did you have any problems in communication with older people?"
- "Can you initiate a conversation with an older worker?"
- "Do you prefer talking to younger workers?"

In this test we used the term "older workers" for persons aged 41- 50 and "younger workers" for persons aged 31-40.

Although this kind of testing is still in progress, we worked under the assumption that most students: 1. work in different age groups; 2. have difficulty finding common topics with older workers; 3. prefer talking to younger workers. In our opinion, when preparing students for communication onboard a ship we have to consider the age structure of its crew. It would be beneficial to introduce elements raising cross-generational awareness prior to the students' first shipboard training. It would certainly have a positive impact on the psychological climate among seafarers, especially in international crews.

3. STATISTICAL ANALYSIS

3.1 Statistical analysis of the composition of international crews

Let us turn to statistics published in a scientific research conducted by international research centre of seafarer authors Ellis H and H. Sampson (Seafarers International Research Centre (SIRC) (Ellis and Sampson, 2008).

Table 1.
Age of seafarers.

Age	Percentage	Cumulative percentage
20 or younger	1.2 %	1.2 %
21-30	26.1 %	27.4 %
31-40	30.5 %	57.9 %
41-50	27.6 %	85.5 %
51-60	13.1 %	98.6 %
61 and older	1.4 %	100.0 %
Total	100.0 %	

As we can see, three age groups predominate on vessels. Since students have a long shipboard practice after their third year of study, they fall under the group of 21-30 year olds, accounting for 26.1 % of the crew and ranking third in the statistics. Therefore, we can draw the following conclusions:

- third and fourth year maritime academy students will work in their own age group during their shipboard training - the third ranking group.
- students must possess the skill of successful communication with 31-40 year olds - the most numerous group.
- students must be able to establish communication with seafarers aged 41-50 - the second ranking group.

Table 2.
Top 10 Nationalities of Junior Officers.

Rank Order	Nationality	Percent
1	Philippines	24.2%
2	Russian	9.4 %
3	India	7.8 %
4	Ukraine	7.8 %
5	China	6.8 %
6	Greece	3.5 %
7	Poland	3.2 %
8	Korea, South	3.1 %
9	Indonesia	2.9 %
10	Romania	2.4 %
Other		(n = 87) 29.0%
Total		100.0 %

Separately, we considered the category of students who have shipboard training after their second year of study. They usually belong to the first, least numerous age group of 20 or younger. This is due to the unavailability of work for them on non-training ships. International crewing companies have high requirements for cadet training and knowledge of English language, and besides, students are not yet ready to go to long voyages. But nevertheless, a small percentage of students from this age group is present onboard ships. As you see, the task of development of cross-generational communication skills is urgent.

Being trained as cadets, the students will contact Junior Officers. Having reviewed the data from Table 2, we came to the conclusion that the students' potential interlocutors are Filipinos, Russians, Indians and Chinese, not excluding other nationalities.

Some students will train for first and second rank sailors. Let us turn to the ethnic composition of the ratings. As you see from Table 3, in this case, their potential interlocutors are Russians, Indians, Filipinos and Chinese, not excluding other nationalities.

Table 3.
Top 10 Nationalities of Ratings.

Rank Order	Nationality	Percent
1	Philippines	36.7 %
2	China	6.3 %
3	Ukraine	5.9 %
4	Russian	5.5 %
5	India	5.2 %
6	Turkey	4.4 %
7	Indonesia	4.1 %
8	Poland	2.7 %
9	Myanmar I	2.6 %
10	Bulgaria	2.1 %
Other	(n = 106)	24.5 %
Total		100.0 %

Communication between the ranks is organized according to seniority rules. But in addition to performing functional duties onboard a ship and on shore, entertainment events are also known to be held at sea, at which cadets will have an opportunity to socialize with senior officers in an informal setting.

Thus, as seen from Table 4, Filipinos represent about 11% of the senior officers, Russians 10 %, Ukrainians 7.4 %, with Greeks and Indians having almost the same rating. Therefore, students will have the opportunity to demonstrate their communication skills to persons of other ranks, with their main potential

Table 4.
Top 10 Nationalities of Officers.

Rank Order	Nationality	Percent
1	Philippines	11.2 %
2	Russian	9.8 %
3	Ukraine	7.4 %
4	Greece	6.2 %
5	India	5.9 %
6	China	4.7 %
7	Poland	4.2 %
8	Korea, South	4.2 %
9	Germany	4.1 %
10	Turkey	3.8 %
Other	(n = 87)	38.5 %
Total		100.0 %

interlocutors being from Russia, the Philippines and India. So in international crews we have cross-generational cross-national communication amongst persons of different ranks. We are convinced that if such a phenomenon does exist, it should be taught to students of maritime institutions.

3.2 Analysis of cross-generational properties for purposes of prediction of topics of seafarers' conversation onboard a ship with an international crew

The Hove – Strauss theory argues that the problem with cross-generational communication are not attitudes towards age but the values of people which are influenced by social, political, economic and technological development and upbringing. According to this theory, we have the following generations:

The Baby Boomer Generation (" spring" 1943-1964 - "the prophets "). Only 13.1 % work onboard ships with international crews. They are optimists, workaholics, capable of teamwork.

Values: loyalty, observance of rules, laws, and respect for position and status, honour, patience.

Preferred topics of conversation:

- sports: football, hockey, basketball,
- recreation, tourism or cottage;
- health, fitness, maintaining an active lifestyle

Young sailors will be appreciated because of their active interest in everything new.

Independent generation or generation X, born 1965-1982. It is believed that the more challenges a young person faces, the better for him. They are always ready for a change. They are individualists, rely on their experience.

Values: readiness for change, choice, global awareness, technological literacy, individualism, lifelong learning, informal views, in search of emotions, pragmatism, hope, ideas of equality.

Preferred topics of conversation:

- favourite sport – boxing and
- holidays.

They are quite pragmatic. The notion of patriotism is not as strong. For them motherland means their family, relatives and children.

I would like to note that in different papers the above age group time spans vary by 3-5 years. There are differences depending on the community. For example, in large cities 40 year old people are referred to as Generation X, and in the provinces – as the " Boomers". In these instances, the scholars agree that people born at the junction of generations (plus or minus three years from the date of the border) partially share the values of both groups and form the so-called "echo generation" (Новиков, 2008). Apparently, their task is to serve as a link between the generations and act as intermediaries.

Generation Y, generation Millennium, born in 1983. This is the generation of students most frequently having shipboard training. This generation appeared against a backdrop of the rapid development of new information, communication, digital and bio technology. Generation Y is naive and tends to work in teams. They are well-versed in computer networks. For them, the separation of the real and the virtual worlds is relative, they stay "alive" in virtual reality. Parents spoiled them with their strong affection, they lack independence, are well controlled, but simultaneously confident in their value. They find it important to be rewarded for their work, because they do not believe in long-term plans. Duty and morality have a much more important place in their value system than in the value system of their predecessors.

Values: the value system of the group includes concepts such as civic duty and moral responsibility, but psychologists point out their innocence and ability to obey. Generation Y places great importance on immediate reward.

Preferred topics of conversation:

- fashion trends;
- satisfaction with life;
- sport - bike, skate or inline skates.

Generation Y grew up in the age of the virtual world of computers and digital technology - their technological literacy is completely different from that of the previous generations. They are focused on quick results and are not willing to wait long for compensation. They are easily adaptable. The preceding generation, X, also values individuality, but for them, the demonstration of their strength and capabilities is a matter of principle. Generation X loves to learn. And Gen Y loves to get an

education. Gen X still reads a lot to get ahead professionally and is grateful when employers allow them to share their knowledge. One of the main challenges of Generation X is fatigue. It is this generation that had to learn to adjust to external circumstances to be successful in the new environment. Many of them received second education, changed their scope of work. Many believe that Gen X is plagued by lack of motivation. After all, Generation X had to raise and nurture Gen Y, conveying it its experience and knowledge. Unlike the X's, the Millenniums (Y) are much more ambitious, including in terms of remuneration. "Members of this generation will insist on higher wages regardless of their knowledge and skills. Moreover, they believe that they are underpaid. They are guided by the logic of "required fees" and "unjust reward"." No matter how much I take – I have to, because it is important that I do" (Новиков, 2008). But we have much to be grateful for to this generation.

We have identified three age groups that are of interest for the further development of our research. However, the above division is inadequate. According to our statistical analysis, Generation X, born 1965-1982, should be divided into the following ages groups: 31-40, representing 30.5 % and 41-50, representing 26.7 %. The characteristics of these age groups onboard a ship will differ due to:

- the small number of crew members (10-20 people):
- living in closed space and
- different life experience.

3.3 Nationality-dependent perception of age

We should check whether different nationalities perceive age differently.

As previously mentioned, the majority of interlocutors onboard an international ship are sailors from Eastern countries. The analysis of research into age perception of Eastern and Western countries is essential. Research on the influence of cultural values and beliefs on attitudes towards aging has been dominated by comparisons of Eastern/Asian and Western cultures (see Giles et al. 2003 for a review) (Lockenhoff et al., 2009; Романов, 2009).This body of work was inspired by the idea that Asian societies are influenced by Confucian values of filial piety and the practice of ancestor worship which are thought to promote positive attitudes towards aging and high esteem for the elders (e.g., Davis, 1983; Sher, 1984; Ho, 1994; see Sung 2001 for a review). Western societies, in contrast, were thought to be youth-oriented and have a more negative attitude towards aging and the elderly (e.g., Palmore, 1975). Empirical evidence for the proposed East-West differences is scarce. Although some studies have found support for the hypothesis that attitudes towards aging are more positive in Asian than in Western cultures (e.g., Levy and Langer, 1994; Tan, Zhang, and Fan, 2004), others report effects in the opposite direction (e.g., Giles et al., 2000; Zhou, 2007; Harwood et al., 2001; Sharps, Price-Sharps and Hanson, 1998), or fail to find any marked cultural differences (e.g., Boduroglu, Yoon, Luo, and Park, 2006; Ryan, Jin, Anas, and Luh,2004; Chappel, 2003; McCann, Cargile, Giles, and Bui, 2004) (Lockenhoff et al., 2009).

After studying different research, while we arrived at the conclusion that differences in the perception of age between nationalities that may be present onboard a ship are not profound, we still recognize that since Eastern countries have a tradition of living in extended families, their inhabitants are more skilful in communication with older workers. Since in Western countries young people often start living separately, they are more used to communicating with persons from their own age group. To integrate the findings of the present study with the previous literature, we also examined gross-level "Eastern" versus "Western" contrasts. To group the cultures in our sample according to broad Asian/Eastern versus Western categories, we drew on the United Nations geographical regions (United Nations Statistics Division, 2008). According to these guidelines, we classified the following countries as Eastern/Asian: Hong Kong, India, Iran, Japan, Mainland China, Malaysia, and South Korea. The Western group was comprised of European cultures (Croatia, Czech Republic, Estonia, France, Great Britain, Poland, Portugal, the Russian Federation, Serbia, Slovakia, and Switzerland) and the U.S. (Lockenhoff et al., 2009).

4. CONCLUSION

Bearing in mind the issue of age differences before coming to work onboard a ship with an international crew, future seafarers should acquire a good level of adequate cross-generational and cross-age communication skills. It means:

- they should be aware of the topics of interest of different age groups;
- they should be aware of cultural differences between Eastern and Western countries pertaining to age stereotypes;
- they should be able to accommodate to different cultural attitudes to cross-generational communication;
- they should be aware of their own stereotypes pertaining to cross-generational communication.

We strongly recommend the introduction of ideas of cross-generational awareness into the curriculums of maritime institutions as a part of a cultural awareness course.

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Optimization of Ship Propulsion Diesel Engine to Fulfill the New Requirements for Exhaust Emissions

Branko Lalić[a], Ivan Komar[a], Danilo Nikolić[b]

KEY WORDS
~ Two-stroke low-speed marine diesel engines
~ Fuel injection
~ Combustion
~ Pollutant formation and composition
~ Reduction methods

Impacts of exhaust gas emissions on the environment and air pollution from ships have received considerable attention in the past few decades. Due to the characteristics of the combustion process, typical for large marine two-stroke low-speed engines, and the use of residual fossil fuels, the world's fleet emits into the atmosphere significant amount of pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbons (HC), sulphur oxides (SO_x) and carbon particles (PM). Impact assessment of the process of their formation, emitted amounts and the influence of emission are important factors for decision making in regulation development and also for engine designers who aim to improve low-speed two-stroke marine engines, for further tightening of regulations regarding limiting emissions. This paper consists of three parts: the first section describes the injection and combustion process in low-speed two-stroke marine engines, the second part describes the formation of the exhaust gas emissions as a product of the combustion process and the third part, in which the known techniques to reduce harmful emissions that are currently used in low-speed two-stroke marine engines are described.[1]

a. University of Split, Faculty of Maritime Studies, Split, Croatia
e-mail: blalic@pfst.hr
e-mail: ivan.komar@pfst.hr

b. Faculty of Maritime Studies, Kotor, Montenegro
e-mail: fzpdekan@ac.me

1. The results presented in the paper have been obtained in the scientific research project No. 250-2502209-2364 and the international research Project "The possibilities of reducing pollutant emissions from ships in the Montenegrin and Croatian Adriatic implementing Annex VI of MARPOL Convention" supported by the Ministry of Science, Education and Sport of the Republic of Croatia.

1. INTRODUCTION

Impact of exhaust gas emissions on the environment and air pollution from ships has received considerable attention in the past few decades. Due to the characteristics of the combustion process, typical for large marine two-stroke low-speed engines, and the use of residual fossil fuels, the world's fleet emits into the atmosphere a significant amount of pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), hydrocarbons (HC), sulphur dioxide (SO_2) and carbon particles (PM). Knowing the process of their formation, emitted amounts and the influence of emission are important factors in improving the low-speed two-stroke marine engine and also for tightening of legislation limiting exhaust emissions.

2. ENVIRONMENTAL LEGISLATION

Constant increase in maritime traffic has caused the need to introduce legislation to limit emissions. Air pollution is mainly regulated by international and regional treaties which monitor the discharge of harmful substances into the atmosphere. Air pollution emissions from ships are particularly considered by the International Convention for the Prevention of Pollution from Ships, MARPOL 73/78 Convention. On 26 September 1997, at a meeting in London, Marine Environment Protection Committee (MEPC) adopted regulations in the form of a supplement to the MARPOL 1973/78 in the way that Annex VI of the Convention, which was then adopted, regulates discharge gases harmful to human health, such as nitrogen oxides (NO_x), sulphur oxides (SO_x), and various halogen gases CFCs that destroy the ozone layer from ships into the atmosphere. Annex VI entered into force on 19 May, 2005 when it was ratified by 25 member states of the IMO. On 10 October, 2008 Resolution MEPC.176 was adopted (58) "Amendments to Annex Protocol of 1997 amending the International Convention for the Prevention of Pollution from Ships", which entered into force on 1 July, 2010. The main changes are related to Regulation 13 on the progressive reduction of emissions of NO_x and SO_x in Regulation 14. An amendment to Annex VI, in terms of emissions of NO_x, is the introduction of two additional Tiers to existing restrictions which have been in force since 19 May 2005, as it is shown in Figure 1. Requirements for the control of emissions of NO_x are applied for each marine diesel engine with power greater than 130 kW installed on a ship and every marine diesel engine with power exceeding 130 kW -where significant modification was made on 1 January, 2000 or later, except to the satisfaction of the Maritime Administration to prove such an engine was an identical replacement for the engine to be replaced. These requirements do not apply to marine diesel engines intended for use only in emergency, or solely for the operation of any device or equipment intended for use only in emergency, or marine diesel engines installed in lifeboats intended for use only in emergency and the marine diesel engines installed on ships operating exclusively in waters under the sovereignty or jurisdiction of the State whose flag the ship flies.

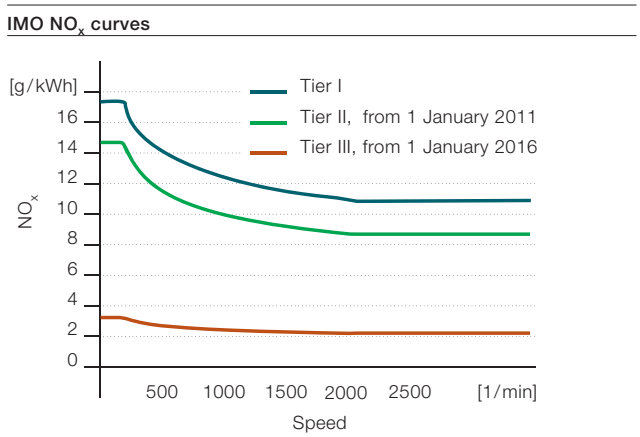

Figure 1.
MARPOL Annex VI, NOx emission limits (ABB Turbo Systems Ltd., 2010).

As the last activity of the IMO, in the field of environmental emission control from ships, we introduce the decision of the MEPC of the inclusion of the new Chapter 4 of MARPOL Annex VI, referring to the "Rules for identification and control of energy efficiency" of ships EEDI, which came into force on 1 January 2013 and applies to all ships over 400 GT engaged in international navigation. The inclusion of Chapter 4 of Annex VI into MARPOL 73/78 aims to improve the energy efficiency of ships by design and operational measures that would result in a reduction of CO_2 emissions generated from fuel combustion process.

3. COMBUSTION

3.1 Combustion Stoichiometry

The aim of the combustion stoichiometry is to determine the required amount of air and fuel in order to achieve complete combustion. A stoichiometric mixture contains the exact amount of fuel and oxidizer, so that after combustion is completed, all the fuel and oxidizer are consumed to form products. This ideal mixture approximately yields the maximum flame temperature, as all the energy released from combustion is used to heat the products (McAllister et al., 2011). Combustion stoichiometry for a general hydrocarbon fuel, ($C_\alpha H_\beta O_\gamma$) can be expressed by equation (1) and it is applied only for single-component HC.

$$C_\alpha H_\beta O_y + \left(a + \frac{\beta}{4} - \frac{y}{2}\right) \cdot (O_2 + 3.76N_2) \longrightarrow$$

theoretical amount of air

$$aCO_2 + \frac{\beta}{2} H_2O + 3.76 \cdot \left(a + \frac{\beta}{4} - \frac{y}{2}\right) \quad (1)$$

There are two typical approaches for multiple-component hydrocarbon fuels. The first method develops the stoichiometry of combustion using the general principle of atomic balance, making sure that the total number of C, H, N and O atoms is the same in the products and the reactants.

$$0.95CH_4 + 0.05H_2 + 1.925\,(O_2 + 3.76N_2) \longrightarrow$$
$$0.95CO_2 + 1.95H_2O + 7.238N_2 \quad (2)$$

The other method of balancing a fuel mixture is to first develop stoichiometry relations individually. Then, multiply the individual stoichiometry equations by the mole fractions of the fuel components and add them. For the study of the fossil fuel combustion it is necessary to know the fuel composition with the help of completed technical and elemental analysis of the fuel. Moisture, volatile combustible matter, solid combustible matter and ash are established by technical analysis. Elemental analysis of the fuel is provided by complex chemical methods such as carbon content in the fuel c [kg_c/kg_g], by weight of the carbon C [kg_c] per kilogram of fuel [kg_g], hydrogen *h*, sulphur *s*, nitrogen *n*, oxygen *o*, ash and the moisture content *w*. From the very definition of the components that make the fuel, the following relation must be obeyed. Components involved in the process of fuel combustion that provide heat are carbon, hydrogen and sulphur.

$$c + h + s + n + o + a + w = 1 \quad (3)$$

The sulphur content in the fuel is very important because of the damaging effects of its compounds on the metal surfaces of the engine. The sulphur content is covered by only sulphur part, that exceeds the soot in the complete combustion, and not the part that remains tied up in ash. Oxygen helps combustion and the amount which is already contained in the fuel, has to be subtracted from the amount taken from the air. Nitrogen, ash and moisture are ballast in the combustion process. Ash can also contain a wide range of other elements such as Br, Ca, Zn, P, V and other elements. Since ash generally does not participate in the combustion process, from the thermal point of view we are not interested in its composition. However, the composition of ash may be important from the exploitation point of view because it is not irrelevant whether it remains solid or melts at high temperature (Bošnjaković, 1970). Each fuel component of the elemental analysis is considered separately via its own stoichiometric combustion equation. The combustion of C leads to its compound with O_2 to form CO_2 and energy is released, so the stoichiometric reaction equation is as follows:

$$C + O_2 \longrightarrow CO_2 + 33900\ kJ/kg_c \longrightarrow$$
$$1kmol\,C + 1kmol\,O_2 \qquad 1kmol\,CO_2 \quad (4)$$

Moles of C, O_2 and CO_2 is calculated according to the equation (5)

$$n = \frac{m}{M} \quad \Rightarrow \quad m = n \cdot M \quad (5)$$

where *n* – is mole of the species (kmol); *m* – is mass of the species (kg); *M* – is molar mass (kg/kmol). Relative atomic weight of carbon Ar(C) is 12 and can be read from the periodic table and can be written as

$$\begin{aligned} M(C) &= Ar(C) = 12\ \ kg/kmol \\ M(O_2) &= 2 \cdot Ar(O) = 2 \cdot 16 = 32\ \ kg/kmol \\ M(CO_2) &= Ar(C) + 2 \cdot Ar(O) \\ &= 12 + 2 \cdot 16 = 44\ \ kg/kmol \end{aligned} \quad (6)$$

Substituting the obtained molar masses in the expression (5), we obtain the masses of participants, as follows:

$$m(C) = n \cdot Ar(C) = 1kmol \cdot \frac{12\ kg}{kmol} = 12\ kg$$

$$m(O_2) = n \cdot M(O_2) = 1kmol \cdot \frac{32\ kg}{kmol} = 32\ kg$$

$$m(CO_2) = n \cdot M(CO_2) = 1kmol \cdot \frac{44\ kg}{kmol} = 44\ kg$$

Substituting the obtained masses of the species in the expression (4) and rearranging the equation

$$c\ kg\ C + 2.67c\ kg\ O_2 \longrightarrow 3.67\ c\ kg\ CO_2 \tag{7}$$

Similar to the previous procedure, during the combustion of hydrogen and sulphur, the stoichiometric reaction equations are as follows:

$$h\ kg\ H_2 + 8\ h\ kg\ O_2 \longrightarrow 9\ h\ kg\ H_2O$$
$$s\ kg\ S + s\ kg\ O_2 \longrightarrow 2\ s\ kg\ SO_2 \tag{8}$$

The required amount of oxygen for combustion will be: for c kg carbon 2,67c kg, for h kg hydrogen 8h kg, for s kg sulphur s kg. Stoichiometric amount of oxygen required for the combustion of 1 kg of fuel is:

$$O_{min} = 2.67 \cdot c + 8 \cdot h + s - o \ \frac{kg_{o_2}}{kg_f} \tag{9}$$

or expressed in volume units

$$O_{min} = 1.867 \cdot c + 5.603 \cdot h + 0.700 \cdot s - 0.700 \cdot o \ \frac{m_n^3 O_2}{kg_f} \tag{10}$$

For the combustion process in diesel engine, oxygen from the air is used. The amount of O_2 in air is 23.3 % by mass or 21% by volume; the minimum required amount of O2 for theoretical combustion is:

$$A_o = \frac{2{,}67 \cdot c + 8 \cdot h + s + o}{0{,}232} \ \frac{kg_a}{kg_f} \tag{11}$$

$$A_o = \frac{1.867 \cdot c + 5.603 \cdot h + 0.700 \cdot s - 0.700\ o}{0.232} \ \frac{m_{na}^3}{kg_f} \tag{12}$$

3.2. Diesel engine combustion

In order for ignition and combustion to occur, fuel must first be mixed with an oxidizing agent. Ignition and combustion are chemical processes, and they are necessarily observed through chemical kinetics for better understanding. According to kinetic theory, gases consist of molecules which move chaotically at medium speed in a certain area under specific environmental condition. If the gas temperature increases, the kinetic energy of the molecules will increase. If the molecules of the fuel and oxidizer are mixed so that there are no differences in local concentrations, then the mixture is considered to be homogeneous. Their mutual reaction, with respect to ignition, will appear only when there is a collision between their individual molecules. Collision energy must be such as to destroy all the internal links in the molecule, which happens only when the activation energy E limit is exceeded. The number of effective collisions can be expressed by equation (13), and the value of effective collision is between 0 and 1 (0<A<1)

$$A = e^{-\frac{E}{R \cdot T}} \tag{13}$$

where *A* - number of effective collisions, *E* - activation energy, kJ/mol, *R* - gas constant, J/molK, *T* - reaction temperature, *K*. The equation shows that the proportion of effective collision depends on the temperature, but the number of effective collisions also depends on the concentration of the reactants. Ignition and combustion of fuel depend on the composition of the fuel mixture, i.e. about the participation of fuel in the mixture, so the mixture can be stoichiometric, rich or lean.

3.2.1 Combustion flow

Process of combustion of fuel is comprised of the following steps: entry of fuel jet into the combustion chamber; disintegration of the jet into droplets; decomposition of larger droplets into smaller; droplets heating; droplets evaporation; mixing of fuel vapour with the surrounding air; simultaneous auto ignition of fuel mixture in several places; continued evaporation of the droplets and burning around (diffusion combustion); formation of soot during combustion in an area near droplets; temperature drop and slowing reaction due to expansion in the cylinder. While the combustion temperature is still high, it is necessary that the particular matters find their reactants (oxygen) to complete combustion reaction. The phases until the simultaneous ignition of fuel mixture in several places represent a delayed auto-ignition. Delayed ignition can be defined as the time or crank angle that elapses from the beginning of

fuel ignition to the auto-ignition of the mixture. Analysing and improving the above phases, determinants of optimal processes with less pollutant in exhaust gas emissions and with better fuel efficiency are obtained.

3.2.2 Fuel jet formation

A good spatial distribution of fuel affects the proper, soft and economical operation of the engine. To achieve a good spatial distribution of fuel, it must be injected at a rate of about 250 ms^{-1}, which requires a pressure of over 80 MPa. Dispersion quality is determined by the injection speed, fuel surface tension, fuel viscosity, density of air in the cylinder, turbulence and cavitation in the nozzle. Opening angle, direction and size of the nozzle hole is determined by the depth of penetration, and the angle of propagation of the jet. Better turbulence, mixing with air and combustion can be achieved by better penetration and propagation of jet fuel. With two-stroke low-speed diesel engine injection is usually done by three injectors with the nozzles that direct the fuel tangentially into the cylinder space. Under the influence of aerodynamic forces of compressed air, fuel jet expands and disintegrates into small droplets. The quality of the fuel spray is defined by average diameter of most droplets and droplet sameness. Better fuel dispersion is achieved with the smaller nozzle holes' diameters and a larger number of holes, greater injection pressure and higher compression pressure inside the cylinder. Fuel speed discharge from the short duct nozzle is approximately calculated according to equation

$$v_f = \Phi_f \cdot \sqrt{\frac{2 \cdot (p_i - p_c)}{\Phi_f}}\ ms^{-1} \tag{14}$$

where: v_f - fuel speed discharge, ms^{-1}; p_i - injection pressure, *Pa;* p_c - compression pressure, P_a; φ_f - fuel density, kgm^{-3}; Φ_f - fuel discharge coefficient. The minimal injection pressure is presented by equation

$$p_i = p_c + \frac{v_f^2 \cdot \varphi_f}{2 \cdot \Phi_f^2}\ Pa \tag{15}$$

At the beginning of the fuel injection the speed is maximal, and therefore the resistance to the movement of fuel in compressed air is the biggest. In this period the jet speed reduction is the most pronounced. The shape of the fuel jet is affected by injection pressure, pressure and temperature in the area of injection, fuel jet swirl as it passes through the injector nozzle holes and injection construction. Acuteness of jet increases with increasing of injection pressure and holes diameter opening on the injector nozzle. Airflow inside the cylinder has a significant impact on fuel jet formation. In the case of intensive air flow inhomogeneity of the jet in terms of droplet size, provides a better opportunity to achieve a good mixture. The efficiency of air indicates the quality of mixture formation, i.e. how long it is homogeneous throughout the combustion chamber. Sauter (Volmajer and Kegl, 2003) defined droplet size according to the volume of the combustion chamber. The reference diameter of the droplets (d_{32}) is used to describe the fineness of the spray. It is the ratio between the sum of the volumes of the droplets and the sum of the surface of the droplets, and it is defined as

$$d_{32} = \frac{\sum_i N_i \cdot d_i^3}{\sum_i N_i \cdot d_i^2} \tag{16}$$

where: N - is the number of droplets, d^2 - droplet surface, mm^2, d^3 - droplet volume, mm^3, and is commonly used for defining of atomization of the fuel spray. For good combustion it is more important to evenly distribute the fuel in the air, even in the form of larger particles, than to achieve local mixtures which, due to poor penetration of droplets, are not sufficiently mixed with air. With the temperature increase of fuel, the spray is better, the width of the jet increases and the length decreases.

3.2.3 Fuel jet breakup

Fuel injection is usually displayed by ratio of fuel injected (dm) per unit angle (dφ) as a function of the crankshaft angle (φ). Once the fuel is injected into the combustion chamber, due to the high injection pressure the jet it disintegrates into droplets and creates turbulent eddies in the fuel jet and their collision with compressed air. Preferably, fuel jet breaks up into a large number of small droplets as it increases the surface area in relation to the mass of fuel injected. A fuel droplet at its partial pressure is subjected to a pressure that first deformed it until fully halved, and that process can be repeated for several times. The injected fuel, which has great turbulence, has a shorter range and better dispersion. Improvement of fuel mixture formation is greatly affected by the flow of air into the cylinder, and it is deliberately

increased by the angle of cylinder liner scavenging openings. If an excessively turbulent flow of air is created, it can lead to burning fuel droplets contact with the cold cylinder liner wall and its extinction. Fuel discharge from the nozzle hole leads to its disintegration, and he can be a primary or secondary breakup. In the primary dissolution fuel jet is divided into vertical volumes and droplets at the outlet of the nozzle, while the secondary breakup is described as the further disintegration of the droplet, under the action of the compressed air to the formation of a stable droplet diameter.

During the breakup of fuel jet from the cylindrical holes into the combustion space, several different areas of the breakup are known (Ofner, 2001):

- The Rayleigh breakup and induced air stream breakup are achieved at very low Reynolds numbers and low-pressure injection. The breakup takes place during the injector needle closing or immediately after the opening of the needle.
- First breakup by induced current generated is increased by output speed. Increasing the relative speed of the jet in the combustion chamber, the influence of aerodynamic effects grows, and higher air density enhances the effect.
- Secondary breakup by induced current occurs at Reynolds number greater than 2,300.
- The atomization is technically the most important mechanism of droplet breakup. The breakup occurs at high Reynolds number and high output speed from the nozzle, and the breakup begins immediately after droplet exits the nozzle hole.

An action of aerodynamic forces that cause secondary breakup is added to the primary breakup of the droplets. Figure 2 represents four types of secondary breakup (Ofner, 2001; Krugler, 2001).

- For small Weber numbers of about 12, vibrational breakup occurs due to droplet vibration until at some point it breaks up into two droplets of similar sizes.
- Bag breakup (12<We<50) oscillation of the fuel droplets enhances the flow of the environment, and the droplets' breakup is carried out by membranes' bursting.
- Bag/streamer breakup (50<We<100), decomposition of the core is similar to the breakdown of the bubble. The form of a droplet transforms into the form of a disc perpendicular to the direction of flow, and then the centre of the disk takes the form of a parachute. Thereafter, the centre of the parachute breaks up into small droplets and the parachute cone disintegrates into bigger droplets.
- Stripping breakup (100<We<350), a large number of small droplets are stripped away from the surface of the droplet periphery, due to aerodynamic forces on the drop surface.
- Catastrophic breakup (350<<We), after forming, disk-shaped droplets decay throughout the volume in a cascade form into very small pieces.

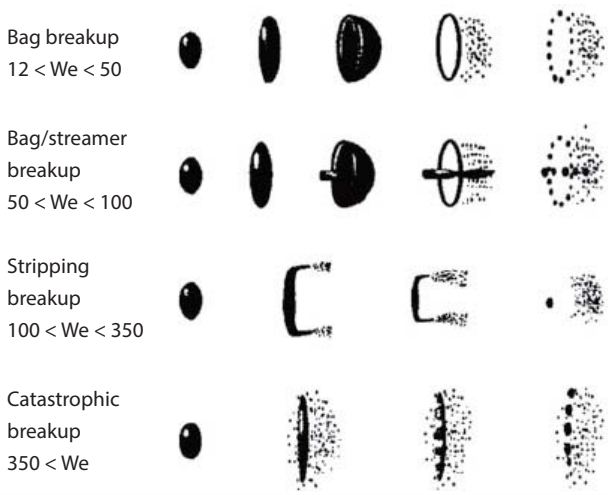

Figure 2.
Aerodynamic breakup mechanisms.

Once the fuel is broken up into droplets, heating, evaporation and combustion of droplets follow.

3.2.4 Combustion process

The combustion process in a diesel engine can be divided into four phases, which are shown in the diagram in Figure 3. The first phase, „Ignition delay, curve C-E", defines the period from the beginning of injection until the ignition starts, and has an impact on the pollutant formation (Golovichev and Nordin, 2001; Ishiyama, et al., 2001). This period defines fuel atomization, evaporation, mixing and the reaction start. At sufficiently low turbulence local flame fronts are created, which eventually increase to the overall flame. Turbulent flames of homogeneous mixture produce high temperature without soot (Urlaub, 1995). The second phase, „Uncontrolled combustion, curve E-F", is a homogeneous phase of combustion. It is determined from the beginning of combustion until a significant drop rate of combustion. At this stage, there are sudden ignition and combustion of the already prepared fuel mixture during the delayed ignition phase. Combustion begins simultaneously in several places and conducts intensively, and there is a sudden increase in the pressure and the temperature. The third phase, „Partially controlled combustion, curve F-G", is diffusion combustion in which fuel droplets vaporize from the surface. Evaporated fuel is mixed with air, and combustion speed is limited by the rate of fuel evaporation and the speed of creating fuel mixture.

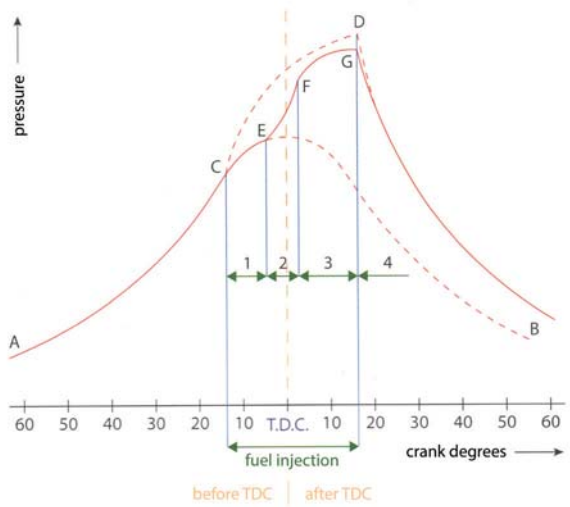

Figure 3.
Phases of the combustion process (Kuiken, 2012).

He fourth phase, „After burning, curve G-till end", is the final part of the combustion and it takes about half of the total duration of combustion. Reactions slow down due to expansion and smaller amounts of reactants. A part of soot that is created during combustion leaves the cylinder as part of emissions.

3.2.5 Adiabatic flame temperature

One of the most important features of a combustion process is the highest temperature of the combustion products that can be achieved. The temperature of the products will be the highest when there are no heat losses to the surrounding environment and all of the energy released from combustion is used to heat the products. An adiabatic constant-pressure analysis is used here to calculate the adiabatic flame temperature T_{ATP}. Three different methods can be used to obtain T_{ATP}:

- Using a mean specific heat capacity $\overline{c}_p$,
- An iterative enthalpy balance,
- Finding the equilibrium state using computer software.
- Using an average $\overline{c}_p$ value method the adiabatic flame temperature is calculated for a lean mixture Φ≤1, as follows:

$$T_{ATP} = T_R + \frac{\Phi \cdot f_s \cdot LHV}{(1 + \Phi \cdot f_s) \cdot \overline{c}_{p,P}} \tag{17}$$

where: T_R - represents the temperature of the reactants, i.e. fuel which after injection and ignition delay has the compression temperature (T_2)

$$T_2 = T_1 \cdot \varepsilon^{n-1} \tag{18}$$

where: T_2 represents temperature at the end of compression; T_1 - temperature at the beginning of compression; ε - the compression ratio; n - polytrophic exponent. Since the volumes of the engine at the beginning and at the end of compression are known and pressures are measurable, exponent polytrophic is (Bošnjaković, 1970)

$$n = \frac{logP_1 - logP_2}{logV_2 - logV_1} \tag{19}$$

Φ represents equivalence ratio for lean mixture; f_s - is the stoichiometric fuel air ratio; *LHV* - is lower heating value of fuel; $\overline{c}_{p,P}$ - is an average value of specific heat of the products.

An iterative enthalpy balances method, despite its being a more accurate approach, requires the complete combustion of the reactants into main products, and cannot be applied to diesel engines.

4. EXHAUST EMISSION

The main pollutants in exhaust emissions occur as a direct result of the combustion process in the engine cylinder. The quality of used fuel has an important role in determining the content of emissions, and the engine speed is shown as one of the main factors that determine the amount of NO_x in the exhaust emissions. The other major pollutants from combustion are CO, unburned HC, soot, SO_x, and oxides of metals.

4.1 Nitrogen oxides (NO_x)

NO_x consist of NO and NO_2. NO is represented by approximately 90% of the volume, NO_2 by about 5% of the volume, while nitrogen (I) oxide, nitrogen trioxide and nitrogen pentoxide occur in traces. NO_x are strongly dependent on the temperature of combustion, the local O_2 concentration and duration of the combustion process. Injection time, turbocharged air temperature, fuel quality as well as mixture quality have an impact on combustion and should be mentioned. Research suggests that NO_x are mainly formed during the diffusion combustion period, but occurs to a lesser extent during the homogeneous phase.

4.1.2 Thermal NO

Three major steps are responsible for thermal NO formation. The first two form the basis of the Zeldovich mechanism (McAllister et al., 2011; Zeldovich, 1946; Lavoie et al., 1970).

$$N_2 + O_2 \xrightarrow{k_1} NO + N \qquad k_1 = 1.8 \cdot 10^{14} \cdot e^{\left(\frac{-38370}{T}\right)} \tag{20}$$

$$N + O_2 \xrightarrow{k_2} NO + O \qquad k_2 = 1.8 \cdot 10^{10} \cdot T \cdot e^{\left(\frac{-4680}{T}\right)} \tag{21}$$

$$N + OH \xrightarrow{k_3} NO + H \qquad k_3 = 7.1 \cdot 10^{13} \cdot e^{\left(\frac{-450}{T}\right)} \tag{22}$$

In terms of combustion in a diesel engine, expanded Zeldovich reaction mechanism is kinetic, which means that under the conditions during combustion in a diesel engine chemical equilibrium concentration of nitrogen oxides won't be achieved. The first two reactions correspond to the formation of NO in the lean mixture and the last one in the formation of a rich mixture. The first reaction is determined by the reaction rate due to its high activation temperature of about 38,000 K. The high activation energy was required to break the triple bond in the molecule of nitrogen that occurs at high temperatures, and hence the name of the Thermal nitrogen monoxide. From the equations (20), (21) and (22), the expression for the rate of formation of NO is as follows

$$\frac{d[NO]}{dt} \cong k_1[N_2][O] + k_2[N][O_2] \cong 2k_1[N_2][O]$$
$$\cong 1.476 \cdot 10^{15}[N_2][O_2]^{\frac{1}{2}} \cdot e^{\left(-\frac{67520}{T}\right)} \; mol\, cm^{-3} s^{-1} \tag{23}$$

where: NO - is the concentration of molecules of nitric oxide, N_2 - is the concentration of nitrogen molecules, O - is the concentration of oxygen atoms. From this we can conclude that the reduction of NO can be achieved by the reduction of reaction rate constant, i.e. lowering the combustion temperature and reducing the concentration of O_2 and N as well. NO formation is often denoted in [ppms-1], and the equation for mole fractions of the observed species is:

$$\frac{dn_{NO}}{dt} \cong 1.476 \cdot 10^{21} \cdot n_{N_2}^{\frac{1}{2}} \cdot n_{O_2} \cdot e^{\left(-\frac{67520}{T}\right)} \cdot \left(\frac{P}{R \cdot T}\right)^{\frac{1}{2}} ppm^{-1} \tag{24}$$

According to Bowman the expression for the total rate of nitrogen oxides formation is [27]

$$\frac{dn_{NO}}{dt} \cong 1.476 \cdot 10^{21} \cdot n_{N_2}^{\frac{1}{2}} \cdot n_{O_2} \cdot e^{\left(-\frac{67520}{T}\right)} \cdot \left(\frac{P}{R \cdot T}\right)^{\frac{1}{2}} mol\, cm^{-3} s^{-1} \tag{25}$$

4.1.3 Prompt NO formation

NO can be produced promptly at the flame front by the presence of hydrocarbon radicals, an intermediate species produced only at the flame front at relatively low temperature. NO generated via this route is named "prompt NO" as proposed by Fenimore. HC radicals react with N molecules with the following sequence of reaction steps:

$$CH + N_2 \longrightarrow HCN + N \tag{26}$$

$$HCN + N \longrightarrow \ldots \longrightarrow NO \tag{27}$$

N atoms generated from (26) can react with O_2 to produce *NO*. Nitrogen reacts with a HC radical to produce hydrogen cyanide (HCN), and further HCN reacts with N to produce NO via a series of intermediate steps. The activation temperature of (26) is about 9,020 K. In contrast to thermal mechanisms that have an activation temperature about 38,000 K from (27), prompt *NO* can be produced starting at low temperatures around 1,000 K.

4.1.4 N_2O Route

Under high pressures, the following three-body recombination reaction can be produced through:

$$N_2 + O + M \longrightarrow N_2O + M \tag{28}$$

Due to the nature of three-body reactions, (M represents inert molecule, and it could be any) the importance of (28) reaction increases with pressures. As soon as N_2O is formed, it reacts with oxygen *O* to form *NO* as follows:

$$N_2O + O \longrightarrow NO + NO \tag{29}$$

Reaction (29) has an activation temperature around 11,670 K and therefore *NO* can be formed at low temperatures of around 1,200 K.

4.1.5 Fuel-Bound Nitrogen FBN

FBN, mostly from solid fuels, is produced by oxidation of nitrogen that is chemically bound in the fuel molecule. If this fuel molecule comes at the flame front, it turns into radicals, respectively into cyanide compounds, which at the flame front area partly oxidize to NO.

4.2 Soot formation

The soot emission is generated by combustion in a diesel engine and mainly consists of unburned fuel and lubricating oil, and their size ranges from 20 nm up to 10 microns. Particulate emission is separated into a soluble organic fraction SOF and an insoluble or dry fraction IF, which is often used as an estimation of soot. The percentage of particles and soot in the total emission is about 40-50 %. Other PM constituents are water, wear metals, ash from burned fuel and lubricant oil and fuel-derived sulphate. The sulphuric acid/sulphate fraction is roughly proportional to the fuel S content. The fraction associated with unburned fuel and lube oil varies with engine design and operating condition and it can range from less than 10 % to more than 90 % by mass (Rakopoulos and Giakoumis, 2009). According to the acetylene hypothesis, soot is formed from unburned fuel that nucleates from the vapour phase to a solid phase in fuel-rich regions at elevated temperatures. HC or other available molecules may condense on, or be absorbed by soot, depending on the surrounding conditions. The evolution of liquid- or vapour-phase HC to solid soot particles, and possibly back to gas-phase products, involves six commonly identified processes: pyrolysis, nucleation, surface growth, agglomeration and oxidation. Conversion of more than 50% of soot is achieved at 1,500 K. Maximum 80 to 90 % of soot can be oxidized at the peak temperature of 1,700 K. With a further increase in temperature higher oxidation is not achieved, which can be explained by the effect of extinction in the near cold cylinder wall. The temperature of 1,300 K is called the boundary-temperature decomposition of soot. Furthermore, by exceeding this limit temperature there is specific time after which soot begins to dissolve, and which is defined as the time reduction.

5. TECHNIQUES FOR REDUCING EXHAUST EMISSIONS

Emissions of NO_x can be reduced by primary and secondary methods, or a combination of both methods. The primary methods are called all engine design changes, while secondary methods are all methods of exhaust gas treatment. The most important primary methods are: Performance adjustment; Scavenge Air Moistening SAM; Water-in-Fuel emulsion WIF; Exhaust Gas Recirculation EGR.

While the most important secondary methods are: Selective Catalytic Reduction SCR.

5.1 The primary methods

5.1.1 Performance adjustment

The concept of reducing the concentration of NOx and soot due to the optimization of the engine entails a change in one or more engine parameters such as fuel injectors and the shape of its nozzle, the start of fuel injection, fuel injection pattern, opening of the exhaust valve, fuel injection pressure, compression ratio and scavenging air pressure and temperature.

Fuel injectors and nozzle form

Two-stroke low-speed marine engines have two or three fuel injectors that are on the edge of the combustion chamber. The interaction between the fuel jets from the holes of the nozzle has a significant impact on the amount of NO_x formation, thus there is an optimum number of holes on each fuel injector nozzle (Goldsworthy, 2002). In a small number of holes in the nozzle delayed interaction of high combustion temperatures and air in the zones between the fuel jets leads to an increase in the

quantity of NO_x formation. The middle number of holes forms high temperatures zones between fuel jets, but they are closer to each other, so there is less oxygen from the surrounding unburned gases. With a large number of holes in the nozzle individual jets burn earlier, forming a high combustion temperature that causes large amounts of nitrogen oxide. Today, as the standard injectors on all two-stroke low-speed marine engines MAN B&W Diesel uses slide-type injection valve in and its sac is reduced to zero. In this way, the fuel is prevented from remaining inside the nozzle after injection execution, which directly leads to a reduction in the concentration of NO_x, CO and HC. Table 1 shows the effect of introducing slide-type injectors.

Table 1.
Effect of fuel valve and fuel nozzle design for a MAN B&W 12K90MC at 90% load (Unknown, 2009).

Test results	NO_x	CO	Smoke	ΔSFOC
Units	ppm / 15% O_2	ppm / 15% O_2	BSN6	g/kWh
Standard valve/ nozzle	1594	109	0,35	0,0
6-hole fuel nozzle	1494	108	0,23	+0,4
Slide-type fuel valve	1232	87	0,18	+1,84
BSN6 is the direct reading of the Bosch Smoke Number after six pump strokes				

Testing the operation of the slide-type injectors MAN B&W Diesel came to the knowledge that its usage achieves 23% reduction in the content of NO_x with a 1% increase in SFOC.

Electronically controlled engines

Basic features of electronically controlled engines are variable injection timing VIT, injection pattern, injection pressure control and variable exhaust valve closing control VEC.

Fuel injection start

The exhaust gases produced before reaching the maximum combustion pressure are practically compressed due to pressure rise until it reaches its maximum. This means that the combustion gases remain under the influence of the peak temperature for a relatively long time compared with the remaining time of combustion, which ultimately allows more time for the formation of NO_x. Delaying injection leads to lower maximum pressures and temperatures throughout most of the combustion but also increases the SFOC due to a late completion of combustion and greater heat loss, and it results in soot incensement due to low temperatures and poor combustion.

Fuel injection pattern

There are three types of fuel injection: pre-injection, triple injection and sequential injection. During the pre-injection and triple injection all three injectors are operational and working at the same time, while the sequential injection can exclude one or two injectors from work. With pre-injection, a small part of the fuel charge is injected before the main charge. With triple injection (pulsed injection), the fuel charge is injected in separate, short sprays. With sequential injection, each of the three nozzles in a cylinder is activated with different timing. Pulsed injection results in about 20 % NO_x reduction and with about 7 % increase in fuel consumption. Sequential and pre-injection give less NO_x reduction and less fuel consumption increase (Brown and Holtbecker, 2007).

Compression ratio, injection timing and injection rate

The most common engine tuning measure is increased in compression ratio combined with retarded injection timing. The peak pressure is the same as for the standard engine and occurs at about the same crank angle, even though combustion begins later than for the standard engine. This means that there is less after-compression of the earlier burnt gas, so it does not reach as high temperature as in the standard case and it resides at high temperature for less time. Increased compression ratio also tends to offset the increases in fuel consumption resulting from retarded injection timing. If the geometric compression ratio is increased by reducing the clearance volume, the combustion space will be flatter, which could result in better cooling of the flame through the surfaces. It results in an increase in soot with an additional decrease in NO_x due to the cooling.

Scavenge Air Temperature, Miller Supercharging

Reduced scavenge air temperature reduces combustion temperatures and thus NO_x. For every 3°C reduction, concentration of NO_x may decrease by about 1% (Holtbecker and Geist, 1998). Excessive cooling of the scavenging air can lead to increased smoke due to poor oxidation of soot formed during combustion. The Miller Supercharging is based on the closing of the intake valve before coming to the bottom dead centre BDC in the scavenging cycles. The charge air then expands inside the engine cylinder as the piston moves towards BDC, resulting in a reduced temperature and, therefore, up to 20 % reduction of NO_x can be reached without increasing fuel consumption.

5.1.2 Scavenge Air Moistening SAM

SAM system increases the heat capacity of the scavenging air, which allows greater absorption of heat in the combustion process, but on the other hand, it reduces the oxygen content in the charged air. The result is a lowering peak combustion

temperature, which ultimately leads to a 50 % decrease in the content of NO_x in the exhaust gas emissions.

5.1.3 Water-in-Fuel emulsion WIF

When using WIF techniques, water is continuously added to the fuel during its consumption, and the homogeneity of the emulsion is ensured mechanically in a homogenizer. When the emulsion is injected into the engine, it comes to the seizure of heat of combustion due to heating, evaporation and superheating of water. That leads to lower peak temperature and better fuel atomization, which results in approximately 1% reduction in the content of NO_x for every 1% of added water. To achieve the optimum fuel atomization, the droplet size must be a maximum of 5 μm, which can be achieved in an ultrasonic homogenizer. In order to maintain the set viscosity values of 12 to 15 mm2/s, it is necessary to raise the emulsion temperature to about 150°C, and even more if the water content increases (Unknown, 2009; Lalić et al., 2009).

5.1.4 Cylinder liner lubrication

The research done by MAN B & W Diesel A / S suggests that the reduction of cylinder oil consumption reduces particulates and soot emissions. Due to environmental and engine operative needs, electronically controlled high-pressure cylinder oil injection system for lubrication at a predetermined time and piston position that ensures optimal lubrication in all the engine operational regime has been developed. Today Alpha Adaptive Cylinder Oil Control ACC from MAN Diesel Company or Pulse Lubricating System from Wärtsilä Sulzer Company represents standard systems used for cylinder liner lubrication.

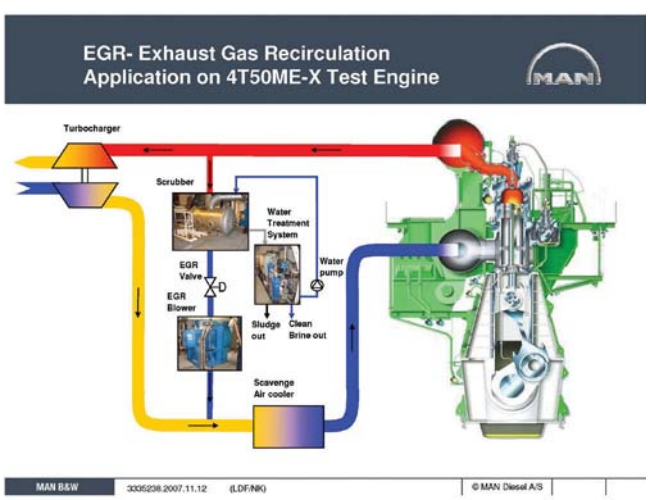

Figure 4.
EGR system.

5.1.5 Exhaust Gas Recirculation EGR

EGR recirculation system implies only a portion of exhaust emission recirculation, Figure 4. After removal of soot and SO_x, the part of the exhaust gases mix with the scavenging air before entering the cooler and the presence of CO_2 and H_2O increases the heat capacity of the resulting mixture. Furthermore, the O_2 concentration is reduced, which means that the engine must be charged with a larger amount of the purified exhaust gas and fresh turbocharged air mixture for a complete combustion of the same amount of fuel. Due to the increase of heat capacity and scavenging mixture mass, a reduction of peak combustion temperature occurs and, thus, lower concentration of NO_x. From all the above mentioned methods EGR system has the best predisposition in terms of meeting the new requirements on the content of NO_x to fulfil Tier III requirements.

6. CONCLUSION

In the past few decades shipping industry and maritime transport have been developing rapidly. From the economic point of view, this trend has a positive impact on economic development but, on the other hand, a very negative impact on the environment in terms of air pollution. When considering air pollution from ships, it primarily refers to emissions such as NO_x, SO_x, PM and soot, which are the products of fossil fuel combustion in marine diesel engines. Therefore, today all major manufacturers of two-stroke low-speed marine diesel engines produce engines that meet the requirements of MARPOL Convention 1973/78, Annex VI. This paper presents the effect of temperature on the formation of pollutants in the exhaust emission. With the aim to reduce these pollutants in the exhaust gas emissions from marine engines, a variety of methods have been proposed and implemented and they are presented in this paper. Satisfaction of these regulations is achieved by the described primary and secondary methods. The rate of formation of concentration of thermal NO as the biggest factor in NO_x emissions and the impact of flame temperature on increasing the speed of its concentration are specially emphasized in this paper. Both in the present and in the future, further development of engine parameter optimization in order to improve its performance and meet increasingly stricter environmental standards remain an imperative.

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Traffic Video Surveillance in Different Weather Conditions

Igor Vujović[a], Marjan Jurčević[b], Ivica Kuzmanić[a]

Various parameters are studied in video-stream traffic surveillance. Weather conditions are one of the most important parameters, influencing the quality of traffic surveillance in any microlocation, such as the town of Metković in this study. This paper examines the influence of weather conditions on traffic surveillance based on the collection of visual data. The quality of the system was tested under the following weather conditions: sunny, windy, cloudy and rainy.

KEY WORDS
~ Vehicle detection
~ Movement recording
~ Road traffic surveillance
~ Weather conditions

a. University of Split, Faculty of Maritime Studies, Split, Croatia
e-mail: ivujovic@pfst.hr

b. Zrinsko-Frankopanska 82, Metković, Croatia
e-mail: charly_mtk@hotmail.com

1. INTRODUCTION

Traffic surveillance is a fast growing area of research. There are many methods, which address different problems in traffic surveillance. Traffic surveillance can be performed by different sensors in different situations and types of traffic, from air traffic separation (Williams et al., 2008) to marine integrated surveillance (Moutray and Ponsford, 1997).

Cutting-edge studies of traffic surveillance deal with components of intelligent surveillance systems and high-level modules of computer vision. However, advances have also been made in low-level processing. An example of both courses of research is provided in (Cucchiara et. al., 2000), where rule-based reasoning on visual data is used. The proposed system consists of several modules, which can be grouped into low-level and high-level. At high level, symbolic reasoning is introduced. At low level, two groups of modules are used: for daylight and nightlight. During the day, motion detection must be corrected with luminance variation detection. At night, morphology and headlight pairing is performed. Low-level problems were addressed i.e. in (Bhandarkar and Luo, 2005), where background updating is addressed or in (Chang, 2006), where shadow removal algorithm is proposed. High level problems were addressed i.e. in (Liu and Payeur, 2003), where activity detection was considered or in (Kumar et al., 2005), where behavior interpretation was considered. A method for vehicle count in the presence of occlusions was proposed in (Pang et al., 2007).

In this paper, we present road traffic surveillance experiments performed in the Metković region known for having weather conditions specific only to that region, making it reasonable and mandatory to examine and investigate the impact of weather conditions on the accuracy of traffic surveillance systems.

The paper is organized as follows. In the second section, a review of some recent research in traffic surveillance taking

weather conditions into account is presented. The third section describes the setups and the experiments performed in this work. The forth section gives conclusions and proposes further research.

2. TRAFFIC SURVEILLANCE UNDER DIFFERENT WEATHER CONDITIONS

There are references dealing not only with traffic surveillance, but also including considerations about weather conditions. In this section, references are grouped as:

- examples of usage from practice (government and private),
- highway (freeway) surveillance, and
- urban traffic surveillance.

2.1 Government and private sector efforts

The Norwegian Public Roads Administration (NPRA) manages the country's roads for everything from weather conditions to accidents (Norwegian Roads Agency Deploys Hardened Wireless Network, 2012). This is important for traffic safety and emergency interventions, as well as for traffic pattern research relevant for planning further road network development.

There are also corporations offering complete traffic surveillance solutions, including weather conditions, which are intelligent and cover motorways, tunnels and waterways (Intelligent solutions for motorways, tunnels and waterways, 2010).

The Arizona Department of Transportation spends about $50,000 per location for the installation of Freeway Management System (FMS) detection, and another $1,000 per annum for the maintenance of each site. They used a list of starting points to establish the common conditions that need to be considered, such as: morning peak, afternoon peak, off-peak, dry weather, wet weather, congested conditions with slow speeds, free-flow conditions, intense fog, blowing dust, full sunlight, full dark, light transitions, and snow.

The (State of the Art Evaluation of Traffic Detection and Monitoring Systems, 2007) reports that the quantity of errors increases in wet weather. For example, while detected errors in dry weather do not exceed 20 %, they may rise up to as many as 65 % in case of wet weather. The importance of these studies can be illustrated by investment in experimental setups.

Governments have also shown concern for weather conditions in traffic monitoring, and ordered the relevant studies. For example, the US Federal Highway Administration obtained results from the Road weather management program (Goodwin, 2003). The report illustrates best practices with examples from US roads.

An example of European private corporation study may be found in (Versavel, 2006). The report states that traffic surveillance problems are due to the fact that there are no standard camera positions, no standard roads, no standard weather and no standard illumination. It is also stated that different applications require different cameras and different camera positions. It has to be pointed out that the main problem in video traffic surveillance is the validity of the obtained traffic data, inevitably leading to the conclusion that weather conditions having to do with the cleanliness of the camera lens are the main issue. The influence of fog depends on the camera's position and density of the fog. If the camera is mounted above the highway and visibility is about 20 m, than it will have no impact on the results of surveillance. On the other hand, rain and snow can influence work by making camera dirty if left unprotected from such conditions. However, right positioning and protection will reduce the effect of snow and rain. Also, it goes without saying that the same goes for dirt. The camera should be mounted at a sufficiently high position.

2.2 Surveillance of highways

The recognition of importance of weather conditions is outlined with research in (Lagorio et al., 2008). An analysis of different weather conditions is presented and solution proposed. The solution is based on the developed system, which uses a statistical framework (mixture of Gaussians, MoGs) to identify specific meteorological events, such as snow, fog or heavy rain. Of course, the above mentioned examples are used for surveillance of state and interstate roads, not for urban traffic.

(Nookola, 2006) introduced methodology for analyzing the impact of weather on traffic. The author used correlation coefficient analysis to establish which weather parameter affects traffic and daily traffic volume variability under different weather conditions.

(Arth et al., 2006) proposed an algorithm that performs reasonably well under adverse weather conditions, such as heavy rain or snow. Errors, however, occur due to shadows or occlusions. Furthermore, the algorithm is sensitive to camera motion, such as jitter. A further drawback is that objects, which become stationary, tend to fade into the background model. They used the approximated median filter for background modeling and Viola-Jones detector (Viola et al., 2001).

(Roh et al., 2013) proved that change in weather conditions triggers variations in highway traffic. The goal of the research was to use truck traffic as a model to plan efficient winter road maintenance programs.

All the above studies indicate that the study of the influence of weather conditions on traffic has practical applications.

2.3 Urban traffic surveillance

Dealing with urban traffic opens a variety of issues. Traffic congestions, common in urban areas and their vicinity, are

managed by the intelligent transport system (ITS). ITS integrates traffic radars, loop detectors and surveillance cameras.

Two main difficulties in the establishment of the virtual loop detector (VLD) are changing illumination and weather conditions. Proposed solution in (Zhidong et al., 2008) increases average accuracy by 95 % under changing illumination in various weather conditions in daytime in comparison to relevant previous research. Texture features in describing the traffic density are used in (Wassantachat, 2009). Background modeling is performed by the SVM kernel, which self-adapts to various lighting environments.

Urban traffic is more challenging due to:

- high traffic density,
- position of cameras, i.e. lower angles resulting in high occlusion rates, and
- variety of road users.

Furthermore, evaluation under challenging weather conditions would be desirable, but is rarely performed (Buch et al., 2011). Different techniques for urban road user detection and classification are proposed, such as in (Buch et al., 2010), where motion silhouettes were extracted and compared to projected model silhouettes. The comparison resolved the issue of the classification of motion silhouettes. Performances were tested under three different weather conditions and results were 87 % better than in competitive algorithms.

One of the challenging problems in urban traffic is the tracking of vehicles at crossroads. In (Liwei at al., 2011), a new method is proposed. The method is innovative in the application of two-stage view selection and dual-layer handling of occlusions. The paper proposed a Multi-Modal Particle Filter (MMPF) for tracking vehicles explicitly. A considerable number of experiments were performed under different weather conditions. The considered weather conditions were snowy, sunny and cloudy.

(Smids, 2006) used webcams (in our example, webcam was also used) for urban traffic monitoring applying the background subtraction technique. The proposed system was evaluated under different weather conditions. The author compared the deterministic and statistical approach in background subtraction and background modeling. The author reported that deterministic subtraction approach had some important limitations. For example, total foreground area was often not fully detected, objects which became background were erroneously detected as foreground. However, results based on statistical approach using per-pixel Gaussian mixture model (GMM) were reported as very promising. The deterministic approach has no limitations. Sunny, cloudy and rainy weather conditions were used in the research. Experimental work was performed with a capture resolution of 640x480 and frame rate was 15 fps. The author is of the opinion that background should be adaptive. In non-recursive modeling techniques, a sliding window approach is used for that purpose. It depends on buffer length, n, and is given as:

$$B_t(x,y) = F(I_{t-1}(x,y),\ldots, I_{t-n}(x,y)) \quad (1)$$

where B_t is the background at time t, $I_t(x,y)$ is the frame coming from the camera at time t and F is a function that is based on the temporal variation of pixel values. Function F is obtained in a variety of ways: such as frame differencing, median filter, linear predictive filter or some non-parametric model. The simplest model is frame differencing, which leads to background definition as:

$$B_t(x,y) = I_{t-1}(x,y) \quad (2)$$

This, the simplest method, is only based on the previous frame. The calculation of the median for several frames in the buffer is a bit more complex:

$$B_t(x,y) = median(I_{t-1}(x,y),\ldots, I_{t-n}(x,y)) \quad (3)$$

In linear predictive filters, background model is defined as:

$$B_t(x,y) = \sum_{i=1}^{n} \alpha_i I_{t-i}(x,y)_i \quad (4)$$

where α_i is the predictive coefficient.

The most popular recursive techniques mentioned are the approximated median, Kalman and mixture of the Gaussians.

(Smids, 2006) used Open Source Computer Vision Library (OpenCV) for the implementation of the proposed work. Finally, (Smids, 2006) concluded that regardless of the weather conditions, the statistical approach outperforms the deterministic approach in video surveillance applications. However, he reported a number of small misclassification intervals due to rainy weather.

(Zhou et al., 2007) reported, according to their experimental results based on real traffic video data, that their vehicle detector was excellent at dealing with different weather and illumination conditions. They based their conclusion on counted vehicles passing by the area under different weather and illumination conditions: afternoon sunlight with long and heavy shadow, morning sunlight with long and light shadow, a rainy day with reflections on the side of vehicles, nightfall with bright vehicle headlights but no streetlight and at night under streetlight with shadows and headlights. Their approach was the implementation of SVM (Support Vector Machine) in training. They obtained

SVM-classifiers, which they used in further experimental work. The scatter matrix for PCA (Principal Component Analysis) is computed using a training sequence. Finally, they concluded that the experimental results derived from real traffic video data showed that their vehicle detector has an ability to deal with different weather conditions.

As stated in (Nandhini and Parthiban, 2012), a video-based monitoring system must be resistant to different weather and illumination conditions. The algorithm deals with shadows as well. The proposed algorithm includes lighting object extraction, connected-component extraction, spatial classification process, potential component tracking, motion-based grouping, tracking of vehicle component groups and vehicle identification and classification. In the research, satellite images were used. The preprocessing of such images consists of several operations, such as atmospheric correction, change detection, image registration or geometric correction. Vehicle lights were used as the silent feature for nighttime vehicle detection. Then morphology was used, as well as shape analysis, etc. Edge-based detection experiments were performed under different weather and lighting conditions. Finally, the authors concluded that their proposed algorithm can be used in real-world and real-time road traffic applications.

(Cheung and Kamath, 2005) are more concerned with the operation of the standard modules, which every reliable video surveillance system of differencing type must have – robust background subtraction. They validated their proposal for background subtraction in urban traffic video.

(Hu et al., 2008) focused on data fusion provided by different viewpoints and the probability of vehicle presence. They submitted that noise caused by weather, sudden light changes and weak shadows could be efficiently eliminated using their method. The authors used a concept of probability fusion map (PFM), which is the probability of a vehicle being present in the scene. PFM is calculated by merging mapped images from different cameras. The additional benefit of using more than one camera is the ability to obtain 3D information, such as length, width and height in the process of blob analysis. They proposed a key factor called PFM factor, which synthesizes the inverse projected images with considerations of Inverse Projector Factors (IPF) and Perspective Accuracy Factor (PAF). The IPF depends on the properties of the pixel and PAF is expressed by factor β:

$$\beta_i(x,y) = 1\,\kappa_i \log_{10} \frac{P_i(x,y)}{P_{i0}} \tag{5}$$

where P_{i0} is camera distance to the nearest feature point, κ_i an adjustment weight parameter and $P_i(x,y)$ is the distance from target to camera calculated on the inverse projected map.

(Narasimhan and Nayar, 2003) concluded that there is no point in improving classic noise-removal techniques to remove the influence of weather from the image. The reason is in contrast decay, which is caused by weather. They developed a physics-based model which describes the appearances of scenes in uniform bad weather conditions.

As can be seen, some papers concentrate on low level and some on high level processing of the input video stream. However, both low and high level processing have the potential for further research due to the above mentioned issues, which still remain unresolved/unresearched or not resolved in a satisfactory manner.

3. EXPERIMENTAL SETUP AND RESULTS

In this section, we described the performed experimental setup, results, and measures of quality. As previously stated, the Metković region is known for having weather conditions specific only to that region. So it is reasonable and mandatory to research and investigate the impact of weather conditions on the accuracy of the traffic surveillance systems. The quality of the system is examined for the following weather conditions: sunny, windy and cloudy, and rainy, since these weather conditions are the most frequent in the geographical microregion of the town of Metković, Croatia.

3.1 Description of experimental setup

Equipment used in the experiments is as follows: network camera AXIS 207, software surveillance application, laptop HP Compaq 6715b. Characteristics of the camera Axis 207 are as follows: dimensions 85x55x34 mm, weight 177 g, network connection RJ45, grid adapter 4 W power, and the input/output terminal connector (Axis 207/207W/207MW Installation Guide, 2012). MJPG format was used for processing. Image resolution was 640x480 pixels. Network cameras make possible the organization of traffic surveillance in control centers. Such cameras are organized as free-standing and can be contacted by different authorized computers. The advantage is the possibility of networking many cameras into a single system.

Further advantages of the cameras used are (Axis net cameras, 2012):

- remote and safe access to live video stream and recorded videos,
- flexible and economic solutions to video control,
- more reliable identification,
- PAL/NTSC may be used, but even higher resolutions can be achieved,
- progressive scanning to remove blur,
- powerful event management with intelligent video features,

- automatic reaction to events and threats, drastically reducing the number of operative personnel and raising the efficiency of video surveillance,
- scalable, easily integrated solution,
- open access technology platform,
- easy integration into other systems as access control or point of sale.
- lower total costs,
- power over ethernet is possible, reducing the costs of installation at remote locations, and
- connection to standard IP network/ethernet.

3.2 Results

Camera was positioned at state road D62 in the vicinity of the town of Metković in the Republic of Croatia.

The first experiment was performed under sunny weather conditions. As shown in Section 2, weather conditions influence the performance of the systems. Therefore, different weather conditions have been experimentally studied. The examples of the results are shown in Figure 1.

a) c) b) d)

Figure 1.
Motion detection in experiment 1(camera is not directly exposed to the sun): a) no motion, b) c) d) motion detected.

In the experiment, the camera was tested in two modes of operation: the shooting of moving images (when there is no motion, no picture is not taken) and constant recording of traffic. Constant recording is useful if motion detector fails to trigger the recording device. It could be examined how well the motion detector and hardware operate in real conditions. Both software and hardware support both modes of operation.

The second experiment was performed in windy and cloudy weather. Generally known problems occurring under these weather conditions are: waving trees, thresholding, detection of cloud movement and so on. In some cases, some of the problems can be avoided by adding specific program routines. This solution cannot be used generally.

a) c)

b) d)

Figure 2.
Motion detection under windy and cloudily weather: a) no motions, b), c), d) wrong detection of motions: waving trees effect.

The third experiment was performed in rainy conditions. In this case, detection of rain as motion presents a problem, which could be avoided by setting a proper threshold. Unfortunately, the camera does not have features which would allow it to differentiate between heavy rain and movement. Therefore, there is no rain sensibility.

a) c)

b)

d)

Figure 3.
Motion detection during rain: a) rain as detected motion, b), c), d) real motion detection.

In order for there to be a noticeable difference, frame differencing has to be performed. The used application software enables frame differencing. The result is in Figure 4. Figures 4.a and 4.b show two neighboring frames in the video stream. Figure 4.c presents the difference between Figures 4.a and 4.b. It can be seen that frame differencing can produce double-vision effect in the motion mask. The result is presented in black and white technique. This type of image is called a motion mask. It is clear from the motion mask that shadow detection can be a very real problem when we want to use the obtained motion mask further in high level applications. The second problem of the application software used is the avoidance of double detection. A higher vision application, like car counting, can instigate false detection by mistake.

a)

b)

c)

Figure 4.
Frame differencing: a) frame 1, b) frame 2, c) motion mask obtained by frame differencing.

The result of image sequence processing is the image difference. Further research should include higher vision applications, i.e. traffic counting, which will enable traffic development planning.

3.4 Measures of quality

Measures of quality can be divided into 11 groups based on:

- pixels,
- objects,
- spatial precision,
- temporal and spatio-temporal precision,
- estimation methodology,
- receiver-operating characteristics,
- perturbation detection rate,
- standalone performance evaluation,
- intra-object homogeneity metrics,
- inter-object disparity metrics, and
- combination of the above mentioned.

In pixel based quality measures, pixels are classified into four groups:

- true positives (TP), which means that the algorithm correctly detected and classified the pixel as foreground,
- false positives (FP), which means that the algorithm mistakenly classified a pixel as foreground instead of as background,
- true negatives (TN), which means that the algorithm correctly classified a pixel as background,
- false negatives (FN), which means that the algorithm classified a pixel as background instead of as foreground.

Based on the above mentioned definitions, several measures are introduced. The best known is the percentage of correct classifications (PCC) (Rosin and Ioannidis, 2003; Elhabian et al., 2008):

$$PCC = \frac{TP + TN}{TP + TN + FP + FN} \tag{6}$$

The second measure based on pixels is the so called Jaccard coefficient (JC), defined as:

$$JC = \frac{TP}{TP + FP + FN} \tag{7}$$

The third statistical measure is Yule's coefficient (YC):

$$YC = \left| \frac{TP}{TP + FP} + \frac{TN}{TN + FN} - 1 \right| \tag{8}$$

False detection rate can be defined as:

$$FDR = \frac{FP}{TP + FP} \tag{9}$$

In some cases, an interesting measure can be false negative detection rate defined as:

$$FNDR = \frac{FN}{TP + TN + FN + FP} \tag{10}$$

The total number of false detections, total false detection rate, TFDR, is defined as:

$$TFDR = \frac{FN + FP}{TP + TN + FP + FN} \tag{11}$$

The issue of statistical pixel measurement is possibly misleading. It is especially noticeable in scenes containing changes small relative to the total number of pixels.

Although misleading in many situations, the pixel criterion is easy to implement, does not require high vision algorithms and high execution times.

For example, if we take Figure 4, we can measure that PCC is 0.74, which is lower than many methods in video surveillance. However, since all of these methods should be evaluated under the same conditions, using the same scenes, this is nothing more than an assumption, not a scientific fact.

Further numerical result is the FNDR, which is only 0.021, because we did not take shadows and double-detections into consideration. However, when shadows and double detections are taken into account, the appropriate measure, FDR, rises to 0.2381 or 23.8 %, which is a very bad result in comparison to the world's best results. TFDR is almost 26 %. One of the problems with real scenes and the evaluation of new experiments is the lack of grounds for comparison. There are not many publicly available and compatible source codes to compare with your scene. On the other hand, if the available reference video sequences are used, one risks being misled, because there is no guarantee that the obtained results can be applied to all scene in general.

Unfortunately, the research results from available literature focus on higher vision applications, such as traffic patterns, time predictions, speed predictions, etc., i.e. in (Roh et al., 2013). For example, vehicle counting is influenced by weather conditions, i.e. in (Zhou et al., 2007) rainy conditions contribute to false car counting by less than 1 %. Error rates increase by minimum 20% in humid weather (see State of the Art Evaluation of Traffic Detection and Monitoring Systems, 2007).

4. CONCLUSION

The study of the influence of weather conditions was justified due to the specific climate characteristics of the Metković region. The goal of this study was to improve automatic traffic monitoring and control systems. The following weather condition were studied: sunny, rainy, and cloudy weather. The obtained results lead to the conclusion that the choice of the selection of the measure for the decision making process is fuzzy. A smart and intelligent system, containing event bases, must be included into research and development.

Experiments performed in the study revealed possible issues when dealing with outdoor applications of video surveillance, such as wrong detection of clouds as road movement, rain as motion or the waving tree effect.

The applications of road traffic surveillance are the study of drivers' behavior, traffic regulation violations, accident detection, traffic regulation, security, safety, and similar. Any of these accidents can be reported to the police or a monitoring station, and further actions can be taken under advisement. In the research, motion mask was the basis for the calculation of the measures of quality.

The experiments were performed as a part of requirements for a master's thesis (MSc). Further work could lead to the framework for the assessment of the influence of weather on traffic monitoring based on low-level image processing criteria. One of the future papers could deal with the calculation of the velocity of a moving object based on frame differencing. Possible issues could include slight camera vibrations or variations in position, which would result in an error in calculation. Small displacements can be caused by natural factors, i.e. the wind.

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Institute of Excepted Perils under the Rotterdam Rules 2009

Nikola Mandić

The Rotterdam Rules set forth, on the lines of the Hague-Visby Rules, a number of excepted perils when the carrier will not be liable for the damage to cargo. The institute of excepted perils was established by the Hague Rules almost 90 years ago, and is still implemented in practice. For such cases exceptionally the carrier is not liable under the principle of assumed guilty, but under the principle of proven guilty. In the preliminary activities for concluding the new international convention, the possibility has been considered of abolition of the institute of excepted perils has been considered, but in the end nevertheless, on the initiative of mainly maritime states, it has been retained, developed and more contemporarily styled, i.e. concerted with the requirements of the contemporary maritime transport. The Rotterdam Rules in Article 17, Paragraph 3, taxatively cite the excepted perils due to which the carrier will be able to exculpate from liability. The key difference is that error in navigation is no longer an excepted peril. Especially important novelties introduced by the Rotterdam Rules are exemption of the carrier from liability due to the acts of piracy, terrorist attacks, undertaking measures to avoid or prevent possible damage to the environment, and alike.

KEY WORDS
~ Rotterdam Rules
~ Liability of the carrier
~ Excepted perils
~ Error in navigation

University of Split, Faculty of Maritime Studies, Split, Croatia
e-mail: nmandic@pfst.hr

1. INTRODUCTION

Carrier's liability is one of the crucial problems regarding the contract of carriage of goods by sea. The carrier is liable to the other contracting party for damage incurred by violation of contractual liability. The main obligation of the carrier is to carry the goods to the place of destination and deliver them to the consignee. Therefore, the carrier is liable for damages to goods he has taken in for carriage and for the delay in delivery. Carrier's liability in the carriage of goods by sea at the international level is regulated by a number of international conventions. However, none of the adopted international conventions has been universally accepted.

The first internationally agreed convention was the International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading dating back to as early as 1924, also known as the Hague Rules. The Rules have been almost universally adopted, and undoubtedly represent a successful international instrument that is still standing. The main reason for laying down the Hague Rules was to limit the freedom of contracting to protect the user of carriage services, as such freedom by the economically stronger party, the carrier, was used against them. The Hague Rules in Article 4, Paragraph 2, provide for special cases due to which the carrier will not be liable for loss or damage resulting from them. Those cases are referred to as excepted perils, and they represent an exception from the general liability principle.

Although the Hague Rules were satisfactorily accepted, in the course of their implementation certain shortcomings were noticed and requirements for their updating appeared. The Hague Rules were revised by enacting two Protocols on revising the International convention for the Unification of Certain Rules of Law Relating to Bills of Lading in 1968, well-known by the name of Visby Rules, that together with the text of the Hague Rules represent the Hague-Visby Rules, in 1979 referred to as SDR Protocol. The main reason for undertaking amendments was a lack of uniformity of judicial practice in the implementation of the Hague Rules, progress of cargo handling and transport

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technology, especially containerization, reduction in value of the world's currencies by inflation, and by introduction into maritime contract law of special drawing rights, as determined by the International Monetary Fund, instead of gold franc. By the Hague-Visby Rules or SDR Protocol did not affect the institute of excepted cases laid down by the Hague Rules.

The other international convention regulating the carriage of goods by sea is United Nations Convention on the carriage of goods by sea concluded in 1978, referred to as the Hamburg Rules. The main reason for concluding the new convention was protection of the user of carriage services, and these are the states mainly importing and/or exporting cargo without a strong fleet. An essential characteristic of the Hamburg Rules is that they significantly stiffen the carrier's liability. The Hamburg Rules provide some interesting up-to-date solutions, but have not gained wider acceptance. The Hamburg Rules have a different approach to solving problems of carrier's liability and do not provide for the institute of excepted perils.

The third international convention regulating the carriage of goods by sea is the United Nations Convention on Contracts of the International Carriage of Goods Wholly or Partly by Sea concluded in 2009, referred to as the Rotterdam Rules. Laying down the Rotterdam Rules was undertaken due to the fact that nowadays in the world to regulate the relations in the carriage of goods by sea more than one system of international convention legal regulations are simultaneously implemented, which certainly does not contribute to the standardization of maritime transport law. A specific feature of the Rotterdam Rules with regard to the other international conventions is that besides the carriage of goods by sea they also regulate the multimodal transport. Although the Rotterdam Rules contain a number of new solutions, in certain cases there has been an attempt to include also the traditional solutions from the Hague-Visby Rules and Hamburg Rules. Thus, they retained the implementation of the institute of excepted cases in accordance with the Hague-Visby rules. However, the Rotterdam Rules have not been implemented and it is very hard to say if it is ever going to happen.

2. THE BASIS OF CARRIER'S LIABILITY

Article 17 of the Rotterdam Rules provides for the basis of carrier's liability for the loss, damage or delay. According to Paragraph 1 of the Article, the carrier is liable for loss or damage to goods, as well as for delay in delivery, provided the claimant can prove that the loss, damage or delay, or an event or circumstances having caused or contributed to the damage, occurred in the course of carrier's liability, as set forth in Chapter 4 regulating carrier's liability. It follows that the carrier's liability is assumed if the shipper can prove that the carrier has taken the goods in for carriage in apparent good order and condition, and that the goods have been damaged in the course of the carriage. According to Paragraph 2 of the Article, the carrier is not liable wholly or partly in accordance with Paragraph 1, if he proves that the cause or one of the causes of loss, damage or delay cannot be attributed to his fault or fault of the persons mentioned in the Article 18, for which the carrier is responsible, on the basis of the Convention, in case of breach of obligation caused by acts or omissions committed by those persons.[1] So, the carrier is exculpated from liability or part of it, if he proves that the cause or one of the causes of damage cannot be attributed to his fault or fault of the persons for whom he is responsible.

According to the Rotterdam Rules the carrier is not liable on the basis of assumed guilty. The burden of proof is distributed so that the claimant proves that the loss, damage or delay occurred in the course of the period of carrier's liability, he does not have to prove what the cause of the damage is, but only that the damage occurred. When the claimant proves that the damage occurred, the burden of proving is transferred to the carrier, and the carrier, to exculpate himself from liability or part of liability, has to prove that the cause or one of the causes of loss, damage or delay cannot be attributed to his fault or fault of any other person under his liability.

The same legal basis of carrier's liability is also set forth in the Hague-Visby Rules and Hamburg Rules, which means that it has not changed since the conclusion of the first international convention. With the Rotterdam Rules the basis of carrier's liability has been differently styled and stipulated by nomotechnical combination of wordings from the Hague-Visby Rules and Hamburg Rules. The authors of the Rotterdam Rules have closely studied potential changes and taken care that the new styling and content does not significantly derogate from the Hague-Visby Rules, and that will mainly preserve valuable interpretations of certain key provisions originated from court and business practice by the implementation of the Hague-Visby Rules.

3. CARRIER'S LIABILITY FOR EXCEPTED PERILS

Excepted perils represent specific events or circumstances providing for the carrier's non-liability, i.e. exceptions from general principles of carrier's liability. The institute of excepted perils consists of specific risks to which cargo is exposed during carriage, and which by their intensity exceed the intensity considered normal during carriage. By the Institute of excepted perils a number of cases have been provided for when the carrier will not be liable for damage incurred to goods. For excepted

1. According to Article 18 of the Rotterdam Rules the carrier is liable for acts and omissions of: the performing party, master or ship's crew members, employees of the carrier or agent, or any other person who performs or undertakes to perform any one of the carrier's responsibilities on the basis of contract of carriage, to the degree to which that person acts, either directly or indirectly, upon carrier's requirement or under his supervision.

perils the carrier is responsible according to the principle of proven guilty, and not, as in other cases, according to the principle of assumed guilty, which is definitely more favourable for the carrier.

The burden of proving is so distributed that the carrier has to, in order to exculpate himself from liability or part of liability, prove the existence of one of taxatively listed excepted perils, i.e. how one or more of the specified excepted circumstances caused or contributed to the loss, damage or delay, as well as proximate cause between that case and the damage. However, the carrier is not then finally exculpated from liability but proving of his guilt is permitted. The user of carriage services can prove that the circumstances specified are not the cause of the damage incurred, but others, that can be attributed to carrier's fault and for which consequently the carrier is liable. These other circumstances that can be attributed to the carrier's fault are ship's unseaworthiness, ship's improper crewing, equipping and supplying, as well as the fact that the ship's holds or her other parts in which goods are carried are not ready and safe for taking in, carriage and protection of goods. In case the carrier does not manage to prove that he has fulfilled the obligations imposed on him, it is considered that there is proximate cause between his omission of due diligence and the damage incurred, so he will be liable. If the damage has occurred due to the existence of one of the excepted perils, but the damage is also consequence of carrier's omission to exert due diligence in making the ship seaworthy, in that case the carrier is liable for the whole damage. The carrier will be liable if his fault, or fault of the persons for whose acts and omissions he is responsible, is proved.

In the Rotterdam Rules the Institute of excepted perils has been retained on the lines of, mutatis mutandis, formulation of excepted perils from the Hague-Visby Rules. In Article 17, Paragraph 3, of the Rotterdam Rules excepted perils are set forth, i.e. the releasing circumstances on the basis of which the carrier can, in case he proves that one or more of the excepted perils contributed wholly or partly to the damage incurred, exculpate from his liability. As a difference from the Hague-Visby Rules, with the Rotterdam Rules the excepted perils also cover the damages due to delay, which is acceptable as some listed perils can also cause the consequence of delay in the delivery of goods. The excepted perils in the Rotterdam Rules have been altered, finalized and more contemporarily styled which is due to a global approach that the Rotterdam Rules have in the regulation of the whole subject. The greatest asset for the inclusion of the Institute of excepted perils into the Rotterdam Rules is that so far they have been widely implemented internationally and as much as possible rely on laid-down sound judicial practice.

Article 17, Paragraph 3, of the Rotterdam Rules prescribes how the carrier is exculpated wholly or partly from his liability in compliance with the Paragraph 1 of the Article if, except by proving not guilty as prescribed in the Paragraph 2 of the Article, he proves that one or more of the following events or circumstances have caused or contributed to the loss, damage or delay: (a) act of God; (b) perils, dangers and accidents of the sea or other navigable waters; (c) war, hostilities, armed conflicts, piracy, terrorism, riots, civil commotions; (d) quarantine restrictions, interferences or impediments created by governments, public authorities, rulers or people, including detention, arrest or seizure, or judicial prosecution to which the carrier or any other person mentioned in the Article 18 have not contributed; (e) strikes, lockouts, stoppages or restraints from labour; (f) fire on the ship; (g) latent defects non-discoverable by due diligence; (h) act or omission by the shipper, documentary shipper, supervising party, or any person for whose acts the carrier is liable according to the Article 33 or 34[2]; (i) loading, handling, stowing or unloading of the goods according to the agreement in compliance with the Article 13, Paragraph 2[3] except if the carrier or performing party has performed such act on behalf of the shipper, documentary shipper or consignee; (j) wastage in bulk or weight or any other loss or damage arising from a latent defect, quality or inherent vice of the goods; (k) Insufficiency or defective condition of packing or marking not performed by the carrier or on behalf of carrier; (l) saving or attempting to save life at sea; (m) Reasonable measures to save or attempt to save property at sea; (n) reasonable measures to avoid or attempt to avoid damage to the environment; (o) acts of the carrier in pursuance of the powers he has in line with Articles 15 and 16[4].

3.1 Act of God

Act of God is an external event that could not have been foreseen, avoided or removed. Act of God at sea commonly occurs as heavy weather, while the common actions of wind and seas are not considered act of God. Heavy weather has characteristics of act of God only if it is an unpredictable occurrence of exceptional force that cannot be overcome by implementation of standard seamanship and wisdom. Exceptionally heavy weather that could have been forecast and avoided (by following meteorological reports) also does not have the characteristics of act of God. In judicial practice so far there has not been a reliable criterion that could help, with the application of the Beaufort scale, to judge

2. Article 33 of the Rotterdam Rules regulates the shipper's responsibility for other persons, whereas Article 34 of the Rotterdam Rules regulates issuance of sea-carriage documents or electronic transport records.
3. Article 13 of the Rotterdam Rules special obligations, among which in Article 2 it provides for the possibility for the carrier and shipper to agree that loading, handling, stowing or unloading of the goods can be performed by the shipper, documentary shipper or consignee providing such a contract has to be specified in the contract clauses.
4. Article 15 of the Rotterdam Rules contains provisions on goods that can become dangerous, while Article 16 of the Rotterdam Rules regulates sacrificing goods in the course of a sea voyage.

the existence of act of God required for exculpation from liability, but it is considered that wind force up to 8 on the scale is not act of God.

3.2 Perils, dangers and accidents of the sea and other navigable waters

Perils from the sea are risks characteristic of the sea, and are in their occurrence exceptional by nature. In the analysis of this excepted peril most authors agree about the need to distinguish if there is difference between, on one hand, peril and distress as synonyms, and, on the other hand, accident at sea. It is thought that the Convention formulation refers to the peril with equal determined legal effects, and that their separate citing does not imply any content effect, since they are all synonyms for one and the same concept – maritime accident.

Maritime accident (peril at sea, accident at sea) in general is an event or a group of events of the same origin causing loss or damage to the ship, cargo or other property at sea or undertaking of an exceptional expense. Maritime accident leads to damage to ship or parts of her in a collision, grounding, fire, breaking and alike. Maritime accident implies only those damages that have occurred due to specific risks to navigation (action of waves, wind, storm, fog)[5]; therefore all events related to navigation are excluded, if they are not results of the perils. It is important that the point at issue is maritime accident as event characteristic of sea element, that it could not have been expected in the navigation area at a certain period of time and that the damages incurred are accidental, i.e. without fault. If a ship is stricken by accident, the ship is damaged in it, and it was seaworthy (which is proved by the carrier), i.e. she could not resist the consequences of sea element, with damage to the cargo, it is reliable evidence that it is the case of maritime accident as an excepted peril. As maritime accident, as an excepted peril, not all maritime accidents as such count, but only distress, i.e. inadvertently occurred accidents whose occurrence is uncertain and unpredictable. Although it is considered that distress at sea should be unpredictable, from a large number of examples of judicial practice results that such events have to be unrecoverable, and in proximate causation with the damage, but need not necessarily be unpredictable. Perils of the sea result from navigation accidents that are not necessarily unpredictable, but are, if the carrier wants to exculpate himself from liability, of such a nature that the carrier was not able to save the cargo carried from the harmful consequences of the events. Therefore, it is most appropriate to state that peril at sea is an unexpected event.

5. Whether an event can be characterized as peril at sea depends on the geographical position, season, intensity of the event, which means that characteristics of each individual event are assessed in dependence of the micro-location at which it occurred.

3.3 War, hostilities, armed conflicts, piracy, terrorism, riots, civil commotions

War is a set of acts of violence by which one state tries to impose its will to another state, and it is also defined as an armed clash between two or among more states, i.e. a set of violent acts undertaken by the armed forces to overcome the enemy and impose conditions of peace according to the winner's wish. It can also be perceived as an armed conflict of organized social forces aimed at reaching mutually contrary political or economic goals. Although the concept of war is determined by the international law regulations, in the current circumstances and from the aspect of international law it is difficult to define the state of war and determine reliable criteria to estimate if a state is in war or not. War as a state commences either by the formal announcement of war or by starting hostilities aiming at warfare. However, announcing war is nowadays avoided since it is by international law prohibited and proclaimed a war crime, and the liability for making war is intended to be avoided. A war ends by agreement or unilaterally, on enemy's surrender.

However, regulations of international law do not apply to commercial-law businesses. The same goes for the contract of carriage of goods by sea. That contract is of private law character and should be interpreted in compliance with the rules of property law and in their business context. Accordingly, the phenomenon of war is considered from the aspect of carrying out a contract, thus the term war implying state of war threatening property or disabling carrying out a contract, and not a state regulated by the rules of international war law. Whether a state is in war or not, a conclusion is reached logically according to the actual state of facts. The fact whether the war has been announced or not is not considered crucial, nor is the fact if a state has formally acknowledged to be at war with another state. Although the concept of war itself implies an armed conflict between states, it is not considered necessary that a party at war has all the attributes of an independent state.

The parties of the contract of carriage can, by special provisions of war clauses, provide for all the cases when, due to the state of war, they can withdraw from the contract. According to such provisions both parties are authorized to proclaim withdrawal from the contract when there is circumstance provided by the contract. Legal validity of such a contractual provision is indisputable. The parties are entitled to withdraw from the contract even when there is no obstruction in carrying out the contract, but if the fact of entry of a state into war has been actualized. The reason to use this contractual option can be exclusively commercial.

Hostilities encompass all the consequences of operations that are specific for the state of war, i.e. they imply acts of war or actions performed with the aim of warfare. It is assumed that the state of war exists and it is essential that the operations are

directed against the determined system of government in an organized way. Such actions are possible even in conditions of civil war, but the term does not imply civil commotions. The possibility of hostility being started by an individual is excluded.

An armed conflict is a conflict of armed forces in which arms have been used, i.e. armed force. Modern conventions of war (humanitarian) law instead of the term war contain the term armed conflict. By an armed conflict is not considered a border incident in the state of peace, of little significance, in which insignificant forces take part. According to the literature available, the concepts of armed conflict and war are used synonymously, therefore it is considered that there is no difference between the conceptual determination of war and armed conflict in the sense of the Rotterdam Rules.

The concept of piracy is used as a criminal case in international law or as piracy representing offence of a certain state's rules. If piracy has been performed in the territorial sea of a state, there is no piracy as international crime, but it is considered piracy according to the internal law of that state, and it can be prosecuted and punished by the coastal state only. Piracy has to be motivated by private ends or any other personal incentive, and not by any means, explicitly, by a political intent. In this very fact lies the main difference between piracy and maritime terrorism, which is primarily motivated by political intents. Article 101 of the United Nations Convention on the Law of the Sea prescribes that piracy consists of the following acts: 1. Any illegal acts of violence or detention, or any act of depredation committed for private ends by the crew or the passengers of a private ship or a private aircraft and directed: a) on the high seas, against another ship or aircraft or against persons or property on board such ship or aircraft; b) against a ship, aircraft, persons or property in a place outside the jurisdiction of any state; 2. Any act of voluntary participation in the operation of a ship or of an aircraft, with knowledge of facts making it a pirate ship or aircraft; 3. Any act of inciting or of intentionally facilitating an act described in Paragraph 1 or 2. The Hague-Visby Rules do not cite exclusively the term piracy but those acts are implied by the term acts of a public enemy. As a difference from the Hague-Visby Rules, in the Rotterdam Rules piracy is explicitly cited as an excepted peril. It is logical since piracy at sea is a contemporary peril. Recently, there has been a dramatic rise in the number of acts of piracy, therefore it is important to undoubtedly stipulate such an event as an excepted peril.

Terrorism is a threat to international safety that does not know borders and that afflicts states and population, independent of geographical or any other factors. Terrorism is said to represent a form of political fight that is conducted by violence and instilling fear. The definition by the United Nations Security Council from 2004 determines terrorism as any act performed to the goal of causing death or inflicting serious injuries to civilians in order to instil fear among population, or compel a government or international organizations to refrain from acting. Terrorism can generally be defined as use of illegal violence, or threat by violence to civil population (with no prior determination) so as to reach political, religious, ideological or other goals. Political murders, destroyed property, destructive attack of civil and military targets such as sabotage, often represent acts of terrorism. Violence that is undertaken with no political goals is not considered terrorist attack, although it instils fear. By terrorism is also intended the threat of use of force with the intent of producing political effects by provoking a state of terror in a group of persons. Acts of terrorism are not directed to targets of immediate attack, but to the social order and its values. Motivation for a terrorist act is often deeply ideological, and individuals or groups of persons believe the criminal and unacceptable act to be a just way of reaching mostly political goals, wherein democratic order and democratic values are imperilled, as well as civil liberties and, above all, right of innocent people to life.

Maritime terrorism is a more recent security threat that has seen its expansion in the past decade. Taking into consideration the volume of the world's merchant trade and vulnerability of maritime transport, it is clear that maritime terrorism causes substantial material losses. This imperils economic and financial, and indirectly also national and international security. By mastering modern technologies terrorists present threats by causing as large a number of human life losses as possible, large-scale ecological disasters and disfunctionality of the system of world maritime transport.

Riot implies an organized and overt uprise, armed revolt against the authorities with the intent to substitute them for new ones. It follows that there is riot when the participants' action is directed towards the government, i.e. the system of government. Consequently, the basic aim of the riot is political, overthrow of the existing authorities. These have to be movements of masses on a limited area for which it is enough to be spontaneous and sporadic.

It is the case of commotions in general when in a common action with instances of violence a significant number of persons participate with a common intent. Commotion implies resistance to authorities by returning force, a movement of a mass. The concept of civil commotions does not have a legal definition. Civil commotions, as a specific type of human behaviour, are positioned between revolt[6] and civil war[7]. Civil commotions imply organized acting of persons whose intent is to create chaos, and it can arise in a spontaneous or organized way. Therefore, it is

6. Revolt implies disorders in which a number of persons take part whose behaviour at a public or private place is ungovernable and vehement.
7. Civil war implies armed conflicts within the borders of a state that are not considered international war, if those conflicts acquire certain political significance and distribution wider than limited riots. Accordingly, civil war from the aspect of international law is not a war.

not necessary to prove the existence of a foreign organization that has inspired chaos. A cause of such an occurrence can be the differences in the political programme or goals, differences in ethnic, racial or religious viewpoint. Commotions differ from riots by their purpose, since the basic intent of the participants is not to dethrone authority, but their acting expresses dissatisfaction for other reasons (ethnic, racial, religious).

3.4 Quarantine restrictions, interferences or impediments created by governments, public authorities, rulers, or people including detention, arrest or seizure not attributable to the carrier or any other person for which the carrier is liable

Quarantine restriction implies hospital isolation (quarantine) to which the ship and persons coming from the areas caught by the phenomenon of dangerous epidemic diseases are submitted, or symptoms of one of the diseases have appeared among persons on board, or there are other reasons to suspect infection.

The conventional expression of impediment or obstacle caused by the government, public authorities or people comprises impediments or obstacles i.e. any violent interference into voyage or maritime venture undertaken by factual authorities in a foreign country, irrespective of whether the authorities are in relations of formal hostility with the state to which the ship belongs. This primarily refers to acts issued by any government or its organs, irrespective of the form of the acts or the form of government. It is irrelevant whether the relative act is legal, and the issuing subject does not have to be internationally acknowledged. It is considered that this exculpation peril includes embargo[8], requisition of ship[9] or cargo by declaration of bootie captured in war or at sea, and prohibition of import or export of cargo.

The conventional concept of detention, arrest or impediment, or prosecution by lawsuit is not easily defined. When it comes to lawsuits, it is considered that it has to be an extraordinary peril that the carrier could not have foreseen. However, the fact itself that the detention or arrest of the ship happened, even if it was due to the carrier's acting, does not deny the carrier his right to adduce that excepted peril. Otherwise, if the carrier was enabled to prevent such a situation by an act, and he omits to do so, then it is considered that he has no right to adduce those circumstances as an excepted peril.

8. Embargo is a general or partial prohibition of import or export, i.e. restriction of free commerce.
9. Requisition is the risk of seizure of ship by military or other authorities on the basis of powers of the state or compulsory seizure of the ship with charge.

3.5 Strikes, lockouts, stoppages or restraints of labour

The term strike in its general meaning can be defined as organized suspension from work so as to satisfy the requirements laid down to the employer. Most often strike is organized to get an increase in salary, improve work conditions and alike. However, strike can also be a result of compensation for dissatisfaction due to protests against something, or providing support, or expressing benevolence towards other workers in such acts. It follows that the nature of strike is not important as it can be economical, political or union. Strike often occurs as a kind of impediment to enforcement of contract on carriage, set up by cessation of work by workers' decision, so that in charter parties special clauses regulate the relations of parties in case of strike. Herein, it is not decisive whether the strike takes place on board ship or not. The carrier will be liable to the user of carriage services for damages caused by strike if he or his persons are guilty of strike occurrence and when they did not exert due diligence to prevent harmful consequences of the strike if it was possible.

Restraint of labour generally denotes suspension of work by the employer, it is a measure of employer's pressure on workers with whom he is usually in dispute, and the concept is also known as employer's strike. Essentially, restraints of labour as employer's countermeasure to the right to strike recognized to workers (i.e. trade unions) consists of the procedure of closing down enterprise due to labour dispute, of employer's refusal to make work assets available to workers and to pay them, in systematic employer's prohibition for a substantial number of workers to have access to their workplace with intent to reach certain goals. In carrying out a contract of carriage the measure of restraint of labour is attributed the same meaning as strike is. The carrier will be liable if he is guilty of mass restraint of labour, which is easier for the user of carriage services to prove than strike. However, the fact that the carrier as employer fired workers of his own free will does not always mean that he is personally guilty. Namely, commonly the carrier does not decide on his own whether he will lay off workers, since the decision is reached by his firm, and he has to comply with it, if he is not to subdue himself to hard material and moral sanctions.

Lockout has the same meaning as strike. By prevention to work are considered all the facts that generally or partly disable joint work operations and, thereby, ordinary carrying out carriage, and they do not have the character of strike or restraint of labour. Such impediments include economic reasons resulting from the contrary interests of employers and employees.

3.6 Fire on the ship

Fire is a chemical process due to combustion of substance and has a wider meaning than fire, because for the concept of fire on the ship it is not necessary that in the course of combustion

flame occurs, but smoke is sufficient. It is a feature of the concept of fire that it develops chaotically, namely, that it spreads beyond the place determined for fire. The cause of fire is not relevant, as it is essential that the initial cause is fire. Damages to cargo due to fire have to develop on the ship. It is not important what caused fire and where it developed, on the ship or outside (on shore, in port, and alike). Damage due to fire is not only the one incurred by combustion of cargo, i.e. direct contact with fire, but it also includes every further causal damage incurred directly by fire (e.g. harmful smoke emissions), also including all harmful consequences of its extinguishing (damages due to water, chemical fire-fighting substances, etc.). In case that the fire developed or could not be prevented or localized due to lack of required fire-fighting apparatus on board, the carrier will be liable for the consequences of fire as he omitted the basic non-derogable obligation to make the ship seaworthy.

According to the Hague-Visby Rules the carrier has the right to exculpation from liability in case of fire on the ship even if it developed by fault of his assistants or servants. It is not important whether the fire developed due to a commercial omission or due to carrying out a technical-navigational function. Such a provision of the Hague-Visby Rules undoubtedly favours the carrier, as he is liable for the damage incurred to the cargo by fire on the ship only if it is proved that he set fire by a personal act or omission.

Fire on the ship is one of few excepted perils from the Hague-Visby Rules, which has been retained in the structure of the Hamburg Rules. In the Hamburg Rules the approach has been modified of the Hague-Visby Rules to liability of the carrier for the case of fire on the ship, but they, however, do not represent a new, significant approach. It can rather be characterized as a compromise solution. Instead of the general principle of presumed guilty, in the Hamburg Rules, for a case of fire on the ship the carrier is liable according to the principle of proven guilty, which has improved his position in proving the legal basis of liability for the case of damage due to fire on the ship.[10] The Hamburg Rules exempt the carrier from this kind of liability if he can prove that the guilt for the fire cannot be attributed either to him, or to his servants. It follows that according to the Hamburg Rules the carrier is liable for the damage in case of fire both for the acts and for omissions of his servants, which is considered a good solution.

The Rotterdam Rules regulate the carrier's liability for fire on the lines of the Hamburg Rules. This has stiffened carrier's liability with regard to the Hague-Visby Rules. Although at preliminary meetings a possibility has been considered of cancelling fire on the ship from the excepted perils, due to its high importance for a number of delegations it was given up. According to the Rotterdam Rules the carrier has to prove the existence of fire and that the fire caused loss, damage or delay. It is important to emphasize that the Rotterdam Rules restrict the implementation of fire as an excepted peril only to the maritime part of the voyage and in cases when the fire developed on board. The ship has to be the one on board which the goods were either actually loaded or on which they were intended for carriage. This means, in fact, that the fire on a third unrelated craft cannot give the carrier the privilege of referring to the fire as an excepted peril. According to the Rotterdam Rules the carrier is liable for the fire on the ship caused by his servants. It follows that the intention of the composer of the Rotterdam Rules was stiffening of liability for fire as the carrier is also liable for the acts of his workers. Such a solution by the Rotterdam Rules is considered most acceptable and represents progress with regard to the conventional solution of the Hague-Visby Rules.

3.7 Latent defects not discoverable by due diligence

A latent defect of a ship is a defect or shortcoming in design, engines or equipment of the ship, which could not have been discovered by a professional using a reasonable degree of skill during regular inspection. The ship's defect is one of the features following from the features of materials themselves, but they differ from the features of natural characteristics of goods. A deficient state of the ship cannot be discovered by application of a common method. It becomes visible in the course of time, most often only after the damage has been incurred. The ship's defects, if not visible, represent an unprovided-for fact, uncertain circumstance, i.e. they cause unpredictable damage, so that the carrier can exculpate himself from such damage. It is, therefore, important to find out whether the defect on the ship is visible or is it a latent defect. A latent defect can cause loss or damage to the ship.

Ship's latent defect is related to the carrier's responsibility for the ship's conditions, i.e. his obligation to provide the user of carriage services with a seaworthy ship, because damage to the cargo can occur due to ship's unseaworthiness as a consequence of the ship's latent defect. To exculpate himself from liability, the carrier has to prove the fact of having exerted due diligence in making the ship seaworthy. It follows that the carrier is not liable for ship's latent defects. If, on the contrary, the defect is not latent, the carrier will be liable for the damage to the goods that results from such a defect, because by exerting due diligence he should have discovered it.

3.8 Act or omission of the shipper, the documentary shipper, the controlling party or any person for whose acts the shipper or the documentary shipper is liable

This excepted peril falls into the group of events or circumstances that remains outside the range of the carrier's

10. Article 5, Paragraph 4, of the Hamburg Rules regulates carrier's liability for damages caused by fire.

knowledge and predictable situations during carriage. Namely, if the carrier handled the cargo with due diligence, and the damage has occurred notwithstanding, it is decisive for the carrier to prove that the damage is in fact a consequence of the act or omission of the shipper, and he is obligated to accurately describe and cite what the omission or act of the shipper includes. This means that for the reference to this excepted peril it is decisive to prove the proximate cause between the act or omission of the shipper and the loss or damage to cargo. The carrier is not liable to the user of carriage services for the damages that he himself incurred. Such a damage is in practice mainly a consequence of indirect acts performed by the shipper, such as e.g. inadequate packing of the cargo, incomplete or false declarations on cargo, provision of inexact and incomplete information on cargo, errors in stowing cargo on board (when the act has been performed by the shipper), incompliance with the master's instructions on the method of stowing cargo, omission in informing the carrier of the dangerous character of the cargo, and alike. If the carrier proves that the damage is a consequence of an act or omission of the shipper, irrespective of his guilt, the presumption of non-liability is valid. The carrier will not be liable to prove the fact of having exerted due diligence. The shipper will be able to prove the contrary, e.g. although the shipper omitted to correctly declare the cargo, the carrier, if he had acted with due diligence, could nevertheless have avoided the damage.

In practice, cases are very rare in which the shipper, or another person authorized to work with the cargo, will cause damage by direct acting, as while the cargo is with the carrier, those persons commonly have no pecuniar abilities to do so. For their indirect acts and omissions their guilt is not essential, which is entirely reasonable. In spite of such acts or omissions of those persons, committed with or without guilt, the carrier is liable to exert due diligence to avoid damage, i.e. to diminish its harmful consequences, since in this excepted case, too, the carrier's counterparty has the right to prove his guilt or the guilt of his servants. As regards the limits to which the carrier has to exert due diligence, it is considered that the carrier's liability would be justified only in case an objection can be made of ill intent or ultimate negligence to the carrier or his servants.

3.9 Loading, handling, stowing or unloading of the goods performed pursuant to an agreement of carrier and shipper that those acts will be performed by the shipper, documentary shipper or consignee, unless the carrier or performing party has performed such an act on behalf of the shipper, documentary shipper or consignee

This is a new excepted peril prescribed by the Rotterdam Rules that was not provided for in the Hague-Visby Rules. It has been provided in the Rotterdam Rules with the intent to regulate situation following from Article 13, Paragraph 2, when it is permitted that some of the carrier's responsibilities on the basis of special agreement are carried out by the shipper, documentary shipper or receiver. This solution of the Rotterdam Rules is logical and justified. Since the contractual parties are permitted to use a special clause in the contract of carriage to agree that the business of loading, handling, stowing or unloading goods, instead of the carrier will be carried out by some other person on the side of the cargo, then it is a justified solution that the carrier is not liable for those acts, with the exception when the carrier carries out such business on behalf of that person.

3.10 Wastage in bulk or weight or any other loss or damage arising from a latent defect, quality or inherent vice of the goods

The carrier is not liable for damage to cargo for which he proves to have occurred due to wastage in bulk or weight or any other loss or damage arising from a latent defect, quality or inherent vice of the goods. It is important to emphasize that this excepted peril is not related exclusively to maritime transport but it can be applied to any branch of transport where the Rotterdam Rules are applied.

For the occurrence of damage to goods due to characteristics of the latent or inherent vice of the goods, acting of an extraordinary external cause is not necessary. The cause of damage in such cases results from the very object of carriage due to a certain quality of its. Therefore, it is logical that the carrier is not liable for such damages.

By defect of goods is understood the deviation of physical qualities of goods from their usual qualities, which can result in the loss or damage to goods. The cause of damage is an inherent vice of goods without an action of an external factor. Defects of goods can be their inherent vice or latent defects. Inherent vice of goods is a negative quality which can result in damage. It is not a common quality of goods and cannot, unless it is visible, be supposed to exist. As characteristic, natural or normal quality of goods, it results from internal quality of goods and is manifested in the course of carriage. Latent defect of goods is such a defect that during loading could not have been discovered by due diligence and control, i.e. common inspection, which does not comprise inspection by an expert. If the defect is visible, the carrier, to exculpate himself, will have to prove the existence of an inherent vice of goods. If the defect is invisible, the carrier will successfully be able to refer to exculpation only in case the counterparty is not able to prove that he has not handled goods in the manner common for the goods when there is no such defect.

Wastage in bulk or weight of the goods can also occur due to qualities of goods by which are understood the natural qualities of goods. A natural quality of goods is considered natural wastage

in bulk or weight and damage or loss that occurs due to a special quality of goods, without the action of an extraordinary external cause. The natural quality of cargo is the normal quality of goods, due to which the goods become subject to regular risks to which it is exposed during carriage. Namely, the damage occurs to goods also in the normal, regular course of the voyage exactly as the result of natural qualities of goods, not in dependence of a transport accident or other risk. This natural wastage refers to the wastage which is no greater than the normal transport ullage that is prescribed in transport, i.e. it is determined according to common norms of wastage in the carriage of a certain type of cargo. In order to prove natural wastage, it is sufficient for the carrier to prove that the wastage ranges within natural ullage, without submitting proof of any other fact.

3.11 Insufficiency or defective condition of packing or marking not performed by the carrier or on behalf of carrier

The goods carried have to be packed so that in normal circumstances they are preserved from complete or partial loss or damage, and that they do not represent a risk to the environment. Errors in packing goods can be reflected in insufficient or defective packing. The concept of insufficient or defective packing implies such a manner of packing that does not comply with the prescribed or common standards for the carriage of each type of goods in a particular branch of transport. When goods are insufficiently or defectively packed, liability of the carrier is mitigated since the goods in such packing are more easily subject to deterioration, and it is harder for the carrier to undertake measures for their preservation. If damage to goods occurs despite normal proceeding of carriage, and if it results from insufficient or defective packing, the carrier is not liable for such damage.

Insufficient or defective marking of goods can result in mixing goods, mistaken delivery, loss or damage to goods. Then, as a rule, the carrier is not considered liable. For their identification, correct handling or stowing the goods carried are marked by special marks. The marks and numbers on goods have to be clearly drawn and engraved or inscribed so as to enable fast identification of cargo, and to warn of requirement of handling with care. Most often packages or pieces are marked with markings and numbers, fire stamps are impressed, inscribed, hammered, or cardboard, plastic or metal plates are made fast to packages, they are marked by different colours, and alike.

For carrier's liability with this excepted peril, it is important whether the carrier entered into sea-carriage document the remark of inexistent or defective packing. If a clean transport document has been issued, with the remark that the cargo has been received in apparently good state and conditions, the carrier will hardly be able to refer to insufficient or defective packing.

3.12 Saving or attempting to save life at sea

By the concept of saving, the activity directed to preservation and protection of the ship, goods and persons on board from the peril that represents a threat related to sea voyage, which can result in the loss of life or goods, is generally understood. The concept of saving also implies rendering assistance. The Rotterdam Rules do not contain the definition of saving of life at sea for the application of this exculpatory reason.

Saving of life at sea is compulsory. The user of carriage services, due to undertaking the act of saving, can suffer damage. The damage can occur due to the loss or damage to cargo, or indirectly, due to deviation from route. If the carrier proves that the damage to goods has occurred due to the act of saving or attempt at saving human life at sea, he will exculpate himself from liability. With regard to saving human life at sea, no attempt at saving can as such be attributed to the guilt of the ship's master, irrespective of any risk at which saving has been attempted or carried out, except if dolus or culpa lata can be objected to him.

Although the Hamburg Rules do not know the Institute of excepted perils, according to Article 5, Paragraph 6, the carrier is not liable for damage occurring due to measures undertaken for saving of human life at sea.

3.13 Reasonable measures to save or attempt to save property at sea

With saving property at sea, it is mainly spontaneous or contractual salvage as well as compulsory, in case of collision of ships. From the term itself of the excepted peril, it follows that the carrier will be able to refer to exculpation from liability due to saving of property only in case of undertaken reasonable measures. This undoubtedly includes compulsory saving of property (that due to ships' collision), whereas for all the other situations it is necessary to take into consideration the circumstances of the relative case.

The carrier will exculpate from liability to the cargo party only in case he has undertaken reasonable measures to carry out saving or attempt at saving property at sea, i.e. in the cases in which for the vessel being saved there is a factual, immediate threatening risk, and saving has to be within the limits of essential saving.

The Hamburg Rules, in Article 5, Paragraph 6, prescribe that the carrier is exculpated from liability for damages resulting from saving property only if it is reasonable.

3.14 Reasonable measures to avoid or attempt to avoid damage to the environment

At present, there is a great peril from the pollution of human environment by harmful substances. In the contemporary process

of maritime transport a special emphasis is put on undertaking measures to protect marine environment. Marine environment pollution is determined by man's direct or indirect bringing into marine environment of substances or energy that have or can have disastrous results such as damage to living resources and marine life, threat to human health, disturbance to maritime activities, reduction in useful qualities of seawater and decreased attraction of coastal and sea environment. The negative effects to marine environment that can result from marine pollution can have far-reaching consequences for the entire environment. Therefore, the solution of the Rotterdam Rules is logical that, due to having undertaken reasonable measures to avoid or attempt to avoid damage to the environment, the carrier can use the privilege of exemption from liability.

Reasonable measures undertaken to avoid or attempt to avoid damage to the environment is a new excepted peril that is prescribed in the Rotterdam Rules. With this excepted peril it is important that the acts undertaken by the carrier have been reasonably undertaken, which is assessed from case to case.

3.15 Acts of the carrier in pursuance of the powers he has of goods that may become a danger and sacrifice of goods during the voyage by sea

The Rotterdam Rules prescribe as an excepted peril acting of the carrier with regard to the powers he has according to Articles 15 and 16. Article 15 of the Rotterdam Rules, that regulates goods that may become a danger, prescribes that the carrier can refuse to take in or load goods, and can undertake other measures that are reasonable, including unloading, destroying or rendering goods not dangerous, if the goods are, or it reasonably looks probable that during carrier's liability they will become a danger for persons, property or environment. Article 16 of the Rotterdam Rules, which regulates sacrificing goods in the course of sea voyage, prescribes that the carrier can sacrifice goods into the sea when this sacrifice is reasonably performed for general safety or to eliminate peril to human life or other property in common enterprise. Therefore, the Rotterdam Rules prescribe a new excepted peril to which the carrier can refer in case he acts according to the powers he has with regard to dangerous goods and sacrificing goods in the course of sea voyage. Such a solution is good and logical as the carrier in performing the above mentioned acts can cause damage to other cargo and, consequently, the privilege of referring to exculpation from liability that ensures him this excepted peril is justified.

4. ERROR IN NAVIGATION– EXCEPTED PERIL THAT BECOMES HISTORY

On comparing provisions prescribing excepted perils in the Hague-Visby Rules and Rotterdam Rules, it is visible that from the Rotterdam Rules a provision from the Hague-Visby Rules has been omitted, under which the carrier is exculpated from liability for loss or damage to cargo that has occurred or can be attributed to an act, undue diligence or omission of the master, crewmembers, pilot or another person in the carrier's service in the course of the voyage and conducting the ship. According to this excepted peril the carrier is liable only if there is his personal guilt. Exculpation of the carrier from liability due to error in navigation is also one of the most contested provisions of the Hague-Visby Rules. Such a form of exculpation from liability is not prescribed in any other branch of transport.[11] Error in navigation as a cause of exculpation of the carrier from liability is a traditional peculiarity of the carriage of goods by sea, which has been intensively discussed for a number of years. The position of the carrier with regard to possibilities of exculpation from liability has been significantly modified by the Hamburg Rules, and this viewpoint has also been adopted in the Rotterdam Rules.

The Rotterdam Rules abandon error in navigation as a possible cause of exculpation of the carrier from liability for damage to goods he has taken in for carriage, which is, undoubtedly, one of the most significant modifications with regard to the Hague-Visby Rules. Although in the process of laying down the Rotterdam Rules the request has repeatedly been discussed of retaining the principle of exculpation the carrier from liability for error in navigation, finally the opinion prevailed of the opponents to the right of the carrier to exculpation. Such a provision of the Rotterdam Rules represents a norm that means stiffening of the carrier's liability. According to the Rotterdam Rules, the carrier is liable also for navigational activities of his servants.

This is considered a good solution of the Rotterdam Rules. In the past, in favour of the introduction of the provision on non-liability of the carrier due to error in navigation, the nature of the carriage of goods by sea and specific navigational risks were emphasized to which the carrier, as undertaker of navigational enterprise, is subject. Although this circumstance had significant influence to the introduction of exculpation due to error in navigation, at present it is hardly acceptable as justification for retaining that institute. In the past, the ship was entirely conceded to the persons acting on behalf of the carrier, of whose acts the carrier, who was most often physically distant from the ship and the crew, did not have any control, i.e. his influence on decision-making related to the ship's navigation was absolutely impossible. Today, however, navigational risk has been greatly decreased. Due to the development of engineering and technology, especially highly developed telecommunication

11. Exculpation for error in navigation was also implemented until 1955 in air transport, when it was abolished by the Hague Protocol to Amend the Convention for the Unification of Certain Rules Relating to International Carriage by Air from 1929.

devices, and advanced nautical equipment, risks, if compared to some past times, can be more easily predicted and avoided. In any instant the carrier can be involved in all ship's navigational activities, and the persons working for him can easily contact him. It is, therefore, considered that in the contemporary conditions of carriage of goods by sea the carrier is in equal position as the ship's master and other members with regard to both their navigational and commercial activities.

5. CONCLUSIONS

Excepted perils are exceptions from the general principles of the carrier's liability. By the institute of excepted perils a whole range of cases when the carrier will not be liable for damage to goods is prescribed. For the excepted perils the carrier is liable under the principle of proven guilty, and not assumed guilty as in other cases, which for him is certainly more favourable.

The Rotterdam Rules, besides the already traditional excepted cases from the Hague-Visby Rules, have prescribed some new excepted perils. These are, primarily, acts of piracy, terrorism, loading, handling, stowing or unloading goods that according to the agreement are carried out by the cargo party, and not by the carrier, reasonable measures undertaken to avoid or attempt to avoid damage to the environment, as well as acting of the carrier relative to the powers he has with regard to dangerous goods and sacrificing goods in the course of sea voyage. An important novelty is introduced by the Rotterdam Rules related to the fire on the ship as an excepted peril. In this respect the Rotterdam Rules have stiffened liability with regard to the Hague-Visby Rules. In case of fire on the ship, carrier is liable also for the fire caused by his servants, which formerly was not the case. Such a solution of the Rotterdam Rules is considered more acceptable and represents progress with regard to the conventional solution of the Hague-Visby Rules.

The most important progress in the institute of excepted perils according to the Rotterdam Rules with regard to the Hague-Visby Rules has been made by non-inclusion of error in navigation to the list of excepted perils. In this respect the Rotterdam Rules have adopted the solution of the Hamburg Rules, i.e. contemporary conditions governing navigation at sea. Namely, engineering and technology have recently made significant advances, and the conditions in navigation cannot be compared to those existing 90 years ago. The carrier, undoubtedly, can influence all navigational activities of the ship and participate in making all key decisions related to navigation in every instant. Therefore, it is considered justified that from such cases he no longer benefits. However, non-inclusion of error in navigation into the Rotterdam Rules can be one of the main reasons that they may never enter into force, or even if they do, they will not be generally applied. Namely, this is what a number of maritime states emphasize as the major impediment in abandoning the Hague-Visby Rules and adopting the Rotterdam Rules. This is also favoured by the fact that the Rotterdam Rules in a more than four-year-long period have been ratified by only two states of the required minimum number of twenty.

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Meteorological Safety of Entering Eastern Adriatic Ports

Ružica Popović[a], Mirsad Kulović[b], Tatjana Stanivuk[c]

Traffic and sea shipping industry are perhaps the most important economic activities in modern economic and social development of the world. Basic features and the meaning of sea shipping industry, as one of the constituent parts of multimodal transport, emerge primarily from special characteristics of the sea as a transportation way.

Ports represent a great economic power; they play an essential role in the international and national economies, as well as in the global commodity exchange. They are of special importance because they are primary starting points for marine economy development. Numerous factors are relevant for the role and development of ports and port systems, and the most important ones include natural characteristics of ports, such as the depth and spatiality of the port maritime zone, shelter from winds, waves, sea currents and tides, and climate features.

KEY WORDS

~ Multimodal Contemporary Transport
~ Sea Shipping Industry
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~ Marine Meteorology
~ Climate
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~ Wind Roses

a. Meteorological and Hydrological Service, Department of Marine Meteorology, Split, Croatia

e-mail: popovic@cirus.dhz.hr

b. College for Traffic Engineering, Pan-European APEIRON University, Banja Luka, Bosnia and Herzegovina

e-mail: m.kulovic@hotmail.com

c. University of Split, Faculty of Maritime Studies, Split, Croatia

e-mail: tstanivu@pfst.hr

The recognition of the importance of meteorology for maritime activities has even changed the schooling of seamen; educational programmes have been adjusted according to WMO recommendations, ships have been equipped with the state-of-the-art meteorological and navigational devices, and once the satellites were introduced the meteorological service has reached a high level of development and forecast accuracy. Therefore, marine meteorology should not be neglected; it should be given as much importance so as to become a constituent part of the skill for choosing the best and optimal shipping route.

Marine meteorology (which includes the river meteorology as well) provides weather information to various maritime and river transportation activities. First of all, it refers to information on the state of wind and sea. Considering the importance of understanding the weather and climate of the area where a port is located, this paper provides a detailed overview of the climatological elements, including wind roses, for each of the presented ports: Rijeka, Zadar (Gaženica), Split (North Port), Ploče and Dubrovnik (Gruž).

1. INTRODUCTION

Multimodal transport, as a modern means of the transportation of goods, is a combined transport which efficiently involves almost all transport branches (means) and modern transportation technologies across the international shipping routes. Unlike conventional or unimodal transport, multimodal transport means the carriage of goods by at least two different modes of transport. It never exists as a specialised or independent mode as it represents a complex system within the international shipping environment.

Transportation of various goods, cargo and passengers by modern infrastructural and suprastructural facilities, and the multimodal operators that directly affect the safety, speed and cost-efficiency of the manipulation and transportation of cargo, represent the main participants in providing transport services in all modes of transport, including the multimodal transport.

One of the major aspects of multimodal transport is the maritime shipping and the sea ports as the departure or arrival points that handle a part of the route between the cargo's starting to final destinations. Basic features and the meaning of sea shipping industry arise primarily from the fact that the sea is a huge transportation way and that seaborne trade accounts for almost three fourths of the global trade. Croatian seaports play a significant role in the national and regional trade. Their importance is based on the favourable geographical position. The long and indented eastern Adriatic coast is home to a number of smaller and larger ports. With regard to transportation of cargo and passengers, the five largest ports include Rijeka, Zadar, Split, Ploče and Dubrovnik.

The Adriatic Sea is the northernmost arm of the Mediterranean Sea penetrating deeply into the European mainland between the long shorelines of Italy and Croatia. Therefore, the Adriatic is the part of the Mediterranean which is the closest and most accessible to Central Europe. Its eastern coast, the Croatian side of the Adriatic, is the most indented part of the sea, comprising a total of 1185 islands, islets, rocks and underwater rocks. The shore length amounts to 5835 km. The sea surface area covers 138,595 km^2, with a maximum depth of 1330 metres (southern Adriatic basin) and an exceptional water transparency up to a depth of 50 metres.

2. METEOROLOGICAL SAFETY OF NAVIGATION

In order to be safe, cost-efficient and operational in all segments, a port has to meet all requirements for unobstructed loading, unloading, embarking and disembarking, but first and foremost, it has to be safe for sailing in and out. The safety of the approaching manoeuvre is largely affected by meteorological and climatological conditions prevailing in the area. These conditions primarily imply the state of the sea and winds.

When designing and constructing any type of the vessel or port, it is obligatory to take into account relevant meteorological elements, phenomena and their side effects. It is also necessary to anticipate the (im)possibility of using the port during certain days or periods over the year, and to define the approaching routes and fairways. The wind force and direction, which are closely related to the development of heavy seas, as well as impaired visibility (fog), may be the limiting factors in the port operation processes. Therefore all branches of navigation and port development require meteorological information, as a number of meteorological phenomena have been detected due to sea accidents. When determining the position and layout of a port, it is considered as good practice to maintain the natural surroundings that decrease the adverse effects of winds and waves. Along the eastern Adriatic coast there are a number of ports that provide excellent shelter from the wind and seas coming from one direction, whereas they are poorly protected against waves and wind coming from another direction. This particularly refers to the north-easterly and south-easterly winds (bora and sirocco).

The type and size of every vessel determine its seaworthiness. The safety of navigation, anchoring and berthing is at risk when crucial meteorological conditions, which are determined as meteorological minima for ports, vessels, phases of navigation and participants in maritime traffic, are exceeded. Many of these minima have not been determined by meteorological measurements or separate analyses; instead, they rely on assessment and experience and are within the competence of the harbour master's office and/or deck officers.

Non-navigational weather conditions refer primarily to anchoring and mooring of vessels. Under these conditions the vessel and her cargo or passengers should be protected against adverse effects of meteorological and oceanological processes including gale, storm, discharge of electricity, waves, currents, high and low tides, and the like.

3. CLIMATOLOGICAL ANALYSIS

Unobstructed performance of traffic in the ports at the eastern coast of the Adriatic Sea requires, among other things, the familiarisation with the prevailing meteorological and climatological conditions in the port area. As it is necessary to meet all safety requirements for the safe operation of maritime traffic, including the meteorological ones, the analysis of climatological elements should be made for five ports at the eastern coast of the Adriatic: Rijeka, Zadar, Split, Ploče and Dubrovnik. The climatological analysis of meteorological parameters relevant for the unobstructed flow of maritime traffic reveals the statistical safety of the individual ports.

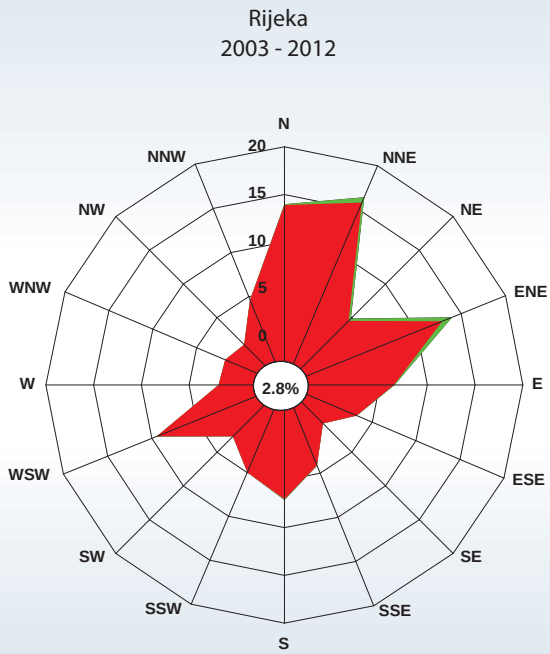
3.1 Port of Rijeka

Croatia's largest seaport is the port of Rijeka which handles, on average, over 50% of all port traffic. The analysis of climatological elements has produced the following results:

Table 1.
Number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), number of days with fog and the wind rose for the area of Rijeka, according to the data referring to the period from 2003 to 2012.

RIJEKA 2003-2012

Month	Days with strong breeze (≥ 6 Bf)	Days with gale (≥ 8 Bf)	Days with fog	Wind Rose
I	78	26	9	
II	92	25	18	
III	84	19	11	
IV	70	8	5	
V	63	6	1	
VI	50	4	-	
VII	64	8	-	
VIII	54	2	-	
IX	73	14	1	
X	80	13	2	
XI	73	16	1	
XII	95	21	7	
Total	876	162	55	
Aver.	87.6	16.2	5.5	



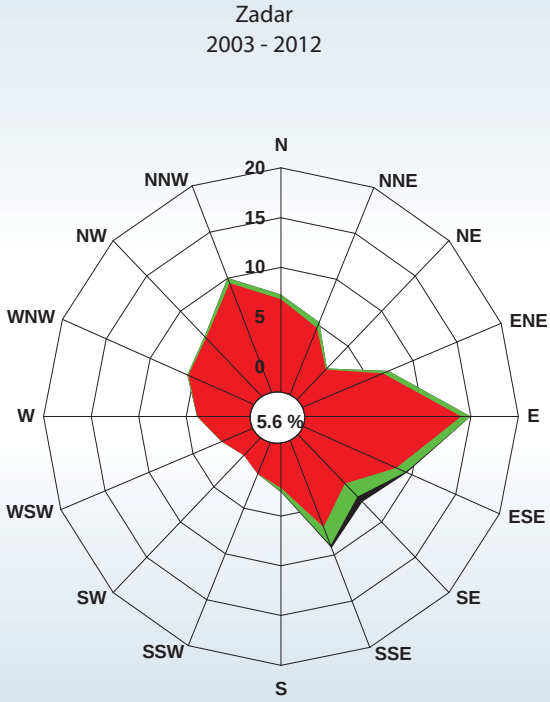
3.2 Port of Zadar

The port of Zadar handles coastal transport of passengers and cargo, warehousing and other transport-related operations.

Table 2.
Number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), number of days with fog and the wind rose for the area of Zadar, according to the data referring to the period from 2003 to 2012.

ZADAR 2003-2012

Month	Days with strong breeze (≥ 6 Bf)	Days with gale (≥ 8 Bf)	Days with fog	Wind Rose
I	15	-	2	
II	21	1	13	
III	25	0	4	
IV	23	0	6	
V	11	1	1	
VI	7	0	3	
VII	3	0	-	
VIII	8	0	1	
IX	11	1	1	
X	29	0	6	
XI	35	2	1	
XII	38	3	1	
Total	226	8	39	
Aver.	22.6	0.8	3.9	



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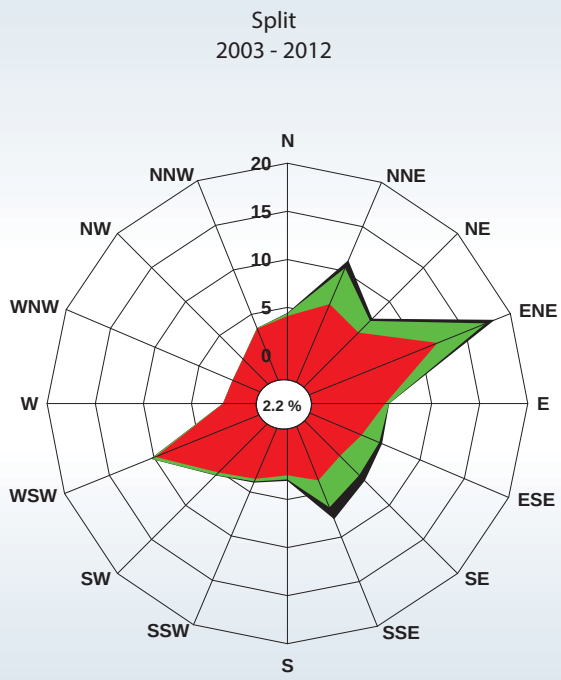
3.3 Port of Split

The port of Split features a favourable geographical and traffic position and is an intersection of several important transport corridors that connect the entire Mediterranean basin.

Table 3.
Number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), number of days with fog and the wind rose for the area of Split, according to the data referring to the period from 2003 to 2012.

SPLIT 2003-2012

Month	Days with strong breeze (≥ 6 Bf)	Days with gale (≥ 8 Bf)	Days with fog	Wind Rose
I	97	13	2	
II	105	20	3	
III	101	20	5	
IV	68	10	5	
V	49	4	-	
VI	23	2	-	
VII	27	2	1	
VIII	32	1	-	
IX	47	4	-	
X	84	5	2	
XI	104	15	2	
XII	131	23	1	
Total	868	119	21	
Aver.	86.8	11.9	2.1	



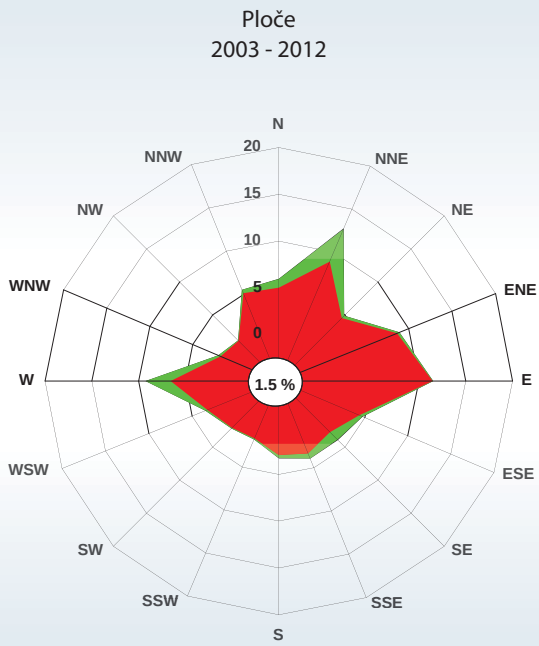
3.4 Port of Ploče

The port of Ploče plays a major role on the transit port service market and has objective capacities to attract cargo from other countries in the hinterland, which forms the basis for its successful further development.

Table 4.
Number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), number of days with fog and the wind rose for the area of Ploče, according to the data referring to the period from 2003 to 2012.

PLOČE 2003-2012

Month	Days with strong breeze (≥ 6 Bf)	Days with gale (≥ 8 Bf)	Days with fog	Wind Rose
I	32	3	3	
II	34	3	3	
III	39	5	6	
IV	22	1	2	
V	17	0	-	
VI	9	1	-	
VII	17	1	-	
VIII	10	1	-	
IX	6	0	1	
X	30	3	9	
XI	25	7	11	
XII	37	9	2	
Total	278	34	37	
Aver.	27.8	3.4	3.7	



doi: 10.7225/toms.v03.n01.006

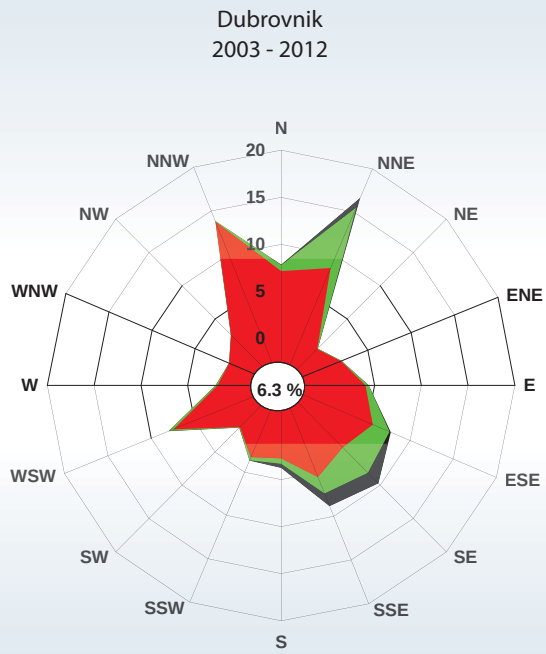
3.5 Port of Dubrovnik

The port of Dubrovnik developed at the south-eastern coast of the Adriatic Sea where the eastern Adriatic chain of islands ends and high seas begin.

Table 5.
Number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), number of days with fog and the wind rose for the area of Dubrovnik, according to the data referring to the period from 2003 to 2012.

DUBROVNIK 2003-2012

Month	Days with strong breeze (≥ 6 Bf)	Days with gale (≥ 8 Bf)	Days with fog	Wind Rose
I	148	47	-	
II	149	40	-	
III	143	43	-	
IV	109	13	3	
V	109	9	1	
VI	82	2	1	
VII	94	3	-	
VIII	93	6	-	
IX	121	17	1	
X	122	24	-	
XI	131	57	-	
XII	157	60	-	
Total	1458	321	6	
Aver.	145.8	32.1	0.6	



The analysis of the above climatological data for the period from 2003 to 2012 shows that the port of Dubrovnik has the highest number of days with strong breeze (≥ 6 Bf) and gale force wind (≥ 8 Bf), but has the least days of fog. Due to frequent winds of strong breeze and gale force there might be difficulties in handling operations inside and outside the port, therefore the port activities should be adjusted to the meteorological conditions. The port of Rijeka is in the area with the highest average of foggy days in the Adriatic, which also represents a meteorological parameter that can obstruct port operations. The tables show that the prevailing winds in the observed ports come from NNE, except in the port of Zadar where the prevailing wind blows from E. In the port of Split, strong breezes (≥ 10.7 m/s) come most frequently from ENE direction, whereas in the port of Dubrovnik they blow from NNE direction.

Maritime meteorology plays an important role in passage planning, particularly in selecting the sailing route and the departure timing. Efficient maritime transport operations depend to a large extent on the amount, quality and speed of obtaining meteorological notices, warnings and information. It is evident that the influence of weather conditions on navigation is the strongest during winter. Storms and strong winds, high seas and poor visibility directly affect the operations of approaching and entering the ports. Pronouncedly rough sea with strong wind gusts and wave pounding may shift the vessel's cargo or even damage the holds, thus affecting the vessel's trim and stability.

The results produced through this research should therefore be taken into consideration when planning the year-round exploitation of ports, in order to achieve safer navigation and performance of port operations, and to reduce costs resulting from using ports in adverse weather conditions.

4. CONCLUSION

In modern maritime trade operations it is essential to bring a vessel from one port to another safely, taking into consideration the length of the voyage and the safety of the cargo and people on board. The factors that affect the safety of the passage include the familiarisation with all relevant meteorological aspects before navigation and the follow-up of the development of weather conditions when under way. These activities are supported by well organised local and global meteorological services.

The meteorological safety of navigation in the Republic of Croatia is within the competence of Croatian Maritime Meteorological Service (CMMS) in Split which is the department of Meteorological and Hydrological Institute of Croatia. Forecasts, reports and warnings are disseminated through VHF messages via three Coast Radio Stations (CRS Rijeka, CRS Split and CRS Dubrovnik). This paper presents a detailed overview and analysis of the climatological conditions, including the wind roses, for Croatia's five largest seaports: Rijeka, Zadar, Split, Ploče and Dubrovnik. Further research into this matter is recommended in order to explore in more detail the correlation between the climatological elements and operational and safety aspects and the possible influence of climatological conditions on the economy and operational efficiency of these ports.

With regard to the overall political and economic situation across the world, it is evident that the level of development of the multimodal transportation in the Republic of Croatia is not satisfactory yet, so that there is large room and need for growth. Multimodal transport represents an important economic factor in connecting Croatia with Europe and the rest of the world. Therefore, both the short-term and long-term planning of the development of multimodal operations should be directed towards permanent enhancement of information and services in all segments of transport, including the segment of marine meteorology.

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Transition Words in Academic Writing

Bisera Plančić, Siniša Ninčević[a]

This article is concerned with transition words and their use in academic writing. These words and phrases, also called linking words or connectives, relate sentences and paragraphs to eventually create a cohesive and coherent text. In order to illustrate how to logically organize information in writing, the authors give some examples of the usage of transition words at sentence and text levels. Mastering transition words is beneficial to all users who wish to improve their writing skills. As writing is one of the most important means of communication in Maritime English, the following examples are based on the textbooks that students use in their ESP class: "English for Maritime Studies "by T.N. Blakey that provides a rich source of target material, a paragraph from "Commercial Management for Shipmasters" by Robert L. Tallac, and The New York Times article by Paul Krugman. Students are encouraged to get acquainted with the function of transition words and expressions, which will serve as a fingerpost how to avoid their misuse or overuse and logically organize thoughts and ideas. The enclosed appendix includes a list of transition words and expressions according to their functions, alongside the selected example sentences which present transition words in action. The article is aimed at improving writing skills so essential in preparing for seafaring and many other careers.

KEY WORDS
~ Transition words
~ Writing
~ Structure
~ Cohesion
~ Coherence

University of Split, Faculty of Maritime Studies, Split, Croatia
e-mail: bisera@pfst.hr

a. University of Split, Faculty of Philosophy, Split, Croatia
e-mail: sinisa.nincevic@ffst.hr

1. INTRODUCTION

Academic writing poses a great problem to both native and non-native speakers of English. This primarily refers to written assignments for academic purposes such as academic essays, dissertations, theses, journal papers, etc. The task of mastering writing skills is complex in terms of syntax, semantics, and punctuation, which is essential for sense-making units in writing. This article, however, focuses on some words and expressions which should not be randomly used in written works since they are essential in relating sentences and paragraphs in order to make text forms more coherent. As they connect sentences and paragraphs, they are referred to as connectives or linking words that are typical of texts from a specialist area, as opposed to literary texts. Namely, the usage of transitional words is indicative of what text type is in question. Transitional words frequently occur in journal articles, theses, dissertations, newspaper articles, etc. However, they are not as common in literary works. Some connectives are non-semantic words as their function is to relate sentences (e.g. conjunctions ***and, because, but***). On the other hand, others occur both at sentence and text levels as adverb phrases (***consequently, hence, however, nevertheless***) or prepositional phrases (***in other words, on the contrary, in conclusion***). These are also called textual connectives since they make sentences part of the text. Connectives can be also viewed in terms of text level as language devices or signals for sentence or clause reference between what has been said (anaphoric reference such as ***the foregoing***) and what is being said (cataphoric reference such ***as the following, as follows,*** and ***thus***), i.e., to point back or forward in written discourse. Some signals can be both anaphoric or cataphoric (***here, it***, and ***this***). In this respect, the aim of this article is to provide the ESL learners with some useful expressions indispensable for study and academic work as to the writing process. Transitional or linking words should be carefully employed in order to create a

well-structured text. This article is tailored to the needs of those who aspire to improve their text building skills. For the foregoing reasons, some transition words are presented at sentence level, based on the textbook "English for Maritime Studies" by T.N. Blakey. The enclosed appendix includes a list of transition words grouped according to their function (addition, reason or cause, consequence or result, qualification and concession, emphasis, summery, conclusion etc.). A paragraph by Robert B. Tallac and an article by Paul Krugman are, respectively, illustrative of their usage at text level.

2. COHERENCE AND COHESION IN WRITING

When writing it is very important to choose a suitable pattern in which to convey information in order to help the reader understand relationships between ideas and thoughts. When this has been achieved, it means that there are clear logical transitions and connections binding the text into a coherent unit. The lack of cohesion (connectivity) and coherence (sense-making) in writing is not only caused by disjointed thoughts and ideas but also by the misuse of transition devices such as connectives or linking words. These words assist us in connecting sentences since they are essential to sense-making units (paragraphs) in terms of getting the reader's attention in the introductory paragraph, elaborating and supporting their ideas in the main text, and restating the main idea in the concluding paragraph. When properly used, transition words will allow an unimpeded reading process, i.e., an effortless movement back or forward through different paragraphs of the text. Of course, in achieving cohesion we must not underestimate the importance of lexical coherence, which includes connective devices such as pronouns, word repetition, synonyms and antonyms, hyponymy and various other transitional markers, even punctuation marks.

The use of devices varies with genres as the same style cannot be applied to all writing assignments. Prior to the study of various types of transition words, students need to be exposed to different text structures to become familiar with organisation patterns. Some structures require information to be expressed either in chronological order, in order of importance or sequence. Sometimes the writing is about a problem that is described and a solution is proposed, or the results of something are explained, or similarities and differences are discussed. All of these require specific structure patterns that help authors to communicate their ideas.

After the students are able to identify and choose structures that complement the ideas they wish to convey, it is important that they acquire receptive and productive knowledge of transition words. All the nuances of transition words should be observed since they usually fall into more than one category, as shown in the appendix attached to this article.

As most of the linking words are not as commonly used in spoken language, it is only through writing and reading that their meaning can be properly acquired. Inaccurately used, these language devices may lead to text misinterpretation or the utter failure to understand the information conveyed by the text.

3. LINKING WORDS (based on textbook by T. N. Blakey "English for Maritime Studies")

In his textbook "English for Maritime Studies", T. N. Blakey pays great attention to linking words and their usage gradually unfolding the most important relationships within the text and its connecting parts. We can say that linking words appear throughout the book as a guiding theme. With numerous examples at sentence and text levels, he successfully explains and illustrates how to achieve cohesion and coherence in the writing process.

The author starts with the most frequent connecting words such as ***and, or, but*** and their use in many examples. Some of them are:

- *Passenger liners carry passengers **and** cargo.*

He explains that in this case and means they carry both and suggests at the same time.

- *Cargo liners are designed to carry containerized **or** conventional cargoes.*

Or here adds an alternative.

- *Merchant ships are classified by type and trade, **but** warships are classified by type and size.*

In examples with ***both…and; not only…but also***, additions to connecting words tell us to expect an addition or an alternative a little later:

- *Some ferries carry **both** passengers **and** cars.*
- *Some ferries carry **not only** passengers **but also** cars.*

Alternatives can also be linked by ***either…or; neither…nor*** (negative) as follows:

- *The sailor had **neither** money **nor** his passport.*

Unit after unit Blakey continues with the connectives in his efforts to show how their effective use may improve communication in students' writing. There are plenty of examples and exercises for students to draw examples from and use them effectively in their own sentences.

Under the heading "Logical connectives" (ii), Blakey lists ***because, therefore*** and ***however*** which express reason or cause, consequence or result, qualification and concession.

- *Passenger liners have high superstructures **because** they need a large number of decks.*

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- *Many ferries are designed to carry vehicles;* ***therefore****, they have doors at the bows or stern.*
- *Multi - deck vessels usually carry general cargo,* ***however****, some carry containers as well.*

In Unit III, textbook readers become familiar with time relaters and learn the use of sequence words to show that events happen one after the other, i.e., to show the order of facts. These words are usually put at the beginning of the process or event that they introduce. These are: *first, then, next, after that, afterwards, later, eventually, finally*. Sequence words can be used in any order except for first and finally.

- ***First****, I went to college. -* ***Then****, I went to sea.*

Then, he introduces time relaters that are used when we want to show that one event takes place at the same time as another. These events may be linked using ***when, while*** and ***as***.

- ***When*** *the ship is launched, the crowds cheer.*
- *Constant checks are made,* ***while*** *the ship is being built.*

When two actions are closely connected, ***as*** can be used instead of ***while***:

- ***As*** *the sun rose, the sky became lighter.*

When we want to show the limit of an action, we use ***until***:

- *The Chief Officer stayed on watch* ***until*** *0800.*

When one event happens at the same time as another, *when/while* can sometimes be replaced by *during*:

- ***During*** *the launching of the ship, tugs stand by ready to help.*

There are many ways to connect cause and effect. Blakey lists the following causal verbs and examples: ***causes, results in, give rise to, produces, is the cause of, is one of the causes of***.

Sea water ***causes*** corrosion. If the effect is put first the links are: ***result from, is due to, arises from, is the result of***: Corrosion ***is caused by*** sea water.

When there are clauses to be linked we may use causal verbs, ***-ing clauses***, and connecting words, such as ***consequently***:

- *The engines reduced speed,* ***causing*** *the ship to slow down.*
- *The engines reduced speed,* ***consequently*** *the ship slowed down.*
-

Purpose for doing something can be expressed by using ***so as, in order, so that***

- *The ship docked* ***in order to*** *take on fuel.*
- *He ran* ***so as*** *not to be late.*
- *The captain looked through his binoculars* ***so that*** *he could see more clearly.*

Comparisons can be made by links such as ***as…as*** and the negative ***not so/ as…as***

- *The Deck Department is* ***as*** *important* ***as*** *the Engine Department.*
- *The Atlantic Ocean is* ***not as*** *big* ***as*** *the Pacific Ocean.*

Finally, Blakey moves from sentences to paragraphs to show how the relationship between paragraphs can be made clearer by linking paragraphs and bridging sentences. He gives three basic types of paragraphs and how they may be linked:

Introductory paragraph:

- *There are a number of reasons for wear in cylinder liners. Wear may be due to friction, corrosion and abrasion.* ***Each of these*** *may have a number of causes.*

Bridging sentence:

- ***Having discussed*** *the causes of frictional wear, let us go on to consider the reasons for corrosion.*

Summary paragraph:

- ***We have shown****, then, that cylinder liner wear is caused by friction between the liner and the piston ring, by corrosion - mainly from burning heavy fuels – and by abrasion from the products of wear corrosion and combustion.*

3.1 Transition words in text examples

The selected paragraphs stand as two examples of the usage of transition words in action at text level. *The Club Correspondents* on marine insurance by Robert L. Tallac is intended for subject-area specialists. *The New Political Correctness* by Paul Krugman is an opinion piece published in The New York Times. The former is an example of the marine insurance register and the latter illustrates one of many journalism styles.

The transition words used in these texts are classified as in the enclosed appendix that contains the expressions grouped into various categories that explain their functions. Each category provides a number of transition words employed to express comparison contrast, exception, reason; also to qualify and emphasize, rephrase or add ideas. Without them our texts would read like a series of incoherent ideas. However, they should be properly used, because we can see from the texts that follow, transition words only signal the link which is usually achieved by other transition devices that are essential for proper sequence and structure of ideas.

THE CLUB CORRESPONDENTS (Robert L. Tallac: Commercial Management for Shipmasters)

*The club correspondents are probably the master's main point of contact with his P&I Club. A club will establish an extensive network of Correspondents, people with maritime-related legal or commercial skills, located in ports throughout the world. The Correspondents are not the agents (**either** of the Club **or** its managers) – (**alternative**) **but** (**contrast**) independent individuals **and** (**addition**) companies. **Indeed** (**emphasis, support**), many Correspondents are used by more than one Club. Perhaps their greatest asset is knowledge of the local maritime trade **coupled with** (**addition**) a good understanding of how Club cover works. **Although** (**contrast**) the Club Correspondents should formally be appointed and briefed by the Club, their role **too** (**addition**) is loss prevention. **In such cases** (**reference**), early involvement of expert assistance is frequently the master's wisest course of action. **However** (**contrast**), he should bear in mind that they may be independent representatives, **rather** (**contrast**) than agents. **Even** (**emphasis**) in relation to non-P&I matters, the Correspondents can be a useful source of information.*

THE NEW POLITICAL CORRECTNESS (Paul Krugman: The New York Times)

*Remember the furor over liberal political correctness? Yes, some of it was over the top — **but** (**addition**) it was mainly silly, not something that actually warped our national discussion.*

***Today, however** (**qualification**), the big threat to our discourse is right-wing political correctness, which — unlike the liberal version — has lots of power and money behind it. **And** (**addition**) the goal is very much the kind of thing Orwell tried to convey with his notion of Newspeak: to make it impossible to talk, and possibly **even** (**emphasis**) think, about ideas that challenge the established order.*

***Thus** (**consequence, result**), **even** (**emphasis**) talking about "the wealthy" brings angry denunciations; we're supposed to call them "job creators". Even (emphasis) talking about inequality is "class warfare."*

***And then** (**sequence**) there's the teaching of history. Eric Rauchway has a great post about attacks on the history curriculum in which **even** (**emphasis**) talking about "immigration and ethnicity" or "environmental history" becomes part of a left-wing conspiracy. **As** (**similarity**) he says, he'll name his new course "US History: The Awesomeness of Awesome Americans." **That** (**restatement**), **after all** (**summary**), seems to be the only safe kind of thing to say.*

***Actually** (**conclusion**), this reminds me of an essay I read a long time ago about Soviet science fiction. The author — if anyone remembers where this came from — noted that most science fiction is about one of two thoughts: "if only", or "if this goes on." **Both** (**reference**) were subversive, from the Soviet point of view: **the first** (**sequence**) implied that things could be better, **the second** (**sequence**) that there was something wrong with the way things are. **So** (**consequence, result**), stories had to be written about "if only this goes on", extolling the wonders of being wonderful Soviets. **And now** (**reference**) that's happening in America.*

4. CONCLUSION

• The lack of flow and cohesion greatly reduces the value of the most brilliant ideas and thoughts. The ideas in this article have been developed to aid students in connecting their ideas logically and to give them a required structure. Transition words are important cohesive devices that put ideas in order and express their relationship. They help students overcome the problem of structure and coherence if they know how to properly use them in their writing. Students should also be aware of various lexical ties they can use instead of conjunctions and connectives. To proceed from awareness of transition words to their receptive use (understanding) and finally production (correct writing), users ought to be motivated to read as much as possible as it is through reading that they may fully grasp the subtle differences in the meaning of various linking words and phrases, as well as find many other ways to achieve the desired cohesion of their texts. This will help them avoid the misuse and overuse of linking words, which is one of the most common style errors in non-native speakers' writing assignments.

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APPENDIX

Transition words

Addition

And, too, similarly, likewise, additionally, in addition, further, furthermore, coupled with, what is more, moreover, equally important, the following, last but not least, also, but also, apart from this, as well as, besides, nor, not only, but also.

- ***As well as*** *being a world-class hub port for containers and new vehicles, Southampton handles a wide range of other trades.*
- ***In addition /Furthermore / Moreover****, students need more time to study.*
- *We are concerned* ***not only*** *by the cost but* ***also*** *by the competition.*
- ***Besides****, I didn't really like that job.*
- ***Last but not least****, let's talk about our destination.*

Exception

Aside from, barring, except, excepting, other than, outside of, save for, exclusive of, excluding.

- ***Excluding*** *few scratches, he's fine.*
- ***Apart from/aside from*** *the final presentation, everything went well.*
- ***Barring / except for / unless there are*** *accidents, they should arrive on time. Is the total* ***exclusive of*** *service charge?*
- *They found all the lost relatives* ***save (for)*** *one.*

Time/sequence

Finally, eventually, firstly, at first, in the first place, in the second place, in the end, lastly, second, secondly, later, next, at first, first of all, first, second, quickly, currently, earlier, now, eventually, in the future, in the past, later on, to begin with, at the same time, in a moment, at the present time, from time to time, sooner or later, whenever, up to the present time, as soon as, as long as, afterward, concurrently, previously, subsequently, formerly, immediately, in the meantime, the former … the latter, to begin with, in due time, without delay, all of a sudden, at this instant, simultaneously, for now, for the time being, the next step, in time, in turn, meanwhile, when, as soon as, until, by the time, then, soon, while, earlier, afterward, in the end, in conclusion, with this in mind.

- ***Next****, I'd like to show you some pictures. Maritime law and insurance are both covered in the course.* ***The former*** *is studied in the first term and* ***the latter*** *is studied in the final term. The doctor will see her again tomorrow.* ***Meanwhile****, she should rest as much as possible. Feel free to call* ***whenever*** *you need help.*

Qualification/concession

Admittedly, in spite of, after all, naturally, all the same, nevertheless, although, no doubt, although this may be true, nonetheless, at the same time, notwithstanding, besides, only, despite, still, doubtless, under certain circumstances, even if/though, up to a point, even so, while, yet, as though, however, despite the fact that/this.

- ***However*** *you look at it, cricket is a boring game.*
- ***Despite the fact that*** *he was well known, he was a very modest man.*
- ***Although*** *tankers sail on fixed routes, they do not carry passengers.*
- *They are spending money* ***as though*** *there's no tomorrow.*
- *The salary offered was very low;* ***notwithstanding****, there were more than three hundred applications for the job.*

Contrast/ comparison

But, despite, in spite(of), even so, in contrast, in spite of this, nevertheless, on the contrary, still, whereas, yet, but, however, also, like, too, by the same token, instead, rather, similarly, as if, while, in the same way, mind you, equally, although, even though, though, as well as, both…and, compared to, in the same way, likewise, unlike, on one hand, on the other hand, on the contrary, nonetheless, in contrast, in contrast to, conversely, by comparison, in common with, in like manner, on the contrary, otherwise

- ***In spite of the*** *present recession, the long-term economic outlook is optimistic. The term "non-contiguous trade" means trade between the contiguous forty-eight States* ***on the one hand****, and Alaska, Hawaii, Puerto Rico, and the insular territories and possessions of the United States* ***on the other hand,*** *and trade from any point in Navy oilers were named for rivers, and so a distant Australian river (that just happened to have the same name as the host state) was chosen;* ***but by the same token****, USN cruisers were named for cities, not other ships. He is unlikely ever to get promoted and I know he is keen to return home at the earliest opportunity.* ***Nevertheless,*** *he will be expected to fulfil his contract and remain with us until the end of the summer.* ***Unlike*** *Europe, the USA has cheap petrol. My mother always had poor health.* ***In spite of this****, she was always cheerful.*

Cause/ Effect/consequence/ result

Accordingly, consequently, as a consequence, as a result, because, because of this, for this reason, hence, in consequence, in order to, owing to this, since, so, so that, therefore, thus so, then, therefore, on account of, then, therefore.

- *Work has become a lot more efficient **since** computers are now widely used. What is the procedure **in case** both of the engines fail?*
- *You'd better go now, **otherwise** you'll miss your bus.*
- *Leave early **so that** you come on time. Multi-deck vessels have "tween decks **because** these help stowage. Vessels are designed for many purposes and **therefore** their type and size vary considerably. She complained of stiffness in her joints. **Accordingly**, she was admitted to hospital for further tests. Her health had deteriorated significantly. **As a result/ On account of this/ for this reason**, she decided it would be best to retire. The company are expanding. Therefore / So / Consequently / As a result, they are taking on extra staff. They are learning English in order that they can study in Australia.*

Exemplifying/illustration

For example, as an example, for instance, such as, thus, as follows, namely, especially, including, in this case, particularly, specifically, in this way, for one thing, in other words, as an illustration, to exemplify, markedly, chiefly, in particular, illustrated with /by, as revealed by.

- *Exams, **such as** final term exams, are very important. **For example**, the government has only recently decided to raise taxes. **In this way,** they hope to create new jobs. This is not good, **particularly** in the areas of leadership and communication. Southampton handles a wide range of other trades **including** cruise ships, grain and fruit and fresh produce, liquid bulks and project cargoes.*

Generalisation

As a rule, for the most part, generally, in general, normally, on the whole, in most cases, usually, as usual, broadly speaking, to some extent, mostly, above all, chiefly, essentially, largely, primarily, generally speaking, broadly speaking, ordinarily, by and large, to a great extent, apart from, except for.

- ***Essentially**, what you are suggesting is that we should make changes in our policy. **Broadly speaking**, I agree with what's just been said. **By and large/Generally speaking/On the whole**, jobs traditionally done by women are paid at a lower rate than those traditionally done by men.*

Restatement/ reformulation/ clarification/ repetition

To put it differently, in other words, once more, again and again, over and over, to repeat, as stated, to retell, after all, as one might expect, clearly, it goes without saying, naturally, obviously, of course, surely, namely, that is, i.e., that is to say, in short, in brief, all in all, again, altogether, in fact, in particular, in simpler terms, to review, to rephrase it, to paraphrase, to reconsider, to clarify, to explain, to outline, to summarize, in essence, or rather, this means, to be more precise, to put it another way, in a sense.

- *The worldwide web, **that is**, the Internet is a valuable research tool. I don't **altogether** agree with them. We need to concentrate on our target examinees, **namely** students aged between 19 and 21. Do you have the right work experience and skills? **In other words,** can you do the job? What he said, **in essence,** was that he can't support our actions and will resign.*

Attitude

Admittedly, certainly, fortunately, luckily, oddly enough, strangely enough, undoubtedly, unfortunately.

- ***Admittedly**, I should have done more and filed a complaint in this legal matter. It is **undoubtedly** the most harrowing documentary I have ever seen. **Oddly enough(strangely enough),** NASA officials failed to regard the warning signs of imminent danger, which eventually led to the disintegration of the U.S. space shuttle Columbia.*
- ***Luckily**, all the passengers were evacuated from the sinking vessel.*

Reference

Mainly, particularly, in particular, as follows, mostly, chiefly, namely, for instance, notably, for example, or, in other words, such as, including, that is.

- *We are concerned about many aspects of her life – her health, **mainly**.*
- *Organise the text **as follows** – introduction, body text, and conclusion.*
- *Maritime safety issues have been addressed, **in particular** for the large passenger ships now being built.*
- *Attracting investors, **most notably** well-reputed financial houses, is essential for a country's economy.*
- *The island of Hvar **chiefly** attracts upscale tourists.*
- *It is important to consider all the factors, **including** the weather. The sinking of the Titanic is, **for instance**, one of the most infamous accidents in history.*

Summary/ conclusion

Finally, briefly, in brief, in conclusion, in short, overall, so, then, to conclude, to sum up, after all, all in all, all (things) considered, therefore, by and large, in any case, in any event (at all events), in fact, usually, on the whole, altogether, in general, at last, consequently, lastly, thus, as a consequence, in either case, in closing, in sum, to summarise, in summary, in essence, in a nutshell, in the final analysis, in the long run, on balance, ordinarily, as can be seen, generally speaking, as shown above, given these points, as has been noted, in a word, in my opinion, for the most part, obviously, ultimately, definitely.

- ***In any event**, she did try to set aside some money every month. **To sum up**, the situation has improved since the last inspection. **Briefly**, the argument was caused by his unwillingness to pay for services. **Consequently/As a consequence**, they eat too much junk food. **Ultimately**, she'll have to make the decision herself.*

Purpose/ condition

In that case, then to, so, in order to, so as to, in case, provided that, providing, given that, unless, only / even if, so that, owing to, in as much as, as long as.

- *I would prefer not to share a room **unless** I have to. You should take an umbrella **in case** it rains. We turned on all the lights **so as to** see well. He behaved like a gentleman **in order to** impress his hosts. **In the event that** he doesn't call by noon, we'll have to leave without him. I would like to reserve a place, **provided that** the safety of the trip can be guaranteed. You can come to work any time **as long as/ provided (that)/providing** you complete everything you have to do.*

Emphasis

Especially, even, in detail, mainly, notably, above all, particularly, singularly, with attention to, chiefly, in particular, significantly, undoubtedly, indeed, obviously, generally, it should be noted, admittedly, in fact, clearly, importantly, of major interest, to culminate, in truth, the climax of, to add to that, without question, unquestionably, as a result.

- ***Admittedly**, it is rather expensive but you need it so much. **It should be noted** that this article examines only written communication. There is **undoubtedly** a great deal of truth in what you've been telling us. They chose a **singularly** inappropriate moment to discuss the issue of money. It was **unquestionably** something that had to be done.*

Inversion for emphasis

Never, nowhere, not for one minute, not since, not until, never gain, rarely, seldom, hardly, no sooner, not only, at no time, in no way, on no account, should, had, were.

- ***Had** I known they were in town, I would have phoned them.*
- ***Never** have I seen such a huge place. **Only** after years of practice could I perform the manoeuvre myself. **Rarely** do you meet a man of such integrity. **No sooner** had they secured this ship than they spotted a second French vessel.*

CONTRIBUTION

News from IMO
Maritime heritage
News
Pjesma / Poem
Guidelines

CONTRIBUTION

News from IMO

Tatjana Krilić

The paper presents current work of selected IMO bodies in the period preceding the publication of this issue of ToMS. The outcome of 28th session of the Assembly in relation to safety and environment protection has been covered, aiming at informing seafarers and shipping industry at large on the decisions taken, as well as on the IMO instruments and/or their amendments that have entered into force.

KEY WORDS
~ IMO
~ Safety
~ Environment protection

International Maritime Organization, 4 Albert Embankment, London, SE1 7SR
e-mail: tkrilic@imo.org

INTRODUCTION

IMO Secretary-General Koji Sekimizu has launched this year's World Maritime Day theme, "IMO Conventions: effective implementation", expressing the hope that the year would see genuine progress towards effective and global implementation of all IMO conventions and stating that the theme provided an opportunity to shine a spotlight on those IMO treaty instruments which have not yet entered into force, as well as wider and more effective implementation of measures already agreed or in place, "because an IMO convention is only worthwhile and meaningful if it is effectively and universally implemented," Mr. Sekimizu said.

Treaties still to enter into force include the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004; the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009; the Nairobi International Convention on the Removal of Wrecks, 2007; the 2010 Protocol to the International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS); and the Cape Town Agreement of 2012 on the Implementation of the Provisions of the 1993 Protocol relating to the Torremolinos International Convention for the Safety of Fishing Vessels.

Mr. Sekimizu noted that implementation of IMO measures already in place was, ultimately, the responsibility of the Member States and the industry, while the forthcoming mandatory audit scheme for Member States would be an important tool for assessing Member States' performance in meeting their obligations and responsibilities as flag, port and coastal States under the relevant IMO treaties. The Organization and the Secretariat also had a role to play, specifically through IMO's extensive technical cooperation programme.

28th session of the IMO Assembly (A 28)

The Assembly, IMO's highest governing body, met at the Organization's London Headquarters for its 28th session from 25 November to 4 December 2013. The selected decisions have been presented in this review, whilst complete information is available to the public on the Organization's IMODOCS website (http://docs.imo.org/).

The Assembly, which normally meets once every two years in regular session, is responsible for approving the work programme, voting the budget and determining the financial arrangements of the Organization. It also elects the Organization's 40-Member Council.

IMO Member State audit scheme

The Assembly adopted key resolutions and amendments relating to the Organization's mandatory audit scheme. The Assembly adopted the Framework and Procedures for the IMO Member State Audit Scheme (resolution A.1067(28)); a resolution on transitional arrangements from the voluntary to the mandatory scheme (resolution A.1068(28)); the IMO Instruments Implementation (III) Code (resolution A.1070(28)), which provides a global audit standard to enable States to meet their obligations as flag, port and/or coastal States; and the 2013 non-exhaustive list of obligations under instruments relevant to the III Code (resolution A.1077(28)).

The Assembly also adopted amendments to the International Convention on Load Lines, 1966; the International Convention on Tonnage Measurement of Ships, 1969; and the Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended, to make the use of the III Code mandatory in auditing Member States to determine how they give full and complete effect to the provisions of those Conventions to which they are party.

Following this, the Organization's Marine Environment Protection Committee, at its 66th session (MEPC 66), held from 31 March to 4 April 2014, adopted similar amendments to Annexes I to VI to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, and its 1997 Protocol, as amended. Similar amendments are expected to be considered with a view to adoption by the Maritime Safety Committee, at its 93rd session (MSC 93), to be held in May 2014, to the International Convention for the Safety of Life at Sea, 1974, as amended; the Protocol of 1988 relating to the International Convention on Load Lines, 1966; and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended.

The adoption of the various amendments and their entry into force will form the basis for an institutionalized audit scheme, under which audits are expected to commence in 2016, once amendments to mandatory instruments have entered into force.

Adoption of resolutions

The Assembly adopted a number of resolutions submitted by the various IMO Committees and by the Council's 27th Extraordinary Session. The topics covered by such resolutions include inter alia:

- Prevention and suppression of piracy, armed robbery against ships and illicit maritime activity in the Gulf of Guinea;
- Revised guidelines on the implementation of the International Safety Management (ISM) Code by Administrations;
- Revised guidelines for a structure of an integrated system of contingency planning for shipboard emergencies;
- Guidelines to assist investigators in the implementation of the Casualty Investigation Code;
- Fair treatment of crew members in respect of shore leave and access to shore-side facilities;
- Recommendations for the training and certification of personnel on mobile offshore units (MOUs);
- Application of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004;
- Entry into force and implementation of the 2012 Cape Town Agreement on the Implementation of the Provisions of the Torremolinos Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977;
- Implementation of the Convention on Facilitation of International Maritime Traffic (FAL);
- Voluntary application of the IMO Ship Identification Number Scheme to fishing vessels of 100 gross tons and above;
- Amendments to the survey guidelines under the Harmonized System of Survey and Certification (HSSC);
- Guidelines for the designation of special areas under MARPOL;
- Amendments to the International Convention on Load Lines, 1966 (1966 LL Convention), to shift the Winter Seasonal Zone off the southern tip of Africa further southward by 50 miles;
- Recommendation on the use of adequately qualified deep-sea pilots in the North Sea, English Channel and Skagerrak; and in the Baltic Sea; and
- Recommendation on the use of national tonnage in applying international conventions.

Amendments to IMO instruments that have entered into force on 1 January 2014

2012 May SOLAS amendments - resolution MSC.325(90)

- amendment to SOLAS regulation II-1/8-1, to introduce a mandatory requirement for new passenger ships for either onboard stability computers or shore-based support, for the purpose of providing operational information to the Master for safe return to port after a flooding casualty;
- amendment to SOLAS regulation III/20.11.2 regarding the testing of free-fall lifeboats, to require that the operational testing of free-fall lifeboat release systems shall be performed either by free-fall launch with only the operating crew on board or by a simulated launching;
- amendment to SOLAS chapter V to add a new regulation V/14 on ships' manning, to require Administrations, for every ship, to establish appropriate minimum safe manning levels following a transparent procedure, taking into account the guidance adopted by IMO (Assembly resolution A.1047(27) on Principles of minimum safe manning); and issue an appropriate minimum safe manning document or equivalent as evidence of the minimum safe manning considered necessary;
- amendment to SOLAS chapter VI to add a new regulation VI/5-2, to prohibit the blending of bulk liquid cargoes during the sea voyage and to prohibit production processes on board ships;
- amendment to SOLAS chapter VII to replace regulation 4 on documents, covering transport information relating to the carriage of dangerous goods in packaged form and the container/vehicle packing certificate; and
- amendment to SOLAS regulation XI-1/2 on enhanced surveys, to make mandatory the International Code on the Enhanced Programme of Inspections during Surveys of Bulk Carriers and Oil Tankers, 2011 (2011 ESP Code, resolution A.1049(27)).

2010 October MARPOL amendments - resolution MEPC.193(61)

- Revised MARPOL Annex III Regulations for the prevention of pollution by harmful substances carried by sea in packaged form, to include changes to the Annex to coincide with the next update of the mandatory International Maritime Dangerous Goods (IMDG) Code, specifying that goods should be shipped in accordance with relevant provisions.
- United States Caribbean ECA now effective - resolution MEPC.202(62)
- The United States Caribbean Sea Emission Control Area (SO_x, NO_x and PM) came into effect, under MARPOL Annex VI, regulation 14, bringing in stricter controls on emissions of sulphur oxide (SO_x), nitrogen oxide (NO_x) and particulate matter for ships trading in certain waters adjacent to the coasts of Puerto Rico and the United States Virgin Islands. Coordinates for the Caribbean Sea ECA can be found in resolution MEPC.202(62). There are now four designated ECAs in effect globally: the United States Caribbean Sea ECA and the North American ECA; and the sulphur oxide ECAs in the Baltic Sea area and the North Sea area.
- Winter Seasonal Zone moved south under amendments to LL Protocol – resolution MSC.329(90)
- Amendments to regulation 47 of the 1988 Protocol to the International Convention on Load Lines (LL), 1966 to shift the Winter Seasonal Zone off the southern tip of Africa further southward by 50 miles.

The Gentle Giant of the Adriatic

Marijan Žuvić

The fact that the best known vessel in the recent history of navigation on the eastern coast of the Adriatic is a humble floating crane must be a surprise in today's world of incredibly big container ships, towering floating hotels and all kinds of futuristic shaped vessels. But the glory of Veli Jože is immortal, kept in stories and memories by generations of the Adriatic islanders and seafarers. Certainly, it is worth sharing with the readership of ToMS.

Many years ago this author discussed the phenomenon of Veli Jože with an old captain in San Pedro, California. Very quickly we came to the conclusion that the Adriatic motto 'Veli Jože is coming' (Stiže Veli Jože, in Croatian) is the same as the well-known American cry of relief 'Cavalry to the rescue'. In the movies, cavalry never failed to save the troops or settlers under siege, and in the Adriatic Veli Jože never betrayed ships or lives.

But who is this Veli Jože? It is the main character of the novel written back in 1908 by one of the greatest Croatian literates, Vladimir Nazor. He is a good giant living in the woods of Istria, symbol of strength as well as of Croatian identity of the peninsula. In English, he would be named Big Joe.

Veli Jože spent 54 years on active duty, and in ship's logs there are reports on hundreds of operations: rescuing of ships and lives, removing wrecks, lifting heavy loads, building ports and bridges... There is hardly another floating crane in the world with such an impressive biography.

The first lines of such an extraordinary ship's chronicle were written in the last months of 1948. The Government of Yugoslavia decided to order a state-of-the-art floating crane to facilitate cleaning of the Adriatic eastern coast. During the Second World War these pristine shores and all major ports became a graveyard of ships: from small coastal steamers to the giant Rex, a proud holder of the Blue Riband of the Atlantic. Cleaning of ports and sea lanes was of the utmost importance for the post-war renewal of Yugoslavia.

In 1947 the state-owned Salvage & Towage Enterprise, best known by the abbreviation Brodospas, was established at Sušak (today a part of Rijeka) but with scarce and fully inadequate equipment for such a challenging task. After a lot of discussion the best decision was made: Yugoslavia will order an especially capable floating crane, the strongest in the Mediterranean. And the shipyard of choice was Rotterdamsche Droogdok Maatschappij N.V. in the Netherlands. Why RDM?

The shipyard, founded in 1902, had almost half a century long tradition and a great experience in building floating cranes. In 1910 RDM built Bison, its first floating crane with lifting capacity of 55 tons. In 1916 a crane Zwaan was built and three years later Moa was delivered. But that was not the only reason for choosing Rotterdamsche Droogdok Maatschappij.

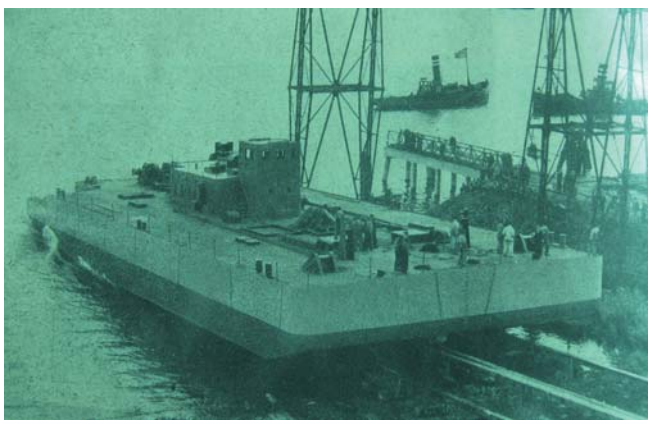

Figure 1.
Rotterdam 1949 – the moment of launching.

Maritime journalist and publicist
E mail: marijan.zuvic@st.t-com.hr

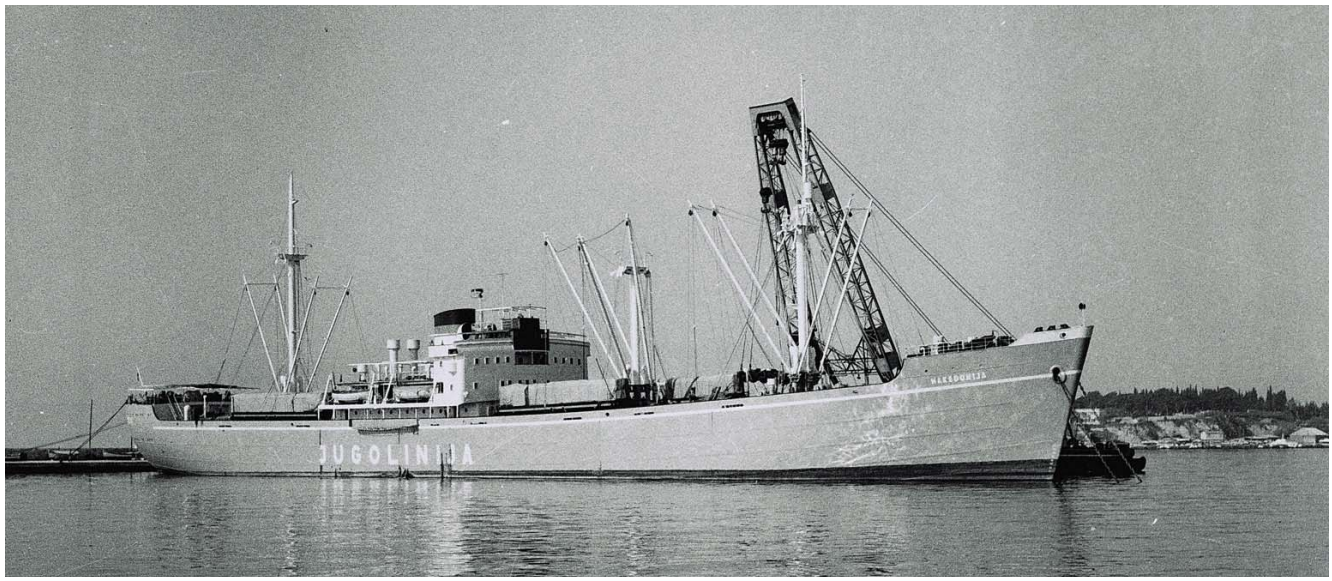

Figure 2.
Born together –Veli Jože and Makedonija.

In the war-torn Europe one of the most important issues was the restoration of merchant fleets of Allied countries devastated during the war. Almost all German merchant ships were seized and, as the war reparations, allocated to various countries by the Inter-Allied Reparation Agency (IARA). So, in 1947 IARA allocated to Yugoslavia German motorship Viktoria, almost brand new, but a war casualty.

She was built in 1941 by the famous Howaldtswerke shipyard in Hamburg and towed to Kiel for completion. But she was seriously damaged by Allied aircraft attacks during 1944. After being allocated to Yugoslavia Viktoria was towed to Rotterdamsche Droogdok Maatschappij. And while she was still under repairs, an annex to the contract was signed: building of a floating crane.

That was quite a big vessel: length overall 41.18 metres, length between perpendiculars 40 metres, breadth 18.02 metres, depth 3.8 metres. The crane arm was 32 meters in length. But the most important and the most impressive was the maximum lifting capacity of 350 tons. She was a sheer-leg type, meaning that the crane is fixed on the pontoon and can't rotate. The crane's winches were powered by three electric generators of a total of 1,000 HP i.e. 735 kW.

The basis of the crane was a steel pontoon divided into 17 spaces by two longitudinal and four transversal bulkheads. In the forward section there were stores for wire ropes, shackles and other gear, in the mid-section there was crew accommodation and aft there were the engine-room and ballast tanks. On the deck there was a superstructure with the bridge and wheelhouse,

Figure 3.
In the arms of a giant – the Italian ship Fiorella.

ship's office, galley and messroom as well as the cabins for the master and chief engineer.

Unlike the majority of floating cranes, Veli Jože was self-propelled with a somewhat odd propulsion. The Dutch shipbuilders' choice was – outboard engines! Such propulsion, although popular in America, was extremely rare in Europe. So Veli Jože was one of the first outboard-engined European vessels. Like numerous other novelties of the 1940's, that propulsion was a battlefield invention.

In 1940 the United States Navy approached engine builders Murray & Tregurtha Inc. of Boston, Massachusetts asking them to develop outboard propulsion for military barges. Murray & Tregurtha was a highly respected company, established in 1885 as the steam engine builder and specialized for diesel engines since 1905. The Marine Outboard Drive Propulsion System (MODPS) was presented to the Navy in 1941. It proved a complete success, both on trials and later on the battlefields, especially in the Pacific. During the war several thousands of barges were built across America and powered by MODPS.

Sparked with such a huge success Murray & Tregurtha designed the civil version of the System, and in 1947 trade-marked it as the Harbormaster. Such propulsion, proved heavy-duty in the Pacific battles, was chosen for Veli Jože. So, the construction of the giant crane commenced. In the general appearance it was a modern version of the floating crane Moa built by Rotterdamsche Droogdok back in 1919. Officially, it was RDM's newbuilding number 276 and the Yugoslav authorities chose the name Heroj (Hero).

The crane's pontoon was finished at the end of 1949 and then towed for the completion to the RDM's subsidiary company Nieuwe Waterweg Scheepsbouw Maatschappij at Schiedam. The superstructure, mighty cranes, winches and other deck equipment emerged there and a vessel was delivered in September 1950. But the name Heroj was overpainted, and the new name emerged on the wheel-house –Veli Jože. Shortly prior to delivery it was decided to name the crane in honour of the mythic Croatian giant.

Towed by two powerful tugs of the Dutch company Smit Salvage, Veli Jože arrived in Dubrovnik on October 31, 1950. And only few weeks later she started never-ending work of cleaning the Adriatic. Certainly, the most famous was her role in breaking up of Rex, the giant Italian transatlantic. Indeed she was a big

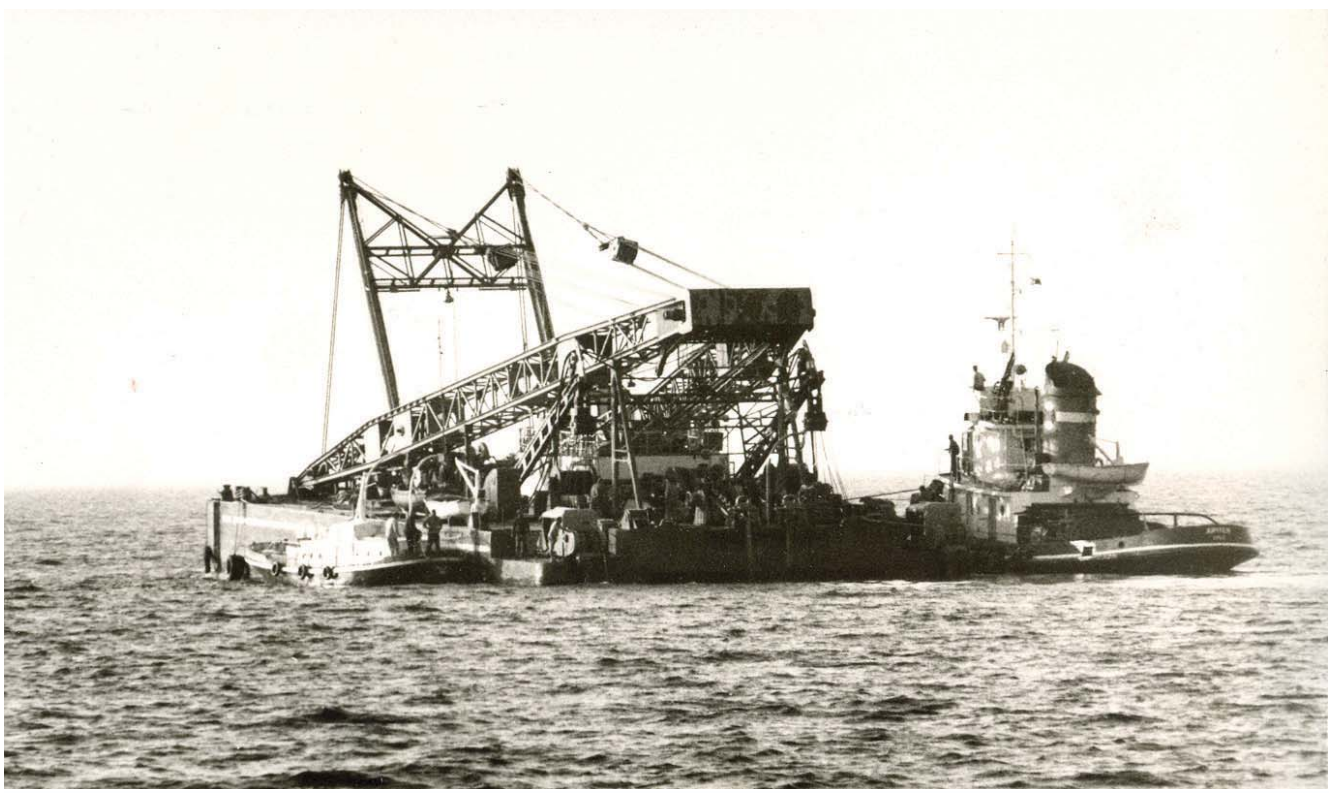

Figure 4.
Always on the move in 54 years.

Figure 5.
Impressive bird's eye perspective.

ship: length overall 268.2 metres, breadth 29.6 metres, measured on 51.000 GRT. She was completed in 1932 by Ansaldo shipyard at Sestri Ponente near Genoa. Powered by twin gas turbines Rex captured The Blue Riband in August 1933 after crossing the Atlantic with an average speed of 28.92 knots.

The winds of war struck Rex as late as in September 1944 when the British aircrafts set her on fire in the Gulf of Trieste. She sank in shallow water near port of Koper / Capodistria. Such a big ship could not be salvaged, and breaking up started few years after the war. But only the arrival of Veli Jože facilitated the enormous task. Finally, more than 20.000 tons of steel were recovered from Rex.

The last big operation of Veli Jože was the salvage of Italian liquefied petroleum gas tanker Brigitta Montanari loaded with 1,324 tons of dangerous vinyl chloride monomer (VCM). Once again she provided a great relief for the Adriatic. The gloomy story, that lasted for more than four years, began on November 14, 1984 when the ill-fated tanker capsized and sank in only two

Figure 6.
Attracting crowd – raising of tug Zrmanja at Split.

Figure 7.
Rare moments of giant's rest.

minutes while sailing near Murter Island. Of the 12 crew members 3 were lost and 9 were rescued by Grgo Carev, native of Murter Island, former master of Veli Jože.

That was the world's first sinking of ship carrying VCM and nobody had any experience in conducting such a tricky salvage. Furthermore, Brigitta Montanari was lying at the depth of 82 meters. In August 1985 the Yugoslav authorities decided to raise the wreck, considering that such a large quantity of toxic VCM was a catastrophic threat to the people and environment. The work commenced in September, but had been abruptly stopped after two Navy divers lost their lives and a third was seriously wounded. Almost three years passed before a new attempt was made. Finally, in May 1988 Veli Jože raised Brigitta Montanari to the depth of 30 meters and she was towed underwater to Remetić Cove on Kaprije Island.

There the dangerous cargo was pumped out to the Italian LPG carrier Capo Verde and Veli Jože concluded the story. The

Figure 8.
Deneb emerges from the bottom.

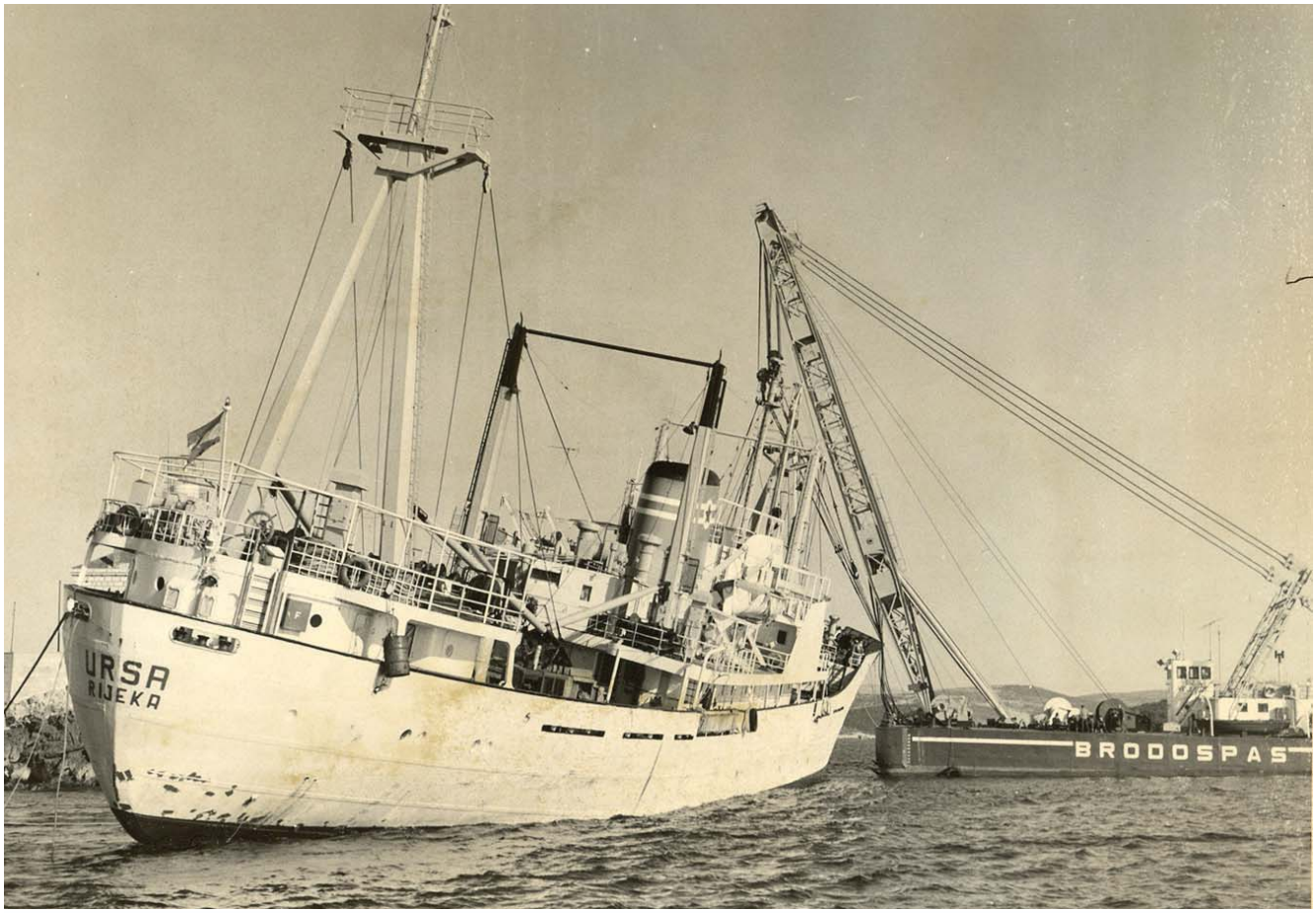

Figure 9.
Salvaging Ursa.

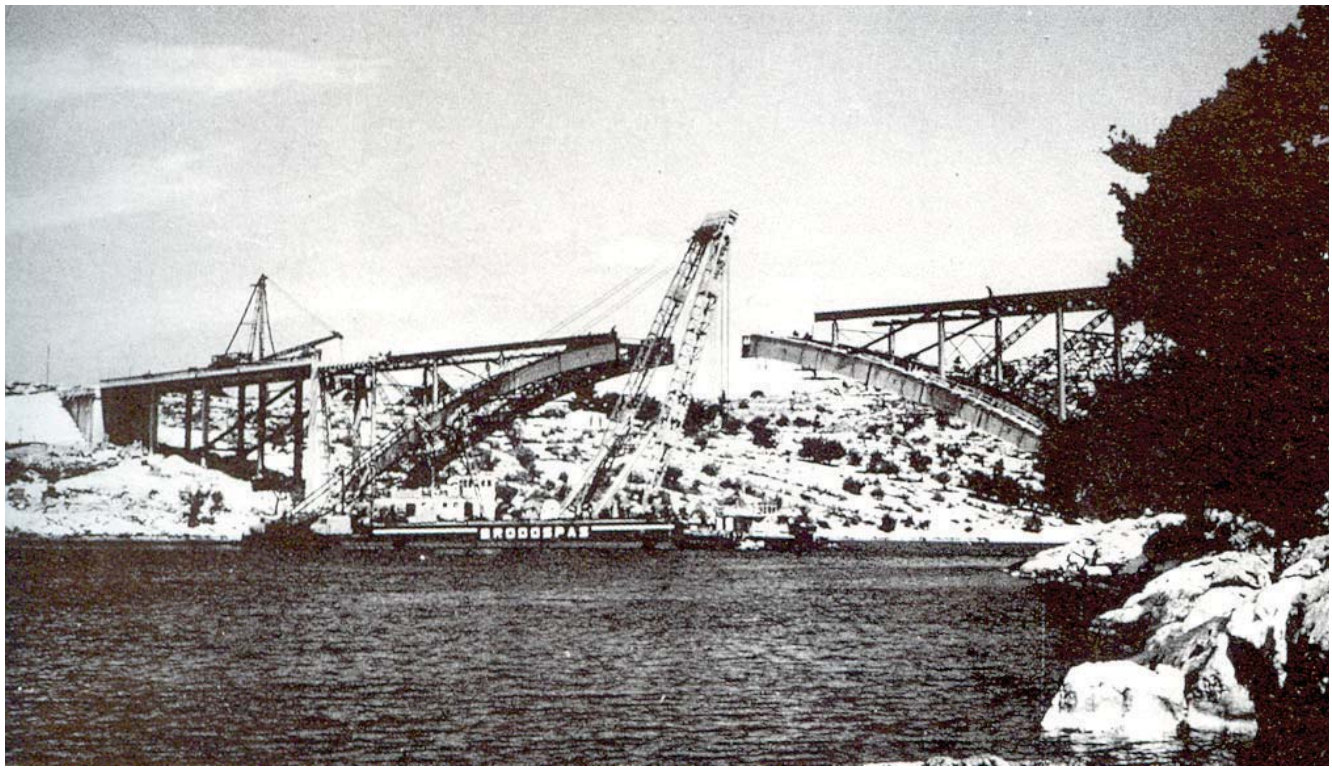

Figure 10.
The bridge builder – in action on the Šibenik bridge.

mighty crane pulled out the empty tanker to the surface and Brigitta Montanari was towed to her final resting place, the shipbreaking yard at Sveti Kajo.

And, what happened between Rex and Brigitta Montanari? Thanks to the motto 'Help anyone and anywhere', the floating crane became a legend for the people in the Adriatic. There was no difference between salvaging an ocean liner and a humble wooden coaster. The best example is Karmen. She was a small vessel, only 25 metres in length, built back in 1933. On January 4, 1966, while sailing from Omiš to Makarska fully laden with sand, she was caught by the gale force northerly wind (bora). The helpless ship sank near the island of Brač at the depth of 77 meters. Two of her crew perished.

Who could expect that the 33-year-old wooden ship loaded with a worthless cargo of sand will be raised from such a depth by the mightiest crane in the Mediterranean? Certainly no one! But there was Veli Jože and the diver team of Brodospas salvage. Working at the biggest depth theretofore they raised Karmen and transported her to the shipyard at Sumartin for repairs. Another reason for spreading the fame of a gentle giant!

Veli Jože also played an uncommon role in the double salvage of the same ship. On May 30, 1956 the Italian cargoship Antonio Altiero was passing through the Kornati Archipelago on voyage from Oran to Trieste with a cargo of scrap steel. She ran aground on the islet of Oključ and sank in a short time due to the serious damages sustained. Raised by Veli Jože she was towed to Punat shipyard and repaired. In February 1959 the same ship, now under Yugoslav flag and name Lun, sank near Biograd after being struck by the steamship Pašman in dense fog. Again she was raised by Veli Jože and towed to Punat for repairs!

So beloved in the Adriatic, the crane soon became famous in foreign waters. As early as in 1954 Veli Jože sailed to Greece to help cleaning the Ionian Sea of war victims. In 1954 and 1955 9 sunken ships were raised. But a year later the world glory for a crane lied in the warm waters of the Suez Canal! In July 1956 the Egyptian Government nationalized the Canal and three months later the United Kingdom, France and Israel attacked Egypt. The heavy fighting during the so-called Tripartite Aggression resulted in the large number of sunken ships in the Suez Canal. So the fast cleaning of the world's most important waterway was of the utmost importance.

Shortly after the fighting ceased, tender for the removal of all the wrecks was invited by the United Nations. The best offer came from the seven-member consortium led by Dutch company

Smit Salvage and Danish Svitzer. Brodospas Salvage & Towage Co. was a member of the consortium and Veli Jože played the leading role. Works in the Canal started on November 27, 1956 and were completed in May 1957. Acting alone Veli Jože raised 90-ton floating crane, Dredger No.6 of 1,200 GRT, Dredger No.23 of 1,600 GRT, Dredger No.19 of 1,900 GRT, pilot vessel Le Hardi and, finally, tug Hercules of 1,200 GRT. Working together with Dutch floating cranes Condor and Arend she raised 150-ton crane and a giant suction dredger Louis Perrier. For that outstanding achievement Veli Jože was especially awarded by the United Nations.

But the Suez job was not finished yet. On the tender invited by Suez Canal Authority Brodospas won again and Veli Jože successfully raised a brand new dredger Paul Solente. That huge vessels, 112 metres in length, was sunk in Port Said, out of the Canal. It is very interesting to know that Veli Jože played the very same role after the Arab-Israeli War of 1967, well-known as the Yom Kippur War. In 1968 she spent many months in Alexandria clearing the port of sunken ships.

After the Suez success Veli Jože became welcome world-wide. Among numerous operations the best known is salvage of Italian tanker Luisa at the Iranian port of Bandar Mashur in the Persian Gulf. In June 1965 the tanker was struck by a terrifying explosion and 30 crew members were killed. Burning ship, 200 meters in length, drifted and finally sank just amidst narrow seaway leading to the oil terminal. Three months later Veli Jože was on route to the Persian Gulf having the main role in an extremely dangerous and demanding operation. Until the spring of 1966 Veli Jože transferred to the shore more than 10,000 tons of steel from the wreck of Luise.

From the Persian Gulf she sailed as far as Cartagena in the western Mediterranean. From an American ship she unloaded 300-ton nuclear reactor for the very first Spanish nuclear power plant Jose Cabrera at Almonacid de Zorita. In 1987 at Alexandria Veli Jože unloaded 326-ton generator for a nuclear plant near Cairo. Back in 1969 the crane was on duty in Italy, first to build the breakwater at port of Castellammare di Stabia, and later to

Figure 11.
Dangerous task – salvaging of Brigitta Montanari.

Figure 12.
Last time in the home port – at Split in 2006.

unload equipment for oil refineries on Sicily. It is curious that on three occasions Veli Jože sailed deep into the river Danube for the transhipment of heavy industrial equipment.

Serving as a bridge builder is less known but a very important role of the gentle giant. Newspapers' chronicles mention that back in 1959 Veli Jože gave full support in building bridge connecting Trogir and Čiovo Island. But the sixties of the past century were the highlight of her bridge building on the route of the Adriatic Highway (Jadranska Magistrala) all along the coast.

In 1965 and 1966 she was engaged in building of the Šibenik Bridge at the mouth of Krka River flowing into the sea. The reinforced concrete arch bridge of 390 meters was the first in the world of the cantilever design. Instead of traditional scaffolding resting on the ground, builders used steel scaffolds moved by Veli Jože. Almost the same bridge, but 301 metres in length, was completed in November 1968 at the narrows of Ljubačka Vrata, connecting Pag Island to the mainland. Two years earlier she had an important role in the completion of 414 meters long bridge over the Neretva River near Rogotin as well as the bridge in the Bistrina Cove near Dubrovnik.

The greatest challenge came in 1976 in the form of 1,430 meters long bridge between Krk Island and the shore. Bridge consisted of two arches, one spanning distance between the Krk Island and Sveti Marko Islet, and the other between the Islet and the mainland. The most interesting fact is that the Krk Bridge was designed relying on Veli Jože's active role. Bridge was opened in 1980 and is still the longest reinforced concrete bridge in the world!

But in the late 1990's the glory began to fade. The long goodbye for Veli Jože started in April 2004 when the ship's certificates expired and the crane was withdrawn from service and laid-up. Only temporarily, it was said. But the whole Croatian maritime community was aware that there was no future for that fine crane. Overhead expenses for 54 years old vessel were too high and Brodospas Salvage & Towage Co. was not ready to pay them. Repeatedly the help was asked from the Croatian Government, but in vain.

Firstly, Veli Jože was laid-up at Split and since 2006 at NCP-Remontno Brodogradilište shipyard at Šibenik. Years were passing by and finally in August 2010 the death sentence came.

Figure 13.
Near the end – laid up at Šibenik.

Brodospas sold Veli Jože for scrap! Dismantling at NCP shipyard already commenced when the Croatian public became aware that a beloved giant was going to die. A public outcry spread all along the Adriatic coast: the legendary crane had to be saved! The official response was immediate and on August 25 the Croatian Ministry of Maritime Affairs, Transport & Infrastructure and the Ministry of Culture stopped further activities.

The importance of Veli Jože for the Croatian maritime history and heritage must be permanently marked, was a clear message from the Government. But the crucial question emerged: to preserve the whole vessel or some significant parts only? After many pro-et-contra discussions the second option was confirmed in September 2010. A complete bridge and wheelhouse will be preserved at the Croatian Maritime Museum in Split together with winches, pulleys, crane hooks, steel ropes and one of the propellers of the crane's outboard engines. But three and a half years later, in April 2014, remnants of the gentle giant are still in a warehouse waiting for a place in the museum...

Figure 14.
Removed wheelhouse still waits for a place in museum.

News

INDIAN MARITIME DEVELOPMENT

Foreign players developed Indian industries, especially in the fields of salvage, dredging, charter ship management and ship manning. The list of foreign firms setting up shop in India is growing. The Indian government is promoting public-private partnerships (PPPs) to bring private-sector efficiency into the development of quality public services. Over the last couple of years India has emerged as one of the leading PPP markets in the world, due to some of the policies adopted and institutional initiatives taken by the government. These include 100 % FDI (foreign direct investment) being automatically allowed for port development projects and 100 % income tax exemption for a period of 10 years. Port traffic has increased from 368 million tons in 2001 to 935 million tons in 2013. According to the 'India Maritime Agenda', port throughput is expected to increase to 2,500 million tons by 2020. The cargo growth outlook for the Indian port sector continues to be positive in the medium to long term, driven by the domestic demand for coal, power and other sectors; crude oil, to meet the domestic petroleum demand; and containers, given the cost and logistical advantages associated with containerization. Short term uncertainty may, however, be associated with particular cargo categories, like imported coal, due to uncertainties plaguing the power sector and persistent delays in the execution of green-field power projects; iron ore, due to unresolved policy issues; and containers, due to the weak global environment affecting the EXIM trade.

A NEW MARITIME CRANE CONCEPT

The new, innovative TCC 14000-400 D Litronic® from Liebherr has two completely different applications. When the crane is used as an offshore crane fixed to a floating installation (barge), it is capable of lifting heavy loads up to a maximum of 400 tonnes, with the outreach of 21 meters.

It can also operate onshore as a mobile harbour crane with high lifting capacities. For the undercarriage, the drive technology of a Liebherr mobile harbour crane was combined with a newly designed steel construction consisting of a central, X-shaped structure with four mounted outriggers. For travelling operation, the base structure is fitted with 48 wheel sets characteristic of the conventional mobile harbour crane.

The multi-purpose crane, having the dead weight of approximately 1,100 tonnes, was assembled in the port of Baku, Azerbaijan. It is currently used for the construction of oil platforms in the Caspian Sea.

Figure 1.
The multipurpose crain.
Source: http://www.liebherr.com/en-GB/144818.wfw.

MAERSK LINE, MSC AND CMA CGM TO ESTABLISH AN OPERATIONAL ALLIANCE

Maersk Line, MSC Mediterranean Shipping Company S.A. and CMA CGM have in principle agreed to establish a long-term operational alliance for the East – West trades, called the P3 Network. The aim is to improve and optimise operations and service offers.

The P3 Network will control 2.6 million TEU (initially 255 vessels in 29 loops) on three trade routes: Asia – Europe, Trans-Pacific and Trans-Atlantic.

While the P3 Network vessels will be operated independently by a joint vessel operating centre, the three lines will continue to have fully independent sales, marketing and customer service functions.

Figure 2.
P3 Network vessel.
Source: http://www.maerskpress.com/NEWS-ROOM/maersk-line-msc-and-cma-cgm-to-establish-an-operational-alliance/s/fdbf6c2e-1dad-4a7c-8d15-e2572055fa27.

Improving customer services

The P3 Network will provide customers with more stable, frequent and flexible services.

Each of the lines will offer more weekly sailings in their combined network than they do individually. For example, the P3 Network plans to offer 8 weekly sailings between Asia and Northern Europe. In addition, the P3 Network will offer more direct ports of call.

The improved network is expected to reduce the number of disruptions experienced by customers due to cancelled sailings.

In order to provide customers with a consistent service offer across the network, the lines will establish an independent joint vessel operating centre.

Need for efficiency

The declining volume growth and over-capacity in recent years have stressed the need for the improvement of operations and efficiency in the industry, prompting the creation of other operational alliances such as G6 and CKYH. Using the P3 Network, the lines expect to be able to improve their efficiency through better utilisation of the vessel capacity.

Subject to approval

The lines intend to start operating in the 2nd quarter of 2014, but the starting date depends on the prior approval of the relevant competitors and other regulatory authorities.

In addition, the establishment of the P3 Network depends on the lines agreeing on definitive contracts. The finalisation and signing of the contracts are planned for the 4th quarter of this year.

FIRST TRIPLE-E NAMED MÆRSK MC-KINNEY MØLLER

The Maersk Line's newest vessel, the first from the Triple-E series, was named this morning in a ceremony at the Daewoo Shipbuilding & Marine Engineering (DSME) shipyard in Okpo, South Korea. It bears the name of the late Mærsk Mc-Kinney Møller, who passed away in April 2012 at the age of 98.

The Maersk Line CEO, Søren Skou, opened the ceremony by welcoming all the special guests and recounting the important tradition of the naming ceremonies in Maersk, from the first event in 1906 when Peter Mærsk was welcomed as the second vessel in the fleet.

The 20 ships are called the 'Triple-E' class for the three main purposes behind their creation — the economy of scale, energy efficiency and environmental improvement — the ships will set a new industry benchmark for size and fuel efficiency. Four-hundred metres long, 59 metres wide and 73 metres high, the Triple-E is the largest vessel of any type on water today. Its 18,000 TEU (twenty-foot container) capacity is large enough to hold 111 million pairs of sneakers.

The Triple-E is the largest ship in the world, and it sets new standards in the container industry, not just in size, but also in energy efficiency and environmental performance. With unique design features for lower speeds and maximum efficiency, this vessel will emit 50 % less CO_2 per container moved than the current average on the Asia-Europe route.

The Maersk Line has ordered a total of 20 of these vessels, which will be gradually introduced into the existing route between Asia and Northern Europe (AE10) over the next couple of years.

BULK CARRIER RAGA & ITS "AERO CITADEL"

The Imabari Shipbuilding Co., Ltd. completed a 95,000 DWT bulk carrier, RAGA, at its Marugame Shipyard. The bulk carrier is unique in that it has adopted a next-generation superstructure called the Aero-Citadel, which according to the shipyard offers significant advantages in both air resistance and antipiracy measures.

The Aero-Citadel has a slim streamlined shape and includes the accommodation quarters, engine room, and funnel casing. This superstructure can reduce the wind pressure during navigation by 25-30 % based on wind tunnel testing. For example, the fuel consumption of a Capesize bulk carrier navigating at normal output against about 9m/sec head wind (Beaufort 5 class) will decrease by 2 %. Moreover, the new design incorporates marine use LED lighting in the accommodation and engine room lighting systems, which reduces the electric power required for lighting by approx. 50 %.

Name	Raga
Type	Bulk Carrier
Shipbuilder	Imabari Shipbuilding
Ship-owner	Higaki Sangyo Kaisha
Length, o.a.	234.9 m
Length, b.p.	227 m
Breadth	38 m
Depth	19.9 m
DWT/GT	95,666/50,615
Main engine	Hitachi-MAN B&W 6S60ME-C (Mark 8) diesel x 1 unit
MCR	12,950kW x 101min^{-1}
NCR	11,010kW x 95.7min^{-1}
Speed, Service:	15 knots
Complement	25
Classifi cation	NK
Registry	Panama

Figure 3.
Bulk carrier Raga & its "Aero Citadel".
Source: Maritime Reporter & Engineering News - December 2013 edition.

SHIP BREAKING ENDS

Ship breaking is one of the most dangerous industries. According to the EU Commission, it is six times more likely to die at work in the Indian ship breaking industry than in the Indian mining industry, and according to a recent report from Sustainalyitics, 1,000 people died in the Bangladesh ship breaking industry over a 10 year period.

NGOs argue that beaching must end now. The Maersk Line has the responsible ship recycling policy. Since 2006, they recycled 23 ships responsibly, and sent none to the beach.

The real answer to the problem is global regulation that would raise the legally acceptable minimum standard for ship recycling. In 2009, the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships was adopted. Yet, only two countries have ratified it in 2013.

The Hong Kong Convention is not perfect – actually it doesn't ban beaching, but merely makes it a lot harder to scrap ships this way. But it is the best we have, and if it entered into force, it could be improved over time.

Figure 4.
Ship breaking.
Source: http://www.shipbreakingplatform.org/photo-gallery-gadani-pakistan-2012/.

If the health and safety statistics of the ship breaking industry are not enough of an argument in favour of the Hong Kong Convention, here is another one: Over the coming decades, steel will get scarcer and therefore more expensive, which means we need to become better at steel recycling.

When ships are scrapped on beaches, it is less likely that the materials are recycled to their full potential. Taking ships to proper recycling yards, like the ones in China, will allow a far better recycling of the steel for reuse in new ships and other constructions.

BOURBON'S SEISMIC SURVEY SUCCESS WORLD'S LARGEST CHEMICAL TANKER

Bow Pioneer was built for Odfjell SE by Daewoo Shipbuilding & Marine Engineering, designed with two longitudinal corrugated bulkheads with lower stools and transverse corrugated bulkheads with lower stools to have 10 sets (P&S&C) of cargo tanks, and 11 tanks for WB, consisting of four pairs of wing and double bottom tanks, one U-type tank and two water ballast heeling tanks. The ship is equipped with a cargo handling system for the loading, storage and discharging of the intended cargos of IBC ship types 2 & 3, with typical cargos such as Methanol, Vegetable Oils, MEG (Mono Ethylene Glycol), EDC (Ethylene DiChloride), MTBE (Methyl Tert-Butyl Ether), Xylene, Toluene, Cyclohexane, etc., as well as refined petroleum products (products with flash point below 60 deg-C). The ship has a continuous upper deck with forecastle, a raked stem with a bulbous bow, a transom stern with open water type stern frame, a balanced spade rudder with flap and a fixed pitch propeller directly driven by MAN B&W 5S60MC-C8 engine, with the maximum rating of 10,870 kW at 103.7 rpm. Double side and double bottom are provided in the cargo area and the volume of individual cargo tanks does not exceed 3,000 cu.m. The deadweight of the vessel will be 75,000 metric tons at the design draft of 13.2 m, without trim, with the vessel afloat in SW with SG of 1.025, and 81,200 metric tons at the scantling draft of 14 m. The speed of the ship is 14 knots at the designed draft of 13.2 m on even keel at 85% MCR. The vessel is trimmed with Inorganic Zinc Silicate coating for cargo and slop tanks, and stainless steel pipes for cargo related systems. Thirty-one cargo manifolds are arranged on the port and STBD sides with two tiers at the middle length of the ship. One raised catwalk is arranged from the front of the accommodation to the manifold platform area and forecastle deck on the upper deck.

FEWER SEAFARERS IN UK BUT MORE OFFICER CADETS

The latest seafarer statistics of the United Kingdom Department for Transport show that the number of seafarers in the UK continues to decline, with a five percent decrease since 2012, to stand at 22,830 in 2013 – with an eight percent decline in the number of ratings to 8,590, following a previous rise between 2007 and 2011. Ratings are largely employed by the cruise and ferry industry, where the numbers working in catering, hotel and other categories fluctuate more than those working in the deck, engine and general/dual purpose categories. However, the number of officer cadets in training, 1,990, was the highest in over a decade.

In 2013, there were 12,660 non-UK nationals with a valid certificate of equivalent competency (CEC), required to be obtained by officers trained outside the UK before they can work as a deck or engine officer on a UK-flagged vessel. The

main country of origin of CEC-holders was the Philippines, which accounted for 15 percent, followed by India's 10 percent, and Ukraine and the Russian Federation, with nine percent each. Foreign national officers were more likely to be younger than UK officers, with 57 vs. 39 percent under 41 years of age.

GUIDANCE ON SECURITY CERTIFICATION FOR SEAFARERS AGREED (WWW.IMO.ORG)

Guidance on training and certification requirements for ship security officers and seafarers with designated security duties was agreed by IMO to address the practical difficulties seafarers have reportedly experienced in obtaining the necessary security certification under the 2010 Manila amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) and STCW Code.

The guidance recommends that, until 1 July 2015, relevant training under section 13 (Training, drills and exercises on ship security) of the International Ship and Port Facility Security (ISPS) Code should be accepted as being equivalent to that required under the STCW Convention and Code.

The guidance was agreed by the Sub-Committee on Human Element, Training and Watchkeeping (HTW), at its first session held on 17-21 February 2014, which expressed a concern that a large numbers of seafarers were reportedly unable to access the approved training courses or be issued certification of security-related training in accordance with the STCW regulations.

The Sub-Committee approved a STCW circular on Advice for port State control officers, recognized organizations and recognized security organizations on action to be taken if seafarers do not hold the certification required in accordance with regulation VI/6 of the STCW Convention and section A-VI/6, paragraphs 4 and 6 of the STCW Code after 1 January 2014.

It also approved a STCW circular on Advice for port State control officers, recognized organizations and recognized security organizations clarifying training and certification requirements for ship security officers and seafarers with designated security duties, which argues that ship security officer (SSO) training encompasses the competence requirements of the STCW Code (section A-VI/6). Therefore, the holders of SSO certificates should not be required to undergo further training and obtain certification.

Figure 5.
HTW training.
Source: Flicker.

NEW SLOP WATER TREATMENT SYSTEM

This is the first order for the new system, strengthening Wärtsilä's position as the marine industry's leading provider of innovative products, solutions and services.

The Wärtsilä slop water treatment system is designed to treat and clean water contaminated with slop or drilling mud. For operators, the large volumes of slop mud mean enormous disposal expenses and represent a potentially significant environmental issue. The drillship for which this first installation is intended, is capable of drilling wells at water depths of up to 10,000 ft (3100 m). Its drill water capacity of 2178 m^3 is an indication of the amount of slop water that will be handled by the Wärtsilä slop water treatment system.

The system's processing principles are based on a combination of chemical treatment and dissolved air flotation. The chemicals flocculate and bind together particles, making them easier to separate, in turn allowing flotation by dissolved air which separates both particles and oil from water.

The result is clear water, free of particles and oil, and acceptable for discharging into the environment or for reuse on the rig. The discharge is monitored by an in-line, oil-in-water content meter ensuring that the oil in the water is below the required limits before the water is pumped overboard.

Wärtsilä has a complete innovative offer for wastewater treatment in the oil, gas and maritime industries. It includes oily water separators for controlling bilge media and discharge, Membrane BioReactor Systems to treat grey and black water, seawater desalination plants to produce fresh, potable water, sewage treatment plants, and vacuum collection systems.

Muore

Ivica Jakšić

Muore; bonaca.
Muore; maštrol.
Muore; vitar prid nevieru.
Muore; furtunol.
Raganj!

To vrije, dimi, huče, buče
val se kalo, po se penje
škrape mloti – riva stenje.

Priko kućih pinu zabacije
tamarise povije
grone lomi
stablo je palo...
onda, kako je počielo
tako je stalo.

I sve je to malo...

Sve je to malo jer...

Jer muore je...

Naše muore je...

Ma kad bi muore reko na mađarski
a ne bi jugo i daje morete kargovalo.
Kad bi muore reko na češki
a se muoren ne bi plovilo
u muoru kupalo.
Kad bi mongolski reko
a bi ga manje ostalo.

I kad bi ćirilicuon napiso muore,
ono bi se uvik, u sto kolurih sjalo.

The Sea

trans. by Mirna Čudić

The sea; a calm.
The sea; the mistral.
The sea; the wind announcing a tempest.
The sea; a seastorm.
A hurricane!

Boiling, smoking, howling, raging
the wave descending, and then ascending
beating against the rocks – the shore sobs.

It throws the foam over the houses
bending the tamarinds
crashing the boughs
a tree has fallen...
and then, just as it had begun
it ceased.

And none of it suffices...

None of it suffices because...

Because the sea is...

Our sea is...

Should one say 'sea' in Hungarian
wouldn't sirocco continue loading the waves?
Should one say 'sea' in Czech
wouldn't one still sail on it
and swim in it?
Should one express it in Mongolian
would it be any the less?

And should one write 'sea' in the Cyrillic characters,
it would always sparkle in hundreds of colours.

Gledot ga – nikad,
nikad me ne bi štufalo!

Muore bi uvik bilo slono
i bonaca – kad ne bi puhalo.

I kad bidu nos istiroli
niki tuji judi,
ča bidu oni s našin muoren činili?
Kako bidu brodili?
Na ribe hodili?
Kako bidu morsku spizu jili – a ne naučili?
Kako bidu jubov vodili?
Kakva bidu njin se dica rodili?

A mi,
diguod bili.
Mi bismo naše muore
u sarce nosili.
I svi bidu znali,
da smo se mi,
baš mi,
na muoru rodili.

To gaze at it – it would
never, ever bore me!

The sea would always be salty
and calm – if there were no wind.

And if we should be exiled
by some foreign people,
what would they do with our sea?
How would they sail?
How would they go fishing?
How would they eat sea food – and never learn?
How would they make love?
And the children born to them, what would they be like?

And we,
wherever we may be.
We would carry our sea
in our hearts.
And everyone would know,
that we,
and none other than us,
were born on the seashore.

RJEČNIK

muore	more
bonaca	utiha
maštrol	maestral, zmorac
neviera	nevrijeme, oluja
furtunol	snažna oluja
raganj	uragan
huče	huči
buče	buči
se kalo	spušta se
mloti	mlati, tuče
riva	obala, šetalište uz more
priko	preko
kućih	kuća (G. mn.)
pina	pjena
grone	grane
počielo	počelo
a ne bi	zar ne bi
i daje	i dalje, još uvijek
moreta	mareta, valovi
kargovalo	nanosilo
ćirilicuon	ćirilicom
uvik	uvijek
u sto kolurih	u sto boja
gledot’	gledati
štufalo	dosadilo
slono	slano
kad bidu	kad bi
nos	nas
istiroli	potjerali, prognali
niki	neki
tuji	tuđi, strani
judi	ljudi
ča	što
hodili	išli
spiza	hrana, jelo
jili	jeli
jubov	ljubav
dica	djeca
diguod	gdje god
sarce	srce

About ToMS: Ethics, Conflict of Interest, License and Guides for Authors

The Journal is published in English as an open access journal, and as a classic paper journal (limited edition).

ToMS aims at presenting the best maritime research primarily, but not exclusively, from Southeast Europe, particularly the Mediterranean area. Papers will be double-blind reviewed by 3 reviewers. With the intention of providing an international perspective at least one of the reviewers will be from abroad. ToMS also promotes scientific collaboration with students and has a section entitled Students' ToMS. These articles also undergo strict peer reviews. Furthermore, the Journal publishes short reviews on significant papers, books and workshops in the fields of maritime science.

Our interest lies in general fields of maritime science (transport, engineering, maritime law, maritime economy) and the psychosocial and legal aspects of long-term work aboard.

1. PUBLICATION ETHICS

Ethical Policies of ToMS

Plagiarism is arguably the most complicated ethical issue. Our policies define plagiarism as "taking material from another's work and submitting it as one's own." ToMS *holds authors — not the Publisher or its editors and reviewers — responsible* for ensuring that all the ideas and findings included in a manuscript are attributed to the proper source. We also refer to our role as steward of what constitutes ethical conduct. Ethical misconduct is the reason for our commitment to continue to strive to educate all the parties in the publishing process how to handle this matter. As a member of Crossref, ToMS has a powerful weapon – iThenticate system, which is not perfect.

"Even if there were reliable and sensitive plagiarism detection software, many issues would remain to be addressed.

For example, how much copying is legitimate? Clearly, the reuse of large amounts of others' text constitutes plagiarism. But what should one think about copying short passages from the author's own earlier work, such as commonly occurs in the Methods section? In the Nature article it is suggested that some journals set a quantitative limit whereby the amount of text that can be reused is limited to about 30 percent. This may be utilitarian, but it seems curious and arbitrary that 25 percent of copied text might be deemed acceptable whereas 30 percent might not. Indeed, two authors who copied the same number of words could find themselves on opposite sides of that border if one author simply was more verbose and thus diluted their plagiarized content below the threshold! No, this is not a simple issue at all." [cited from: http://newsletter.aspb.org/ethics.cfm]

Expectations for publishing in ToMS

Faculty of Maritime Studies expects authors submitting to and publishing in its journals to adhere to ethical standards to ensure that the work they submit to or publish in the journal is free of scientific misconduct. Authors must:

- Take credit only for work that they have produced.
- Properly cite the work of others as well as their own related work.
- Submit only original work to the journal.
- Determine whether the disclosure of content requires the prior consent of other parties and, if so, obtain that consent prior to submission.
- Maintain access to original research results; primary data should remain in the laboratory and should be preserved for a minimum of five years or for as long as there may be reasonable need to refer to them. All authors of articles submitted for

publication assume full responsibility, within the limits of their professional competence, for the accuracy of their paper. Instances of possible scientific misconduct related to papers submitted to or published in the ToMS will be addressed by following the procedure outlined below.

2. CONFLICT OF INTEREST

The authors, reviewers and other participant are obligated to clearly state possible conflict of interest. Editor-in-chief, senior editor and/or executive editors board decide on actions based on conflict of interest (COI).

Editors' Duty

Disclosure and Conflicts of Interest: The editor cannot use unpublished materials, disclosed in submitted manuscript for his/her own research, without prior written consent of the author(s).

If author(s) of submitted paper is a member of editorial board or editor-in-chief, the submission, review and decision process is carried by the highest ranking editor who is not the author.

Reviewers' Duty

All reviewers should have no conflict of interest with respect to the research, the authors and/or the funding bodies.

3. MALPRACTICE

Procedure for addressing allegations of scientific misconduct or other ethical violations

Scientific misconduct in publishing includes but is not limited to:

- Fraud: fabricating a report of research or suppressing or altering data;
- Duplicate publication;
- Plagiarism and
- Self-plagiarism.

Procedure for handling allegations of misconduct

- All allegations of scientific misconduct or ethical violation will be referred to the editor for research integrity or to the editor-in-chief. All allegations should be made in writing.
- Editor for research integrity will report the case in the meeting of the Editorial board and recommend the actions in 30 days.
- Except redraw of the paper, punishment could be inclusion in the black list of the journal and prohibition of further publishing in ToMS.

Submission declaration

Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright-holder.

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Originality: Authors must ensure that their work is entirely original.

Multiple, Redundant, or Concurrent Publications: Authors should not concurrently submit the same manuscript for publishing to other journals, or conference proceedings. It is also expected that the author(s) will not publish redundant manuscripts, or manuscripts describing the sameresearch in several publishing venues, after the initial manuscript has been accepted for publication.

Acknowledgement of Sources: Author(s) should acknowledge all sources of data used in the research and cite publications that have influenced their research.

Authorship of the Paper: Authorship should be limited only to those who have made a significant contribution to conceiving, designing, executing and/or interpreting the submitted study. All those who have significantly contributed to the study should be listed as co-authors. The corresponding author should also ensure that all the authors and co-authors have seen and approved the final submitted version of the manuscript and their inclusion as co-authors.

Data Access and Retention: Authors should retain raw data related to their submitted paper, and must provide it for editorial review, upon request of the editor.

Disclosure of Financial Support: All sources of financial support, if any, should be disclosed.

Fundamental errors in published works: When an author discovers a significant error or inaccuracy in his/her submitted manuscript, the author must immediately notify the editor.

5.2 Duties of reviewers

Confidentiality: Manuscript reviewers, the editor and the editorial staff must not disclose any information regarding submitted manuscripts. All submitted manuscripts are to be treated as privileged information.

Acknowledgement of Sources: Reviewers of manuscripts must ensure that authors have acknowledged all sources of data used in the research. Any similarity or overlap between the considered manuscripts, or with any other published paper, which is in personal knowledge of reviewer, must be immediately brought to the editor's notice.

Standards of Objectivity: Review of submitted manuscripts will be conducted objectively. The reviewers shall express their views clearly, with supporting arguments.

Promptness: If a reviewer believes it is not possible for him/her to review the research reported in a manuscript within the designated guidelines, or within stipulated time, he/she should notify the editor, so that the accurate and timely review can be ensured...

Conflict of Interest: All reviewers should have no conflict of interest with respect to the research, the authors and/or the funding bodies.

5.3 Duties of the editor

Publication Decisions: Based on the editorial board's review, the editor can accept or reject the manuscript or can send it for modifications.

Review of Manuscripts: The editor ensures that each manuscript is initially evaluated by the editor, who may make use of appropriate means, to examine the originality of the contents of the manuscript. After the manuscript passes this test, it is forwarded to two reviewers for double-blind peer review, and each of whom will make a recommendation to publish the manuscript in its present form or to modify or to reject it. The review period will be no more than30 days.

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Confidentiality: The editor must ensure that information regarding manuscripts submitted by the authors is kept confidential.

Disclosure and Conflicts of Interest: The editor cannot use unpublished materials, disclosed in submitted manuscript for his/her own research, without prior written consent of the author(s).

6. GUIDELINES FOR AUTHORS

The Journal is published in English as an open access journal, and as a classic paper journal (limited edition).

ToMS aims at presenting the best maritime research primarily, but not exclusively, from Southeast Europe, particularly the Mediterranean area. Papers will be double-blind reviewed by 3 reviewers. With the intention of providing an international perspective at least one of the reviewers will be from abroad. ToMS also promotes scientific collaboration with students and has a section entitled Students'ToMS. These articles also undergo strict peer reviews. Furthermore, the Journal publishes short reviews on significant papers, books and workshops in the fields of maritime science.

Our interest lies in general fields of maritime science (transport, engineering, maritime law, maritime economy) and the psychosocial and legal aspects of long-term work aboard.

6.1 Before you begin

6.1.1 Ethics in publishing

For information on Ethics in publishing and Ethical guidelines for journal publication see Publication Ethics

6.1.2 Conflict of interest

All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, their work.

6.1.3 Submission declaration

Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere including electronically in the same form, in English or in any other language, without the written consent of the copyright-holder.

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This policy concerns the addition, deletion, or rearrangement of author names in the authorship of accepted manuscripts:

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6.2 Guidelines for authors: manuscript preparation and submission

6.2.1 Organization of the manuscript

First (title) page

The first page should carry:

a. the paper title;
b. full names (first name, middle – name initials, if applicable), and last names of all authors;
c. names of the department(s) and institution(s) to which the work should be attributed. If authors belong to several different institutions, superscript digits should be used to relate the authors' names to respective institutions. Identical number(s) in superscripts should follow the authors names and precede the institution names;
d. the name, mailing address and e-mail of the corresponding authors;
e. source(s) of research support in the form of financial support, grants, equipment or all of these.

Last page

The last page should carry:

a. ethical approval, if required;

b. authors' declarations on their contributions to the work described in the manuscript, their potential competing interests, and any other disclosures. Authors should disclose any commercial affiliations as well as consultancies, stock or equity interests, which could be considered a conflict of interest. The details of such disclosures will be kept confidential but ToMS urges the authors to make general statements in the Acknowledgement section of the manuscript.

c. a list of abbreviations used in the paper (if necessary);

Other pages

Each manuscript should follow this sequence:

- title page;
- abstract;
- text (Introduction, Methods, Results, Conclusions/ Discussion);
- acknowledgments;
- references;
- tables (each table complete with title and footnotes on a separate page);
- figures and figure legends, and the last page.

6.2.2 Text organization and style

6.2.2.1 Abstract

The second page should contain the Abstract. ToMS requires that the authors prepare a structured abstract of not more than 250 words. The abstract should include (at least) four sections: Aims, Methods, Results, and Conclusion, not necessarily separated.

Aim. State explicitly and specifically the purpose of the study.

Methods. Concisely and systematically list the basic procedures, selection of study participants or laboratory/ experimental/simulation setup, methods of observation (if applicable) and analysis.

Results. List your primary results without any introduction. Only essential statistical significances should be added in brackets. Draw no conclusions as yet: they belong in to the next section.

Conclusion. List your conclusions in a short, clear and simple manner. State only those conclusions that stem directly from the results shown in the paper. Rather than summarizing the data, conclude from them.

6.2.2.2 Main text

Do not use any styles or automatic formatting. All superscripts or subscripts, symbols and math relations should be written in MathType or Equation editor.

Introduction

The author should briefly introduce the problem, particularly emphasizing the level of knowledge about the problem at the beginning of the investigation. Continue logically, and end with a short description of the aim of the study, the hypothesis and specific protocol objectives. Finish the section stating in one sentence the main result of the study.

Results

Key rules for writing the Results section are:

a. the text should be understandable without referring to the respective tables and figures, and vice versa;

b. however, the text should not simply repeat the data contained in the tables and figures; and

c. the text and data in tables and figures should be related to the statements in the text by means of reference marks.

Thus, it is best to describe the main findings in the text, and refer the reader to the tables and figures, implying that details are shown there. The formulations such as "It is shown in Table 1 that the outcome of Group A was better than that of Group B" should be replaced by "The outcome of Group A was better than that of Group B (Table 1)."

The need for brevity should not clash with the requirement that all results should be clearly presented.

Discussion/Conclusions

The discussion section should include interpretation of study findings in the context of other studies reported in the literature. This section has three main functions:

a. assessment of the results for their validity with respect to the hypothesis, relevance of methods, and significance of differences observed;

b. comparison with the other findings presented in the relevant literature; and

c. assessment of the outcome's significance for further research.

Do not recapitulate your results, discuss them!

6.2.2.3 Tables

Information on significance and other statistical data should preferably be given in the tables and figures. Tables should not contain only statistical test results. Statistical significances should be shown along with the data in the text, as well as in tables and figures.

Tables should bear Arabic numerals. Each table should be put on a separate page. Each table should be self-explanatory, with an adequate title (clearly suggesting the contents), and logical presentation of data. The title should preferably include

the main results shown in the table. Use tables in order to present the exact values of the data that cannot be summarized in a few sentences in the text.

Avoid repetitive words in the columns: these should be abbreviated, and their explanations given in the footnotes. Present data either in a table or a figure.

Each column heading for numerical data given should include the unit of measurement applied to all the data under the heading. Choose suitable SI units.

Place explanatory matter in footnotes, not in the heading.

Explain in footnotes all nonstandard abbreviations that are used in each table.

6.2.2.4 Figures

Figures should be numbered in sequence with Arabic numerals. Legends to figures should be listed on a separate page, in consecutive order. Minimum resolution for all types of graphics is 300 dpi and 600 dpi is recommended. The legend of a figure should contain the following information:

a. the word "Figure", followed by its respective number;
b. figure title containing major finding (e.g. Manuscripts which follow Guidelines for Authors had higher acceptance rate, and not Relationship with manuscripts style and their acceptance rate).

Use simple symbols, like closed and open circles, triangles and squares. Different types of connecting lines can be used. The meanings of symbols and lines should be defined in the legend.

Each axis should be labeled with a description of the variable it represents.

Only the first letter of the first word should be capitalized. The labeling should be parallel with the respective axis. All units should be expressed in SI units and parenthesized. Make liberal use of scale markings.

Graphs, charts, titles, and legends in accepted manuscripts will be edited according to ToMS style and standards prior to publication.

Preferred format for graphs or charts is xls. Graphs and charts saved as image (raster) files such as JPG, TIF, or GIF and imported or copied/pasted into Word or Power Point are not acceptable.

The resolution for photographic images should be at least 300 dpi, and minimum image width should be 6 cm. Please submit files in RGB format. For published manuscripts, image files will be posted online in their original RGB format, maintaining the full color of your original files. Note that we will still need to convert all RGB files to CMYK for printing on paper and color shifts may occur in conversion. You will not receive a CMYK proof. You can view an approximation of print results by converting to CMYK in Adobe® Photoshop® or Adobe® Illustrator®.

6.2.2.5 Authorship statement

All contributing authors must fill out and sign these statements and submit them to the Editorial Office. Accepted manuscripts will not be published until signed statements from all authors have been received.

6.2.2.6 Acknowledgments

Technical help, critical reviews of the manuscript and financial or other sponsorship may be acknowledged. Do not acknowledge paid services, e.g. professional translations into English.

6.2.2.7 References

References cited in the manuscript are listed in a separate section immediately following the text. The authors should verify all references. Usage of DOIs is encouraged.

Examples of citation in text:

It is well known fact (Strang and Nquyen, 1997; Antoniou, 2006) that FT is not an appropriate tool for analyzing nonstationary signals since it loses information about time domain.

First group of authors (Vetterli and Gall, 1989) proposed Multiresolution Signal Analysis (MRA) technique or pyramidal algorithm. Second group (Crochiere et al., 1975; Crochiere and Sambur, 1977) proposed subband coding algorithm. Legal acts are cited as in example: The Constitution of the Republic of Croatia (Constitution of the Republic of Croatia, 2010) is the main legal source for this subject matter, as well as any other subject matter relating to the Croatian legal system. References from the Web are cited in the text as (Author(s) last name, year of origin if known (year of accessed in other cases). If the author is unknown, such as in case of company web page, instead of author's name, title of the web page is used.

Examples for reference section:

Journals

Petrinović, R., Wolff, V. S., Mandić, N. and Plančić, B., (2013), International Convention on the Removal of Wrecks, 2007. – a New Contribution to the Safety of Navigation and Marine Environment Protection, Transaction on Maritime Science, 2(1), pp. 49-55., http://dx.doi.org/10.7225/toms.v02.n01.007

Pennec, E. and Mallat, S., (2005), Sparse Geometric Image Representations with Bandelets, IEEE Transactions on Image Processing, 14(4), pp. 423 – 438., http://dx.doi.org/10.1109/TIP.2005.843753

Web links

Donoho, D., Duncan, M. R., Huo, X. and Levi, O., (1999), Wavelab, available at: http://www.stat.stanford.edu /_wavelab/, [accessed 12 August 2011.].

Unknown, Wavelab, available at: http://www.stat.stanford.edu /_wavelab/, [accessed 12 August 2011.].

ToMS home page, available at: http://www.toms.com.hr, [accessed 12 July 2012.].

Books

Mallat, S., (2009), A Wavelet Tour of Signal Processing, 3rd Edition, New York: Academic Press.

Conference proceedings

Łutowicz, M. and Lus , T., (2013), Effect of Loss of Cylinder Pressure Indicating Channel Patency on Parameters Values Obtained from Indicating Graph, Proc. 5th International Maritime Science Conference, Solin, Croatia, April 22 – 23, pp. 382-389., available at: http://www.pfst.hr/imsc/archive/2013/IMSC2013_proceedings.pdf

Kingsbury, N.G. and Magarey, J.F.A., (1997), Wavelet Transforms in Image Processing. Proc. First European Conference on Signal Analysis and Prediction, Prague, Czech Republic, June 24 – 27, Birkhauser, pp. 23 – 24., available at: http://www.sigproc.eng.cam.ac.uk/~ngk/publications/ngk97b.zip, [accessed 12 August 2011.].

Regulations, standards or legal acts:

Constitution of the Republic of Croatia, (2010), Narodne novine, 2010(76), pp. (if known).

6.2.2.8 Supplementary materials

Supplementary materials are optional. Authors can submit different types of materials which will be available on-line.

6.2.2.9 Language

Authors may use standard British or American spelling, but they must be consistent. The Editors retain the customary right to style and, if necessary, shorten texts accepted for publication.

This does not mean that we prefer short articles – actually, we do not limit their size - but rather a resection of the obviously redundant material.

The past tense is recommended in the Results Section.

Avoid using Latin terms; if necessary, they should be added in parentheses after the English terms. Real names rather than "levels" or "values" should refer to parameters with concrete units (e.g. concentration).

6.2.2.10 Abbreviations

Only standard abbreviations and symbols may be used without definition and may be used in the title or the page-heading title.

Non-standard abbreviations should not be used in the title or page-heading title. They must be explained in the text in the following way: the term should be written in full when it appears in the text for the first time, followed by the abbreviation in parentheses; from then on, only abbreviation is used in the text. This applies separately to the Abstract and the rest of the text.

6.2.3 Submission of manuscripts

Paper submission via Open journal system.

Manuscripts can also be submitted to:

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Transactions on Maritime Science,
Faculty of Maritime Studies,
Zrinsko-Frankopanska 38,
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