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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 eighth issue of the internationally reviewed scientific journal *Transactions on Maritime Science* published by the Faculty of Maritime Studies of the University of Split. As always, the Journal is published in printed and electronic, open access form. Our desire is for our readers to have an easy access at minimum expense.

This issue brings you papers from several scientific areas. The first, extremely interesting paper investigates an ability of system identification in difficult operating conditions. A simulation-based experiment was performed on a simple, second order system with noise signal superimposed to the output signal. The system was identified using conventional method with least squares estimate and an alternative method, a multi-layer perceptron network.

The paper from the field of maritime law explores the provisions of the Rotterdam Rules 2009 relating to the performing party in general and the maritime performing party in particular. The maritime performing party is a new concept introduced by the Rotterdam Rules. The central intention of that paper is to study and analyze the concept, legal standing and liability of a maritime performing party under the Rotterdam Rules.

Authors from Croatia and Belgium present us with the paper "Improving Energy Efficiency by Advanced Traffic Control Systems". The paper deals with inland transport. The authors present a demonstration corridor in the city of Zagreb and a simulation model based on the traffic data collected in real traffic situations developed.

Scientists from Montenegro and Croatia have contributed with the paper "Familiarisation aboard Ships of Croatian and Montenegrin Officers". The authors believe that familiarisation includes technical skill related to ships'equipment and that familiarisation should last for more than a month. Familiarisation time and lack of familiarisation are considered as period of great risk of human error.

The aim of the paper "The Worldwide Tanker Shipping Market (2010 – 2020) Information Model" is to provide the information model for the worldwide tanker shipping market 2010 – 2020. The evaluation and analysis of the relevant variables of the model and the resulting growth rates are used to describe the most important theoretical principles of the worldwide tanker shipping market over the observed period of time.

The paper by Adelija Čulić-Viskota is based in part on an earlier publication on Standard Marine Communication Phrases development, but includes new chapters on sociolinguistic and cultural issues arising during pilot's taking the vessel into/out of harbour with tug assistance.

The "Contribution" section brings you the news from the International Maritime Organization from London, from the pen of our associate Tatjana Krilić. All the news from the past six months has been brought.

In the "Maritime heritage" section we have prepared a new contribution by a renowned journalist and publicist Marijan Žuvić entitled "Dalmatia: The Forgotten Milestone". You will also find news from different maritime branches.

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 island of Hvar. This contribution is presented in bilingual form: in the picturesque language of the author, Marica Gamulin and in the striking translation by Mirne Čudić.

We always hope that the papers we publish will encourage your cooperation.

System Identification in Difficult Operating Conditions Using Artificial Neural Networks

Petar Matić, Ivana Golub Medvešek, Tina Perić

To investigate an ability of system identification in difficult operating conditions. A simulation based experiment was performed on a simple second order system with white noise signal superimposed to the output signal. Interferences are added to the output signal in order to simulate difficult operating conditions present in a real system environment. Based on system simulation measurements, the system was identified using conventional method with least squares estimate and an alternative method, a multi-layer perceptron (MLP) network. Graphical evaluation of simulation results showed that MLP network produced better results than conventional model, with significantly better results in case of interferences in the output signal. To model dynamic system, a simple two-layer perceptron network with external dynamic members was trained in Matlab using Levenberg-Marquardt algorithm.

KEY WORDS
~ System identification
~ Difficult operating conditions
~ Artificial neural network
~ Multy-layer perceptron
~ Levenberg-Marquardt.

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1. INTRODUCTION

The model of the system is often used in research to perform experiments instead of a real system, to optimize system performances and to design system control. Basic controller design principle says that controller is possible to design only if the system and its environment are known (Astrom and Wittenmark, 1989), meaning a system is possible to model. Model reference adaptive control systems (MRAC), discussed in (Astrom and Wittenmark, 1989) and (Narendra and Parthasarathy, 1989), predictive control systems, discussed in (Astrom and Wittenmark, 1989) and (Al Seyab and Cao, 2008), as well as methods of controller settings, such as self-tuning regulator (STR) described in (Astrom and Wittenmark, 1989), are all based a model of the system. Therefore, the possibility of forming a reliable system model is of great importance.

However, each system model represents only a fairly good approximation of the actual system, which means that the model as such will inevitably differ from the actual system. Generally, model can be formed based on the mathematical formulation of the physical processes that occur in the system being modelled and that model is called physical model. The model can also be formed on the basis of the measured values of input and output variables of the system. That model is called the experimental model, and the process of forming the model is called identification, i.e. parameter identification. The experimental model, although it does not give insight to the physical properties of the system, is easier to form and better describes the input-output behaviour of the system. This property makes it suitable for control system designing, as well as prediction of the system behaviour. The identification can be performed

during the operation of the system (on-line identification) or through specially prepared experiment (off-line identification), as described in a third chapter of this paper.

It is possible to use alternative methods for system identification, such as artificial neural networks (ANNs) briefly described in the second chapter of this paper. Over the years ANNs have emerged as an important tool for representing nonlinear transformations and have proved successful in system identification and control. To identify the system using ANN means to optimize network parameters to achieve the minimum objective function, i.e. to train the network. As can be found described in detail in (Petrović, 1998), a system identification of a non-linear dynamic processes can be performed with a static neural network. A static neural network is preferably used over a dynamic network primarily because of its structural stability and ease of training. In order to use static neural network for dynamic system modelling, external dynamic members are added to the network. Where, it is possible to use a different model structure, such as NARX structure used in this paper and described in section 3.2.

System identification using ANN does not represent a new approach, since it has been used to model different systems, as described in (Seyab and Cao, 2008), (Amlashi et al., 2013), (Narendra and Parthasarathy, 1989), (Leyva et al.,1997) and (Asgari et al., 2013). Furthermore, it has been shown that neural network model is more accurate in comparison to conventional nonlinear models, as in the example from paper (Amlashi et al., 2013). However, the quality of ANN model is largely influenced by the quality of a measurements performed on a system, and sometimes the interferences are inevitable. The goal of this paper is to investigate the possibility of identifying a system in difficult operating conditions that are reflected in a noisy system output signal. The basic idea is to make use of the ANN's generalisation ability to improve the model identification in case of difficult operating conditions, since network is expected to adapt to unknown operation conditions better than a conventional model. Difficult operating conditions are common in all types of plants, but especially ships where measured values are affected by different disturbances such as vibration, waves, temperature, etc. Therefore, it is expected that models identified using artificial neural networks could mean an improvement in system modelling for the case of difficult operating condition.

2. ARTIFICIAL NEURAL NETWORKS

Inspired by biological neural networks, artificial neural networks (ANNs) represent a simplified mathematical model of the process that occurs in a brain of the living beings. ANN resembles the brain in two respects. First, knowledge is acquired by the network through a learning process, and second, interneuron connection strengths, known as synaptic weights, are used to store the knowledge (Haykin, 1998). Therefore, ANN is an artificial structure that consists of a number of interconnected artificial neurons and resembles to the brain in terms of information processing and storage. Based on a type of a neuron and the way they are connected different ANNs have been developed. Essentially, they all operate in a similar manner. Using a value of input variables ($x_{n,t}$) and network parameters (synaptic weights and biases, $w_{n,t}$) at instant t, every neuron calculates its response (y_t) based on the expressions (1) and (2), where φ represents an activation function, and p_t is a sum of weighted inputs. Model of an artificial neuron defined by (1) and (2) can be shown in "Figure 1" for better understanding.

$$p_t = \sum_{n=0}^{m} (w_t \cdot x_t) \tag{1}$$

$$y_t = \varphi(p_t) \tag{2}$$

ANNs have a number of properties amongst which: learning from example, generalization and nonlinearity represent the most distinguished ones. During the process of learning, a number of input-output pairs are presented to the network as examples of the system behaviour. Based on the known inputs, network output is calculated and, and since the desired output is also available, the error, i.e. the difference between the network output and the desired output, can also be calculated. Learning algorithm then uses the error information to adjust network parameters (w) in order to reduce the error (e). The second most important property of ANN, the generalization, can be interpreted as the network ability to extract the general rule from the examples it has been exposed to during training, and solve examples it has not encountered during the training process. And finally, nonlinearity, i.e. ability to approximate nonlinear functions, is defined by the properties of neuron activation function, for which sigmoidal functions are often used.

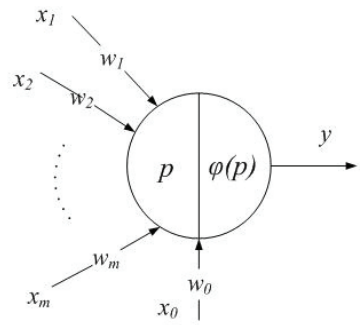

Figure 1.
Artificial neuron.

When referring to ANNs as a tool, it may be said that ANNs represent a data driven technique for modelling systems based on available data. This enables modelling of a system where it is possible to define input and output variables and measure them. In the initial moment, the network has no information on how the system works nor does it know the relationship between input and output variables. It introduces a system through a process of learning (i.e. training). Once trained, ANN can be used to generate the value of an output variable based on the values of input variables, i.e. to simulate system behaviour.

2.1. Multi-Layer Perceptron (MLP)

As different neural networks exist in nature, different ANN types have been formed to model to a different properties of a system. However, static feed-forward ANN called Multi-Layer Perceptron (MLP) represents the most commonly used network for modelling processes. Figure 2 displays a structure of an MLP neural model, also known as universal approximator with *m* inputs, *h* hidden neurons and o output neurons. Adjustable network parameters (i.e. network weights, *w*) have been marked with respect to the neurons they are connecting, using double indexes; and based on the corresponding layer, using the exponent; as shown in Figure 2, thus using a three-dimensional notation. However, for the training purposes they are marked using a one-dimensional notation, with a single index. The relation between these notations is following: $w_1 = w^1_{1,1}$; $w_2 = w^1_{1,2}$; …; $w_N = w^2_{0,o}$. MLP network with universal approximation properties uses nonlinear sigmoidal activation functions in a hidden layer and linear activation function at the output layer neurons. Although optimal number of layers was often subject of research, it has been proven that two-layer structure is sufficient to approximate any practical function, given enough neurons in hidden layer (Cybenko, 1989). Therefore, a two-layer perceptron network is used in this paper for system identification purposes.

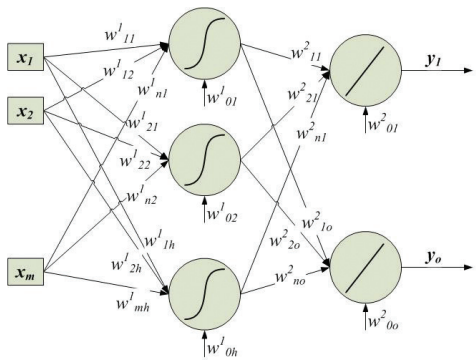

Figure 2.
A Two-layer perceptron network.

2.2. Training of MLP Network

Although defined by its structure, i.e. number and type of neurons, ANN takes a final form only after learning process is over. The procedure used to perform a learning process is called learning (or training) algorithm. Its function is to modify the network parameters in an orderly fashion to attain a desired objective, i.e. to minimize error between network output and desired value. A basic algorithm developed for training MLP network is error backpropagation (EBP), which could be regarded as one of the most significant breakthroughs in field of neural networks. Although EBP algorithm is still widely used, many improvements have been made to the original algorithm to improve its slow convergence.

In this paper, Levenberg-Marquardt (LM) algorithm is used to train MLP network. LM algorithm is a second order local algorithm for training feedforward ANNs, which can be briefly described in four steps, as stated below, or explained in more detail in (Hagan and Menhaj, 1994) and (Hao Yu and Wilamowski, 2011). First, the network is excited and the output (*y*) is calculated based on expressions (1) and (2), for the set of current input values (*x*) and network parameter values (*w*). Sum of square error (SSE), defined by the expression (3), is then used to get information about total error for the training set of input-output pairs. The output error ($e_{s,o}$), defined by (4), is calculated based on desired network output (*d*) and actual network output (*y*) for every pair s and every output (*o*).

$$SSE = \frac{1}{2}\sum_{s=1}^{N_s}\sum_{o=1}^{N_o} e^2_{s,o} \tag{3}$$

$$e_{s,o} = d_{s,o} - y_{s,o} \tag{4}$$

Secondly, a Jacobian matrix which is calculated according to the expression (5), where *N* is a total number of network parameters, N_s is number of input-output pairs and N_o is the output number.

$$J = \begin{bmatrix} \frac{\partial e_{1,1}}{\partial w_1} & \frac{\partial e_{1,1}}{\partial w_2} & \cdots & \frac{\partial e_{1,1}}{\partial w_N} \\ \vdots & & \ddots & \vdots \\ \frac{\partial e_{S,K}}{\partial w_1} & \frac{\partial e_{S,K}}{\partial w_2} & \cdots & \frac{\partial e_{S,K}}{\partial w_N} \end{bmatrix} \tag{5}$$

Thirdly, new values of the adjustable network parameters (w_{t+1}) are calculated according to the expression (6) and SSE is calculated again. Finally (step 4), if the new value of the SSE is higher than the one calculated in step 1, the parameter μ is multiplied by a factor of constant amount (κ). If the step in the training process results in a reduction of SSE, the parameter μ is divided by factor κ. Steps 1 to 4 are repeated until the objective function (SSE) minimum is achieved, or until progression of error reduction becomes negligibly small.

$$w_{t+1} = w_t - (J^T_t \cdot J_t + \mu \cdot I)^{-1} J^T_t \cdot e_t \tag{6}$$

A key problem in LM algorithm is to determine the elements of the Jacobian matrix. The computation process for Jacobian matrix can be organized according to the traditional backpropagation computation. Therefore, elements of the Jacobian matrix can be calculated based on the expression (7), where δ_j stands for the local gradient and x_j stands for an input of neuron j. Since an input to the second layer neurons is equal to the output from the first layer ($y_{j-1} = x_j$), value of x_j is calculated in the forward computation, while δ is obtained in the backward computation, and it depends on the position of neuron j. For the output layer neurons δ can be calculated based on (8), and for hidden neurons it is calculated based on (9).

$$\frac{\partial e_{S,K}}{\partial w_{j,i}} = -\delta_j \cdot x_j \tag{7}$$

$$\delta_j = e_j \cdot \varphi'_j (p_j) \tag{8}$$

$$\delta_j = \varphi'_j (p_j) \cdot \sum_1 (\delta_{j+1} \cdot w_{j,i})_1 \tag{9}$$

3. SYSTEM IDENTIFICATION

System identification is model determination process based on the measured values of the input and output signals of the system. As discussed in (Petrović, 1998), identification process can generally be divided into five basic steps, which are: input-output data acquisition, model structure determination, evaluation measure selection, i.e. quality criteria, model parameter estimation, validation of the model.

If data is collected during normal operation, the process is called on-line identification, as it is the case with the adaptive systems. If the input-output data is collected during specially prepared experiment, then the process is called off-line identification. For the identification experiment purposes a Band Limited White Noise signal (BLWNS) is used to excite the system. The identification experiment is usually performed in open loop, except in cases where, due to the instability of the system or of production reasons, a closed loop is used. A key step of the system identification process is a structure determination. A flexible structure that can describe a large class of different systems is usually used. This structure represents so-called black box model since it does not model in detail exact physical processes that occur in the system. A second order transfer function is usually used based on the assumption that most physical systems could be approximated using a second order system. Selected structure has unknown parameters that can be determined by one of the available methods, and in this paper least squares estimate (LSE) is used. If the model satisfies the validation process, it is accepted as a valid model of the system, and if not, the identification process is repeated. Validation is carried out using the excitation signal with a different random numbers than the ones used during identification.

In addition to conventional identification methods, there are alternative methods, such as the application of artificial neural networks. ANNs ability to approximate nonlinear functions enables their use in the identification of nonlinear dynamical processes as described in section 3.2 of this paper.

3.1. Least Squares Estimate (LSE) Method

If the structure of the discrete-time transfer function is used, as represented by the expression (10), total number of model parameters (θ) is than defined as $L = 2m$.

$$G_E(z) = \frac{\Theta_0 + \Theta_1 \cdot z^{-1} + \ldots + \Theta_m \cdot z^{-m}}{1 + \Theta_{m+1} \cdot z^{-m+1} + \ldots + \Theta_{2m} \cdot z^{-2m}} \tag{10}$$

LSE method for model parameters identification is based on using the same excitation for calculating model response $\hat{Y}(k)$ and the actual system response $Y(k)$ in order to determine the error of the model $E(k)$, as expressed with (11), where the upper case letters were used to represent the matrixes.

$$E(k) = Y(k) - \hat{Y}(k) \tag{11}$$

The excitation used represents a sequence of the system input $u(k)$ and output $y(k)$ signals, and can be presented by matrix $H(k)$, as defined by the expression (12). Identification goal is to estimate model parameters (θ) that would produce minimal SSE calculated for different time instants (k).

$$H(k) = \begin{bmatrix} u(k) & u(k-1) & \dots & u(k-m) & -y(k-1) & \dots & y(k-m) \\ u(k-1) & u(k-2) & \dots & u(k-m-1) & -y(k-2) & \dots & y(k-m-1) \\ \vdots & \ddots & & & & & \\ u(k-L) & u(k-1-L) & \dots & u(k-m-L) & -y(k-1-L) & \dots & y(k-m-L) \end{bmatrix} \quad (12)$$

Mathematically, this condition can be expressed as (13), where *W(k)* is a weight matrix (usually diagonal, identity matrix), indicating the importance of discrete time instant used for calculation of the parameters of the impulse transfer function.

$$J(\theta) = E(k)^T \cdot W(k) \cdot E(k) \quad (13)$$

As explained in (Stipaničev and Marasović), equation (13) has a minimum value for the parameter θ calculated from (14). Equation (13) gives the required values of the model parameters, which are then introduced into the expression (10) to obtain the model of the system in the form of a discrete transfer function.

$$\theta = [H^T(k) \cdot W(k) \cdot H(k)]^{-1} \cdot [H^T(k) \cdot W(k) \cdot Y(k)] \quad (14)$$

3.2. System Identification Using Artificial Neural Network

It makes perfect sense to use dynamic neural network for dynamic system modelling. However, dynamic neural networks are structurally unstable due to internal feedback connections. These feedback connections are making the process of learning more difficult, and also make stability analysis of the model necessary.

A dynamic system modelling using static ANN is possible if external dynamic members (time delay units, z^{-1}) are added to the network. By adding external dynamic members, a regression vector is formed which represents the input vector for the static ANN. As described in (Petrović, 1998), different signals can be used to form regression vector. The most common structure used for non-linear system modelling is NARX structure, shown in "Figure 3", which uses the input (*u*) and the output (*y*) system signals to form the regression vector.

NARX model can be considered as a general model of non-linear systems. Its output is the estimated value of the output signal of the process, calculated on the basis of the currently available input and output signals of the process, according to the expression (15), where φ(k) stands for regression vector defined by the expression (16).

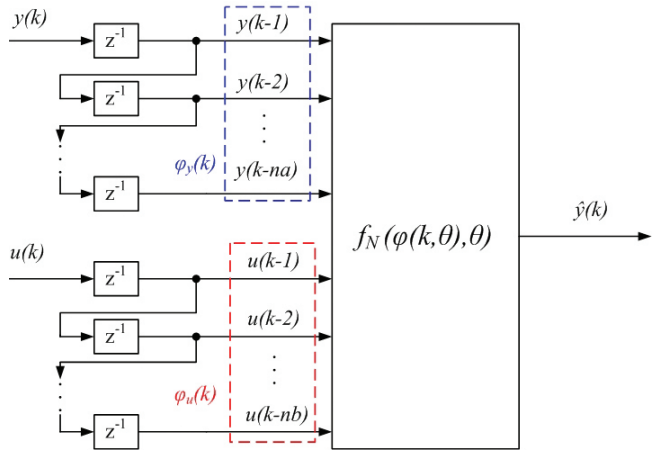

Figure 3.
NARX model.

$$\hat{y}(k) = f_N(\varphi(k), \theta) \quad (15)$$

$$j(k) = [j_y(k), j_u(k)] = [y(k-1),\dots,y(k-na), u(k-1),\dots,u(k-nb)]^T \quad (16)$$

Therefore, a general model of nonlinear dynamical systems can be represented as a function composition. First function relates the space of the measured values of input and output signals to the regression space and second relates the regression space to the system output space. A static ANN can be used to model the second function, thus making the identification problem equal to the function approximation. The task of the parameter estimation using ANNs is to find the optimal values of the adjustable network parameters for with which the error is minimal. This process is called learning or training and is described in section 2.2 of this paper.

4. CASE STUDY: IDENTIFICATION OF A SECOND ORDER SYSTEM

A second order system defined with the expression (17) is used in this paper to investigate possibility of system identification using LSE method and ANN for the case of difficult operation conditions. For the simulation purposes, system parameters are chosen as $K = a = 1$. Values of the input and output signals of the system are recorded during simulation performed in Matlab/Simulink with a calculation step size $Ts = 0.1$ s.

$$G(s) = \frac{K}{s(s+a)} \tag{17}$$

The white noise signal is superimposed to the system output to simulate the inevitable appearance of interference that affects the output of the system under real operating conditions in complex systems like ships. The input signal used to excite the system in order to gather the information for identification purposes represents a series of random numbers obtained as the sum of the white noise signal of limited frequency range (BLWNS) and the triangular signal.

4.1. Second Order System Identification Using LSE Method

Structure selection in this case is facilitated since the actual structure of the system is known. Therefore, assumed structure is identical to the structure chosen for the simulation purposes (17). To proceed with identification, a Z-transformation is applied in order to determine discrete transfer function, according to the expression (18), and the equivalent discrete transfer function (19) is obtained.

$$G_E(z) = \frac{z-1}{z} \cdot Z\left[\frac{G(s)}{s}\right] \tag{18}$$

$$G_E(z) = \frac{\Theta_0 + \Theta_1 \cdot z^{-1} + \Theta_2 \cdot z^{-2}}{1 + \Theta_3 \cdot z^{-1} + \Theta_4 \cdot z^{-2}} \tag{19}$$

Given that the largest index of unknown parameters is $L = 4$, with arbitrarily chosen moment for performing identification (discrete instant k = 100), discrete transfer function of a system can be identified using LSE method, as described in section 3.1 of this paper. In case of no interference in the output signal, the solution to the problem is presented by (20), while in case of interferences the solution is presented with the expression (21).

$$G_E(z) = \frac{0.004836 \cdot z^{-1} + 0.004675 \cdot z^{-2}}{1 - 1.90531 \cdot z^{-1} + 0.905214 \cdot z^{-2}} \tag{20}$$

$$G_E(z) = \frac{-0.0074 - 0.0420 \cdot z^{-1} + 0.0529 \cdot z^{-2}}{1 - 0.4275 \cdot z^{-1} - 0.5948 \cdot z^{-2}} \tag{21}$$

4.2. Second Order System Identification Using Static MLP Network

In order to perform system identification using static ANN, a regression vector is formed having 6 members, three successive excitation signals *u(k-1), u(k-2), u(k-3)* and three successive output signals *y(k-1), y(k-2), y(k-3)* of the system being modelled. While regression vector represents a network input, current values of the model output *tt* are used to form "target" vector for network training purposes. A double-layer perceptron is used, with first layer having 20 neurons and one neuron in the second layer. A neural network used has a structure of universal approximator which means that first (hidden) layer neurons have non-linear (tansig) and the output neuron uses linear (purelin) activation function. Although optimal number of layers was often subject of research, it has been proven in (Cybenko, 1989) that two-layer structure is sufficient to approximate any practical function, given enough neurons in hidden layer. To determine the initial values of network parameters Nguyen-Widrow function (initnw) was used. The network was trained with Levenberg-Marquardt algorithm, with mean square error (MSE) used as a performance function. The process of forming a neural model in Matlab can be found explained in (Hagan et al., 1994). Optimal network type, number of neurons, training algorithm, number and type of inputs and performance function were not investigated in this paper. Therefore, experiments and/or methods to determine optimal values of these parameters should be performed in order to achieve optimal results.

5. SYSTEM IDENTIFICATION RESULTS

To examine the identification process results, models responses are compared as presented in figures 4 for case with no interference, and in figure 5 for the case with an interference in the output signal. During this test, an original system and the identified models were excited with a signal different from the one used for identification purposes.

As it can be seen from "Figure 4", both identification methods produce fair results, with ANN model response better fitting the actual system response. The LSE method is not an iterative

process and system identification is performed in an arbitrary step with a finite number of pre-recorded samples of input-output parameters. In order to reduce deviation response of LSE model a recursive least squares estimate (RLSE) could be performed.

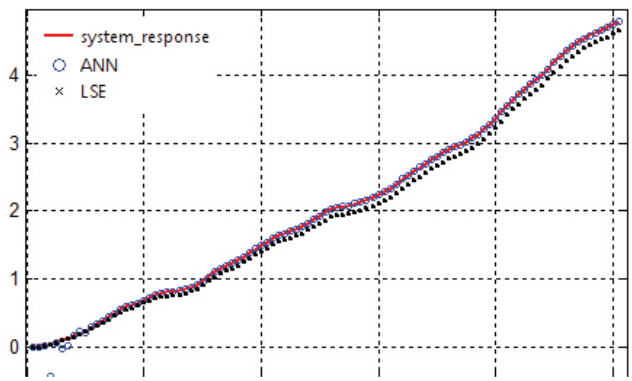

Figure 4.
Model comparison for the case without interference in the output signal.

From the results shown in "Figure 5", it is obvious that ANN is able to identify the system even in case when there are interferences present in the output signal, while LSE obtained model has no such ability. Neural model follows the response of the actual system, while LSE method model was not able to track the response of the actual system.

6. CONCLUSION

In this paper system identification was performed using conventional parameter estimation with least squares estimate (LSE) and alternative solution, identification with artificial neural network (ANN). The complexity of the system itself was not an issue; therefore a simple second order system was used as a case study, but rather the complexity of the environment. In order to simulate difficult operating conditions, i.e. complex system environment, white noise signal was superimposed to the output signal of the system being modelled. Interference in the output signal was used to simulate realistic operating conditions where noise usually occurs in the signal due to the industrial operating conditions and/or measurements imperfections. The main goal of the paper was to investigate the premise that successful identification could be performed in case of difficult operating conditions if artificial neural network was used. Therefore, two methods (LSE and ANN) were used to perform a system identification of a simple second order system in case of normal and difficult operating conditions. Both methods proved to be good solutions for the purpose of system identification in case of no interference present in the output signal, with ANN obtaining a slightly better results.

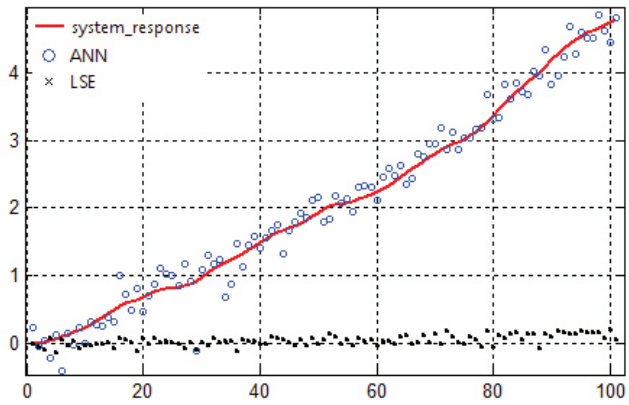

Figure 5.
Model comparison for the case with interference in the output signal.

However, in case of interference present in the output signal, LSE method could not produces satisfactory results, while ANN proved to be quite efficient. Based on the simulation results it can be concluded that the ANN justified the reputation of a flexible, easy-to-use tool for modelling systems even in difficult operating conditions. Results from this paper could use as a guidelines for further investigation which should be oriented towards ship's system identification and control design. For that purpose, an effort of adequate data acquisition should be made as prerequisite for the system identification.

REFERENCES

Al Seyab, R.K. and Cao Y., (2008), Nonlinear system identification for predictive control using continuous time recurrent neural networks and automatic differentiation, Journal of Process Control, 18(6), pp. 568-581., http://dx.doi.org/10.1016/j.jprocont.2007.10.012

Amlashi, N.J.S., Shahsavari, A., Vahidifar, A. and Nasirian, M., (2013), Nonlinear System Identification of Laboratory Heat Exchanger Using Artificial Neural Network Model, International Journal of Electrical and Computer Engineering (IJECE), 3(1), pp. 118-128.

Asgari, H., Chen, X., Menhaj, M.B. and Sainudiin, R., (2013), Artificial Neural Network Based System Identification for a Single-Shaft Gas Turbine, Journal of Engineering for Gas Turbines and Power 135(9), pp. 092601-092607., http://dx.doi.org/ 10.1115/1.4024735

Astrom, K.J. and Wittenmark, B., (1989), Adaptive Control, Reading, MA: Addison-Wesley.

Beale, M.H., Hagan, M.T., Demuth, H.B., (2015), Neural Network Toolbox™, User's Guide, Natick, MA: Mathworks.

Cybenko, G., (1989), Approximation by Superpositions of a Sigmoidal Function, Mathematics of Control, Signals and Systems 2(4), pp. 303-314., hppt://dx.doi.org/10.1007/BF02551274

Hagan, M.T. and Menhaj, M.B., (1994), Training Feedforward Networks with the Marquardt Algorithm, IEEE Transactions on Neural Networks, 5(6), pp. 989 – 993., http://dx.doi.org/10.1109/72.329697

Haykin, S., (1998), Neural Networks: A Comprehensive Foundation, Upper Saddle River, NJ: Prentice Hall PTR.

Leyva, R., Martınez-Salamero, L., Jammes, B., Marpinard, J. C. and Guinjoan, F., (1997), Identification and Control of Power Converter by Means of Neural Networks, IEEE Transactions on Circuits and Systems – I: Fundamental Theory and Applications, 44(8), pp. 735 – 742.,
http://dx.doi.org/10.1109/81.611270

Narendra, K.S. and Parthasarathy, K., (1989), Adaptive Identification and Control of Dynamical Systems using Neural Networks, Proc. of the 28th Conference on Decision and Control, Tampa, Florida. December 13 – 15, 2: pp. 1737 – 1738., http://dx.doi.org/10.1109/CDC.1989.70448

Petrović, I., (1998), Identifikacija nelinearnih dinamičkih procesa statičkim neuronskim mrežama, doktorska disertacija, Zagreb: University of Zagreb, Faculty of Electrical Engineering and Computing.

Stipaničev, D. and Marasović, J., (2008), Digitalno vođenje, Split: university of Split, Faculty of Electrical Engineering, Mechanical Engineering and Naval Architecture.

Yu, H. and Wilamowski, B.M., (2011), Levenberg – Marquardt Training Industrial Electronics Handbook, vol. 5 – Intelligent Systems, 2nd Edition, chapter 12, pp. 12-1 to 12-16, Boca Raton: CRC Press.

Familiarisation Aboard Ships of Croatian and Montenegrin Officers

Pero Vidan[a], Tatijana Dlabač[b], Goran Jerković[a]

New officers joining the ship must be aware of their obligations regarding information of security and safety on board. Furthermore, familiarisation includes technical skill related to ships' equipment. Because of the lack of time during handover due to a short time of cargo operations in port, handover is often inadequate. Familiarisation should last more than a month. Officers' contracts are usually shorter than familiarisation process. Familiarisation time and lack of familiarisation are considered as period of great risk of human error.

In this paper the authors research familiarisation and handover as safety aspects.

KEY WORDS
~ Familiarisation
~ Handover
~ Croatian Officers
~ Montenegrin Officers

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1. INTRODUCTION

According to the research conducted by the British Marine Accident Investigation Board (MAIB), Canadian Transportation Safety Board (TSB), and Australian Transportation Safety Board (ATSB), which carefully studied 350 cases of maritime accidents, 82 to 85 % of all accidents were either directly initiated by human error or were associated with human error by means of inappropriate human responding to threat situations. The incidence of human error in maritime shipping industry does not arise exclusively from the operator's failure. There is a wide range of factors contributing to the occurrence of human error. One of them is modern technology. Although all equipment aboard has to be standardized according to the Safety of Life at Sea-SOLAS Convention requirements, it is considered that inadequately designed equipment made difficulties to operators and caused 1/3 of major sea accidents. Another aspect affecting the human error is the interaction between the technology and human beings i.e. lack of training and familiarisation with equipment's operation procedures. A study performed by R. Ziarati and M. Ziarati reveals that inadequate use of navigation equipment causes 28 % of accidents (Baker et al., 2005). In this case, "inadequate" refers to the use of equipment in an inappropriate manner due to insufficient training or non-adapted equipment.

Most of regulations and standards applying to ships do not address complex issues such as cognitive activities associated with implementing new technologies on board ships. The number of standards and regulations that exclusively deal with the relationship between on-board automation and human beings are relatively low. Almost 80 % of the regulations in

maritime shipping industry refer to technical rules, whereas the remaining 20 % refer to humans (Baker et al., 2005).

For instance, SOLAS Chapter V, regulation 15, lays out the principles relating to bridge design and design of navigational systems and equipment. Operators have to cope with the equipment produced by various manufacturers competing in additional abilities not obligatory according to SOLAS requirements and may be used very rarely, bur can lead to confusion making the overall bridge system inconsistent. The equipment installed on ships of the same type and purpose may greatly vary from vessel to vessel, so that operators have to adjust to a new equipment layout, differing specifications etc., which represents a potential source of failure. The American National Transport Safety Board states that almost one out of three failures is caused by inadequate equipment design, where the lack of standardisation is the key contributing factor (Albayrak et al., 2010).

According to British psychologist Lissiane Banbridge, the core of the problem is that equipment manufacturers and their designers often tend to displace a human being out of the system wherever possible but keep on requiring an operator to carry out the tasks for which they have not found adequate solution. One of the problems that may arise in automated systems is undoubtedly the poorly designed technology that does not allow an adequate interaction between the human being and the equipment. If the interaction between a device and an operator is not ergonomic, it is likely that the operator will be overloaded and confused by the information provided by the device. For example, in case when a number of alarms are given at the same time, it is possible that critical warnings remain unnoticed (Vidan et al., 2015).

Modern integrated systems of shipping management have considerably contributed to the increased safety of sea traffic. Yet, it is necessary to introduce changes within these systems in order to reduce the share of human error in causing accidents. For instance, SOLAS regulations define the layout of the bridge, but do not define its precise design. This allows substantial room for the manufacturers who, apart from meeting SOLAS requirements, frequently install additional options to the equipment in order to boost their price and competitiveness on the market. In this way, seafarers are moved to a less favourable position, as the design of technologies forming a modern operating system has not been developed on the basis of the seafarers' needs and is likely to lead an operator to making a mistake. In order to use the available technology in a fast and efficient way, the operator has to be thoroughly familiar with all the equipment specification and modes of use and operation. To achieve this, the operator has to complete adequate training and familiarisation which will help him/her to identify all advantages and drawbacks of the equipment. Proficiency and familiarisation are the key factors in the prevention of failures and safety hazards. However, although a large number of seafarers employed by forward-thinking maritime companies attend various forms of training in order to acquire certificates of competence in operating specific systems, this does not guarantee that a seafarer will perform his/her duties using the very device and the very model that he/she familiarised with during training.

The problem of insufficient use of the equipment still exists. Some of the primary causes of failures resulting in poor exploitation of modern systems are shown in Figure 1. One of the essential aspects of this issue is the fact that the equipment often differs considerably from vessel to vessel, and seafarers rarely serve the same or similar vessels throughout their career. The end result is the superficial familiarisation with the system. Although every device has a user's manual offering certain information and instructions to the operator, the latter is often unable to read the manual thoroughly upon joining the ship due to the lack of time. Consequently, this leads to a situation where the operator is forced to handle the devices he/she is not entirely familiarised with. The operator improvises, relies on the previous experience and transfers it from the previous devices to the new ones that do not necessarily have the same mode of operation. These situations open up huge potential for misinterpreting the information that is provided by automated systems (Foord et al., 2006).

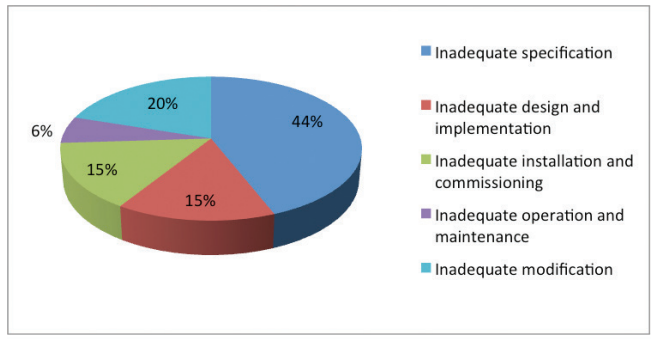

Figure 1.
Primary causes of failures in modern exploitation systems.

2. FAMILIARISATION AND HANDOVER ABOARD

The new officer crewmembers joining the ship must be aware of their obligations regarding the use of equipment, security and safety on board. The main purpose of familiarisation is to introduce new officers with important safety procedures on board, emergencies and proper use of ship technology. The captain shall appoint a qualified person responsible for training new members of the crew. Although all members of the crew joining a ship must pass a standardized training by Standards of Training, Certification and Watch-keeping for Seafarers-STCW,

there are specific instructions and requirements specific to each ship:

- Instructions on SOLAS and International Convention for the Prevention of Pollution from Ships-MARPOL
- Important features of muster list
- Guidelines on how to tackle all kinds of emergency situations on ships
- Important documents and publications of ships
- Ship's Fire Control Plan
- Different types of fire-fighting appliances and procedures to use them

During familiarization the officer will be introduced with specific details of his job depending of the type of ship and organization of crew on board. This familiarisation also includes reading manuals of new engines and equipment in order to be able to properly use them.

Except in the performance of watch-keeping at sea and in port, the new crew members will be informed of all standing orders of the chief engineer or master.

Training for lifesaving appliances and fire appliances should be completed as soon as possible and no later than two weeks after the receipt of the ship or the provisions of a single company ship owner (Unknown, 2012).

The familiarization training will include:

- Duties to eeks after joining the ship (Unknown, 2015)

Shipboard audits and port-state control results show this to be a weak area. In many cases, the crew is unfamiliar with the ship-specific and pollution-prevention equipment (Navigational Claims Brochure, 2014).

Handover is a process during the exchange of duties of two crew members of the same rank. It is usually obtained in ports. It is a normal procedure on board ships that the new crew member will be given handover of his or her duties by the person who is being relieved. During handover the new crew member has been introduced with the ship, her equipment, specific details of technology of ship and also duties. During handover, information about vessel documentation, accounts, logs etc. are usually exchanged (Shahrokh, 2015; Squire, 2015).

3. HYPOTHESIS

Handover is usually short and inadequate because of the lack of time in ports. It depends on the educational background of the officer, with the same or similar vessel and/or equipment.

Familiarisation is a process which starts after embarkation and lasts for 30-45 days. Because of hi-tech ships it can exceed 45 days. Familiarisation is performed usually according to the International Safety Management Code-ISM between the new crew member and a crew member designated by a senior officer. It depends on education of the officer.

4. METHODOLOGY

A research has been performed by the Faculty of Maritime Studies in Split and Maritime Faculty in Kotor with Croatian and Montenegrin officers using questionnaires. The subjects of the questionnaire were the quality of familiarisation and handover in their companies. The questionnaires were anonymous, but with the telephone number of the surveyed to enable checking. 20 % of the questionnaires were checked.

Questionnaires were written in the Croatian and Montenegrin languages. Croatia and Montenegro have similar systems of education of seafaring officers. After the secondary maritime school seafarers become cadets or engine apprentices. After a year of navigation as cadets, they sit for an exam in the Harbour Master's Office for officer in charge on vessels of 500 GT or more (STCW II/1) or engineer officer in charge on vessels with propulsion of 750 kW or more (STCW III/1). Captains of vessel of 3,000 GT or more (STCW II/2) and chief engineers on ships with propulsion of 3,000 kW and more (STCW III/2) have to have higher education (maritime faculty) degree and at least one year of experience as chief mate (deck) or 2nd engineer (engine), or 3 years of experience as deck officer (deck) or 3 years' experience as engineer officers (engine). After that they have to pass an exam in the Harbour Master's Office.

5. RESULTS

200 officers were surveyed, 113 Croatian and 87 Montenegrins. From the total number of 200 officers, 65 (32.5 %) of them are 25-30 year old, 79 (39.5 %) are 30-40 years old, 33 (16.5 %) are in the range between 40 and 50 years of age and only 23 (11.5 %) are older than 50. Officers are experienced, with less than 4 years of navigation (7 %), 4-10 years (29 %) and more than 15 years of navigation (29 %) (Figure 2).

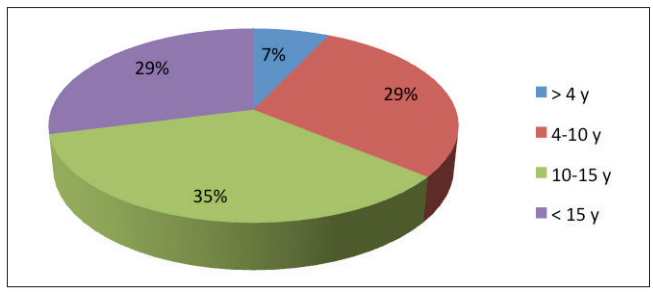

Figure 2.
Experience of navigation (n=200).

47 (26 %) officers graduated from a maritime faculty and 133 (74 %) finished secondary maritime school (Figure 3).

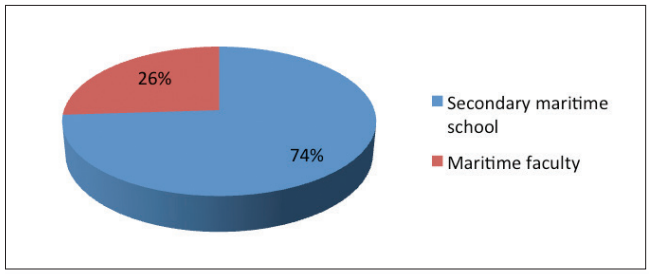

Figure 3.
Education of officers (n=200).

To the question about duration of handover, 64 (31 %) officers answered "up to 2 hours". Duration of 2-4 hours was chosen by 28 officers (14 %), 4-6 hours by 26 officers (13 %). More than 6 hours was the choice of 84 officers (42 %) (Figure 4).

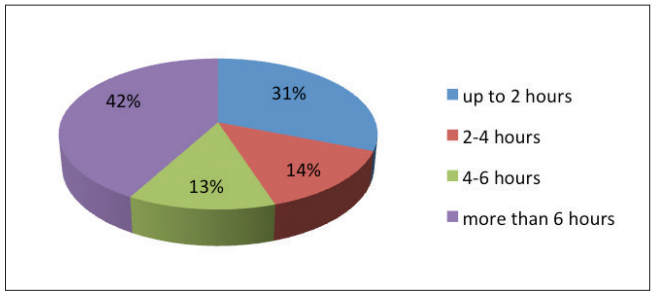

Figure 4.
Duration of handover (n=200).

The duration of familiarisation up to 7 days was stated by 174 officers (87 %), 20 officers (10 %) had 7-15 days of familiarization. 4 (2 %) officers had 15-30 days' familiarisation. 2 officer (2 %) replied about 30-45 days' familiarization (Figure 5)

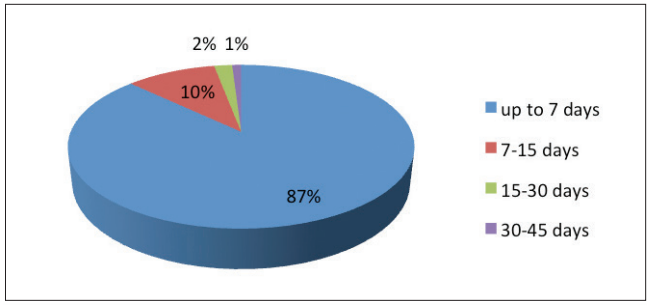

Figure 5.
Duration of familiarisation (n=200).

From the total number of 200, 102 officers considered handover as sufficient and 88 of the officers surveyed considered familiarisation as sufficient.

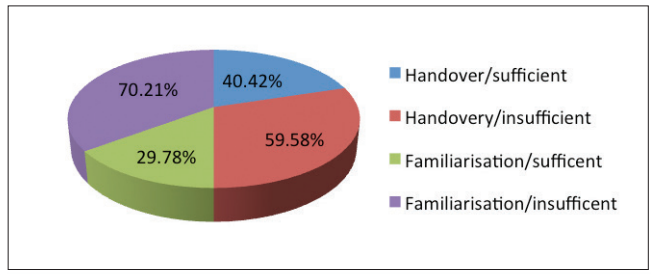

Figure 6.
Answers of officers who graduated from maritime faculty (n=47).

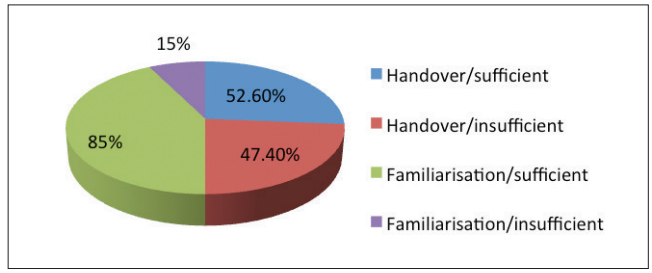

Figure 7.
Answers of officers who finished maritime secondary school (n=133).

From the total number of 133 officers who finished maritime faculty, 28 considered handover as insufficient and 33 thought the same about familiarisation (Figure 6). The officers who finished only maritime secondary school thought that handover was insufficient were 63 and 20 thought the same about familiarisation (Figure 7). 58 % of officers sail on board

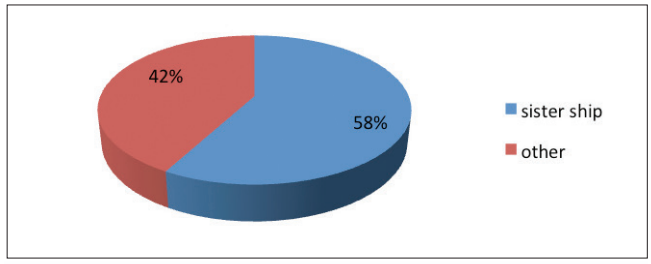

Figure 8.
Answers about similarity of vessel where officers sailing.

sister ships. The remaining 42 % do not sail on board sister ships, but on ships using the same technology.

6. DISCUSSION

200 questionnaires are not a representative number, but the research shows significant phenomena. There has not been a similar research up to date, so that the amount of deviation from the control number could not be calculated. The authors expect this survey to lead to a future research about familiarisation of crew aboard ships.

Most of the officers surveyed finished a secondary maritime school - 74 % (Figure 5) and most of the surveyed have experience of sailing 10-15 years (Figure 4). Comparing Figure 6, which shows answers of officers graduated from a maritime faculty, and Figure 7, which shows answers provided by those having finished a secondary maritime school, it's obvious that handover and familiarisation do not depend on the education level. In a future survey it is recommended to compare how experience in sailing and training affects familiarisation and handover.

Results are the same for Croatian and Montenegrin officers, so there was no need for a detailed analysis by nationality.

42 % of the surveyed answered that they had handover longer than 42 % which s consider ad enough (Figure 4). 87 % of surveyed had familiarisation up to 7 days which consider as insufficient. Most officers (Figure 6) are satisfied with time of familiarisation, although it was up to 7 days (Figure 4). This result is confused but it is consequence of fact that 58 % of officers have sister ship as last ship of sailing (Figure 8), and 98 % officers has last ship with same technology as previous.

Although 42 % of surveyed officers had handover longer than 6 hours, 59.58 % of officers considered this period as insufficient. Taking into consideration Figure 8, it is to conclude that handover requires more time. The interview with the officers also discovered that, in an inversely proportional manner the ship administration has recently increased while handover has become shorter.

7. CONCLUSION

Familiarisation and handover are considered as very important for the safety and security of ship. Technological innovations prolong them. Seafarers+ contracts become shorter. In some cases, e.g. on offshore vessels, where contracts have duration of one month aboard and one month at home, familiarisation can last as long as the contract period.

STCW and International Maritime Organisation-IMO are introduced with the problem of familiarisation and handover. Because of this, they prescribed familiarisation trainings for special ships and equipment.

Shippers, in order to reduce familiarisation time and handover, usually embark seafarers, especially officers on sister ships or ships of the same technology.

This survey includes 200 seafarers, officers from Croatia and Montenegro. There was no previous research about familiarisation and handover, so this statistics does not include control group and deviation data.

In a future research it is necessary to include data about experience and how experience affects familiarisation and handover. For better results, officers should not navigate on sister ships. It is also recommended to include shippers and agencies that embark seafarers and try to research their statements and opinions.

During this survey, a researcher found out that in a future survey it would be very important to analyse how officer rank and the size of ship and engine affect the time of handover and familiarisation.

For the representativeness of the number of surveyed, it is necessary to extend the survey to other nations with different systems of education and promotion and increase the number of surveyed to at least 1,000.

REFERENCES

Albayrak, T. and Ziarati, R., (2010), Training: Onboard and Simulation Based Familiarisation and Skill Enhancement to Improve the Performance of Seagoing Crew, Proc. International Conference on Human Performance at Sea HPAS 2010, Glasgow, Scotland, UK,June 16 – 18, pp. 11 – 21., available at: http://www.egmdss.com/pictures/press/2010_06_16_tr_HPAS2010_improve_the_performance_of_seagoing_crew.pdf

Baker, C.C. and McCafferty, D.B., (2005), Accident database review of human element concerns: what do the results mean for classification?, Proc. International Conference on Human Factors in Ship Design, Safety and Operation, London, UK, February 23 - 24, availabe at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.437.6892&rep=rep1&type=pdf

Bielic,,T. and Zec, D., (2004), Influence of Ship Technology and Work Organisation on Fatigue, Pomorski zbornik, 42 (1), pp. 263-276.

Foord, A. G. and Gulland, W. G., (2006), Can technology eliminate human error?, available at: http://wildeanalysis.co.uk/system/downloads/371/original/Can_Technology_Eliminate_Human_Error.pdf, [accessed 21 April 2015.].

Navigational Claims Brochure, (2014), available at: http://www.swedishclub.com/upload/Publications/navigational-claims-brochure.pdf, [accessed 11 February 2015.].

Shahrokh, K., (2015???), Familiarisation on Board, available at: http://www.he-alert.org/filemanager/...-/he01095.pdf, [accessed 12 June 2015.].

Squire, D., (2006), The Human Element in Shipping, available at: http://www.he-alert.org/filemanager/root/site_assets/standalone_pdfs_0355-/he00350.pdf, [accessed 1 September 2015.].

Unknown, (2006), Guidance to Masters, 2nd Edition, Arendal, Norway: Gard, available at: http://www.gard.no/Content/20651969/GTM_web.pdf, [accessed 1 September 2015.].

Unknown, (2013), Familiarization for New Crew Members on Board of the Ship, available at: http://sea-jobs.net/encyclopediaen/190, [accessed 1 September 2015.].

Unknown, (2012), Procedure for Ship Familiarization for New Crew Members on Ships, available at: http://www.marineinsight.com/misc/marine-safety/procedure-for-ship-familiarization-for-new-crew-members-on-ships/, [accessed 30 august 2015.].

Vidan, P., Bukljaš Skočibušić, M. and Rubić, J., (2015), Influence of New Technology on Human Error, Proc. 17th International Conference on Transport Science, Portorož, Slovenia, May 21 – 22, pp. 554-562.

Improving Energy Efficiency by Advanced Traffic Control Systems

Miroslav Vujić[a], Ivana Šemanjski[b], Pero Vidan[c]

The problem of traffic congestion is particularly acute in urban areas in which the possibilities for the physical increase of capacities are limited or nonexistent. Traffic congestion has a direct impact on the emission, energy efficiency and fuel consumption of personal vehicles. Several projects in the European Union are focused on solving this problem (both at the physical level – automotive industry, as well as at the traffic management level). This paper explores the possibility of the implementation of advanced traffic control systems in urban areas in which driving behavior involves a multitude of stop-and-go actions, lower speeds in lower vehicle gears. Since this type of driving behavior affects vehicle fuel consumption and emission, relevant evaluation parameters were defined (queue length, average vehicle speed, etc.). A demonstration corridor in the city of Zagreb was chosen and a simulation model based on the traffic data collected in real traffic situations developed. The basis for further research is laid down to allow the application of the proposed model and adaptive traffic control algorithms to the greater urban traffic network.

KEY WORDS

~ Intelligent Transport Systems
~ Fuel Consumption
~ CO_2 Emission
~ Signal Control

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1. INTRODUCTION

Nowadays, traffic and transportation are the sector with the highest energy consumption, especially in urban areas where driving regimes (greater number of stop-and-go actions, lower average speeds, etc.) differ from "normal", free ride driving regime (International Energy Agency, 2009). Apart from efforts to reduce emissions at the physical level (Kadijk et al., 2015), signal control logic could also be regulated across a wider area to allow the reduction of a part of vehicle energy efficiency parameters. Likewise, raising the quality of public transportation (PT) systems may lead to the reduction of the number of personal vehicles in urban areas (Vujic, 2013). Global industrial demand for primary energy is projected to rise by 40 % by 2030 in comparison with the 2007 levels. This would put global energy-related CO_2 emissions at 40.2 gigatonnes (Gt) in 2030, with an annual growth rate of 1.5 % (International Energy Agency, 2009). The International Energy Agency (IEA) estimates that there is a potential for a 50 % technical improvement in new vehicle fuel economy by 2030 (International Energy Agency, 2009a; Gudelj and Krčum, 2013). The usage of PTV VISSIM simulation tool for modelling energy efficiency and fuel consumption started in the first decade of the 21st century (Stathopoulos and Noland, 2003; Scora and Barth, 2006). But in the quoted papers, the optimization of relevant parameters was not considered. The optimization of signal timings at signalized intersections in urban areas reduces the waiting time of vehicles, while simultaneously having a direct impact on the energy efficiency of personal vehicles (Shamshirband, 2012). Owing to the increasing consciousness of traffic and transport pollutants, several European Union (EU) funded Framework Program 7 (FP7) projects aim to deal with this issue. One of them is the eCoMove Integrated Project aiming to reduce the overall fuel consumption by 20 % with the usage of several advanced intelligent transport system (ITS) solutions (eCoMove, 2013).

2. PUBLIC TRANSPORTATION PRIORITY STRATEGIES

The delays of public transportation vehicles at signalized intersections account for 27 % - 35 % of all delays induced by all traffic in the urban network (including public transportation) (Zhizhou et al., 2014). Advanced adaptive control of signalized intersections includes turning on green lights for public transport vehicles whenever possible. Three main approaches in PTP assignments are defined as (Nash and Sylvia, 2001):

- passive approach,
- unconditional approach,
- active approach.

Predefined signal schemes are used when implementing passive priority approach to contribute to the reduction of public transportation vehicle travel times. The passive priority approach does not require the presence of a public transportation vehicle, nor a notification of its arrival to a signalized intersection. Specific passive priority techniques include cycle length reduction and phase splitting.

Public transportation vehicles are given unconditional priority at signalized intersections regardless of which phase of the cycle is active. After the end of the active phase (taking into consideration minimum safety/passenger green times), green light for public transportation vehicles is immediately activated. Although rarely used in public transportation, the unconditional approach is widely used for emergency and VIP vehicle priority assignment.

Active priority techniques are activated only when a public transportation vehicle arrives at a signalized intersection, or when a priority demand is sent to the control center. After the demand is sent, the priority technique is activated within the limits of minimum safety parameters.

Active approach techniques include green light phase extension, early green light phase (red light truncation), green light phase insertion, phase rotation or substitution and selective strategies.

a) Green phase extension

If public transportation vehicle approaches a signalized intersection, and green light is on, it can be extended for a period required by a public transportation vehicle to pass through the intersection (Figure 1). Maximum extension limit is used to limit the impact on cross street vehicles.

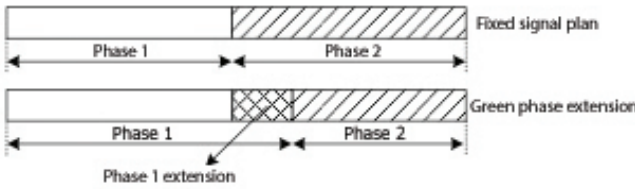

Figure 1.
Green phase extension technique.

Different projects and references define maximum green light extension times ranging from 10-20s in the implemented scenarios (Hounsell and Shretsha, 2012).

b) Early green phase (red light truncation)

If public transportation vehicle approaches a signalized intersection, and red light is active, it can be shortened so that early green phase can be activated (Figure 2).

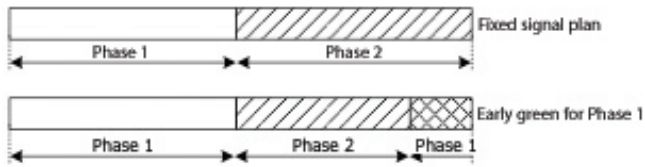

Figure 2.
Early green light phase (red light truncation) technique.

Maximum red light truncation values are lower than green light extension values because red light truncation depends on the inter-green light matrix (minimum time necessary for pedestrians to cross the road).

c) Green light phase insertion

If a public transportation vehicle approaches a signalized intersection (with three or more signal phases) green light (which is not in the signal expected in the cycle) may be introduced to accommodate the approaching public transportation vehicle (Figure 3).

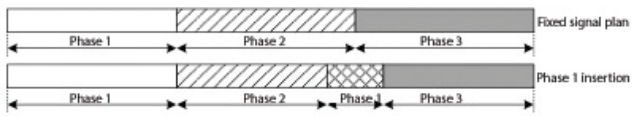

Figure 3.
Green light phase insertion technique.

A certain phase of the signal cycle can be skipped when there is no traffic load in the respective lane. In that case, green light for an approaching public transportation vehicle may be turned on, thus reducing the public transportation vehicle delay (Vujic, 2015). After PT vehicle detection, the system calculates the anticipated time of vehicle arrival at the signalized intersection.

3. USE CASE – DEMONSTRATION CORRIDOR IN THE CITY OF ZAGREB

One of the main traffic problems in the City of Zagreb is the daily commutation of inhabitants from one part of the City to another

(mostly east-west and vice versa). The traffic corridor of King Zvonimir Street is one of the main links connecting the east part of the City with the City center (Figure 4). The corridor is 2,690 m long, with traffic in both directions, with separated public transportation (PT) lanes.

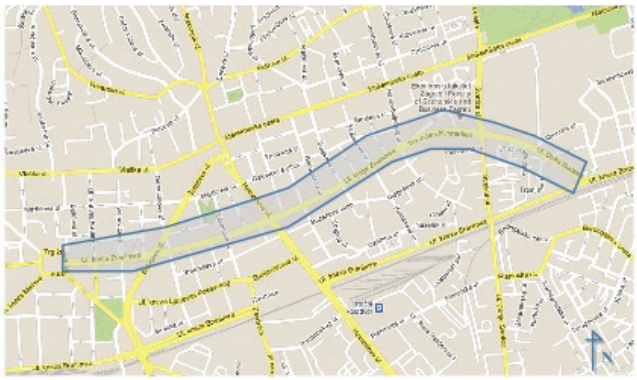

Figure 4.
Selected demonstration corridor in the city of Zagreb.

There are 24 intersections in the corridor, eight of which are signalized. All intersections have horizontal and vertical traffic signalization, and signalized intersections are also equipped with signal controllers using fixed control logic.

The simulation model was defined and developed in the PTV VISSIM simulation software in keeping with the collected real-life data (number of vehicles and their categorization). The morning rush hour was selected (8 AM – 9 AM), and relevant data were implemented into the simulation model. Owing to the complexity of the simulation model and a vast amount of traffic data, only one intersection was selected for this research (Figure 5) for data collection and evaluation.

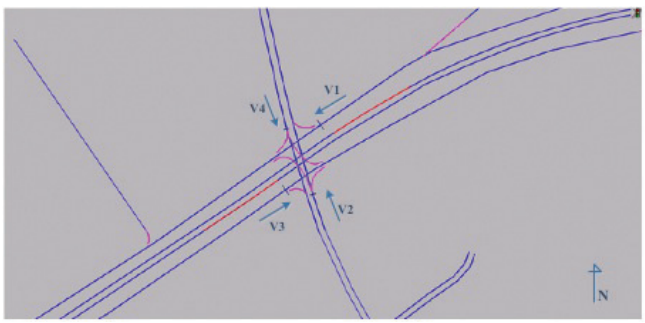

Figure 5.
Signalized intersection Harambašićeva Street – King Zvonimir Street.

The main traffic flow is the King Zvonimir Street (signal groups V1 and V3), with two lanes in each direction (eastbound and westbound), with the side lane being Harambasiceva Street (signal groups V2 and V4), with one lane in each direction. The fixed signal program is illustrated in Figure 6 with a signal cycle duration of 90 s.

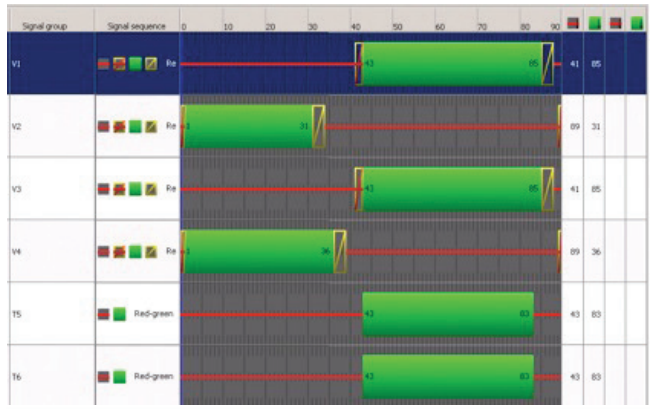

Figure 6.
Fixed signal program for the selected signalized intersection.

The fixed signal program clearly shows the control to be a two-phase signal plan with four signal groups for road traffic (V1, V2, V3 and V4) and two signal groups for public transportation vehicles (T5 and T6).

3.1. Adaptive Traffic Control of the Signalized Intersection

Although the proposed scenario includes adaptive traffic control of all signalized intersections in the selected corridor, a detailed description and data collection/evaluation are presented for only one intersection (Harambasiceva Street – King Zvonimir Street). Detector D2 is positioned at the northern approach to the intersection at the distance of 30 m from the stop line, since the average queue length is 8 vehicles. Respectively, detector D3 (at the eastern approach) is positioned 20 m from the stop line, since the average queue length is 4 vehicles.

If there are no road vehicles (or their number is smaller than the average queue length number) on the side lane detectors (D2 and/or D3), the main flow phase of 10 s is extended to 50 s. In case that a road vehicle activates D2 and/or D3 detectors (after 40 s of the main flow phase), side lane phase is activated for 20 s (which is 10 s shorter than in the fixed signal program).

Since the number of vehicles in the main flow is greater than the number of vehicles in the side lane approaches, and PT vehicles are part of the main flow, this algorithm can increase the level of service (LoS) at all signalized intersections in the selected

corridor. After the completion of the side lane phase (duration of 20 s), the main flow phase is activated, and the presence of vehicles on side lane detectors reexamined.

4. SIMULATION RESULTS

The first stage of simulation model development consists of making traffic network sketches (road and PT lanes, signalized intersections, etc.), defining signal plans, establishing the location of signal lanterns at every signalized intersection, entry of vehicle numbers and classification data, connecting signal logic with adaptive traffic control algorithms, etc. (PTV AG, 2014).

4.1. Simulation Model of the Selected Corridor

Following the calibration of the simulation model against the actual situation in the selected corridor, evaluation parameters pertaining to energy efficiency and emissions (Molina, 2005) needed to be defined. Based on the available data, vehicle compositions were entered into the simulation model, and the simulation was ran exclusively for personal vehicles with petrol and diesel engines (Table 1).

Evaluation parameters are defined and described in the following chapters.

Table 1.
Estimated classification of personal vehicles used in the simulation model.

EURO engine category	Petrol engine vehicles	Diesel engine vehicles
EURO II	15 %	10 %
EURO III	30 %	20 %
EURO IV	15 %	10 %

4.2. Link Evaluation

Since results can be collected and evaluated at link level, four links were defined (Figure 7).

At the link level, following evaluation parameters were defined:

- average vehicle speed [km/h],
- traffic flow [veh/km],
- CO_2 emission [mg/m],
- fuel consumption [mg/m].

Simulation duration was 3600 s (defined rush hour), with additional 1800 s for network charging, and the defined data collection interval was 60 s. Gathered results are shown in Table 2 and Table 3.

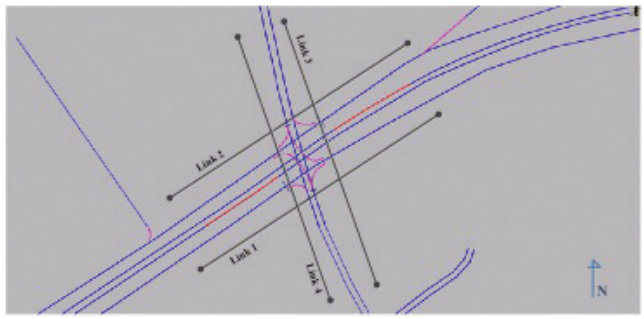

Figure 7.
Definition of links at the selected intersection.

Table 2.
Gathered results for the existing traffic situation.

Link	Average speed [km/h]	Traffic flow [veh/h]	CO_2 emission [mg/m/s]	Fuel consumption [mg/m/s]
Link 3	33.60776279	239.3355774	12.34101689	3.920178699
Link 4	25.26322023	223.9535919	14.11279782	4.484941204
Link 2	28.345801	594.3164542	31.91026888	10.12928811
Link 1	20.77310873	789.115241	54.51243549	17.30349592

Table 3.
Gathered results for the simulation with implemented adaptive traffic control.

Link	Average speed [km/h]	Traffic flow [veh/h]	CO_2 emission [mg/m/s]	Fuel consumption [mg/m/s]
Link 3	29.95277839	240.9064021	12.81411279	4.068477747
Link 4	21.65459486	222.7703678	15.52181427	4.931558853
Link 2	32.748382	604.3792071	31.11571712	9.876467152
Link 1	29.57466041	786.5396428	43.72176149	13.87812517

Tables 2 and 3 clearly show that all defined parameters are improved with the same traffic flow at all approaches to the selected intersection. However, significant improvement is realized at main flow approaches because adaptive traffic control is defined in favor of the main traffic flow (greater number of vehicles).

4.3. Time Loss - Queue Length

A parameter directly illustrating the impact of adaptive traffic control on traffic flow is queue length. In PTV VISSIM, a vehicle is considered to be in queue when its speed drops under 3 km/h, maximum 100 m from the stop line to the last vehicle under the same conditions, until its speed exceeds 5 km/h. Queue counters detecting vehicles upstream are positioned on stop lines. In the selected demonstration corridor, four queue counters were defined as seen in Figure 8.

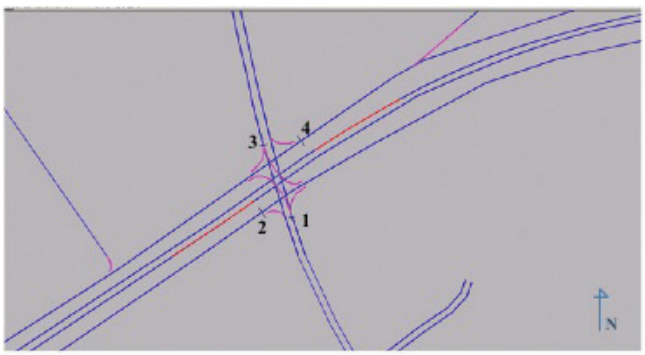

Figure 8.
Queue counter placement in the simulation model.

Data are gathered every five minutes and shown in Tables 4 and 5.

Table 4.
Queue length and number of stops in the existing situation.

Counter	Average queue length [veh]	Maximum queue length [veh]	Number of stops
1	3.16	38	7.5
2	6.58	52	2.54
3	7.8	51	13
4	16.08	77	53.16

Table 5.
Queue length and number of stops for the simulation model with implemented adaptive traffic control.

Counter	Average queue length [veh]	Maximum queue length [veh]	Number of stops
1	4.33	45	9.58
2	4.33	52	21.75
3	9.58	50	12.6
4	6.75	68	27.16

As shown in Tables 4 and 5 and Figure 8, counters are positioned on the stop lines of every approach to the selected intersection. Counter 1 is located at the southern approach, counter 2 at the western approach, etc. The number of stops is a parameter describing the average number of situations in which road vehicle

speed is 0 km/h, which is cumulated for every vehicle upstream of the stop line. At the southern approach (counter 1), the average number of stops is slightly higher due to the shorter duration of the green light at this approach (according to the implemented adaptive control algorithm). As expected, the average number of stops at main line approaches decreased (especially at the eastern approach) owing to the longer duration of green lights.

4.4. PT Vehicle Time Savings - Average Public Transportation Travel Time

Apart from the defined parameters, another important indicator of adaptive traffic control efficiency is average PT travel time (measured along the entire demonstration corridor). Two 2,500 m long travel time sections were defined in the simulation model (one in each direction). The measured PT travel times are shown in Tables 6 and 7.

Table 6.
Measured PT travel times for the existing traffic simulation.

Direction	Average PT travel time [s]	Standard deviation [s]	Minimum [s]	Maximum [s]	Average PT speed [km/h]
Westbound	671.1	57	544.1	803.9	13.4
Eastbound	696.8	71	475.3	891.8	12.9

Table 7.
Measured PT travel times for the simulation model with implemented adaptive traffic control.

Direction	Average PT travel time [s]	Standard deviation [s]	Minimum [s]	Maximum [s]	Average PT speed [km/h]
Westbound	631.6	48.2	533.7	715.8	14.2
Eastbound	654.3	57.6	557	795.5	13.8

The main evaluation parameter in the defined travel time sections was average PT travel time. Owing to the specifics of the developed adaptive traffic control (favoring main traffic flow used by PT vehicles), average travel time was decreased by 39.5 s in the westbound direction and by 42.5 s in the eastbound direction. Respectively, as average PT travel time decreased, average PT vehicle speed increased. This only applies if the number of passengers remains the same. Of course, if the quality of PT service improves, the number of passengers is expected to increase. In that case, the relations between these parameters would change.

5. RESULT ANALYSIS

In the previous chapter the simulation model development process was presented, as were the results realized in the existing traffic situation and using the adaptive traffic control model. Since the main traffic flow (King Zvonimir Street) is simultaneously a PT line route, the benefits of adaptive traffic control are obvious. Link level evaluation was conducted for the entire demonstration corridor, with adaptive traffic control algorithms implemented at all signalized intersections. Other gathered data were evaluated for only one selected signalized intersection, but projections were made for the entire corridor taking into consideration distances traveled under different driving regimes.

5.1. Link Level Evaluation

At link level, evaluated defined parameters were the average speed of personal vehicles, traffic flow (for each defined link), CO_2 emission and fuel consumption. As expected, the average speed of personal vehicles in main (priority) lanes increased, while decreasing in the side lanes. This is mainly due to the shortening of green light duration (signal phase) in the side lanes, with unmodified duration of the signal cycle.

In the main lane (eastbound direction), the average personal vehicle speed increased from 29.07 km/h to 33.01 km/h (an increase of 3.94 km/h), and in the westbound direction from 22.81 km/h to 26.90 km/h (an increase of 4.09 km/h). In the side lane (southbound direction), average speed decreased from 36.57 km/h to 35.53 km/h, and in the opposite direction (northbound) from 28.11 km/h to 27.17 km/h, which is not a drastic decrease of average speed.

CO_2 emission and fuel consumption are also important evaluation parameters in link level evaluation, but since they depend on queue lengths (stop-and-go actions) at every intersection approach, queue length will be analyzed in the next section.

5.2. Queue Length and Average Number of Stops

Queue length and average number of stops were measured in the simulation for every approach to the intersection. In the main traffic flow (with implemented adaptive traffic control), the values of the above parameters decreased when compared to the existing traffic situation with fixed signal timings. At the western approach (Counter 2), average queue length decreased from 6.58 to 5 vehicles, with the average number of stops decreasing from 24.33 to 20.33 stops. At the eastern approach, average queue length decreased from 16.08 to 11.25 vehicles, with the average number of stops decreasing from 53.16 to 37.41 stops. These data show that queue length decreased along the entire main traffic flow (King Zvonimir Street), having a direct impact on fuel consumption and emission.

5.3. CO_2 Emission and Fuel Consumption

Based on the collected data, implemented adaptive traffic control algorithms were anticipated to reduce CO_2 emission and fuel consumption. Table 8 shows the total values of CO_2 emission and fuel consumption for one hour (rush hour) of the simulation, for all vehicles passing through the chosen intersection.

Table 8.
Total values of CO_2 emission and fuel consumption for the selected intersection.

	Existing situation		Adaptive traffic control	
Link/lane	**CO_2 emission [mg/m/s]**	**Fuel consumption [mg/m/s]**	**CO_2 emission [mg/m/s]**	**Fuel consumption [mg/m/s]**
Northbound	2953.644	48.378	3087.001	52.133
Southbound	3160.611	63.295	3457.800	76.546
Eastbound	18964.797	323.228	18805.692	307.313
Westbound	43016.593	943.255	34388.898	606.776
TOTAL	68095.647	1378.158	59739.393	1042.770

The analysis of results from Table 8 shows that the total CO_2 emission of vehicles passing through the chosen intersection in one hour decreased by 12.3 % when compared to the existing situation. The gathered fuel consumption values are 24.36 % lower in the simulation model with implemented adaptive traffic control algorithms.

6. CONCLUSION

In urban areas, adaptive traffic control is not only an essential tool for traffic flow harmonization, but also a very effective tool for improving energy efficiency and reducing emissions and fuel consumption. This research focused on the introduction of adaptive traffic control into a 2,690 m long demonstration corridor in the City of Zagreb. Based on the results achieved and the analysis of a signalized intersection in the selected corridor (Harambasiceva Street – King Zvonimir Street), vehicles at any intersection can be concluded to enter into a different driving mode (repetition of stop-and-go actions, waiting to pass the intersection, etc.). The estimated length of this type of driving in the selected corridor is 2,000 m, i.e. approx. 2/3 of the corridor, with the "free ride" regime in the remainder of the corridor being unsuitable for improving on the defined parameters (average speed, CO_2 emission, fuel consumption, etc.) by introducing adaptive traffic control strategies. At the level of the entire corridor, an overall reduction of CO_2 by 5.5 %, and fuel consumption by 14.8 % can be expected based on the analysis and the defined areas of traffic light intersections. The introduction of an adaptive management area larger city network to increase the average speed of road vehicles, reduce CO_2 emissions and fuel consumption is possible. Further research will focus on the expansion of the corridor in a part of the City of Zagreb, and on gathering additional data from vehicles to improve the accuracy of simulation results. The improved public transportation system is expected to attract greater numbers of PT users, consequently reducing the number of personal vehicles.

REFERENCES

eCoMove, (2013), Cooperative Mobility Systems and Services for Energy Efficiency, Development and Testing of Traffic Management And Control Measures, D.5.7., available at:
http://www.transport-research.info/Upload/Documents/201212/20121211_105904_61055_D5.7_-_Development_and_Testing_of_Traffic_Management_and_Control_Measures.pdf

Gudelj, A. and Krčum, M., (2013), Simulation and Optimization of Independent Renewable Energy Hybrid System, Transactions on Maritime Science, 2(1), pp. 28-35., http://dx.doi.org/10.7225/toms.v02.n01.004

Hounsell, N. and Shretsha, B., (2012), A New Approach for Cooperative Bus Priority at Traffic Signals, IEEE Transactions on Intelligent Transportation Systems, 13(1), pp. 6-14., http://dx.doi.org/10.1109 %2fTITS.2011.2172869

International Energy Agency, (2009), World Energy Outlook, Paris, France: OECD/IEA.

International Energy Agency, (2009a), Transport, Energy and CO2: Moving Toward Sustainability, Annual Report, Paris, France: OECD/IEA.

Kadijk, G., Lingterink, N., van Mensch, P., Spreen, J., Vermeulen, R. and Vonk , W., (2015), Emissions of Nitrogen Oxides and Particulates of Diesel Vehicles, report No. TNO 2015 R10838, Delft, The Netherlands: TNO.

Molina, M., (2005), An Intelligent Assistant for Public Transport Management, Advances in Intelligent Computing, Lecture Notes in Computer Science, Heidelberg: Springer Berlin,Vol. 3645, pp. 199 - 208., http://dx.doi.org/ 10.1007/11538356_21

Nash, B., A. and Sylvia, R., (2001), Implementation of Zurich's Transit Priority Program, Mineta Transportation Institute Report 01-13, San Jose, CA, USA: San Jose State University.

PTV AG, (2014), PTV VISSIM 6 User Manual, Karlsruhe, Germany: PTV.

Scora G. and Barth, M., (2006), Comprehensive Modal Emission Model (CMEM), Version 3.01 User's Guide, Riverside: University of California.

Shamshirband S.: A Distributed Approach for Coordination Between Traffic Lights Based on Game Theory, The International Arab Journal of Information Technology, 2012; 9 (2), pp. 148-153.

Stathopoulos, F.G. and Noland R.B., (2003), Induced Travel and Emissions from Traffic Flow Improvement Projects, Transportation Research Record: Journal of the Transportation Research Board, 1842, pp. 57–63., http://dx.doi.org/10.3141/1842-07

Vujic, M., (2013), Dynamic Priority Systems for Public Transport in Urban Automatic Traffic Control, PhD, Zagreb: University of Zagreb, Faculty of Transport and Traffic Sciences.

Vujic, M., Mandzuka, S. and Greguric, M., (2015), Pilot Implementation of Public Transport Priority in the City of Zagreb, Promet – Traffic & Transportation, 27(3), pp. 257-265., http://dx.doi.org/10.7307/ptt.v27i3.1735

Zhizhou, W., Li Z. and Jian S., (2014), A Study of Dynamic Right-Turn Signal Control Strategy at Mixed Traffic Flow Intersections, Promet–Traffic&Transportation, 24(6), pp.449–458., http://dx.doi.org/10.7307/ptt.v26i6.1357

The Worldwide Tanker Shipping Market (2010 – 2020) Information Model

Vinko Vidučić[a], Gorana Jelić Mrčelić[a], Martina Penović-Buble[b]

The aim of this paper is to provide the information model for the worldwide tanker shipping market 2010 – 2020. The evaluation and analysis of the relevant variables of the model and the resulting growth rates are used to describe the most important theoretical principles of the worldwide tanker shipping market over the observed period of time. The research produced direct growth rates of the variables on the index scale from 1 to 100: 1. Innovations in maritime shipping (37.5), 2. Global economy (25.0), 3. Shipbuilding (14.3). 4. Globalisation (12.5) and 5. Freight rates (12.5). It can be concluded that the direct growth rates of all model variables of the worldwide tanker shipping market 2010 – 2020 have realistic chances to be implemented. By 2020 it is expected that the demand on the tanker shipping market will increase more intensely than the demand in other trades.

KEY WORDS
~ Information model
~ Tanker trade
~ Global economy
~ Globalisation
~ Freight rates
~ Shipbuilding
~ Innovations in maritime shipping

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1. INTRODUCTION

Until 2000 the global economy was growing moderately and it was expected that the economic cycle would last for around ten years, depending on the growth intensity of the transport of crude oil and oil derivatives. The growth of the tanker trade was considerably affected by the development of the global economy in the early 21st century (Puljiz, 1998). However, the growth trends indicated that the crude oil cycle compared to the cycle of oil derivatives was twice longer.

Over the first ten years of this century the tanker sea-borne trade experienced major technological changes. At the same time, the discrepancy between the supplied tanker capacities and the worldwide demand for the transport of crude oil and oil derivatives decreased steadily. After 2003 the supply of tanker shipping capacities expanded due to the delivery of newbuildings that had been commissioned earlier. The supply growth stabilised after 2005. All tanker shippers had to replace their single-hull ships with double-hull tankers by 2010 (Cerović and Bašić, 2008). Tanker trade maintained high freight rates throughout 2008 and until the first quarter of 2009 when the drop in demand for crude oil, combined with the increased tanker capacities, resulted in significant reduction in freight rates. The late 2008 and the early 2009 experienced a deterioration of the global monetary system followed by a recession resulting in the devastating effects across the maritime shipping industry, including surplus shipping capacities in most trades, steep fall in freight rates, reduction in bank investment in the maritime trade, order cancellations, and bankruptcies of renowned shippers with implications for the shipbuilding industry (Vidučić, 2011).

The worldwide tanker capacities decreased in 2008, and this trend remained until 2012 when the global tanker fleet capacity increased again. The year 2010 was marked by low freights and surplus shipping capacity except in the segment of tanker trade. This segment did not experience major employment problems in 2010 because Asian economies continued to grow, somewhere even above 7 %. The economies of the USA and EU were also on their way to recovery (www.statista.com). A further development of the tanker trade was affected by the general growth of the worldwide economy during 2013. The key factors included high oil prices (averaging more than 100 USD per barrel for the third year in a row), demography, geopolitical uncertainty, energy efficient technologies, and changes in supply/demand related to the traditional consumer markets. In 2013 a lower amount of crude oil was imported in the USA, while the country exported more refined oil products at the same time (RS Platou Economic Research, 2014).

In 2014 the worldwide tanker fleet was flying the state flags of: 1. Greece (17.6 %), Japan (11.9 %), 3. Norway (6 %), China (5.1 %), 4. Germany (5.0 %), USA (4.6 %) etc. (www.unctad.org). At the end of 2014 the prices of new-buildings on tanker trade market were decreasing (three-month trend) and were about 0.5 – 1 % lower than in August 2014 (Tijardović, 2012).

Tanker freight rates decreased since October 2014 from an average of 80,000 USD/day (Suezmax and VLCC tankers) to around 44,000 USD/day for Suezmaxes and 55,000 USD/day for VLCCs, whereas in the Aframax segment the rates dropped from 60,000 USD/day to about 32,000 USD/day. Meanwhile, freight rates in the product tanker segment increased since October 2014: for MR Handymax tankers the rates increased from 20,000 USD/day to 23,000 USD/day, for Handysize tankers from 22,000 USD/day to 29,000 USD/day, and for the Panamaxes from 22,000 USD/day to 25,000 USD/day. In the segment of 20,000 DWT chemical tankers fitted with stainless steel tanks, the freight rates remained stable in 2014 and early 2015 amounting to around 14,000 USD/day. In the world order-book for 2015 there were 937 tankers with approximately 75 million DWT, i.e. about 15 % of the current tanker fleet (www.hb.hr). Despite the excess capacity of the world fleet, vessels of the new generation have been commissioned. The trend is likely to gradually displace standard vessels out of the market (www.dnv.com)

Recently, most shippers have started using economical sailing speeds and adjusted their shipping schedules accordingly. Reduced fuel consumption helps to mitigate huge oscillations in fuel prices on the global oil market. The economical speed is about 20 % less than the full speed used before the economic crisis. The oil prices tend to grow constantly and no major changes can be forecasted, at least for the time being. It remains unknown to what extent the current oil prices will affect the shipbuilding market, but it is well known that in similar situations on the oil market in the past the impact was great (Kunda, 2013).

The fast growing economies, like China and India, have become major oil importers with immense plans regarding the expansion of their refinery capacities.

The major issue in forecasting the development of the worldwide seaborne shipping is the intensity of global economic growth. The tanker shipping market has been under tremendous pressure due to various events associated with oil exploitation and product refinement, so that it is very unrewarding to predict future trends (www.unctad.org).

The growth of the national and international maritime trade is expected by 2017 and this should result in higher rates (Zelenika and Pupovac, 2000). Forecasts for worldwide seaborne shipping market pronounce the trend of the demand restructuring, the increased market share of tramp and liner services, and the reduced market share of tanker trade. The process of globalisation will encourage the transfer of register of vessels from national to open registries. It is assumed that half of the world merchant fleet has already been flying flags of convenience (http://ec.europa.eu/).

It is expected that the tanker shipping market will remain balanced until 2020, with oil supply mainly running through pipelines from the Middle East, Africa and Russia, and that the import into China and India will be higher in 2020 than it was in 2012 (Cerović and Bašić, 2008). It is also expected that the near future will bring a slight growth in tanker trade, with crude oil supply increased by 1.2 % and oil product supply increased by 3.6 %. The USA is likely to remain the key player on the market. Other essential aspects affecting the development of the tanker trade market include the expected reduction of export from North Africa due to relatively poor infrastructure and civil unrests. Tensions remain high across the areas that are essential for oil production and export, such as North Africa, parts of sub-Saharan Africa, West Asia, etc. (www.intertanko.com). The contribution of Iran remains uncertain regardless of the agreements achieved.

The major routes for shipping crude oil and oil derivatives are expected to change: the currently prevailing shipments from West Asia and West America are likely to be outnumbered by shipments from North America towards Asia, especially to China and India. Such forecasts imply the shifting of tanker trade growth from the developed towards the developing economies.

A study carried out by the Finnish Ministry of Transport and Communications in January 2005 predicted that the import of energy products to the fast growing economies (Mexico, Russia, India, China, and other Asian countries) would double by 2030 (Kunda, 2013). According to DNV Shipping 2020 report, more than 1 in 10 newbuildings will be delivered with gas fuelled engines. The newbuildings in 2020 will emit up to 10 to 35 % less CO2 than today's ships (RS Platou, Economic Research, 2014). The tanker trade is expected to grow by 2020 along with the application of new technologies. According to the forecasts of the World Research Institutes from New York, oil production will

continue to grow until 2020. After that, the production will be decreasing. TRANSvisions predicts that by 2050 the freight rates will reach higher values than in 2008 (www.dnv.com).

2. THE INFORMATION MODEL FOR THE WORLDWIDE TANKER SHIPPING MARKET FROM 2010 TO 2020

The design of the information model for the worldwide tanker shipping market 2010 – 2020 is based on the previously set variables. The variables that are considered critical are: Global economy, Globalisation, Freight rates, Shipbuilding and Innovations in maritime shipping (see Table 1). Table 1 shows the variables of the information model for the worldwide tanker shipping market 2010 – 2020, and the ranking of their growth values: 1. Innovations in maritime shipping (30), 2. Global economy (20), 3. Globalisation (10.0), 4. Freight rates (10.0) and 5. Shipbuilding (10.0).

Table 1.
Values of the variables of the information model for worldwide tanker shipping market from 2010 to 2020.

Variables of the information model for the worldwide tanker shipping market from 2010 to 2020		Inputs *y*			Growth
		2010	2015	2020	2010/20
1.	Global economy	60	70	80	20
2.	Globalisation	70	75	80	10
3.	Freight rates	70	75	80	10
4.	Shipbuilding	60	65	70	10
5.	Innovations in maritime shipping	50	60	80	30

The assessment of the variables of the model takes into consideration synergetic effects of individual variables, values and the importance of variables of the model in the period observed, i.e. from 2010 to 2020. The quantification of the model variables is performed on the index scale from zero to 100. Zero is the value of the model variables which corresponds to the situation on the seaborne shipping market in 2008, when the global crisis shook worldwide economies. The value 100 corresponds to the situation on the maritime shipping market before 2008, i.e. when the freight rates index reached its record high. The model comprises the variables quantified for the year 2010 as well as the expected values of the variables for 2015 and 2020.

It is asserted that the worldwide tanker shipping market consists of "n" inter-reliant elements. The value of an individual model variable is expressed as y_{if} and y_{it-1} of the *i* variable in the period *t* and *t-1*. An increase of the input value of the *i* variable of the model is expressed as $\Delta y_{it} = y_{it} - y_{it-1}$ (Vidučić, 2007). An indirect growth rate of the $_i$ variable in relation to *j* is defined as the relation among the input growth of the *i* variable of the information model, Δy_{it}, and the input value of the *j* variable of the model in the period *t*, that is the indirect growth rate is expressed by the equation:

$$r_{ijt} = \frac{\Delta y_{it}}{y_{it}} \quad (1)$$

where: *i, j*=1, …, n, whereas $y_{it-1} \neq 0$. The indirect growth rates can be expressed in a form of the growth matrix of the model variables:

$$r_t = \begin{bmatrix} r_{11} & r_{12} & L & r_{1nt} \\ r_{21} & r_{22} & L & r_{2nt} \\ L & L & L & L \\ r_{n1t} & r_{n2t} & L & r_{nnt} \end{bmatrix} \quad (2)$$

where $t = 1,...t$;

The variables on the main vertical refer to direct growth rates ($i = j$). The variables in the *i* row refer to the input growth in the *i* variable in relation to inputs in other variables. The variables in *i* column refer to the value growth of the input in all variables of the model in relation to the input of the *i* variable in the period *t*. Therefore, each variable in the growth matrix is represented by one row and one column, with elements expressing indirect or relative growth relationships. Other rows and columns refer to other variables of the information model for worldwide tanker shipping market 2010 - 2020.

Indirect growth rates can be defined in relation to the inputs of the j variable of the model in the period:

$$t = 1: r'_{ijt} = \frac{\Delta y_{it}}{y_{j,t-1}} \quad (3)$$

where: i, j = 1, …, n. The following inter-relation reflects the relationship among the indirect growth rates:

$$r_{ijt} = \frac{r'_{ijt}}{1 + r'_{i,jt}} \tag{4}$$

and

$$r'_{ijt} = \frac{r_{ijt}}{1 - r'_{j,jt}} \tag{5}$$

where: i, j = 1, …, n. The matrix type can be determined through the external vector of the model variable, the vector of the growth of the model variables being: $\Delta y_{it} = \Delta y_{it}, \ldots \Delta y_{m^*t}$. The vector of the reciprocal values of the model variables is defined as: $\left(\frac{1}{y_t}\right) = \left(\frac{1}{y_{1t}}\right), \ldots, \left(\frac{1}{y_{nt}}\right)$, where i, j = 1, …, n, whereas $y_{it-1} \neq 0$. The growth matrix of the model defines the external vector of the growth of the coefficients of the model variables and the vector of the reciprocal values:

$$R_{pt} = \Delta y'_t \left(\frac{1}{y_t}\right) = \left[\frac{\Delta y_{1t}}{\Delta y_{mt}}\right] \cdot \left(\frac{1}{y_t}, \ldots, \frac{1}{\Delta y_{nt}}\right) \tag{6}$$

If only the direct growth rates are analysed, then the growth of a variable is expressed irrespectively of the growth of other variables. On the other hand, an analysis of the indirect growth rates, i.e. an analysis of the growth rates of the *i* variable in relation to *j* (*i, j* = 1, …, n) allows to determine the structure of growth of the variables and express all the relationships through the growth matrix in the entire system. By expressing the direct and indirect rates, it is possible to follow both the intensity changes of the growth of variables and their structural relationships at the same time.

Here is the growth matrix of the model for worldwide tanker shipping market in relation to the current and future values for the period of 2010 – 2020.

The vector of the model growth is: $\Delta y_{2014} \begin{bmatrix} 20 \\ 10 \\ 10 \\ 10 \\ 30 \end{bmatrix}$;

The vector of the reciprocal values of the model is:

$$\frac{1}{y_{2020}} = \left(\frac{1}{80}, \frac{1}{80}, \frac{1}{80}, \frac{1}{70}, \frac{1}{80}\right);$$

$$[R_{2020}] = \begin{bmatrix} \frac{20}{80} & \frac{20}{80} & \frac{20}{80} & \frac{20}{70} & \frac{20}{80} \\ \frac{10}{80} & \frac{10}{80} & \frac{10}{80} & \frac{10}{70} & \frac{10}{80} \\ \frac{10}{80} & \frac{10}{80} & \frac{10}{80} & \frac{10}{70} & \frac{10}{80} \\ \frac{10}{80} & \frac{10}{80} & \frac{10}{80} & \frac{10}{70} & \frac{10}{80} \\ \frac{30}{80} & \frac{30}{80} & \frac{30}{80} & \frac{30}{70} & \frac{30}{80} \end{bmatrix}; \tag{7}$$

$$[R_{2020}] = \begin{matrix} 0{,}250 & 0{,}250 & 0{,}250 & 0{,}286 & 0{,}250 \\ 0{,}125 & 0{,}125 & 0{,}125 & 0{,}143 & 0{,}125 \\ 0{,}125 & 0{,}125 & 0{,}125 & 0{,}143 & 0{,}125 \\ 0{,}125 & 0{,}125 & 0{,}125 & 0{,}143 & 0{,}125 \\ 0{,}375 & 0{,}375 & 0{,}375 & 0{,}429 & 0{,}375 \end{matrix} \tag{8}$$

The research has provided the direct growth rates of the model for worldwide tanker shipping market 2010 – 2020 (Table 2). The model has provided both direct and indirect growth rates of the individual variables. Because of limited space, the indirect growth rates are not elaborated on in this paper.

According to Table 2, the direct growth rates of the model variables on the index scale 1-100 are ranked as follows: 1. Innovations in maritime shipping (37.5), 2. Global economy (25.0), 3. Shipbuilding (14.3), 4. Globalisation (12.5) and 5. Freight rates (12.5).

Table 2.
Growth rates of the information model for worldwide tanker shipping market from 2010 to 2020 on the index scale from zero to 100.

Model variables	1	2	3	4	5
1	**25.0**	25.0	25.0	28.6	25.0
2	12.5	**12.5**	12.5	14.3	12.5
3	12.5	12.5	**12.5**	14.3	12.5
4	12.5	12.5	12.5	**14.3**	12.5
5	37.5	37.5	37.5	42.9	**37.5**

Direct growth rates of the model variables have higher values than their real growth (see Table 1, growth 2010-2020) due to the synergetic interrelation of all the variables (see Figure 1), as follows: Innovations in maritime shipping (growth 30 ↔ direct growth rates 37.5), Global economy (growth 20 ↔ direct growth rates 25.0), 3. Shipbuilding (growth 10 ↔ direct growth rates

14.3), 4. Globalisation (growth 10 ↔ direct growth rates 12.5) and 5. Freight rates (growth 10 ↔ direct growth rates 12.5).

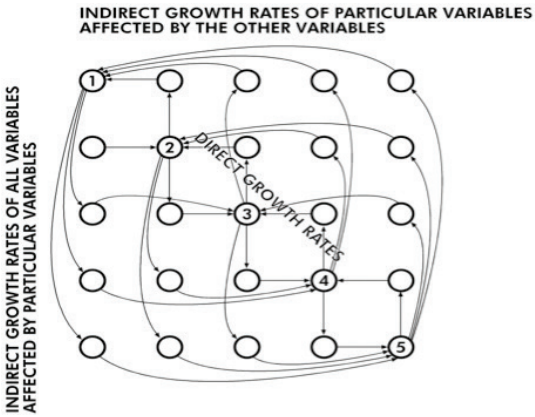

Figure 1.
Growth rates of the information model for worldwide tanker shipping market from 2010 to 2020.

It is obvious that the greatest difference between the growth value and the value of direct growth rates will change the ranking of the variables compared to the ranking according to the values of their direct growth rates: Innovations in maritime shipping (7.5), Global economy (5.0), Shipbuilding (4.3), Globalisation (2.5) and Freight rates (2.5).

3. CONCLUSION

The design of the model has been based on the most relevant variables including: Global economy, Globalisation, Freight rates, Shipbuilding, and Innovations in maritime shipping. The quantification of the model has been performed on the basis of the scientific and theoretical aspects of the mental-verbal insights into individual variables and their importance within the observed period, from 2010 to 2020. The research produced direct growth rates of the variables on the index scale from 1 to 100: 1. Innovations in maritime shipping (37.5), 2. Global economy (25.0), 3. Shipbuilding (14.3). 4. Globalisation (12.5) and 5. Freight rates (12.5). The direct growth rates of all model variables of worldwide tanker shipping market 2010 – 2020 have realistic chances to be implemented. This also means that the hypothetical values of all variables of the model have been set realistically. The present geopolitical tensions obstruct the growth of tanker shipping trade. By 2020 it is expected that the demand on the tanker shipping market will increase more intensely than the demand in the other trades. The essential feature of the global economic growth is the rationalisation of energy consumption. The trend is likely to affect the tanker shipping market after 2020.

REFERENCES

Cerović, LJ. and Bašić, N., (2008), Analiza i prognoza ponude i potražnje svjetskog tankerskog brodarstva, Ekonomska misao i praksa DBK, 17(1), pp. 29-46.

DNV GL Home Page, available at: http://www.dnv.com, [accessed 05 April 2015.].

European Commission Home Page, available at: http://ec.europa.eu/, [accessed 05 April 2015.].

Hrvatska brodogradnja Home Page, available at: http://www.hb.hr, [accessed 05 April 2015.].

Intertanko Home Page, available at: http://www.intertanko.com, [accessed 05 April 2015.].

Kunda, I., (2013), Utjecaj globalizacije u svjetskom gospodarstvu na tržištu morskog brodarstva, Diploma thesis, Rijeka: University of Rijeka, Faculty of Maritime Studies.

Puljiz, V., (1998), Globalizacija i socijalna država, Zagreb: Studijski centar socijalnog rada Pravnog fakulteta Sveučilišta u Zagrebu.

RS Platou, (2014), Economic Research, available at: http://www.platou.com/Shipbroking/Economic-Research, [accessed 2 May 2015.].

Statista Home Page, available at: http://www.statista.com, [accessed 05 April 2015.].

Tijardović, I., (2012), Budućnost LNG tankera, Brodogradnja, 63(4), pp. 375-376.

UNCTAD Home Page - Review of maritime transport 2014, available at: http://www.unctad.org, [accessed 05 April 2015.].

Vidučić, V., (2007), Pomorski turizam, Split: University of Split, Faculty of Maritime Studies in Split, p. 194.

Vidučić, V., (2011), Sustavi pomorskog tržišta, Split: University of Split, Faculty of Maritime Studies in Split p. 119.

Zelenika, R. and Pupovac, D., (2000), Od protekcionizma do liberalizacije transporta, Naše more, 47(5-6), pp. 181 – 194.

Maritime Performing Party under the Rotterdam Rules 2009

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This paper explores the provisions of the *Rotterdam Rules 2009* relating to the performing party in general and the maritime performing party in particular. Performing party means a person who performs or undertakes to perform any of the carrier's obligations under a contract of carriage with respect to the receipt, loading, handling, stowage, carriage, keeping, care, unloading or delivery of the goods, to the extent that such person acts, either directly or indirectly, at the carrier's request or under the carrier's supervision or control. Maritime performing party means a performing party who performs or undertakes to perform any of the carrier's obligations during the period between the arrival of goods at the port of loading and their departure from the port of discharge of a ship. The maritime performing party is a new concept introduced by the *Rotterdam Rules*. The central intention of this paper is to study and analyse the concept, legal standing and liability of a maritime performing party under the *Rotterdam Rules*. A comparative analysis of the legal standing of persons analogous to the performing party in conventions regulating the carriage of goods by sea is also provided.

KEY WORDS
~ Carrier
~ Performing party
~ Maritime performing party
~ Actual carrier
~ Carriage of goods by sea
~ Rotterdam Rules

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1. INTRODUCTION

At the international level, carriage of goods by sea is regulated by several international conventions none of which are universally acknowledged. The fact that multiple international convention legal norm systems are currently being used throughout the world to regulate the relations pertaining to the carriage of goods by sea is unsatisfactory and fails to contribute to the uniformity of the maritime carriage law, as such systems were originally intended to do.

The International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading from 1924, also referred to as the *Hague Rules*, is widely acknowledged and undoubtedly a successful international instrument which managed to hold out to this day. Since the application of the *Hague Rules* has proved them to have certain shortcomings, demands have been made for their modernisation. The *Hague Rules* were amended by the adoption of the two *Protocols to Amend the International Convention for the Unification of Certain Rules of Law Relating to Bills of Lading*, first in 1968, better known as the Visby Rules, which together with the text of the *Hague Rules* constitutes the Hague-Visby Rules, and then in 1979 by what is known as the *SDR Protocol*. The 1978 *United Nations Convention on the Carriage of Goods by Sea*, known as the *Hamburg Rules*, was adopted to additionally improve the position of the users of carriage relative to the then current conventions. Although the *Hamburg Rules* offer a number of interesting modern solutions, they are not widely accepted.

Changes in relations between parties to maritime contracts of carriage, containerisation, internetisation and the rise of electronic communication have changed the manner business is conducted in the carriage of goods by sea. None of the extant conventions adequately resolves the issue of the regulation of modern carriage practice. These circumstances have led the

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United Nations Commission on International Trade Law to launch an initiative for the adoption of a new international convention. Exhaustive discussions and negotiations on the text of the new convention lasted from 2001 to 2008, during which period several drafts of the text were devised. Following the finalization of the discussions and the harmonization of the text, the new convention titled the *United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea*, also known as the *Rotterdam Rules*, was finally adopted in 2008, and officially signed in Rotterdam in 2009. The *Rotterdam Rules* have been signed by 25, but ratified by only three countries[1]. The *Rotterdam Rules* were envisaged to enter into force and effect after being ratified by a minimum of 20 countries, and have been open for ratification since the day of their signing.

The *Rotterdam Rules* were intended to replace the current conventions some time in the future to ensure the uniform regulation of carriage of goods by sea. Although the *Rotterdam Rules* are characterized by a plethora of new, modern solutions, some attempts have also been made to integrate the traditional solutions from the *Hague-Visby Rules* and the *Hamburg Rules*. However, the *Rotterdam Rules* did not enter into force yet and it is still uncertain whether they ever will.

In contrast to other conventions currently in force, the *Rotterdam Rules* regulate not only carriage by sea, but multimodal transport (i.e. door to door transportation) as well. Consequently, the *Rotterdam Rules* apply both if carriage is performed entirely by sea and if a part of carriage is performed by forms of transportation other than carriage by sea. This solution was also intended to resolve the open issue of international regulation of multimodal transport, since the 1980 *United Nations Convention on International Multimodal Transport of Goods* has still not entered into force and most likely never will.

2. THE CONCEPT OF CARRIER

In maritime legal conventions the carrier is defined as any person who concludes a contract of carriage of goods with a shipper. The generally accepted position is that the carrier may be any person who enters into a contract of carriage of goods by sea in its own name. An analysis of the definition of the carrier in the *Hague-Visby Rules* and the *Hamburg Rules* reveals certain differences in the scope of the concept of carrier. Pursuant to Article 1, paragraph 1, subparagraph a) of the *Hague-Visby Rules*, the concept of carrier includes the owner or charterer who enters into a contract of carriage with a shipper. This convention definition of the concept of carrier implies that a person other than the shipowner may be a carrier, and specifically makes mention of the charterer from the charter contract. Pursuant to Article 1, paragraph 1, subparagraph 1 of the *Hamburg Rules*, a carrier is any person by whom or in whose name a contract of carriage of goods by sea has been concluded with a shipper. The definition of the carrier in the *Hamburg Rules* is wider than that found in the *Hague-Visby Rules* since the concept of carrier includes any person who enters into a contract of carriage of goods by sea with a shipper, be it a shipowner, charterer from a charter contract or any other person.

Pursuant to Article 1, paragraph 1, subparagraph 5 of the *Rotterdam Rules* the carrier is defined as any person who enters into a contract of carriage with a shipper. In comparison with the *Hague-Visby Rules* and the *Hamburg Rules*, the concept of carrier finds its most general definition in the *Rotterdam Rules*. Given such a broad definition, the *Rotterdam Rules* allow any number of different entities to act as carriers, since the person of the carrier is primarily defined as a party to a contract of carriage, regardless of its relation to the ship. Consequently, under the provisions of the *Rotterdam Rules*, a shipowner, ship operator, charterer from the charter contract, freight forwarder and multimodal transport operator (including carriers using other modes of transportation, etc.) may all act as carriers, providing partial or full carriage by sea is contracted. Although a carrier may perform entire carriage by itself, in practice, especially in case of multimodal transport, the likelihood of it actually doing so is very low and the carrier needs to include third persons in the process.

Therefore, under the *Rotterdam Rules*, any person who enters into a contract of carriage with a shipper is a carrier, regardless of whether it performs carriage by itself or entrusts all or some of the actions from the contract of carriage to another person, e.g. other carrier, agent, freight forwarder, etc. To facilitate the identification of the person of the carrier, Article 37, paragraph 1 of the *Rotterdam Rules* stipulates that if a carrier is identified by name in the contract particulars, any other information in the transport document or electronic transport record relating to the identity of the carrier have no effect to the extent that they are inconsistent with that identification. If no person is identified in the contract particulars as the carrier, Article 37, paragraph 2 of the *Rotterdam Rules* stipulates iuris tantum that the registered owner of that ship shall be presumed to be the carrier, unless it proves that the ship was under a bareboat charter at the time of the carriage and identifies the bareboat charterer, in which case such bareboat charterer shall be presumed to be the carrier. Alternatively, the registered owner may rebut the presumption of being the carrier by identifying the carrier and indicating its address. The bareboat charterer may rebut any presumption of being the carrier in the same manner. Nothing prevents the claimant from proving that any person other than a person identified in the contract particulars or pursuant to Article 37, paragraph 2 of the *Rotterdam Rules* is the carrier.

The analysis of the concept of carrier across all current conventions regulating the carriage of goods by sea has shown that a carrier undertakes to perform transport prestation, without

1. They are: Congo, Spain and Togo; www.uncitral.org [accessed 25 January 2015].

necessarily undertaking to personally execute transportation. In fact, in modern commercial and maritime practice, the (contractual) carrier as a rule never personally executes all the obligations from the contract of carriage. The majority of carriers are corporations acting exclusively through their agents, and it is worth noting that nowadays all carriers subcontract the performance of particular aspects or parts of transportation with other companies. The issue of the so called actual carriers or performing parties, in the sense of their precise identification and the regulation of their rules, obligations and, most importantly, liabilities, is exceptionally important for the functioning of the institute of liability for damage stemming from the legal transaction of carriage of goods by sea.

The issue of defining and regulating the status of persons who are not parties to a contract of carriage, but perform any of the obligations of the carrier under such contract, exists not only in the carriage of goods by sea, but is also present in all other forms of transportation. However, the lack of its uniform regulation by different instruments represents one of the major issues indicative of the lack of uniformity in the legal regulation of not only carriage of goods by sea, but carriage in other forms of transportation as well.

3. THE CONCEPT OF THE PERFORMING PARTY AND THE MARITIME PERFORMING PARTY

The first drafts of the new convention envisaged a very broad definition of the concept of the carrier-performing party. The term carrier-performing party was widely criticised since a number of independent persons execute the obligations of the carrier from the contract of carriage, and if linguistic interpretation is applied, such persons do not carry goods. E.g. stevedores and port terminal operators can not be considered carriers, but perform tasks inseparably related to carriage. This resulted in the introduction of a new concept of the performing party. The drafters of the *Rotterdam Rules* likewise considered the concept of the actual carrier from the *Hamburg Rules* inappropriate, i.e. believed it to be confusing due to it implying that a (contractual) carrier is not the actual carrier in spite of being referred to as the carrier throughout the text of the instrument. During the drafting of the *Rotterdam Rules* the stylization of the provision defining the performing party was widely discussed, to the extent that it was considered if the definition of the performing party should even be included in the text of the convention and the provisions of the draft convention were changed on multiple occasions.

Pursuant to Article 1, paragraph 1, subparagraph 6 of the *Rotterdam Rules* (a) a performing party means a person other than the carrier who performs or undertakes to perform any of the carrier's obligations under a contract of carriage with respect to the receipt, loading, handling, stowage, carriage, keeping, care, unloading or delivery of the goods, to the extent that such person acts, either directly or indirectly, at the carrier's request or under the carrier's supervision; (b) performing party is not a person who, instead of acting on behalf of the carrier, acts, directly or indirectly, on behalf of the shipper, the documentary shipper, the controlling party or the consignee.

Under the *Rotterdam Rules,* for a person to have the qualities of the performing party, it must meet the following requirements:

– perform or undertake to perform any of the carrier's obligations under a contract of carriage with respect to the receipt, loading, handling, stowage, carriage, keeping, care, unloading or delivery of goods,

– act, directly or indirectly, at the carrier's request or under the carrier's supervision,

– not act, directly or indirectly, on behalf of the shipper, the documentary shipper, the controlling party or the consignee.

Due to such a broad definition, under the *Rotterdam Rules*, the concept of the performing party covers any person performing the carrier's obligations under a contract of carriage with respect to the receipt, loading, handling, stowage, carriage, keeping, care, unloading or delivery of goods, who could be sued based on extra-contractual relations (offence relations).

According to the definition, the performing party is a person participating in the execution of essential carrier's obligations from a contract of carriage. It may be, e.g. a maritime carrier, a carrier providing land-based transportation services, a stevedor, a terminal operator. This definition of the person of the performing party was directly influenced by the fact that the *Rotterdam Rules* do not regulate exclusively carriage by sea, but multimodal transport as well. By contrast, e.g. persons executing jobs at the container terminal and in a specific period, are responsible only for the preparation of certain documentation for the carrier, while shipyard employees repairing a ship (to make it seaworthy) all for the account of the carrier, are not covered by the definition of a performing party.

The concept of the performing party does not only include carrier's subcontractors, but other helpers executing the contract as well (e.g. subcontractor's subcontractors), the key condition being that such persons must execute or undertake to execute an essential carrier's obligation from a contract of carriage.

Apart from the general definition of the performing party, Article 1, paragraph 1, subparagraph 7 of the *Rotterdam Rules* also provides a definition of the maritime performing party. The said provision stipulates that a maritime performing party is a performing party who performs or undertakes to perform any of the carrier's obligations during the period between the arrival of goods at the port of loading and their departure from the port of discharge of a ship. An inland carrier is a maritime performing party only if it provides or undertakes to provide its services exclusively within a port area. By analogy, a non-maritime performing party is a performing party who performs or undertakes to perform any of the carrier's obligations after

the arrival of goods at the port of loading or after their departure from the port of discharge of a ship.

Accordingly, under the *Rotterdam Rules*, a maritime performing party must meet the following conditions:

– be a performing party, i.e. not be a carrier in the sense of a person entering into a contract of carriage with a shipper, or more accurately, a carrier and a maritime performing party may not be one and the same person;

– perform or undertake to perform any of the carrier's obligations under a contract of carriage with respect to the receipt, loading, handling, stowage, carriage, keeping, care, unloading or delivery of the goods, to the extent that such person acts, either directly or indirectly, at the carrier's request or under the carrier's supervision - the phrase perform or undertake to perform is used in the *Rotterdam Rules* implying that a maritime performing party need not necessarily physically perform any obligation of the carrier, but rather that the very fact of having undertaken to perform any of the carrier's obligations suffices for such a person to be considered a maritime performing party in the sense of Article 1, paragraph 1, subparagraph 7;

– perform any of the carrier's obligations during the period between the arrival of goods at the port of loading and their departure from the port of discharge of a ship, i.e. in the port-to-port period. The meaning and scope of the phrase period between the arrival of goods at the port of loading and their departure from the port of discharge of a ship are of crucial importance for resolving the issue of whether a particular person is considered a maritime performing party or not; although the term port is crucial for determining whether a particular actor is a maritime performing party or not, the *Rotterdam Rules* do not provide a definition.

4. LIABILITY OF THE MARITIME PERFORMING PARTY

The *Rotterdam Rules* contain provisions on the liability of the performing party. The scope of liability of a performing party envisaged in the *Rotterdam Rules* is different for maritime and non-maritime performing parties. In case of a maritime performing party, the same scope of liability applicable to the carrier is applied, while in the case of a non-maritime performing party, under certain conditions, the Rules proscribe the applicability of unimodal conventions applicable to mode of transportation other than by sea.

Distinguishing the liability of the performing party from the liability of the carrier is crucial. The carrier is liable both under the provisions of the *Rotterdam Rules* and the contract of carriage in the period of responsibility as defined by Article 12 - from the receipt of goods for carriage until the delivery of such goods. On the contrary, a performing party is not liable under a contract of carriage and has no extra-contractual liability under the *Rotterdam Rules*. In other words, to avoid extra-contractual liability, under the *Rotterdam Rules*, a performing party is liable while the goods are under its control, or if it otherwise participates in the transportation.

The sidestepping of the *Rotterdam Rules* by filing a suit against the performing party for extra-contractual liability is thus thwarted. This also protects the (contractual) carrier, since if the respondent were successful in the extra-contractual liability proceedings instigated against a performing party, the damaged party could otherwise be awarded compensation for damage even if the carrier could be exempted from liability pursuant to the provisions of the *Rotterdam Rules*.

Although the *Rotterdam Rules* are a maritime convention, they also regulate multimodal transport in the period prior to the loading of goods onto a ship and after their unloading from the ship. The *Rotterdam Rules* establish a set of rules on liability which are to an extent harmonized with the network system, but pretty limited in comparison with the full network system. In a full network system the rules on liability for each part of the transportation route are determined by the rules which would otherwise apply to that part of the transportation route, with the same rules being applied to all performing parties and (contractual) carriers.

As stated, the *Rotterdam Rules* do not provide for a full network system. Article 26 of the *Rotterdam Rules* regulates the issue of transportation preceding or succeeding carriage by sea, i.e. resolves the issue of the conflict of conventions (unimodal applicable to other, non-maritime forms of transportation and the *Rotterdam Rules*). It stipulates that when loss of or damage to goods, or an event or circumstance causing a delay in their delivery, occurs during the period of carrier's responsibility but exclusively before their loading onto the ship or after their unloading from the ship, the provisions of the *Rotterdam Rules* shall not prevail over the provisions of another international instrument, at the time of such loss, damage or event or circumstance causing delay: (a) if the provisions of such international instrument would have applied to all or any of the carrier's activities if the shipper had made a separate and direct contract with the carrier with respect to a particular stage of carriage in which the loss of, or damage to goods, or an event or circumstance causing delay in their delivery occurred; (b) if such instrument specially provides for the carrier's liability, limitation of liability, or deadline for suit; and (c) if no withdrawal or withdrawal to the detriment of the shipper is allowed under that instrument.

In case of unknown place of occurrence of an adverse event and the non-existence of coercive provisions of a unimodal convention, if the adverse event occurs during the maritime part of transportation, the *Rotterdam Rules* are applied door-to-door.

Article 82 of the *Rotterdam Rules* regulates the application of international conventions regulating the carriage of goods by other forms of transportation. It stipulates that no provision of the *Rotterdam Rules* affects the application of any of the

following international conventions in force at the time of entry of the *Rotterdam Rules* into force, including any future amendment to such conventions, regulating the liability of the carrier for the loss of or damage to the goods: (a) any convention governing the carriage of goods by air to the extent that such convention according to its provisions applies to any part of the contract of carriage; (b) any convention governing the carriage of goods by road to the extent that such convention according to its provisions applies to the carriage of goods that remain loaded on a road cargo vehicle carried on board a ship; (c) any convention governing the carriage of goods by rail to the extent that such convention according to its provisions applies to carriage of goods by sea as a supplement to the carriage by rail; or (d) any convention governing the carriage of goods by inland waterways to the extent that such convention according to its provisions applies to a carriage of goods without trans-shipment both by inland waterways and sea. To illustrate, let us take a look at two hypothetical situations. In the first hypothetical case, a container is reloaded from a truck and loaded onto a ship and in the second, a container is loaded onto a ship together with the truck for purposes of further carriage by sea. The analysis of Article 82 of the *Rotterdam Rules* and Article 2 of the *Convention on the Contract for the International Carriage of Goods by Road* is not only illustrative, but very interesting from the legal standpoint. In the first hypothetical situation, if a container is reloaded from a truck and loaded onto a ship, the *Rotterdam Rules* would apply since the provisions of the *Convention on the Contract for the International Carriage of Goods by Road* stipulate that the convention is applicable only to the transportation of goods loaded onto a road cargo vehicle carried on board a ship, and in the described case, the road cargo vehicle is not carried on board a ship, but merely the container. By contrast, in the second hypothetical situation, if a vehicle (truck) carrying a container is loaded on board a ship for purposes of further carriage by sea, in accordance with Article 82 of the *Rotterdam Rules* and by the application of Article 2 of the *Convention on the Contract for the International Carriage of Goods by Road*, in the described case, the provisions of the *Convention on the Contract for the International Carriage of Goods by Road* would apply to the entire route. However, if loss, damage or delayed delivery of goods are proved to have occurred during carriage by sea, the liability of the carrier, i.e. the performing party will not be established in accordance with the *Convention on the Contract for the International Carriage of Goods by Road* but in accordance with the *Rotterdam Rules*.

As previously stated, the *Rotterdam Rules* separately regulate the liability of the maritime performing party and stipulate the same scope of liability as applied to the carrier. Article 19 of the *Rotterdam Rules* regulating the liability of the maritime performing party in paragraph 1, stipulates that a maritime performing party is subject to the obligations and liabilities imposed on the carrier under that Convention and is entitled to the carrier's privileges and limits of liability as provided for in that Convention if: (a) the maritime performing party received the goods for carriage in a Contracting State, or delivered them in a Contracting State, or performed its activities with respect to the goods in a port in a Contracting State; and (b) if the occurrence which caused loss, damage or delay took place: (i) during the period between the arrival of the goods at the port of loading of the ship and their departure from the port of discharge from the ship and either (ii) while the maritime performing party had custody of the goods or (iii) at any other time to the extent that it was participating in the performance of any of the activities contemplated by the contract of carriage. Accordingly, under the described conditions, the maritime performing party has the same obligations and liabilities as imposed on the carrier, and can simultaneously benefit from the carrier's privileges and limitations of liability contemplated by the *Rotterdam Rules*.

Article 19, paragraph 2 of the *Rotterdam Rules* stipulates that if the carrier agrees to assume obligations other than those imposed on the carrier under that Convention, or agrees that the limits of its liability are higher than the limits specified under the same Convention, a maritime performing party is not bound by this agreement unless it expressly agrees to assume such obligations or such higher limitations.

There have been cases of a (contractual) carrier agreeing to depart from the limitations of liability in favour of a shipper or a consignee. A classic example is that of agreeing to higher limitations of liability than those stipulated in Article 59, paragraph 1 of the *Rotterdam Rules*. When such contractual privileges are agreed between a (contractual) carrier and a shipper, applying such higher limitations to the maritime performing party who did not participate in that business decision and in a majority of cases would not necessarily benefit from the favourable conditions or counter services agreed in exchange for such privileges, would be unfair.

That is why Article 19, paragraph 2 of the *Rotterdam Rules* stipulates that a maritime performing party is not bound by such special agreements, unless it expressly agrees to assume such obligations or higher limitations of liability. The maritime performing party contracts limitations of liability higher than those envisaged by the Convention with the carrier as its contractual counterpart. In practice, to facilitate the process of proving the existence of an agreement on acceptance of greater obligations between a carrier and a maritime performing party, the shippers may make it conditional that upon the conclusion of a contract of carriage the carrier undertakes to ensure that its performing parties (subcontractors) also enter into such a contract with it. Since the existence of such an agreement benefits the claimant, the burden of proof naturally rests on the claimant. Article 19, paragraph 3 of the *Rotterdam Rules* stipulates that a maritime performing party is liable for the breach of its obligations under that Convention caused by the acts or omissions of any person

to which it has entrusted the performance of any of the carrier's obligations under the contract of carriage under the conditions set out in paragraph 1 of that Article.

In other words, the liability of a maritime performing party extends to cover its own non-fulfilment of obligations imposed by the Convention on such party or any person to which it has entrusted the performance of any of the carrier's obligations under a contract of carriage. Consequently, a maritime performing party is liable for the actions and oversights of its dependent and independent assisting parties, provided that they act at the request of such maritime performing party in the fulfilment of any of the carrier's obligations.

Article 19, paragraph 4 of the *Rotterdam Rules* stipulates that nothing in the Convention imposes liability on the master or crew of the ship or on an employee of the carrier or of a maritime performing party.

This provision of the *Rotterdam Rules* explains that neither the master or crew of the ship or an employee of the carrier or of the maritime performing party are liable under the Convention. In contrast to the classic *Himalaya Clause*, under which such persons were jointly protected on the same bases as the carrier, the *Rotterdam Rules* rescind the direct liability of the master of crew, the crew or employees.

Article 20 of the *Rotterdam Rules* envisages the joint liability of the carrier and one or more maritime performing parties. Pursuant to paragraph 1 of that same Article, if the carrier and one or more maritime performing parties are liable for the loss of, damage to, or delay in the delivery of goods, their liability is joint but only up to the limits provided for in the Convention, while paragraph 2 of that Article stipulates that without prejudice to Article 61, proscribing the loss of the privilege of limitation of liability, the aggregate liability of all such persons shall not exceed the overall limitation of liability under the Convention.

Therefore, if the carrier and one or more maritime performing parties are liable for damage to goods, they are jointly liable up to the limitations proscribed by the *Rotterdam Rules*. Such joint liability may not exceed the overall limitation of liability under the *Rotterdam Rules*.

Article 20 actually provides an additional opportunity for claimants because the *Rotterdam Rules* proscribe the joint liability of the carrier and maritime performing parties. This allows the claimant to request full compensation from any (or all) of them, leaving the respondents the option to claim reimbursement, refund or compensation for damage, depending on their mutual internal arrangements and legal relations. The limitations of such joint liability are those provided for in Articles 59 and 60 of the *Rotterdam Rules*.

Therefore, if a claimant collects indemnification from one solidary debtor, the obligation is fulfilled and all other debtors are exempted. The very term "joint (solidary) liability" derives from the authority of any creditor (in this case user of transportation services - damaged party) to request the fulfilment of an obligation in full, in solidum, from any co-debtor. Although paragraph 2 stipulates that the joint liability of all such persons shall not exceed the overall limitation of liability under the *Rotterdam Rules*, there are exceptions. The classic example is that of a (contractual) carrier agreeing to higher limitation of liability.

5. THE CONCEPT AND STATUS OF PERSONS ANALOGOUS TO THE MARITIME PERFORMING PARTY IN OTHER CONVENTIONS REGULATING THE CARRIAGE OF GOODS BY SEA

Under the *Hague Rules*, the regime of liability for damage targets exclusively the carrier as a contracting party, while the issue of subcontracting and possible liability of a person actually performing an obligation from a contract of carriage is mentioned nowhere in the Convention. The *Hague Rules* regulate merely the carrier-shipper relationship, without regulating the relationships between (actual) carriers and shippers. Therefore, if a user of transportation files a suit against persons who the (contractual) carrier entrusted with the execution of transportation on certain parts of the transportation route, they may not invoke the stipulations of the main contract, nor limitations of liability and exemptions from liability applicable under the *Hague Rules*.

Carriers are interested in having the conditions of the contracts of carriage applied to the persons they cooperate with and other subcontractors, since this would allow such persons to obtain the right to the same scope of liability as proscribed for the carrier, a one-year period of limitation and the possibility to invoke exemptions from liability applicable to the carrier. In the maritime business practice, the legal effect of having the conditions applicable to carriers, i.e. conditions from the contract of carriage, also applied to the carrier's subcontractors is ensured by including special contractual provisions known as the *Himalaya Clause*[2] into bills of lading. Under the Clause, the effect of the exemption clauses from the bills of lading is extended to include the carrier's subcontractors as well. It is worth noting that the Clause includes not only the employees and representatives of the carrier, but independent entrepreneurs like e.g. stevedores as well, if such persons are hired by the carrier or when acting in relation to and within the scope of their work tasks. The *Himalaya Clause* has become a regular component of every bill of lading. Since its legal validity has been affirmed in a number of court cases, its application is recommended by P&I clubs. In maritime-legal practice, when contracting a clause of this type, the carrier acts as an agent, i.e. on behalf of and for the account of the, e.g.

2. The Himalaya Clause owes its name to the 1955 judicial award in "The Himalaya" case adjudicated by the English Appellate Court (Adler v. Dickson), when the right of the master of crew to invoke the conditions of the contract of carriage first came under discussion in an extra-contractual suit of a passenger.

subcontractor. This requires the following conditions to be met: (a) the provisions of the bill of lading must clearly indicate the intention to protect the subcontractor, (b) the carrier must act as an agent of the subcontractor, with its prior or subsequent consent. That being done, the subcontractor may successfully invoke the provisions of the *Himalaya Clause* in case of liability for damage relating to the performance of a work task entrusted to the subcontractor by the carrier to execute a contract of carriage, providing such damage may not be ascribed to the qualified culpability of the subcontractor.

The *Hague-Visby Rules* started resolving the issue of the liability of persons used by the carrier in its operation by attempting to resolve the Himalaya issue. However, that merely began to tackle the issue of the liability of actual carriers or performing parties and other persons used by the carrier in the execution of the main contract. The *Hague-Visby Rules* stipulate that the carrier's employees may invoke the exemptions and limitations of liability invokable by the carrier within the meaning of that Convention if a suit is lodged against them. It should be noted that this provision pertains solely to the carrier's employees and proxies, while expressly excluding independent contractors. A clear distinction between the carrier's employees and proxies on the one hand and independent contractors on the other is thus drawn. Due to such wording, independent contractors (stevedores, terminal operators and similar) are considered to be expressly excluded from the benefits at the disposal of the carrier's employees and representatives.

Following the example of air law, the *Hamburg Rules*, i.e. the Convention, Supplementary to the Warsaw Convention, for the Unification of Certain Rules Relating to International Carriage by Air Performed by a Person Other than the Contracting Carrier adopted in Guadalajara in 1961, introduce the concept of the actual carrier into their regime of liability. This is the first real attempt to resolve the issue of liability of persons on the side of the ship, i.e. persons who are not contractual carriers but perform contractual prestation from the main contract.

Article 1, paragraph 2 of the *Hamburg Rules* defines the actual carrier as any person to whom the performance of the carriage of the goods, or of part of the carriage, has been entrusted by the carrier, and includes any other person to whom such performance has been entrusted. Article 10 of the *Hamburg Rules* regulates the issue of the liability of the carrier and of the actual carrier. It stipulates that the carrier is responsible for carriage performed by the actual carrier, for actions and oversights of the actual carrier and its employees or proxies who acted within the scope of their work task. All provisions of the *Hamburg Rules* pertaining to the liability of the carrier are likewise applicable to the liability of the actual carrier for any carriage performed by such actual carrier. Within the scope of liability of the carrier and the actual carrier, their liability is joint.

Article 15 of the *United Nations Convention on International Multimodal Transport of Goods* regulates the liability of the multimodal transport operator for its employees, representatives and other persons. A multimodal transport operator is liable for the actions and oversights of its employees and proxies if such employees or proxies act within the scope of their work tasks. The operator is likewise responsible for any other person whose services it uses in the performance of a multimodal transport contract when such person acts in the performance of such contract. The operator is liable for the acts and omissions of above persons as if they were the actions and omissions of the operator. In other words, under the *United Nations Convention on International Multimodal Transport of Goods* the operator's liability for persons includes, i.e. covers independent contractors as well. There is a noticeable broadening of the circle of persons the operator is responsible for in comparison with the *Hague-Visby Rules* and the *Hamburg Rules*. This wide phrasing also includes all persons whose services the operator uses in the performance of a multimodal transport contract when such persons act in the performance of such contract. Independent contractors are thus also included, as well as the operator's subcontractors and persons the operator contracts services in the organization of multimodal transport with (e.g. carriers).

6. CONCLUSIONS

During the adoption of the *Rotterdam Rules*, the intention to modernize the international transport law was clearly stated. In that sense, the *Rotterdam Rules*, among other things, introduce new entities with specific rights and obligations relating to the performance of the contract of carriage into transport law. Similar to other modern conventions on transport law, the *Rotterdam Rules*, apart from the contractual carrier as a person entering into a contract of carriage, also distinguish and define the person actually performing transportation. The *Rotterdam Rules* refer to this person as the performing party. The term performing party may be concluded to be derived from the concept of the actual carrier from the *Hamburg Rules*.

The scope of liability of a performing party envisaged by the *Rotterdam Rules* is different for maritime and non-maritime performing parties. A maritime performing party is subject to the obligations and liabilities imposed on the carrier under the *Rotterdam Rules* and is authorized to invoke the same exemptions and limitations of liability invokable by the carrier. By contrast, since non-maritime performing parties do not have such privileges at disposal, their liability is for the most part regulated by the regime of liability applicable to the relevant, non-maritime form of transportation. The liability of the carrier will always be governed by the *Rotterdam Rules*, and the liability of non-maritime performing parties either by the *Rotterdam*

Rules or any of a number of unimodal conventions. The legal standing of non-maritime performing parties has undergone a partial change when compared to the *Hague Rules*, the *Hague-Visby Rules* and the *Hamburg Rules*.

Namely, the *Rotterdam Rules* apply to contracts of carriage contemplating both carriage by sea and carriage by another form of transportation, under the conditions proscribed by Article 26 of the *Rotterdam Rules*. If a shipper is unable to identify the place of occurrence of damage, the provisions on liability for damage from the *Rotterdam Rules* will also apply to carriage by other forms of transportation. Likewise, the provision of Article 26 of the *Rotterdam Rules* stipulates that if damage to goods occurs prior to the loading of goods on board a ship and/or after unloading, but the adverse event occurs during the maritime part of transportation, the provisions of the *Rotterdam Rules* have precedence over the provisions of another international instrument, since the damage to goods did not occur exclusively prior to their loading onto the ship or exclusively after their unloading from the ship.

While the *Rotterdam Rules* give the maritime performing party protection from third party extra-contractual claims, they also impose on the maritime performing party obligations towards third parties stemming from the fact of it having concluded a contract with the carrier. If the carrier contracts obligations greater than those imposed by the *Rotterdam Rules,* the performing party is not liable for such obligations to the user of transportation, unless expressly agreed to by the performing party. The liability of a maritime performing party also extends to cover its own non-fulfilment of obligations imposed by the *Rotterdam Rules* on such party or any person to whom it has entrusted the performance of any of the carrier's obligations under a contract of carriage.

The *Rotterdam Rules* envisage the joint liability of the carrier and one or more maritime performing parties, providing that such joint liability may not exceed the overall limitation of liability. This provision provides the claimants an additional opportunity since it allows the claimant to request full compensation from any respondent, leaving the respondents the option to claim reimbursement, refund or compensation for damage, depending on their mutual internal arrangements and legal relations.

If the solutions contained in the instruments regulating the carriage of goods by sea are compared, the *Rotterdam Rules* may be observed to treat the issue of the definition and standardization of the liability of persons other than the (contractual) carrier, who participate in the execution of transport prestation in the widest sense, most comprehensively. With regard to the regulation of the issue of the circle of persons who may be liable for damage for loss, damage or delay under the Convention, the *Rotterdam Rules* envisage the widest circle of persons and proscribe their liability most exhaustively, while also specially regulating the issue of relations with other conventions. The stylization of the *Rotterdam Rules* is distinctive and differs from the stylization encountered in other conventions.

REFERENCES

Baatz, Y., Debattista, C., Lorenzon, F., Serdy, A., Staniland, H. and Tsimplis, M., (2009), The Rotterdam Rules: A practical Annotation, London: Informa.

Bulut, B., (2014), Position of the Shipowner as a Maritime Performing Party, TransLawFer, Zagreb, Croatia, November 13 – 14, pp. 49-56.

Grabovac, I., (2010), Nova konvencija o međunarodnom prijevozu stvari u cijelosti ili djelomično morem (Rotterdamska pravila), Kapetanov glasnik, 20, pp. 10-15.

Grabovac, I., (2010), Pridonose li Rotterdamska pravila unifikaciji?, Poredbeno pomorsko pravo, 49(164), pp. 159-168.

Ivošević, B., (2013), Roterdamska pravila – novi pokušaj međunarodnopravnog uređenja odgovornosti za pomorski prijevoz stvari i s njime povezanim drugim granama transporta, Poredbeno pomorsko pravo, 52(167), pp. 105-148.

Mandić, N., (2014), Institute of Excepted Perils under the Rotterdam Rules 2009, Transactions on Maritime Science, 3(1), pp. 42-52., http://dx.doi.org/10.7225/toms.v03.n01.005

Mandić, N., (2015), Odgovornost prijevoznika u prijevozu stvari morem s posebnim osvrtom na Rotterdamska pravila, 2009., PhD thesis, Mostar: Pravni fakultet Sveučilišta u Mostaru.

Osante, J. M. M., (2014), Liability Regime of Carriers and Maritime Performing Parties in the Rotterdam Rules, TransLawFer, Zagreb, Croatia, November 13 – 14, pp. 119-124.

Pavić, D., (2006), Pomorsko imovinsko pravo, Split: Književni krug.

Skorupan, V., (2007), Nacrt Konvencije o prijevozu stvari (u cijelosti ili djelomično) (morem), Zbornik radova Pravnog fakulteta u Zagrebu, 57(1), pp. 7-60.

Skorupan, V., (2006), Pravna osobnost, odgovornost i uloga izvršitelja prema Nacrtu instrumenta o prijevozu stvari (u cijelosti ili djelomično) (morem), Poredbeno pomorsko pravo, 45(160), pp. 31-64.

Skorupan Wolff, V., (2013), Polje primjene Roterdamskih pravila – unimodalni i multimodalni aspekti, Poredbeno pomorsko pravo, 52(167), pp. 37-79.

Thomas, R., (2010), The Carriage of Goods by Sea under the Rotterdam Rules, London: Lloyd's List.

United Nations Commission on International Trade Law home page, available at: http://uncitral.org, [accessed 25 January 2015.].

Ziegler, A., Schelin, J. and Zunarelli, S., (2010), The Rotterdam Rules 2008, Commentary to the United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea, Alphen aan den Rijn: Kluwer Law International.

SMCP Development for Pilotage and Tug Assistance in the Light of Diffusion of Innovations Theory

Adelija Čulić-Viskota

This paper is based in part on an earlier publication[1] on SMCP development, but includes new chapters on sociolinguistic and cultural issues arising during pilot's taking the vessel into/out of harbour with tug assistance. In this case the multinational, multilingual and multicultural bridge team is further extended onto pilot/s communicating with the tug master(s). A request has been made by the IFSMA[2] to provide shipmasters with a set of phrases for pilots and tug masters in their working language - English - to be used during manoeuvring, since the existing Standard Marine Communication Phrases (SMCP) have not been considered elaborate enough for the operation. Maritime English lecturers twinned with maritime professionals have provided a set of appropriate phrases and exercises to help students/trainees adopt them, as the conclusion of the 2014 seminar organized by G.A.M.E. - *Gesellschaft für Ausbildung in Maritimem Englisch* (German Association for Maritime English) with the seat at Bremen University of Applied Sciences, Nautical Department, in order to meet the requirements from the maritime industry. A sociolinguistic and cultural issue has arisen as a result of the IFSMA's invitation to G.A.M.E for a further development of the SMCP Pilotage and Tug Assistance Phrases and for presentation of the newly developed phrases for assessment to the IMO as a most influential safety factor. It would be a great benefit for shipmasters worldwide who regularly find themselves in situations when they cannot follow the pilot's communication with the tug master(s) because it is carried out in a local language and the pilot, due to being involved in communication with several external parties, is often not in the position to translate the communication for the ship's master due to the shortage of time. This intention of the IFSMA has met an overt disagreement by the pilot representatives taking part in the activities of the 2014 G.A.M.E. seminar and previously by the EMPA as their association. Therefore, following the approach starting from Rogers' Diffusion of innovations theory (1960), revised later by Clarke (1999) and Orr (2003), is proposed here to present the stages through which a technological innovation, this extension of SMCP being rightfully considered one, passes on its way to successful adoption.

KEY WORDS
~ ESP
~ Maritime English
~ SMCP
~ Pilotage
~ Tug assistance
~ G.A.M.E.

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1. INTRODUCTION

The world's oceans present no borders. Likewise, ships have long been manned with crews gathered internationally. Among the early examples of this practice is Magellan's Spanish

1. Čulić-Viskota, A., Essential English for Pilotage and Tug Assistance – Proposal for SMCP Extension, ToMS, Vol.03, No.02, October 2014, pp. 158-164.
2. IFSMA Res. 1/2012 (AGA 38), Further Development of SMCP (Standard Marine Communication Phrases).

expedition, his fleet consisting of a culturally diverse crew of Spaniards and Portuguese as a vast majority of the sailors, but also of mariners from Greece, Sicily, England, France, Germany and even North Africa[3]. Surprisingly, there were even Basques among the crew. De Borja (2005: 10) provides the following information: *"The list of Basques involved in the preparation and manning of the expedition was notable. ... Of the 275 men who made up the crew of the expedition, at least 35, or 12.7 percent, were Basques."* ... *"Second, members of the multinational crew, particularly the Spaniards, were hostile toward Magellan."* (ibid.) ... *"On February 13, 1522, Elcano, together with a crew of forty-six Europeans and nineteen Malays, left the island of Timor to head back home."* (2005:12). Another, more recent example is Thor Heyerdahl. *"He was also a fervent internationalist; his crew was always multinational and his boats flew the UN flag."*[4] Since early vessels crossed a body of water either for conquest or trade, possibilities have been arising for mixed crews.

Nowadays, shipping is one of the most integrated industries in the world economy and major means of transport (Ljung, 2010; Gekara, 2008), in which about 70-80 % of the world's merchant fleet has multicultural crews (Magramo and Cellada, 2009; Pyne and Koester, 2005). The vast majority of modern ships can be considered as meeting points of representatives of different cultures gathered to form a working team with the purpose of reaching the common aim of making profit for themselves and their employers.

In this paper, the navigating team gathered on the navigating bridge of a ship during pilot's assistance in manoeuvring the ship to her berth or when leaving berth, often calling for assistance of harbour tugs will be considered from the sociolinguistic aspect, i.e. the relationship between language and society, which can help uncover the social relationships within a community. In most cases, the above mentioned situation involves individuals of different nationalities and native languages meeting in their social working environment. In this case it is the bridge team, already multinational and using English as occupational language, extended onto the pilot(s) and tug master(s), speaking usually the same local language(s), the former most often with high proficiency in English, especially Maritime English, and the latter usually expecting the communication with the pilot(s) to be carried out in the local language, but being increasingly aware of the need to master Maritime English, especially in ports with heavy international traffic. Since nationality and language are cultural components, their expressions by the pilots and tug masters tend to be deeply rooted as local customs and retained due to the capacity of providing them with power at the local level, while the linguistic diversities within this extended bridge team, on the other hand, can easily lead to misunderstandings, poor communication and maritime accidents.

The development of the set of Standard Marine Communication Phrases (SMCP) with particular emphasis on the operations of pilotage and tug assistance[5] has already been reported as crucial for the circumstances in which the bridge team is extended to parties external to the ship's crew and speaking a different common language. The multilingual issues that have arisen are taken into consideration from the sociolinguistic and cultural point of view.

Maritime lecturers are also considering possible ways of implementing the new phrases into the existing syllabi for Maritime English courses at higher-education institutions through the development of new exercises to accompany the phrases developed.

However, the implementation of the phrases into university Maritime English syllabi is not in itself a guarantee of their full implementation for the reasons discussed in the following chapters. A large number of innovations are opposed at the very attempt of their being brought into life for a variety of reasons. In many cases it is the fear of something new, unknown and its possible adverse effect on the existing state of affairs. This fear is largely overcome with the passing of time and the end users of innovation gain consciousness of its usefulness and the benefits it brings along. Another possible reason for opposing an innovation is an anticipation of the loss it can bring about to part of the participants in the process without regarding the benefits it brings to the other party/-s involved in the process. This situation is for obvious reasons more intricate to deal with and calls for subtle methods after an initial analysis of the actual pros and cons. This is the reason for attempting to see the issue in the light of *Diffusion of Innovations* theory applied to SMCP Pilotage and Tug Assistance phrases with a view to a future more consistent implementation of SMCP as working code.

2. CULTURE / MULTICULTURALISM / INTERCULTURALITY

Culture is defined in many different ways with reference to its different aspects. The term has originated from the Latin noun *cultura*, ae f. derived from the verb *colo,3. colui, cultum* = to cultivate (land), to take care of, to respect, to honour. The concept was already used in ancient times by Cicero referring to *"cultura animi"*[6] implying an abstract concept. It was later re-established in the 17th ct. Europe with the meaning of personal refinement, mostly through education. In the following centuries the original metaphorical meaning was disregarded, as well as the relation between culture and nature that was so important in the Roman

3. source: http://www.history.com/news/history-lists/10-surprising-facts-about-magellans-circumnavigation-of-the-globe (accessed: October 5, 2014).
4. source: Lonely Planet Norway, by Anthony Ham, Stuart Butler, Miles Roddis, Lonely Planet, August 1, 2011, p. 132 (accessed: October 5, 2014).
5. For further details see: Čulić-Viskota, A.(2014).
4. "Cultura autem animi philosophia est; ..." in Cicero's Tusculan Disputations, Book Two – On Bearing Pain.

times, and culture began to be conceived of as a common reference point of different peoples or as a universal human capacity of refinement of the mind. The 20th ct. saw culture as an umbrella concept implying a range of human traits not directly attributable to genetics only. In the anthropological sense culture means a diversity of learned human behaviour patterns[7], providing persons with the capacity to use them imaginatively and creatively, and also the capacity related to different ways in which people process, classify and represent their experiences and ultimately act creatively. Thus, Hoebel designates culture as *"the learned behaviour in its aggregate"* or *"the integrated sum total of learned behaviour patterns which are manifested and shared by the members of a society"*. (Hoebel, 1954: 7) He also points out that *"man alone has culture-producing and culture-maintaining capacities"* and that "*man alone can convey learned behaviour through speech.*" (ibid.) Thus, culture is passed on from generation to generation by learning and once adopted it becomes habitual or "natural". So, the relatedness of culture to human behaviour can be compared to the relatedness of grammar to a language. They both determine the user's position and relations within an environment or system, the former in the social, the latter in linguistic sense. Just as it is the case with language, being itself part of culture, culture determines our worldview, the way in which we view, experience and interact with different aspects of the world around us. At this point, the concept of *cultural invention* should also be introduced, just as new terms are introduced into a language to denote previously unknown concepts or objects. It can mean any innovation thought to be useful to a group of people to express their behaviour. Cultural innovations also strive to achieve their appropriate positions. There are always forces in favour of changes and those opposing them. These forces depend upon the substance of which current structures are made: the more resilient ones will insist on the preservation of cultural practices within the current conditions; still, these structures themselves are likely to undergo changes. Therefore, new cultural models sometimes have to wait for changes to happen first within the society in order for an evolutionary action to start. Different experiences can also emerge from and be perceived through contacts with representatives of different cultures, i.e. in multicultural environments. *Multiculturalism* is rather a descriptive term implying the coexistence or simultaneous existence of two or more cultures in the same environment. It refers to the factual state of affairs without further particulars. *Inter-culturality* or *cross-culturality* implies interaction between/among coexisting cultures, i.e. their representatives, in our case seafarers as members of multinational crews. This can be referred to as acculturation, or replacement of the traits of one culture with those of another, either at individual or group level. Changes in cultural practices can be influenced by contacts between/among societies at a particular point in time, which may encourage or impair the changes. This is exactly what the pilotage-and-tug-assistance situation implies: there are at least two, sometimes even three, languages involved in the operation which calls for being conducted in one language only so that the communication becomes legible to all the participants. The language proposed by the shipmasters and opposed by the pilots and part of the tug masters is English, as the occupational language in maritime affairs in general. The whole setting in which the local language is used instead of the working language in order to preserve the roles of the local participants in the scene is a form of cultural event. The participants are striving to preserve the linguistic (cultural) relations as they currently are in order not to be deprived by any chance of their importance in a future, possibly altered scene. Thus, striving to preserve the use of the local language in this specific kind of setting means preserving cultural pragmatics in favour of the local culture in which pilots and tug masters have always communicated in the local language without an insight into other participants' needs.

2.1 Multinational / -Cultural / -Lingual Aspect of Ship's Bridge Team

It has become clear to shipping company managements that efforts have to be made to raise the level of cultural awareness with their employees since seafarers' education worldwide is still rather poor as far as cross-cultural communication is concerned. So, shipping companies invest their knowledge and effort to make their shore-based and on-board staff culturally aware. Thus, in 2007 the Japanese shipping company NYK informed about a research which involved all of their employees originating from different cultures and resulted in the Guidelines for intercultural relations, i.e. a circular sent to the masters of NYK-owned ships with the following note: *"It is hoped that these Guidelines' readers will have the awareness in breaking the barriers, deterring misconception and misjudgement against certain cultures that may hinder a productive relationship on board ship; and for a greater number of our people to feel greater satisfaction and enjoyment because of an enhanced good working relationship in any ship."* It was recommended to provide a copy of the circular in the mess halls and other conspicuous areas on board to serve its purpose.[8] In short, the *Guidelines* consisted of three parts: *Part One*, focused on explaining the notion of intercultural relations, on looking for similarities rather than differences, on learning

7. The term was first used in this way by the pioneer English anthropologist Edward B. Tylor in his book, Primitive Culture, published in 1871. Tylor defines culture as "that complex whole which includes knowledge, belief, art, law, morals, custom, and any other capabilities and habits acquired by man as a member of society."

8. For details, see: Culic-Viskota, A & Bielic, T., Cultural and linguistic differences as factors of ineffective communication, IMEC-19 Proceedings, Rotterdam, October 9-12, 2007.

about differences as enriching and exciting experience, on falling into the trap of generalisations or cultural stereotypes but the emphasis was always put on good will, care for whom/what is different, showing interest and tolerance. *Part Two*, called *Practice Cultural Sensitivity*, is based on the idea that each person is unique despite his/her belonging to a certain group that may be characterized by set stereotypes. Therefore, what is of utmost importance is the awareness that differences of opinions and beliefs should be expected and consideration and respect should guide a person's behaviour. The remaining part of the *Guidelines* is dedicated to particular cultures whose representatives are most usually found on board NYK Company ships and each chapter is divided into *Do's, Dont's* and *Things to remember when with...* But, special attention was paid to the attempt of explaining certain basic notions of Chinese culture which correspond to the notion of face in western cultures[9], related to politeness in communication. So, an attempt was made at both theoretical and practical explanations of how cultures in contact work, in order to raise the level of self-awareness in the context of one's own culture as well as awareness of the existence of other, different cultures deserving respect and tolerance. Other attempts in the field of maritime affairs followed, both by the International Maritime Organisation and shipping companies as well as by maritime departments at universities worldwide.[10] All of the studies mentioned are focused on the significance of multicultural awareness, intercultural relationships on board vessels and implementation of multicultural contents into maritime education and training.

2.2 English-Language Bias as a Cultural Issue

With all the praiseworthy initiatives to establish and preserve cultural differences on board ships, Maritime English, a form of ESP, is the working language in shipping.[11] Maritime English is deeply rooted in centuries-long British seafaring tradition which has established it as a proper worldwide-recognized seafaring jargon. As Crystal (2003: 106) points out: *"English has long been recognized as the international language of the sea, and in recent years there have been attempts to refine its use to make it as efficient as possible. Larger and faster ships pose greater navigational hazards. Shipping routes continually alter and present fresh problems of traffic flow. Radio and satellite systems have greatly extended a ship's communicative range. In such circumstances, mariners need to make their speech clear and unambiguous, to reduce the possibility of confusion in the sending and receiving of messages."*[12]

It is a well-known fact that English is also the working language in aviation but in this branch it has been fully adopted and no other language is used for communication, not even in situations when pilots and air-traffic controllers speak the same language. This state of affairs has followed from several plane accidents resulting from communication failures.

On this basis there have been attempts to set up the minimum language proficiency requirements for members of ships' crews as well. Moreover, a study[13] on actual maritime language proficiency level was carried out through collaboration of several leading maritime education and training institutions in the EU as it had been found out that English language skills of the ships' crews were at a very low level, resulting in ineffective communication and this ineffective communication was the major cause of many accidents. The study included 64 lecturers and professors and more than 30 maritime academies and universities worldwide. The results of the questionnaire about their students' proficiency level showed that 41 % of the students were at B1 Intermediate level, 34 % at B2 Upper Intermediate level but 24 % were at A1 Beginner and A2 Elementary levels, which is utterly unacceptable. On the other hand, SOLAS (Safety of Life at Sea) Convention still allows in Chapter V: Safety of Navigation, Regulation 14 (4): *"English should be the working language … for the bridge, bridge-to-bridge or shore and on board for the communication between the pilot and the bridge watch-keeping personnel … unless those directly involved in the communication speak a common language other than English."* Thus, there seem to be apparently contrary forces at work: those promoting the use of an internationally-agreed working or occupational language for on-board use in all circumstances with the clear objective of raising safety through simple and unambiguous communication,

9. The term was first introduced by Erving Goffman (1959) when referring to human relationships in everyday life. It was later elaborated on by Brown & Levinson (1987) in their account of developing strategies of polite communication. (for more, see Culic-Viskota,A.& Bielic,T. (2007:29).
10. Jenni Storgård, Nora Berg & Olli-Pekka Brunila in their "Insight in Ship Crews – Multiculturalism and Maritime Safety", Centre for Maritime Studies, Univ. of Turku, Finland, IMISS, June 12, 2013, take into account 18 previous studies related to multiculturalism and maritime safety. Another important study carried out at Constanta Maritime University is Chirea-Ungureanu,C. & Raluca Vişan, I., Teaching Communication Skills as a Prerequisite of the Course on "Intercultural Communication Onboard Ships" presented at the International Conference IMLA-19, Opatija 2011. Also, KNOW-ME, The European Academic and Industry Network for Innovative Maritime Training, Education and R&D project has resulted in different maritime e-courses of 45-hour duration that can be started any time when one is online and among which there is also Cross-Cultural Training. All courses are intended for potential and current workforce onboard and onshore, employees in the maritime industry. The course has been developed by Dorina Pörksen, qualified industrial engineer of maritime transport, whose diploma thesis was part of a project funded by the European Commission with a research focus on cultural diversity on board and the development of cross-cultural competences of future seafarers..
11. More about Maritime English in: Culic-Viskota, A., Kalebota,S.,(2013) Maritime English – What Does It Communicate", ToMS, Oct.2013, Vol.2,No.4,ISSN 1848-3305, pp.109-114.
12. Emphasis added by Čulić-Viskota, A.
13. "Captains Project - Communication and Practical Training Applied in Nautical Studies" (2010-2012) finalized and available at: www.captains.pro. , accessed on (April 21, 2015).

and those insisting on retaining culture-specific traits of the participants in maritime affairs, their native and local languages being obvious examples of those traits. Yet, however hard it might sometimes be to separate the personal from the public, individual or partial from common, maximum effort should be invested in cases where it contributes to raising the level of safety for all the involved alike.

2.3 Specific Language/Cultural Requirements in Pilotage and Tug Assistance

The ship's master, pilot and tug master represent the three pivots in conducting the ship to her berth or seeing her out when she is leaving it, and communication between them should be clear and unequivocal. The ship's master may, of course, decide to rely completely on the pilot's competency, but he should definitely be given the chance to decide so on his/her own by being able to follow the pilot's communication with the external parties, especially with the tug master(s).

In the paper cited above[1] an example is presented of Capt. Eric Blom's[14] experience. He describes the situation in which his helm orders had to be translated into three different languages before they were executed by the helmsman and where establishing a closed loop[15] was a real challenge. Therefore, Capt. Blom insists on the importance of effective communication among the bridge team members using one instrument only, i.e. Maritime English.

Cultural differences should also be taken into consideration as they often combine with deficient knowledge or total inability to conduct communication in English. Thus, to relate this issue to Hofstede's cultural dimensions, here we can observe numerous situations where cultural predisposition towards leadership and authority emerges. Namely, the pilot is perceived as an authority whose decisions in many cultures it is difficult to correct or even question. This may mean that correction of errors may therefore not be made in time or suggested at all. A number of maritime accidents have occurred exactly due to this reluctance to interfere.[16] This, obviously, also applies to tug assistance and the relative communication, which should be conducted in a language common to all the parties involved to minimize the possibility of communication failure. In case the pilot speaks in a language which is not understood by the master, it makes it difficult for the master to develop situational awareness.

An enhanced form of SMCP Chapter on Pilotage and Tug Assistance can help to avoid language difficulties leading to accidents.

Capt. Meyer's[17] draft version of extended SMCP for pilotage and tug assistance, revised during the 2013 Bremen workshop after having consulted the work done by some of the former contributors to this specific field such as: Capt. Brooks and Capt. Schisler from the USA, Capt. Michael Kelly, Sydney Pilot, Capt. Peter Liley from Brisbane, Capt. Cerwyn Phillips, Pilotage Operations Manager, Port of London Authority, and taken into consideration the contributions from pilots in Los Angeles and Rotterdam was subsequently discussed with pilots from the ports of Bremerhaven and Hamburg to round up the picture of their needs during pilotage and tug assistance in order to be able to contribute to a further development and curricular implementation of the SMCP chapter extended. It was at this point that the participants of the G.A.M.E. seminar were faced with an overt disapproval of the extension of SMCP to cover their activities in English, especially of the possible mandatory use of English for communication serving piloting and tug assistance during manoeuvring when the parties involved do not share the same native language. The pilots made efforts to convince the lecturers that it was impossible for them to use English for communication during the above mentioned manoeuvres. Their view of the current issue was also supported by a former Chief Pilot in the port of Split, Croatia[18]. Among the reasons presented were:

1. Harbour tug assistance has more than a long tradition and, as regards safety of manoeuvring with tug assistance, the current mode of operation (i.e. communication between the pilot and the tug master(s) in their mother tongue) has been established for a very long time.
2. The Master of the assisted vessel was always in the position to follow what the tug was doing, although he sometimes did not understand the language of communication. Namely, by seeing the tug taking a certain position, by seeing the propeller thrust astern of the tug, by seeing the load in the towing line, if or how much slack there is in it, etc., the Master could follow what was happening and possibly make a remark, if he is not satisfied.
3. If in the future we force the pilots and tug masters to use for mutual communication a foreign, in this case the English language, we would, especially in the beginning, have difficulties in adaptation, with possible harmful consequences.
4. Very little, almost nothing is gained by the ship's master by hearing a command that he can understand because most often,

14. Capt. Erik Blom, Master of the M/V BLACK WATCH, Fred. Olsen Cruise Lines, entitled "Is the pilot a part of the bridge team?".
15. The "closed loop" is a communication protocol where information is given, repeated by the receiver and normally confirmed by the issuer. This is the only way one can be sure an order is being followed and is a vital part of the bridge team management.
16. This reluctance to interfere with whom is considered an authority is referred to as leadership complacency (more in: Bielić, T., Complacency as Element Influencing Ship Accidents, Naše more 51(3-4)/2004, pp.89-95).
17. Capt. Matthias Meyer is a full member of G.A.M.E. and the principal author of the extended SMCP for Pilotage and Tug Assistance (for more see: Čulić-Viskota, A., Essential English for Pilotage and Tug Assistance – Proposal for SMCP Extension, ToMS, Vol.03, No.02, October 2014, pp. 158-164.).
18. Author's personal communication.

before he sees the consequence of the new command, he will not make an objection anyway.

5. The alleged concern to ensure better safety masks the tendency for the ship master to be more actively involved in the realisation of all the tug/s-related actions so that the ship masters worldwide do not require pilot assistance (as pilots have always communicated with tug masters in their own mother tongue) but are able to work on their own, without pilot assistance during manoeuvring in port, even in case when tug assistance is required.

From the above presented reasons the underlined parts unveil many facts that can be brought down to cultural issues. Namely, the statement in 1) could be rephrased as "disrupting the status quo can disrupt people's comfort level". The pilots feel comfortable the way manoeuvres are currently carried out and they could not put themselves in the position of the ship's master who would actually benefit from the mandatory use of English. The statement in 2) shows a degree of allowance for the ship's master but an effort from his side to understand what is being done with the ship he/she commands is considered acceptable by the pilots. The statement in 3) brings about a dose of concern with possible effects of the mandatory introduction of English as if subtle spreading of concern was expected to arouse with lecturers concern about their possible responsibility in case an accident happens due to enforcing the communication in English. In 4) there is an obvious attempt to present a presupposition as an argument, while in 5) there is finally the fear expressed for possibly being disarmed of the local language tool which in this context represents power, and power ensures existence, both financial and social. This could be represented as follows:

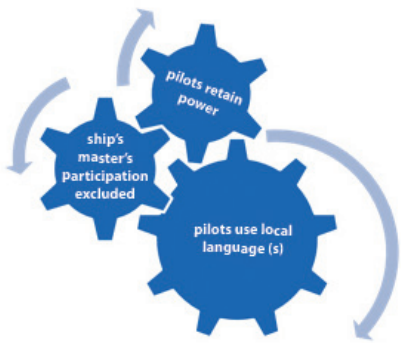

Figure 1.
Language as power.

Therefore, from the cultural point of view it has to be taken into consideration that cultural changes take time to root, and pilot's and tug master's switching to a foreign language even if occupational and however functional, can definitely be considered one, since so far they have been used to making use of their common native language even in cases when the bridge team members are of different native languages and use English for on-board communication. The exception to this practice is the pilot – master exchange of information, but in the occasions when the pilot hardly finds enough time to translate commands to the ship master, the latter remains an outsider. When no problems arise during manoeuvring, the master can be said to be relieved in a way by the presence of the pilot and due to the reliability of his knowledge and skills, but when things go wrong, it is always the master to take the blame. Therefore, this initiative of the IFSMA for the development of elaborate set of phrases in English to be used during pilotage and tug assistance is entirely justified.

From the sociolinguistic point of view, i.e. the point of view of the influence of language on society, it is vital to gain consciousness of the role that knowledge of a language and sharing it with the local community usually has. As Angela Carter, 20th-ct. British journalist and writer, said: *"Language is power, life and the instrument of culture, the instrument of domination and liberation."* In this sense, the opposition of pilots and tug masters to the implementation of English-biased communication among the extended bridge team members during pilotage and tug assistance is entirely understandable. People readily reject giving up weapons that can ensure their survival, and language can in many occasions be regarded as such powerful weapon. In this case it undoubtedly preserves their positions in the current state of affairs and ensures their domination. On the other hand, introduction of English-biased communication during pilotage and tug assistance would mean liberation for the ship masters, who would feel relieved by the possibility of understanding what is going to be undertaken with regard to his/her vessel without dependence on the pilot's translation, which sometimes misses due to his being burdened with his own, complex enough responsibilities.

Thus, striving of pilots to retain their current position in the state of affairs by not being in favour of changes obviously beneficial for the other party involved, i.e. ship masters, has obvious influence on language, more precisely occupational language or jargon pragmatics.

3. DIFFUSION OF INNOVATIONS (DOI) THEORY[19]

A whole theory has been developed under the name of *Diffusion of innovations* theory dealing with the conditions to meet in order for new ideas, products or practices to be adopted. According to this model based on research carried out in the fields of anthropology, sociology and education DoI was developed by Everett Rogers, a sociologist and professor in communication studies, in 1962 and is still followed, influenced by and expanding into other more modern theories and disciplines. Considered as one of the oldest social science theories originated in the field of communication, it is focused on explaining how, in the course of time, an innovative idea or product, either physical or of thought, spreads through the social network, or part of it, to ultimately gain acceptance. This means that with the adoption of an innovation people start acting differently from what they have previously done due to perceiving the new product, idea or behaviour as innovative.

The pivots of the theory and the stages through which a technological innovation passes have been summed up by Clarke (1999) and Orr (2003)[20] as follows:

1. **knowledge** (exposure to its existence, and understanding of its functions);
2. **persuasion** (the forming of a favourable attitude to it);
3. **decision** (commitment to its adoption);
4. **implementation** (putting it to use); and
5. **confirmation** (reinforcement based on positive outcomes from it).

The important **characteristics** of innovation or stages through which an innovation is adopted include:

1. **relative advantage** (the degree to which it is perceived to be better than what it replaces);
2. **compatibility** (consistency with existing values, past experiences and needs of potential adopters);
3. **complexity** (difficulty of understanding and use);
4. **trialability** (the degree to which it can be experimented with for a limited time);
5. **observability** (the visibility of its results).

The different **adopter categories** are identified as:

1. **innovators** (venturesome, individuals who want to be first to try the innovation, develop them even at the cost of taking risks);
2. **early adopters** (respectable, opinion leaders readily embracing change opportunities, already aware of needs for changes they do not need additional reflections to convince them);
3. **early majority** (deliberate to see first the evidence of innovation effectiveness before adopting it for themselves, rarely leaders but faster in adoption than average persons);
4. **late majority** (skeptical, resistive to innovation until it has been tried by the majority);
5. **laggards** (traditional and conservative, the hardest to convince).

In the process of adoption in the target population there are always at the extremes the groups that will readily adopt the innovation (1-2 above) and those that will try to hinder the adoption (4-5 above). So, it is of utmost importance to understand the motives setting these opponent groups on the go in specific cases. In the middle there will always be a group which will follow the more influential party.

The **change agent functions** are:

1. **to develop a need for change on the part of the client**;
2. **to establish an information-exchange relationship**;
3. **to diagnose the client problems**;
4. **to create intent to change in the client**;
5. **to translate this intent into action**;
6. **to stabilise adoption and prevent discontinuance**;
7. **to shift the client from reliance on the change agent to self-reliance**.

On the basis of this theory the implementation and diffusion of the body of phrases intended for pilotage and tug assistance, taken as innovation, will be considered.

4. DIFFUSION OF INNOVATIONS THEORY APPLIED TO SMCP FOR PILOTAGE AND TUG ASSISTANCE

Despite the fact that English is the occupational language in shipping and that the introduction of English into few niches devoted to the use of local languages seems to be a natural and expected course of action, there are still forces opposing it for reasons mentioned above as major. In this case, the application of DoI theory could be most helpful.

The most important element in the diffusion of English as occupational language in shipping, especially the current SMCP and their inevitable future extensions is decisiveness to diffuse them for the benefit of all the parties involved in the maritime venture or business involving speakers of different native languages as participants. This means that the IMO should recognize the importance of such initiatives as the introduction of SMCP for pilotage and tug assistance (extended version) and show commitment to their adoption worldwide. This institution is the top in the hierarchy of opinion leadership regarding all the innovations in maritime affairs, so it can initiate familiarisation

19. More about the theory on Boston University webpage available at www.sphweb.bumc.bu.edu (accessed March 17, 2015).
20. Diffusion of Innovations, by Everett Rogers (1995) as reviewed by Greg Orr on March 18, 2003, available at https://web.stanford.edu/class/symbsys205/Diffusion %20of %20Innovations.htm (accessed November 23, 2014)
Diffusion of Innovations, by Everett Rogers (1995) as reviewed by Roger Clarke, Visiting Fellow, Department of Computer Science, Australian National University, Canberra, on September 26, 1999 (accessed November 23, 2014).

of the parties involved with the body of phrases developed providing them with explicit reasons for the development and indicating their pragmatic function. This is the most usual method of forming favourable attitudes with prospective users, i.e. after undergoing the process of familiarisation with what one is expected to use, and after mastering the use itself and gaining thorough knowledge about the innovation, a favourable attitude is more easily formed and the innovation is more easily implemented. Of course, as soon as the first positive outcomes appear, the prospective users of innovation should be promptly and extensively informed about them.

In order for the innovation to be accepted by the prospective users, it should be compatible with the existing value system, past experiences and needs of potential adopters. In the case of SMCP extension for pilotage and tug assistance, the innovation supports the legal responsibility of a ship master in case of any incident involving his/her vessel. Thus, the consistency of the existing value system is strengthened. This can be further supported by reference to the past experiences, and in the case of the SMCP for pilotage and tug assistance there are a number of examples, in which the use of a shared working language during pilotage and tug assistance could have helped to avoid the accidents. So, this can certainly contribute to enlightening the benefits of potential adoption of innovation. Here, it is only part of future users who currently see the advantages of the adoption of innovation as the other parties in question are handicapped by individual benefits that due to their short reach obscure the more distant targets and the relative advantage of the innovation over the current practices. In view of the complexity of the ship operations to which the SMCP for pilotage and tug assistance refer, despite the advocacy of their high predictability due to mostly standard procedures followed in certain ports, and the three or more different parties involved, the phrases should be elaborate to the point of covering as many known standard procedures as possible. Therefore, a more comprehensive study of the needs of the prospective users and their contributions would certainly be welcome. The body of phrases developed should be put into use for a limited time so that the users may experiment with it. Their feedback information would contribute to the observability of the project, as it would provide the developers with the necessary hints as for the possible required corrections.

With regard to **adopter categories**, all ship masters would like to see this innovation implemented as soon as possible; tug masters in the area in which the development project originated are, according to freelance instructors of Maritime English providing training to towage companies, also increasingly aware of its overall advantages; only the pilots appear to be largely resistant to change of practices. Still, the change appears to make waves over time and pilots from some other ports, like the representatives of the Rotterdam pilots taking part in the 2015 G.A.M.E. seminar[21], have expressed a supportive opinion to the G.A.M.E.'s project and may be viewed as prospective early adopters in terms of DoI. As regards pilots in general, it appears that, although they are normally the ones to lead, their vision is blurred by the fear of losing their unquestioned current positions in the maritime world.

Obviously, the situation calls for mediation and the DoI change agent function seems crucial. The change agent should develop the need for the change with the clients, i.e. pilots and part of tug masters, by presenting them with explicit analyses of the past ship incidents involving communication breakdowns due to use of different languages during pilotage and tug assistance operations. Often people are out of reach of other people's experiences, either due to being distant from them in place or time, or due to a lack of interest in other people's negative experiences on the grounds of believing certain things cannot happen to them, which is by all means one of the most dangerous attitudes.

G.A.M.E. participants in the 2014 summer seminar aimed at initiating the development of the need for change on the part of pilots by inviting their representatives to take part in the discussion of pros and cons of the project implementation. The participating pilots' remarks were taken into consideration and appropriate adjustments made. On this course further discussions and analyses should be undertaken in order to clarify the problems from as many different aspects as possible. Problems pointed out by the pilots or tug masters should be considered for inclusion into an extensive survey that should be administered to the two parties involved in order to enable the exchange of information among pilots in different ports as well as among pilots and tug masters. Better exchange of information should provide pilots with a sense of safety regarding different possible, but again comparatively few situations that are not in compliance with the standard procedures and are therefore not covered by the SMCP. IFSMA should insist on translating their intent into action and IMO will certainly recognize the intent as an influential contributor to the so much strived for safety at sea. Adoption of the innovation can be stabilized and its discontinuance prevented by bringing the opposing parties around an oval table for discussion on the prerequisites of the implementation of this kind of innovation. Similar changes require meticulous preparations by all the parties involved so that at a future instant in time they may confidently switch from the usage of SMCP due to IMO recommendations to its usage based on the belief in increased safety for all the participants in shipping.

In this sense, insistence on education of all the parties involved as regards linguistic skills as well as bridge team requirements doubtfully represents the course to steer.

21. 2015 G.A.M.E. one-day seminar took place in Bremen, on April 29th, 2015 at the seat of the Association.

5. CONCLUSION

1. Maritime English as occupational necessity vs. cultural diversity of ships' crews

To learn a language and to use it purposefully means more than to be able to render discrete words or sentences into a different code. The contemporary society is increasingly aware of the fact that knowledge of a language represents opportunity and potential. While on one hand there is the distinct need of mastering one of the major languages in order to be able to participate in the activities they rule, on the other hand there is never more fervent striving to establish and preserve cultural differences, and preserving the language of a community is one of the most successful instruments. Crystal (2003: 191) contemplates on the future of global English as follows: *" In 500 years' time, will it be the case that everyone will automatically be introduced to English as soon as they are born (or, by then, very likely, as soon as they are conceived)? If this is part of a rich multilingual experience for our future newborns, this can only be a good thing. If it is by then the only language left to be learned, it will have been the greatest intellectual disaster that the planet has ever known."* Along this line of thought a conclusion can be reached that English as occupational language facilitating multiple operations in the shipping business is definitely the safest route to follow, as it has already been elaborated to high standards and maritime lecturers worldwide are continuing this work fully mindful of the underlying tradition. At the same time, the same lecturers are aware of their role as intercultural brokers[22] promoting the wealth of cultural and linguistic variations outside the borders of occupational languages, but within the same human environments.

2. Maritime English as working code

Maritime English is the language used by the participants in maritime affairs in general and by those who carry out ship's business in particular. This means that the safest way to perform all kinds of ship operations is to resort to the common practice of maritime English, which should be constantly kept abreast with the introduction of new technologies into shipping business.

3. Solving issues related to the introduction of ME into few niches still ruled by local languages by way of education

The only possible way to succeed in conquering these niches, pilotage and tug assistance being such an example, is penetrating thoughtfully into the opponents' arguments. In many a case, the arguments we hear from opponents are not the actual ones, the opponents themselves often not being aware of them or not wishing to set the real arguments forth because it makes one feel vulnerable. This waypoint reached, the next to steer towards is education. As Tony Blair, former British PM, said in his 1997 general election speech, when referring to what would be the three main priorities for his government, the emphasis should be on *"Education, education, education"*! It is inarguably vital to inform all persons taking part in a common operation of the pros and cons all the participants present with regard to a change in the approach that part of the participants insist on. Enforcing a cultural change, for even in the field of an occupational language switching to new practices is always a cultural change if the professional setting is imagined as based on its specific cultural traits, is never a successful method. Educating people on the necessity of change, in this case within the occupational cultural environment, and raising the level of their awareness about other participants in the operations, as well as giving opportunity to all those involved who show readiness to neglect individual benefits in order to promote the common ones, to contribute to the project as equal and valuable collaborators is an absolute necessity.

4. Reliance on the Diffusion of innovations theory

SMCP extension for Pilotage and Tug Assistance is an innovation in the sense of occupational language extension, and its implementation and future use in the maritime business niche so far held by the local languages while pilots and tug masters of the future can rightfully be considered users of innovation in the area of the occupational working culture. Cultural changes take time to start living their best life; *Diffusion of innovations* theory as presented above could help in accelerating this cultural change period. In the table below the participation of all the parties involved is represented.

5. Make your opponent your promoter strategy

The current paper is also conceived of as an invitation to all the parties interested in the subject, both maritime lecturers and maritime professionals, to take part in the June 2016 G.A.M.E. summer seminar to be held in Split, Croatia where the issue will be further discussed and solutions to it sought after in order for all the parties involved to benefit from it. It is most important that the decision on the implementation be made without horizontal conflicts and implemented consciously and voluntarily to the benefit of all the on-scene subjects with positive public consequences and avoiding private ones.[23] As Meyer and Rowan (1977:343) state: *"This process is most effective when norms, values, or expectations about certain forms or practices become deeply ingrained in society – institutionalized – and reflect widespread and shared understandings of social reality."*

In all issues, instead of enforcing solutions or taking punitive action insisting on negotiations and argumentation is the safer course to our destination.

22. Bocanegra-Valle, A. uses the term to refer to Maritime English lecturers as promoters of interculturality in shipping business courses.

23. Barbara Wejnert is a professor at the University at Buffalo. Her research concerns worldwide diffusion of democracy. She has introduced the concepts of public and private consequences in the diffusion of innovations..

Table 1.
Parties to diffuse SMCP Pilotage and Tug Assistance extension as innovation .

IFSMA (ship masters)	pilots and tug masters	Maritime English lecturers and maritime professionals in education and training	IMO
- to contribute to forming favourable attitude to innovation by informing on the current needs on the basis of examples of past negative experiences to be avoided in future by the introduction of new practice;	- pilots and tug masters in favour of changes should help raise awareness among colleagues; - to show willingness to discuss their own and other parties' problems related to prospective new practice and suggest possible solutions:	- diffusion of knowledge through teaching, ME and training courses, - education of new generations of students aiming at developing sensitivity for requirements of other participants in joint operations - training of actual seafarers with a view to adoption of current innovation and new future practices;	- to devise methods of forming favourable attitude to change; - to show commitment to adoption of innovation; - advise putting innovation to use (for a trial period); - require feedback information from users of all parties involved on relative advantage and compatibility to stabilise adoption and prevent discontinuance.

REFERENCES

Blair, T., (2014), Tony Blair's speech, available at: http://www.youtube.com/watch?v=2kAhChC_qxU, [accessed 22 November 2014.].

Bocanegra-Valle, A., (2015), Intercultural learners, intercultural brokers and ESP classrooms: The case of a shipping business course, Proceedings of the 32nd International Conference of the Spanish Association of Applied Linguistics (AESLA): Language Industries and Social Change, 3-5 April 2014, Seville, SPAIN, Procedia – Social and Behavioral Sciences 173 (2015), pp. 106-112. Cicero, M. T., (1918), Tusculanae Disputationes, Pohlenz, M. (ed.), Leipzig: Teubner.

Clarke, R., (1999), available at: http://www.rogerclarke.com/SOS/InnDiff.html, [accessed 17 May 2015.].

Čulić-Viskota, A., (2014), Essential English for Pilotage and Tug Assistance – Proposal for SMCP Extension, Transactions on Maritime Science, 3(2), pp. 158-164., http://dx.doi.org/10.7225/toms.v03.n02.007

De Borja, M.R., (2005), Basques in the Philippines, Reno: University of Nevada Press.

Diffusion of innovations, available at: http://en.wikipedia.org/wiki/Diffusion_of_innovations, [accessed 18 May 2015.].

Gekara, V., (2008), Globalization, State Strategies and the Shipping Labor Market, The UK's Response to Declining Seafaring Skills, PhD Thesis, Cardiff, UK: Cardiff University.

Haugh, M. and Hinze, C., (2003), A Metalinguistic Approach to Deconstructing the Concepts of 'Face' and 'Politeness' in Chinese, English and Japanese, Journal of Pragmatics, 35(10-11), pp.1581-1611, available at: http://www98.griffith.edu.au/dspace/bitstream/handle/10072/14601/33409.pdf?sequence=1, [accessed 26 October, 2014.]., http://dx.doi.org/ doi:10.1016/S0378-2166(03)00049-3

Hoebel, E.A., (1954), The Law of Primitive Man: A Study in Comparative Legal Dynamics, Cambridge, MA, USA: Harvard University Press.

Ljung, M., (2010), Function Based Manning and Aspects of Flexibility, WMU Journal of Maritime Affairs 9(1), pp. 121-133., http://dx.doi.org/10.1007/BF03195169

Magramo, M. and Gellada, L., (2009), A Noble Profession Called Seafaring: the Making of an Officer, TnasNav, The International Journal on Marine Navigation and Safety of Sea Transportation 3(4), pp. 475-480.

Merriam-Webster's Online Dictionary, for "questionnaire," available at: http://www.merriam-webster.com/dictionary/questionnaire, [accessed 21 September 2014.].

Meyer, J.W. and Rowan, B., (1977), Institutionalized Organizations: Formal Structure as Myth and Ceremony, American Journal of Sociolhy, 83, pp. 440-63, in Wejnert, B., (2002) Integrating Models of Diffusion of Innovations: A Conceptual Framework, Annual Review of Sociology, (2002), 28, pp. 297-326., http://dx.doi.org/10.1146/annurev.soc.28.110601.141051

Nielsen, D., (2005), Maritime Security and MET, Malmö, Sweden:WIT Press .

NYK Shipmanagement ltd., (2004), Guidelines on Intercultural Relationship.

Peabody, A. P., (1886), Cicero's Tusculan Disputations, Boston: Little & Brown, (pp. 195–250), available at: https://archive.org/details/cicerostusculand00ciceiala, [accessed 2 September 2015.].

Pyne, R. and Koester, T., (2005), Methods and Means for Analysis of Crew Communication in the Maritime Domain, The Archives of Transport, 17(3-4), pp. 193–208.

Rogers, E., (2003), Diffusion of Innovations, 5th Edition, Glencoe: Simon and Schuster.

Rogers, E., (2003), Diffusion of Innovations, available at: https://web.stanford.edu/class/symbsys205/Diffusion %20of %20Innovations.htm, [accessed 17 May 2015.].

Talbot, M., Atkinson, K. and Atkinson, D., (2003), Language and Power in the Modern World, Edinburgh: Edinburgh University Press.

Textbook of Maritime Medicine, Norwegian Centre for Maritime Medicine, available at: http://textbook.ncmm.no/component/content/article/39-6-the-sea-as-a-working-place/760-multinational-crews-a-communication, [accessed 2 September 2015.].

The guardian, (2014), available at: http://www.theguardian.com/politics/2007/apr/26/tonyblair.labour, [accessed 22 November 2014.].

Wejnert, B., (2002), Integrating Models of Diffusion of Innovations: A Conceptual Framework, Annual Review of Sociology, 28, pp.297-326., available at: http://www.wejnert.com/files/out2.pdf, [accessed 18 May 2015.]., http://dx.doi.org/10.1146/annurev.soc.28.110601.141051

CONTRIBUTION

News from IMO
Maritime Heritage
Popularization of Science and Technology
News
Pjesma / Poem
Guidelines

CONTRIBUTION

News from IMO

Tatjana Krilić

This contribution presents a compilation of information on current work of selected IMO bodies in the period preceding the publication of this issue of ToMs. The outcome of IMO bodies responsible for safety and environment protection has been covered, aiming at informing readers 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

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INTRODUCTION

Since the last issue of ToMS, the Maritime Environment Protection Committee (MEPC) met at the Organization's London Headquarters for its 68th session from 11 to 15 May 2015, and the Maritime Safety Committee (MSC) held its 95th session from 3 to 12 June 2015. Selected decisions and outcome of discussions of both Committees have been presented in this review.

Complete information on the outcome of various IMO bodies is available in their reports, which can be found on the Organization's IMODOCS website (http://docs.imo.org/). More information and highlights on the work of the Organization can be found on its public website (http://www.imo.org), including press briefings and meeting summaries available in "Media Centre" area, whilst most of the Organization's technical and operational data, some of which is available to the public, is stored in the Global Integrated Shipping Information System (GISIS) (https://gisis.imo.org), which is also accessible via the public website.

68th session of the Marine Environment Protection Committee (MEPC 68)

Polar Code environmental requirements adopted

The MEPC adopted the environmental requirements of the International Code for ships operating in polar waters (Polar Code), and the associated MARPOL amendments to make the Code mandatory, following the adoption of the safety part of the Code by the Maritime Safety Committee (MSC) in November 2014. The Polar Code is expected to enter into force on 1 January 2017.

MARPOL Annex I amendments relating to oil residues adopted

Amendments to regulation 12 of MARPOL Annex I, concerning tanks for oil residues (sludge) were adopted. The amendments update and revise the regulation, expanding on the requirements for discharge connections and piping to ensure oil residues are properly disposed of.

Extension of Great Barrier Reef and Torres Strait PSSA adopted

The MEPC adopted a resolution to extend the eastern limit of the current Great Barrier Reef and Torres Strait Particularly Sensitive Sea Area (PSSA) to encompass the south-west part of the Coral Sea, part of Australia's Coral Sea Commonwealth Marine Reserve (CMR), a remote ocean ecosystem which provides refuge for a wide range of threatened, migratory and commercially valuable species.

Ballast water management status and technologies reviewed

The MEPC reviewed the status of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention), 2004, which is close to receiving sufficient ratifications to meet the remaining entry into force criterion (tonnage). The number of Contracting Governments is currently 44, representing 32.86 % of the world's merchant fleet tonnage. The BWM Convention will enter into force 12 months after the date on which not fewer than 30 States, the combined merchant fleets of which constitute not less than 35 % of the world's gross tonnage, have ratified it.

Among other decisions, a "Roadmap for the implementation of the BWM Convention" was agreed, which emphasises that early movers, i.e. ships which install ballast water management systems approved in accordance with the current Guidelines (G8), should not be penalized.

Further ballast water management systems that make use of active substances were granted Basic Approval (five systems) and Final Approval (one system).

Further development of energy-efficiency guidelines for ships

The MEPC continued its work on further developing guidelines to assist in the implementation of the mandatory energy-efficiency regulations for international shipping and adopted amendments to:

- the 2014 Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI) and endorsed their application from 1 September 2015, at the same time encouraging earlier application;
- the 2013 Interim Guidelines for determining minimum propulsion power to maintain the manoeuvrability of ships in adverse conditions, for the level-1 minimum power lines assessment for bulk carriers and tankers, and agreed on a phase-in period of six months for the application of the amendments; and
- the 2014 Guidelines on the method of calculation of the attained EEDI.

Text agreed for further development of a data collection system to analyse the energy efficiency of ships

The MEPC agreed the text to be the full language for the data collection system for fuel consumption of ships, which can be readily used for voluntary or mandatory application of the system, and noted that a purpose of the data collection system was to analyse energy efficiency and for this analysis to be effective some transport work data needs to be included, but at this stage the appropriate parameters have not been identified.

Revised air pollution guidance and requirements agreed

The MEPC considered a number of amendments and revisions to existing guidance and requirements related to air pollution measures and, inter alia, adopted amendments to:

- the 2009 Guidelines for exhaust gas cleaning systems (resolution MEPC.184(59)); and
- the 2011 Guidelines addressing additional aspects to the NOX Technical Code 2008 with regard to particular requirements related to marine diesel engines fitted with Selective Catalytic Reduction (SCR) Systems (resolution MEPC.198(62)).

Fuel oil availability review to be initiated this year

The MEPC agreed terms of reference for the review, required under regulation 14 (Sulphur Oxides (SOx) and Particulate Matter) of MARPOL Annex VI, of the availability of compliant fuel oil to meet the global requirements that the sulphur content of fuel oil used on board ships shall not exceed 0.50 % m/m on and after 1 January 2020. The IMO Secretariat was requested to initiate the review by 1 September 2015, with a view to the final report of the fuel oil availability review being submitted to MEPC 70 (autumn 2016) as the appropriate information to inform the decision to be taken by the Parties to MARPOL Annex VI.

95th session of the Maritime Safety Committee (MSC 95)

IGF Code adopted

The MSC adopted the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code), along with amendments to make the Code mandatory under the International Convention for the Safety of Life at Sea (SOLAS), with the expected date of entry into force of 1 January 2017.

The use of gas as fuel, particularly liquefied natural gas (LNG), has increased in recent years due to lower sulphur and particulate emissions than fuel oil or marine diesel oil. But gas and other low-flashpoint fuels pose their own set of safety challenges, which need to be properly managed. The IGF Code aims to minimize the risk to the ship, its crew and the environment, having regard to the nature of the fuels involved.

The IGF Code contains mandatory provisions for the arrangement, installation, control and monitoring of machinery, equipment and systems using low-flashpoint fuels, focusing initially on LNG.

The Code addresses all areas that need special consideration for the usage of low-flashpoint fuels, taking a goal-based approach.

The MSC also adopted related amendments to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), and STCW Code, to include new mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on ships subject to the IGF Code. The amendments also have an entry into force date of 1 January 2017, in line with the SOLAS amendments related to the IGF Code.

IMSBC Code amendments adopted, guidance approved

Amendments to the International Maritime Solid Bulk Cargoes (IMSBC) Code were adopted and related guidance approved. The amendments include those intended to improve the requirements relating to the provisions for concentrates or other cargoes which may liquefy; amendments to provisions for specially constructed cargo ships for confining cargo shift; the addition of new individual schedules such as iron ore fines, among others, and amendments to a number of existing ones, including a revised schedule for iron ore.

Unsafe mixed migration by sea

During a special session, the MSC agreed that urgent action was needed to prevent huge losses of life given the forecast increase in unsafe mixed migration by sea. The Committee stressed the need for the international community to make greater efforts to address unsafe migration through more safe and regular migration pathways, and taking action against criminal smugglers.

To progress work on aspects of this humanitarian disaster that come under the purview of IMO, the Committee agreed to place an agenda item on its work programme and initiated related actions by the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR) and the Facilitation Committee.

Passenger ship safety - draft SOLAS amendments on evacuation analysis approved

As part of the ongoing work programme to improve passenger ship safety, the MSC approved draft amendments to SOLAS regulation II-2/13 to extend the requirements for evacuation analysis to all passenger ships, not just ro-ro passenger ships.

Also MSC approved draft amendments to SOLAS regulation II-1/22, along with the related guidelines, to clarify when watertight doors may be opened during a voyage (applicable to all ships).

Cyber security matters referred to MSC 96 and FAL 40

The MSC considered a number of submissions relating to cyber security, agreeing that it was an important and timely issue. The MSC noted that the shipping industry round table (including the Cruise Lines Industry Association (CLIA), was developing guidance on cyber security on board ships, to be submitted to the next Facilitation Committee (FAL 40) and MSC 96 in 2016.

Circular on definition of "high risk" piracy area agreed

An MSC Circular on Best Management Practices (BMP) for Protection against Somalia Based Piracy was approved, calling on the BMP authors to amend the coordinates of the High Risk Area (HRA) in BMP 4 (promulgated as MSC.1/Circ.1339), following a proposal by Egypt to remove the Gulf of Suez and the Red Sea from the HRA definition.

The MSC also approved Revised Interim recommendations for flag States regarding the use of privately contracted armed security personnel on board ships in the High Risk Area (to update MSC.1/Circ.1406/Rev.2) to recommend that Private Maritime Security Companies (PMSC) employing privately contracted armed security personnel (PCASP) on board ships should hold valid, accredited, certification to ISO 28007-1:2015 or meet applicable national requirements.

Ship-routeing measures adopted

In addition to the extension of Great Barrier Reef and Torres Strait PSSA, as adopted by MEPC 68 in May 2015, the MSC adopted new ship-routeing measures aimed at protecting sensitive areas in the south-west Coral Sea off Australia, including an "area to be avoided" (ATBA) and two new, five nautical mile wide, two-way routes. Five recommendatory ATBAs in the region of the Alaska Aleutian Islands were also adopted. The new measures will be implemented on 1 January 2016 at 0000 hours UTC.

Goal-based standards - work plan for further work on GBS-SLA agreed

The MSC approved a work plan for continued work on goal-based standards safety level approach (GBS-SLA), over the next three sessions and approved the MSC.1/Circ.1394/Rev.1 on the Generic guidelines for developing IMO goal-based standards. GBS are defined as high-level standards and procedures that are to be met through regulations, rules and standards for ships.

The MSC noted that, by the end of March 2015, all five GBS verification audit teams had delivered their interim reports, which included 13 interim reports on relevant recognized organizations (ROs); and two interim reports on IACS Common Packages.

Under the GBS standards, construction rules for bulk carriers and oil tankers of classification societies which act as ROs, or national Administrations, must be verified, based on the Guidelines for verification of conformity with goal-based ship construction standards for bulk carriers and oil tankers (resolution MSC.296(87)) (GBS Guidelines).

Amendments to IMO instruments that have entered into force

- 2012 amendments to the Protocol of 1996 to amend the Convention on Limitation of Liability for Maritime Claims, 1976 (amendments to the limitation amounts set out in article 3) (resolution LEG.5(99)) have entered into force **on 8 June 2015**.
- 2014 amendments to MARPOL Annex VI and the NOX Technical Code 2008 (resolution MEPC.251(66)) have entered into force **on 1 September 2015**.

'Dalmatia': The Forgotten Milestone

Marijan Žuvić

The most important moment in the history of liner navigation on the Dalmatian coast was the establishing of 'Dalmatia' steamship company in 1908. A century later this milestone is completely forgotten. But, the fact is hardly surprising! In all the past decades there were no serious attempts to describe the exciting years of battles pro-et-contra united shipping company; short but fascinating rise of 'Dalmatia' and her end only 14 years after.

Back in 1962 Dr.Oliver Fio, leading researcher of Croatian maritime history, published his capital work 'Parobrodarstvo Dalmacije 1878 – 1918' (Dalmatian Steam Shipping). A part of that excellent study dedicated to 'Dalmatia' is still the most relevant work on this important matter. But, after so many years few copies of Fio's book are available only in libraries.

Boosted by the fact, I prepared a short history of 'Dalmatia', based on Oliver Fio's work and the results of my own researches, especially on ships sailing in the company's fleet. I believe that publishing in ToMS magazine is the best way to make such an interesting story available much further than bookshelves.

Few, just as the copies of Dr. Fio's book, are the photos of the company's steamers. Still, thanks to the great help of Italian maritime historians and researchers Nereo Castelli and Mario Cicogna, history of 'Dalmatia' is illustrated with the photographs taken a century ago.

Officially, the story of 'Dalmatia' begins on the very first day of 1908 when the ships of the four Dalmatian shipping companies for the first time sailed under new flags and livery: great white letter D on traditionally black funnels. Few months earlier owners

Figure 1.
'Dalmatia' steamers at the port of Split.

Maritime journalist and publicist
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Figure 2.
'Brač'.

of companies Braća Rismondo of Makarska, Dalmatinsko-Istarska Paroplovidba Pio Negri i Drugovi of Šibenik, Serafin Topić of Vis and Zaratina Società di Navigazione a vapore of Zadar decided to merge their fleets in a Trieste-based consortium called Consorzio di Navigazione 'Dalmatia'.

These enterprises were the forerunners of coastal liner shipping in Dalmatia. The leading one was the Braća Rismondo. The first traces of Rismondo family's connection with the city of Makarska date back to 1789 and from the early 1850's they were permanent citizens. The family originated from Rovinj in Istria and as merchants often visited Makarska with their own sailing ships. The pioneer in shipping business based in Makarska was Frane Rismondo. His sons Vjekoslav, Petar, Ante and Ivan followed their father's business. Ante was a seafarer, firstly served on sailing ships, then became a master mariner and was later in command of the family vessels. In many registers Capt. Ante Rismondo, instead of Braća Rismondo, was stated as the owner of the ships.

In 1878 the Rismondos purchased two wooden steamers to operate a weekly line between Makarska and Metković. 'Barone di Rodich', later renamed 'Dalmazia', was built in 1858 at Sestri Ponente and 'Erzegovina' was built in 1868 in Trieste. 'Barone di Rodich' was 26.7 meters in length and powered by a steam engine of only 16 HP. 'Erzegovina' was even smaller and weaker with a 10 HP engine. Nevertheless, small 'Barone di Rodich' in November 1880 inaugurated a regular line Trieste – Metković, with calls at Zadar, Trogir, Split and Makarska.

In 1881 the company ordered the steamship 'Eco' of 29.2 meters from the Trieste shipyard Stabilimento Tecnico Triestino. Two years later from the same yard came a much bigger steamer 'Salve' of 43.3 meters. Later she was renamed 'Barone de Pino' and in 1901 became 'Jadro'. At the same time two more Trieste-built ships were purchased. 'Barone Rodich', built in 1878, was purchased in 1881, but only a year later, it was sold to the Turkish owners. Purchased in 1885 was the biggest Rismondo's steamer up to that date: 'Isea' of 42.9 meters. This ship lasted until 1911. On the very Christmas Day she caught fire and was forced to run aground on Sestrice Islet near Rogoznica, finally becoming a total loss.

One more newcomer from Stabilimento Tecnico Triestino entered fleet in 1888. She was 'Dinara' of 36.6 meters. From the same yard in 1896 came the steamer 'Mosor'. Until the establishing of 'Dalmatia' two second-hand steamers were purchased. In 1892 it was the famous 'Dubrovnik', built in 1880 at Dumbarton for Dubrovnik owners. The Rismondos renamed her as 'Biokovo'. The German-owned coastal steamer 'Brunsbüttel II', built by Howaltswerke at Kiel in 1896 was purchased in 1903. She was renamed as 'Brač' and sailed under the same name for 60 years, before being scrapped at Sveti Kajo breakers' yard.

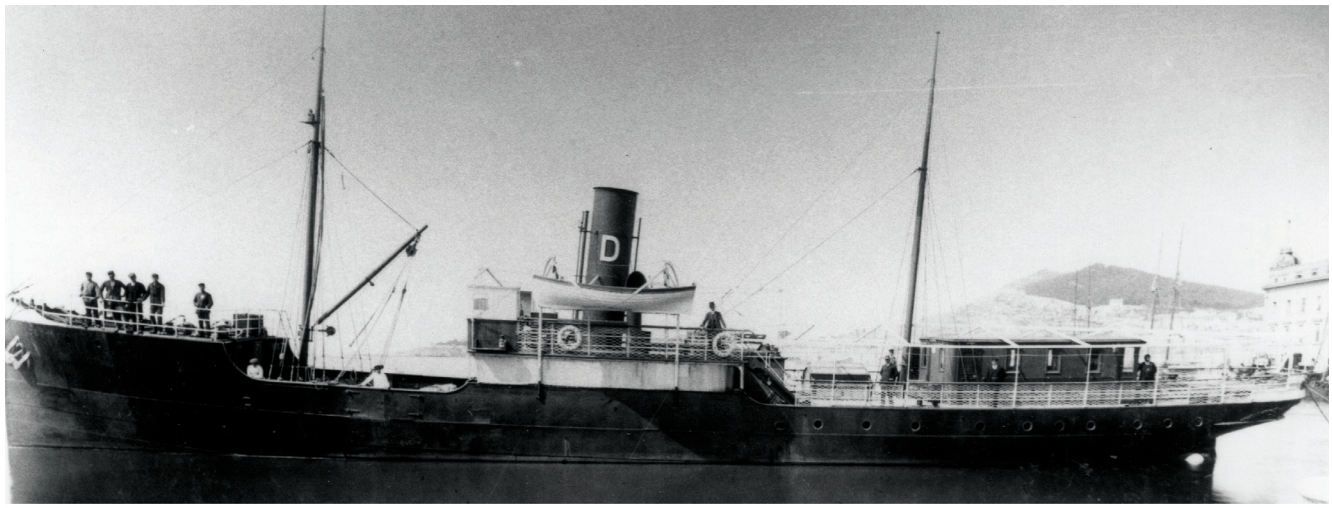

Figure 3.
'Cetina'.

The second Dalmatian steamship company was established on the Island of Vis in 1890 by the wine merchant and shipowner Serafin Topić. Serafin's father Ante came to the island from the village of Topići in the Dalmatian hinterland and in 1848 was registered as a wine wholesaler. Serafin, with several partners from Vis, owned sailing ships 'Višanin' and 'Serafino', engaged mainly in wine trade.

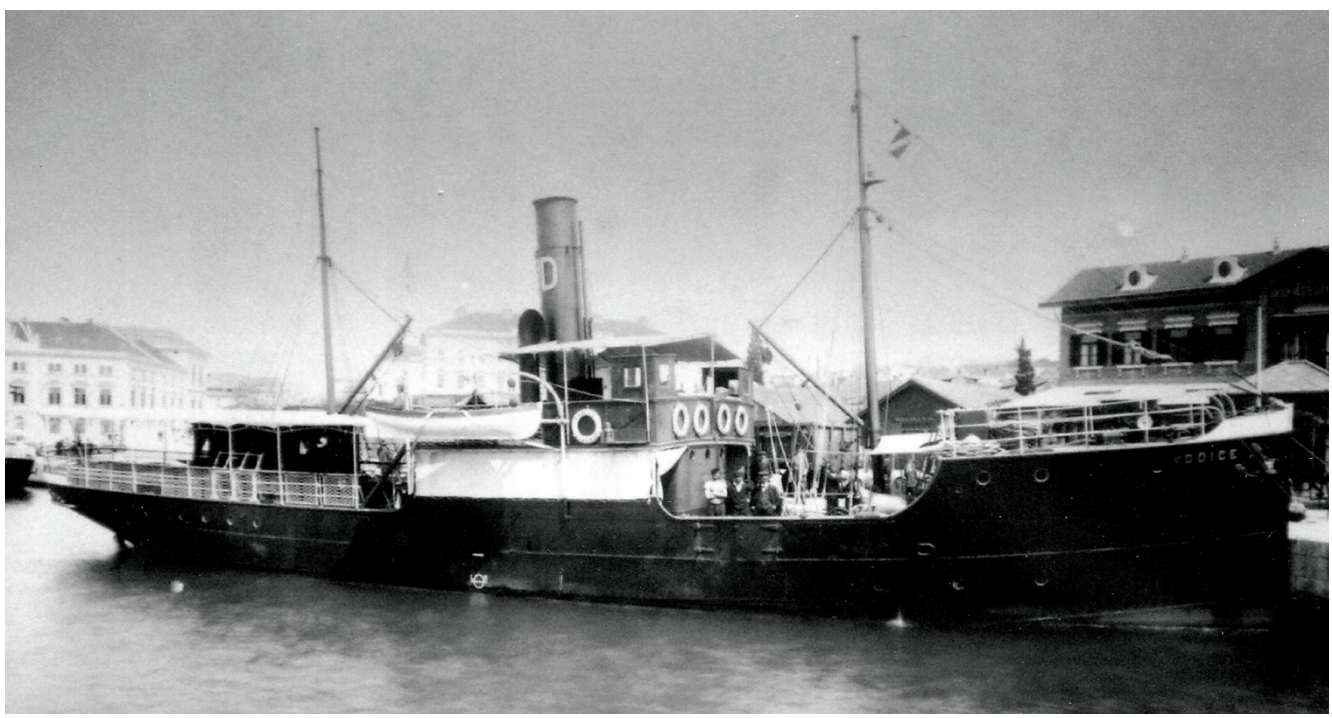

Figure 4.
'Vodice'.

Figure 5.
'Makarska'.

Topić made a grand entrance in the steam shipping world with a brand new cargo/passenger ship 'Vila' built in 1890 by Howaldstswerke at Kiel. It was a big and very modern ship of 46.4 meters and steam engine of 450 HP. She was engaged on Split-Trieste route, mainly carrying wine to the northern Adriatic and returning with general merchandise.

Still, ships that followed were far from being big and new. In 1892 Topić purchased from Franjo Olivieri of Senj the steamship 'Vitez'. She was a veteran, built at Blackwall near London in 1868 as a side-wheeled paddle tug. But shortly prior to purchase by Topić she was rebuilt and re-engined. In the same year fleet was boosted with its biggest ship named 'Vis'. Originally being 'Trieste' in the fleet of Österreichischer Lloyd, she was of 440 gross register tones and 62.4 meters in length. A big ship indeed, but she was built back in 1870 in Trieste, also as a side-wheeled paddle steamer. Shortly after purchase 'Vis' was sent to Trieste to be rebuilt into a twin-screw ship and re-engined with a 450 HP steam engine.

The third ship purchased in 1892 was a small steamer 'Zara', but she was sold only three years later. In 1893 another newbuilding from Howaldtswerke entered Topić's fleet, the relatively small 'Lussin' of 39 meters. The following year saw another newcomer, but again a veteran. She was 'Jason' of 51.4 meters, built by Glasgow shipyard of Blackwood & Gordon as 'Belle of Dunkerque' in 1876. One more veteran was purchased in 1899 and it was the last Topić's acquisition prior to the establishing of 'Dalmatia'. Originally built by Neptun shipyard at Rostock for German owners, but purchased from Italians, she was named 'Medea T.'

For many years after the creation of 'Dalmatia' it seemed that the Topić family left shipping business forever. But in 1926 Serafin's son Ante founded a company named Slobodna Plovidba Topić and, in a short time, became one of the leading Yugoslav shipowners. It is interesting to know that the family's flag and funnel markings are still on the blue lanes. The Topić company

Marfin Management, based in Monte Carlo, is today among the highly respected in the shipping world.

The third founding company of 'Dalmatia' association was Dalmatinsko-Istarska Paroplovidba Pio Negri i Drugovi of Šibenik, represented with a fleet of small and antique steamers. The first liner to sail in Šibenik area was 'Šibenik', built in 1875 in Gloucester as 'Augusta'. In 1878 she was registered in Split, being purchased by forwarding company Prini and Tartaglia. But that company lasted for only three years. 'Augusta' was bought in 1881 by Ante Šupuk, a businessman and the Mayor of Šibenik. In 1890 'Šibenik' became the first ship owned by Pio Negri.

Negri, one of the leading merchants in Šibenik, renamed the ship properly: the 'Primo'. A year later 'Nada' was purchased. But she was just a steam boat, only 11 meters in length, built in 1888 at Korčula for brothers Gustav, Josip and Jerolim Bonačić from Milna, Brač Island. 'Nada' was purchased by the company called Paroplovidba Pio Negri i Drugovi (often referred to as Pio Negri & Co.) as Negri's partners became Capt. Andrija Zafranović and the shipbuilders Krsto and Šimun Ježina. Only two years later 'Nada' was sold.

The third ship was purchased in 1892 and was renamed improperly: the 'Secondo'. It was also a small ship of 18 meters, built in 1868 in Trieste as 'Elvira P.'. In the same year the fleet entered second steamer named 'Primo'! The first one was sold and the brand new one was purchased from the shipbuilders in Mali Lošinj. In 1894 another newbuilding from Mali Lošinj, named 'Tommaseo', entered the fleet.

Paroplovidba Pio Negri i Drugovi became a strange mixture of new ships and obsolete steamers. In 1896 'Sibyl', a ship with a very interesting history was purchased. She was built in 1872 by Day, Summers & Co. in Southampton as a yacht 'Sibyl' for William Lon. In 1884 she was sold to Prince Nikola of Montenegro, but kept her original name. The Prince, later to become the King, was known for his passion for yachts and during his reign he owned ten royal pieces. Obviously, 'Sibyl' didn't meet his expectations, so in 1886 he sold her to Mate Švrljuga from Rijeka. Rebuilt into a passenger ship she kept the name 'Sibyl' and sailed in the northern Adriatic until 1896, when she arrived at Šibenik to be renamed 'Krka'.

Figure 6.
'Mosor'.

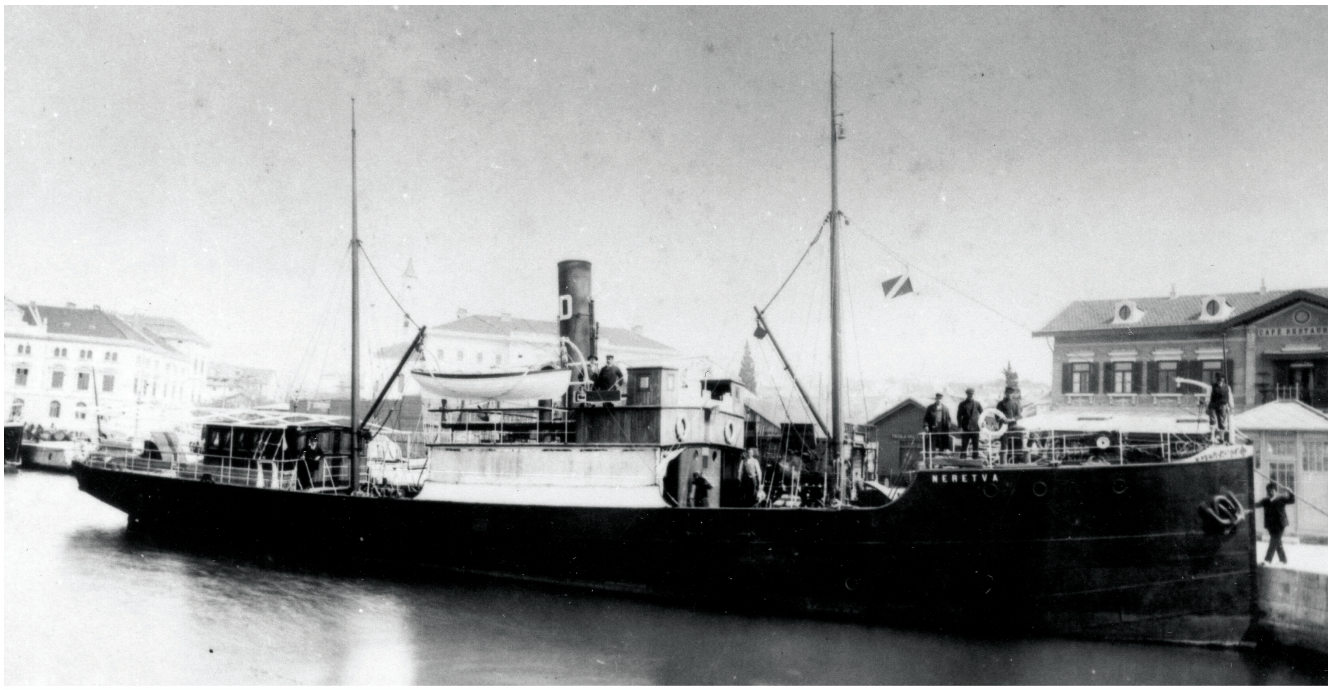

Figure 7.
'Neretva'.

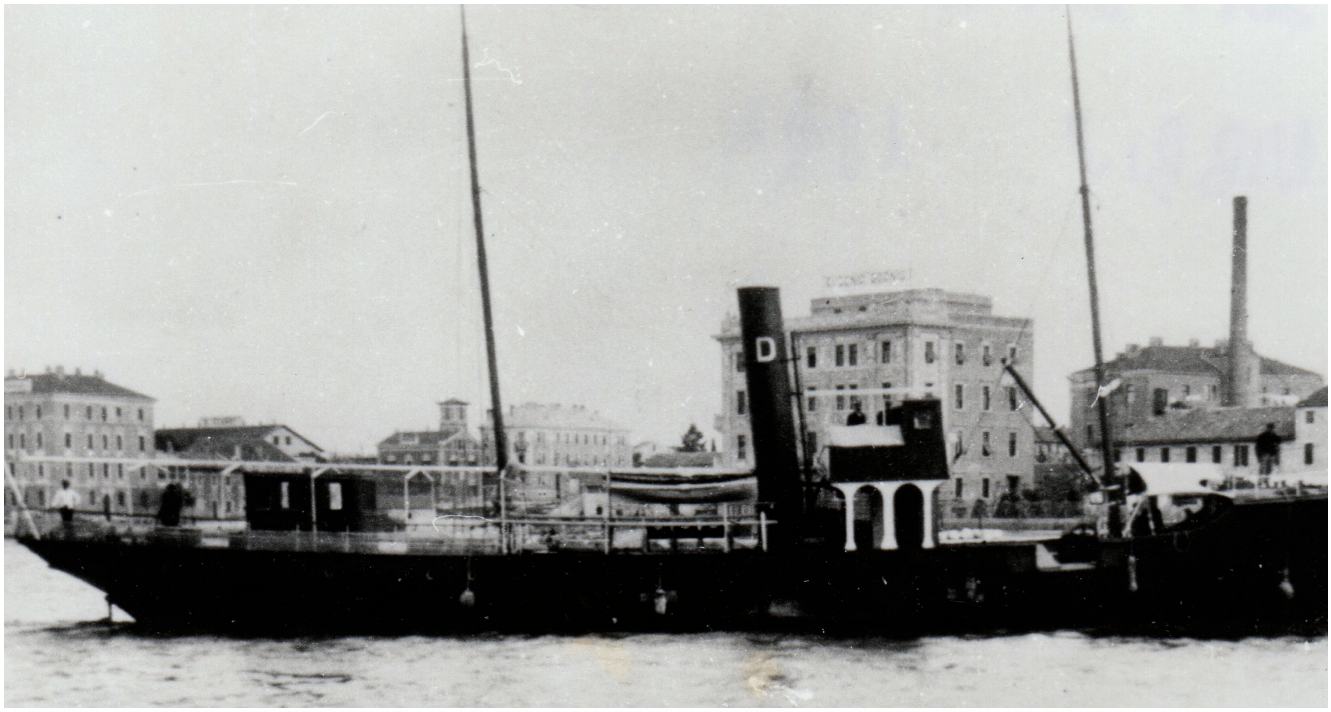

Figure 8.
'Nibbio'.

A year later 'Zlarin', built in Kiel in 1866 as 'Worvärts' was purchased. Then, in 1898 from Mali Lošinj came the pride of the fleet, a brand new steamship 'Sebenico' of 41.2 meters. Only a year later the ancient 'Iniziatore' was bought. She was built at Marseilles in a year unknown and in 1883 was rebuilt by Stabilimento Tecnico Triestino. Very often 1883 and Trieste are quoted as a year and place of her construction. Not so ancient was the 'Risorto', purchased in 1900. As 'Flink', she was built at Mali Lošinj in 1886.

In 1904 the company name was changed to Dalmatinsko-Istarska Paroplovidba Pio Negri i Drugovi (Dalmatian-Istrian Steam Shipping), primarily to point out that Pio Negri was born in the Istrian city of Labin. The only acquisitions of the newly named company were 'Istriano' and a second ship named 'Krka'. The brand new 'Istriano' was built in 1904 by Stabilimento Tecnico Triestino, but a year later she was sold to Ungaro-Croata. In 1905 the steamer 'Cherso', built in 1898 at Mali Lošinj as 'Barone de Chlumecky' was purchased. She became 'Krka' after the existing ship under that name was christened 'Obrovac'. The last ship to enter the fleet was the old steamer 'Nada', purchased in the late 1907 from the Italian owners. She was built in 1885 at Wallsend-on-Tyne as the yacht 'Salamander'.

A tiny shipping company 'Zaratina' was the fourth founding father of 'Dalmatia'. In 1888 Giuseppe(Josip)Perlini, a prominent merchant and property owner of Zadar, purchased at Senj the wooden steamship 'Vinodolac' of 24.7 meters and renamed her 'Falco'. Thirteen years earlier she had been built by Stabilimento Tecnico Triestino as 'Capodistria'. In 1892 Perlini with his partners ordered two somewhat larger wooden steamers in Mali Lošinj:'Airone' and 'Rondine'. These wooden coasters became the cornerstone of 'Zaratina', Societa di Navigazione a Vapore, founded in Zadar in 1895 by a group of local enterpreneurs.

Until 1908 and the creation of 'Dalmatia' only two ships entered the fleet. In 1899 from Mali Lošinj arrived a brand new steamer 'Nibbio' of 33.8 meters and in 1903 the company's flagship 'Zara'. Built by Rotterdamsche Droogdok Maatschappij, she was a sturdy passenger/cargo ship of 43 meters, with steam engine of 420 HP. She lasted for 62 years. Under the name of 'Hvar' she arrived at Sveti Kajo breaking yard in April 1965.

On the fleet list of 'Dalmatia' from January 1908 by far the biggest are the steamships 'Bosnia' and 'Danubio' of the mighty Österreichischer Lloyd. During the painstaking negotiations about united Dalmatian company, Lloyd acted on behalf of the Government in Vienna and eventually became one of the partners with these two ships. 'Bosnia' was a ship of 49.6 meters with powerful steam engine of 600 HP and she was delivered to Lloyd in the summer of 1899 by Lloyd's own Arsenal in Trieste. On the contrary, the much bigger 'Danubio' of 62.7 meters was a worn-out veteran, being built by 'Vulkan' shipyard at Stettin back in 1866. While 'Bosnia' was estimated at 330.000 Austrian Krone, 'Danubio' was worth only 50 thousand.

So, it seemed that on the New Year's Day of 1908 ended the war that lasted from the late 19th century: the pro-et-contra war of words about the united steamship company on the Dalmatian

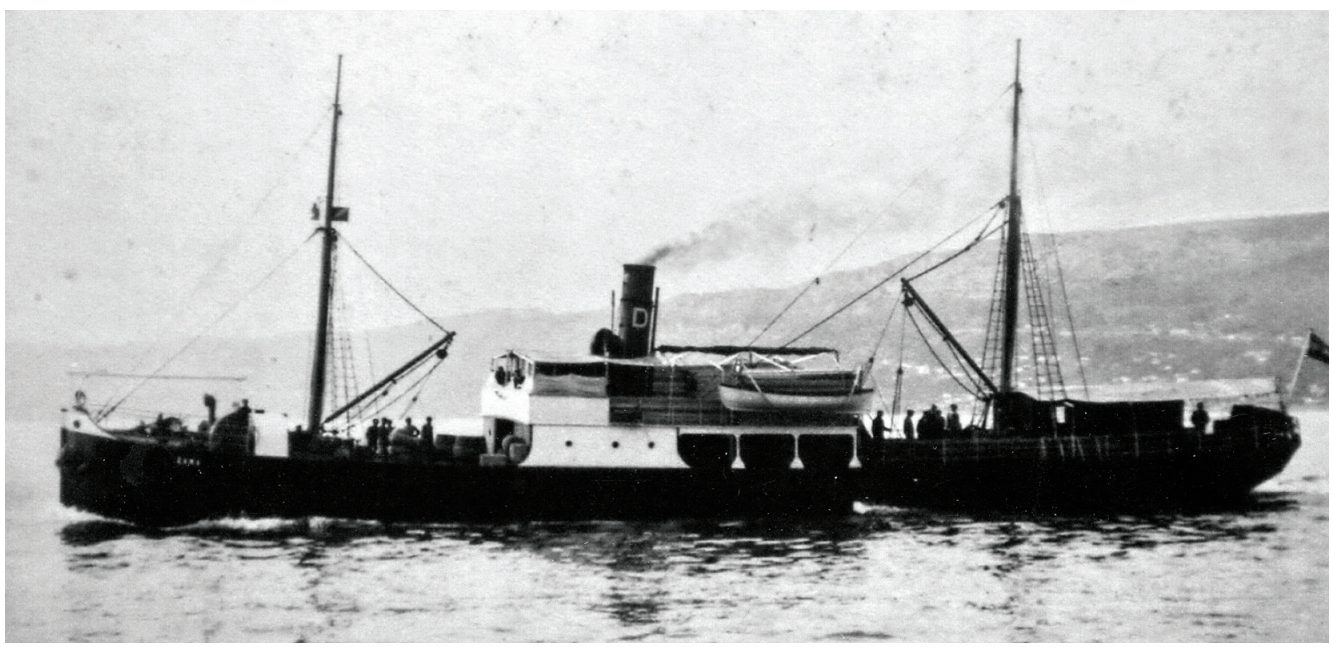

Figure 9.
'Zara'.

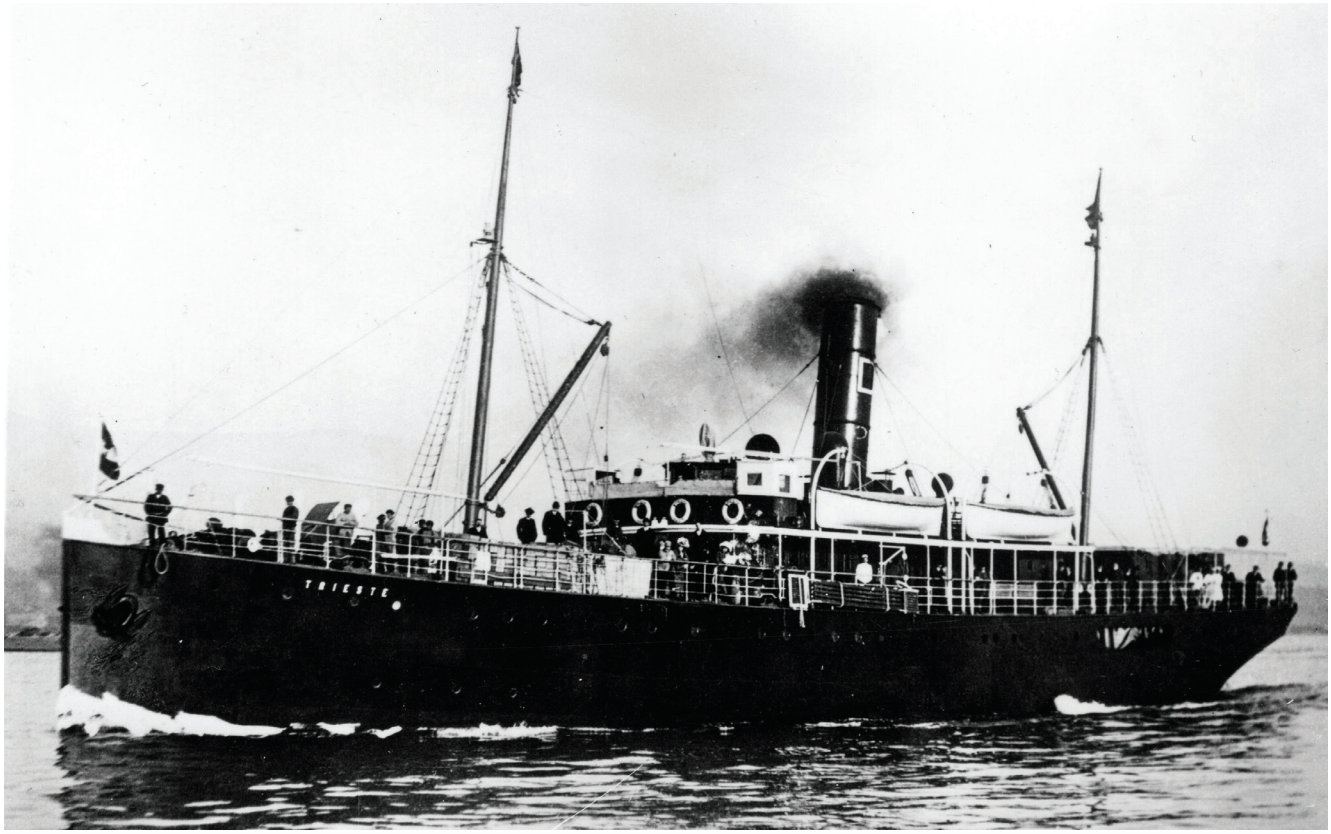

Figure 10.
Pride of the fleet: 'Trieste D.'.

coast. It is impossible to describe in short all that was happening, as it was quite a complex mixture of political and economical interests, huge distrusts and fears, national sentiments, petty local interests and alike.

The steam navigation in Dalmatia was lagging behind the northern Adriatic where Österreichischer Lloyd and Ugarsko-Hrvatsko Dioničko Pomorsko Parobrodarsko Društvo, better known under the Italian short name Ungaro-Croata, ruled the sea lanes. There were many initiatives to establish a Dalmatian company strong enough to deal with the Austrian and Hungarian competitors. The leading entrepreneurs required a single company having in mind the possibility for significant cutting of transport costs and, thus, attracting the cargoes into Dalmatian ports.

At the end of the 19th century the Croatian national sentiment was very strong in Dalmatia. In the early 1880's the supporters of the Croatian national revival won the elections in the Dalmatian cities and in 1883 Croatian had been declared the official language. A Croatian shipping company was a matter of national pride. But there were strong oppositions of all kinds. Especially expressed was a fear that the authorities in Vienna and Budapest would, sooner or later, find the way to control such a company.

The most serious initiative for the merger of Dalmatian shipping companies came in 1904, not from the Dalmatian cities but from Ljubljana in Slovenia. Dr. Ivan Hribar, director of Ljubljanska Kreditna Banka and the Mayor of Ljubljana, met on the 24th of February with numerous prominent Dalmatians, including shipowners Serafin Topić, Ante Rismondo and Pio Negri. He presented a very detailed plan on the merger of the Dalmatian companies, supported by the Croatian and Slovenian banks. Hribar insisted that his only aim was a strong company able to compete with Lloyd and Ungaro-Croata.

But the proceedings of that meeting were sent only to the Maritime Government in Trieste and the Ministry of Commerce in Vienna, being unavailable to the Split Chamber of Commerce and other interested parties. As expected, that caused anger and immense distrust on Hribar's initiative. The battles lasted for months and years. Finally, under the official Vienna auspices, on August 27, 1907 a framework for agreement on 'Dalmatia' consortium with the head office at Trieste was adopted. The opponents of 'Dalmatia' acted promptly by establishing a

Figure11.
Delivery of 'Trieste D.' at Monfalcone.

company called Dalmatinska Plovidba. But, to make the story shorter: the Final agreement on 'Dalmatia' was signed in Vienna on November 27, 1907 and the company was brought to light on January 1, 1908.

Only two weeks later, on the 15th of January, the new company was hit by a general strike of crews. Contrary to the earlier strikes on the coastal steamers, this one was led by the captains and not the ordinary seamen. The management of 'Dalmatia' abandoned the usual communication with the captains on the issues of wages, food allowances and pension conditions, thus making a way for rumours and fear. Captains, already doubtful about the company intentions, believed in the rumours that the former Austrian naval officers would be preferred as masters on 'Dalmatia' ships. Above all expectations, the dramatic strike lasted for two weeks and was finally ended on January 29.

So, the fleet renewal became again the main issue of 'Dalmatia'. The number of 30 ships sounds mighty, but in reality it was a rag-tag fleet of steamers of all shapes and sizes, with only one ship built in the 20th century! Many ships were wooden, far more were built of iron and not steel, generally powered by weak steam engines and being very slow. The real strength and importance of 'Dalmatia' was the ambitious newbuildings programme.

The results were visible in the first year of the company's existence. Stabilimento Tecnico Triestino built four most modern coastal liners: sisterships 'Cetina' and 'Makarska' of 42.4 meters and a smaller pair of 'Adria' and 'Vodice' of 34 meters. On the trials, 'Cetina' and 'Makarska', powered by steam engines of 520 HP, achieved the speed of 14 knots. All of these steamers proved reliable and durable and, except for 'Vodice', which was lost in the Second World War, sailed for nearly 60 years.

In the history of 'Dalmatia' 1909 was the most important year. From the shipyard of Marco U. Martinolich at Mali Lošinj came another pair of modern coastal liners – 'Liburnia' and 'Neretva' of 37 meters. But, the prides of fleet came from Cantiere Navale Triestino at Monfalcone, the brand new shipyard of the Cosulich brothers. They were the sisterships 'Trieste D.' and 'Split D.', newbuilding numbers 1 and 2. The ships of 60 meters, powered by 1,000 HP steam engines and with the speed of 13 knots, were near copies of the successful Lloyd's liners 'Metcovich' and 'Almissa' built in 1893.

Together with the fine new ships came the new organisation of the company boosted mainly by the Government in Vienna. On June 21, 1909 'Dalmatia' became joint stock company named Austrijsko Parobrodarsko Društvo na Dionice in Croatian, Österreichische Dampfschiffahrts-Aktiengesellschaft in German and Società Anonima Austriaca di Navigazione a vapore in Italian. The old companions became shareholders in the company worth 3 million Krone. Serafin Topić was the biggest one with the shares worth 806,000 Krone, than followed Rismondo (794,800), Pio Negri i Drugovi (570,400), 'Zaratina' (478,800) and Österreichischer Lloyd with the shares of 380,000 Krone.

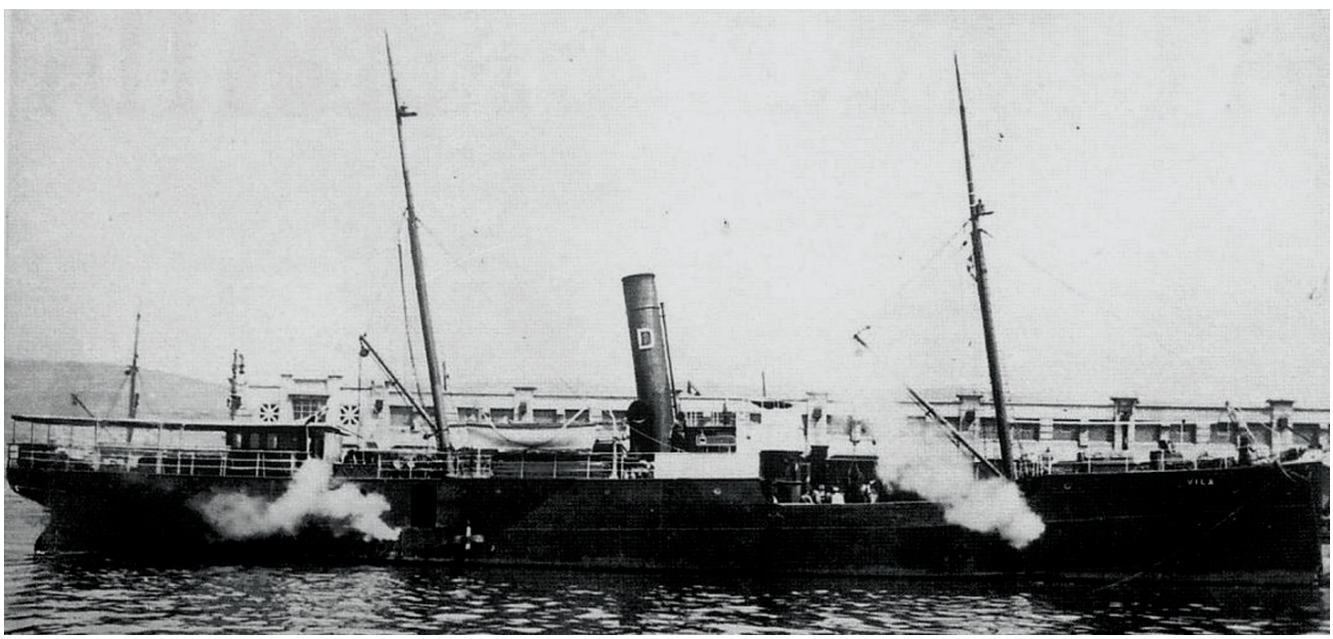

Figure12.
'Vila' – the only victim of WWI.

The following year Lloyd entered the company with a big, but antiquated liner 'Sultan' of 61.4 meters. She was built back in 1863 by Vulkan yard at Stettin with the traditional clipper bow of the sailing ships. Only three years later 'Sultan' became a casualty. On June 25, 1910 she hit a rock near Vis, but managed to reach the port of Vis where she sank. Raised and towed to Trieste, she was abandoned to the underwriters. She was purchased by Austro–Americana of Trieste, repaired and returned to service as 'Josephine'. Still, she was ill-fated. In September 1914 she struck a mine and sank off the Istrian coast.

The total of 11 newbuildings entered the fleet in only six years, making 'Dalmatia' success story so impressive. The last three were built in 1913. The sisterships 'Velebit' and 'Zrmanja' of 28 meters were built at Mali Lošinj and 'Hercegovina' came from Akers yard of Norway. She was a sturdy ship of 58 meters and with the cargo capacity of 960 tons. In December 1914 came 'Val', the very last entry in the fleet. She was also a cargo ship, but a very old one, built in 1888 at Sunderland as 'Portslade' for the renowned Stephenson Clarke company.

During the First World War the majority of 'Dalmatia' steamers were requisitioned for various military duties and the only 'Vila' was lost by the enemy action. On June 30, 1918 she was torpedoed and sunk by the Italian submarine 'F 7' near Šibenik. After the armistice all the company's vessels passed under the control of the Inter-Allied Reparations Commission (IARC). In September 1920 Italy and the newly formed Kingdom of Serbs, Croats and Slovenes (later renamed Yugoslavia) concluded the Trumbić - Bertolini Agreement and divided the fleets of the Austro-Hungarian shipping companies. By the Agreement, confirmed by IARC in August 1921, the fleet of 'Dalmatia' was divided at the ratio of 65:35 in favour of Yugoslavia.

In 1921 the offices were moved from Trieste to Split and the company title was changed to 'Dalmatia' Parobrodarsko d.d. Previously, in 1919, the word Austrian was deleted from the name. The final chapter of 'Dalmatia' history was written in the late 1922, when it merged with five other coastal shipping companies to form Jadranska Plovidba d.d. On January 1, 1923 the black funnels with the large white D disappeared from the Adriatic...

Table 1.
'Dalmatia' fleet list.

entry	steamship	GRT	YOB	place of built	owner
1/ 1/ 1908	AIRONE	64	1892	Mali Lošinj	Zaratina
	BIOKOVO	229	1880	Dumbarton	Rismondo
	BOSNIA	540	1899	Trieste	Lloyd
	BRAČ	135	1896	Kiel	Rismondo
	DALMAZIA	57	1858	Sestri Ponente	Rismondo
	DANUBIO	817	1866	Stettin	Lloyd
	DINARA	118	1888	Trieste	Rismondo
	ECO	85	1881	Trieste	Rismondo
	FALCO	49	1875	Trieste	Zaratina
	INIZIATORE	37	n/a	Marseille	Pio Negri
	ISEA	225	1881	Trieste	Rismondo
	JADRO	237	1883	Trieste	Rismondo
	JASON	407	1876	Glasgow	Topić
	KRKA	110	1896	Mali Lošinj	Pio Negri
	LUSSIN	253	1893	Kiel	Topić
	MEDEA T.	217	1872	Rostock	Topić
	MOSOR	132	1896	Trieste	Rismondo
	NADA	161	1885	Wallsend-on-Tyne	Pio Negri
	NIBBIO	112	1899	Mali Lošinj	Zaratina
	OBROVAC	55	1872	Southampton	Pio Negri
	PRIMO	42	1891	Mali Lošinj	Pio Negri
	RISORTO	110	1886	Mali Lošinj	Pio Negri
	RONDINE	85	1892	Mali Lošinj	Zaratina
	SEBENICO	297	1898	Mali Lošinj	Pio Negri
	TOMMASEO	67	1894	Mali Lošinj	Pio Negri
	VILA	405	1890	Kiel	Topić
	VIS	440	1870	Trieste	Topić
	VITEZ	186	1868	London	Topić
	ZARA	338	1903	Rotterdam	Zaratina
	ZLARIN	94	1866	Kiel	Pio Negri
1908	ADRIA	164	1908	Trieste	
	CETINA	226	1908	Trieste	
	MAKARSKA	226	1908	Trieste	
	VODICE	154	1908	Trieste	
1909	LIBURNIA	160	1909	Mali Lošinj	
	NERETVA	160	1909	Mali Lošinj	
	SPLIT D.	896	1909	Trieste	
	TRIESTE D.	896	1909	Trieste	
1910	SULTAN	752	1864	Stettin	
1913	HERCEGOVINA	748	1913	Kristiania	
	VELEBIT	100	1913	Mali Lošinj	
	ZRMANJA	100	1913	Mali Lošinj	
1914	VAL	594	1888	Sunderland	

Maritime Faculty Presented Student Works at the Festival of Science

Igor Vujović

The Festival of Science is presented in (Puljak, 2015) (available at: http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=203412). The Faculty of Maritime Studies was represented by two talented students: Matko Stanić and Željka Popović.

The first demonstration was a solar ship, with actual solar panel control (Stanić, 2015). Panel efficiency was maximized by lending them the ability to rotate towards sources of light using simple photo-resistors instead of electronics. Mr. Stanić built the solar panel ship model from scratch. A video of the ship's navigation is available in the supplementary materials (at link: http://toms.com.hr/archive/vol4/no2/maritime_faculty_presented_student_works.mp4).

Figure 1.
Ship model at the Festival.

E mail: ivujovic@pfst.hr

Figure 2.
Solar panel rotation towards sources of light (starboard).

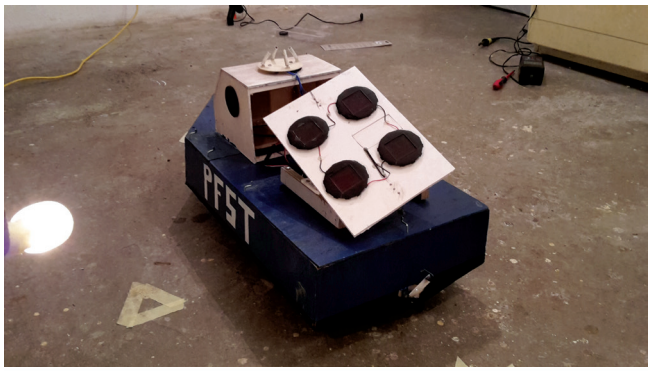

Figure 3.
Solar panel rotation towards sources of light (port and aft).

The other presentation of the Faculty of Maritime Studies in Split was an experimental simulation of a magnetic storm, performed by student Željka Popović, also a member of the Faculty's Student Council. She used a student globe, compass and an electromagnet. Compass needle started changing direction with the approach of the solar storm (with the electromagnet acting as the storm). The experiment shows how we depend on our star.

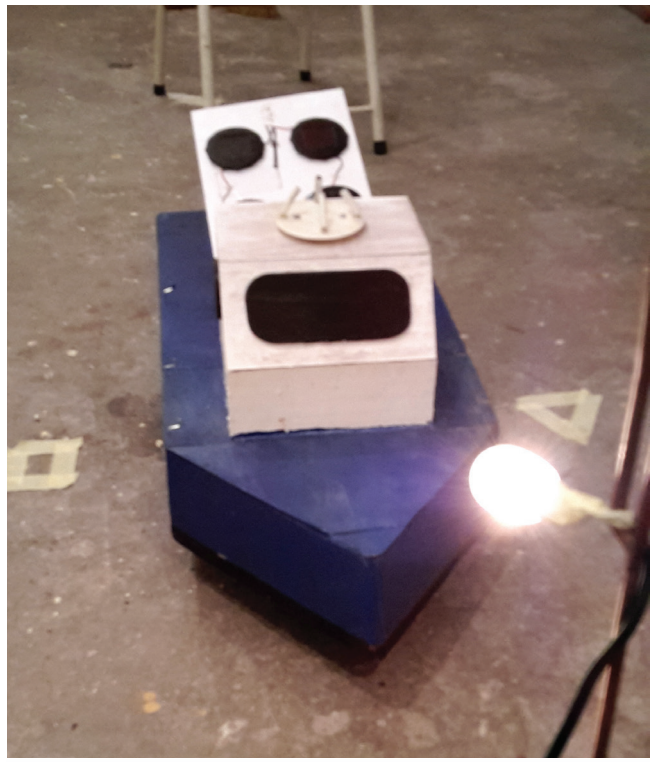

Figure 4.
Solar panel rotation towards sources of light (starboard).

The needle was also shown to change direction in the presence of a turned-on mobile phone.

REFERENCES

Puljak, L., (2015), Festival of Science: An Opportunity to Promote University Research, Transactions on Maritime Science, 4(1), pp. 85.
http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=203412

Stanić, M., (2015), Upravljanje modelom broda na solarni pogon, (in Croatian), Master Thesis, Split: University of Split, Faculty of Maritime Studies in Split.

News

STRONG TANKER MARKET EXTENDS PEAK SEASON EARNINGS

The Baltic and International Maritime Council (BIMCO) reported that tanker earnings for crude oil tankers have risen to new strong levels in the first quarter of 2015, with averages unparalleled since 2008. The demand for crude oil tankers remains high even though the winter months are far behind us. Following the winter peak season of 2013/14, crude oil tanker earnings collapsed and remained low during spring, before rebounding over the summer. This was not the case in the winter peak of 2014/15. The market appears to have kept momentum, keeping the crude oil tanker earnings at a high level. The average VLCC earnings were around $51,000 per day in the first quarter of 2015, i. e. 76 % higher than in the first quarter of 2014, when they averaged to approximately $29,000 per day. This also applies to Suezmaxes earnings, which amounted to around $50,000 per day in 2015 and around $31,000 in 2014. Although the difference was not as large in the Aframaxes, it was still noticeable with around $40,000 per day in Q1 2015 and around $29,000 last year.

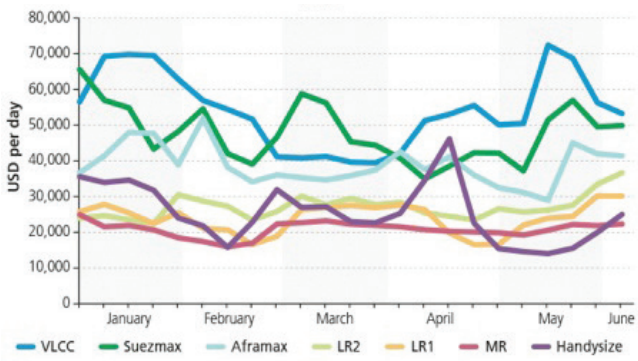

Figure 1.
Tanker Earnings 2015.
Source: BIMCO, Clarksons.

As published in the https://www.bimco.org.

STOWAWAYS: THE HIDDEN TRUTH?

The IMO has recently released its annual statistics for stowaways in 2014. The headline figures could provide a good news headline, 'A 40 % decrease in reported stowaway incidents in 2014', but is this really the case?

It is difficult to believe that, considering mass, irregular migration around the world, in particular from North Africa across the Mediterranean, only 120 cases were reported worldwide in 2014, which is a 40 % decrease from the 203 reported in 2013. I suppose this could be seen as a good news story and an argument that security has improved in all ports, thus deterring people from attempting to embark on ships in an unconventional manner. However, the report only takes into consideration caught or identified stowaways, not their total number. How many stowaways actually managed to evade capture? We are unlikely to ever know the real numbers but with the record levels of illegal migration from Africa witnessed in 2014[1], and a reported reduction in stowaway numbers, this rather than being good news suggests that incidents were almost certainly not reported or security at the ports failed to stop them.

It is difficult to estimate the exact number of incidents that have gone unreported, or the number of stowaways who successfully completed their journey undetected. The IMO's stowaway report for 2008 set a high point of 494 incidents and 2052 actual stowaways, i.e. seven times of what was reported in 2007 and twice as many as reported in 2009. However, none of the reports attempts to explain the spike. Is it just an anomaly? Has security at ports really improved so much since 2008 that these irregular migrants dare not risk being caught on board a merchant ship while accepting the possibility of death in the Mediterranean? Has the security situation in Africa or the Middle East improved so much that there is no need for these methods of illegal migration, or do the 2008 figures represent a closer approximation to the actual numbers of stowaways? Unfortunately, we are unlikely to ever know the actual numbers involved.

Maritime security is at the heart of this issue. Instead of being political or economic migrants, these stowaways could be

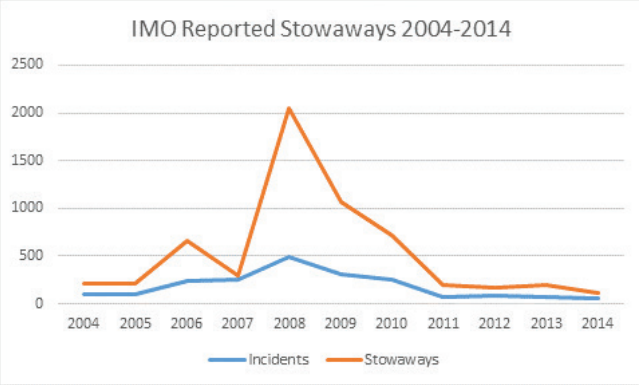

Figure 2.
Irregular migration numbers source.
Source: http://www.dryadmaritime.com.

terrorists attempting to gain access to western countries by less protected routes. The Islamic State has already made its intention to use the irregular migrant routes in the Mediterranean to enter southern Europe clear. What is to stop them from attempting to do so as stowaways? Until we have clear reporting and a better understanding of the problem, it is likely that ports, and some shipping companies, will ignore it. There should be no stigma attached to being recorded in the IMO's stowaway statistics since this represents a demonstrable success on the part of the shipping companies and ports which cought them, rather than let them slip away. The question is, 'are we seeing the full scale of the problem or is the truth, like the stowaways, hidden from our view?'

As published in the http://www.dryadmaritime.com

MARITIME CRIME FIGURES FOR Q2 2015

The following narrative accompanies Dryad's maritime crime figures for Quarter 2 (April to June) of 2015, assessing the situation across our main areas of maritime interest. The report is not limited to traditional piracy and maritime crime, but includes commentary on other threats and issues; from civil war and terrorism in Yemen and Libya to criminal gang-enabled mass migration – areas and issues upon which we report regularly to our clients. The narrative, compiled by Dryad's regional analysts, is set against a highly visible, complex and dynamic international backdrop.

Southeast Asia

There has been a 22 % increase in reported incidents across Southeast Asia in comparison with the first six months of 2014; 120 instances of piracy and maritime crime have been reported to Dryad. 12 vessels were hijacked in the first half of the year; which is a three vessel increase in comparison with the same period last year. The purpose of ten of these hijacks was cargo theft, eight of which were successful; MT Sun Birdie and MT Orkim Harmony were both recovered with their cargo intact. The boarding and subsequent robbing of vessels transiting the Singapore Strait continued apace with 48 vessels reporting incidents in the first six months of the year, which is a 118 % increase from the 2014 figures. The most significant decline in incidents was in the anchorages to the east of the Singapore Strait. While 18 vessels were boarded in the area in the first six months of 2014, only five were boarded in the same period of this year. The robbing of vessels at anchor around Southeast Asia continues, with most cases occurring in Bangladesh and Vietnam.

The arrest of two groupus of hijackers in the first six months of the year will likely result in the declining number of hijackings of small, local product tankers in the area. However, this will almost certainly be just a temporary setback for the crime syndicates which appear to be able to evade arrest and recruit new members to carry out the actual attacks. Dryad expects to see a resumption of attempted hijacks in July.

With little apparent evidence of coordinated security patrols of the Singapore Strait by the three surrounding nations, the criminal gangs who board passing vessels are operating almost with impunity, sometimes boarding three vessels a night. The vast majority of these boardings take place in the eastbound Traffic Separation Scheme (TSS) between Pulau Karimun Kecil and Pulau Besar. Until effective patrols are put in place these crimes will almost certainly continue.

Indian Ocean

There have been no incidents of piracy across the HRA in Q2. The last confirmed vessel to have been fired upon by suspected Somali pirates in the Indian Ocean HRA was in February 2014. Interestingly, there have been only six advisory notices promulgated by the UKMTO in Q2, and only one of these has been in the BaM/Southern Red Sea. This sudden reduction in suspicious incident reports coincides with the intervention of the Saudi led coalition in Yemen. The only confirmed reports of maritime crime were four cases of robbery; three from vessels at Kandla, India and one in Mombasa, Kenya. These incidents were carried out by opportunistic local criminals and have no links to Somali piracy.

The civil war in Yemen is still raging with daily airstrikes by coalition aircraft on Houthi positions. In the Gulf of Aden, the port city of Aden is one of the most violent areas, with rival factions fighting intensely over large areas of the city. Vessels attempting to dock at Aden have been fired upon with rockets and shells and the refinery at Aden was hit and reported to be burning out of control. Despite being in Houthi hands, the Red Sea ports of Hodeidah and Saleef continue to operate. All vessels heading

for these ports are required to have the appropriate permissions to arrive there; on approach, they are stopped and searched by Saudi and Egyptian warships with any non-conformity resulting in the vessels being denied entry to the ports.

During Q2, three vessels were harassed, with two being fired upon by Iranian military vessels in the Strait of Hormuz. One vessel, MV Maersk Tigris, was arrested and forced to sail to Bandar Abbas where she was anchored under Iranian control for nine days before being released. The Iranian authority's rationale for this arrest was an unpaid bill from over 10 years ago. However, in the week prior to this incident, a convoy of Iranian vessels heading towards Yemen, and suspected of delivering supplies to the Houthis, was intercepted by US naval forces and forced to turn back to Iran.

The Southwest Monsoon has now taken hold of the Somali Basin/ Arabian Sea and will continue through to mid-September. During this period, sea conditions will be outside of limits of operation of small crafts. There is very little opportunity for Somali pirates to operate in open ocean areas during the Monsoon. Conditions within the Gulf of Aden and the Southern Red Sea will, for the greatest part of this period, be within limits of pirate operations, but there are no current indicators suggesting the resumption of pirate activity.

Gulf of Guinea

In April and May, at least 20 mariners were taken from five vessels off the shores of Rivers and Akwa Ibom States in Nigeria. Kidnapping of crew for ransom still remains the most significant threat to seafarers in the region. Given the historical frequency of attacks off Bayelsa State, Nigeria, it is somewhat surprising that there has been only one attack offshore this year, with none occurring during this last quarter. Dryad believes it is only a matter of time before attacks on a range of commercial shipping resume in this area, with the prime motive of crew kidnapping for ransom.

There have been no incidents of cargo theft in West Africa since MT Mariam was hijacked off the coast of Warri on 11 January. This form of piracy in the region has reduced in frequency since two tankers were hijacked in June and July 2014 off the coasts of Ghana and Togo. That said, as the risk of attack remains a very real one, there should be no room for complacency amongst product tanker operators.

Overall, there have been 16 confirmed incidents reported in the second quarter of 2015 compared to 18 in the first quarter, and 15 in the same period last year – records of Dryad's reportable incidents in the Gulf of Guinea are generally consistent with the number of recorded incidents in previous years.

Mediterranean

The extremely unstable political and military situation in Libya continues, affecting adjacent countries as well as normal shipping and trading operations, as is the continuing humanitarian crisis of Mediterranean migration emanating from Libya and other countries.

Oil export remains of critical importance to Libya's economy and continued fighting seriously affects the country's ability to maintain its finances. It was anticipated that Q2 would see this improve, but the hopes that Ras Lanuf and As Sidr would reopen have not yet been realised and these oil export terminals remain closed to tanker traffic. UN sponsored talks in Morocco are at a critical juncture with both sides meeting for face to face talks at the end of the period. The acceptance of the negotiated plan will hopefully reduce the level of violence but, as with any similar agreement, it is only the continued acceptance by the lowest level of fighters on all sides that will prevent the re-ignition of violence.

Further attacks on merchant ships in the vicinity of the Libyan coast have occurred following the attack on MT Araevo on 4 January. MV Tuna 1 and MT Anwar Afriqya were both attacked in May, in waters off Derna and Sirte, respectively. More recently, an unconfirmed report suggests that a probable fishing vessel was attacked off Benghazi in June.

In Q2, the Islamic State has had mixed success in establishing itself in Libya. While it had some success in Sirte, it appears to have been ejected from Derna. Its reach has expanded to adjacent countries with the attacks in Tunisia on both the Bardo Museum in March and on the beach in Sousse being claimed by IS affiliated groups. Despite the indirect maritime nature (cruise ship passengers and beach hotel victims), there is insufficient evidence for Dryad to change its previous opinion that the terrorist threat to transiting merchant traffic is low.

The risk to foreigners ashore in Libya, however, remains high throughout the country, with visiting workers in danger of inadvertently being caught up in the heavy fighting ashore, as well as facing the threat of kidnap. These conditions mean that vessel crews are strongly recommended not to leave the confines of the terminals and ports they work in.

On migration, the recent UN report stating that over 137,000 migrants crossed the Mediterranean in the first 6 months of the year compared to only 75,000 in the same period last year further highlighted the scale of the humanitarian crisis. The European Unions' efforts to deal with the problem have not yet been fully approved by the United Nations. However, additional Coastguard and Naval vessels are operating in the area alongside charities, such as Migrant Offshore Aid Station (MOAS), in an attempt to

prevent the loss of life seen earlier this year. Despite these efforts, commercial vessels are still being engaged in rescue operations involving large numbers of migrants. There are also threats to navigation in the transit areas as traffickers act covertly with unlit boats at night.

Latin America and the Caribbean

Reports of robbery from sailing vessels and anchored merchant vessels have reduced from 10 in Q1 to four in Q2. Two of these were robberies from sailing vessels at anchor and two from MVs at anchor. There is a threat to sailing vessels throughout the Caribbean. Yachts anchored in exposed bays are targeted due to the perception that the owners are wealthy and carrying large amounts of cash. These attacks commonly see the use of extreme violence with knives and guns often used. Despite the continued uncertainty in Venezuela, there have been no instances of crime reported against MVs in the country's ports. Ports in Brazil, Peru and Colombia have seen robbery from vessels at anchor and alongside in the recent past. Sensible security measures should be put in place when operating in these areas.
As published in the http://www.dryadmaritime.com

RISING FROM THE ASHES

The federal government is now taking steps to reverse its 2010 decision to terminate the nation's LORAN program. The LORAN program was initiated during World War II, when US and Allied forces fighting in the Pacific Theater needed a good means of navigation in that vast ocean. The US Coast Guard was charged with establishing and operating chains of Loran-A stations throughout the Pacific. With the war's end, the program was extended to coastal areas of the United States and elsewhere. Over time, Loran-A was replaced by Loran- C, which provided both greater coverage and improved accuracy. As part of the digital revolution, the Coast Guard began exploring the possibility of developing an enhanced version of Loran in 2000, soon referred to as eLoran. In an effort to reduce the hemorrhaging federal deficit, the Administration's Budget for 2010 proposed the termination of the Loran program, using these terse words: "The Budget also supports the termination of outdated systems such as the terrestrial-based long-range radionavigation (LORAN-C) operated by the U.S. Coast Guard resulting in an offset of $36 million in 2010 and $190 million over five years." Although only the bean counters thought this was a good idea, the Department of Homeland Security and the U.S. Coast Guard bit their respective tongues and went along, as did the Congress. Thus, Loran-C was terminated as was the work on the development of eLoran.

Figure 3.
E loran.

Similar to Loran-A and Loran-C, eLoran is a low-frequency terrestrial navigation system utilizing a number of transmission stations emitting a precisely timed and shaped radio pulses. In eLoran, the pulses are centered at 100 kHz. Each station emits a sequence of eight pulses spaced 1000 microseconds apart. The stations are grouped into chains, each consisting of one master station and two or more secondary stations. The master station transmits first, followed by successive transmissions from each of the secondary stations in the chain. The master/secondary transmission sequence is repeated periodically, with the period between repetitions referred to as the Group Repetition Interval (GRI). Unlike the hyperbolic Loran-C system, modern eLoran receivers can simultaneously measure the "time of arrival" of signals from many stations in multiple chains. Using solid-state transmitters and atomic clocks, eLoran provides extremely accurate timing. The transmitters also provide a data channel carrying correction and integrity messages. Using built-in microprocessors, eLoran receivers output latitude and longitude directly, eliminating the need for Loran-line charts. The eLoran system operates in much the same way as GPS or other global navigation satellite systems (GNSS), but as a complementary and independent system. There are no failure modes in common with GNSS systems. Operating at significantly higher power than satellite-based systems, eLoran is much more difficult to jam or spoof. Since at least 2004, studies have pointed out the nation's (and indeed the world's) increasing reliance on GPS and other GNSS for positioning, navigation, and timing (PNT). Surveyors, farmers, and others rely on GPS to accomplish many of their tasks. Modern transportation networks rely on GPS for their operation and safety. Modern communication, financial, and power networks could not operate without the precise timing provided by GPS. Of the 16 commercial sectors identified as vital to the nation's economy, security, and health – referred to as critical infrastructural sectors – at least eleven rely extensively on GPS. GPS technology and GPS-supported applications are deeply embedded into the fabric of our modern lives. Computers, cellular telephones, automatic teller machines (ATMs), and electronic chart display and information systems (ECDIS) would all cease to operate properly without the PNT output available from GPS. While GPS is taken for granted, it is a relatively recent

development and is highly vulnerable. Solar flares and other high-energy electromagnetic fields (natural or man-made) can temporarily or permanently disrupt transmissions.

Terrestrial or airborne transmitters can jam or block reception of satellite signals over wide areas. Due to the lower power of the satellite signals, receivers can be spoofed or fooled into accepting and utilizing bogus signals.

The Government Accountability Office (GAO) reported that there are significant concerns about the sufficiency of efforts of the critical infrastructure sectors to mitigate the anticipated adverse effects of GPS signal loss. Other studies have shown that the only reasonably available mitigation technology to address GPS signal loss is Loran.

The federal government seems to be finally awaking from its self-induced slumber on this vital issue. On 23 March 2015, the Department of Transportation (DOT) published a notice seeking public comments regarding potential plans by the government to implement eLoran as a complementary PNT capability to GPS. On 27 March, representative John Garamendi (D-CA) presented the bipartisan National Positioning, Navigation, and Timing (PNT) Resilience and Security Act of 2015 (H.R. 1678). If enacted into law, the bill would require the Secretary of Defense, in coordination with the Commandant of the Coast Guard and the Secretary of Transportation, to provide for the establishment, sustainment, and operation of a reliable, land-based positioning, navigation, and timing system to provide a complement to and backup for GPS, to ensure the availability of uncorrupted or non-degraded PNT signals for military and civilian users if GPS signals are corrupted, degraded, unreliable or otherwise unavailable. The General Lighthouse Authorities of the United Kingdom and Ireland (GLA) have never given up on eLoran. Rather, since 2007 they have constructed transmitter sites and conducted tests at sea to determine the accuracy and robustness of the system. In partnership with other European nations, there are now nine operational transmitters providing coverage for northwest Europe. The Russians have converted their Chayka radionavigation system to broadcast a signal that is compatible with eLoran. Only time will tell if the legislative and executive branches of the federal government have the political will to move forward on this vital and long overdue initiative. The technology is readily available, but it will take determination to make these first tentative steps a reality. Scarce funds will have to be appropriated. Priorities will have to be rearranged. While the government has imposed a number of resilience requirements on the private sector, it has omitted to take an important step of its own. Measures are being taken to rectify that oversight. In mythology, the phoenix is a long-lived bird that is cyclically regenerated or reborn. A phoenix obtains new life by arising from the ashes of its predecessor. The allusion fits the situation with Loran. Loran-A gave birth to Loran-C. After its death, Loran-C may be about to give birth to eLoran.

THREATS TO GLOBAL NAVIGATION SATELLITE SYSTEMS

Originally developed to guide Allied convoys safely across the Atlantic, the use of synchronized low frequency radio signals as a navigational aid revolutionized modern maritime navigation in the 1940s. Faced with operating ships and aircraft over vast areas, researchers pioneered the use of radio signals to aid navigation in regions where poor weather conditions made traditional methods—such as dead reckoning and celestial navigation—exceptionally difficult. This system was eventually named LORAN. When in range of three or more shore-based transmitters, LORAN receivers placed onboard ships and aircraft allowed operators to fix their location within minutes regardless of the weather. The original system, known as LORAN-A, and its eventual replacement, LORAN-C, were operated by the U.S. Coast Guard and other nations until 2010. The U.S. portions of the system were phased out in favor of the satellite-based Global Positioning System (GPS) which became operational in July 1995. The latest LORAN Position Navigation and Timing (PNT) system known as "eLoran" is currently in use or under consideration in several countries. Eventually, Loran C systems throughout the world are expected to be replaced by eLoran. The impact of GPS on the commercial transportation industry has been enormous. Everything that moves—ships, cars, trains, aircraft, and even farm equipment—is now navigated by GPS, or a similar GNSS system. Companies worldwide use GPS to time- stamp business transactions, maintain records, and ensure traceability. Major financial institutions use GPS to synchronize their computer networks around the world. Large and small businesses now use automated systems which can track, update, and manage multiple transactions made by a global network of customers. These systems require accurate timing information available through GNSS Systems such as the GPS (National Coordination Office for Space-Based Positioning, Navigation, and Timing, 2014).

The commercial maritime industry has become especially reliant on GNSS technology. eCharts provide a continuous, real time plot of the true and relative movements of both the vessel and nearby objects, often using radar images and Automatic Information System (AIS) transponder signatures superimposed on the electronic chart (see Figure 1). Most merchant marine academies continue to teach their cadets skills such as how to fix a vessel's position using terrestrial and celestial bearings. However, these techniques are less frequently used in the modern shipping industry, which continues to move irreversibly towards the use of fully integrated electronic bridges.

Yet, in the event of a GNSS compromise, these basic seaman skills may be necessary to counter a cyber attack. Several other satellite-based PNT systems are also in operation. In 1995, the same year that GPS became operational, the Russian Federation announced

the deployment of the GLONASS. This system has been hampered by uneven funding and suffered a well-publicized 11-hour service outage in April 2014, among other failures. In Asia, China plans to deploy its BeiDou-2 (formerly known as COMPASS) satellite navigation system. The BeiDou-1(BDS) system currently provides only regional coverage, however China has announced plans to provide global coverage by 2020. In Europe, the European Space Agency (ESA) continues with the development of the Galileo satellite navigation system. When complete, Galileo will provide low precision PNT services to the general public, while high precision services will be available for a fee to commercial and military subscribers.

Figure 4.
Sample eChart. (Ship Technology Global, 2014).

GNSS Signals produced by PNT satellite systems range between 1162 and 1610 MHz (see Figure 2). U.S. GPS emits two types of signals: one which is broadcast on a single frequency and available free to all users; and second which is broadcast on a separate encrypted frequency available only to the military. These two signals, are equally accurate. However the availability of the second signal on a different frequency allows the military to compensate for naturally occurring interference within the ionosphere, resulting in a more accurate fix and greater system resiliency. It is important to note that GNSS pulses are extremely weak. GPS signals have been compared to the light emitted by a "40 Watt light bulb as seen from 11,000 miles away (17,700 km)" (Daniels, 2014). As such GNSS signals are vulnerable to: (1) jamming and interference - the broadcast of a stronger signal that intentionally or unintentionally blocks or impacts a GNSS satellite signal; (2) spoofing - the broadcast of a false GNSS signal, but of a slightly greater power which deceives the GNSS receiver into locking onto the spoofed signal. A spoofing attack can be

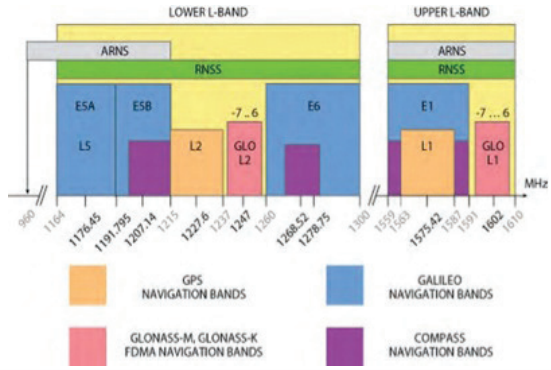

Figure 5.
GNSS frequencies, including Radio Navigation Satellite Service (RNSS); and Aeronautical Navigation Satellite Service (ARNS) frequencies. (MicrowaveJournal.com May 2012).

very difficult to detect.

(3) meaconing - the intentional delay and re-broadcast of a GNSS signal intended to introduce error into receivers;

(4) Extreme Space Weather (ESW) - solar activity such as solar flares, coronal mass ejections, high-speed solar wind, and the impact of energy particles on the earth's ionosphere.

(5) other vulnerabilities - kinetic or laser attacks on satellite constellations or collisions with space debris are only a couple of the other known susceptibilities of the GNSS. Shipboard Systems Affected by the Loss of GNSS Signals – a significant portion of navigation equipment on the bridge of a modern ocean- going commercial vessel (see Figure 3) and various offshore energy platforms will likely be affected by the loss of GNSS signals. For the components listed above, the loss of GNSS may not prevent the component from functioning through an alternate sensor input. However, tests conducted by the General Lighthouse Authorities (GLA) of the United Kingdom and Ireland in 2008 showed how easily error messages and auditory warnings prompted by the loss of the GPS can distract (and overwhelm) a vessel's bridge team (Grant, Williams, Ward, & Basker, 2008). This can be especially dangerous for vessels operating in confined waterways, near shallow areas, or maneuvering in higher traffic densities.

These vulnerabilities are not unique to the maritime industry. A number of other industries are also at risk. For instance, the aviation and financial industries are heavily dependent on properly functioning PNT systems and would be affected in varying degrees by a cyberattack on the GNSS. Largely unique to the maritime industry however, is that much of marine environment information transfer is via radio frequency (RF) and not a dedicated hard-line network or directional microwave dish. A good example of this type of transfer are positioning

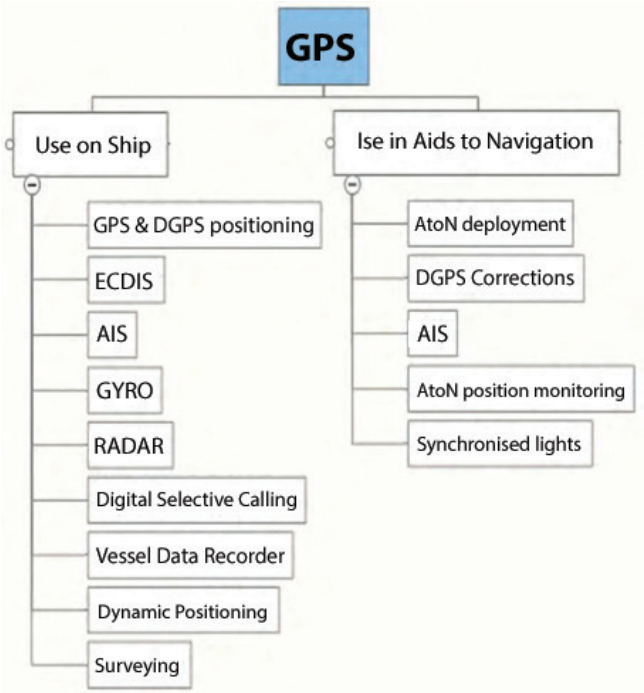

Figure 5.
Maritime navigation equipment that use GPS as a data input. (Grant, Williams, Ward, & Basker, 2008).

Figure 6.
Small jammers that can be purchased via the Internet.
Source: U.S. Government

signals emitted by satellite systems. Data being sent to and from shipboard computers along with other shipboard technology are cyber; therefore interference with the data flow constitutes a cyber threat. Ergo, a Maritime Cyber Security (MCS) issue.

Figure 7.
Coverage area of the GPS jamming unit at 25m above ground level on maximum power of 1.58W ERP. (Grant, Williams, Ward, & Basker, 2008 - Image courtesy of DSTL).

GNSS Jamming Equipment

With some exceptions, the use of GNSS jammers is generally illegal in the U.S., Canada and Europe. Despite this, jammers of various sizes and power ratings (see Figure 5) are available via the internet. These small handheld jammers are extremely difficult to locate and suppress for law enforcement officials because they can be used intermittently, disguised or hidden easily, are highly mobile, and if necessary disposed of quickly by perpetrators. Advanced GPS receivers are more resistant to jamming than conventional designs. For example, receivers equipped with nulling antennas are more resistant to jamming than receivers without them (Jones, 2011). Figure 5 shows the area affected by a GPS jammer during tests conducted at Bridlington, U.K. along the coast of the North Sea in 2008. During the test, a jamming unit was positioned 25m above ground, with the maximum power of 1.58 watts. These tests demonstrated that relatively small jamming units can effect GNSS reception over great distances (Grant, Williams, Ward, & Basker, 2008).

Threat Scenarios

At this time, the three most likely GPS maritime cyber threat scenarios to consider are:

• Jamming of a port or other congested waterway by an individual or a small group of non-state actors using small, portable jammers.

Rapid movement of these individuals, coupled with intermittent use of the jammer(s) would make it very difficult for local law enforcement officials to track and arrest the perpetrators quickly. Attacks of this type can result in significant economic losses, as well as loss of confidence by system users.

• State-sponsored GNSS Jamming.

The best documented examples of state-sponsored jamming attacks occurred in the Republic of Korea (see Table 1). On three different occasions, the Republic of Korea was subjected to intentional, high-power jamming by North Korea over a wide area. The source of these attacks appear to have been large truck-mounted jamming units placed at strategic geographical locations (Figure 6). Amongst many attacks, the 2012 attack affected over 1000 aircraft and 250 ships (Seo & Kim, 2013).

• State-sponsored Spoofing.

Eventually, spoofing may pose a significant maritime threat to GNSS as it has the potential to lead vessels astray into dangerous waters, resulting in significant loss of life (cruise liners and ferries) or environmental damage. Presently, spoofing requires a level of technical sophistication that is normally presented through nation states. However, small groups have conducted successful spoofing tests, most notably students of the University of Texas under Professor Todd Humphreys.

Primary Defenses Against Jamming

• Improved Maritime Training and Education.

Ship crews should be taught how GNSS systems interact with shipsystems and how to recognize when GNSS signals may have been compromised. The maritime industry should also be encouraged to maintain basic seamanship skills, such as dead reckoning and the ability to use piloting instruments. Routine ship drills should include signal loss and spoofing of the signal.

• Improved Equipment. The development of new GPS receivers capable of identifying non-GPS signals by their relative location (jamming and spoofing signals come from terrestrial locations not satellites) and strength (jamming and spoofing signals must by necessity be stronger than GPS satellite-generated signals). In addition to receiver signal strength alarms and specialized antennas, the effects of intentional jamming could be mitigated through the use of inertial navigation systems (INS) and Inmarsat offers radio frequency (RF) jamming detectors. However, at the moment, it is unclear when such equipment will be available to and employed by the commercial industry, or how much it will cost.

• Installation of Powerful Alternate Ground Based PNT Systems. Coastal nations most at risk should consider the installation of alternate (back-up) or complementary, land-based PNT systems, such as enhanced LORAN (known as eLoran).

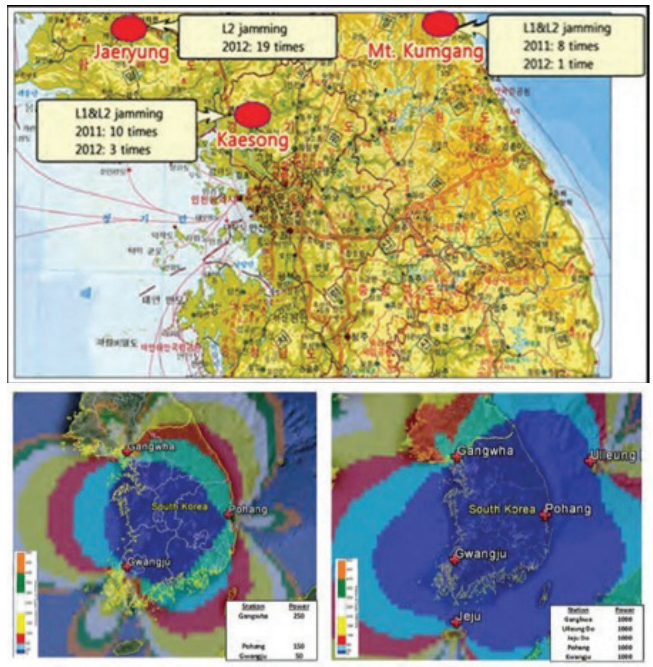

Figure 8.
Location of North Korean Jammers.

Rather than purely "back-up", it is "complimentary" in that the low frequency of the powerful eLoran signals permits PNT reception in GNSS denied environments. However, the main benefit of such systems is to provide PNT users with a second and more resilient PNT signal – one that is too powerful to be effectively jammed or spoofed.

Recommendations

Worldwide dependence on Global Navigation Satellite Systems (GNSS) continues to grow. Ongoing advancements in jamming technology and the availability of small, portable jammers constitute a significant threat to maritime commerce and safety. In the face of a GNSS jamming attack, most commercial ports could be forced to suspend operations until the source of the interference is located and suppressed. It is very possible that a group of individuals operating small, portable jammers could force the closure of a major seaport or international maritime chokepoint. The economic consequences of such an attack could amount to billions of dollars. In the long-term we also anticipate that more powerful jamming technology and delivery systems (such as broadband jammers and drones) will become

widely available and constitute two of the greatest threats to GNSS. The maritime community needs to become more vigilant, actively train to recognize and respond to cyber attacks including jamming and spoofing, and encourage the immediate installation of complementary PNT systems such as eLoran in strategic maritime locations.

Table 1.
Intentional High-Power Jamming of Korea.
Source: Maritime Reporter & Engineering News, May 2015.

Intentional High-Power Jamming of Korea			
dates	August 23-26, 2010	March 4-14, 2011	August 28-May 13, 2012
Jammer Locations	Kaesong	Kaesong and Mt. Kumgang	Kaesong
Affected Areas	Gimpo, Paju, Gangwon	Gimpo, Paju, Gangwon	Gimpo, Paju, Gangwon
GPS Disruptions	181 cell towers 15 aircraft, 1 military vessel	145 cell towers, 106 aircraft, 10 vessels	1.016 aircraft, 251 vessels

As published in the May 2015 edition of Maritime Reporter & Engineering News - http://magazines.marinelink.com/Magazines/MaritimeReporter

CATERPILLAR CONTINUES TO BE SUCCESSFUL IN DUAL FUEL ENGINE RETROFITS, SUPPLIES COMPLETE GAS SYSTEM FOR FUER WEST TANKER

Hamburg, Germany – Building on the success of recent MaK diesel engine dual fuel retrofit conversions, Caterpillar Marine is currently underway on another dual fuel engine retrofit conversion onboard the 472 foot Fure West tanker, owned by Furetank Rederi A/B. The MaK™ M 43 C diesel engine onboard the tanker will be retrofitted in hull, in the 7 cylinder M 46 dual fuel platform, with each cylinder offering 900 kW of rated power. Additionally, Caterpillar is also supplying the complete gas system for the tanker, including bunker stations, 2x LNG tanks measuring 4.15 meters by 24 meters and the vaporizer.

This project, backed by the European Union and developed with the Zero Vision Tool, will mark the second MaK engine dual fuel retrofit. In 2014, Caterpillar successfully completed the dual fuel engine retrofit conversion on the Anthony Veder Coral Anthelia LNG carrier. "We're pleased to continue to build upon our successful track record of dual fual conversions in the commercial marine industry and offer an increased scope of supply to our customers," Finn Vogler, Caterpillar Marine senior engineer noted. "We have a market-ready technology available that our commercial marine customers can be completely confident in and after our success onboard the Coral Anthelia, we have seen the demand for MaK dual fuel solutions increase substantially."

With a bore of 460 millimeters and stroke of 610 millimeter, the M 46 dual fuel engine was designed for electric drive propulsion systems as well as mechanical propulsion systems. Although designed for unlimited operation on LNG, marine diesel oil and heavy fuel oil, the M 46 DF will reach industry-leading efficiency in gas mode. The M 46 DF was strategically engineered to allow for the retrofitting of current M 43 C engines. Additionally, existing M 32 E engines can be retrofitted into the MaK M 34 DF dual fuel platform. As a result of the synergies between the two platforms, Caterpillar can perform in hull retrofit conversions without having to move the engine block or perform extensive machining. Cat dealer Pon Power had a significant role in the Fure West conversion. "We're able to differentiate our solutions in the market by offering a collaborative partnership with our dealers to ensure the retrofit conversions are completed in an expedited manner and with a reduced number of parties involved as a result of our ability to provide the complete gas system for a vessel as well," Vogler noted.

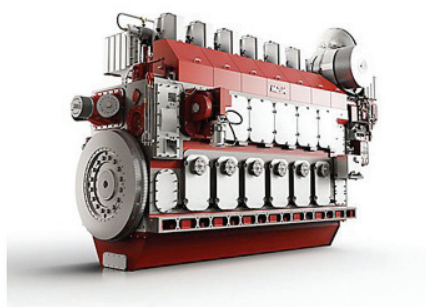

Figure 9.
Caterpillar.

About Caterpillar Marine

Caterpillar Marine, with headquarters in Hamburg, Germany, brings together all the marketing and service activities for Cat and MaK™ marine diesel, dual fuel and gas power and propulsion systems within Caterpillar Inc. The organisation provides premier power solutions in the medium- and high-speed segments with outputs from 93 to 16,800 kW in the main propulsion and 10 to 16,100 kWe in marine generator sets, as well as a comprehensive portfolio of propulsion solutions. The sales and service network includes more than 2,100 dealer locations worldwide dedicated to providing support to customers in ocean-going, commercial marine and pleasure craft wherever they are.

About Caterpillar

For nearly 90 years, Caterpillar Inc. has been making sustainable progress possible and driving positive change on every continent. Customers turn to Caterpillar to help them develop infrastructure, energy and natural resource assets. With 2014 sales and revenues of $55.184 billion, Caterpillar is the world's leading manufacturer of construction and mining equipment, diesel and natural gas engines, industrial gas turbines and diesel-electric locomotives. The company principally operates through its three product segments - Resource Industries, Construction Industries and Energy & Transportation - and also provides financing and related services through its Financial Products segment. For more information, visit caterpillar.com. To connect with us on social media, visit caterpillar.com/social-media.

Power Range	5400-8100 kW
Engine Specifications	
Speed Range	500-514 rpm
Emissions	IMO II
Aspiration	Turbocharged
Bore	460.0 mm
Stroke	610.0 mm
Rotation (from flywheel end)	Counterclockwise / Option for Clockwise
Configuration	Inline 6,7,8,9
Dimensions & Weights	
Minimum Dry Weight	94000.0 kg
Minimum Length	8271.0 mm
Maximum Length	10528.0 mm
Minimum Height	5130.0 mm
Maximum Height	5501.0 mm
Minimum Width	2878.0 mm
Maximum Width	2878.0 mm
Benefits & Features	
Related Products	

DNV GL'S UNMANNED FLNG CONCEPT BOOSTS SAFETY AND REDUCES COSTS

DNV GL has developed a new unmanned floating LNG concept that overcomes many of the challenges currently faced by those looking to unlock the potential of remote offshore gas fields.

Called Solitude, the concept demonstrates how technological advances – most of the technology already within reach — can be combined into a solution offering a 20 percent reduction in annual OPEX, adding only a few percent increase in CAPEX and at the same time increasing the overall safety.

FLNG technology is developing rapidly as part of the industry's quest for resources in more remote waters. A number of concepts have been discussed, but only a few are currently under construction, as many oil and gas companies have experienced double-digit growth in both capital and operational expenditure over the last decade.

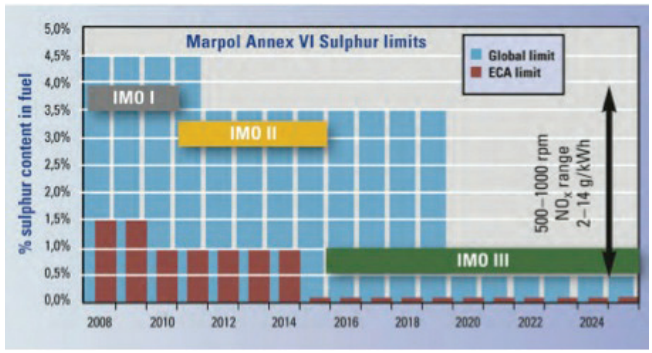

Figure 10.
Upcoming IMO III emission regulations,selected operation profi les and diesel fuel costs make the M 46 DF a preferred engine regarding lowest cost of operation..
Source: www.wartsila.com.

Foreseeing the need for more remote projects to be able to overcome even more challenging cost barriers, whilst still meeting increasingly stringent safety and environmental standards, DNV GL embarked on an Extraordinary Innovation Project to explore the future of LNG technology.

"Solitude has been developed with maintainability foremost in mind," says Elisabeth Tørstad, DNV GL CEO Oil & Gas. "By changing the focus from maximum efficiency to maximum reliability, and selecting robust processing options with built-in redundancy, we were able to develop a solution that ensures production levels and boosts the economic viability of FLNG projects."

Solitude makes use of advanced but widely available technology to provide its power. Power that would otherwise be generated by high-maintenance gas turbines can, for example be generated by fuel cells. This improves power generation reliability and reduces the unit's environmental footprint.

Equipment throughout the FLNG is modularised and monitored from shore with much of the routine maintenance and fault elimination being carried out by self-programming autonomous inspection and maintenance units (robots). The topside has a system of rails that run along each process train, providing these robots with access to all equipment.

Wireless sensor networks act as eyes, ears and noses, feeding information to a condition monitoring system that overseas fault detection, proactive maintenance and repair planning.

As there will be no one living on board or working on the topside during normal operation, the associated personal safety risks are eliminated. When people enter for extensive maintenance works,

the topside would be prepared as a safe working environment. A new support and accommodation vessel concept and its associated docking system on FLNG further boost the safety of interventions.

"Existing frontier oil and gas projects have resulted in tremendous technological developments, particularly in the subsea realm, and Solitude draws on this," says Tørstad. "Operators are already controlling subsea installations and simple, fixed offshore installations from shore. Given the on-going advances in autonomous systems and remote operations, unmanned offshore installations are a natural development over the next few decades."

"While Solitude is a holistic concept, many of its solutions can be implemented independently – and some are already available today. These projects are our way of thinking out loud. Our aim is to present high-level concepts that can form a basis for discussion and be further developed in collaboration with the industry. We see Solitude as a new opportunity for the future," ends Elisabeth Tørstad.

DNV GL's Extraordinary Innovation Projects are part of the organization's commitment to provide foresight into the future. Five percent of the company's revenue is invested in research and development.

About extraordinary innovation

Innovation starts with understanding the current situation, being open-minded, learning from others and playing with ideas. In DNV GL's Extraordinary Innovation Projects, we use this approach to take a fresh look at the industries we work with and the challenges they face. Our aim is to inspire our stakeholders to think differently and support the development of safer, smarter and greener solutions to their problems.

About DNV GL

Driven by its purpose of safeguarding life, property and the environment, DNV GL enables organisations to impove the safety and sustainability of their business. We provide classification and technical assurance services, along with software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.

As published at https://www.dnvgl.com/news/dnv-gl-s-unmanned-flng-concept-boosts-safety-and-reduces-costs-24193

IS MARITIME SIMULATION THE SOLUTION TO MARITIME CYBER SECURITY THREATS

The U.S. Executive Branch has declared the cyber threat one of the most serious economic and national security challenges we face as a nation, and that America's economic prosperity in the 21st century will depend on effective cyber security. Before the maritime industry sounds the danger signal, it needs to monitor other industries and branches of the government and take proactive preventative measures. There is no better place to prepare future and current mariners for these challenges than maritime simulators.

Cyber Security

Cyber security refers to the technologies and processes designed to protect computers, networks and data from unauthorized access, vulnerabilities and attacks via the Internet by cyber criminals. The advent of computers, network devices and telecommunications capable of transporting data via radio frequency, opened up a whole new world of vulnerabilities to hackers wishing to tap, steal, destroy or alter data. It ushered in a new era of potential maritime threats that go well beyond physical piracy such as the Maersk Alabama. With the recent GPS spoofing of a yacht by students of the University of Texas, the maritime sector has entered into a new arena which must be addressed as Maritime Cyber Security. In early 2013, the U.S. Executive Branch, as a world leader and major target for terrorism, signed an Executive Order (EO) 13636 to Improve Critical Infrastructure (CI) Cyber Security and Presidential Policy Directive 21 – Critical Infrastructure Security and Resilience (PPD-21). It established an All Hazards approach to critical infrastructure security and resilience. The cyber security EO establishes a requirement for federal agencies to collaborate with their respective industry sectors to identify Critical Infrastructure that can be impacted by cyber activity.

This initial foray by the federal government has led other departments and agencies to take initial steps to address the growing issue of cyber threats. The U.S. Department of Transportation, Maritime Administration (MARAD), being one of those proactive organizations, has recently teamed up with the Ship Operations Cooperative Program (SOCP) to cooperatively develop Information Systems Security Awareness Computer- Based Training (CBT) on cyber threats in the maritime environment. This is a first for the U.S. maritime community to recognize and take action to assist vessel owners and operators with training U.S. mariners on best practices to reduce the risks and vulnerability associated with information systems

and devices. The newly developed cyber training will give mariners a comprehensive overview of the range of threats that information systems and devices are subject to, and the practices recommended to minimize those vulnerabilities. Best practices addressed in the training include a wide range of topics, from maintaining network security, to the use of workplace computers for private purposes, good password practices, and issues concerning the use of social media like Facebook and Twitter. The training also addresses issues faced by mariners working aboard vessels, such as specifi c log-in policies and rules surrounding working with sensitive information. The Department of Homeland Security (DHS), through the United States Coast Guard (USCG), has also taken to task these growing threats and established that American ports, terminals, refineries, vessels and supporting industries are vital for the safekeeping of the nation's infrastructure, security and economy. In short, there are as many potential avenues for cyber damage in the maritime sector as there are cyber systems. While only some cyber-attack scenarios in the maritime sector could credibly lead to a transportation security incident, we must identify and prioritize security and survival at sea.

Security and Survival at Sea

Will the next hacker chess match take place on the high seas, involving oil tankers, container ships and other specialized vessels transporting approximately 90 percent of the goods moved around the world? Many devices are connected online which makes them more vulnerable to attack. As the maritime and offshore energy industries connect ships and oil rigs to computer networks, they expose considerable weaknesses that hackers can exploit. For example, it was discovered that pirates off the coast of Somalia and other key piracy areas hand pick their targets by tracking vessels by AIS, ECDIS and radar. In the oil industry, hackers have caused much turmoil, including the tilting of an oil rig, causing it to be shut down, as well as accessing networked computing systems on another rig and entering malware that took trained personnel almost three weeks to clear. Other events have included smugglers hacking into networked systems to locate containers with drug contraband and cleanly confiscate the drugs without being detected. They even went so far as attempting to delete shipment data. While data on the extent of the maritime industry's exposure to cyber-crime is hard to come by, a study of a related energy sector conducted by insurance companies recently indicated that much of it may be insurable. As the energy and oil industry has been targeted for some time, statistics indicate that the attacks already have a billion dollar impact on the world economy. In the maritime ndustry, the number of known incidents appears to be low due to either the companies being unaware of the cyber-attacks or because of the desire to keep such news from reaching the press with potential detrimental business impact on the company. There are several documented reports about hackers compromising maritime cyber security. But scientists indicate they have identified security issues in three key navigation systems used by mariners: GPS, Automatic Identification System (AIS), and the system for viewing digital nautical charts Electronic Chart Display and Information System (ECDIS). The maritime domain and the energy sector have been increasingly turning to technology to improve production, while reducing costs and shortening delivery schedules. These technologies have now become a liability because the equipment became accessible to outsiders. As vessels continue to increase in size and the crews diminish in numbers, with the paramount shift in vessel operations, ship owners and yards have been adding increasing quanitties of automated and remote monitoring systems to vessels. This has led to a dilemma, since systems and devices on vessels can raise productivity and improve safety on the one hand, while simultaneously giving hackers more systems to compromise and control. It is fairly well known that a significant portion of computing and network devices are connected to the internet using serial ports with poor security. Devices range from simple traffic apparatuses such as stoplights, which have been proven to have been controlled remotely by hackers, to complex items for the oil and gas industry which monitor and control oil rigs. It has been reported that some ships switch off their AIS systems when passing through waters where pirates are known to operate, or fake the data to make it seem they're somewhere else. Some shipping companies are now taking cyber risks as true and credible threats and taking necessary measures to beef up network and telecommunications security. Recent studies of U.S. ports have established that only a handful conducted cyber assessments and even fewer developed a response plan. Very little federal money has been allocated to the maritime industry for cyber security projects or training. This lack of cyber security preparation by U.S. ports actually carries over to the shipping companies most of which have been discovered to have substantial security issues. However, on the bright side, maritime computing and network systems have only been compromised to a limited extent. This may have something to do with the fact that they have not been a high priority and have slipped under the hackers' radar screens unnoticed. What should concern many in the maritime industry is that the main ship navigation systems including GPS, AIS and ECDIS receive data via radio frequency transmission at sea and as such are extremely vulnerable to hacking. The recent IMO 2010 Manila Amendments made AIS and ECDIS mandatory on larger commercial and passenger vessels. This new requirement has increased the need of shipping companies for security measures and protocols capable of

protecting these devices from intrusion by outside sources. It has also been known for some time that ECDIS systems and the required software update downloads can be compromised by hackers with severe repercussions. This came to light last year with the grounding of a U.S. naval vessel in the Pacific Ocean where it was reported that the ECDIS charts were incorrect and may have had an impact on the accident. A related discovery has been the widespread abuse of AIS by the maritime sector. Many ships deliberately transmit incorrect AIS position data for security reasons in certain parts of the world, including off the coast of Somalia; in the Caribbean, smugglers do it to avoid tracking and arrest by law enforcement and fishermen for financial gain by fishing in forbidden areas. The need for the maritime community to understand the principles of information systems and cyber security and how they apply to on-board equipment before they can implement changes and conduct training so the personnel are aware and can act accordingly, is of paramount importance. Several areas the maritime industry will need to come abreast with are the following:

GPS SPOOFING

There are many recent stories portending to GPS spoofing, including the June 2013 project at the University of Texas where they employed GPS spoofing as they hacked and manipulated the software to disorient the navigation system on a luxury yacht. Upon cloaking the device and transmitting the false signal, the yacht changed course abruptly when it received the false signal. Although this occurred because a system linked to the ECDIS handled the steering instead of a helmsman, it still happened. This opened up a new issue of the manner of establishment of the accuracy and correctness of GPS signals.

eLORAN

GPS has vulnerabilities that pose potential risks. In 2008, in response to presidential direction, the U.S. government announced that they would establish a nationwide resilient terrestrial-based system to augment GPS, going by the name of eLoran. This new system would build upon and modernize the old Loran-C system, while being less expensive to operate and much more accurate. The U.S. is not alone in recognizing GPS vulnerabilities; numerous other countries including most of Europe, India, Russia and China have installed or will install eLoran systems. Unfortunately, the US Department of Homeland Security planned to dismantle the remains of the old LORAN-C infrastructure even though it can be feasibly used for the new eLoran. The good news is that there are currently plans in place to resurrect and enhance the old system and turn it into a state of the art electronic terrestrial-based system which will complement and backup GPS. It was recently reported that prominent aids to navigation on the approach to and within San Francisco harbor have now been added into the electronic aid to navigation (eATON) system. San Francisco has become the Beta port in the U.S. as it is the first to begin using this unique system. The process is not expensive to implement, as it does not require the U.S. Coast Guard to install electronic transmitters on the aids to navigation. Due to the fact that the aids to navigation are located at fixed positions in the ocean or on land or fixtures such as the Golden Gate Bridge, they have their own electronic identification assigned to them which is added into the Automatic Identification System (AIS). The center span of the Golden Gate Bridge is marked by RACON, and bridge towers by eATON digital markers. In the San Francisco area, the system is also being used in conjunction with reporting points in the Traffic Separation Scheme (TSS), including the San Francisco "SF" buoy that serves as the embarkation point for the Bar Pilots. It has been reported by the USCG that ATONs will not replace the actual physical navigation aids but supplement the existing technology, as well as add a virtual layer of aids to navigation in areas in which that was previously physically impossible or impractical. This now allows the USCG to place an eATON in the TSS at places which were previously too deep, as well as mark a bridge tower that was practically needed the most during reduced visibility. This technology will eventually allow the USCG to install transmitters on buoys to allow prudent mariners to track the actual position of the buoys as opposed to where they should be if nautical charts were consulted. In a conflicting statement, it was also recently reported that certain aids to navigation will be removed off the coast of California. This decision was based on the presumption that all vessels are equipped with Electronic Chart Display and Identification System (ECDIS) in accordance with the IMO 2010 Manila Amendments which required the system to be installed on most vessels (tied to class and size) over a six-year period starting as of 2012. This could have disastrous consequences because a significant part of the maritime industry, including towing, fishing and recreational are not required to have ECDIS. Additionally, even for blue water international commercial fleets, reliance on ECDIS and GPS alone can be dangerous, especially in light of the recent GPS spoofing phenomenon. Prudence and situational awareness demand that professional mariners rely on visual aids. Otherwise, just try to imagine what would happen in case of an electronics failure and loss of ECDIS or both of them on a commercial vessel?

ECDIS

ECDIS is believed to have some underlying software security vulnerabilities that could have disastrous consequences for ships at sea. The basis of ECDIS is a navigation based charting system

which uses a computing system to digitally display nautical charts along with the exact location and tracking of the ship. This is a dramatic alternative and improvement to paper maps and the current system of hand plotting positions. ECDIS's are installed on the bridge of a vessel and larger vessels are required to have two of them, one as backup. When properly used with an ENC chart, they can replace paper nautical maps, which is an increasing trend in the maritime industry. The problems do not arise when the ECDIS is in standalone mode, but when several ECDIS's are networked together and when data is downloaded via an external source, whether through a USB port via a memory stick or via the net. Based on the recently released IMO 2010 Manila Amendments, regulations were implemented which now require the EDCIS to be installed on all commercial vessels of a certain size. This will slowly eliminate reliance on paper maps and take the maritime industry on a journey into the electronic world where the next evolution will be the use of portable smart devices by navigators. Safeguards need to be put in place for ECDIS data updates, as well as for external security breaches when used in a networked setting.

AIS

When AIS is operated as intended, it is a useful navigational aid that can be instrumental in collision avoidance. As previously published, due to the configuration of the system, much of the transmitted data can be manipulated or distorted. This was recently confirmed by several sources including the Israelis. They noticed that vessels transmitting AIS spurious signals were nowhere near their actual location and on other occasions they also had phantom ships appear that could not be found. This system, along with the GPS and the recent spoofing episode, needs to be enhanced to include some type of signal authentication process so that erroneous signals will not be displayed.

Smart Ships

Smart ships are on the horizon and are anticipated to make an appearance sometime between 2020 and 2030, going about their normal business at sea without a crew and totally monitored from shore. Shipyards are already constructing fully sensored vessels which can be monitored after delivery and at sea for maintenance and servicing purposes. These vessels can take two forms and be either autonomous or unmanned. Autonomous is defined as a vessel primarily guided by automated on-board decision systems but controlled by a remote operator in a shore-based control facility. Unmanned is one step beyond autonomous and is fully controlled from a shore-based control station. Key features would be the standard maritime policy of having redundant systems and emergency backups on board. Where does this new technology take us in the maritime simulation world? Possibly as is done with USAF, we will have ship drone training and certification. This could tie into the scenario with a fully integrated navigation suite of GPS, eLORAN, EATON and a digital visual sensor system capable of being fully controlled and monitored 24/7/365.

Marine Simulation

Maritime simulation is important as it imitates the operation of a real life vessel in a safe environment. The simulation of cyber threats and scenarios will allow us to focus on the new cases of spoofing and jamming through the mariner's heavy reliance on Radio Frequency (RF) transmissions that can potentially be comprised. Simulation can be used to show the possible real effects of alternative conditions and courses of action on the vessel. Simulation is of utmost importance especially when we need to interact in congested waterways, narrow channels, dense traffic and with many other restrictions including dangerous cargoes. What simulation will allow us to do is introduce many of these potential cyber threats from real life environment and let the mariner exercise and respond in real time. In developing the next wave of maritime education, going beyond Vessel Security Officer (VSO) is a logical step, as is the creation of a new position of a Vessel Cyber Security Officer (VCSO) in a Maritime Cyber Security (MCS) program. This position could be an extension of the VSO or a new certification. In either case, having crew members with these skill sets who can act as responsible officer(s) on each ship is essential. They would be responsible for all levels and details of cyber security and defense. In the recently released STCW 2010 Amendments, the IMO has already proactively moved forward by introducing an Electro Technical Officer (ETO) and an Electro Technical Rating (ETR). How does the industry move forward and get to that logical level of training and preparedness? It first needs to review existing maritime simulations to determine the equipment and systems we are using. The next step is determining the manner of their integration, as well as the built-in securities. From this we can embark on a journey of determining how cyber threats could attack, destroy or disable the equipment … or in the worst-case scenario … take command of it. In the end, it is through the awareness training and education that mariners will be able to thwart these infiltrations. Another source of mariner awareness and training must be the use of the Internet and the download of data potentially corrupted by viruses, worms, phishing, spoofing and hacking. Regardless of whether corruption is due to improper training or lack thereof or circumstances or oversight due to fatigue, it must be avoided. A similar path applies to the use of vessel email and the threat of receiving spear phishing emails purported from reliable

sources with clickable links to websites that are fraudulent and will take control of your computer back door or install a virus. To summarize, as we move forward, we need to incorporate into the syllabi of all maritime simulation courses the basics of Maritime Cyber Security (MCS) as it is an ever present threat that will not go away. It is only by diligence and proper training and awareness that seagoing mariners will be prepared and ready to take appropriate action when warranted.

The Author

Emil Muccin currently holds the position of Assistant Department Head, Maritime Business Division of Marine Transportation Department and is also an Associate Professor of Nautical Science at the United States Merchant Marine Academy. He was previously a Marine Transportation Department STCW Coordinator. He is also the Faculty Advisor to the Cyber Defense and Propeller Clubs. Emil graduated from the USMMA with a BS in Nautical Science and from Pace University with an MBA in Information Systems. He sailed for many years as the Master of paddle wheelers on the Hudson River.

As published in the June 2015 edition of Maritime Reporter & Engineering News

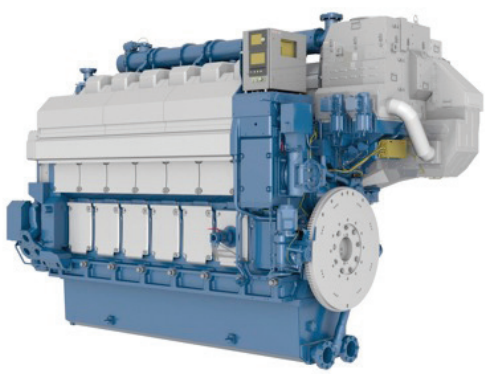

Figure 11.
6-cylinder in-line Wärtsilä 34DF engine.
Source: www.wartsila.com.

WÄRTSILÄ 34DF DUAL-FUEL AUXILIARY ENGINE BECOMING THE GLOBAL STANDARD FOR LNG CARRIER APPLICATIONS

Wärtsilä Corporation Press release
27 August 2015 at 10:00 AM E. Europe Standard Time

The upgraded version of the Wärtsilä 34DF engine is rapidly becoming established as an industry standard. The three major South Korean shipyards are supporting the use of this engine for auxiliary applications in the LNG Carrier segment where dual-fuel engines are favoured. South Korea currently has more than 80 % of the total order book for LNG tankers, while the Wärtsilä 34DF engine has achieved an auxiliary application market share of approximately 70 % in this sector.
In the first half of this year Wärtsilä was awarded contracts for 56 Wärtsilä 34DF dual-fuel auxiliary engines for 14 new LNG Carriers being built for four different owners. This means that Wärtsilä has already received orders for nearly 100 such engines from these three yards since its re-launching with a higher MCR (maximum continuous rating) in 2013. All these orders were placed by South Korea's three leading shipyards and the ships are being built for European, American and Asian owners.
"The Wärtsilä 34DF dual-fuel engine is a powerful, versatile, and efficient engine that is helping shipping move into the gas age. The impressive track record of 100 engines sold in a two year period speaks for itself. While the success has been universal, with contracts from yards and owners globally, the fact that the world's largest shipbuilding nation, South Korea, is increasingly opting for the Wärtsilä 34DF is especially gratifying," says Lars Anderson, Vice President, Engine Sales, Wärtsilä Marine Solutions.

The Wärtsilä 34DF engine

The Wärtsilä 34DF was originally introduced in 2008 and was based on the successful Wärtsilä 32 engine platform. In 2013 it was upgraded to provide 11 percent more power and increased efficiency without changing the physical dimensions. The upgraded version has a power output range from 3,000 to 10,000 kW at 500 kW per cylinder.

Wärtsilä in brief

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximizes the environmental and economic performance of the vessels and power plants of its customers. In 2014, Wärtsilä's net sales totalled EUR 4.8 billion with approximately 17,700 employees. The company has operations in more than 200 locations in nearly 70 countries around the world. Wärtsilä is listed on Nasdaq Helsinki, Finland.

As published at www.wartsila.com

Figure 12.
Mr. Ki-tack Lim (Republic of Korea).
Source: www.imo.org

Mr. Ki-tack Lim (Republic of Korea) elected as IMO Secretary General

Mr. Ki-tack Lim (Republic of Korea) was elected the Secretary General of the International Maritime Organization (IMO), with effect from 1 January 2016, for an initial term of four years.

The vote took place during the 114th session of the 40-member strong IMO Council, held 29 June-3 July 2015. The decision of the Council will be submitted to the IMO Assembly, which is scheduled to hold its 29th session 23 November-2 December 2015, for approval.

Mr. Lim is currently the President of Busan Port Authority. He served as the Republic of Korea's Deputy Permanent Representative to IMO from 2006 to 2009 and was Chairman of the Sub-Committee on Flag State Implementation (FSI) from 2002 to 2004.

As published at www.imo.org

ART

Đànetova molìtva muôru

Marica Gamulin

A Prayer to the Sea

trans. by Mirna Čudić

Muôre, drõgo muôre, lĩpo muôre,
ne zõv me,
ne izazĩvoj me, ne mõtoj me,
ostàv se mène,
pũst me na mīrũ.

Dvô miêtra od tèbe son se rodî
ũzo te ditînstvo prõve,
gnjõtè močî,
skõkô po brodìma,
potiēzõ cìme,
provukũvo se među konopìma,
ũdicon u rũcì
ûrima na rîvu sīdì.

Začorãlo si me, õpilo,
a jõ son se ũ te zajũbî,
živõt ti dãrovo
i nôjlipje se čũtî
kad son brõdon po tèbi kurî,
navigô ili na rìbe hodît.

Oprostì mi ča hrõnìlo si me,
a vìrovo ti nīsôn,
nego vrôt iskrīvî
štroligàt ãriju,
glèdot õbloke, čõrne, obìšene, nakostrũšene
da me ne privãriš.

Vojãlo si me, grũholo, polivãlo,
slôpon opõlìlo,
pũno pũtih i pristrãšilo.
Muôre snõžno, hirovìto
svè ti oprõščon, tõ je tvõj zõkuôn.

O sea, my beloved sea, my beautiful sea
do not call me
do not tempt me,
leave me alone,
leave me in peace.

Two yards away from you was I born
passed my childhood at your side,
soaked my ankles in you,
leapt from boat to boat,
pulled the lines,
crawled between them,
fishline in hand
sat on the quay for hours.

You have bewitched me, inebriated me,
I fell in love with you,
gave you my life as a gift
and felt happiest
sailing a boat,
navigating or fishing.

Forgive me for not trusting you,
when you fed me,
for rather twisting my neck
scrutinising the air,
looking at clouds, black, sagging, bristled
lest you should trick me.

You have rolled me, pushed me, washed over me,
splashed me with a cascading wave,
time and time again frightened me.
Mighty sea, moody sea
I forgive you all, it is your law.

Ti si ostàlo ìsto
u snōzì, u lipotì,
u dubinì, u širinì
ni pàrst vìšjē,
ni pàrst nìžje
ìsto si kako kad son mõli bî,
a jõ son ostãri.

Zatő drõgo moje muôre,
folã ti za svè ča si mi dôlo,
ali zaklìnjen te, ne zőv me,
ne mõtoj me, ne izazĩvoj me,
ostàv se mène, pũst me na mīrű
jőš ovè dvî ûre dők son žîv.

You have remained the same
in your might and your beauty,
your depth and your width
not an inch higher,
not an inch lower
you are the same as you were in my childhood,
and I have grown old.

Therefore, my beloved sea,
I thank you for all you have given me,
but I beseech you, do not call me,
do not lure me, do not tempt me,
leave me alone, leave me in peace
this brief moment of this ephemeral life of mine.

RJEČNIK

muore	more
drogo muore	drago more
lipo muore	lijepo more
ne zov me	ne dozivaj me
ne izazivoj me	ne izazivaj me
ne motoj me	ne mami me
ostav se mene	okani me se
pust me na miru	ostavi me na miru
dvo mietra	dva metra
son se rodi	rodio sam se
uzo te ditinstvo prove	uza te proveo djetinjstvo
gnjote moči	močio gležnjeve
skoko po brodima	skakao po brodicama
potiezo cime	povlačio cime / užad
provukuvo se među konopima	provlačio se među užadi
udicon u ruci	udicom u ruci
urima na rivu sidi:	jedio na rivi satima
začoralo si me	zatravilo si me
jo son se u te zajubi	zaljubio sam se u tebe
život ti darovo	darovao sam ti život
nojlipje se ćuti	najbolje se osjećao
kad son brodon po tebi kuri navigo ili na ribe hodit	kad sam po tebi plovio brodom plovio ili ribario.

ča	što
oprosti mi ča hronilo si me	oprosti mi što si me hranilo
a virovo ti nison	a nisam ti vjerovao
nego vrot iskrivi	nego sam iskrivio vrat
štroligat ariju	ispitivao zrak
gledot	gledati, promatrati
obloci / obloke, čorne	oblaci / oblake, crne
obišene	obješene
da me ne privariš	da me ne prevariš
vojalo si me, gruholo, polivalo	valjalo si me, treslo, polijevalo
slopon opolilo	udarilo slapom (padajućim valovima)
puno putih i pristrašilo	često i preplašilo
muore snožno	more snažno
sve ti oprošćon	sve ti opraštam
zokuon	zakon
u snozi, lipoti	u snazi, ljepoti
ni parst višje, ni parst nižje	ni prst / milimetar više, niže
kako kad son moli bi	kao kad sam bio dječak
a jo son ostari	a ja sam ostario
fola ti za sve ča si mi dolo	hvala ti za sve što si mi dalo
ali zaklinjen te	ali preklinjem te
još ove dvi ure dok son živ	još ovo malo života što mi je preostalo

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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The first page should carry:

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d. the name, mailing address and e-mail of the corresponding authors;
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Last page

The last page should carry:

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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.

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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!

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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.

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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:

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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.

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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.

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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).

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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).

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

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