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EDWARD'S FINAL VOYAGE

In loving memory of Edward Dalley, Professor of Technical Marine English in the Department of English of the University of Cantabria, and member of the linguistic committee of the Journal of Maritime Research (JMR) edited by the Spanish Society of Maritime Research.

On March 6th this year, Edward Dalley set out on his final voyage, the journey towards the endless horizon which we all must make some day. Edward was a great collaborator on the JMR, working diligently on quality control on the language committee and generally helping to make the journal work.

From the very beginning, he believed in the review and was always there to lend a hand. We shared the dream of taking the JMR to the greatest heights of international prestige.

We also shared many work sessions, ideas, heated debates and coffee breaks. But, above all, we shared a friendship that I shall never forget. I always admired and respected his great human warmth. He has gone, perhaps, just when we needed him most; now, when honest people like him are among the few referents we have to allow us to believe in a better future.

Edward left with no noise or anger. He accepted his fate with the same fortitude and coherence with which he lived. He did not want anyone else to suffer for his situation, so he always said that everything was fine. He bade farewell to his people, as if he had done so many times before, like the old sailor about to set out on his last journey. Amongst his luggage was a huge suitcase full of love and affection.

Dear Edward, I remember the day when you told me you only had time for one more voyage – time was running out and there was no way round it. You told me not to worry, that all was in order; and thus, while I cursed fate, you gave encouragement and remained calm.

I hope that you have come to rest in a peaceful port and that you can walk along that huge, sandy beach you so loved to dream of. When the time comes, I shall look for you where you always liked to lay your towel, half-way down and a little to the left, next to the lifesavers. See you soon, my friend.

C. A. Perez-Labajos
Editor

LA ÚLTIMA SINGLADURA DE EDWARD

En memoria de Edward Dalley, profesor de Inglés técnico marítimo del Departamento de Filología Inglesa de la Universidad de Cantabria, miembro del comité lingüístico del Journal of Maritime Research (JMR) editado por la Sociedad Española de Estudios Científicos Marinos.

El pasado 6 de marzo Edward Dalley emprendió su último viaje. Ese viaje hacia el horizonte infinito que todos antes o después tenemos que realizar. Edward fue un gran colaborador de JMR desarrollando controles de calidad en el comité lingüístico y ayudando en su funcionamiento asiduamente. Desde el principio, siempre creyó en el proyecto de la revista y siempre estuvo ahí para echar una mano. Compartimos la ilusión y la idea de llevar a JMR a las más altas cotas de prestigio internacional. También compartimos muchos ratos de trabajo, ideas, encendidos debates y cafés. Pero, por encima de todo, compartimos una amistad que no olvidaré jamás. Siempre respeté y admiré su gran calidad humana. Se ha ido quizás en el momento que más le necesitábamos. Ahora precisamente cuando las personas honestas como el son las pocas referencias que tenemos para poder seguir creyendo en un futuro mejor.

Edward se fue sin ruidos ni enfados. Aceptó su destino con la misma entereza y coherencia que vivió. No quiso que nadie sufriera por su situación, así que decía que todo iba bien. Se despidió de la gente, sin aspavientos, como si ya lo hubiera hecho antes en numerosas ocasiones, como el viejo marino cuando va a emprender su última singladura. Entre su equipaje se llevó una enorme maleta cargada de cariño y afecto.

Querido Edward, recuerdo el día en que me comunicaste que sólo te quedaba tiempo para una singladura más. Que no te podías quedar más tiempo, que no había solución. Me dijiste que no me preocupara, que todo estaba en orden y mientras yo maldecía al destino tú me dabas ánimos y mantenías una gran serenidad.

Espero que hayas recalado en buen puerto y que estés paseando por esa enorme playa de arena que tanto te gustaba imaginar. Cuando llegue el momento te buscaré donde siempre solías extender tu toalla, en la zona del centro un poco a la izquierda, cerca de las socorristas. Hasta pronto amigo.

C. A. Perez-Labajos
Editor

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DELPHI STUDY OVER LANGUAGE TECHNOLOGIES USE TO IMPROVE MARITIME COMMUNICATIONS

R. de la Campa Portela[1], F. Louzán Lago[2] and S. Fernández Hermida[3]

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ABSTRACT

The inadequate knowledge of language is identified by International Maritime Organization as one of the forty four components of the so-called human factor or human element.

One of the possible actions aimed to prevent or to reduce the negative consequences derived from the lack of misuse or a common language on maritime communications is based on the research over the use of new communication and information technologies in maritime settings and its adaptation to communication needs in such setting.

In that respect and from University of A Coruña, a project is being developed with the object of studying the feasibility of these technologies application to maritime communications, with the purpose of improving its efficiency as well as to encourage the maritime safety aspects related to them.

One of the basic actions to develop this project is the carrying out of a Delphi study –experts' panel– with the aim of stating the legal, commercial and technical viability of the use of this kind of resources through the enquiry to maritime experts which develop a considerable part of their professional activities in an international communication environment.

The present article analyse the views expressed by these experts on maritime communications over the possible implementation of language technologies in maritime settings.

Keywords: maritime communications, information and communication technologies, language technologies, Delphi.

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INTRODUCTION

More than a decade ago research began into automatic speech translation, a technology that combines speech recognition and automatic translation, as a tool to improve communication in different areas. Its achievements are based in large measure on the use of so-called “controlled languages” between interlocutors. These languages stand out for their simplicity based on the use of a limited vocabulary and the restriction of grammar rules.

In the maritime workplace, Standard Maritime Communication Phrases (SMCP) fulfils the necessary requirements to be considered a controlled language, as these phrases are useful in an automatic speech translation system. As a part of the University of A Coruña’s project entitled “Language industries as applied in the maritime workplace”, this article endeavours to describe the results obtained in a Delphi study. The aim of this study was two-fold. First, to gather the opinions of maritime communications experts on the possible use of new computer science technologies and communication in order to improve maritime communication, and second, to determine the suitability of using SMCP as a basic tool in the running of these applied technologies within the maritime workplace.

INTRODUCTION TO THE CONCEPT OF THE DELPHI METHOD

The Delphi method is defined (Landeta, 1999: 32) as “a systematic and repetitive process which seeks to collect the opinions of a group of experts, and if possible reach a general consensus”. Its evaluation methodology belongs to the so-called qualitative research methods, whose main characteristic is that the study’s objective is the determining factor in selecting the method and not vice-versa: “the objectives are not reduced to individual variables, but rather they are studied in all their complexity and totality within a day-to-day context” (Flick, 2004: 19).

A Delphi study is basically a selection of a group of experts who are asked about their opinions on issues dealing with future events. The experts’ opinions, which are anonymous are gathered and analysed in successive rounds with the aim of reaching a general consensus but without infringing on the participants’ complete autonomy (Astigarraga, 2006). As a whole the Delphi method allows one to foresee what could be the most important changes within the next few years in the object of study.

THE DELPHI PROCEDURE: A STUDY ON THE APPLICATION OF LANGUAGE INDUSTRIES IN MARITIME COMMUNICATION

The study’s aim

An inadequate knowledge of a language is identified by the International Maritime Organisation (IMO) as one of the forty-four components of the so-called human factor or element. The problems stemming from an inadequate use of the language are, thus, an inherent risk area of typical maritime trade activities, which can occur during on-board operations, especially on ships with multicultural and multilingual crews. Problems can also arise as a result of interaction between ships or between ships and land services.

One of the possible measures to prevent or reduce the negative consequences stemming from the mistaken or poor use of a common language in maritime communication is based on the research on the use of new computer technologies and communication in the maritime workplace and its adaptation to the communication needs in this area. On the one hand research into speech recognition could lead to new aids for the running of the ship and could, at the same time, reduce communication problems due to the training of multilingual crews; on the other hand research into automatic translation applied to this area could make oral communication easier, mainly those types of communication that are done with the aid of communication equipment.

In this sense, the Delphi study included in this project entitled "The language industries applied within the maritime workplace", which is being undertaken by the University of A Coruña, is one of this project's goals. The study has been undertaken with the aim of establishing the legal, commercial and technical feasibility of the use of this type of resource by consulting with maritime experts who work to a considerable extent within an international communication environment.

Hence this article analyses the points of view expressed by these maritime communication experts on the possible implementation of language technologies in the maritime workplace.

Stages of the study

As previously mentioned, a Delphi study is basically the undertaking and analysis of successive questionnaires with the aim of attaining the greatest level of convergence among the experts who were surveyed. Prior to handing out the questionnaires we should resolve several matters that will determine the research's guidelines, such as determining the number of experts and getting their consent to participate, the number of rounds that are to take place and the manner that will be used to hand out and collect the questionnaires. As for the number of experts participating in this study it is important to indicate that there were 30 initially, but as a result of the number of withdrawals in successive surveys the number of expert participants was reduced to 10.

Table 1 summarizes the participation and withdrawal rate of the participants, who were divided into two groups in order to make the results clear:

— Experts: traffic control operators and professors who are experts in maritime communication.
— Affected individuals: merchant marine captains, tugboat captains and port pilots.

Table 1: Participation rate in the Delphi study

	Number of initial surveys	Number of replies in the first round	Number of replies in the second round	Number of replies in the third round	Number of total replies	Percentage of final participation	Percentage of follow-up
Experts	12	7	6	6	19	50%	86%
Affected	18	16	7	4	27	22%	25%
Total	30	23	13	10	46	33%	44%

The results found in the table show that the high rate of withdrawals is due to communication difficulties with certain groups of participants, in particular with the captains.

Likewise it is important to indicate the need to convey to the experts information on the objectives and methodology of the study, the number of questionnaires, the approximate duration of the process and the potential use of the information that is received, in order to get from them an even-level of participation that is thoughtful and justified.

In our study this previous stage took place by sending out a letter of introduction which explained and provided the aforementioned information as well as contact information of the study's coordinator. As for the establishment of the number of rounds, we considered that in order to achieve the aims of this research project an adequate consensus could be reached with three rounds. Finally, it is important to indicate that the handing out and picking up of the questionnaires took place via electronic mail, as it was the fastest method.

Results

The Delphi study "Language industries applied within the maritime workplace" that is presented in this article consists of three questionnaires, whose replies are divided into two parts: part A has 8 points which gather the replies to questions about the relation between communication and security, peculiarities and problems in oral communication and the use of the IMO's Standard Maritime Communication Phrases. Part B, which has 9 points, collects the comments on the use of language industries as a support tool in order to improve exterior oral communication in the maritime workplace; we also find in this part comments on the functional specifications of a speech translation unit designed for this purpose. All of these results are presented in the following section in a question-answer form.

Part A

1. *Do you think that spoken communication between people of different nationalities can be a problem for maritime safety?*

91% of the experts replied affirmatively to this question, while 8% answered negatively.

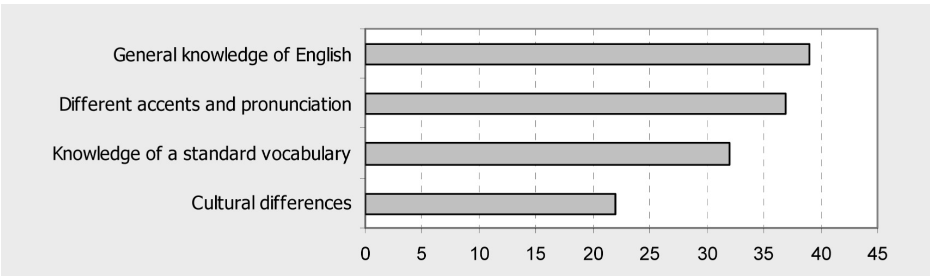
2. *What types of communication do you consider to be more problematic: ship-to ship, ship-to-shore or internal?*

38% of the experts consider ship-to-shore communication to be the most problematic, while ship-to-ship and internal communication were considered to be the most problematic by 31% of the experts who were surveyed. Hence we can also infer from these data that 69% of the experts consider external communication (the sum of ship-to-ship and ship-to-shore communication) to be the most problematic, vis-à-vis the 31% of those surveyed who consider internal communication to be the most problematic.

3. *The following points are proposed as the most important problems that affect ship-to-ship and ship-to-shore communication. Rank them according to priority from the most important to the least important: knowledge of a standard vocabulary, general knowledge of English, different accents and pronunciations, cultural differences between interlocutors.*

Once a point system of 1 to 4 was established for the previous points, the following results were obtained in Figure 1. Thus according to the opinions of the experts who were consulted, the most important problem that affects communication is general knowledge of the English language (39 points), closely followed by different accents and pronunciation (37 points), the next important problem would be knowledge of a standard vocabulary (32 points), and finally, with a relatively low score, cultural differences (22 points)

FIGURE 1: the most important problems that affect ship-to ship and ship-to-shore communication



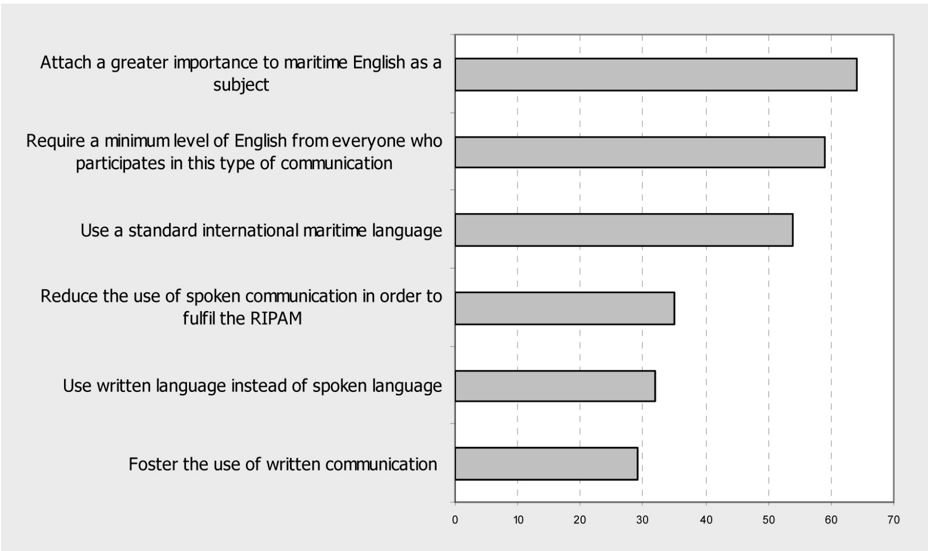
4. *In order to improve this type of communication the following solutions are proposed. Rank them according to whether you consider them to be more or less suitable:*

– *attach a greater importance to maritime English as a subject*
– *use a standard international maritime language (IMO Standard phrases)*
– *use written language preferably instead of spoken language*

– *require a minimum level of English in hiring anyone who is involved in this type of communication*
– *foster the use of written communication such as fax or electronic mail*
– *reduce the use of spoken communication in order to comply with the international law on the prevention of collisions at sea*

Once a point-system from 1 to 6 was established for these possible solutions on the part of the experts who were surveyed, the following data was gathered in Figure 2, which shows that they considered the best solution for this type of communication problem would be to attach a greater importance to maritime English as a subject (64 points), followed by the requirement of a minimum level of English for those who participate in this type of communication (59 points). The third solution would be to use a standard international maritime language (54 points), followed by the reduction in the use of spoken language in order to comply with the international law on the prevention of collisions at sea (35 points). The two solutions that were considered to be the worst are the use of written language instead of spoken language (32 points) and the fostering of written communication (29 points).

FIGURE 2: solutions for improving this type of communication

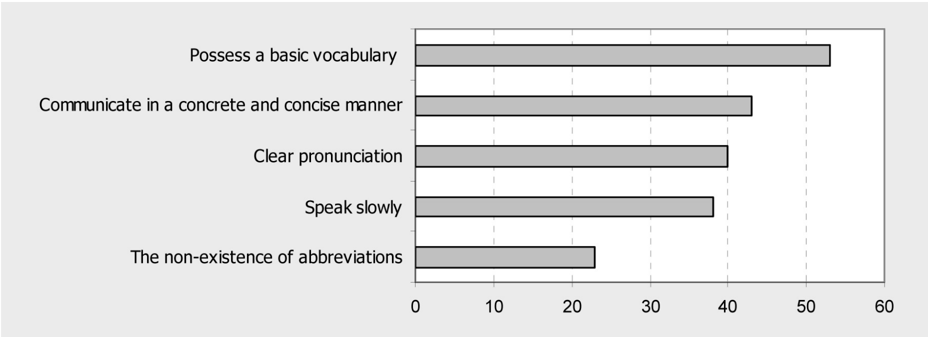


5. *The following points reflect the linguistic aspects of a language that could foster spoken communication. Rank them according to whether you consider them more or less important: possessing a basic vocabulary, the non-existence of abbreviations, speaking slowly, clear pronunciation, concise and concrete communication.*

Once these aspects were ranked according to importance on a point scale of 1 to

5, the following results were tallied: possessing a basic vocabulary (53 points) is considered to be the most important aspect by the experts who were surveyed, followed by clear and concise communication (43 points) and clear pronunciation (40 points). The least important aspects were speaking slowly (38 points) and the non-existence of abbreviations (23 points), as shown in Figure 3.

FIGURE 3: linguistic aspects of a language that could foster spoken communication



6. *Have you used the IMO's Standard marine communication Phrases habitually in the course of your professional obligations and to communicate with ships and authorities on land?*

71% of the experts admitted to not using these standard phrases in a regular manner for exterior international communication, while 29% asserted that they had used them regularly for this purpose.

The experts who were consulted indicated that the main reason these phrases are not used regularly for maritime communication is due to the general ignorance of said phrases.

7. *Do you believe that the use of this kind of standard vocabulary makes international communication easier?*

77% of the experts stated that the use of standard phrases does make international communication easier, while 23% believed that it did not.

It is important to mention that the experts who answered negatively claim a general lack of knowledge with regards to the use of said phrases.

8. *The following are features that could be attributed to the IMO's Standard marine communication Phrases. Indicate if you agree very much, agree, disagree or disagree very much with the following statements:*

– *Standard phrases make comprehension easier*
– *They are a relatively small collection of phrases which enables one to learn and practise them well.*

– *In case they are used in stressful situations people who do not have a good level of English will find them easier to use*
– *In the case of a lack of communication they enable all the crews and coastal stations to follow the same communication guidelines*
– *They make communication easier in emergency situations.*
– *They avoid errors in interpretation.*
– *They are a standard language based on short and clear phrases.*
– *They are a common ground for communication that is not excessively long.*
– *They reduce vocabulary by avoiding the use of different words to describe the same thing.*
– *They provide information clearly and concisely.*
– *They allow one to understand people with a low level of English.*

Figure 4 shows the results of all of these questions. In these data one can observe a rather general consensus among the experts, with the exception of the affirmation that these phrases enable one to understand people who have a low level of English. The majority of the experts "disagree" on this last point. It is also important to highlight the resounding affirmation that these phrases make comprehension easier, since 60% of the experts stated that they "agreed very much" with this statement. On the other hand this statement, along with "they are a standard language based on short and clear phrases" and "they avoid errors in interpretation", are the only questions in which no expert "disagreed".

Part B

9. *Do you think that new communication technologies, such as automatic translation or voice recognition, could be applied in any way to foster an effective maritime communication process?*

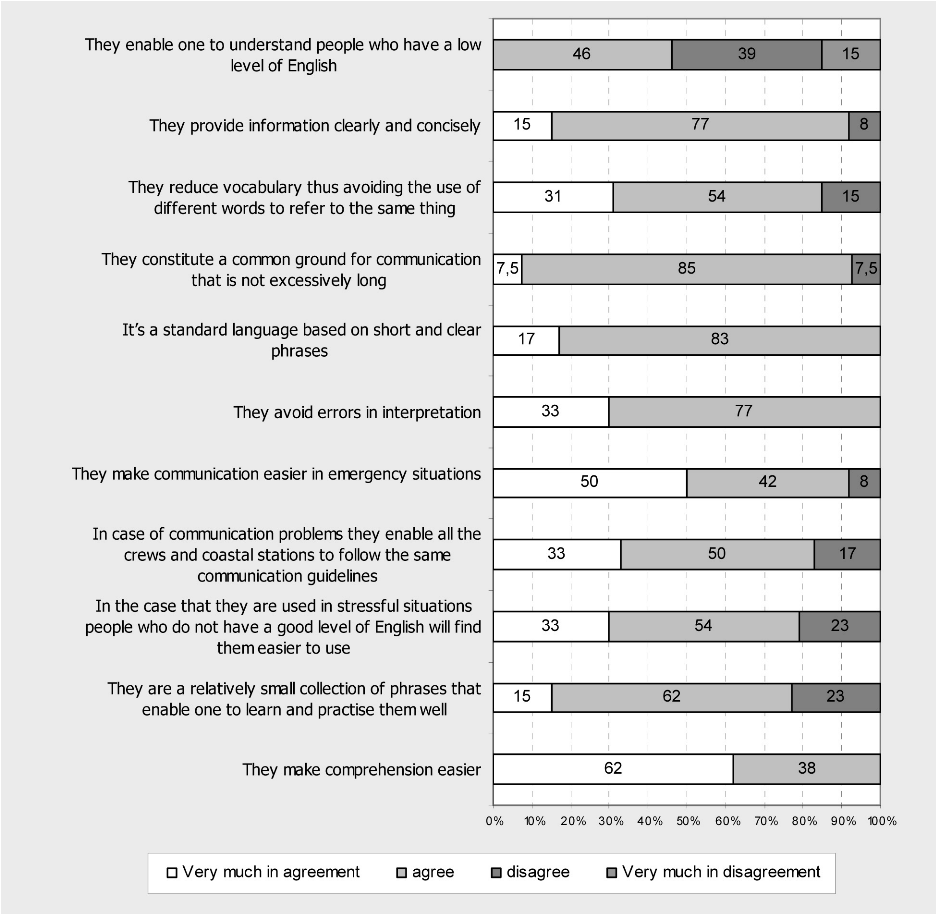
This question reveals the great level of disinformation that exists within the maritime milieu vis-à-vis these types of technologies, since 35% of the experts did not reply on account of their lack of knowledge on this topic. On the other hand, 35% of the experts consider that these technologies cannot be applied currently or in the future to improve the maritime communication process, while 30% consider that they can be successfully applied to achieve this goal.

10. *How could these technologies be used in the maritime workplace?*

These are some of the comments on the matter of possible uses of new technologies to improve maritime communication:

— "The best thing would be to receive a written translation of what had been received via VHF"
— "instantaneous written communication between ships and ship-to-shore"
— "in my opinion, the best way to use these technologies would be to provide a

FIGURE 4: Characteristics that could be attributed to the IMO's Standard Maritime Communication Phrases



discreet control device on each ship that would translate into the operator's mother tongue on a digital screen"

— "all of the ship or land stations' VHF should have a visual data screen according to the transmission equipment; upon receiving calls from a station this equipment would carry out a simultaneous voice translation"
— "the new technologies could recognise the language and translate directly, if this conversation were recorded on a screen one could translate it perfectly even if the communicator can no longer transmit anything else for whatever reason"
— "[new technologies] are an aid for written messages"

Prior to formulating questions 11 to 17 we briefly explained to the experts the process of automatic speech translation, and we outlined the idea of the development of a maritime communication unit with this feature. The following questions are thus related to the characteristics of such a unit as well as other important aspects dealing with the possible implementation and use of such equipment.

11. *Should this equipment always work as part of the VHF or as an independent unit onto itself?*

With respect to this question 77% of the experts were of the opinion that the equipment should be independent of the VHF, and in any case it should be added to this if it were necessary, while 33% believe that such equipment should be part of the VHF and should always operate with the VHF equipment.

12. *After having made a prior selection of the opinions on the operation of the equipment, the following were chosen more often:*

A – The communicating officer should speak in his/her mother tongue (Spanish for example) and the device should translate into English before sending the message. The message would appear on a screen in written form.

– The receiving device does it in English and translates into the mother tongue of the receiving officer (Danish for example) by relaying this translation orally. At the same time the equipment displays the message received in English on the screen in written form.

B – The officer should speak English and the device would transmit in this language and also display it in English on a screen.

– The receiving device does it in English and transmits orally in this language. The equipment also displays the written message on the screen in written form, either in English or in the native language of the receiving officer.

C – The officer who transmits should speak in his/her native language (Spanish for example) and the device would translate into English before sending out the message. The message would appear on a screen in written form.

– The device receives in English, translates into Danish, sends the message orally in English and the message appears on the screen in Danish.

Taking into account that a unit of this type would be, in any case, a communication aid that would not exempt anyone from having the responsibility of possessing a good level of English, which option do you believe would be the most interesting?

Options A and B were chosen equally by the experts who were surveyed.

13. *The following points reflect some of the technical and linguistic barriers that could*

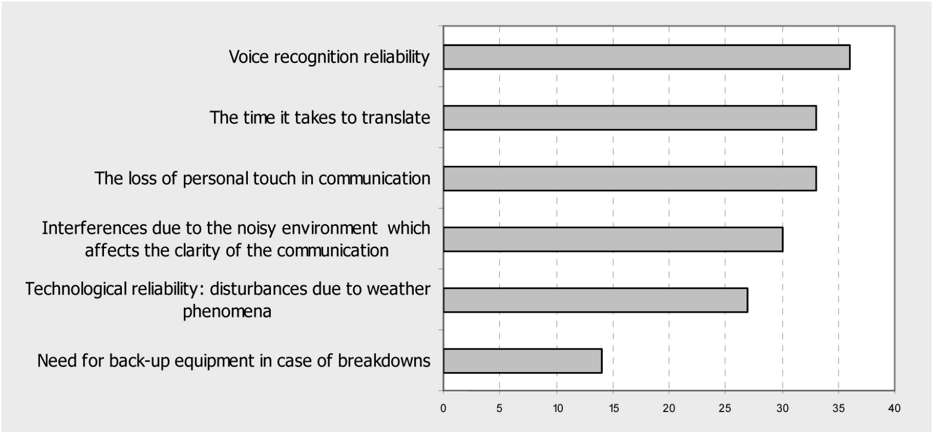
arise while using this equipment. Rank them according to whether you consider them to be more or less problematic or difficult to overcome:

- *The loss of the personal touch in communications*
- *The time it takes to do the translation*
- *Reliability of the speech recognition mechanism*
- *Interferences due to the noisy surroundings which affect the clarity of the communication*
- *Technological reliability: disturbances due to weather phenomena*
- *The need to have back-up equipment in case of breakdowns*

Once the point system of 1 to 6 was set up, the following conclusions were reached: reliability of the voice recognition system is considered to be the most problematic and difficult aspect to resolve (36 points), followed closely by the time used up to translate, and the loss of the personal touch in communication, both were considered to be equally problematic (33 points). Next in the ranking were the disturbances due to the noisy surroundings (30 points) and the technological reliability due to disruptive weather conditions (27 points).

The premise that was considered to be less problematic and thus easier to resolve was the need to the have back-up equipment (14 points). All of these data are shown in Figure 5.

FIGURE 5: technical and linguistic barriers that could arise while using this equipment



14. *If this equipment were developed and in a testing period, would you be willing to try it out?*

85% of the experts would be willing to try this equipment out, while 15% would not.

15. *Would you recommend the development of equipment with these features as an aid in maritime communication?*

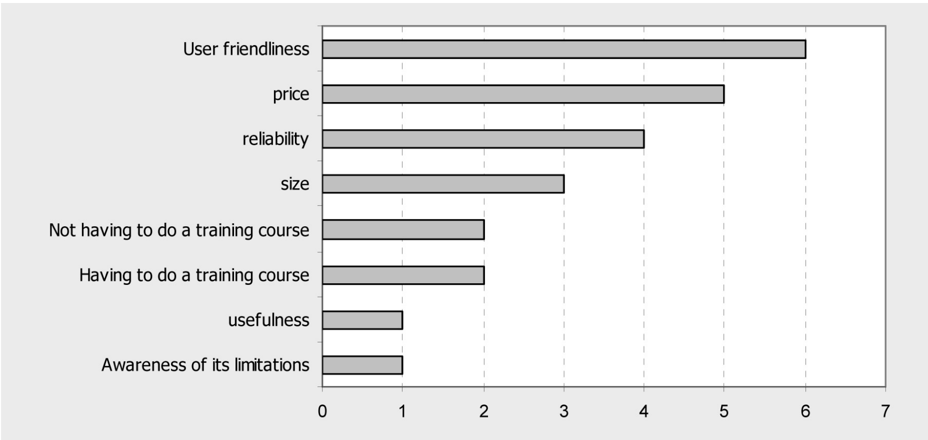
69% of the experts would recommend the development of equipment with these features, while 31% would not.

16. *If you were thinking about the possibility of acquiring this type of equipment, what would you consider to be the most important features?*

The following characteristics were indicated by the experts as being the most important when purchasing this type of equipment: user friendliness, price, reliability, size, need to do training courses, usefulness of the equipment and awareness of its limitations.

Figure 6 shows how these characteristics ranked according to their importance.

FIGURE 6: If you were thinking about the possibility of acquiring this type of equipment, what would you consider to be the most important features?

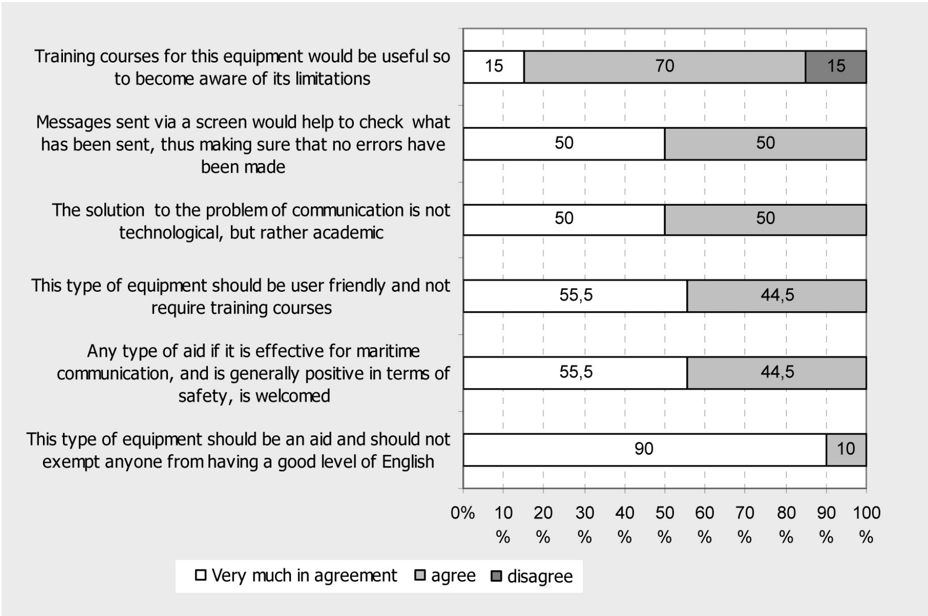


17. *Indicate if you are very much in agreement, agree, disagree or disagree very much with the following statements:*

- *This type of equipment should be an aid and should not exempt anyone from possessing a good level of English*
- *Any type of aid if it is effective for maritime communication, and is generally positive in terms of maritime safety, is welcomed.*
- *This type of equipment should be user friendly and not require any training courses.*
- *The solution to the problem of communication is not technological, but rather academic.*
- *The messages sent via the screen would help to check what has been sent, thus making sure that no errors are made.*
- *Training courses on how to use the equipment are useful so as to become aware of its limitations.*

Figure 7 shows us how the experts replied to this question. As we can see they almost agree unanimously on all of the statements, except for the statement about whether training courses would be useful in order to become aware of the equipment's limitations, as 15% of the experts stated that they disagreed.

FIGURE 7: Indicate if you are very much in agreement, agree, disagree or disagree very much with the following statements



CONCLUSIONS

1. As for the matter of the relation between communication and safety:

— A large majority of the experts coincide in believing that oral communication between people of different nationalities can be a safety problem in the maritime workplace, and they also consider that the most problematic types of communication are those that take place externally: ship-to-ship, and ship-to-shore.

— On the other hand general knowledge of English is considered to be the most problematic area in external communication, as differences in pronunciation and accent and awareness of standard vocabulary are also seen as the most problematic factors for developing such communication.

— To improve external spoken communication experts stress above all the need to lend greater importance to maritime English as a subject; they also indicate the need to involve maritime administrators and authorities so that they can demand a minimum level of English from the people who are involved in this type of communication. The Use of a standard international maritime language is considered to be the third best solution for these communication problems.

2. The use of the IMO's Standard marine communication Phrases

— Despite the fact that the use of standard vocabulary appeared in the previous point as one of the best solutions for the problems of spoken communication, only 30% of the experts stated that they use or have regularly used this vocabulary professionally. In harmony with this contradiction, 77% of the experts consider that the use of this type of vocabulary makes international communication easier; they all agree, to a greater or lesser extent, that these phrases facilitate understanding and avoid mistakes in interpretation. Likewise the majority of the experts agree that these phrases provide information clearly and concisely and facilitate communication in emergency situations.

3. The usefulness of language industries in maritime communication

— To start with, one third of the experts state that they have no specific knowledge about the use of language technologies in the maritime workplace; another third of the experts think that such technologies could not be applied in this environment, and the last third believes that these communication technologies can be applied in some way so as to foster an effective communication process in the maritime workplace. Thus there is initially a clear and apparently irreconcilable difference of opinion.

— However, once a possible design was proposed for a unit of equipment that would use speech recognition and automatic translation as an aid in external oral communication, almost 70% of the experts would recommend the development of equipment with these features, and 85% would be willing to try out the equipment if such equipment were developed and in the testing stage.

4.-Functional specifications of the equipment

— Almost 80% of the experts who were surveyed would opt for an independent VHF unit, that in any case could be fixed to it whenever it were necessary.

— As for the running of the equipment, 50% of the experts would select the following model:

– The officer who transmits a message should speak in his/her native language (Spanish for example) and the device would translate into English before sending out the message. The message would appear on the screen in written form.

– The receiving device produces it in English and translates into the mother tongue of the receiving officer (Danish for example) by sending out the translation orally. At the same time the equipment displays the message received in English in written form on the screen.

The other 50%, however, would opt for this other model:

– The officer should speak in English and the device would transmit in this language, displaying the message in English on a screen.
– The receiving device produces it in English and transmits in this language orally. The equipment also displays the received message in written form on a screen, either in English or in the mother tongue of the officer who receives the communication.

Based on the comments made by the experts themselves and transcribed previously, we can conclude that those experts who selected the second option as the most suitable believe that the translation process is more complex than the speech recognition process. Therefore they choose to avoid it insofar as it is possible.

In addition, it is interesting to point out that the third option in which the interlocutors send and receive messages in their native tongue, was not selected by any of the experts.

— As for the most problematic areas that would have to be overcome to ensure the proper running of the equipment, reliability of the voice recognition system and the time it takes to do the translation are indicated as being the most problematic technical and linguistic barriers and the most difficult to solve.
— Finally, according to the experts who were consulted, user friendliness, price and reliability are, in this order, the most important characteristics that should be taken into account when thinking about the possibility of buying a unit with these features.

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ESTUDIO SOBRE EL USO DE LAS TECNOLOGÍAS DEL LENGUAJE PARA MEJORAR LAS COMUNICACIONES MARÍTIMAS

RESUMEN

El conocimiento inadecuado de la lengua es identificado por la Organización Marítima Internacional como uno de los cuarenta y cuatro componentes del llamado factor o elemento humano.

Los problemas derivados del uso inadecuado de la lengua son, por lo tanto, un área de riesgo inherente de las actividades típicas del comercio marítimo, que pueden producirse tanto durante las operaciones a bordo, especialmente en buque con tripulaciones multiculturales y multilingües, como pueden surgir en la interacción entre buques o entre buques y servicios de tierra.

Una de las posibles acciones encaminadas a prevenir o a reducir las consecuencias negativas derivadas de la falta o mal uso de una lengua común en las comunicaciones marítimas está basada en la investigación sobre el uso de las nuevas tecnologías de la información y la comunicación en el ámbito marítimo y su adaptación a las necesidades comunicativas en dicho ámbito. Por un lado la investigación en el reconocimiento del habla conducirá a nuevas ayudas para la operación del buque y, a su vez, reducirá los problemas comunicativos debidos a la formación de tripulaciones multilingües; por otro lado la investigación en traducción automática aplicada a este ámbito facilitará las comunicaciones orales, principalmente aquellas realizadas con la ayuda de equipos de comunicación.

En este sentido, como parte de los objetivos del proyecto "Industrias de la lengua aplicadas al ámbito marítimo" desarrollado desde la Universidad de A Coruña, se encuentra el estudio presentado a continuación, cuyo fin es el establecimiento de la viabilidad de la aplicación de las nuevas tecnologías de la información y la comunicación a las comunicaciones marítimas, con el fin de mejorar su eficacia así como resaltar los aspectos de la seguridad marítima relacionados con ellas.

MÉTODO

Desarrollaremos, en el presente artículo, el procedimiento y resultados obtenidos de un estudio Delphi realizado con el fin de establecer la viabilidad legal, comercial y técnica del uso de las nuevas tecnologías de la información y la comunicación en el ámbito marítimo, a través de la consulta a expertos marítimos que desarrollan una considerable parte de sus actividades profesionales en un ambiente comunicativo internacional.

Un estudio de este tipo consiste básicamente en la selección de un grupo de expertos a los que se les pregunta su opinión sobre cuestiones referidas a acontecimientos futuros. Las estimaciones de los expertos se recogen y analizan en sucesivas rondas, anónimas, con el fin de conseguir consenso pero con la máxima autonomía por parte de los participantes. En su conjunto el método Delphi permitirá prever las transformaciones más importantes que puedan producirse en el fenómeno analizado en el transcurso de los próximos años.

El presente artículo analiza, por lo tanto, los puntos de vista expresados por expertos en comunicaciones marítimas sobre la posible implantación de las tecnologías del lenguaje en el ámbito marítimo.

CONCLUSIONES

De entre las conclusiones obtenidas de este estudio es interesante destacar los siguientes puntos:

La gran mayoría de los expertos coincide en que la comunicación oral entre personas de distinta nacionalidad puede suponer un problema para la seguridad en el ámbito marítimo, y además encuentran que las comunicaciones más problemáticas son aquellas que tienen lugar con el exterior: buque-buque y buque-tierra.

Por otro lado el conocimiento general de la lengua inglesa es considerada el área más problemática en las comunicaciones exteriores, siendo las diferencias en la pronunciación y acentos y el conocimiento de un vocabulario normalizado considerados factores también muy problemáticos en el desarrollo de tales comunicaciones.

Para la mejora de estas comunicaciones orales exteriores los expertos recalcan sobre todo la necesidad de conceder una mayor importancia a la formación en inglés marítimo, también indican la necesidad de implicar a los gestores marítimos y a las autoridades competentes para que exijan un nivel mínimo de inglés a los implicados en dichas comunicaciones. El uso de un lenguaje marítimo internacional normalizado es señalado como la tercera mejor solución a estos problemas comunicativos.

A pesar de que el uso de los vocabularios normalizados se exponía en el punto anterior como una de las mejores soluciones a los problemas de la comunicación oral, sólo el 30% de los expertos declara utilizar o haber utilizado de forma habitual estos vocabularios en el desarrollo de sus funciones profesionales.

En consonancia con esta contradicción, el 77% de los expertos considera que el uso de este tipo de vocabularios facilita las comunicaciones internacionales, estando todos ellos de acuerdo, en mayor o menor grado, en que dichas frases facilitan el entendimiento y evitan los errores de interpretación. Así mismo la mayoría de los expertos coinciden en que estas frases proporcionan información de forma clara y concisa y en que facilitan las comunicaciones en situaciones de emergencia.

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NEW INDICATORS TO MEASURE PORT PERFORMANCE

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ABSTRACT

Throughput volume is the most widely used performance indicators in the port industry, but does not provide information on the (regional) economic impact of the port and the attractiveness of the port as a location for port-related industries. Therefore, port-related employment and value added are also used as port performance indicators (PPIs). Due to the ongoing commercialization of port authorities (PAs) and the increasing pressure of stakeholders on PAs, new PPIs are developed. Such new indicators do not only satisfy the port authority's need for insight in port performance, but are also relevant for stakeholders with socio-economic interests in a port.

In this paper we present a number of potential new PPIs. These PPIs are related to three 'port products'. Besides an overview of currently used PPIs, we analyse performance indicators in other relevant economic and spatial entities like airports, regional economies and business parks. The result is an overview of new port performance indicators whose introduction may be useful for the port industry.

Keywords: Port performance indicators, performance measuring, port products

INTRODUCTION

The general trend towards more and more advanced performance measurement is also visible in the port industry. However, developing appropriate PPIs is not

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straightforward. The performance of *terminals* is analysed frequently. In some cases the term port performance is used even though terminal performance is measured. Such studies are relevant, since terminals are the most essential function of ports. However, ports and terminals can no longer be regarded as stand alone facilities (see for instance Cullinane et al, 2004), UNCTAD, in a classic monograph on port performance indicators (UNCTAD, 1976) discusses PPIs such as berth occupancy, revenue per ton of cargo, and capital equipment expenditure per ton of cargo. These PPIs also focus on the productivity of terminals. Performance measurement of *ports* is more complicated. This is explained by the fact that the port is a cluster of economic activities (De Langen, 2004) where a large number of firms provide products and services and together create different port products.

The most widely used PPI is throughpout volume. Ports are ranked according to the volume of cargo that is handled. These cargo volumes figure prominently in media and on websites of port authorities. Growth of throughput is regarded as evidence of the performance of ports. Even though the use of volumes as performance indicator is widespread, there are at least three limitations of throughput as PPI:

— Adding up throughput volumes of different commodities to one aggregated throughput figure limits the value of a comparison between ports. E.g. one ton of crude oil is very different from one ton of fruit juice.
— Throughput volumes do not tell much about the economic impact of a port.
— Growth of throughput volumes is mainly explained by international trade flows, and not by the performance of a port.

A second PPI, that is used in a number of ports, for instance in the Netherlands and Belgium, is the *value added* generated in seaports. This PPI is relevant for assessing the economic importance of the port but does not say anything about the efficiency of the port.

The increasing integration of ports in logistics chains has also led to attention for PPIs to assess this integration (Bichou and Gray, 2004). These PPIs are specifically focused on supply chain integration and not included in this overview of port performance indicators at a more general level. Due to the commer-

Table 1: Introduction of PPIs in the port of Rotterdam

Year – period	Indicators
Beginning 20th century	Number of ships Throughput volume
1990s	Port related employment Value added Port value added as % of regional GDP
2002	Development in turnover Profitability of firms in port
2003	Investment level of private firms in port area
2004	Establishments of (new) companies in port area

Sources: Port of Rotterdam (2006), Rabobank (2003), ECORYS-NEI (2003), Rebel Group/Buck (2005) cialization of (some) port authorities and the increasing pressure from stakeholders on port development, new PPIs are introduced in the port industry. Table 1 shows the emergence of new PPIs in the port of Rotterdam in the last decades.

Table 1 shows the recent introduction of new PPIs[3]. Further progress with respect to PPIs is to be expected. Therefore, this paper identifies and evaluates possible new PPIs. First, an analysis of currently used PPIs is made. Second, a distinction is made between different 'port products'. Third, performance indicators used in other relevant economic entities like airports, regional economies and business parks are discussed. We finalize the paper with conclusions on new port performance indicators.

CLASSIFYING PORT PERFORMANCE INDICATORS

Performance indicators (PIs) have mainly three functions: they provide management information for organizations, they serve to compare performance (of organizations and other units, such as countries) and they are used to communicate with relevant stakeholders. Publicly owned organizations increasingly use performance indicators to ensure public expenditure is managed effectively and the results of public investments can be measured.

For ports, a distinction in three types of performance indicators is relevant. *Output indicators* show the relevant output. For instance, the most important output indicator for firms is profitability, while for countries GDP per capita is the main output indicator. These output indicators are important, but do not provide insights in how a certain performance is achieved. *Upgrading indicators* provide additional insight in factors that influence the long term development of the port. The term upgrading is derived from the global commodity chain literature (Gereffi, 1999) and encompasses developments that strengthen the position of a port in commodity chains. *License to operate indicators* are increasingly required to report to stakeholders, such as residents and environmental groups, on the social and environmental performance of the port.

As ports have developed into clusters of economic activities, where cargo handling, logistics and port related manufacturing takes place, a distinction can be made between three different (but complementary) *port products* .

1 The *cargo transfer product* product. This product consists of the loading and unloading of ships. The most important users of this product are the shipping lines.

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[3] These PPIs are collected by Port of Rotterdam, a large bank in Rotterdam and the National Ports Council.

2 The *logistics product*. This product consists of storage and value adding activities, including re-packing, labelling and quality inspection. The most important users of this product are the logistics service providers and importing and exporting companies. Both can decide to locate logistics facilities in seaports.

3 The *port manufacturing product*. This product consists of the provision of space and conditions for investments in manufacturing facilities. The most important users of this product are (multinational) manufacturing companies that invest in manufacturing plants in the port area.

The cargo transfer product is the backbone of the port: the port only functions if it is an efficient node in transport networks. This product consists of terminal handling, towage, pilotage, customs, and other activities required to enable the transfer of goods from seagoing ships to other transport modes (or vice versa). The cargo transfer product is not the only product: many ports develop logistics zones in the vicinity of the port in order to attract logistics facilities. Examples include Rotterdam, Barcelona, Shanghai and Busan. This logistics product is a different product, with different port users and different competitors. Ports not only face competition from other ports, but also from other inland nodes (Van Klink, 1998). The third product, port manufacturing, is relevant for ports that aim to attract manufacturing activities. Because of the presence of a variety of raw materials in ports and the quality of transport infrastructure, some ports have developed in substantial centres of manufacturing, for instance for petro-chemical activities. Examples of ports with much manufacturing activities include Houston, Antwerp and Marseille. These ports provide locations and conditions for manufacturing activities. This port manufacturing is a third port product, also with different port users and competitors.

These three port products are complementary, but highly different: the port users and their selection criteria differ substantially. The competitive position of ports for these three products generally also differs substantially. For instance, Gioia Tauro has an attractive cargo transfer product, but a less attractive logistics and manufacturing product while Antwerp has an attractive logistics and manufacturing product.

Table 2 summarizes the most important characteristics of these three port products. These three port products all consist of activities of a large number of firms and organizations such as the port authority and customs.

The two distinctions discussed above –between three types of performance indicators and three different port products- is used to categorize PPIs and to enable a more precise analysis of potential new PPIs. Specific PPIs for the three port products are better than PPIs for the port as a whole, because of the large differences between these port products. For instance, it is not very useful to compare the value added generated between ports with completely different positions in each of the port products. PPIs for specific port products provide more detailed and insightful for management information and allow for better comparison between ports.

Table 2: Important characteristics of the three different port products

Characteristic	Cargo transfer Product	Logistics product	Manufacturing product
Most relevant firms for the provision of this product	Terminal operating companies, towage, pilotage and bunkering firms	Logistics service providers, transport firms, forwarders	Port authority (landlord), utility providers for manufacturing (water, heat, energy)
Competition	Other ports in the proximity	Other logistics zones, either in ports or in inland distribution centres	Other 'sites' for manufacturing activities
Relation with other port products	A better cargo transfer product improves attractiveness of both other products	A better logistics product, increases demand for cargo transfer product and improves attractiveness of manufacturing product.	A better manufacturing product increases demand for both other port products
Performance indicators	Throughput volume, ship waiting time	Value added in logistics, m^2 logistics space	Value added and investment level in port related manufacturing.

However, some licence to operate indicators, can best be developed for the port as a whole, because the port is perceived by its stakeholders as one economic complex.

PORT PERFORMANCE INDICATORS USED IN LEADING PORTS

In table 3, 4, and 5 PPIs presented in the annual reports of a number of leading port authorities are classified into the three different port products and the three different types of PPIs. PPIs that are relevant for the port as a whole are given in table 6. For this research, annual reports of over 30 ports were collected, and the PPIs presented in these annual reports were listed[4]. Not all ports present 'new PPIs', the ports that report 'new' PPIs are given in the tables. Most annual ports report throughput (for various commodities), turnover, profits and some other financial indicators.

[4] Sources: Port of Vancouver (2005), Port of Dampier (2005) Ports Corporation of Queensland (2005), Port of Long Beach (2004), Port of Tacoma (2005), Port of Valencia (2003), Port of Stockholm (2004) and Port of Antwerp (2004). These ports are located in densely populated areas with organized stakeholders. This explains why new PPIs emerge in these ports.

These are not given as they are standard. The financial indicators do not demonstrate the performance of the port, but of the *port authority*.

Most of the PPIs in the following tables are not updated annually and also not reported for consecutive years. More importantly, international comparison of PPIs is hardly possible because of the lack of uniform definitions and methods of data collection.

Table 3: PPIs for the cargo transfer product

Type of PI	PPI	Example of port that collects this PPI
Output indicators	Throughput volumes Value added of port Investment level in port Market shares in hinterland regions	Virtually all ports Belgian & Dutch ports Antwerp Long Beach
Upgrading indicators	Number of 'first port of call' services Value of goods passing though the port EDI use in port	Halifax Most ports in US Antwerp
License to operate indicators	Modal split hinterland traffic Index of port dues at 'real prices' Custom revenues from port	Rotterdam Dampier Long Beach

Source: Annual Reports port authorities

An interesting 'license to operate indicator' is the index of port dues at real prices. This shows whether the port dues rise or fall in real terms. This indicator shows whether or not port costs decline in relative terms over time. For large numbers of port users, especially consumers, this indicator is relevant.

Table 4: PPIs for the port logistics product

Type of PI	PPI	Example of port that collects this PPI
Output indicators Upgrading indicators	Warehouse area (m^2) Time to majo consumer markets	Antwerp and Rotterdam New Orleans
License to operate indicators	No indicators found	—

Not many ports collect PPIs for the logistics products, even though most ports increasingly recognise their role in logistics chain. Both Rotterdam and Antwerp collect data on the warehouse space in the port area. This shows the supply of logistics services in the port.

Table 5: PPIs for the port manufacturing product

Type of PI	PPI	Example of port that collects this PPI
Output indicators	Value added in port related manufacturing Investments in port manufacturing	Dutch & Belgian ports Dutch ports
Upgrading indicators	Number of major chemicals available in port (compared to other major chemical manufacturing sites –mostly ports)	Antwerp
License to operate indicators	Emissions of greenhouse gasses	Rotterdam

The use of indicators for the port manufacturing product is limited to those ports that have developed into large manufacturing sites, such as Rotterdam and Antwerp. Investment in port manufacturing is the most relevant output indicator.

Table 6: PPIs for the port as a whole

Type of PI	PPI	Example of port that collects this PPI
Output indicators	Value added of port Investment level in port	Belgian & Dutch ports Antwerp
Upgrading indicators	Certification of management programmes Average wage port industries compared to regional economy	Stockholm Tacoma
License to operate indicators	Number of environmental accidents Water quality in port Employment in port region Economic impact of a port	Queensland Valencia Long Beach Most large ports

Most licence to operate indicators are developed for the port as a whole and not related to specific port products. Examples of such indicators include the number of environmental accidents, the water quality in the port and the employment in the port region. The most widely used indicator in this respect is the economic impact of a port (see Hall, 2004, for a recent critical analysis of economic impact studies).

This overview shows that a large number of PPIs is in use. However, different ports use different PPIs, and more importantly, there is no uniform method to calculate the indicators. This is a major weakness of current performance measurement practices in seaports.

NEW PORT PERFORMANCE INDICATORS

The preceding section showed that various PPIs are used, but not always in a uniform way. This section explores PPIs that are used in other environments and that may also be useful for the port industry. An analysis was made of performance indicators for airports, clusters, industrial parks and regions.,Performance indicators may also be introduced to the port industry.

Airports are similar to seaports because they are nodes in international transport networks (O-Kelly, 1998). Performance measurement at airports is advanced compared to seaports (see Francis et al, 2002, and Oum and Yu, 2004). Consequently, performance indicators used in airports are analysed. Airports measure environmental performance, including perceived risk of incidents, and safety, measured by the number of accidents. Airports also measure customer service indicators, for passengers, airlines and cargo owners are recognized as customers. A discussion of customer service measures is available in Doganis and Graham (1987). Indicators like variability in service times and average time to deliver cargo from airplane to cargo terminal could be useful in the port industry.

Clusters are similar to seaports because ports can be considered as specific examples of clusters (De Langen, 2004). Studies on performance of clusters (Porter, 2003) have used indicators like number of patents, that may also be introduced in the port industry.

Industrial parks and business parks are similar to ports because ports are also areas with large numbers of complementary and interrelated firms. Ports can be considered as special cases of industrial parks, aimed at attracting companies that require land with deep-water access (see for a recent article on industrial parks Eilering and Vermeulen, 2004). The economic performance of industrial and business parks (incl. shopping areas) is mainly measured by (real estate) developers and banks. Relevant indicators include expenditures per visitor, land price, and rental prices. These indicators are not used as performance indicator in ports, but could be valuable.

Finally, performance measurement of ports may be able to use performance indicators used for regions, because port regions are in many cases mainly specialized in port related activities. The most used indicator for regional economic performance is gross regional product. Other indicators include average wage level (Porter, 2003) and a number of indicators related to “living attractiveness” and “investment climate”. These indicators could be useful to extend port performance measurement. Studies on location decisions of port related activities, such as Oum and Park (2004) for distribution centres, provide relevant insights for ports aiming to attract such industries.

Table 7, 8, 9 and 10 show relevant new indicators that are derived from this analysis. Some further explanation is given below the tables.

Table 7: New PPIs for the cargo transfer product

Port product	Type of PI	New PPI
Cargo transfer	Output	Ship turn around time Connectivity index
	Upgrading	Throughput per square meter
	License to operate	Consumer benefits from lower transport costs

Even though *ship turnaround time* is already discussed in academic literature for more than 30 years (see Heaver and Studer, 1972), no port systematically reports the ship turnaround times. This turnaround time includes the time spend with entering the port, loading, unloading and departing. Even though this is clearly relevant for shipping lines, ports do not report turnaround time in annual reports or other publications.

A *connectivity index* can be used to quantify how well a port is connected to overseas destinations. Such a connectivity index is used for airports (Button and Stough, 2000) but does not exist for seaports. The most practical approach would be to develop an index for both overseas accessibility and hinterland accessibility. The index can be calculated based on the quality of connections (in terms of frequency and and transit time) to a large number of ports and intermodal terminals in the hinterland.

A good upgrading indicator would be the average throughput per square meter. This indicator has been calculated in a number of cases, but is not reported structurally by ports. This indicator is used more frequently in the airline industry (see Park, 2004).

Table 8: New PPIs for the port logistics product

Port product	Type of PI	New PPI
Port logistics	Output	Percentage of goods to which value is added in port region
	Upgrading	Land price Value added (or employment) per square meter
	License to operate	-

The indicator 'consumer benefits from lower transport costs' can be estimated by calculating the additional costs when a 'second best' port would have to be used. These additional costs do not have to be incurred because of the presence of the port. Thus, they can be regarded as the benefits of the presence of this port. Due to the competition between ports, it can be assumed that these benefits are passed on to the port users, and finally to the consumers in the hinterland served by the port. Even though some economic impact studies do argue along these lines, the benefits to consumers in the port hinterland are not presented explicitly.

A relevant output indicator for the port logistics product is the percentage of goods to which value is added in the port area. This indicator shows to what extent the port is a logistics location. Such an indicator would be especially relevant for containerised commodities.

A relevant upgrading indicator is the price of warehouse space. This price reflects the willingness to pay for a location in the port. Thus, higher prices reflect upgrading of the product[5]. These prices are collected by logistics consultants, such as Cushman and Wakefield, but not reported by port authorities.

A second relevant upgrading indicator is be the value added per square meter. Such an indicator demonstrates the value of the logistics services provided in a warehousing area.

Table 9: New PPIs for the port manufacturing product

Port product	Type of PI	New PPI
Port manufacturing	Output	Investment level manufacturing sites
	Upgrading	Productivity port industries Wage level port manufacturing industries
	License to operate	-

Most ports do not report any PPIs for the port manufacturing product. The most relevant output indicator is the investment level in manufacturing facilities. This indicator shows whether port manufacturing is expanding or declining. There are two relevant upgrading indicators. First the productivity of the industries. A proxy to measure productivity would be the value added per employee. Second, the wage level in port manufacturing is relevant. Relatively high wages indicate a highly qualified workforce and can be expected to lead to high productivity.

For the port as a whole, a number of performance indicators can be developed that are used to analyse the performance of regions (see e.g. Porter, 2003 and Wennekers & Thurik, 1999). New establishments (either start-ups or branch offices) are

[5] This argument is only valid when one assumes that the market for land is relatively free. In such cases, firms can choose locations and the price level in attractive locations will rise. In the case the land market is heavily regulated, a high price cannot be associated with the quality of the location.

Table 10: New PPIs for the port as a whole

Port product	Type of PI	New PPI
Port as a whole	Output	-
	Upgrading	New establishments Number of patents Education levels employees Wage level port industries
	License to operate	Housing prices in vicinity of port

a good indicator of the attractiveness of the port for new companies. Special attention could be given to 'knowledge intensive' start-ups, since these are especially relevant for upgrading processes. An indicator could use data from company registers to assess how many new firms are established. The number of port related patents registered by companies operating in the port could be a second upgrading indicator. However, the number of patents in the port industry (even when broadly defined) is rather limited. A third upgrading indicator that could be developed for ports is the education level of employees. This indicator also provides information on the presence or absence of upgrading processes. The final potential new PPI is the wage level earned in the port. This could also show upgrading, especially if there is no reason to assume employees in the port area can extract economic rents (Goss, 1999).

The prices of houses in the vicinity of the port could be a good licence to operate-indicator. When these prices rise, relative to the national or regional average, this indicates that the negative effects of the port are rather limited, or are offset by the positive effects of the port (e.g. living close to the waterfront).

CONCLUSIONS

In this paper an analysis was made of Port Performance Indicators (PPIs) in the port industry. The use of such indicators is useful, to measure whether the development of the port is satisfactory or not, to compare ports and learn where performance can be improved and to communicate the performance of the port to a wide range of stakeholders. Because of the complexity of seaports, and the fact there the 'port' consists of large numbers of different firms, so far, most ports hardly collect PPIs in a structured way. However, due to commercialization of the port authority and the increased pressure from stakeholders on port performance, the introduction of new PPIs can be expected. The case of Rotterdam shows that new indicators were developed over the last years.

The distinction between the cargo transfer, port logistics and port manufacturing product is relevant. For each port product, PPIs differ substantially. Depending on their structure, different PPIs are relevant for different ports.

In this paper, a couple of potentially useful new PPIs were discussed, based on an overview of annual reports of leading port authorities and an analysis of performance measurement of units that are similar to ports, such as airports and clusters.

The introduction of new PPIs may lead to new academic research. While the current research mostly focuses on throughput volumes, new research opportunities for instance an analysis of the performance of ports in logistics chains and an analysis of conditions that explain the efficiency of land use in ports, may become viable once new PPIs are introduced.

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MAINTENANCE STRATEGIES SELECTION MODELING FOR NAVAL SYSTEMS

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ABSTRACT

This paper presents a qualitative Maintenance Strategies Selection Model for Naval Systems based on basic RCM (Reliability Centered Maintenance) principles taking into consideration particularities of a warship and maintenance in former Serbian and Montenegro Navy. Due to the lack of statistic data on maintenance and failures, we used expert knowledge of naval systems operators and maintainers. Creation of a specific model was also necessary due to the lack of engineering resources and time for all the required analysis of complex technical items. Additional problem was a need to extend the ship's life cycle. With a purpose to make rational use of the resources for the analysis of all complex systems of the ship, three different approaches have been modeled depending on whether some experience in the previous maintenance exists and on the amount of their maintenance costs. Pilot-analyses conducted against this model showed its applicability and potential to reduce maintenance costs of ship's systems.

INTRODUCTION

A constant need for budget reduction planned for maintenance and prevention of technological lagging behind the neighboring countries conditions advancement and improvement of maintenance in former Serbian and Montenegro Navy. On the basis of previous research results, it can be said that a maintenance strategy is the key factor influencing effectiveness and efficiency of a maintenance system (Stanojevic et al, 2000; Stanojevic et al, 2004) thus its (strategy) selection represents a basic

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problem, which should be solved in the maintenance system in its phase of creation, as well as in the phases of its later improvement. Strategy determines which maintenance activities will be performed, at what frequency i.e. when and in what scope, for the purpose of achieving maintenance system objectives. The strategy could be defined for parts of a technical device, individual technical devices and maintenance system on the whole. This created a request for making maintenance strategies auditing model for naval systems which are already in use for the purpose of reducing maintenance costs and preserving functional safety and combat readiness as a step in advancing the existing maintenance systems of naval systems (Aleksic, 2006).

Prior to modeling, particularities of the warship first had to be taken into consideration. Maintenance of warships is the most expensive in comparison to the maintenance costs of other military equipment. Former Serbian and Montenegro Navy has a developed preventive maintenance with characteristic overhauls that require a specific infrastructure and labor force specialties. Maritime strict regulations related to the safety of navigation, crew, cargo and natural surroundings also adhere to Navy. Regarding the number and complexity of implemented systems, a warship has the most complex equipment and devices. Every complex system on a warship has operators. Most of critical systems on a warship are redundant.

Distinctive features of maintenance in former Serbian and Montenegro Navy, which are relevant for the new model, are also identified. The Serbian and Montenegro Navy has very experienced personnel. The experience is large, both of the personnel that operates or has operated with the systems and skilled/scientific personnel in institutions envisaged for the development of maintenance systems or maintenance of systems themselves. Ships have been in use for a long time and what is expected is extension of their life cycle. Furthermore, there is a problem of deciding on and managing failures in conditions that lack adequate statistic data, so the basic attention has been paid to qualitative methodologies. Ships belonging to our former Serbian and Montenegro Navy have relatively shorter routine missions, due to the small territorial sea.

The following maintenance strategies have been selected: corrective maintenance, preventive maintenance, detective maintenance, predictive or condition based maintenance and proactive maintenance. Detective maintenance is a new strategy proposed for the purpose of adjusting to modern world trends. The content of this strategy has not got anything new in particular, except that it stresses the importance of managing hidden failures characteristic for protective systems. There is no evidence of a hidden failure occurring, because it in itself does not produce any consequences. Proactive maintenance is presented as a group of special techniques and methods for the improvement of maintenance systems in use (Deshpande and Modak, 2002).

RCM - Reliability Centered Maintenance has been selected as a model for the modeling methodology that has a holistic approach to the systems and treats all maintenance strategies equally in the sense that there is a tendency of creating their optimum mixture. When choosing a maintenance strategy, *RCM* predominantly starts from consequences of failure (Moubray, 1997). The basic idea of *RCM* methodology is presented in literature, but procedures are not appropriate for conditions and restrictions of the investigated systems in the form they were applied (Stanley and Heap, 1979; "NAVAIR 00-25-403, Guidelines for the Naval Aviation Reliability–centered Maintenance Process", 2001; "Reliability Centered Maintenance Guide for Facilities and Collateral Equipment", 2001; Conachey, 2005). Methodologies based on *RCM* are not too complicated, but are demanding regarding the engagement of the best specialists for a longer period of time, which is the biggest problem that has to be taken into consideration ("Study of existing RCM approaches used in different industries", 2000). This is why an original model has been developed, which takes into account the stated particularities of the system and methodology limitations.

BASIC CHARACTERISTICS OF THE NEW MODEL

Selection of RCM methodology for the improvement of the Naval ship maintenance is too demanding for our present engineering capacities. Speaking objectively, the largest problem in the application of RCM methodology is consumption of enormous effort and time for the analysis. For many who have tried it, RCM stands for "Resource Consuming Monster" (Dunn. S). In order to save time and labor force resources, which have to be engaged during the analysis of maintenance strategy selection, we suggest some improvements in the methodology. This paper presents a more balanced approach where different ship's systems have been dealt with in a different manner. For this reason, three branches of methodology have been modeled and they differ in depth of analysis, Figure 1.

The first step that needs to be made is breakdown the ship into the hardware sub-systems (systems). The next step is elimination of elements that will not be analyzed. Data needed for the analysis may be classified into three groups: construction data, operating data and reliability data.

The first separation is made against the principle of existence of defined maintenance programm in the previous period. If Naval Repair Facility is capable of performing system overhaul, which is the most complicated maintenance activity, it is considered that there is defined maintenance of the sub-system in the life cycle. It was decided that different approaches are used depending on the existence of significant maintenance experience.

In case there has been no defined maintenance programm in the previous period – the only source that could be relied on is operators' experience. Thus, systems that do not have maintenance programm defined by overhaul documentation fall into the first branch and they are marked with number I on the Figure 1. The beginning

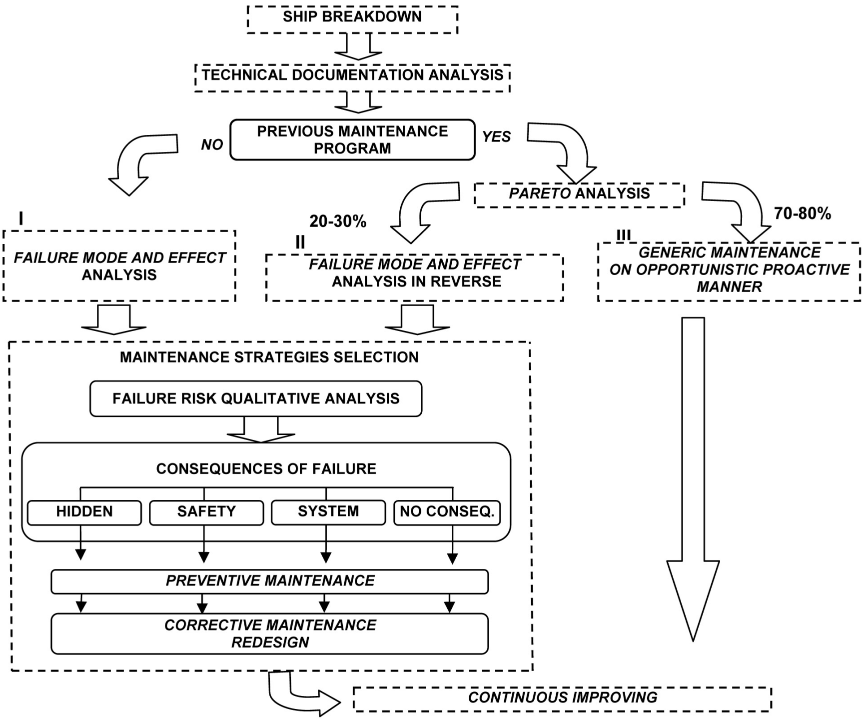

Figure 1. Model of Maintenance Strategy Selection

involves a very detailed analysis, which starts practically from null. This procedure enables systematic screening of systems. The important fact is that there are not many systems of such kind, so the problem of analysis duration is for the most part solved.

The second procedure is applied on the remaining group of systems for which previously defined maintenance programm exists. The beginning involves already performed and tested maintenance programm thus the analysis, apart from operator's experience, can rely on maintainers experience and technical documentation on systems maintenance. There have been some indications that there is a big problem of engaging human and material resources and time for analysis performance. To prevent the amount of the sub-systems being analyzed into more details, another selection has been made according to economic criteria – Pareto analysis of maintenance costs. In short, every element has a known or expected maintenance costs. Accordingly, 20-30% of the systems are classified into branch II whose maintenance costs are 70-80% of the total ship maintenance costs. The third branch (III) includes 70-80% of the systems whose maintenance costs make 20-30% of the total price paid for ship maintenance. The second branch is also systematic, but has a considerably smaller scope because it takes previous maintenance programm as its basis. The third is the simplest analysis that actually represents a systematization of familiar procedures. By this, greater attention will be directed to the systems whose analysis may bring the largest profit and relatively not so detailed analysis will be performed on most of the systems that have lower maintenance costs.

BRANCH I

Branch I represents a maintenance strategy selection methodology for complex ship systems that have not had defined maintenance programm. It has two basic stages: modified *FMEA* and maintenance strategies selection against the complete *FMEA* methodology.

Modified *FMEA* makes assumptions how to compensate the lack of statistic data on failures that are necessary for quanitative methodologies. This is achieved by a systematic analysis of failures that is directed on the function and system itself; hence it is performed from top to bottom. Other hardware parts of minor importance, which are not connected to the main function of the system, may fail without consequences and its repair should be done when most convenient. A special feature of the modified *FMEA* method is qualitative determining of a risk matrix consisting of failures consequences and failures frequency. Consequences and frequency of failures are determined on the basis of familiarity with the system that in this manner compensates the lack of statistic information on failures. Analysts perform functional systems failures modeling which makes the subject of analysis on the basis of technical documentation, expert knowledge of the system and engineer judgment. Modern views on analytic proactive techniques show that there is a need for the introduction of team techniques and methods for the purpose of increasing quality of subjective judgment (Durán, 2005; Tsang, 2002). An analytic team requires: operators, maintainers, members of command structure and, if possible, constructors.

The second stage in branch I is the selection of maintenance strategy. An original algorithm has been developed and it adheres to the basic principles of *RCM* methodology and is also adjusted to our conditions and limitations. The entire model is based on the principle of separation of the relevant from irrelevant (classical elimination method). The algorithm refers to all types of failures from the *FMEA*-list prepared. Rough separation is made using the failure risk matrix. If failures are categorized as small risk failures, then no prevention is performed, which means corrective maintenance will be performed according to the need, when a failure occurs. Failures that fall into high risks call for a redesign, that is, modification.

According to this model, the attention should be paid to consequences of failures and not to the failure itself. Four possible analysis directions have been defined based on consequneces of failures. Those are:

1. Failures with hidden consequences.

2. Failures with consequences dangerous for the safety of ship, people and environment.
3. Failures with consequences for system functioning.
4. Failures without consequences for system functioning.

Special attention and prevention need failures with consequences dangerous for the safety of ship, people and enviroment and failures with hidden consequences. Failures with hidden consequences mostly reffer to the environment protection and they are the first line of defense from multiple failures and accidents with more serious final effects. Failures with consequences for system funcioning require prevention if conditions exist, whereas failures without consequences for system functioning require corrective maintenance.

The next step involves consideration of technical characteristics of failures, that is, analysis of possibilities of preventive or corrective maintenance performance. In this model all maintenance strategies have an equal status meaning that any strategy may be selected if it is optimal against the given criteria. Preventive maintenance includes: technical diagnostics as a maintenance activity of condition based maintenance; then preventive repair and replacement as preventive maintenance tasks. Every strategy requires examination of specially defined technical feasibility and effectiveness. It is important that the economnic criteria is taken into consideration only after the safety criteria (consequences of failures). If there is no possibility for preventive maintenance then corrective maintenance is performed which includes: corrective repair, detective maintenance for hidden failures or redesign.

When considering application of preventive maintenance for maintenance strategy selection, the first places takes examination of condition based maintenance possibilities, because those techniques are not destructive or invasive. Most often system operation does not have to stop in order to perform technical diagnostics. Finally, it has been proved that it is the most cost-effective and technically the best choice. Condition based maintenance creates the possibility to utilize maximum lifetime of equipment and act preventively at the same time.

If there is no possibility to perform preventive maintenance, there is a possibility to perform corrective maintenance. When there is equipment that does not have a direct or significant effect on the safety or critical state of mission performance, it can be repaired after its failure. Possibility to accept equipment failure risks is a basic condition for proposing corrective maintenance. If it is about hidden failure, then, most often, detective maintenance is applied. Detective maintenance is characteristic for protective devices, which fail without giving a signal of their failure.

The last alternative is redesign. When there is no reliable data or indications of failures and when dangerous consequences can not be tolerated, the suggestion is to change design or process functioning. It is logical that such a maintenance activity is put on the last place, because it is performed very rarely and opted for less often due to its high costs.

BRANCH II

A smaller group of significant systems, according to the Pareto principle fall into the branch presented under the number II. If maintenance defined with documentation and standard overhaul statements exists, then revision of the previous maintenance is suggested for 20-30% of ship systems and equipment that make 70-80% of maintenance costs. In such a case experience obtained from the previous maintenance would not be used. This means that if this maintenance was used as the starting point, a lot of time would be saved because no redundant analysis would be performed. It starts from the assumption that the previous maintenance covered all critical failures. Our warships have been in use for a long time. On most failures that occurred during that time and had not been preventively maintained, corrective maintenance has been performed in the sense that afterwards those failures modes have been preventively maintained. Since the goal is to keep the sub-systems performance and low costs of the maintenance, this previous maintenance strategy needs to be revised.

This branch also consists of two basic steps. In order to provide a detailed analysis so called *reversed FMEA* is used (Girdhar, 2001). It starts with the inventory of maintenance operations from the last maintenance program on the basis of which identification of failure modes of the stated maintenance operations can be performed. This is followed by the review of failure modes whereupon the existing and additional failure modes are estimated for their effects and consequences. After failures modes are identified, with their effects and consequences, maintenance strategy selection is made in the same manner, as is in the branch I. It should enable introduction of new strategies and thus improve the previous maintenance.

BRANCH III

For most of other systems, modified methodology has been modeled on the basis of *RCM,* but with some important simplifications that enable an increase in the speed of analysis and costs reduction (Dozier, 1996). For the purposes of this paper it has been called *generic maintenance on opportunistic proactive manner* and it is presented under the number III in the algorithm (Figure 1). The title for this branch of methodology for maintenance strategy selection for complex ship systems says that generic maintenance is applied to that 70-80% of ship systems and equipment that take up 20-30% of maintenance costs. It represents maintenance strategies chosen for generic groups of equipment or systems that work and are maintained under the same or similar conditions. Opportunistic means that it is applied where it gives the best results and where no analysis is required. Proactive manner means that improvement of maintenance systems in use is done and that activities based on *RCM* and *RCFA* methodologies are performed for the purpose of preventing problems in equipment operation.

Generic group represents same systems or equipment, for example, pumps, engines, etc. This concept may be applied if it refers to the equipment that has a similar design, similar failure modes and failure frequency and also if such maintenance has proved to be proper during a longer period of time. The object of research in this paper are Naval ships for which it has been determined that they have similar or the same operative context in complex ship systems. In such conditions, generic principle leads to the use of standardized procedures. They reduce efforts and costs of maintenance strategy selection, ensure uniform and consistent maintenance activities, facilitate an analysis of a group of systems, as well as create conditions for a more simplified provision of documentation for this equipment and systems.

CONTINUOUS IMPROVING PROCESS

When analysis is performed on all three-algorithm branches, the defined programme has to be tested in real conditions. On the basis of information on its implementation, its constant improvement can and must be done with various proactive maintenance techniques. This means that maintenance strategies selection made in one of the three manners is not constant and it is subject to changes during time so the last stage called a process of continuous improving has been foreseen.

EXAMPLE OF SYSTEM MAINTENANCE STRATEGY SELECTION THAT DID NOT HAVE A DEFINED MAINTENANCE

This paper will show results of the first pilot-project of maintenance strategy selection for sonar ship system (underwater electric locator) on frigate type “Kotor”, which has formerly been maintained in another Repair Facility. This means that certain operators experience in the system existed and they monitored maintenance and overhaul in the former period, which indicates that considerable experience in exploitation existed. Preventive maintenance of this type of sonar was one of conditions to docking the ship. This means that certain maintenance activities on this system had to be or could be performed only while the ship was in the dock. Since the extension of docking cycle is one of very important activities for cost reduction of ship maintenance, the analysis results represent the support for a possible decision of such a kind. Only analysis of antenna subsystem has been performed, whose maintenance previously required docking. Antenna part of the sonar has been placed below the keel line of the ship in the cupola made of a special rubber and enforced with a steel grid. Inside of the cupola are: high-frequency converter, low-frequency converter and cylindrical network of hydrophones of a broadband converter.

The analysis is performed according to *Branch I* that has two basic stages: modified *FMEA* and maintenance strategies selection against the complete *FMEA* methodology. Two primary functions of the analyzed part of the sonar system have been defined as well as four protective and safety functions. Upon functions definitions, it was relatively simple to define functional failures: five primary functional failures and six failures of protective and safety functions.

Defining failures modes and their effects require classic engineering knowledge since systematic analysis of failures is done and this is the phase which takes up most of the time of the analysis. In total, 41 failures modes have been defined. Every failure effect contains description of indications of an operator and a procedure of avoiding final negative effects. Then there are definitions what should be done to perform a repair, which should do it and what spare parts are required. It has been showed that several functional failures may have the same failure mode. Then all failure modes have been grouped and hardware parts-subsystems to which they refer identified.

After *FMEA* followed maintenance strategies selection against a developed algorithm in first branch. First of all, it has been stated that there are no legally regulated maintenance measures or procedures for this system. After that a rough separation was performed on the basis of an estimated risk for every failure mode. High-risk failures modes have not been identified. They have been eliminated by high reliability of the installed elements and robustness of the performance. Four failures modes with small risk have been identified. Other failure modes with small risk are not stated, because we judge only the failure modes with reasonable likely failures, those that have already been discovered and those prevented by the existing maintenance programm.

After that, for the remaining failure modes maintenance strategies selection has been performed against other algorithm points: first, group failures according to consequences that are showed in Table 1. It can be seen that most failures have system consequences.

Failure consequences	Total failure modes
Hidden – safety	2
Hidden- system	10
Safety	1
System	24

Table 1 Failures modes grouping according to consequences

Maintenance strategies were selected according to failure consequences and meeting of conditions of technical feasibility and effectiveness and then economy. Most of corrective maintenance activities exist predominantly for electronic components. Predictive activities have also been introduced which user provided for the purpose of extending the useful lifetime of a system. What was achieved is that docking is no longer required as a preventive activity, but only for the needs of corrective maintenance. Previous maintenance programme performed by other Repair Facility did not have that and several preventive activities were performed on the dock. Daily check-ups are not stated in the tables as separate activities and procedures defined in the basic user's documentation are used. In this programme operators received new maintenance tasks. Operators do a six-moth preventive testing which fits into the maintenance programme.

Strategy	Total strategies	Total failure modes
Corrective	10	12
Preventive	5	8
Predictive	6	9
Detective	2	2
Redesign	4	6

Table 2: Number and structure of selected strategies

Afterwards, selected strategies are grouped into maintenance programmes according to planned periods. Every selected strategy is from a technological point of view elaborated and written as a separate procedure. Corrective maintenance also has a worked out repair and replacement technology. The use of *FTA* method enabled creation of a diagnostic diagram for possible multiple failures, on the first place of compression systems, although there was no need for a more significant application of *FTA* method.

In this case, with the use of a detailed "screening", we carefully studied the system, identified critical failures and made maintenance procedures. What were created were conditions for maintenance performance by our own resources, an increase of reliability and availability after the period of predominantly reactive maintenance. Operators have for the first time been in a situation to participate in such an assignment. They showed maximum motivation after they have been introduced with the tools that offered them a possibility to view systems from the point of view required for the maintenance. This is why an increased safety in system exploitation may be expected.

EXAMPLE OF SYSTEM MAINTENANCE STRATEGY SELECTION WHICH HAD A DEFINED MAINTENANCE PROGRAMME

As an example of maintenance strategy selection for systems that did not have prior defined maintenance programm, other pilot-project for FCS-Fire Control System on missile patrol boat type "401" shall be presented.

Figure 2 shows scheme of block subsystems for fire control on ship automatic cannons A and B (which, in this case, are not the subject of analysis). The system consists of 25 blocks altogether. It is a very complex system that on the system level can define 16 basic system functions. The system is particularly convenient for maintenance. It consists of about 80% of typically electronic subsystem and components which require maintenance by modules replacement. Fault location is facilitated by built/in test equipment - *BITE* and functional control -*FC* programme.

The analysis is performed according to *Branch II* that has two basic stages: *reversed FMEA* and maintenance strategies selection against the complete *FMEA* methodology. According to manufacturers' documentation, maintenance strategies are divided into corrective and preventive maintenance alone. By documentation analysis and conversations with maintenance experts and operators, together 241

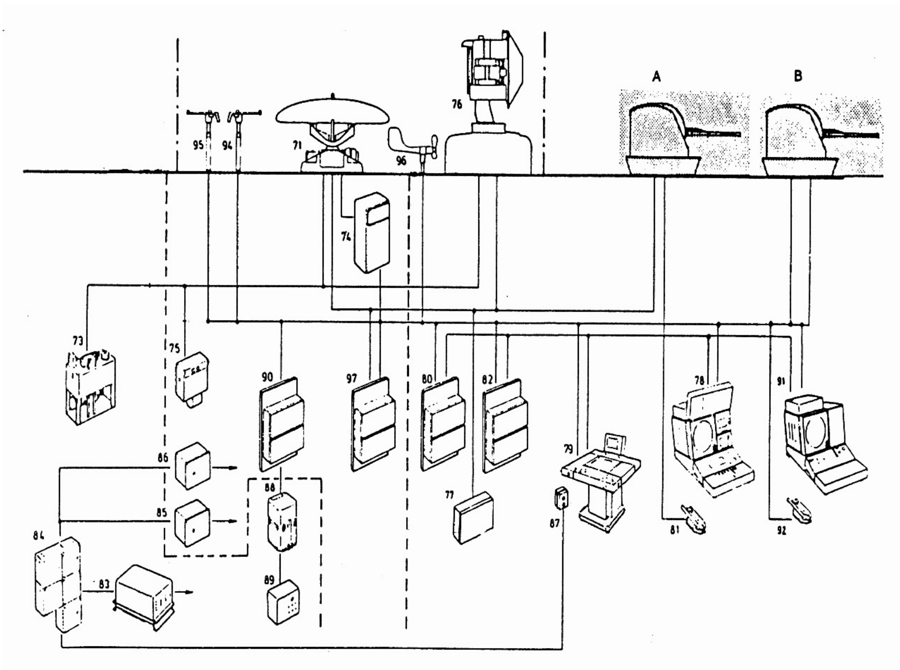

Figure 2. Scheme of FCS subsystems

corrective maintenance activities were identified. A manufacturer defined corrective maintenance as follows: after failure on module level has been localized by *BITE* or *FC* programme, follows replacement of malfunctioning module or component and after that repair of the module in the Naval Repair Facility. Concerning preventive maintenance, documentation defined altogether 73 preventive repairs, replacements or inspections. Some system components should be replaced regularly in accordance with the availability. On the basis of manufacturers recomendations the overhaul cycle of the system lasted only 6 years. Activities of a three-year inspection are already included in preventive control inspections whereas this was not so simple for the six-year overhaul thus special analysis was made. Overhaul included 70 maintenance activities that together with already mentioned 73 activities for the system in the overhaul cycle counted 143 preventive maintenance activities all told.

The last algorithm point is deciding on the maintenance strategy. Every maintenance activity was analyzed against the created algorithm for the selection of a maintenance strategy. For each of them was decided on the required elements: failure modes and failure consequences. For each of them was decided on the required elements: failure modes and failure consequences. A proposal was made that those failure modes which have been identified to meet specially defined effectiveness criteria and technical feasibility keep the previous strategy and schedule.

Strategy	Old Programme	New Programme
Corrective	241	218
Preventive	143	40
Predictive	0	35
Detective	0	3
Redesign	—	2

Table 3. Summarized revision results of FCS maintenance.

The biggest change was proposed in the overhaul cycle. It was suggested mandatory omittance of the overhaul as it was defined that the servo-system of antenna and directing element is sensitive to unnecessary disassembling. The use of technical diagnostics system was proposed: SPM, vibro-analysis, oil leakage inspection, oil analysis, parameter analysis against special programme and thermovision tasks. Thus, it can be said that instead of an overhaul composed of 70 overhaul maintenance activities now can be introduced 6 activities of predictive tasks. Directing elements and antenna's servo-system shall be disassembled only when there is need for such an activity. This created an opportunity to use its service life to the full.

Analysis of consequences of failure showed that some subsystems require redesign. Since these consequences have an impact on system functioning with evident or hidden failures, according to the algorithm in branch II, redesign in favorable and has to be economically justified. It can be stated that, from a technical point of view, the new maintenance programme is improved in comparison to the old one. If performed properly, an increased reliability and readiness of the system are expected.

For the purpose of comparing maintenance costs of the old and new manner, we used the norm of the Naval Repair Facility. It was taken that costs were calculated in average man hours (NH) for one overhaul cycle in duration of six years. It was decided that daily check costs were not included since they were performed by operators. They do it within their regular working hours so it does not incur additional costs. All other works are performed by specialists the Naval Repair Facility or special teams of experts from other companies. According to the old programme this cycle includes: 6 tasks on every six month (30 NH), 4 anual tasks (50 NH), one tasks on every three year (60 NH) and one overhaul (400 NH). Only prevention costs are taken into consideration without corrective maintenance which shall not be included in calculation. This leads to the number 840 NH. New maintenance programme requires 656 NH. In comparison to the old one it is obvious that the new one is cheaper for 22%.

What is interesting is to compare costs occurrence during the overhaul cycle. Figure 3 shows a period of 7 years (14 half-years) to point to the difference between the old and new programme. It is obvious that expenses per one group of preventive inspections are something higher but these relatively low costs are distributed linearly. In the old programme preventive inspections are cheaper but they have high costs during the overhaul. It is obvious from that aspect as well that new programme is more convenient than the old one.

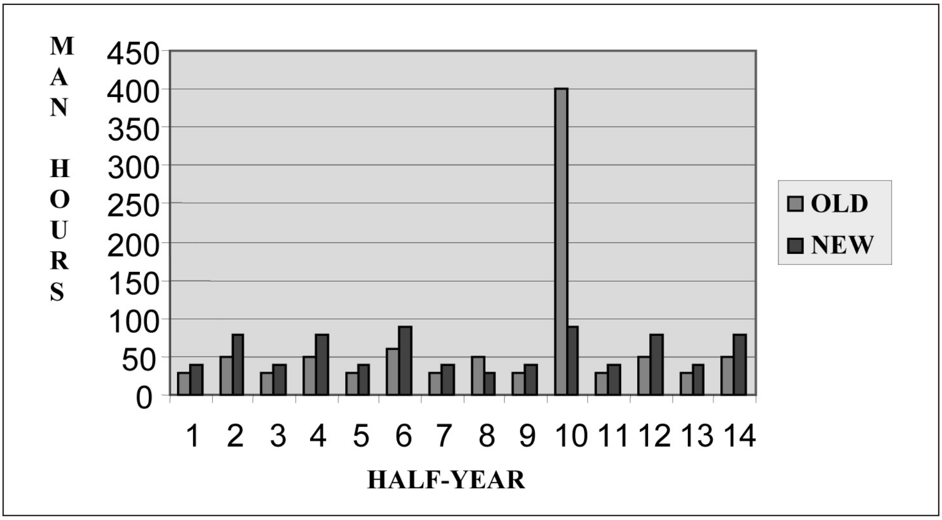

Figure 3. Comparison of maintenance costs of the old and new programme

Costs of detective maintenance activities are not included because they are performed by operators and are considered to be very simple activities. Costs of redesign are estimated to 540 NH of electronics engineer. Importance of FCS as a key combat system of patrol boat justifies the investment.

CONCLUSION

Pilot-analyses made on the basis of this model have showed its applicability and potential to reduce maintenance costs of Naval ship systems. There is no simple model for a big and complex item such as a war ship and only a detailed "screening" can make a significant profit. Since there are no required resources, a balanced approach has been made against the maintenance experience existence criterion and maintenance costs criterion. In this way conditions for achieving positive effects of the new methodology are created with relatively quick applicability. This is possible if an analytical team is well trained for the application of the new methodology and aided by the analytical software based on this methodology and diagnostics resources which create conditions for the application of condition based maintenance.

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CONTIGENCY PLAN FOR HYDROCARBON SPILLS IN THE PORT OF IBIZA

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ABSTRACT

The main objective of this work is elaborating a Interior Contingency Plan for a hydrocarbon spill in the Port of Ibiza (Islas Baleares, Spain), in adherence to the Royal Decree 253/2004.

Firstly, marine and land environment of the Port of Ibiza is located and described. Secondly, technical characteristics of the unloading point are established in Ibiza's Port, so that the installations and existing connections. Thirdly, main operations carried out in the zone and which could generate some risk are described. In the fifth place, an inventory of the available human and material means is done. In the sixth place, an Activation Procedure of the plan is established. Here, activation systems in front of a hydrocarbon spill versus the category of the accident and the answer level are described. The conditions which reach to the declaration of the End of the Emergency are defined. However, the plan is not possible to be concluded without previously doing a Revision of the carried out Actuations, so the Contingency Plan on the whole. The object of this revision is the detection of the possible failures for the improvement of future answers. Finally, is necessary to establish Training Programs for the personnel, so doing periodical simulations and exercises, including the bibliography recommended for this course.

Key Words: Hydrocarbon spill, Contingency Plan, Simulation Models, Port of Ibiza.

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INTRODUCTION

Petroleum and its by-products are one of the most important sources of sea pollution mainly due to tanker accidents, oil extraction or load and unload docks. This fact is related to the great demand of these products nowadays. When an oil spill occurs so in the sea as in the land, the hydrocarbons which constitute the crude or the spilt mixture are affected by atmospheric agents (wind, temperature, solar radiation,…) and the physical chemistry properties of the hydrocarbons which constitute the crude oil or the mixture.

If the spill occurred in the sea, it would be also necessary knowing the swell and marine currents which make changes in the physical properties and displace hydrocarbons with the consequent increasing of the spill area. The total of these phenomena is called ageing.

Parallely to the ageing processes and for minimizing the effects of the hydrocarbon spill on the environment, a series of external actions for hydrocarbon retaining and recovering and for the cleaning and restoration of the affected areas (Bergueiro and Moreno, 2002). The total of these external actions are part of the Contingency Plan (Bergueiro and Domínguez, 2001; Bergueiro et al., 2004). Equally, the concretely prediction of every black tide, that is, the area, the place where it will go, the intensity of every ageing phenomena, … is tried to be predicted with the aim of minimizing the environmental impact with the minimum quantity of sources. This objective could be reached by the simulation models, which are computerised programmes connected to data banks with properties of the different crude oils and with climatic and geographical characteristics of the area where the spill occurred.

METHODOLOGY

Location of the probable spills

The first step is knowing the main oil tanker routes which surround the studied area, the main ports where hydrocarbons are unloaded, the kind and characteristics of them, the frequency with that the oil tankers pass, the transported tonnage, the predictable meteorological conditions and the kind and characteristics of the coastal areas susceptible to be affected by the spill.

Once the main oil tanker routes where spill could occur are known, the other conflictive point where the spills could occur is in the unload terminal in the Port of Ibiza.

Operations in the unload terminal

The main operations in the Port of Ibiza are the crude by-products unloading which are used in the means of transport which, by means of pipes are transported to the factory of the Logistic Company of Hydrocarbons (CLH) located in Ca Na Glaudis. Fuel is directly unloaded from the tanker to the power station of GESA. If need be, fuel could be pumped from the tanker to the CLH installations and, from there, to the power station of GESA.

The 99% of fuel's consumption in Ibiza is for GESA (power station) and for the desalination plant of sea water.

Analyzing the activities in the mooring quay, it could be concluded that the most probable accidents which could occur were:

— Breakage of the unloading arms of hydrocarbons.
— Breakage of transportation pipes and/or impulsion pumps between the mooring quay and the factory in Ca Na Glaudis.
— Supply of fuel to the tankers.
— Cleaning operations of tanks and elimination of residues.
— Accidents during the operations of mooring place.

These operations are the main reason of hydrocarbon spills in the terminal. Consequently, it is necessary the elaboration of an Interior Contingency Plan for this area.

The oil tankers which habitually supply the fuel to the island of Ibiza are: Mar Rocío, Alcudia and Castillo de Trujillo.

DEVELOPMENT

Identification of the areas susceptible to hydrocarbon spills in the island of Ibiza

According to the Royal Decree 253/2004 of 13 of February, the first step for the elaboration of the Interior Contingency Plan is the identification of those areas that, due to the activities in these areas, are highly susceptible to suffer a hydrocarbon spill. Areas susceptible to hydrocarbon spills near the unloading terminal which CLH has in the island of Ibiza must be identified and classified. It is expected to obtain a list from this classification of all the areas where the spill could be diverted to know the environmental impact and the necessary means for minimizing this impact. Equally, all the necessary means for the spill treatment and restoration of the polluted environment could be known. The susceptible areas which could be affected by a hydrocarbon spill in the unload-

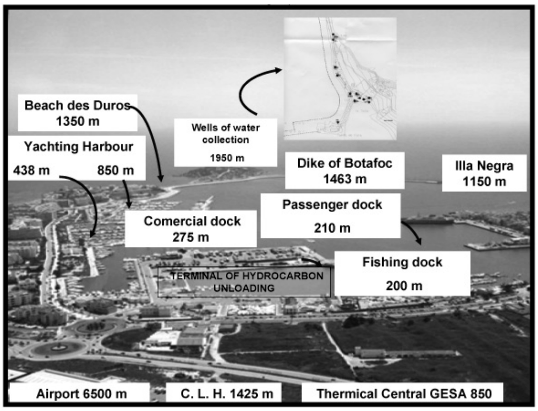

Figure 1. Main areas susceptible to be affected by the spill and their distance to the unloading hydrocarbon Terminal.

ing Terminal are mooring quays of passenger ships, mooring docks for the pleasure boats of the yachting harbour, just as the Beach des Duros, the points of water collection and the city of Ibiza (Figure 1).

Kinds and quantities of hydrocarbon unloaded in the port of Ibiza

The products consumed in the island of Ibiza could be classified in four great groups:

— Petrol DE 95, 97 and 98 octanes.
— Aviation gas (light aircrafts) called 100 LL.
— Aviation kerosene called JET A-1 (jet planes).
— Diesel oils A, B y C.
— Fuel oils: Fuel oil nº1 and Fuel oil BIA (Low Index of sulphur).

Quantities unloaded during 2005 in the Port of Ibiza, from where it is transported to the Island of Formentera, just like the ones unloaded in all the Balearic Islands during 2004 are shown in Table 1.

PRODUCT	UNITS	IBIZA AND FORMENTERA	BALEARIC ISLANDS
Gasoline 95	Lts.	44222165	308159285
Gasoline 97	Lts.	2063593	8278166
Gasoline 98	Lts.	4224985	41212863
Avgas 100LL	Lts.	161030	713079
JET A-1	Lts.	65176940	583093916
JP-8	Lts.	0	1814108
Crude Oil	Lts.	0	13907
Diesel Oil A	Lts.	52423446	462256443
Diesel Oil B	Lts.	14593784	103120732
Diesel Oil C	Lts.	24977527	479382251
TOTAL	Lts.	207843470	1988044750
PRODUCT	UNITS	IBIZA AND FORMENTERA	BALEARIC ISLANDS
Fuel Oil BIA	Kg.	0	112465720
TOTAL	Kg.	0	112465720
TOTAL	Lts./Kg.	207843470	2100510470

Table 1. Kinds and quantities of hydrocarbons unloaded in the Balearic Islands during 2005

Meteorological and geographical conditions in the port of Ibiza

Values of direction and intensity of the wind which could affect to a hydrocarbon spill in the Port of Ibiza were obtained in the meteorological station in the

Ibiza's Airport, property of the National Institute of Meteorology (INM). The average of velocities and directions predominant per months and seasons are shown in Table 2.

MONTH	WIND DIRECTION	WIND VELOCITY AVERAGE (km/h)
JANUARY	SW/W/NW	8.1/13.7/7.2
FEBRUARY	SW/W/NW	7.5/12.2/8.1
MARCH	E/SW/NW	11.6/7.6/6.8
APRIL	SW/W/NW	8.0/12.1/8.4
MAY	E/SW/NW	11.1/7.6/6.6
JUNE	E/SW/NW	11.9/7.6/6.0
JULY	E/SW/NW	11.7/7.1/5.4
AUGUST	E/SW/NW	11.9/6.7/5.4
SEPTEMBER	E/SW/NW	12.0/8.1/5.7
OCTOBER	SW/W/NW	7.7/10.1/6.1
NOVEMBER	SW/W/NW	9.7/12.9/7.7
DECEMBER	SW/W/NW	8.6/13.2/7.3
SEASON	WIND DIRECTION	WIND VELOCITY AVERAGE (km/h)
SPRING	E/SW/NW	11.5/7.7/7.3
SUMMER	E/SW/NW	11.8/7.2/5.6
AUTUMN	SW/W/NW	8.4/11.5/6.6
WINTER	SW/W/NW	8.1/13.2/7.5

Table 2. Direction and velocity average of the wind in months and seasons

Simulation models of hydrocarbon spills in the sea

— Simulation models EUROSPILL and OILMAP were used to the simulation of the different spills in the Port of Ibiza.
— By means of these models, next parameters were set:
— Possible trajectories which could follow the hydrocarbon mixtures.
— Possible coastal areas which could be affected.
— Variation depending on time of the spilt emulsioned and deposited in the coast quantity.
— Variation depending on time of the area and thickness of the spill, diameter and length of the stain.
— Variation depending on time of the density, viscosity and flash point of the spilt hydrocarbon mixture.

A total of a hundred and eight simulations with petrol, aviation kerosene JET A1 and diesel oil have been done. The spilt quantity is 12500 l, maximum quantity that, theoretically, could be spilt from the oil tankers which unload fuels in the Port of Ibiza.

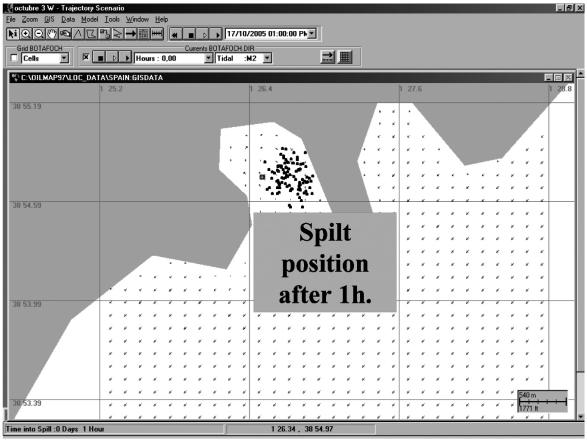

Figure 2. Spilt position after 1 hour.

As an example, a simulation for every one of the models mentioned above has been selected. In the case of OILMAP, a simulation did in the interior of the Port of Ibiza considering a spill of 12500 l of Diesel Oil C has been selected. Currents are typical in the area and the wind velocity is 3 m/s in the West direction (Figures 2 and 3).

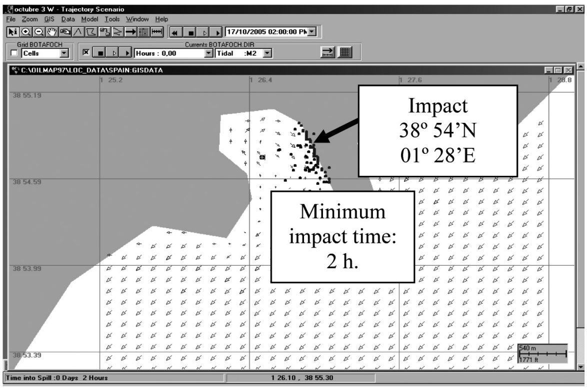

Figure 3. Spilt position after 2 hours.

The impact point is located at the geographical coordinates 38º 54' N and 01º 28'E (Figure 4).

Referring to the EUROSPILL model, one of the simulations did in the environment of the Island of Ibiza is shown. A spill of 100000 tonnes of Arabian Light oil come from the refinery of Tarragona is considered. The initial coordinates of the spill are 38º 50'N y 01º 50'E, considering typical marine currents of the area and a wind of 3,3m/s in East direction. (Figures 5, 6 and 7).

The coordinates of the impact point are 38º 86'N and 1º 93'E, belonging to the beach Es Cavallet, very near to the Natural Park of Ses Salines. The minimum impact time is 130h.

Antipollution means available in the island of Ibiza

In the surrounding area of the Port of Ibiza, the next antipollution means are available:

— Two barriers FENCE BOOM 61m long, placed in the CLH factory and the power station GESA.
— A barrier SENTEC/TROIL BOOM 500 m long, in the CLH factory.
— One skimmer VIKOMA-KOMARA with a recovery capacity of $12m^3/h$, located in the CLH factory.
— Barriers and adsorbent blankets located in the CLH factory.
— 2000l FINASOL OSR-2 dispersant, located in the power station of GESA.
— 10000l FINASOL dispersant in the unloading terminal of the port.

In the case of a emergency, it could resort to the antipollution means that CLH and GESA have in the Port of Palma de Mallorca and its installations and the ones which the State Society of Maritime Rescue and Security has in Madrid.

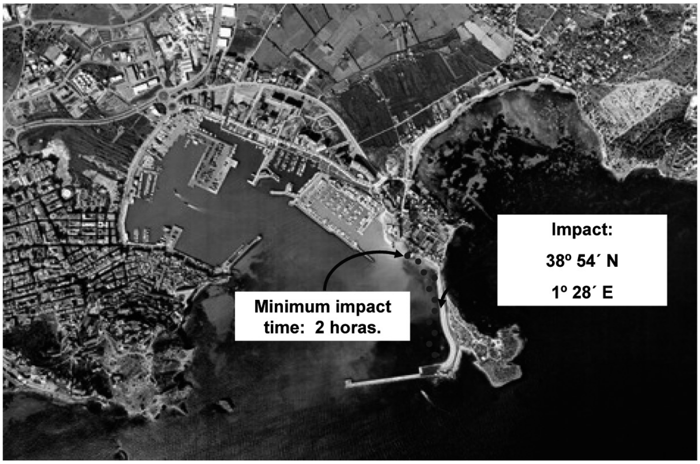

Figure 4. Location of the impaoint and minimum impact time to the coast.

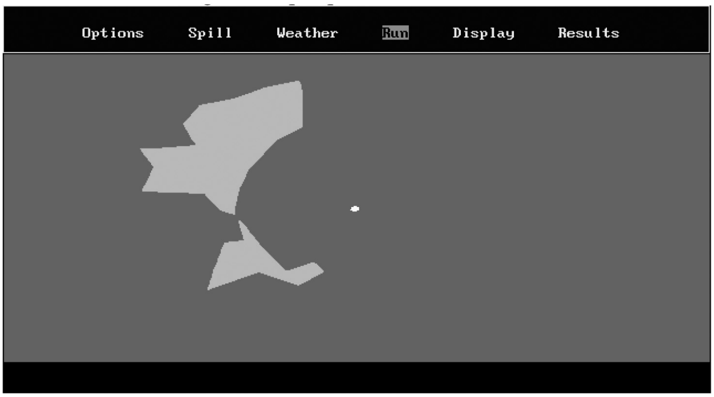

Figure 5. Spill position after 1 hour.

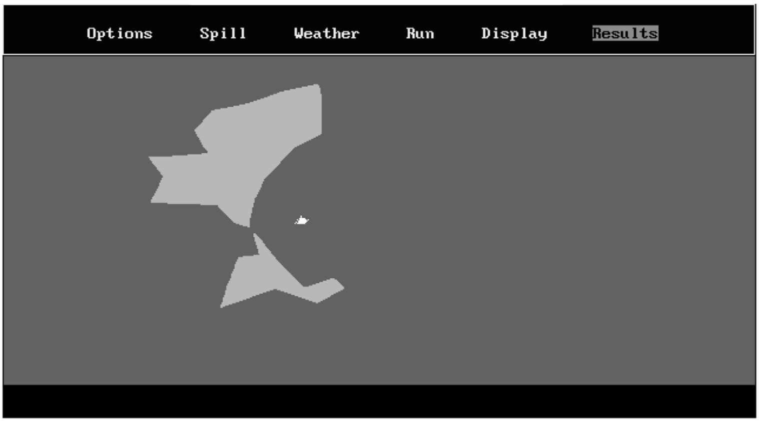

Figure 6. Spill position after 80 hours.

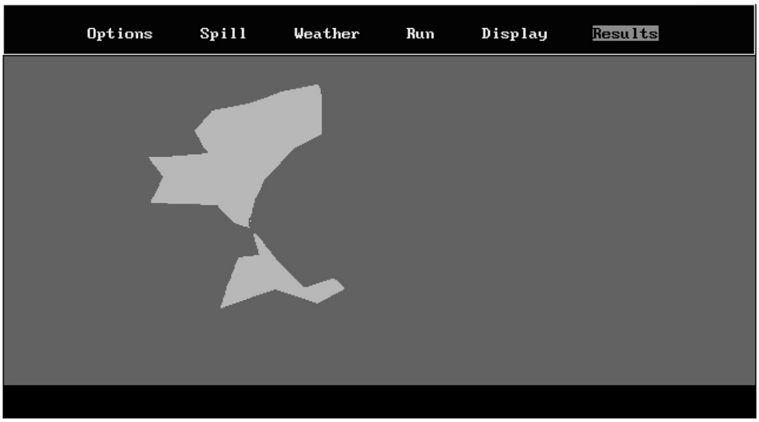

Figure 7. Spill position after 130 h, when the spill reaches the coast.

CONCLUSIONS

1. An Interior Contingency Plan is expected to be done for the CLH dock in the Port of Ibiza, applying the Royal Decree 253/2004, of 13 of February, which establishes the prevention measures and the fight against the pollution in the loading, unloading and hydrocarbon manipulation in the marine field.
2. The Interior Contingency Plan must be fast and easy to access, so a computerised medium containing updated databases belonging to the information needed for combating a spill is pretended to be developed.
3. The oceanographic and meteorological conditions predominant in the area would be detailed.

4. The main operations in the dock, the main kind of hydrocarbons unloaded with their belonging manipulated quantities are described.
5. Simulation Models are computerised systems that allow the determination of the most probable trajectory of a spill depending on the oceanographic and meteorological conditions.
6. As well as the simulation models, the location of the susceptible areas of impact and the minimum time is pretended. Because of this, models allow the estimation of the answer time for combating the spill in the impact area and taking the most suitable measures depending on the environmental characteristics of this area.

ACKNOWLEDGEMENT

Authors are grateful to the Ministerio de Educación y Ciencia for financial support TRA2004-02460/TMAR project titled "CARACTERIZACIÓN DE ZONAS REFUGIO PARA BUQUES SINIESTRADOS QUE TRANSPORTAN HIDROCARBUROS: APLICACIÓN A LAS ISLAS BALEARES".

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PLAN DE CONTINGENCIA ANTE UN VERTIDO DE HIDROCARBUROS EN EL PUERTO DE IBIZA.

Resumen

El objetivo principal de este trabajo es el de elaborar un Plan Interior de Contingencia, para el puerto de Ibiza (Islas Baleares, España), ante un vertido de hidrocarburos, de acuerdo con el Real Decreto 253/2004. Inicialmente, se describe todo lo referente al medio ambiente terrestre y acuático de dicho puerto. Seguidamente, se describen las características de la zona de descarga de derivados del petróleo, al igual que las instalaciones y las conexiones existente con la zona de almacenamiento. En tercer lugar, se indican las principales operaciones de carga y descarga, los riesgos que de las mismas puedan derivarse y los medios materiales y humanos disponibles. Se establece el procedimiento de activación del plan desarrollado. En este punto, se describe el sistema de activación frente a un vertido de hidrocarburos en función de la categoría del accidente y del nivel de respuesta. No obstante, no se puede finalizar el plan sin una revisión de las actuaciones realizadas para detectar los posibles fallos para tenerlos en cuenta en futuras aplicaciones. Finalmente, es necesario establecer cursos de formación, incluyendo simulaciones y ejercicios periódicos, para el entrenamiento del personal. En dichos cursos, y como complemento, deberá recomendarse la bibliografía más actualizada.

INTRODUCCIÓN

Las principales causas mediante las cuales crudos de petróleo y productos derivados pueden derramarse en el mar incluyen los procesos de extracción, el transporte y las operaciones de carga y descarga de los mismos. Con el objeto de minimizar el efecto de los hidrocarburos en el medio ambiente, es necesario tomar una serie de acciones externas encaminadas a la contención y recuperación de la mayor parte de los hidrocarburos derramados (Bergueiro y Moreno, 2002). Todas estas acciones se deben contemplar prioritariamente en el Plan de Contingencia (Bergueiro y Domínguez, 2001; Bergueiro y otros, 2004). La trayectoria seguida por los hidrocarburos se puede estimar mediante modelos de simulación.

METODOLOGÍA

Para la elaboración del Plan Interior de Contingencia del puerto de Ibiza, se han analizado los datos de vientos y corrientes marinas, parámetros indispensables para la alimentación de los modelos de simulación mediante los cuales se pueden obtener las diferentes trayectorias de los vertidos planteados. De esta forma se podrá determinar, en función del tiempo y de la cantidad y tipo del hidrocarburo vertido, los siguientes factores: longitud y anchura del derrame, cantidades evaporadas, dispersadas y emulsionadas, coordenadas del centroide del derrame y el punto de impacto en la costa. De igual forma se determinará el tiempo mínimo de impacto.

DESARROLLO

El inicio del estudio se centró en la descripción de las áreas de importancia socio-económica que podían ser susceptibles de contaminarse por un vertido. Las mezclas de hidrocarburos simuladas fueron gasolinas de automoción, queroseno de aviación Jet A1, gas-oils y fuel-oil BIA. Las condiciones meteorológicas que afectan a los diversos vertidos se obtuvieron del Instituto Nacional de Meteorología, clasificadas por meses y por estaciones, con datos de direcciones predominantes y velocidades medias. Se han realizado 108 simulaciones de vertidos de 12500 litros de hidrocarburos, mediante la utilización de los modelos OILMAP y EUROSPILL. Bajo el efecto de un viento de 3 m/s que sopla en dirección oeste, y tomando como origen del vertido la zona de descarga en el puerto de Ibiza, el vertido tarda dos horas en impactar un punto de la costa de coordenadas 38º 54' N y 01º 28' E.

CONCLUSIONES

1. Se ha desarrollado un Plan Interior de Contingencia para el puerto de Ibiza, de acuerdo con el R.D. 253/2004.

2. El Plan Interior de Contingencia permite acceder a un sistema informatizado que contiene la información necesaria para prevenir y combatir los derrames de hidrocarburos.

3. Se indican las condiciones meteorológicas y oceanográficas predominantes en el puerto de Ibiza y se describen las principales operaciones de carga y descarga de hidrocarburos y las cantidades de los mismos.

5. Mediante los modelos de simulación EUROSPILL y OILMAP, se han obtenido las trayectorias más probables que seguirán diferentes vertidos, bajo condiciones meteorológicas y oceanográficas diversas.

6. Del análisis de las trayectorias obtenidas con los diferentes modelos, se determinaron las áreas de costa susceptibles de ser afectadas por los vertidos y el tiempo de impacto mínimo de los mismos. En base a lo anterior, se pueden estimar las medidas y los medios necesarios para combatir un derrame que ha impactado en un área concreta.

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THE OPTIMUM TRACK USING THE CLASSIC METHOD WITH THE HELP OF A PERSONAL COMPUTER

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ABSTRACT

The main objective of this paper is to announce the impossibility of applying on board the classic method for finding the optimum track depending on wave predictions for the ocean in the following 5 days. This method is the only one intended to be used by mariners on board a ship. Using 120 hours wave prediction the authors consider that the amount of calculations to find the optimum track is so extensive that the method is impracticable without the help of a personal computer. It has been developed one computer program that allows a successful solution to the problem.

Key Words: Optimum track, weather routing, computer aided navigation.

INTRODUCTION

The optimum track between two maritime harbours is always the fastest. For great ships the fastest track is the safest from a meteorological point of view. According to the accurate modern methods of navigation only the waves can deviate a powerful vessel from her track. The wind only plays a role related to the size of waves that is capable of generating. Winds of short duration or winds blowing over a small sea area are irrelevant for long sea tracks of the powerfully propelled modern mer-

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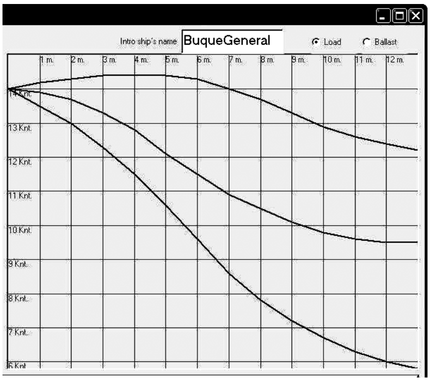
chant vessels. Development of high seas requires strong and persistent winds blowing over a vast ocean area. For many years, sailors can get waves prognosis for the following days of their track. These prognoses are developed by meteorological services all around the World. These predictions are made up by the effort of some thousands of professionals working for "World Meteorological Organization". Modern merchant ship's Captains use this facility intending to find the optimum track, but as we are going to explain in this article this is a work too laborious to be done without the help of a computer. Ship's Captains trying to find an optimum ocean track have worked in very different manners along the history. At the beginning of the millennium, navigation too far away from the coast was very dangerous and that's why the optimum track was always along the coast. The knowledge of general atmospheric circulation from the point of view of the sailor elapsed more time than geographic skills. Since XVI century, with better meteorological skills, oceanic sailors began to choose the best track between various ones. The paramount of these ancient navigators were the captains of the merchant vessels propelled by means of the wind that sailed last time at the beginning of XX century. These vessels transported wheat from Australia to Europe during the years between both world wide wars trying to compete with mechanic propelled ships that were already leading oceanic transportation. They completed the voyage to Australia in around 80 days of navigation and came back to Europe in around 90 days. These great sailing ships followed tracks based in climatology, what means that they sailed by areas with constant sea wind all around the year. They were not optimum tracks since weather prediction at sea like today did not exist. The navigator dead reckon his track based on his own skills and personal experience. Nowadays ship's captains can sail with full meteorological information. Still this way of navigate is not by optimum track. Although they can use 120 hours weather prediction, calculations to get the optimum track are too much simplified on board even we could say that they simply dead reckon their optimum track. To be continued we explain why.

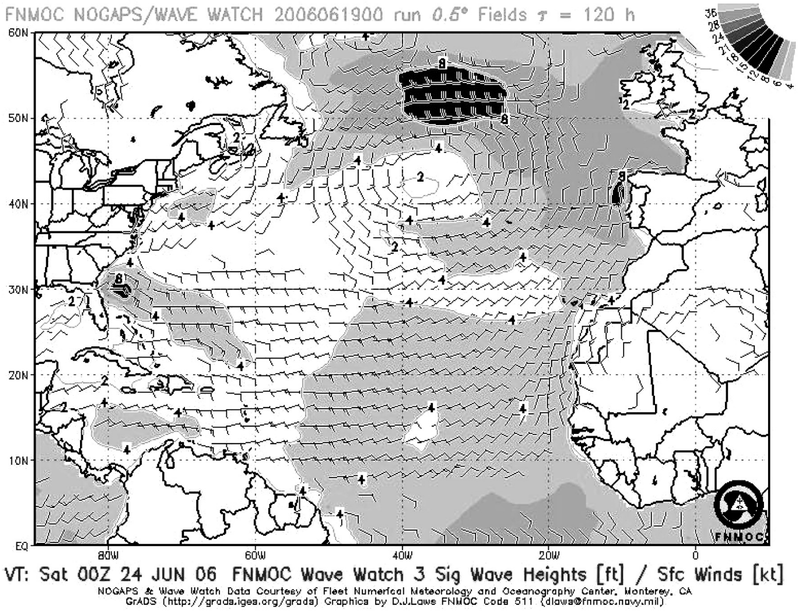


METHODS

Classical methodology for drawing optimum tracks by means available on board a merchant vessl.

We begin to work with maps of wave's prognosis for the following 5 days. Once we have an idea of the height and direction of waves that will affect the track of our ship, the Captain can calculate the reduction in ship's speed using graphics with curves of maximum ships speed in function of height and angle upon the bow of the waves. In the attached graph the curves represent the maximum speed that one ship can sustain in waves. There are three curves for cero, 90, and 180 degrees of waves coming from the bow respectively. The construction of these curves can be done from the experience at sea or just the calculations carried out during ship's construction. The curves are different for every ship condition (ballast, full loaded) or even the cleaning condition of the hull.

Another set of data that sailors need for their calculations are the prediction of the height and direction of waves that the ship could encounter in her voyage. These prediction charts can be obtained by radio facsimile or from INTERNET or Satellite Comms.



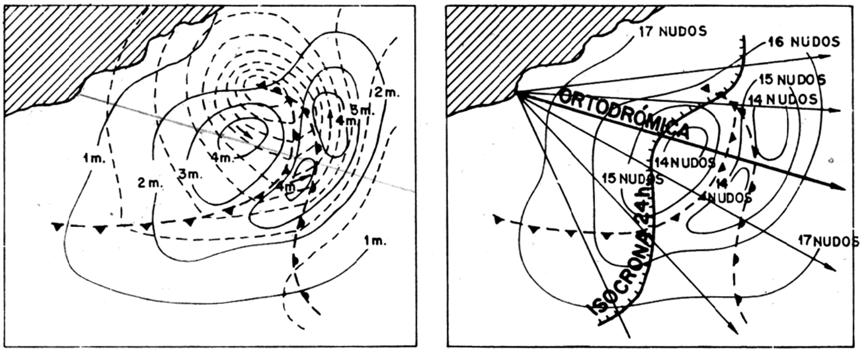
In the attached sample the height of significant waves and the bearing of the winds that produce those waves can be read. This prediction is for 120 hours in advance and can be obtained even for 144 hours.

With all this information, the sailor can afford optimum track calculations by classical methods but we will see in this article that it is not an easy matter. Next are included literally, as an example, the instructions given by the most well known Spanish classical books. Although it is a text published 30 years ago, it continues to be a reference book due to its good reception between mariners in Spain. This book is named "Meteorology and Oceanography Course" by Sánchez Reus y Zabaleta

Vidales. In the last chapter of this book, what we call the "classic method" is explained and it can also be found in other publications of same date and even modern ones.

"…. It has been already said that the basic tools of this method are maps of wave's prediction for a long period of five days in advance.

The second step consists in the conversion of wave-height isopleths into ship's speed isopleths…

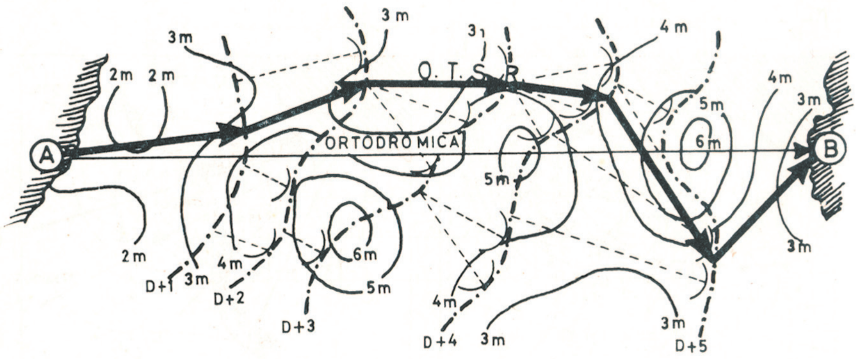


On the left side of the attached figure is drawn a depression with broken lines as isobars and with full lines as isopleths of waves heights. On the right side the isopleths of wave heights have been transformed into isopleths of maximum speed for a determined vessel.

The next step consists in the drawing of the optimum track (O.T.S.R.) itself. The problem is very similar to the track followed by a light ray running through a variable refractive index material which consists in _the shortest track as well.

Also on the right side of the same figure it has been traced several tracks from departure point with the ortodromic track in the middle and calculated over them the distance sailed in 24 hours depending on the maximum speeds allowed in function of waves. The resultant points found are drawn at the figure and joining them one isochrone for the first day of the voyage is obtained, that is to say, every position that the vessel can reach after 24 hours navigating. To obtain the isochrone for the second day of voyage several points along the first isochrone must be chosen and arcs of isochrone for the next 24 hours traced and then covering them to obtain the second day final isocrhrone. Repeating these ways of work are obtained isochrones for all the following days of the voyage, as it is shown in the next attached figure."

If we bear in mind successive sea conditions found by our ship, it is evident that she will not reach any place more far away than isochrone for first day of voyage and similarly will be other isochrones for the next days. Consequently, the optimum track, that is to say, the track that allows our ship to travel more distance in the same



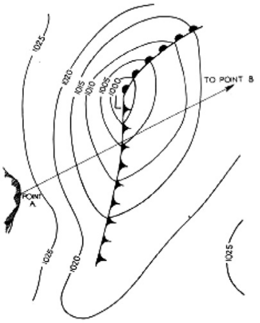
time amount will be logically the one that links longest distances between successive isochrones. We intend to clarify all this, looking at the figure attached.”

This text has been translated from a Spanish academic book. This method is similar to the one included in other classic texts as, for instance, the Meteorological Office in 1967 (See references).

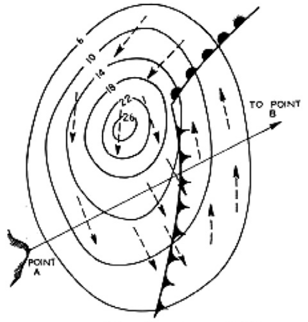
“In order to get the best advantage out of weather routeing, it seems almost essential that the ship should have a facsimile receiver on board so that the Master can have, readily available, a regular series of analysis and prognostic maps of surface weather conditions and of waves. Armed with these, and with the regular written bulletins that are issued by radio, the Master should be in a good position to interpret the advice given him by the meteorologist and, to confer with him by radio about it as necessary.

It does not seem very likely that the weather routeing described above will be extended to oceans other than the North Atlantic and North Pacific, due to the relative sparseness of the meteorological information available (e.g. from ship reports) in the other oceans.

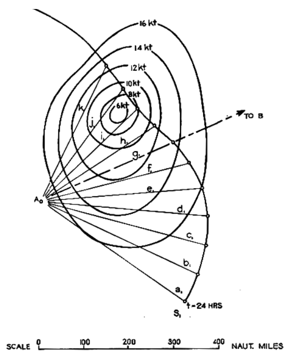
It seems, however, that the modern shipmaster, if he has kept his meteorology up to date and if his ship has a facsimile receiver so that he can have before him actu-



Surface weather chart along track AB



Wave chart along track AB
Wave-height isopleths in feet.



Example of least-time track, first day’s travel
Isopleths are ship’s speed, straight lines are possible tracks.

al and forecast maps of weather and waves, aided by the radio weather bulletins and climatic and ocean current data which are at his disposal, should be able to do his own weather routeing in a simple or modified form fairly effectively."

The practice of these classic methods is almost impossible without the help of a computer. To convert isopleths of wave height into isopleths of ship's maximum speed can be done for a few geographic positions but not for the necessary ones to calculate isochrones for the following 5 days of oceanic voyage.

The classic method of isochrones only can be applied in a simplified way. The next table shows the work that a good navigating officer can carry out before the ship starts her ocean voyage.

Day	Track	Sea	Wav. ang	Wav. Height	Max. Speed	Dist.	Track	Sea	Wav. ang	Wav. Height	Max. Speed	Dist.
1	ort	WNW	30	3.5	12.3	295						
1	lox	WNW	40	4.5	11.4	274						
1	merid	W	30	5.5	10.6	254						
2	ort	WNW	30	2.5	12.8	307	Dev. To S	WNW	25	2.7	12.8	307
2	lox	W	20	3.0	12.4	298	Course to aprox a middle position between ortodromic and loxodromic.					
2	merid	SW	0	5.0	10.5	252						
3	ort	W	20	7.5	8.7	209	Dev. To S	W	25	5.5	10.6	254
3	lox	W	30	5.5	10.7	257	Course to a position close to loxodromic but more south					
3	merid	WNW	40	3.0	12.7	304						
4	ort	WSW	10	3.0	12.4	298						
4	lox	N	120	2.5	13.8	331						
4	merid	NNE	140	3.0	13.9	334						
5	ort	NW	70	3.5	12.8	307						
5	lox	NW	50	4.5	12.0	288	Var. N	NW	40	4.0	12.2	293
5	merid	WSW	0	5.5	10.2	245	By ortodromic track to destination					

In the column "Max. Speed" the officer introduces the maximum speed that the vessel can hold for a given wave height and the angle from the bow that waves are predicted to be coming. Previously the officer has judged a mean waves height that can be encountered for every one of the first five days of the voyage. This work has to be done for the ortodromic track, loxodromic track, and for one more track that goes closer to the earth equator (here called meridional track). This last one is a track that goes closer to the Equator than loxodromic itself. What is intended is to avoid bad weather areas and for that purpose it is a better practise to approach subtropical anticyclones as much as possible. The column labelled as "Dist." is easy to calculate. The column "Sea" (direction from where wind waves are coming), must be reckon just watching waves prognosis charts. The same procedure must be carried out to get column labelled as "Wave Height". The column "Wave Angle" is the angle formed by the waves and the ship's course. This calculation must be done for every of the three tracks. Once this work is done for the whole left side of the table, maybe it is possible to find a fourth track that, going between any two of the main three, could be the better one. So it can be observed that the second day the ship's course can be modified by 5º degrees to port and so can be avoided the worst waves size that affects ortodromic track by the third day. Later on the track will continue close to loxodromic until the arrival. What we have done is just to find out another new track that starting from ortodromic by second day just avoid big waves on the third day at the ortodromic. It is important not to alter the initial course too much since advantages in speed could be compensated by lengthening of total voyage distance. Distance to arrival position is the most important item. It is not intended to get only a faster speed but to approach to destination sooner. This is not the same meaning. To complete the finding of a track using this simplified optimum track method, we estimate a work length of at least two hours for a well trained sailor. This procedure is based in a lot of estimated data but if weather prediction is good the resulted track will be good as well.

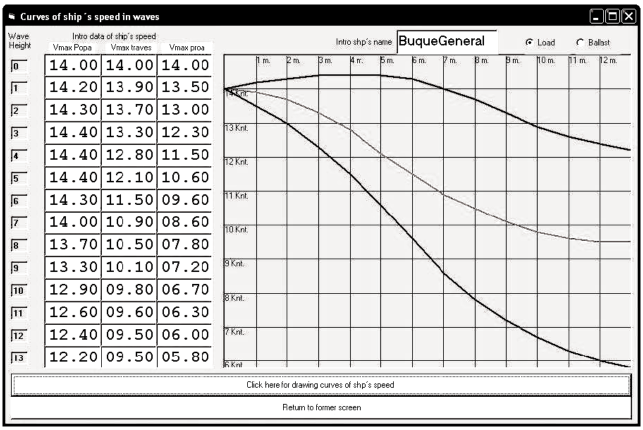
Modern method for following an optimum track

Every modern method is based in numerical calculations applied from wave grid data from meteorological centres. The flux of numerical data must be analyzed with a computer and to do it there are several algorithms. This type of methodology presents advantages clearly proved. But from the point of view of the maritime sailor it has one important objection. This objection is that the ship will not sail the track as her master would like to sail it.

Development of the classic method but with the help of the computer.

It is the method of isochrones by classic teaching books already reviewed in this article. With the help of the personal computer the work can be done in a few minutes following the next steps:

1 The data regarding to maximum speed of the ship depending on wave height and direction are loaded into the personal computer memory. These maximum speeds can vary depending on loading conditions of the ship. Accordingly the computer program must allow to modify this input data. (the closest figure shows one screen capture)



2 The sailor gets the charts of sea state prediction for the following 5 days.

3 Studying those wave prediction charts the sailor introduces data into the following table:

To do this work it is easier drawing the three tracks over the wave charts and so estimate a mean wave height and direction for every day at the position the ship will be at the same time predicted for every chart. It is not an easy task but it is the minimum work to do if we really want to have a simple idea about the sea conditions to be found ahead for every one of the three tracks and, of course, just only in case of the weather service prognosis is good enough

4 With former data completed and departure-arrival positions and times also introduced, the computer makes the calculations and delivers the following results:

— Ship's position at noon estimated for the following 5 days in lox-ort-meridional tracks.

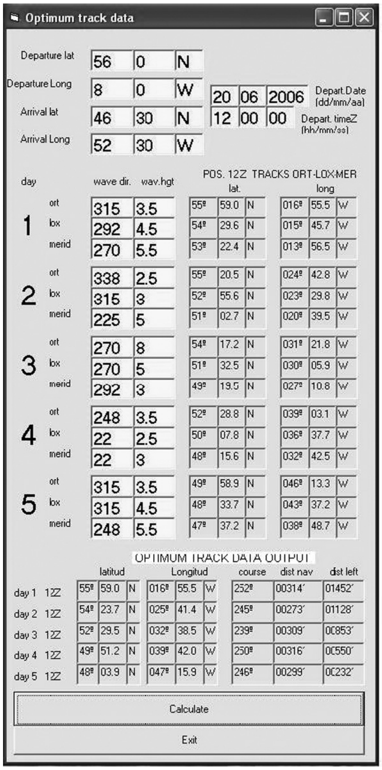
— Ship's position at noon of the optimum track for the following 5 days as well as every course, distance sailed and distance to sail to destination for every of the following 5 days

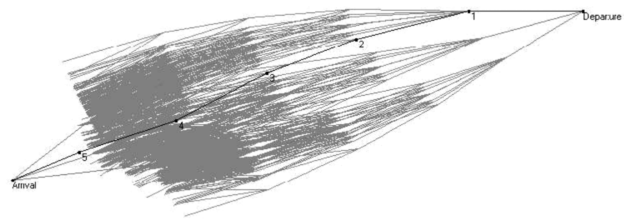
— One graphic showing the whole tracks calculated to find out the optimum track delivered.

The next figures attached are the two computer screens with data above mentioned:

Methodology applied for calculations

Once the following data: departure lat-long, arrival lat-long, departure time-date, and height and direction estimated for waves in the following 5 days is input, the computer extracts from its memory the maximum ship speed for the three initial tracks (ort-lox-merid) and so computer knows lat-long estimated at noon for the following 5 days. Next, it calculates from lat-long of first day in the three tracks other 3 new tracks altering course to port and starboard just the amount of degrees corresponding to the difference between ortodromic and loxodromic tracks. From the second day, the computer calculates again other 3 tracks from every point found in the first day, so we have now 9 new tracks from ortodromic, 9 new tracks from loxodromic and 9 new tracks from meridional track. For the third day, it works in the same manner and so are found 27 new tracks from ortodromic, 27 from loxodromic, 27 from





meridional. Finally for the fourth day there are 81 new tracks for every one of the three initial ones already mentioned. Completed this first cycle of calculations, it is repeated again but altering course to port and starboard an amount of the half of the initial quantity of degrees. Finally it is repeated one more time with a third of the initial course alteration. Completed the 3 cycles of calculations, the computer knows the data regarding 729 tracks between departure and arrival positions. Only one of these tracks is the optimum track. It is the one that in day 5 reaches a position that is closest to arrival position. In the attached sample, the optimum track can be observed black painted. Computer is essential to perform this amount of calculations. The angles upon the bow of the waves are different for every one of the 729 tracks and so it is the ship's speed.

This method can be applied once the trip has commenced and especially if wave predictions are changed by meteorological services.

CONCLUSIONS

This article has commenced announcing to mariners the convenience of getting waves map prognoses for the following 5 days to avoid areas of bad weather that could affect the safety of their full powered ships. The possible advantage in safety should always be united with an advantage in ship's speed.

There have been revised classical methods for the finding of the optimum track depending on waves and it has been found that these methods are almost impracticable without the help of a computer.

It has been developed one computer program that resolves this problem using a methodology that is very close to the method proposed by classical publications. It is a method that mariners can afford and clearly understand due to its simplicity. The method consists in analysing 729 different tracks between departure and arrival position and just taking the fastest one. Previously to get these results, the computer must be informed by the mariner about the estimated waves that can be found along three main tracks during following 5 days. This data input consists only in 5 heights and 5 directions of estimated waves found along the 3 tracks already mentioned and named ortodromic, loxodromic, and one closer to equator that is called meridional

The facility of programming a computer allows the mariner to repeat calculations as many times as needed during the voyage and also in case of errors found in meteorological services prediction products.

Finally the most important conclusion is that the classical method of isochrones explained in all nautical books intended for teaching navigators is almost impracticable without the help of a computer. It has been developed a computer program that eliminates this impossibility.

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LA DERROTA ÓPTIMA POR EL MÉTODO CLÁSICO CON AYUDA DEL ORDENADOR PERSONAL

RESUMEN

El principal objetivo de este artículo es anunciar la imposibilidad de aplicar en la práctica la metodología clásica para el cálculo de la derrota óptima en función del oleaje previsto para los próximos 5 días. Este método clásico es el que aparece en todos los textos para la formación de marinos y el único aplicable con los medios de a bordo. Utilizando las predicciones de oleaje a 120 horas, los autores consideran que la cantidad de trabajo de cálculo que hay que realizar para trazar la derrota óptima es demasiado grande sin la ayuda de un ordenador personal. Se ha desarrollado un programa de ordenador que permite realizar este trabajo a bordo del buque.

METODO

Metodología clásica del cálculo de la derrota óptima con los medios de a bordo.

Empezamos a trabajar a partir de las cartas de predicción del oleaje para los próximos 5 días. Una vez conocidos demora y altura del oleaje que va a afectar la derrota de nuestro buque, el Capitán podrá calcular la reducción de la velocidad máxima que el buque desarrollará en base a los ábacos de curvas velocidad del buque en función del oleaje. La consecución de estas funciones se puede realizar por los datos del cuaderno de bitácora del buque en base a la experiencia o bien por cálculos teóricos realizados en la construcción de buque. Las curvas serán diferentes para los distintos estados del buque, es decir, cargado, en lastre, casco en buen estado, etc.

La segunda fuente de datos que el navegante necesita son las cartas de oleaje previsto. Estas cartas se pueden obtener por radiofacsímil o desde Internet y proporcionan la altura de las olas así como una demora aproximada de su propagación por la superficie marítima.

Con todo ello el navegante, según los textos clásicos, tiene todo lo necesario para calcular la derrota óptima. Pero veremos que no es nada fácil. A continuación se incluyen literalmente, a modo de ejemplo, las instrucciones dadas en el texto “clásico” más conocido entre los estudiados por los marinos mercantes (El “Curso de Meteorología y Oceanografía “ de Sanchez y Zabaleta).

La realización práctica de este método es prácticamente imposible sin la ayuda de un ordenador. La conversión citada de isolineas de altura de olas en isolineas de velocidad del buque puede realizarse manualmente en unas cuantas decenas de posiciones geográficas pero será del todo insuficiente para contemplar todas las posibilidades que pueden darse en el transcurso de 5 días a lo largo de la derrota ortodrómica y sus áreas próximas hacia el Polo y hacia el Ecuador, tal como el método expuesto exige.

Este método, el de la isócronas, solo es aplicable a bordo de forma simplificada.

Métodos modernos para el seguimiento de la derrota óptima

Todos se basan en métodos numéricos aplicados a datos del oleaje suministrados en forma de rejilla desde los centros meteorológicos. El flujo de datos numéricos ha de ser tratado por ordenador y para ello existen diversos algoritmos. Este tipo de metodología presenta ventajas plenamente demostradas. Desde el punto de vista del navegante marítimo también presenta algunos inconvenientes como son el coste económico previo que se compensa posteriormente y la sensación de que la derrota que sigue el buque no es la del propio Capitán.

Desarrollo del método clásico con ayuda del ordenador personal

Una vez introducidos los datos iniciales (posición de salida, posición de llegada, fecha y hora de salida, demora y altura de las olas para 5 días) el programa calcula las velocidades máximas en las tres derrotas (ortodrómica, loxodrómica y meridional) y así conoce las posiciones geográficas estimadas para el mediodía de los 5 días siguientes. A continuación, desde las posiciones del primer día recalcula otras tres derrotas alterando los rumbos a babor y a estribor una cantidad de grados similar a la diferencia que existe inicialmente entre la ortodrómica y la loxodrómica. A partir del segundo día recalcula de forma similar desde cada nuevo punto hallado, es decir, 9 nuevas derrotas para la ortodrómica, 9 para la loxodrómica y 9 para la meridional. El tercer día recalcula otras 3 para cada punto alcanzando las 27. Finalmente desde el cuarto día recalcula igual, es decir, 81 derrotas en la ortodrómica, 81 derrotas en la loxodrómica y 81 derrotas en la meridional. A continuación se repite este primer ciclo de cálculos aplicando la mitad de la alteración del rumbo a babor y a estribor. Finalmente se vuelve a repetir el mismo ciclo aplicando un tercio de la alteración inicial del rumbo a babor y a estribor. Al término de los tres ciclos se conocen los datos de 729 derrotas entre la salida y la llegada. Una de estas 729 derrotas, al final del 5 día, nos deja más cerca del destino que las demás. Esta es la derrota óptima. En el ejemplo que se adjunta, la derrota óptima puede verse resaltada en color negro. La utilización del ordenador para el cálculo de la derrota óptima, se hace esencial. La marcación de las olas y consecuentemente la velocidad máxima del buque, varían constantemente a lo largo de las 729 derrotas. La cantidad de cálculos a realizar es impracticable sin la ayuda de un ordenador moderno.

A lo largo de todo el viaje pueden repetirse los cálculos cuantas veces se necesite y especialmente si la predicción del oleaje se ve modificada por los servicios meteorológicos.

CONCLUSIONES

En este artículo se comienza enunciando la conveniencia de estudiar el oleaje que puede esperarse en los primeros 5 días de una derrota oceánica con el fin de eludir áeas de mal tiempo y mejorar la seguridad de la navegación del buque de propulsión mecánica. Esta mejora de la seguridad se ve unida a una mejora de la velocidad del buque.

Los métodos clásicos para el cálculo de la mejor derrota oceánica en función del oleaje previsto son de difícil aplicación práctica sin la ayuda de un ordenador.

Se desarrolla un programa informático que permite resolver el cálculo de la mejor derrota entre dos posiciones marítimas en función del oleaje previsto hasta un máximo de 120 horas. La metodología de cálculo que utiliza este programa es la misma que proponen los textos clásicos de enseñanza para navegantes marítimos y en particular analiza 729 distintas derrotas como variantes de tres iniciales que son la ortodrómica, la loxodrómica y una más cercana al ecuador que se le da el nombre de "meridional".

La facilidad de cálculo permite repetir las operaciones las veces que se desee y en especial en caso de que varíen las predicciones meteorológicas durante el viaje.

La conclusión más importante consideramos que es la denuncia de la imposibilidad de llevar a cabo un cálculo completo de la derrota óptima por el método de las isócronas sin la ayuda del ordenador personal. Se desarrolla un programa informático que supera esta imposibilidad.

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THE PROJECTS OF TURKIYE IN THE 2023 FOR CRUISE TOURISM

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Abstract

In this study, after examining the cruiser tourism coming on the scene, the place of Turkiye in the field of cruiser tourism is appraised within the World scale.

The cruiser tourism in the World, especially after the World War II, has shown great developments. By the en of 1985, 60 million people have taken part in the cruiser tourism. The cruiser tourism is creating an input of 80 billion US dollars for the World economy.

Norway, Greece, Italy, Russia, England and France are having great income from the cruiser tourism. In the cruiser tourism between the years 1995-2000, various countries have achieved growth rate percentages, where United States has been with 7, England with 17, Spain with 24 and Southern Cyprus Greek Section with 40. Within this period, the achievent growth percentage of the total of Europe has been around the level of 15.

The cruiser tourism has shown development especially in the Caraibbees, Mediterranean, Europe and Alaska lines. In addition to these, the routes of Mexico, Hawaii and South America are very important. Turkiye, where she is in a situation to provide service to the cruiser tourism as a main route, she also stands in a position to market cruiser voyages to Black Sea and especially to the Middle East Gulf countries with Eastern Mediterranean basin.

Keywords: Cruise, Tourism, Turkiye, Turkish Sea Ports, Turkish Tourism.

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SCOPE OF THE STUDY

The cruiser tourism in the World is improving at a high speed. Thne importance of the cruiser tourism is increasing with each passing day. Thanks to cruiser tourism which can be defined as appraising in *its own location*, the introduction and advertisement of the countries and locations are being realized

Turkiye can offer to the countries of the Black Sea basin, to the countries of the East Mediterranean basin and Middle East Gulf countries to open themselves to the cruisr tourism. With the improvement of cruiser tourism in Turkiye, new job opporntunities will be created and with the start of building cruiser vessels Turkiye will gain or create new Technologies. Development of cruiser tourism, shall have an impact and support on the modernizing of the substructures and facilities of the Turkish ports, will lead the way to the improvements in cruiser tourism culture and provide positive support to the Turkish economy.

In this study, applicable ideas are brought forth, to have the natural beauties and historical inheritance of Turkiye to be beter known and more appraised by humanity; and to include Turkiye into the main cruiser lines.

MATERIALS AND THE METHOD

In this study, after examining the cruiser tourism coming on the scene in the World, the importance of the fleet of cruiser vessels within the World trade fleet is appraised. Later on, the developments in the cruiser vessels are evaluated under the light of the information gained from relevant sources. Within the light of such information, the activities of the Turkiye owned vessels suitable for cruiser tourism are examined. The ports and port facilities of Turkiye providing service to the cruiser tourism are examined. Taking the cruiser tourism ports of other countries and bringing the shortages of the Turkish ports providing service to the cruiser tourism, the conditions for their improvements and competition are appraised.

While the potentiality of Turkiye to be used in the field of cruiser tourism are being appraised, benefits were made from local and foreign sources. For Turkiye, to be more active in tnhe field of cruiser tourisim, assesments are made relevant to the sources which may be used locally or abroad. Suggestions are made to have Turkiye take more share from the cruiser tourism revenues of the World, amounting to an annual sum of approximately 80 billion US dollars.

INTRODUCTION

For the touristic travelling vessels, the word used in French is “croisiere”. Although it is not yet used as widely in Turkish, the touristic travelling vessels are named as “kurvaziyer”. Whereas in English, the word “cruiser” is used for them. The word “cruise” in English is sometimes adapted into Turkish and written as is it sounds.

In the Turkish Language Institute (TDK) dictionary, while it is noted that the word "kruvaziyer" is derived from the French word "croisiere", it is explained as "big travelling vessels". In Turkish, mainly for the big travelling vessels, the word "kruvaziyer" is used. However, from time to time, the word "kurvaziyer" is the most preferred one to be used.

HISTORICAL DEVELOPMENT OF CRUSING TOURISM IN THE WORLD

The vessel named Mary, used by the British King Charles II in the year 1660 when he was paying a visit to the Netherlands, is now accepted to be the first yacht (Giorgetti, 2006). Moreover, this vessel may as well be accepted as the first "cruiser".

Passenger carrying with cruiser vessels which may be signified as sea tourism, was in fact realized for the first time by Albert Blain in the year 1890. Germany, in order to support the cruise tourism, had started to spread out the slogan "enjoy yourself, gain power" (Kadioglu, 1997).

In the recent years, the passenger vessels not only have enlarged the services they provided but also have grown in capacity to the largest sizes possible. Yet, the vessel "Spirit of London" with a tonnage of 17.000, was one of the most popular vessels in the year 1957. Around to the end of the 50's, while Italy was active in the cruiser tourism with 26 vessels, France was with 9, Russia with 10, Norway with 13, Greece with 10, USA with 1, Panama with 7 and Liberia with 5 vessels (Alderton, 1973). When the year 1979 was reached, as in accordance with the statistics given, without making any discrimination between the cruiser vessels, the number of ferries and passenger carrying vessels had reached to a total of 3150. The share ratio of these vessels was then at a level of 2 percent in the World sea trade (Nersesian, 1981).

The growth in the number of passengers between the years 1980-1983 was realized at an annual ratio of 9.2 (Guler & Kadioglu, 1998). In the CLIA reports, it was estimated that annually eight million people would be travelling by vessels between the years 1995-2000. By the end of the term, this approximation was surpassed. Americans of the US are paying much more interest to cruiser tourism. The cruiser passengers number of 570 thousand in the year 1970 has reached to 1 million 600 thousand in the year 1985. Whereas, in the year 1994, 4 million 800 thousand people had participated in the cruiser tourism. Following the year 1984, where the interest of Americans in cruiser tourism was gradually decreasing, some other nations had started to pay more interest to the cruiser tourism. The new customers of the cruiser tourism nowadays are the Germans, Brits and Spaniards (Kadioglu, 1997).

At the beginning of year 2000, of the total tonnage of the cruiser vessels in the World, belonged to Norway, Russia, Panama, Greece and Italy (Ucisik & Kadioglu, 2001).

The number of vessels built to provide service to the cruiser tourism, are increasing day-by-day and their service qualities are getting much beter.

The "Costa Concordia" built as the biggest passenger carrying vessel of Europe and launched by the company Costa Grociere in July of 2006, has a tonnage of 112 thousand, with a breath of 290 meters and an overall height of 52 meters. The "Costa Concordia" has 1500 cabins and a capacity to accomodate 3 thousand 700 passengers. Being different than the other cruisers, she has a Formula-1 track Simulator, and a thermal facility. The swimming pool of the Costa Concordia has the specifications of the biggest one that can be found in a vessel.

THE HISTORICAL DEVELOPMENT OF CRUISER TOURISM IN TURKIYE

Operating cruiser vessels in Turkiye had started in the years following the World War-2 with the vessel named "Ege", a liner for passenger transportation. Later on, plus to the 2nd hand vessels bought from the USA, "Samsun" and "İskenderun" vessels built in Italy in the year 1950, had participated in the cruiser tourism, running between various ports of the Mediterranean.

In its true sense, the existence of a cruiser vessels operation in Turkiye, can not be specified. Because, the vessels being operated for voyages in Turkiye do have a comparingly lower design standards. Against the vessels built in accordance with the World standards, the competition chances of the Turkish passenger vessels is of no significance (Ucisik & Kadioglu, 2001).

The lines which can be classified as cruiser voyages in the foreign destination routes of Turkiye being only İstanbul-Barcelona, İstanbul-Egypt, İstanbul-Haifa, İstanbul-Soçi, where these have come to being after the year 1990. The İstanbul-Soçi route was established in the year 1990. In addition to these, besides the Western Mediterranean, the voyages in the Islands Sea(Aegean Sea) was started (Mmt, 1989-2000).

Turkiye, as a matter of fact, in operating Turkish flag cruisers or Turkish owned cruisers, has not been able to provide the required progress. Following the privatization process in the maritime sector, some Turkish ship-owners founding an incorporation have bought the "Ankara" and "Samsun" vessels. With these vessels, to start with, they started to carry passengers and vehicles, firstly between İstanbul and İzmir and later on between Turkiye and neighbouring countries. But these lines, in its true sense, can not be specified and classified as cruiser lines.

TODAY'S CRUISER TOURISM IN THE WORLD

Following the widespreading of mass tourism, the vacationers started to long for similar vacations to be spent in facilities which are very much alike. The vacation consumers having turned towards diversified searches, has led to an expansion in the variety of products within the last 10 years, numbering to 400 which can be offered to the tourists.

In the cruiser tourism, an annual growth of 8.4 percent is being encountered. 15 percent of the USA population and 10 percent of the European population are participating in the vessel tours. Whereas in Turkiye, it is estimated that only an average of 10 thousand people are annually participating in the vessel tours.

Within the World, there are approximately 20 companies which are specialized in the field of cruiser tourism. Within the last 20 years, more than 60 million people have travelled on the cruiser vessels. Only in the year 2003, it is stated that 10 million people in the World have participated in the vessel tours.

Within the World economy, the crusier tourism sector has approximately a market share volume of 80 billion Us dollars.

In the cruiser tourism between the years 1995-2000, a growth rate of 7 percent in the USA, 17 in England, 24 in Spain and 40 in the Southern Greek Side of Cyprus, were maintained. Whereas, within the same period, the growth rate achieved by the total of the European countries was at a level of 15 percent.

The four destinations in which the highest growth rate achieved in the cruiser tourism were the Caribbees, Mediterranean, Europe and Alaska. In addition to these, Mexico, Hawaii and South America destinations are hightly important.

THE DEVELEPMENTS IN THE TURKISH MARITIME TRADE SECTOR

At the beginning of the year 2005, in an evaluation made taking vessels of 300 GRT and over depending on their flags, the World maritime trade fleet of the 154 countries was consistent of 39.932 vessels. The total capacity of this fleet was 888.000.000 DWT at the beginning of the year 2005.

The Turkish maritime trade fleet being the 18th in the row of the World maritime trade fleet in the begining of the year 2000, has dropped down to 20th in 2001 and 23rd in 2004. Due to financing problems and preferrance of other flags instead of the Turkih flag, the Turkish maritime trade fleet has dropped down to 24th in the row of the World maritime trade fleet. Inspite of these negativenesses, the Turkish maritime trade fleet, with the entries of new vessels in the year 2005, by showing a modest increase in comparison with the previous year, has reached to a DWT of 7.4 millions.

It is assumed that the Turkish maritime trade fleet will be in an increasing trend in the coming years because of the deliveries to be made of the new vessels being built within the country and abroad.

CRUISER TOURISM IN THE DEVELOPMENT PLANS OF TURKIYE

In 1994, the last year of the 6th 5-years Development Plan of Turkiye, although it is noted that 260 million people have been transported by the vehicles of the public sector, the share of the cruiser tourism values within this number has not been differentiated.

Within the term of the 7th 5-years Development Plan of Turkiye, the operating rights of the 7 of the public sea-ports were turned over to the private sector. After this turning over, it was observed that some Turkish sea-ports have directed themselves towards specialization in the cruiser tourism field.

Between the years 2001-2005 covering the 8th 5-years Development Plan, it was decided that some of the Turkish sea-ports should be re-constructed in criterias of size, administrative wise, service understanding, as to constitute a point of focus/artery within the World transportation web (Spo, 2000).

Moreover, it was also decided within the 2001-2005 term, that the Turkish sea-ports should be operated with contemporary principles oriented towards competition with the territorial ports, suitable with procedures and technological developments in compliance with the port operation strategies of the European Community and other international organizations (Spo, 2000).

In the 8th Development Plan period, it was decided to use the inter-sector possibilities to support the purchasing of the cruiser passenger vessels, having them built in Turkiye, and to renew the currently available ones.

In order to materialize the coordination and establishment of a healthy structure relevant to the activities in connection with the maritime tourism, it was aimed to provide legal arrangements (Spo, 2000).

The 9th Development Plan of Turkiye was prepared with the vision for "a Turkiye growing in stability, sharing her income more justly, having a competition power in a global scale, transforming herself into a data processing community, having completed her process in unification with the European Community" and a Long Termed Strategy (2001-2023).

The Ninth Development Plan covering the 2007-2013 term, consequently has to encounter a period where the changes are to be more dimentional and lived fast, competitions to be more intensified and indefinitess to be piled up. In this period where the globilization will be highly effective in every area and where the opportunities and risks are to increase for the individuals, corporates and nations, the Plan is envisaging that Turkiye will be realizing her developments in economical, social and cultural areas with a totalitarian approach (Spo, 2006).

TODAY'S CRUISER TOURISM IN TURKIYE

Besides the technical insufficiency, the sea-ports to provide services to the cruiser vessels being lacking in number and the capacities of these ports being too low, the operators of cruiser vessels are not preferring Turkiye at a desired level.

Another reason why the operators of the cruiser vessels for not preferring Turkiye is the fact that the charges are being too high for the services rendered with the currently available but insufficient facilities. Better equipped and confortable passengers lounges wherein cruising voyagers are to be entertained and provided with hospitality are newly planned. For ports to provide accordioncouplings to the berthed vessels, tenders are newly put out.

Turkiye is planning to establish the coasts of Turkiye to become unabondanable and much frequented locations for the cruising vessels. Therefore, highly important studies were. Undertaken in Turkiye by the end of 2000 to attract touristic vessels of large sizes. With the legal procedures setforth, the fuel charges in the seas were reduced by 50 percent. And again, in the tariff for port charges, the rates were reduced approx. by 50 percent.

Turkiye, after providing these reductions, has lived an improvement, though rather small, in the cruiser tourism. Until the year 2003, cruiser vessels were using only 2 ports of Turkiye for stop-overs. However, in the year 2006, regular visits to 7 sea-ports of Turkiye has started.

In 2002, the number of cruiser vessels were 336 and the number of passenger were around 115 thousand. In the year 2003, the number of the vessels has increased to 351 and the number of passengers upto around 270 thousand. After 2003, in the number of cruiser vessels coming to the Turkish ports an increase by 30 percent and in the number of passengers an increase by 50 percent were maintained.

THE SEA-PORTS IN TURKIYE PROVIDING SERVICE TO THE CRUISER TOURISM

In Turkiye, namely the ports of İstanbul, İzmir, Kuşadasi, Antalya, Alanya and Marmaris being the ones suited, there are 6 ports for cruisers. Although the ports of Fethiye, Dikili and Bodrum with their currently available piers, are considered to be cruiser ports, due to their lengths being insufficient for embarking, medium and large size cruiser vessels not coming over, they have a rather small market share not worth mentioning.

The operators of the cruiser vessels, when determining the stop-over locations of their vessels, are really flexible in their choices. In the event these operators of cruiser lines would encounter some mischiefs in a port they would visit, with a simple routing change, they make another port with suitable contions as their stop-overs.

To provide services to the cruiser vessels, considered as rising values in the tourism, new ports are being built in Turkiye. The Kepez Port, port of Bodrum planned to be opened by 2007 and cruiser vessel port planned to be built in Lara of Antalya, are considered to be strong competitiors to the cruiser ports currently active in our day.

In the case these ports with their reduced port charge rates, improved service quality and other advantages they provide, will be able to attract the cruiser lines which have already placed Turkiye in their routes for a stop-over location, will obviously have serious positive changes in their market shares.

Plus to Turkiye's not being able to show the determination required in the development of cruising tourism, Greece the neighbouring country having a strong maritime trade fleet is yet another factor. The Greek vessels are operating in the Limasol, Haifa, Çeşme-Kuşadasi lines (Sturmey, 1995). In these lines, the Greek vessels are in severe competition with the Turkish vessels.

Izmir Alsancak Port

The first cruiser vessel voyage with a stopover to the İzmir Alsancak Port in November of the year 2003 was realized by the Costa Victoria vessel with a capacity of 2500 passengers.

Besides the Costa passenger vessels, Marco Polo and Royal Iris cruiser vessels handled by different agencies have also organized various visits to İzmir Alsancak Port at various dates. To İzmir Alsancak Port, the number of cruiser vessels berthing for stopovers was 32 in 2004, 26 in 2005 and 73 in 2007.

Whereas the number of passengers coming to İzmir with cvessels was 58.170 in the year 2004, this number has risen upto 66.968 in 2005. The cruiser vessels have brough to İzmir approximately 150 thousand passergers in the year 2006.

Istanbul Zeytinburnu Port

In the cruiser tourism field, big investments are being planned in Turkiye. İstanbul, with the new investments, will be having one of the biggest and most modern cruiser vessel ports in the Mediterranean basin. With the erection of a port in İstanbul Zeytinburnu to provide services to the big and luxury passenger vessels, it is calculated that an additional 8 million tourist contribution will be maintained. It is also targeted to increase this number upto 16 million tourists in the year 2020.

Kusadasi Port

Tourism in Kuşadasi has created great changes in a short time. For the tourism effecting Kuşadasi at such speed, plus to the basic factors, such as the geographical situation of the county centre, the natural and historical wealth within her nearby environment, her port facilities have undoubtedly played a very important role.

The Kuşadasi Port being mended and renewed in the year in the year 1963, it was started to be used by the trade and passenger vessels. After the year 1990, the Kuşadasi Port being specialized, has started to provide service for the foreign tourist vessels. In the Kuşadasi Port, with the characteristic of being the biggest cruiser port of Turkiye, the length of the pier lengths are between 183 to 264 meters.

Within the context of cruiser vessel voyages, 345 vessels and 279 thousand passengers had come to Kuşadasi in the year 2004. Whereas in the year 2005, these numbers had increased to 480 in vessels and 380 thousand in passengers.

Antalya Port

As Per the given values for the year 2005, Antalya Port amongst the Turkish ports, was the last one in the row, with a market share rate of 4.23 percent in the number of berthing vessels and 4.01 percent in the number of passengers. On the other hand, the Kuşadasi Port was the most important one amongst the Cruiser vessel ports of Turkiye with a market share ratio of 46.62 in the number of vessels and 37.80 in the number of passengers.

The Antalya Port is mainly preferred by the cruiser passangers arriving to Antalya by air and taking the Eastern Mediterranean short journey vessels en voyage to destinations such as Lebanon, Egypt, Israel, Cyprus Greek Section. Therefore, for Antalya, the qualification of cruiser torism has much different characteristics as tour-wise when compared with the tours covering Kuşadasi, İzmir, Marmaris, İstanbul and like Greece and Italy located in the nearby and popular routes of the Eastern Mediterranean.

Pier of Alanya

The Pier of Alanya is in competition, especially with the Middle East Antalya Port. In the year 2004, 70.000 passengers had come to the Pier of Alanya, thus with this value at hand, she was the most important pier within the province of Antalya, with a market share ratio of 52.30 percent. As per the given values for the year 2004, the number of the passengers arriving at Middle East Antalya Port was 54.117. Middle East Antalya Port, with a market share ratio of 40.43 percent, was the second important pier within the province of Antalya.

Until the August of 2006, by the cruiser vessels, 30 voyages to the Middle East Antalya Port and 90 voyages to the Pier of Alanya, were organized.

THE EFFORTS OF IMPROVING THE MARITIME TOURISM IN TURKIYE

The educational and income standards of those participating in the cruiser tourism being at a high level, these people provide important contributions for the introduction and presentation of the country and the region. The tourists, to the areas they visit, bring an economical vigor.

Turkiye, to solve the problems relevant to the yacht and cruiser tourism sector, has realized the required legal arrangements. For the development of yacht and cruiser tourism in Turkiye, the authority in the issuance of port entry permits to the foreign flag yachts being handled by different state organizations, is now gathered into one organization.

From the point of view of the development of maritime tourism, the yacht registration documents, charges per bed, the revenues collected from the sector as in accordance with the Yacht Tourism Regulations, have come to be distributed to the sector to be used for the improvements to be made in the sector and in the fairs.

The “Maritime Tourism Regulations” in Turkiye is prepared in a manner to cover the cruiser vessels, water sports, yachts payin visits for the day, scuma divings and similar activities and to meet the requirements of the day.

In order to further the improvements of the yacht clubs, establishment of a yacht system with termed property ownership known to be yachts with multiple owners, is maintained.

For the benefit of Turkiye, the target countries having presedence were determined. In Turkiye, the zones suitable for the improvement of tourism being determined, tourism corridors are constituted.

Of these corridors, the one named as "Southern Marmara Olive Corridor" covers the area composed of the province of Bursa, Gemlik and Mudanya counties, province of Balikesir, Gönen, Bandirma and Erdek counties, situated in the South of the Marmara Sea and the coastal and surrounding area of Çanakkale province extending to the county of Ezine, Erdek Kapidaği Peninsula and the islands of Avşa, Paşalimani and Ekindi and the Marmara island within the boundaries of the Marmara county.

The second corridor being named as the Corridor of Faith, is the area starting with Tarsus, covers the vicinities of Gaziantep, Şanliurfa and Mardin. This corridor is thought to be expanded to include the Selçuk- Ephesus area.

Some areas are declared as the tourism cities and these areas are encouraged with incentives oriented towards tourism. Depending onto this, Muğla-Dalaman, Çeşme-Alaçati are the tourism cities previouslydeclared. As the new tourism cities, İğneada Kiyiköy, Kilyos, Saros, Kapidaği Peninsula-Avşa-Marmara Islands, Datça, Kaş-Finike, Anamur's coastal section and Samandağ are designated.

Based on the idea of transforming some metropolises having sufficient tourism potentiality and bringing them upto points of attraction for the tourists, the city tourism sites are designated. İzmir being appointed as a sample of the city tourism site, the İzmir city tourism project was given a start.

In the provinces where it is planned to establish the city tourism, founding of locations such as city museums in the international standards, restorations of buildings having historical, cultural and architectural characteristics and locations of ruins, illumination of historical buildings such as the monuments, castles, aqueducts, city walls, hans (ancient inns with large court yards), cadavanserais, etc.and arrangimint of their landscapes are planned.

CONCLUSION

With the revenues of the Maritime Tourism being perceived rationally, the new opportunities being appraised and completion of the new projects, the share Turkiye will obtain from the maritime tourism will be gradually increasing day-by-day.

In the year 2002, the Turkish Maritime Trade sector, has provided a support of 8.550 billion US dollars to the Turkish economy (Cos, 2003). Of this supporting amount, 2 billion US dollars was earned in maritime tourism. It is estimated that the Turkish Maritime Trade Sector has provided an input over 10 billion US dollars in the year 2005. It is also figured out that of this input, 3 billion Us dollars were earned in maritime tourism.

It is considered that 10 billion US dolar can be earned by Turkiye from the maritime tourism and 1 billion US dollars from cruiser tourism, in the medium term.

Within the course of an important part of the cruiser tourism, one flies in a plane to the city accepted as the center, take the vessel from there and upon the vessel completing her voyage route, then the return trip starts via the airplane from the accepted center. For example, the vacationer participating in the Caraibbees tour, firtsly flies by a planet o Miami and takes the vessel from there and completing the tour, returns back to Miami and takes the flight back to where he had borded the plane the first time. Within this framework, it is essential to establish fast and confortable transportation lines between the coastal line of Turkiye where the natural beauty and historical spots are strongly perceived and the internal cities of the country, which will only be a daily round trip.

Turkiye, following the collapse of the Soviet Socialist Republics of Russia, may engage herself with the duty of introducing and presenting the natural beauties and historical wealths of the newly liberated states, such as Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan, Kirghizistan, with which she has fundamental and a common language and historical ties.

In order to have the cruiser tourism market developped in Turkiye, besides the people coming to Turkiye from other countries, it is also required that the number of outgoing native tourists should increase. As in accordance with the data provided for the year 2002, there are 3.5 million Turkish people who have an annual income between 28 thousand and 100 thousand US dollars. Accordingly, as per the same appraisal, there is a community of 80 thousand people having an annual income of 150 thousand US dollars and over.

In the cruiser tourism, a vessel voyage of 8-10 days costs between 1.500-3.000 US dollars. Likewise, the operators of cruise tourism with a successful introduction and arvertisement may convince a large part of the Turkish community consistent of 3.5 millon people to participate in the vessel tours.

Turkiye, same as it is in learning hotel management in the sector for the temporary stay-over accomodations, bringing up the issue of annual chartering of the vessels into the agenda, may as well prepare the grounds for learning to operate the vessels.

The operators of cruiser tourism in Turkiye, if they become successful in their endevours, may receive partnership and new investment offers from global incorporations.

In 1998, the Turkish Travel Agencies Association (TURSAB) and Russian Travel Agencies Association (RATA) made an attemp to give a start to the cruiser tourism in Black Sea. Being in lieu with this attemp, the route of the vessel would be directed to Turkiye, Georgia, Ukraine, Russian Federation, Moldavia, Rumania and

Bulgaria's ports, cities and gulf such as Odessa, Burgas,Varna, Costance, Sochi, Trabzon, Rize, Novorossiysk, Sivastopol,Yalta, Nicolayev and Tuapse, of the countries having a coastal line in the Black Sea. This attemp being supported by the International Tour Operators Association (IFTO), could not somehow be realized. This attemp should be achieved and put to life by any means whatsoever.

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