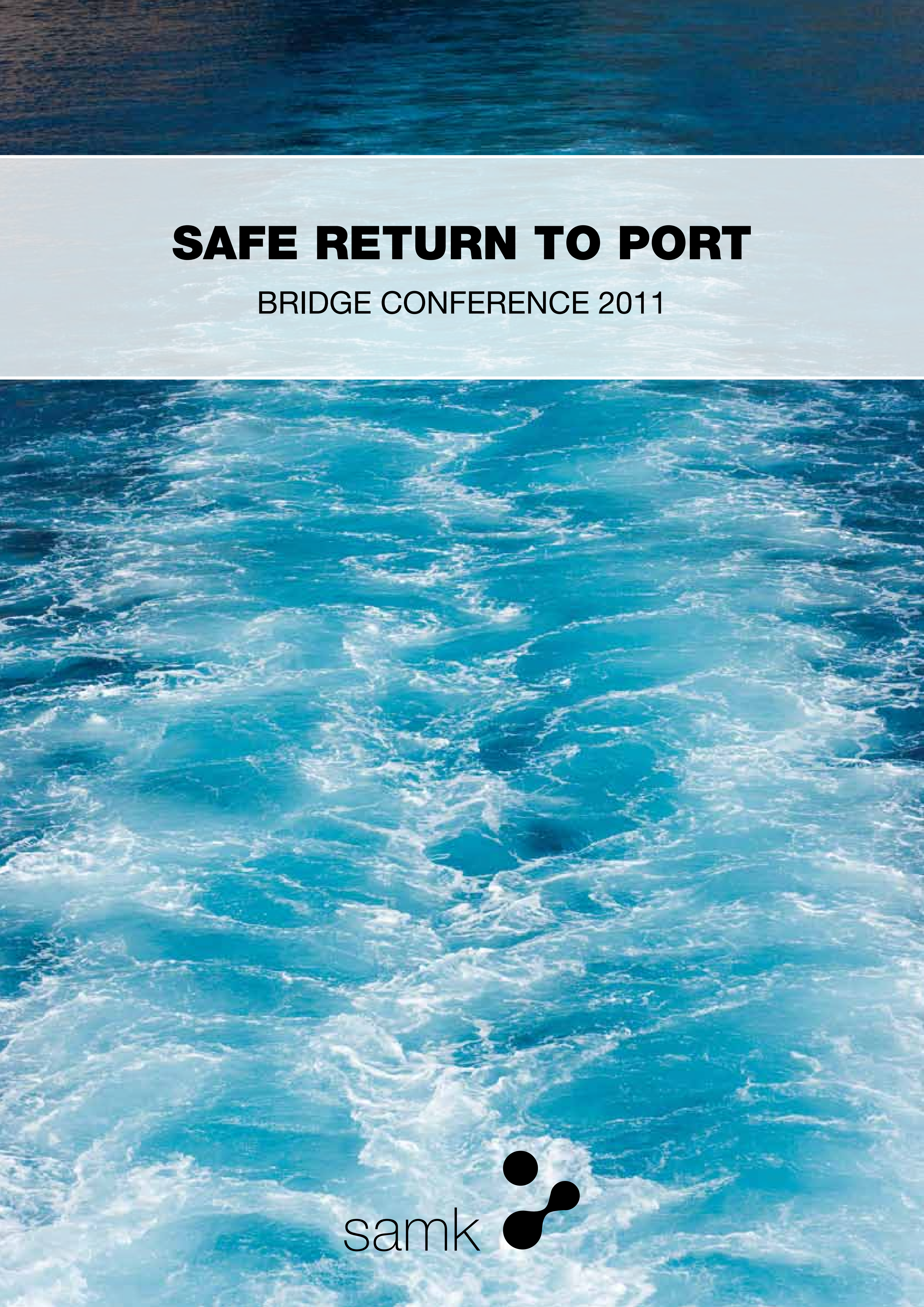
SAFE RETURN TO PORT

BRIDGE CONFERENCE 2011



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Sarja C, Oppimateriaalit 1/2011 | Series C, Study materials 1/2011
ISSN 1457-0718

Satakunnan ammattikorkeakoulu
Satakunta University of Applied Sciences
Pori 2011

Editor: Kirsi Uola
Layout: Jatta Lehtonen
Front page: FutureImageBank

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FOREWORD

SAFE RETURN TO PORT AS THE THEME OF BRIDGE CONFERENCE FOR 2011

Different aspects of maritime safety have been the central themes of Bridge conferences held at the faculty of Maritime Management at Satakunta University of Applied Sciences in Rauma. The local shipyard has been an important partner at the conferences. The conference discussed new research on the industry, the development of command bridge appliances and viewpoints on maritime training.

The special theme for the conference held in June 2011 was “Safe Return to Port” aka SRTP, for which the International Maritime Organisation IMO has set specified SOLAS regulations. The regulations particularly concern passenger ships and the aim was the prevention of accidents as efficiently as possible and the design of ship structures to support evacuation possibilities, so that the people onboard can remain on the ship in the event of accident until the ship has reached the dock. Prevention and preparation concern severe accidents, such as water entering the ship or onboard fires.

The share of human factor in accidents became clear from the presentations of several speakers at the conference, while the topic was already familiar from previous conferences. Critical factors and risk accumulation were discussed from various perspectives. It is estimated that 60 to 70 percent of accidents in commercial seafaring are influenced by human factor. Accidents cause major human and economical losses. In addition to these, near-miss incidents are also unfortunately common.

The Finnish Transport Safety Agency has created a special guide for command bridge work, Co-operation on the bridge, which was published at the Bridge conference in Rauma. It guides the user to avoid human errors in command bridge work through instructions and practical examples. The premise is that errors must not be underestimated, and indeed, they need to be recognised and conscious measures need to be taken to avoid them.

The acquisition of competence to meet various requirements of the integrated command bridge was discussed from the viewpoints of training, education and research. In industry-specific training, simulators are used to build up experience in systems that will be used in actual work. Great requirements are placed on training, as it should produce expert officers whose skills are guaranteed to work at the global maritime industry. Employers and educational institutions are expected to tighten their cooperation so that common lines can be defined. The employer defines the scope of work and required knowledge, skills and responsibilities. On the other hand, training produces qualified professionals who are able to fulfil the necessary role.

The Bridge conferences introduce the newest ship command bridge appliances and simulation applications. The centralised and efficient management of appliances is important for maritime safety. Data and information can be read from the same multipurpose work station that controls the integrated functions of the ship.

Bridge conferences have been previously held in Rauma in 2006, 2007, 2009 and the conference in summer 2011 was the fourth one. The initial idea of organising this kind of an event together with the shipyard was already in the air in 2005 at the 125th anniversary of maritime training at Rauma. The following year, the idea was realised. Each time, the event has attracted large numbers of research and educational professionals as well as business experts.

The Rauma-based shipyard has always been very visibly on display at the conference, and visitors have had the chance to get a glimpse of newbuilds currently under construction. In summer 2011, one project attracting plenty of attention from the visitors on the STX Rauma shipyard was newbuild number 1368, the M/S Spirit of France of the P&O Ferries shipping company, the first passenger ferry to comply with the SRTP requirements. In previous years, visitors have had the chance to get to know Tallink M/S Galaxy and especially its command bridge appliances delivered by Kelvin Hughes as well as Color Line’s M/S Color Magic and Sperry appliances at the Aker Yards shipyard. In 2009, the target of interest at the STX Rauma shipyard was newbuild 1359, Tallink’s M/S Baltic Queen with command bridge appliances manufactured by SAMK.

Heikki Koivisto
Kirsi Uola

ABSTRACTS

SAFE RETURN TO PORT REQUIREMENTS

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ABSTRACT

STX Finland has three SRTP vessels on order with the world's first SRTP ferry – NB 1367 the Spirit of Britain – delivered. Design, approval and commissioning NB 1367 was a challenge because the rule guidelines were being developed. The designers are looking forward to STRP improving safety justifying the investment.

1. INTRODUCTION

IMO's Maritime Safety Committee adopted at its 82nd session at the end of 2006 a set of amendments to SOLAS. One part of this were formed by Safe Return to Port Regulations that are dealing with design criteria for passenger ship systems to remain operational after a fire or flooding casualty.

The background for these amendments was motivated by the fact that prevailing SOLAS regulations could not meet the challenges introduced with new passenger ship designs and there could be seen areas of potential concern in casualties and emergency situations. The work in developing the amended regulations was guided by basic philosophy with two premises being as (1) more emphasis should be placed on the prevention of a casualty from occurring, and (2) ships should be designed for improved survivability so that persons can stay safely on board as the ship proceeds to port after a casualty.

As one result of the above mentioned development work SOLAS was amended with Safe Return to Port Regulations II-1/8-1, II-2/21 and II-2/22. These new regulations define redundancy criteria for essential systems of passenger ships having length of not less than 120 metres or having three or more vertical main fire zones. The regulations entered into force on 1st of July in 2010.

2. CONTENTS OF THE REGULATIONS

Casualty threshold is describing criteria for the amount or extension of a damage that a ship is able to withstand - in terms of structural and system design - and is still capable of returning to port safely.

3. SRTP FERRY DESIGN (ARI's CHAPTER)

3.1 SRTP VESSELS ON STX FINLAND'S ORDERBOOK

NB 1367-8 the Spirit of Britain and the Spirit of France: Being 213 m long this ferry pair is by far the largest travelling between Dover and Calais that is the busiest ferry route in the world. NB 1367 is already sailing. NB 1368 will be delivered in September. The ferries are designed for 2000 passengers, 2750 trailer lanes and 200 additional cars.

NB 1369 is another benchmark delivery for the Rauma yard. The 134 m long Antarctic supply and research ship is an icebreaker, special purpose ship, passenger ship, dry cargo ship and a tanker. She is diesel electric and carries 150 people, cargo and fuel for the South African polar bases. She is independent with cranes, helicopters and extensive oceanographic research facility.

NB 1376 is the new Viking Line ferry for the Turku – Stockholm route. At 57,000 GT she carries conveniently 2800 passengers day and night. She is the world's first LNG ferry with a dual fuel diesel electric machinery.

3.2 SRTP AS A DESIGN STANDARD

SRTP legislation sets design standards but not operational guidelines as a rule. However there will be a lot of operational requirements for mariners to take advantage of the new battle hardiness built into the passenger ship.

SRTP rule lists the 14 systems or features which shall be designed operational within the casualty threshold. Additional redundancy is then required in the orderly evacuation situation beyond the threshold.

Every required system redundancy must be designed individually. IMO has agreed and published guidelines and interpretations for safety criteria of the pipe and cable routes. Another important guideline is the list of spaces that may not be origins of fire.

Statutory approval takes time because a new approval stage for each system is required.

Assessment of the system redundancies is a very laborious process because it is done by analyzing each fire or flooding scenario system by system.

3.3 CASE OF NB 1367-8

In August 2008 the letter of intent for the ship contract was signed with P&O Ferries. In time the SRTP Rule had beed adopted by IMO and it was known to enter into force on 1 July 2010.

The keels of both ferries were to be laid before the entry date. However the Owner decided to adopt the new rule as a part of an extensive safety approach with the project. This made us all pioneers in the field.

The development of the rule in IMO was seriously lagging behind schedule. There was no published rule for the SRTP flooding scenarios. No official interpretations or guidelines existed.

With the Owner the yard managed to make an agreement with the Flag Authority (MCA) of the most important interpretations as a protocol signed by all parties. This agreement worked well during the design and approval process.

Some agreed points:
- Flooding excluded (no rule existed)
- SRTP time set to 6 hours
- Ballasting excluded by calculations
- AC requirement excluded

Redundant Design Features:
- Main engine rooms
- Shaft lines
- Cooling systems
- Steering gear rooms
- Auxiliary power generation
- Main Switchboards

Some major challenges
- Redundant bilge system design
- Redundant flooding detection system design
- Redundant toilets (!)
- Sprinkler design
- SRTP system assessment
- Approval process
- NB 1367-8 have also the LR PMSR* redundancy notation. It requires 50% propulsion power redundancy in any single failure. Its requirements are not always parallel with SRTP rule.

All parties involved were on steep learning curves. Design and indeed approval schedule was critical. All parties were happy to see the final approval and certificates stamped without major modification on agreed delivery date.

3.4 CONCLUSIONS

SRTP initiated on high political and cruise ship owner level. Rule making process was of novel type and the schedule tight. In the end the legislation involves nearly all passenger ships. Main question remains if the ship operators can make the most of this new safety tool: Should the ship be evacuated or not?

For the ship owner it is an investment. Additional building cost arises from more

- some doubled equipment
- routing design
- cabling and electrical components
- piping, valves and their control.
- Crew training.

If this investment increases passenger safety at least as much than if invested in other safety features, it is money well spent and we are saving lives.

SRTP is an investment in passenger ship hardware required by law. It makes the ship more complicated and requires special training of mariners. Passenger safety is the objective.

ENHANCING BRIDGE SIMULATION TRAINING PROGRAMMES WITH THE APPLICATION OF MARITIME AIDS FOR EMERGENCY RESPONSES

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ABSTRACT

As human factors are the most important cause of incidents at sea and in harbors, a systematic attempt is made to develop a training program targeting correction of human behaviour in emergency situations. The EU funded project Maritime AIds Development for Emergency Responses (M'AIDER) is looking at developing training programmes for officers and cadets working onboard vessels by studying incidents that have occurred in the past. Also, by analyzing the results of questionnaires handed out to experienced seafarers so as to find out the most frequent occurred emergency situations and the prevailing conditions. Through this study the human factors leading to emergency situations are identified providing information as to how various incident scenarios could be selected for further implementation in integrated and full-mission ship simulators. The ship and bridge simulator training environment can be enhanced by following a pre-developed format for the description of various scenarios to be used into exercises in the simulators. This paper demonstrates the recent research carried out on analyzing ship accident and incident reports as well as the analyzed results of the questionnaires and how this analysis is implemented and tested at the facilities of a full mission simulator training of a maritime university.

Keywords: Shipping incidents, Communication, Human errors, Maritime education, Full mission simulator training

NOMENCLATURE

AIS: Automatic Identification System
ARPA: Automatic Radar Plotting AID
AWO: Assistant Watch Officer
COLREGS: Collision Regulations
CPA: Closest Point of Approach
HOW: Head of Watch
MAIB: Maritime Accident Investigation Branch
M'AIDER: Maritime AIds Development for Emergency Responses
MET: merchant navy education programmes
MSTC: Maritime Simulator Training Centre
RG: Helmsman
QPS: Quality Positioning Services
WO: Watch Officer

INTRODUCTION

Various efforts have been made in the past to address the effects of human factors in ship accidents and incidents at sea [Aslan and Turan, 2010]. With the M'AIDER project the intention is to go one step further by developing a scenario based training programme reducing risk of human errors specifically related to navigation leading to collisions, grounding or other dangerous situations [Bosma et al, 2010].

Another focal point of M'AIDER project is the training of deck officers in particular as the accidents are directly related to the activities on the bridge including communication within the team as well as the bridge and engine department]. By analysing the results of questionnaires handed out to experienced seafarers, the most frequent occurred emergency situations and the prevailing conditions, incidents can be predicted.

Through this study the human factors leading to emergency situations will be identified providing information as to how various incident scenarios could be selected for further implementation in integrated and full-mission ship simulators.

In this project a systematic attempt in developing accident or incident scenarios for training of young cadets and seafarers working at sea and ports is done. This investigation was carried out at the Maritime Simulator Training Centre (MSTC), which is part of the Maritime Institute "Willem Barentsz", in cooperation with the University of Strathclyde. Together development of training programmes for deck officers is a unique opportunity in order to prevent accidents. They should be based on real emergency situations/scenarios and focus their attention on what could await them when at sea.

The present paper is structured as follows: section one provides a brief introduction to M'AIDER project and shows the main aims and objectives of the project. Section two includes the analyses of the results of questionnaires handed out to experienced seafarers so as to find out the most frequent occurred emergency situations and the prevailing conditions are shown. In section three the analysis of the MAIB accident and incident reports and the relation between human factors and shipping incidents are presented. Section four presents the further implementation of the information in integrated and full-mission ship simulators, in which the task of the MSTC in this project was to implement a scenario in student training and investigate the results of this scenario. The scenario was based on a real accident, which happened in 2008 in Dover Strait. Finally section five presents the conclusions of the paper in hand.

1.1 PROJECT AIMS AND OBJECTIVES

The main aim of the M'AIDER project is to improve safety at sea and in ports. [Bosma et al, 2010]. For that purpose the most frequent emergency situations are identified and analysed. The results of the analysis will contribute to the development of the training courses for the maritime education training of seafarers looking at simulator training, e-learning and e-assessment. Based on these scenarios intelligent exercises will be developed for application in both the bridge area and in the integrated and full-mission simulators.

M'AIDER project also investigates the transfer of the knowledge already existing in the form of video software or existing internet e-learning/assessment platform for above mentioned purposes. In Fig 1 the main structure of the project is shown.

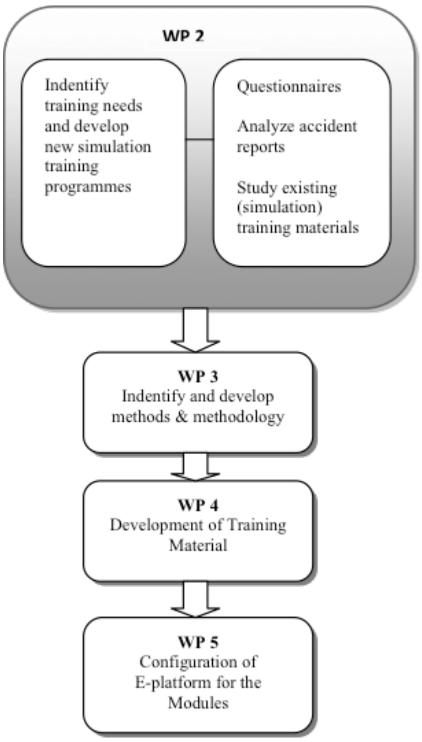

Fig.1. M'AIDER work-package (WP) flowchart.

This paper mainly focuses on the developments in WP 2. This work package includes the following tasks:

- Investigate the main causes of previous ship accidents and incidents by analysing the Marine Accident Investigation Branch (MAIB) accident reports of the past 19 years.
- Distribute a generic questionnaire. The questionnaire has been distributed to a sample of shipping companies and experienced seafarers. The outcomes of the questionnaires have been analyzed to indentify the training needs of young seafarer students.
- Study existing (simulation) training materials, so that the training needs can be identified as well as new training can be added in the already existing training programmes.

The outcome of the analysis of the scenarios together with the results of the questionnaires help to create the final scenario for application on the bridge simulation, as well as in integrated and full-mission simulators. The project continues with WP3 with the main aim to identify and/or develop appropriate methods and methodologies for the development of training course. This leads to the development of training material (WP 4) and the design and development of the training contents. A software system will be developed for the representation of the learning material. At a later stage of the project an e-learning and e-assessment platform will be generated (WP 5-WP 9).

ANALYSED RESULTS OF THE OUTCOMES OF THE QUESTIONNIARE

This paragraph presents the analysis of the questionnaire that has been distributed to experienced merchant marine seafarers. The main aim of the distribution of the questionnaire is to find the shortcomings in the current seafarer's maritime education training and seagoing experience related to emergency scenarios and their knowledge of the regulations to avoid accidents at sea. The results of the 145 received questionnaires will contribute to the improvement of the safety at sea and in ports. For that purpose the results of the analysis of the questionnaires will contribute to the development of the training courses for the maritime education training of seafarers looking at simulator training, e-learning and e-assessment.

2.1 GENERAL INFORMATION

The majority of participants who filled in the questionnaire are from Lithuania, 30%, Followed by the UK, with 21% and the Netherlands, 19%. Just 11% from Turkey and the smallest group of participants are from Slovenia, 4% (Fig 2).

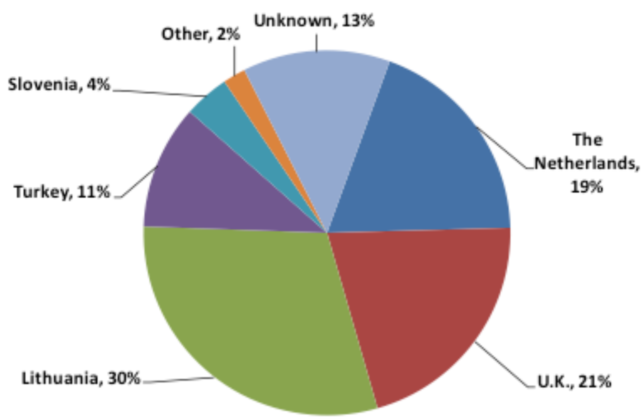

Fig. 2. Nationality distribution

The percentage of each rank within the age group is shown in Fig 3.

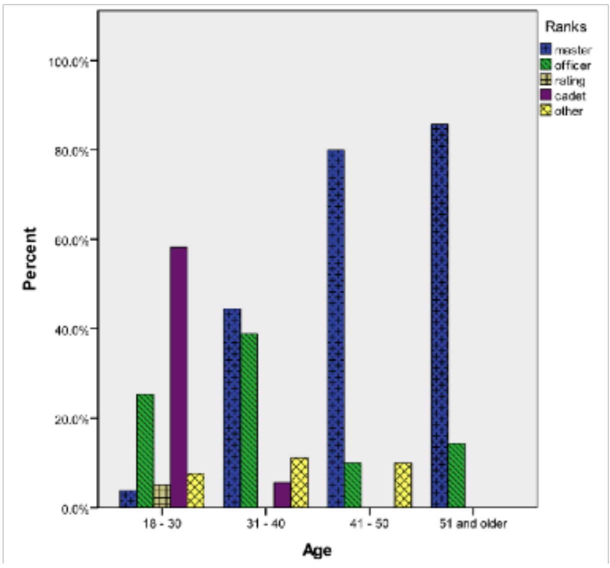

Fig. 3. Age/Rank relationship

In Fig 3 60% of the cadets belongs to the 18-30 age-group. Cadets have little sea going experience, which should be taken into consideration when generating the conclusions about the relationship between the age groups. Officers in the same age group are second in count after the cadets. The ratings and masters are very low in this age. Masters under the age of 30 are very rare, as a certain amount of sailing years are needed to obtain masters certificate licence. In the age group of 31-40 years, the cadets are the smallest part. Cadets normally are within the age of 18-25, as part of their training education. More than 40% are masters within this age group and about a little less than 40% are officers. No ratings participated in this age group. In the age group of 41-50, 80% is master and 10% officer. In the age group of 51 and older, 85% are master and 18% officer.

2.2 BRIDGE SIMULATION TRAINING

The questions related to the bridge simulator training of the participants were analysed, in order to find the shortcomings in the current seafarer's bridge simulation training and seagoing experience relates to their bridge simulation training and their knowledge of the regulations to avoid accidents at sea. This section of the questionnaire all relates to experiences of the participants with bridge simulator trainings. The first sets of question were about the general information of the participants with their training, where they have been trained and what methods were covered.

61% percent of participants have been trained on a bridge simulator against 39% who not have been trained on a bridge simulator. In order to find out if there is a relationship between the nationality of the participants and the bridge simulation training, cross tabulation has been carried out (Fig. 4).

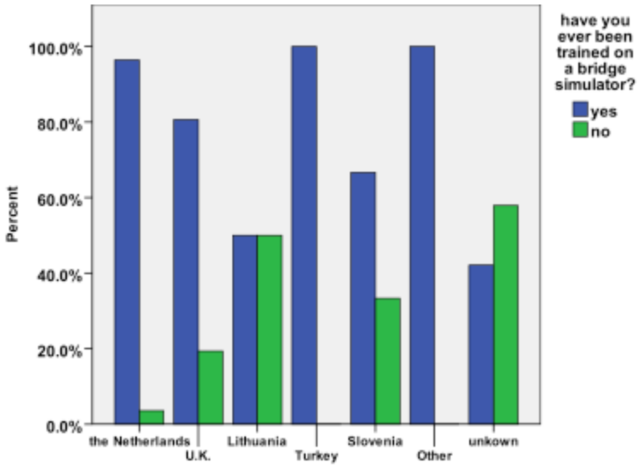

Fig. 4. Cross tabulation bridge simulator training and nationality

Fig. 4 shows the percentages per nationality from the 145 participants who did not have had training on a bridge simulation.100% of the participants from the group: 'other countries, include Belgium, US etc, did undertake bridge simulation training, as so did the group of participants who are from Turkeys nationality. More than 90% of the Dutch participants had bridge simulator training, against just a very small 4 % who did not. As shown in the Fig. 2, 20% of the U.K participants were not trained by means of bridge simulation training and 80% from the U.K. did undertake bridge simulation training. However the most concerning results from this questionnaire is that 50% of the Lithuanian participants were not trained on the bridge simulator, and 33 % of the Slovenian participants who weren't trained on the bridge simulator either. This high amount of percentages from these two countries are concerning. There are not enough bridge simulators or there is no money to train them on the bridge simulator, priority is that these young seafarers from these countries get the change to develop the necessary emergency response skills in order to avoid accidents at sea.

Table 1 shows the frequency of participants who undertake Bridge Simulator Training within the age groups.

		have you ever been trained on a bridge simulator?	
		yes	no
Age	18 - 30	50	29
	31 - 40	18	0
	41 - 50	8	2
	51 and older	11	3
Total		87	34

Table 1. Count of participants with Bridge Simulator Training within the age groups

As shown in Table 1, 36% of the seafarers who did not have had training on a bridge simulation are in the age group of 18-30 years old (count of 29). For the age group 31-40 years old, all of the participants had Bridge Simulator Training. 20% of the 41-50 years age group had Bridge simulator Training (count of 2) and 21% of the 51 and older age group (count of 3).

The existing bridge simulation training methods covered, mainly exist out of practice the ship safety scenarios, as a second most covered training methods, role play was chosen. Role play can be very useful in order to provide more communication training and an as real life situation as possible. The role play will be part of the simulator scenario and is discussed by means of standard lecturing and feedback afterward.

The analysed results of the question asked to the participants if they could name the situations or scenarios they have been trained in while receiving bridge simulator training, are presented (Fig. 5).

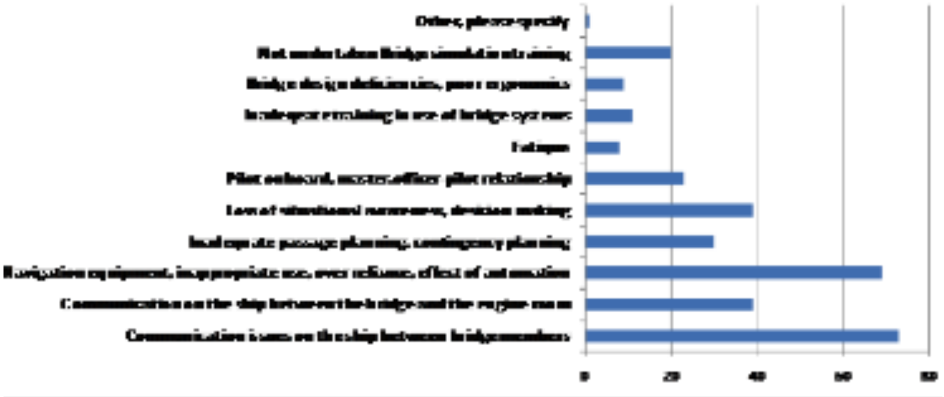

Fig. 5. Human factor situations that were covered in BST

Fig. 5 shows the count of human factor situations that were covered in bridge simulation training given by Maritime training Institutes. The situation that is covered by participants training on the Bridge simulator is ‘communication issues on the bridge between bridge members’. Communication problems occur very often on board between bridge members. There are several factors that can cause this communication issues. One of them could be that the standard orders of the captain or other officers or look out crewmembers, are not clear due to cultural problems [Progoulaki 2006]. In this case, it is quite often to come across misinterpretation of the message/orders in the bridge area.

After analysis of the questions related to the usefulness of the bridge simulator training compared to real life situations, over 55 % of the participants experienced the bridge training scenarios as very or quite useful compared to real life situations. It can be concluded that most participants have experienced the training scenarios that were trained on a bridge simulator, as very useful compared to real life situations at sea.

One of the most important conclusions of the analysed results of the MAIB database accident reports, presented in section 3 of this paper, is that 88% of the accidents at sea are caused by human factors, of which 60% are directly related to individual mistakes. More than 70% of the participants of the questionnaire said that the absence of human physical well-being due to circumstances on board daily life, fatigue, seasickness and the absence of stress is the most important difference compared to real life situations at sea (Fig 6).

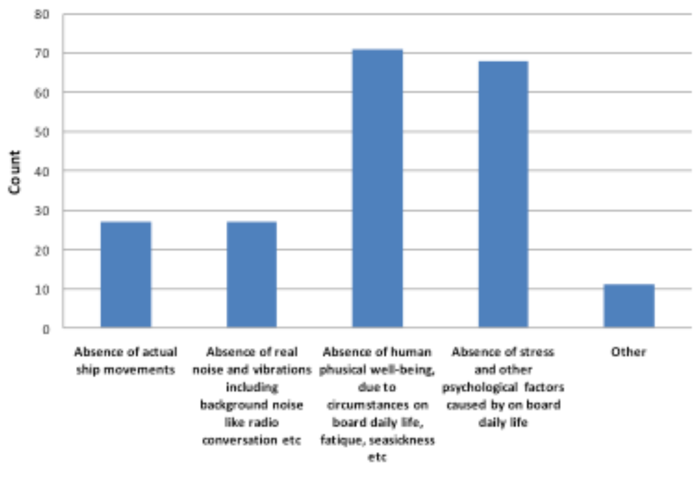

Fig. 6. Most important differences between BST and real life situations

This absence of real human factors during the bridge simulation training can cause lack of awareness of the importance of these factors in real life emergency scenarios at sea. To raise the awareness among the seafarers concerning the human factors as 88% of the cause in an incident, running the real life case scenarios on the bridge simulators as part of the MAIDER project is of paramount importance.

In the question asked to the participants if they were aware of an incident database system with procedures and reports of past shipping incidents in order to simulate real accident scenario on the bridge simulators for training purposes, more than 60% answered they were not aware of an already existing system like this. More than 65% of the participants agreed that creating an incident database system would be very useful in order to improve people's awareness and prevent future incidents.

2.3 COLREGS

The second part of the questionnaire was about the COLREGS, the International Regulations for Avoiding Collisions at Sea. As shown in the previous chapter: 'Analysis of human factors leading to the most occurring scenarios', one of most important human errors leading to an incident is about collision regulations that are not applied or are applied incorrectly. For this reason, the participants of the questionnaire were asked about their familiarity with the COLREGS and how useful they were to them compared to the reality. Analysis were carried out to find out what type of incident the participants have experienced and were involved in themselves, furthermore the participants were asked, in a couple of questions, about their familiarity with the COLREGS, and what training methods they received to get familiarised with the COLREGS.

The analysed results of the two most effective COLREGS learning techniques, according to the participants of the questionnaire, are presented in this paragraph (Fig.7).

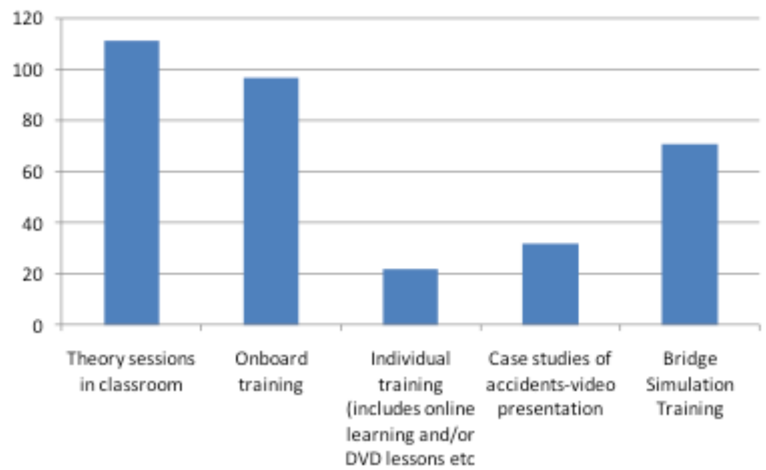

Fig. 7. Most effective COLREGS training methods

As shown in Fig.6 the theory session in the classroom and onboard training both are chosen as the two most effective learning techniques. Theory session in the classroom as a training method to the COLREGS was selected 111 times by the participants and onboard training as most important method to train the COLREGS was selected 97 times. Bridge training was found more useful than both individual training and training by means of case studies and video presentations of the accidents. Bridge simulator training was ticked 71 times; case studies just 32 times and individual training about 22 times, which is very low. Showing accident case studies as an effective learning technique to train the COLREGS is still a much unknown method, and therefore the smallest group.

The see if there is a relationship between the participants who were trained for the COLREGS by one of these methods and the most effective training methods they have chosen in this answer a comparison was made (Table 2).

Training methods	Familiarity with COLREGS	Most effective method
Theory session in classroom	115	111
Onboard training	77	97
Individual training, includes online learning and/or DVD lessons etc	47	22
Case studies of accidents-video presentation	30	32
Bridge Simulator Training	60	71

Table 2. Comparison count received training methods/ chosen most effective training methods

In Table 2 the comparison between right column, the received training methods, and left column; the most effective training methods that were chosen is shown. 115 participants have been trained through theory sessions in the classroom to get familiarised with the COLREGS, 111 participants' selected this method as of the most effective one as well. Out of the 77 participants who were trained by means of onboard training to get familiarised with the COLREGS, 60 of them thought this was one of the most effective learning techniques, this means that 17 of them, that's 22%, who did receive this training to get familiarised with the COLREGS, thought it was not the most effective technique. Out of the 47 participants who were trained by individual learning techniques, just 22 of them thought this was a useful technique to get familiarised with the COLREGS. 30 participants were trained by means of case studies and 32 participants thought this was a useful technique. Bridge simulator training as a training method for familiarisation to the COLREGS was ticked 60 times. Twice as many participants were trained on a bridge simulator to get familiar with the COLREGS compared to the participants who were trained by using accident case scenarios as a learning technique. Far more participants (72) thought this was one of the most effective techniques to use to train people in the COLREGS.

Both case studies and bridge simulator training are very important methods that have to be used in order to familiarise people with COLREGS. In order to familiarise all student seafarers with all the real accident case scenarios and all the human underlying factors as a serious cause of these accidents, more knowledge of both methods have to be studied and developed.

The results of the question about the participants experience at sea and in what type of accident they were involved in are presented in Fig 8.

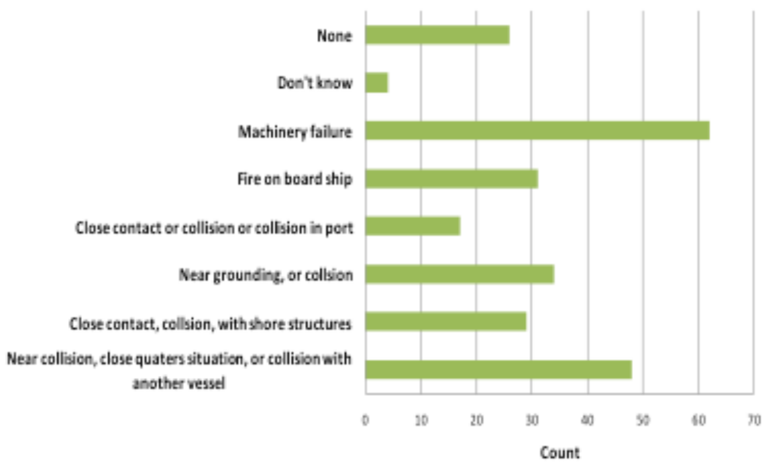

Fig. 8. Participants' involvement in incidents count

As shown, the count of participants who were involved in one of the most occurring incidents is shown. Most incidents experienced are machinery failures, more than 60 participants out of 145 that are over 40%. The cause of the machinery failures in this case is unknown. If this was due to lack of maintenance, human factors or other remains unknown. Nearly 50 participants out of 145 experienced a near collision, while close quarter's situation with another vessel is more than 30%. Participants who experienced a close contact or a collision with a shore structure are just under the count of 30. Collision means that the vessel hits another vessel in port or at sea or a vessel that is anchored. This was followed by 34 participants who experienced a near grounding or collision; grounding means making involuntary contact with the ground and 31 participants experienced fire onboard the ship. Close contact or even a collision in port has not been experienced very often, just 17 participants out of 145 (12%). The most frequent experienced incidents by the participants on board the ships are collisions. 86% of the participants were involved in a collision or near collision during their time at sea. This is in agreement with the analysis carried out of the MAIB database accident reports of which the results were partly presented in the next chapter. After analysis of the incident types with UK flagged merchant ships involved, 36% % of the accidents are collisions.

In another set of questions the participants were asked about the reason the collision occurred. Most said it had to do with low vision or leaving or entering a harbour or channel or that the collision was caused by the high density of traffic. Collision caused by a poor lookout was not chosen very often as a possible cause to collision, just 12 % of the participants have actually chosen 'poor lookout' as the real cause of the collision (Fig.9).

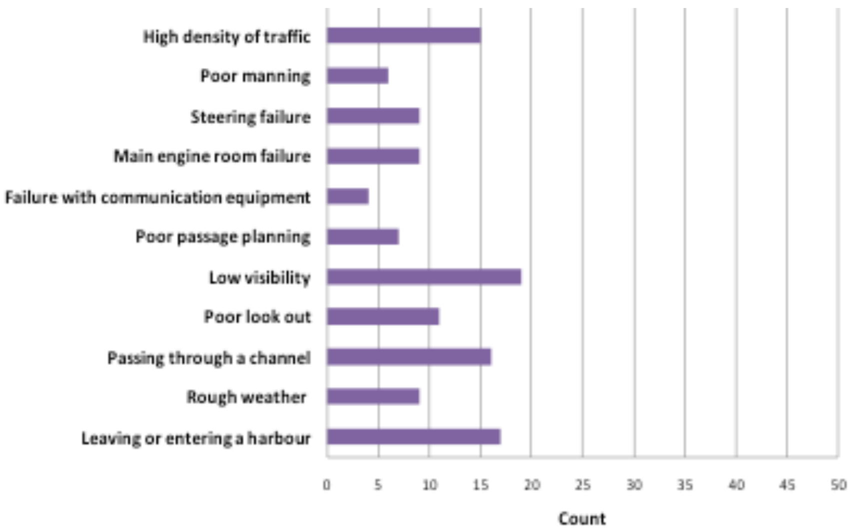

Fig. 9. Type of collision scenario count

This is a remarkable conclusion because in the question asked if the participants could rank the factors contributing to collisions, they ranked the factor 'poor look out' as one of the most important factors contributing to collision (Table 3).

Ranking according to importance	Conditions and their contribution to grounding and collisions
1	Poor look out
2	Poor look out
3	High density of traffic
4	Passing through a channel
5	Low vision
6	Poor passage planning
7	Passing through a channel/Poor passage planning
8	Leaving or entering a harbour/Poor look out/Steering room failure
9	Poor passage planning
10	Steering room failure
11	Main engine room failure

Table 3. Ranking according to importance

The conclusion therefore is that most of the participants are unaware of the real underlying human factors contributing to the incidents. Incidents caused by low vision have often to do with lack of knowledge in the COLREGS or not applying these regulations correctly in low vision situations. Even more frequent occurring emergency scenarios are due to poor look out.

More awareness of the usefulness of bridge simulator training in order to prevent incidents at sea is needed. 86% of the participants agreed that bridge simulation training is efficient training method to prevent collision incidents at sea.

One of the most important conclusions learnt in the questionnaire is the need of improvement of people's awareness; in order to prevent incident at sea, mitigating the amount of human errors that cause the incidents, improvement of people's awareness of the importance of bridge simulation training and of the part the human behaviour and errors are playing a role in this, is needed.

RESULTS OF THE ANALYSIS OF THE MAIB ACCIDENT REPORTS

In the report 'Investigation of ship incidents based on the analysis of the MAIB database' (Bosma et al, 2010) the identification of the most critical emergency cases that can be used in developing real case scenarios to enhance the training approach and content was presented.

3.1 ANALYSIS MOST FREQUENT ACCIDENT SCENARIO

In order to find the most occurring accident scenario, the most frequent occurred accident scenarios were analysed. The majority of incidents occurred in coastal waters, 36%. After analysis the relationship between the different vessel categories and the frequency of accidents, passenger vessels had the highest incident frequency in both coastal waters as in port and harbour areas, 52% and in river/canal areas even 56%. As 12 % of the UK merchant vessel fleet are passenger vessels. In general collisions, 36% and groundings, 33% are the most frequent occurred incident types on all locations. Using the analysis results in the perfect choice of emergency scenario in order to set up a training approach will have to include the following: an incident in coastal waters involving a collision with a passenger Ro Ro ferry as 59% of these passenger vessels are Ro-Ro vehicle/passenger ferries. Therefore the best training scenarios will have to involve an incident in coastal water with a Ro-Ro ferry as can be seen in Fig 10.

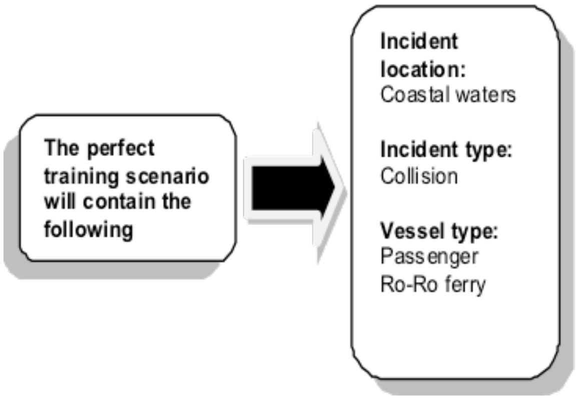

Fig. 10. Show the perfect training scenario location, incident type and vessel type according to the results of the MAIB database analysis report [Bosma et al, 2010]

3.1 ANALYSIS OF HUMAN FACTORS LEADING TO THE MOST OCCURING SCENARIOS

The second part of the MAIB database analysis, presented the results of the analysis of human factors that are leading to the most occurring scenarios. There are a lot of underlying factors like alcohol abuse on board which Branangan et al investigated in their paper [Branagan and Turan, 2010] or misinterpretation of the regulations but the most notable factors in this category are:

- The Unawareness of a situation (9%). This could be an incorrect understanding of the current situation which can lead to faulty hypothesis regarding a future situation.
- Poor decision making, use of information (7%).
- Procedure carried out inadequately (7%)
- Inattention. The loss of attention, (6%).

These three most frequently occurred underlying factors will eventually lead to the human errors; these are the errors that will lead directly to the incident. The two most frequent occurring types of human error are:

- Incorrect or insufficient action taken (17%)
- Collision regulations not applied (9%)

By integrating some of the most frequent occurring incidents caused by human errors in the bridge simulators training programmes, human errors leading to incidents can be mitigated.

IMPLEMENTATION OF ACCIDENTS SCENARIO AND OBSERVING THE RESULTS

The M'AIDER project mainly concerns aspects of human error related to emergency situations which can be corrected by preparing a whole range of scenarios, simulating actual incidents, incidents and near misses. The MSTC investigated the knowledge of students attending a simulator course as part of their training to become a marine officer. The task of the MSTC in this project was to implement a scenario in student training and investigate the results of this scenario. The scenario was based on a real accident, which happened in Dover Strait in 2008.

4.1 INITIAL SITUATION

The accident occurred on 29 October 2008 when the UK registered general cargo vessel Scot Isles was in collision with the Egyptian bulk carrier Wadi Halfa. The Scot Isles, which was on a passage from Rochester to Antwerp and crossing the NE traffic lane of the Dover Strait Traffic Separation Scheme, did not detect the Wadi Halfa. This resulted in a collision.

The simulation exercise starts at 03.15 UTC when the Scot Isles starts to cross the Traffic Separation Scheme. For this simulation, ship models were used which had a service speed close to the speed of the vessels involved.

Further initial settings of simulator were (Table 4):

Own Ship Type Dimensions (m)	"Willem Barentsz" PIPZ General Cargo vessel (129.0 * 20.5 * 8.7)m
Area	Dover Strait
Destination	Antwerp
Chart(s)	BA 323, BA 2449
Waypoints	none
Course / Speed	112° / 12 kn (Full Seaspeed)
Wind	NW 3 Bft
Visibility	> 10M
Instrumental correction (i.c.)	0.0°
Tidal Stream	To be determined
Starting Position Date / Time	51°24'.4 N, 001°50'.1 E 29/10/2008 at 03.15 UTC

Table 4. Initial settings of the simulator

STUDENT CHARACTERISTICS

In total the simulation training exercise 'run' approximately 40 times, just enough to give a good judgement about the exercise. The students which participated in the exercises were mainly students studying at secondary nautical institutes in the Netherlands. The students:

Have already followed two years of education on their institutes.
- Will most probably start their time at sea as cadet in the next few months.
- Have followed a short course on radar observation and navigation.
- Should have knowledge of the COLREGS.

4.3 PREPARING STAGE FOR THE SIMULATION PROCESS

The exercises have a duration of two and a half hours each and consist of:
a) Briefing
b) Simulation
c) Debriefing (evaluation)

4.3 (a) Briefing

During the briefing the students are familiarized with the goals of the exercise and have time to prepare the exercise. Main items during the briefing include:

- Plan voyage as indicated by instructor.
- Vessel is heading for Antwerp and has to cross Dover Strait.
- Comply with the regulations and sail the vessel safely towards the West hinder traffic lane.

After having received the basic theoretical instructions the students have to plan the exercise themselves. During the briefing the instructor keeps a low profile. He checks if the preparation is done thoroughly. The briefing room is a specially equipped room with all the material necessary for preparation available such as instruction books, charts etc. At the end of the briefing the students inform the instructor about their passage planning. The bridge procedure briefing is also part of the total evaluation of the exercise.

4.3 (b) Simulation

The exercise is 'run' as part of the simulator training on a 360° simulator. The students have to show that they meet the goals set during the briefing. For the purposes of the exercise, a scenario is written to cover the whole process. By following the scenario the instructor can see that all students meet the same degree of difficulty. During the exercise the instructor only interact in the simulator training if by any means goals cannot be reached without interaction of the instructor. Normally the instructor does not give any instructions during the training. He/she only observes the students during the training and takes notes during the exercise. These notes are written in a logbook for each group. The instructor can use video recording as well, which enables him/her to give detailed information about Bridge Resource Management.

4.3 (c) Debriefing

After the training, the exercise is debriefed. During the debriefing everything that happened during the exercise is discussed by the instructor and the students. This is a step-by-step approach by means of a computer, with the possibility to replay the exercise. The debriefing is a very important part of the training and therefore has to be done thoroughly. At first the students can give their opinion about the way they have performed and can ask questions and discuss things with each other. Then the instructor gives his opinion about whether and how the students have reached their goals. With the aid of an additional video of QPS, with AIS data of the accident, there can be a discussion with the students about the things that happened during the real scenario when both ships collided and the exercise the students have participated in.

At the end, conclusions can be formulated about human factors that play an important role in this accident. Finally the instructor provides a total review of the exercise.

ASSESSMENT OF STUDENTS

Training students using simulators is an expensive way of education. This is why the usage of trainers and simulators needs to be optimized. However there must be time available to assess the students as well. For this particular exercise there was a function created for each member in the group. The following tasks were created: Head of Watch (HOW), Watch Officer (WO), Assistant Watch Officer (AWO) and Helmsman (RG). The tasks of the functions were defined as follows:

Head of Watch: Overall responsibility of the bridge process, control of set criteria for the predefined route.
Watch Officer: Knowledge of shipping in vicinity of own vessel, by using radar plots, AIS and other means of identification of shipping. In case of close quarter situation WO should inform HOW. He/she carries out the necessary communication with other ships.
Assistant Watch Officer: In control of position own vessel by using Charts, Radar and AIS information. As a member of the Bridge team he informs HOW about dangers when vessel comes close to relevant dangers.
Helsman: Steers the vessel on manual and obey orders of HOW. As a member of the Bridge team he informs his colleagues when he observes irregularities.

During the exercise the instructor assesses the students on their tasks. The MSTC developed a web-based assessment tool which makes it possible to assess the students during a week of training. Each student is assessed by several trainers and on several assessment criteria. At the end of the training week an overall score is calculated by the system for the final assessment.

4.4 (a) Assessment tool

The assessment tool is custom-made for the training process at the MSTC. Every week about 28 students carry out simulation training. The students are divided in 7 groups of 4 persons each. The simulation training is divided in Cargo Handling, Bridge and Engine room simulation. The process for filling in this assessment is:

Instructor login

- Selecting group to assess
- Select the person or whole group to assess
- Select exercise to assess
- Fill in exercise criteria

- Select next person to assess or stop assessment if all persons are assessed or group is assessed as a whole

4.4 (b) Continue assessments

Filling in an assessment takes an instructor a couple of minute's time. During the exercise, he/she makes some notes, so it is only filling out these notes into the web-based system.

4.4 (c) More features

Other features of the system are:

Student record tracking
- Certificate administration
- Evaluation of student remarks for the quality system
- Analyze assessment data

RESULTS

During this exercise the focus was laid upon the following items:
a) When do students notice the target for the first time?
b) When do students first recognize the risk of collision?
c) When do students start avoiding the target?
d) Which actions are taken to avoid the target?
e) What will be the Closest Point of Approach (CPA)?
f) Finally, when do they return to original course continuing the voyage?

4.5 (a) When do students notice the target for the first time?

Students needed, in general, a lot of time to get acquainted with the simulator instruments. So their first focus is mainly on the instruments. As the target is still some 9 miles away and the radar range is mostly set on a 6 mile radius, the students do not notice the target at once.

Results showed that the majority of the students saw the target after approx. 10 minutes (Fig. 11).

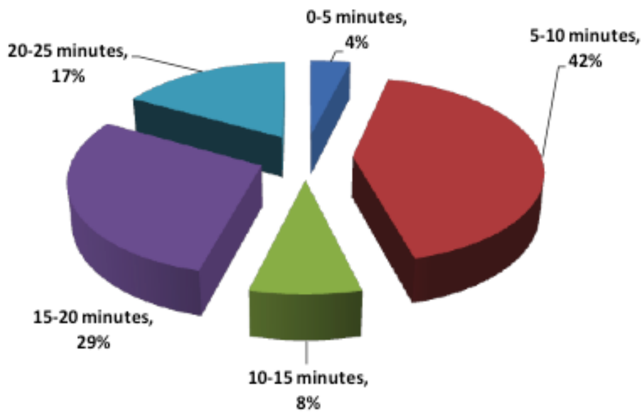

Fig. 11. First detection of target

There are some differences in the measuring results as a large group of results also showed that the target was seen after approx. 18 minutes. This can be declared by the fact that during the time of taking these results some of the students were sent to the training institute without having any experience with radar. After 18 minutes the target becomes visible on radar screen with a 6 mile radius (radar centre in the middle).

4.5 (b) When do students first recognize the risk of collision?

In this case the students start plotting the target as it is shown in the radius of 6 mile. With the aid of ARPA and AIS as well, the risk of collision is observed by the students. Hardly any group has shown any intention until now to look what the target's position is in the outside view. Observation of groups of students shows that the students are relying much on automation systems. They hardly use the visual bearing anymore. Fig 12 shows most of the students mostly recognize the risk at approx. 20 minutes.

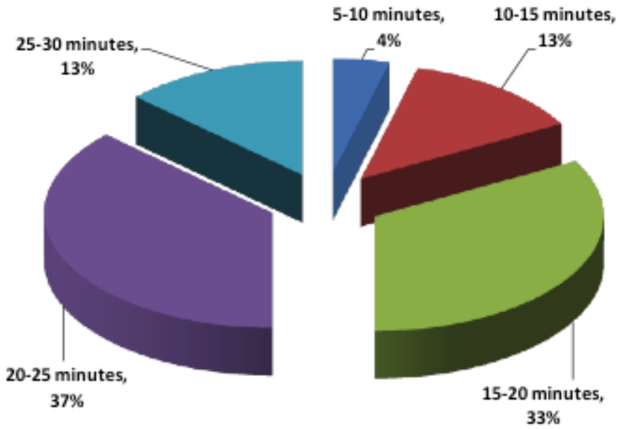

Fig. 12. First recognition of collision

When we look closer to the results of the exercise, we observe that the students who detect the target after approximately. 10 minutes are more relaxed due to the distance of the vessel. They observe the risk of collision and after approximately 5 minutes they decide what action should be taken. Intensive conversation in the bridge team is also observed. The action which is decided after close consultation with the bridge team is mostly a relative small alteration of course to Starboard (SB) (in relation with CPA) and sometimes the reduction of speed.

Students who detect the target after approx. 18 minutes start avoiding the target relatively quickly after they recognise the risk of collision. When risk is observed there is mostly a quick action to avoid the target. Most of the time this action is carried out by making an alteration of course to SB.

4.5 (c) When do students start avoiding the target:

As also mentioned in the paragraph above, the students who have relatively a lot of experience in radar plotting are more relaxed in deciding which alteration should be made. Students with relatively small experience in radar plotting are eager to start immediately avoiding the target even if there is a lot of time before action is to be taken. The majority of the students take appropriate action in time as can be seen in the figure below (Fig. 13).

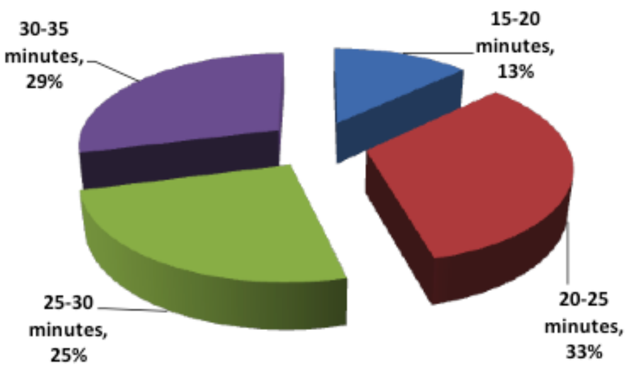

Fig. 13. Timing the action taken so as to avoid the target (in minutes)

Keeping in mind that the real accident occurred at 03.49 UTC and simulation starts at 03.15, and then Fig. 11 shows that approximately 29% of the students were relatively late in avoiding the target. Approximately 12% of the students started very early to avoid the target and the target then was relatively still at a great distance.

4.5 (d) what actions are taken to avoid the target (Fig 14).

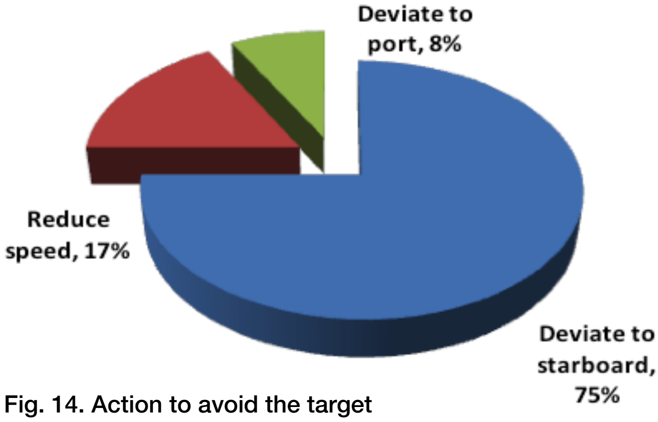

Fig. 14. Action to avoid the target

As can be seen in Fig 14 most of the students started to make a deviation to Starboard to avoid the target. A few of the students (17%) anticipated by making a reduction in speed. Those students who reduced speed did this well in time, which resulted in a safe passage of the ships. In case of the course alteration to SB several situations occurred; a few of the students made use of trial observation on radar and were changing course in accordance with the results observed on radar. Most of the students however changed course more than 60°. In several occasions this was done by making course changes in steps of 5 to 10 °.

4.5 (e) what will be the Closest Point of Approach (CPA)?

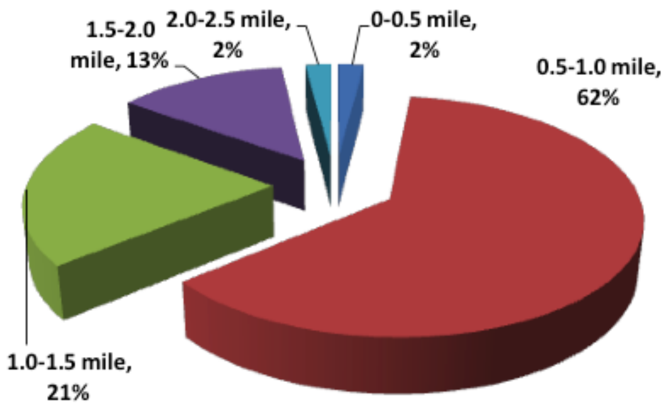

Fig 15. Closest Point of Approach (CPA)

As shown in Fig 15, average CPA which was observed in the exercises was between 0.5 – 1 mile. Those students, who made an early deviation to SB and at the same time reduced speed, had CPA's of approximately 1 – 2 miles.

4.5 (f) finally, when do they return to original course continuing the voyage?

Most of the students returned to original course as soon as the target was passed and well clear on Port side of own ship. Course was set to the next waypoint and in some circumstances change of course was made.

4.6 CONCLUSIONS OF SIMULATION SCENARIO

It appears that during the exercise students had been well aware of the risk of collision with the target on starboard side. The target has been spotted in 95% of the time on an early stage and adequate action had been taken by the students. When observing the video with the accident, as manufactured by QPS, students were surprised that this accident had occurred.

Discussion was held by the instructor about the competence of the officer navigating the vessel and students own experiences during the exercise. Questions were asked about:

- Doing nothing when the lookout observed the red light to starboard.
- Not plotting of ship positions on the chart.
- Not plotting any ship's positions
- The possibility of fatigue (although there is no evidence to conclude this)
- The advantages of AIS information and what was done with this information.

5 CONCLUSIONS AND DISCUSSION

The M'AIDER projects' intention is to develop a scenario based training programme reducing risk of human errors specifically related to navigation leading to collisions, grounding or other dangerous situations. Another focal point of M'AIDER project is the training of deck officers in particular as the accidents are directly related to the activities on the bridge including communication within the team as well as the bridge and engine department. By analysing the results of questionnaires handed out to experienced seafarers, the most frequent occurred emergency situations and the prevailing conditions, incidents can be predicted. Through this study the human factors leading to emergency situations has been identified providing information as to how various incident scenarios could be selected for further implementation in integrated and full-mission ship simulators.

With regards to the above, a systematic attempt in developing accident or incident scenarios for training of young cadets and seafarers working at sea and ports is performed. This investigation was carried out at the Maritime Simulator Training Centre (MSTC), which is part of the Maritime Institute "Willem Barentsz", in cooperation with the University of Strathclyde. Concurrent development of training programmes for deck officers is a unique opportunity in order to prevent accidents. They should be based on real emergency situations/scenarios and focus their attention on what could await them when at sea.

The analysis of the results of questionnaires handed out to experienced seafarers so as to find out the most frequent occurred emergency situations and the prevailing conditions are shown. One of the most important conclusions of the analysed results of the MAIB database accident reports, presented in section 3 of this paper, is that 88% of the accidents at sea are due to human factors, 60% of which are directly related to the individual mistakes. More than 70% of the participants in the questionnaire said that the absence of human physical well-being due to circumstances on board daily life, fatigue, seasickness and the absence of stress is the most important difference compared to real life situations at sea. This absence of real human factors during the bridge simulation training can cause lack of awareness of the importance of these factors in real life emergency scenarios at sea. To raise the awareness among the seafarers concerning the human factors as 88% of the cause in an incident, running the real life case scenarios on the bridge simulators as part of the MAIDER project is of paramount importance [Hetherington C et al, 2006].

The most frequent experienced incidents by the participants onboard the ships are collisions. 86% of the participants were involved in a collision or near collision during their time at sea. This is in agreement with the analysis carried out in the MAIB database. After analysis of the incident types with UK flagged merchant ships involved, 36% % of the accidents are collisions. Collision caused by a poor lookout was not chosen very often as a possible cause to collision, just 12 % of the participants have actually chosen 'poor lookout' as the real cause of the collision.

This is a remarkable conclusion because in the question asked if the participants could rank the factors contributing to collisions, they ranked the factor 'poor look out' as one of the most important factors contributing to collision. The conclusion therefore is that most of the participants are unaware of the real underlying human factors contributing to the incidents. Incidents caused by low vision have often to do with lack of knowledge in the COLREGS or not applying these regulations correctly in low vision situations. Even more frequent occurring emergency scenarios are due to poor look out.

One of the most important conclusions from the questionnaire is the need of improvement of people's awareness; in order to prevent incident at sea, mitigating the number of human errors that cause the incidents, improvement of people's awareness of the importance of bridge simulation training and of the part the human behaviour and errors are playing a role in this, is needed [Wagenaar and Groeneweg, 2008]

The task of the MSTC in this project was to implement a real emergency accident scenario in student training and investigate the results of this scenario. The real case scenario, an accident which occurred in Dover strait in 2008, was based on the results from the analysis of the MAIB database and the results of the questionnaire. During this exercise students were well aware of the risk of collision with the target on starboard side. The target was spotted in 95% of the time on an early stage and adequate action was taken by the students. When observing the video with the accident, as manufactured by QPS, students were surprised that this accident had happened. By training the seafarer students on bridge simulators with real case scenarios like this, the awareness for human factor errors is raised and therefore accidents at sea mitigated.

ACKNOWLEDGEMENTS

The authors of this paper would like to thank QPS Company in the Netherlands and MAIB for its most elaborate assistance and cooperation in this project. Further acknowledgement is made of the EU funded research project M'AIDER (Maritime AIds Development for Emergency Responses).

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INTEGRATED BRIDGE SYSTEMS IN SIMULATION

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ABSTRACT

In this paper an attempt to consider two aspects of IMO definition of the IBS as a component of an up-to-date Bridge Operation Simulator have been made: 1) Which systems and on which workstations are included in the combination with the declared functionality and 2) What should be understood to mean the suitably qualified personnel. The Chapter 2 contains some extracts from the DNV additional requirements for simulators intended for training on Integrated Bridge Systems including Integrated Navigation, and provides some comments on them. Transas NTPRO Simulator layouts illustrate these extracts. The Chapter 3 contains a graphic description of Transas "Multi-Function Display 4000" INS. The Chapter 4 contains some extracts from the IMO STCW 78 Code with Manila Amendments for drawing the following conclusion: the IBS bridge operation simulators with 7 workstations described in this paper are perfectly suited for the seafarers' training and certification at the management, operational and support levels of responsibility.

Keywords: Bridge resource management, DNV standard 2.14, Integrated Bridge System (IBS), Integrated Navigation System (INS), Manila amendments, Navi-Trainer Professional (NTPRO) simulator.

1. INTRODUCTION

An integrated bridge system (IBS) is defined by the IMO as a combination of systems which are interconnected in order to allow centralized access to the sensor information or command/control from workstations, with the aim of increasing safe and efficient ship management by suitably qualified personnel.

In this paper we have made an attempt to consider two aspects of this definition of the IBS as a component of an up-to-date Bridge Operation Simulator:

1. Which systems and on which workstations are included in the combination with the declared functionality.
2. What should be understood to mean the suitably qualified personnel.

When looking into the first aspect, we will take DNV Requirements 2.14 Standard "Maritime Simulator Systems" (January 2011) [1] as a point of departure. In considering the second aspect we will proceed from the requirements of the IMO STCW 78 Code with Manila Amendments (June 2010) [2, 3, 4, 5]

2. CENTRALIZED ACCESS TO SENSOR INFORMATION AND COMMAND/CONTROL FROM WORKSTATIONS

The Chapter will contain some extracts from the DNV additional requirements for simulators intended for training on Integrated Bridge Systems including Integrated Navigation, and provide some comments on them, the main comment being offered right away:
All workstations are completely multifunctional (MFWs), and may be used for any IBS function at any time. All MFWs provide access to all information, enabling the duty officer(s) to configure the bridge console layout in accordance with the mission being performed, bridge manning or system status (i.e., damage or malfunction), or to suit the personal preference of the navigation officer.
Note: All systems related to the IBS include failure control(s) and method(s) to train and assess the learner in the use of advanced equipment, technology and enable familiarization and training to understand the limitations of automatic systems.

2.1 IBS BRIDGE ERGONOMICS

Transas has many years of experience with advanced IBS bridge layouts, and the latest innovations in user ergonomics are taken into account. Three-dimensional layout studies are offered to ensure the best possible working environment and compliance with IMO and class rules. Control of all main systems is readily available from the navigator chairs. Visibility analysis will ensure minimal interference of blind angles and ensure optimal visual capability.

Fig.1. Transas NTPRO Simulator. IBS bridge layout

2.2 WORKSTATION FOR NAVIGATING AND MANOEUVRING

The interconnected systems included in the Workstation for navigating and manoeuvring are shown in Fig.2

Fig. 2. Transas NTPRO Simulator. Workstation for navigating and manoeuvring

2.2 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- MFD 4000 ECDIS / Radar X-Band / Conning Display / AMS (Master station);
- Manoeuvring console with controls and indicators for main engine(s), propulsion and steering systems;
- Overhead navigation display for indication ship surge, sway, heave, yaw, roll and pitch values;
- Overhead navigation display for indication weather conditions;
- Overhead navigation display for indication navigational instruments data;
- Ship's signals transmitter;
- Automatic device for emergency alarm;
- VHF point with channel selector;
- Internal communication equipment;
- Night vision and searchlight equipment;
- Watch and internal alarms panel.

2.3 WORKSTATION FOR MONITORING

The interconnected systems included in the Workstation for monitoring are shown in Fig. 3

Fig. 3. Transas NTPRO Simulator. Workstation for monitoring

2.3 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- MFD 4000 ECDIS / Radar S-Band / Conning Display /AMS (Slave station);
- NTPRO Conning Display;
- Ship's signals transmitter;
- VHF point with channel selector;
- Internal communication equipment;
- Watch and internal alarms panel.

2.4 WORKSTATION FOR STEERING (HELMSMAN'S)

The interconnected systems included in the Workstation for steering are shown in Fig. 4

Fig.4. Transas NTPRO Simulator. Workstation for steering

2.4 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- Steering wheel / steering lever
- Steering mode selector switch
- Rudder pump selector switch
- Autopilot;
- Gyro and Magnetic repeaters;
- Rudder order and angle indicators;
- Rate of turn indicator;
- Talkback to bridge wing workstation.

2.5 WORKSTATION FOR DOCKING (BRIDGE WING)

The interconnected systems included in the Workstation for docking are shown in Fig. 5

Fig. 5. Transas NTPRO Simulator. Workstation for docking

2.5 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- Steering position selector switch;
- Controls and indicators for main engine(s), propulsion and steering systems;
- Indicators for wind direction and velocity;
- VHF point with channel selector;
- Internal communication equipment;
- Night vision and search light equipment;
- Watch and internal alarms panel.

2.6 WORKSTATION FOR PLANNING AND DOCUMENTATION

The interconnected systems included in the Workstation for planning and documentation are shown in Fig.6

Fig. 6. Transas NTPRO Simulator. Workstation for planning and documentation

2.6 (a) Comments

The following equipment and systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- Chart table with drawing instruments;
- MFD 4000 ECDIS (BackUp station) with Chart Assistant, Route Planner and Weather chart plotter;
- NavAids Conning Display;
- Command printer;
- VHF point with channel selector

2.7 WORKSTATION FOR SAFETY

The interconnected systems included in the Workstation for safety are shown in Fig. 7

Fig. 7. Transas NTPRO Simulator. Workstation for safety

2.7 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:

- Auxiliary Systems from Transas Engine Room Simulator (Fire alarm, Fire-extinguishing, Air condition and Ventilation, Refrigerating, Bilge and Ballast systems);
- Electric Power Plant controls and indicators from Transas Engine Room Simulator (SEPS control panel, Bridge distribution switchboard);
- Fin Stabilizer Control panel;
- Strength Load Monitor;

- Monitor of SOx and NOx emissions, CO concentration and unburned fuel contents, fuel consumption;
- Internal communication equipment;
- Two-way VHF radiotelephone (walkie-talkie).

2.8 WORKSTATION FOR COMMUNICATIONS

The interconnected systems included in the Workstation for communication are shown in Fig. 8

Fig. 8. Transas NTPRO Simulator. Workstation for communication

2.8 (a) Comments

The following systems of the Workstation are integrated in the Transas IBS Simulator [6]:
- GMDSS equipment as required for the applicable sea area:
- VHF-DSC, radiotelephone
- MF-DSC, radiotelephone
- MF/HF-DSC, NBDP, radiotelephone
- Inmarsat-SES
- NAVTEX/EGC/HF direct printing telegraph
- EPIRB trigger
- Main station for two-way VHF radiotelephone (walkie-talkie).

3. MFD 4000 INTEGRATED NAVIGATION SYSTEM

Transas Multi-Function Display (MFD) 4000 is the kernel of the NTPRO IBS [7].
The MFD 4000 is very flexible concerning the interfacing of navigation sensors, combat management systems, Integrated Platform Management System and communication systems. Because of this system integration expertise and open system approach, the MFD 4000 can accept sensor inputs from a wide variety of suppliers supporting most common signal transmission methods and protocols, while being able to adapt to special needs.

Closed Circuit Television (CCTV) operation and presentation, Advance Position Prediction and Voyage Data Recorder (VDR) are available for integration with the MFD. Integration of Automatic Identification Systems (AIS) with ECDIS/ARPA is also offered as required by IMO regulations. Provided below are figures of the main MFD 4000 sub-systems with some explanatory notes.

3.1 TRANSAS INTEGRATOR UTILITY

Fig.9. Transas Integrator utility

3.2 TRANSAS CHART ASSISTANT UTILITY

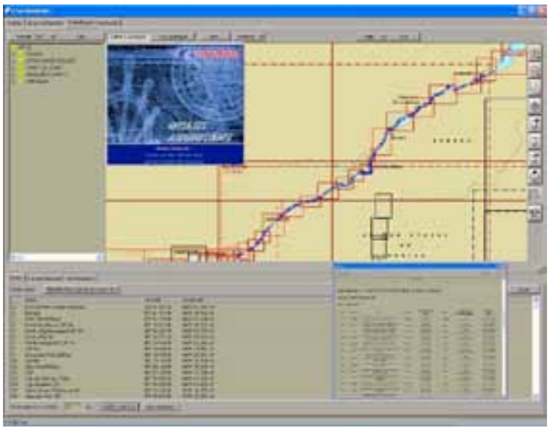

Fig.10. Transas Chart Assistant utility

3.3 TRANSAS NAVI-PLANNER

Fig.11. Transas Navi-Planner

3.4 ECDIS MULTI-FUNCTION DISPLAY

Fig. 12. ECDIS Multi-Function Display

3.5 RADAR MULTI-FUNCTION DISPLAY

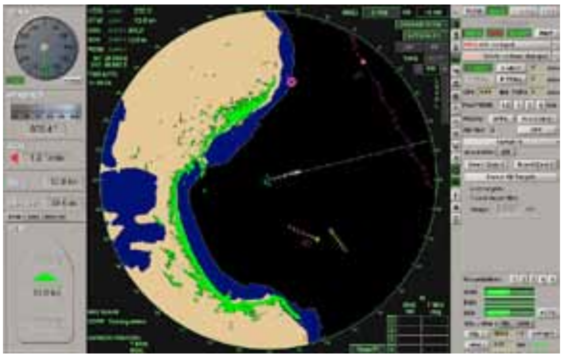

Fig. 13. RADAR Multi-Function Display

3.6 CONNING MULTI-FUNCTION DISPLAY

Fig.14. CONNING Standard View

3.7 CONNING MULTI-FUNCTION DISPLAY (CONTINUATION)

Fig. 15. CONNING Charts with CCTV

3.8 ALARM MONITORING SYSTEM

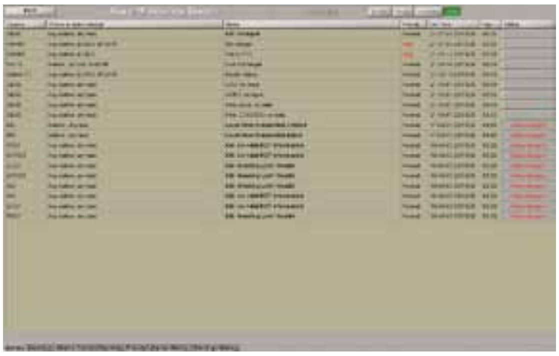

Fig. 16. Alarm Monitoring System

3.9 MFD PLAYBACK

Fig. 17. MFD Playback

3.10 VOYAGE DATA RECORDER

Fig. 18. Voyage Data Recorder

3.11 MFD 4000 SENSORS

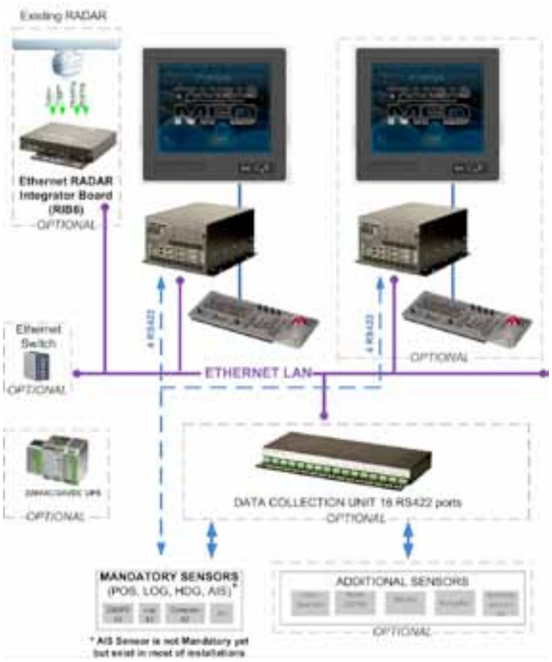

Fig. 19. MFD 4000 Sensors

3.12 MFD INTERCONNECTION DIAGRAM

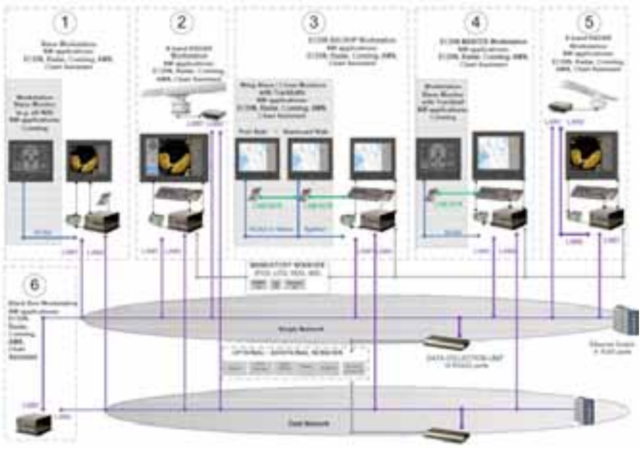

Fig. 20. MFD Interconnection Diagram

4. NEW STANDARDS OF TRAINING AND CERTIFICATION FOR SUITABLY QUALIFIED PERSONNEL

Considering the issue of what should be understood to mean the suitably qualified personnel, we will proceed from the new requirements of the IMO STCW 78 Code with Manila Amendments (June 2010).

A) Let us start with the "Standard of competence for OONW on ships of 500 gross tonnage or more". Here 4 new Bridge resource management requirements have appeared for the "Maintain a safe navigational watch" competence, including:

1. allocation, assignment, and prioritization of resources;
2. effective communication on board and ashore;
3. assertiveness and leadership, including motivation;
4. obtaining and maintaining situational awareness.

B) We will then refer to the "Standard of competence for masters and chief mates on ships of 500 gross tonnage or more". Here numerous requirements have been added for the assessment of an entirely new competence: "Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision making". Here are the most significant of them:

1. manage procurement, licensing and updating of chart data and system software to conform to established procedures
2. system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development
3. create and maintain system configuration and backup files
4. create and maintain log files in accordance with established procedures
5. create and maintain route plan files in accordance with established procedures
6. use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses
7. use ECDIS playback functionality for passage review, route planning and review of system functions

C) Also added here are some requirements for another absolutely new competence: " Use of leadership and managerial skill ".

Knowledge and ability to apply effective resource management:

See item A) and the following additional requirement:

5. decisions reflect consideration of team experiences

Knowledge and ability to apply decision-making techniques:

1. situation and risk assessment
2. identify and generate options

3. selecting course of action
4. evaluation of outcome effectiveness

In addition to A), B), C), the scope of courses and trainees is going to expand:

1. Special training courses for personnel on certain types of ships, including large ships with Azipod propulsion system;
2. Joint ship and port Security Officer courses;
3. Electrical Department personnel courses for the additional maintenance of electronic navigational and GMDSS equipment;
4. Members of the ship's deck crew other than the master or an officer (deck ratings) will have to demonstrate their ability to perform elementary navigator's duties: course plotting, course selection for a helmsman, etc.

So, the most important new knowledge and skill the navigator is required to have is to be capable of situational awareness in the conditions of various arising risks. It is, therefore, simulators for the concurrent training and competency assessment of different marine specialities which will be in demand.

5. CONCLUSIONS

The IBS bridge operation simulators with 7 workstations described above are perfectly suited for the seafarers' training and certification at the management, operational and support levels of responsibility.

Thank you for your attention!

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AN INVESTIGATION INTO COLREGS AND THEIR APPLICATIONS AT SEA

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ABSTRACT

It has been almost 40 years since the 1972 International Regulations for Preventing Collisions at Sea known as Colregs were introduced and there have been several amendments to Colregs rules since then until now.

Collision avoidance is believed, in a sense, to prevent groundings, the striking of fixed obstacles and ships colliding. Over the last half-century despite improvements in navigational aids such as ARPA and attempts to raise the standards of training through various STCW conventions, collisions still occur. Many studies and accident reports indicate that the accidents are caused by either human error or are associated with human error as a result of inappropriate human responses. Collisions commonly represent the majority of these accidents.

This paper does not attempt to examine all Colregs rules, but is concerned with the basic rules that are usually ignored or disregarded, in order to identify the deficiencies in the application of Collision rules at sea. This paper will also touch on the deficiencies in the maritime education and training (MET) navigational officers' programme that is related to Colregs teaching.

This paper will suggest the development of a course with a set of standards and study units for testing the understanding of seafarers in applying the Colregs rules. The standards will be developed from real accident cases while testing the potential navigators' understanding with real time situations. This would improve the application of the Colregs rules at sea environment.

Keywords: Colregs, maritime education and training, collision avoidance

1. INTRODUCTION

Colregs is one of the internationally agreed conventions of the sea. It is essential to ensure that all officers responsible for the navigational watches have a full understanding and good interpretation of the rules to apply them at sea to avoid collisions. The International Maritime Organisation (IMO) developed the first standards for Vocational Education and Training (VET) programmes for merchant navy officers (STCW) in 1978, and it has been amended in 1991, 1995, 2003 and 2010 respectively. However, there are currently no mechanisms to monitor how these standards are being applied as many VET providers have been found not to follow many of the requirements. Therefore, there has always been substantial diversity on the knowledge, understanding, interpretation and application of these rules in the high seas and coastal waters that has always threatened the safety of life at sea. Colregs rules are reported to be difficult to understand and apply at sea by navigational officers (Stitt, 2002). Ziarati (2007) reports that majority of these accidents and incidents are related to collisions and near misses. Therefore, there is a need to reduce the accidents and near misses at sea.

The Colregs rules are basically a set of rules that are required to be followed by all navigation officers. The rules provide various guidelines regarding passing, crossing, overtaking manoeuvres to be made; detailing which ships have the right of way depending on the circumstances and the types of ships involved, and what actions these ships should take. It also describes the rules on signals (lights, shapes and sounds signals). It is one of the most important International Conventions in a seafarer's education and training, where full understanding and knowledge must be performed by interpreting the Colregs rules.

The rules in fact serve two main purposes:
a) To provide guidance to mariners on how to prevent collisions at sea
b) To serve as a basis for apportioning blame when collisions occur (Stitt, 2002)

The recent IMO bulletin "maritime knowledge centre" reports that more than 90% of collisions are attributed to the human factors (IMO, 2010), and this had earlier been reported by Parker (2010). It is interesting to note that earlier studies reported human error, contributing to 85% of all accidents, either directly initiated by human error or associated with human error as a result of inappropriate human response (Ziarati, 2006). Human error is reported to be the main cause of accidents, which has now apparently increased by some 5 percent in recent years.

The following figure shows the number of accidents that UK merchant vessels involved in recent 12 years.

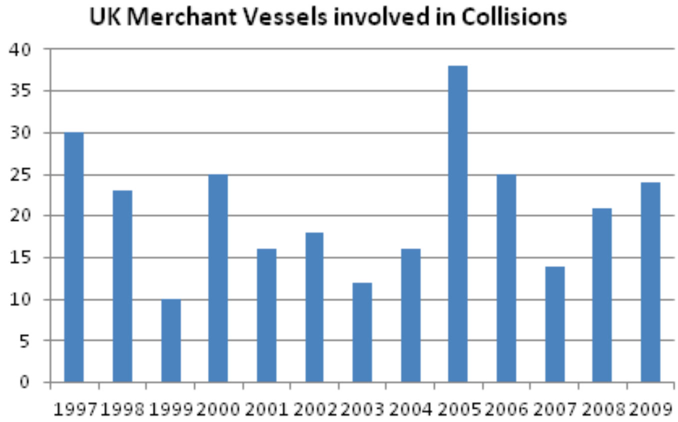

Fig. 1. UK merchant Vessels involved in Collisions [Source: maritime Accident Investigation Branch 1997-2009]

The Maritime Accident Investigation Branch (MAIB) and Mariners' Alerting and Reporting Scheme (MARS) reports conclude that many of the basic principles of collision avoidance are improperly understood/applied at sea (MAIB, MARS). There is a clear signal from the reports that Collision regulations are either not understood or ignored, even though Colregs provides a primary set of rules for taking actions to avoid collisions.

2. COLREGS IN MET

Maritime education and training programmes include Colregs training under a Navigational Watch unit, which is usually supported by full mission simulator training. This includes a number of hours teaching in a classroom environment at a theoretical/practical level, whilst also being supported by full mission simulator training. The IMO model courses allocate 100 hours for this Navigational Watch Unit for deck officer programmes (IMO, 1999). Similarly, at senior and higher levels, the programmes include 30 hours of training that is considered as a refresher course. These model courses are designed to provide additional guidance to MET providers as per required in the Standard Training Certification and Watchkeeping (STCW) II/1 level.

Different countries have varying methods of teaching Colregs rules as well as having different methods to test and certify the knowledge and competency of deck officers in Collision rules. For instance, in Turkey, the national authorities choose to test the knowledge of seafarers with multiple choice type questions. Whereas, in the UK, candidates are tested through a one-to-one oral examination with an experienced captain directing questions using model ships as a demo to identify whether the candidate is able to explain their Colregs knowledge and apply it to different situations where the risk of collisions exists.

The research conducted by Syms (2002) highlights the seafarers' view. The seafarers agree that the improvement of maritime training and education (MET) systems are necessary, when they think it will help to improve the application of Colregs at sea.

The same research (Syms, 2002) also reports that in northern countries such as the United Kingdom, Germany and France, the application and understanding of Colregs is of a higher standard than when compared to other countries.

Ziarati (2006) extends the problems associated with Colregs emphasising that mistakes are usually made not because of deficient or inadequate regulations, but because the regulations and standards, that do exist, are often ignored.

3. RESEARCH INTO COLREGS RULES

Colregs currently have thirty eight rules and four annexes. It applies to all vessels on the high seas and in all waters navigable by seagoing vessels, except where the local rules are not in effect. However, the local rules in any case should be in line with the international rules where possible as stated in Rule 1 (Application) of Colregs (Ford, 2003). For instance, in the United States of America, additional rules for vessels navigating inland waterways are published alongside the international rules (US, 1989).

Belcher (2002) states that Colregs are intended to operate in a environment where the Navigation Officer on each vessel has a complete understanding of the situation, knowing which rules are in effect, how those rules are interpreted and what needs to be done. In case the action does not occur, Belcher (2002) perceives that Colregs operate in an environment of mutual comprehension, understanding and coordination, with clear logical steps ensuring clarity and predictability.

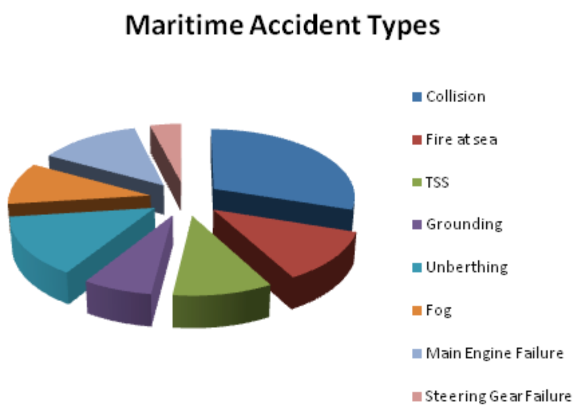

Fig. 2. Variation and Causes of Accidents [Source: UK Protection and Indemnity Club, 2007]

MAIB (2004) has conducted a safety study that reviewed 66 collisions and near collisions in their accident database. As a result of the study, the most common contributory factors in all these collisions were poor lookouts (Rule 5) and poor use of radar (rule 7(b), (c). This means that the standards of lookouts are poor and ineffective and radar is not used properly to identify the risk of collision. In fact, Colregs clearly state the necessity of maintaining lookout in Rule 5 and the use of radar in Rule 7(b) and7(c):

“Rule 5 - Every vessel shall all the times maintain a proper lookout by sight and by hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make full appraisal of the situation and the risk of collision”

“Rule 7(b) – Proper use shall be made on radar equipment if fitted and operational, including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observations of detected objects.

Rule 7(c) – Assumptions shall not be made on the basis of scanty information, especially scanty radar information.

Examples of Colregs Rule 5, Rule 7(b) and Rule 7(c) are basic and easy to understand, interpret and comply with compared to the other rules of Colregs. However, it is interesting to note that the application of these Rules is the first concern of the report, expressed in the MAIB full study (MAIB, 2004). The same report (ibid) also points out that substantial numbers of accidents occurred at night and in restricted visibility. This proves the lack of understanding of seafarers Part C – Lights and Shapes and Rule 19 – Conducts of Vessels in restricted Visibility.

The accident case below shows the collision attributed by poor lookout.

Case 1 - Poor lookout

A dredger collided with a fishing vessel in Dover Traffic Separation Zone, in daylight, calm conditions and clear visibility. The dredger had been on passage and following the flow of traffic, and the fishing vessel was not engaged in fishing when in the separation zone. The vessels approached each other on a collision course for 10 to 12 minutes with the fishing vessel on the dredger's port bow. The watchkeeper on the dredger had seen the other vessel and, having identified it as a fishing vessel not engaged in fishing, was expecting her to alter course at the last minute.

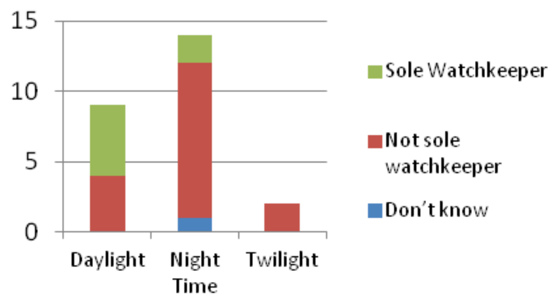

Fig. 3. Vessels failing to keep a proper lookout [Source: Maritime Accident Investigation Branch, 2004]

With regard to the provision of a lookout, STCW 95 states that the officer in charge of the navigation watch may be the sole lookout "in daylight" provided it can satisfy the provisions in STCW for lookout requirements (STCW, 95). Despite this international requirement to maintain lookout at night, the MAIB research also points that at least three of fifteen vessels involved in accidents had failed to do so.

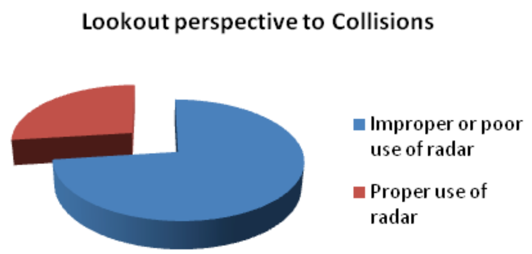

Fig. 4. Lookout perspective to Collisions [Source: Maritime Accident Investigation Branch, 2004]

In the same report, the reason for not maintaining a lookout was attributed to a "lack of competency". However, MAIB believes that poor visual lookout is also linked to the poor employment of ratings on the bridge (MAIB, 2004).

The same report also points that many collisions has two common factor: One is that many seafarers are found to be fatigue and second is that there is an issue with the competency of seafarers in complying with rules.

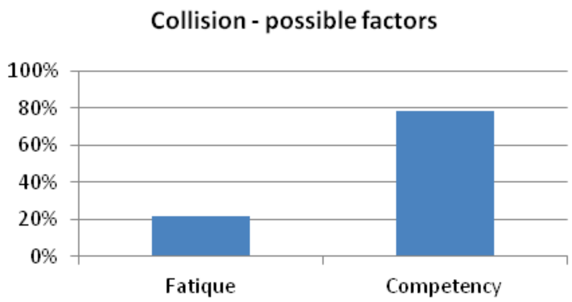

Fig. 5. Possible factors of Collisions [Source: Maritime Accident Investigation Branch,2004]

Bridge watchkeeping practices have inevitably changed in recent years under the influence of automated systems which are being implemented in order to enhance efficiency and safety as well as overcoming the shortage of seafarers (Hwang, 2001). As advanced automation systems are developed and deployed on board, it influences the international rules and regulations which are under consideration for being updated in parallel to revolved systems on board the vessels.

An earlier survey conducted among seafarers highlighted the concerns regarding the application of Colregs rules at sea. The survey results showed that 50% of the responses by these seafarers either ignored or disregarded Colregs rules (Syms, R.J, 2002). In the same survey, 90% of the responders identified the reason as "ignorance", "Poor knowledge of Colregs" and "lack of training".

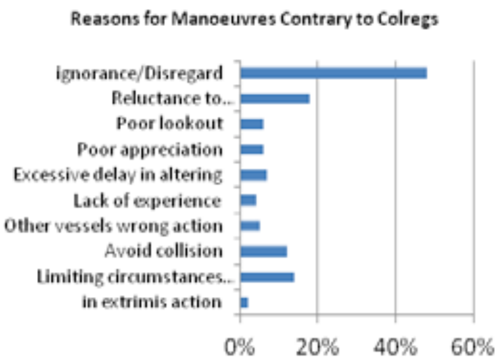

Fig. 6. Reasons for manoeuvres contrary to Colregs (Syms, R.J, 2002).

4. THE USE OF VHF AT SEA

Collisions should theoretically be avoided if all navigation officers comply with International Rules for the prevention of collisions at Sea 1972. It is however dreadful that these regulations are contravened to varying degrees in different locations across the world, as evident in many of the MAIB and MARS reports.

It is reported that the use of VHF radio is more attractive and it has become common practice in collision avoidance, although it is not part of Colregs. The MCA (Maritime and Coastguard Agency) in the UK and several other countries took this issue seriously and issued guidance for their seafarer network to highlight the dangers associated with the use of VHF radio (MCA, 2002). The summary of that same report states that

"Although the use of VHF radio may be justified on occasion in collision avoidance, the provisions of the Collision Regulations should remain uppermost, as misunderstandings can arise even where the language of communication is not a problem"

Similarly, MARS reporting has been collating the collision and near miss reports received from seafarers to emphasize the dangers associated with the use of VHF. (MARS, 2005). MARS recommended the following:

"The use of VHF should be kept to minimum and only be used, for instance, an obstruction exists on starboard side for stand on vessel, and however, reduction of speed should be preferred on communicating the intention on VHF"

It should not normally be the case for a navigation officer to use VHF to take action to avoid collisions, however, it does usually happen, and the only reason might be that using VHF is easier than understanding and interpreting the 38 rules and annexes in different collision situations.

The MAIB (2004) study shows that after examining the use of VHF in collisions and near misses that it was only used in 14 of the 47 collisions, and was only effective in 3 of those.

The accident cases below shown below is a collision attributed with the use of VHF radio.

Case 2 - VHF assisted collision
A cargo vessel was outbound from the River Humber in poor visibility. The master of the cargo vessel had the control, a helmsman was steering and the bosun was stationed on the forecastle as a lookout. The master saw the target of an inbound vessel on his radar, and he called the unknown fishing vessel using VHF with the intention of requesting to pass "green-to-green" in the channel. He received instant response but, by then it was too late. His ship was committed to the manoeuvre, and the fishing vessel was trying to pass red-to-red. They collided, causing extensive damage to the fishing vessel.

Case 3 – VHF assisted collision
Two container ships were navigating in the China Sea. A risk of collision appeared however both did not realised until 3 minutes before the accident. The stand on vessel tried to make contact via VHF on 3 minutes before the collision instead of complying with the Colregs rules. However, he received a response after several calls, and disagreement took place and the ships collided.

5. E-COLREGS TESTING STANDARDS

Colregs in a way is not dissimilar to the necessity of seafarers to be able to make use of Maritime English at sea. It is very obvious that it is one of the most critical safety regulations, and that if it is known and applied in an environment that has mutual understanding. It would stop many collisions and groundings from happening if it is applied correctly. Without creating a common understanding and interpretation for navigational officers to take action against the risk of collision, Colregs rules are not effective to prevent the collisions, as stated in many MAIB accident reports.

Every country has diverse systems in training and testing seafarers understanding in collision avoidance. The knowledge of seafarers in collision avoidance is usually tested in the maritime colleges/universities in which the students are enrolled. Later on, students are externally tested again by the national authorities of the countries that they will be certified as competent. These exams are usually carried out in the way of multiple choice and open ended questions or one-to-one exams to make sure that the candidate is able to act and take action against any risk of collision under their certification processes.

There is currently no international or European common interpretation of these rules that is efficiently applied by all countries. The level of navigators understanding and interpretation of Colregs rules are inconsistent. Besides, there is always a question mark how student's knowledge is taught and being tested. Furthermore, the level of competency varies significantly across institutions in a given country and this is even more inconsistent across EU. The officers are in fact expected to reach certain levels of proficiency and competency either by their companies or potential employers. The collision avoidance actions require to be applied in all waterways, unless additional national rules are set by national authorities in their inland and coastal waters.

There are currently two generic problems with Colregs. Firstly, there is no common interpretation of Colregs rules that are widely used, where navigators could have the same understanding. Secondly, it is difficult to apply Colregs rules in different locations and situations at sea. To remedy the first problem, there needs to be a common interpretation which is used by countries taking into account where and how those rules should be applied. A solution to the second problem is a set of scenarios, including critical parts of the world, being developed based on real accidents. This would be a novel approach of showing where the Colregs rules are being breached. This will remedy the difficulties in applying the Colregs rules at sea in real time situations. The common interpretation and testing may well be translated to different country languages so that it would aid the creation of a mutual understanding of Colregs. To this end, a set of standards to test the competency of navigators in applying the Colregs rules at sea could be the main focus. The standards will be designed so that the industry could use them to assess the competency of their potential employees.

In some countries, many seafarers have serious problems in understanding and interpreting the rules, and that complicates the application of the rules at sea as the individual ships do not operate in a vacuum.

The focus should be to remedy the problems relating to the competency of seafarers in Collision regulations when they are applied to real time situations. A project could be developed concerning the establishment of standards of collision regulations for all classes of navigators. The standards are expected to be recognised by international professional bodies and licensing authorities. To ensure these developments are implemented effectively, the project could:

- develop supporting training programmes for the intended standards by formation of pilot groups in many countries and then re-run them and/or validate them in other countries
- establish a network of transnational partners to support the development of the project to set the standards for application of Colregs rules set in Colregs 1972 by IMO
- design a programme for trainers and assessors development and their certification for the application of the intended standards and subsequent tests as well as for the internal assessment ad verification process, in line with European Vocational qualifications for Assessors and Verifiers
- facilitate the secondment of trainers and assessors to partners' establishments on short assignments in order to familiarise the trainers and assessors with the necessary skills and good practice

6. CONCLUSIONS

Establishing standards for collision rules from real accident cases should be considered innovative. Developing standards for potential navigational officers and targeting skill/competencies needed in a unit of study could be used as a guideline and a benchmark for improving existing Colregs testing standards so that Colregs can operate in an environment of mutual comprehension, understanding and coordination.

The content of the tests will rely on existing Colregs rules with a number of real time situations developed from real accidents to test the knowledge of seafarers.

It is evident that in the northern part of Europe, Colregs are being taken more seriously and the probable effect is that more confident navigation duties that are performed by officers the less they need to depend on VHF.

MET programmes are not complete if Colregs are not effectively interpreted and navigators are tested to see whether they can apply it in real time situation. MET institutions should revise their navigation programmes and make sure that the seafarers know Colregs as required.

National authorities should take the Colregs rules more seriously and issue guidance similar to MCA (2002) to their seafarers with an intention to spread the word Colregs and discourage the use of VHF at sea.

ACKOWLEDGEMENT

The author would like to thank Centre for Factories of the Future (C4FF) for providing an opportunity to undertake this research.

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COLLISIONS AND GROUNDINGS – MAJOR CAUSES OF ACCIDENTS AT SEA

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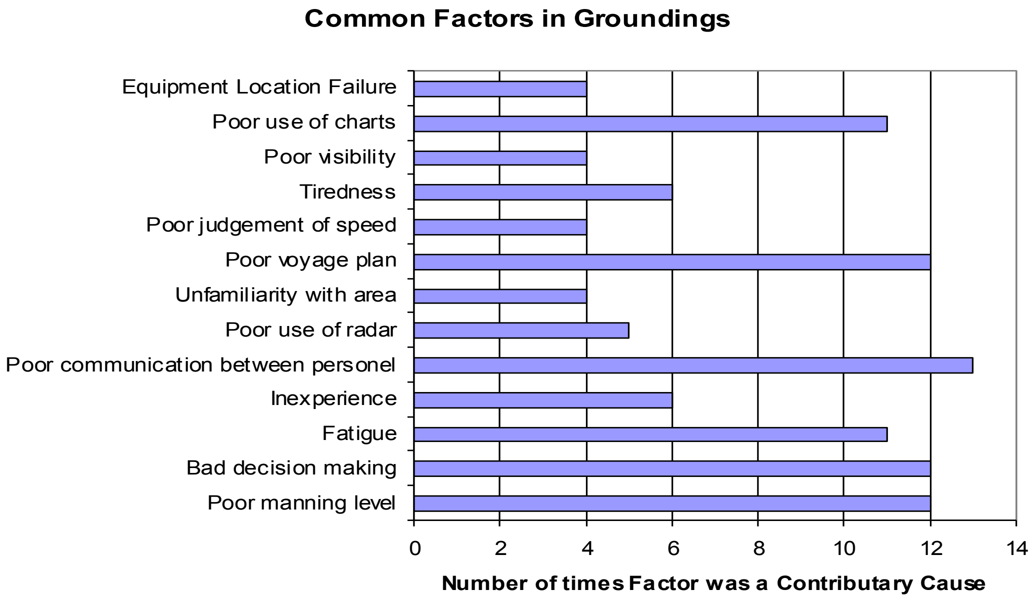
A careful study of the accident reports reveals that 85% of all accidents are either directly initiated by human error or are associated with human error by means of inappropriate human response (Ziarati, 2006). This is in line with the findings of a recent paper (IMO, 2005) that 80% of accidents at sea are caused by human error. Turkish Government is also aware that collision is the most common type of accident in Turkey and this was again confirmed by the latest data published by the Main Search and Rescue Coordination Centre of Turkey in 2009. Collision amounted to 60% of all accidents if grounding and contacts are included.

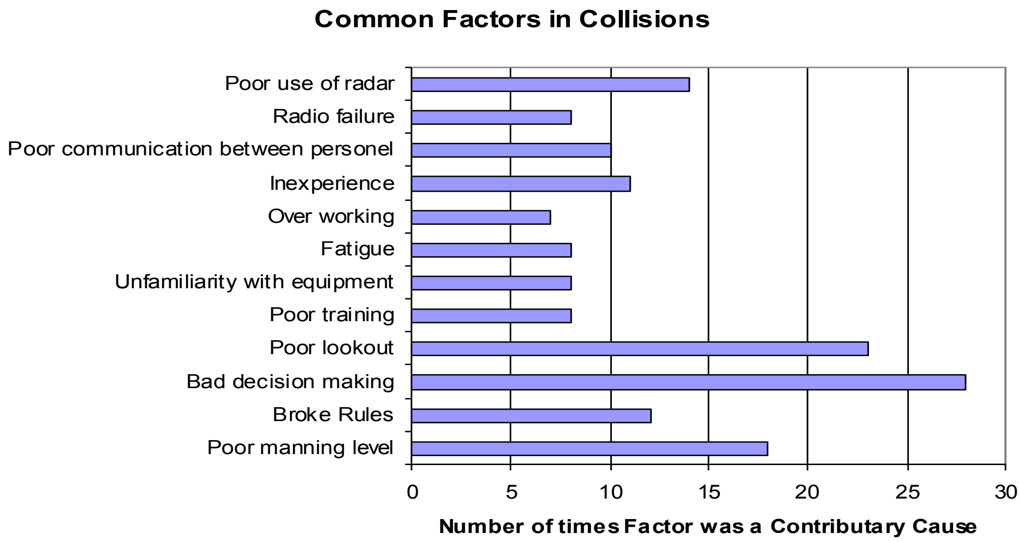
The research shows that mistakes are usually made not because of deficient or inadequate regulations, but because the regulations and standards, that do exist, are often ignored. The IMO MSC (Ziarati, 2006) clearly indicates the causes of many of the accidents at sea are due to deficiencies in maritime education and training (MET) of seafarers or disregard for current standards and regulations. Ziarati also reports (2007) that majority of accidents and incidents are related to collisions or groundings.

The International Regulations for Preventing collisions at Sea 1972 (Colregs) are rules to be followed by Deck/Navigation officers. It was initially designed to update the Collision Regulations of 1960 and entered into force in 1977. The last amendments were made in 2007. It is one of the most important International Conventions that all seagoing officers must have full knowledge of it before taking charge of a ship. However, a case law (MARS, 2005) indicate that many of the basic principles of collision avoidance are improperly understood /applied. It is also a common practice to use VHF Radio in collision avoidance procedures although not being part of the Colregs (MAIB, 2001; Ziarati, 2007).

The project aims to transfer innovation from existing novel products and practices developed in the UK (‘Rule of the Road’ exercises and e-assessment) and Slovenia (e-learning) to other partners in the project with the intention of improving the existing knowledge and VET training practice of Deck officers and raise awareness on the correct application of International Regulations to prevent collisions at sea (Colregs). The main aims of the project are to:

1. Promote and identify VET key competencies in collision avoidance,
2. Improve systems for VET quality assurance through the transfer of innovation from the outcomes of the two successful Leonardo projects, EGMDSS and MarTEL, and
3. Involve shipping companies including the smaller ones to interpret Colregs correctly and through MET institutions to promote correct application of Colregs.





Figs. 1 and 2. Common Factors in Collisions and Grounding (Source: Ziarati, 2007)

The partnership is composed of major MET centres in several EU countries (Holland, Poland, Finland, Slovenia, UK and Turkey) with considerable Leonardo experience. The partners have been involved in Leonardo e-learning projects (E-GMDSS 2006-08, E-GMDSS 2008-10 and MarTEL 2007-09). The main tangible outcome is an online and novel learning and assessment platform facilitating the correct application of Colregs leading to substantially reduced accidents at sea. Impact will be substantial as it concerns the training of all Deck cadets and officers and an up-dating course for those already working in the sector.

Why this project is important

The International Regulations for Preventing Collisions at Sea 1972 (Colregs) are a set out of the rules to be followed by Deck/navigation officers at sea. It was initially designed to update the Collision Regulations of 1960 and entered into force in 1977. A series of amendments have been made in 1981, 1987, 1989, 1993, 2001 and 2007. It fundamentally prescribes the conduct of vessels underway; specify the display of internationally understood lights and collision avoidance actions in close quarter situations at sea. It is one of the most important International Convention that all seagoing Officers must have full knowledge, and the implementation skills, before taking charge for Bridge navigation duties. However, a case law, (MARS 2005) indicate that many of the basic principles of collision avoidance are improperly understood. It is also a common practice to use VHF Radio in collision avoidance procedures although it is not prescribed or stated in the Colregs (MAIB, 2001, Ziarati, 2007).

A careful study of the accident reports reveals that 85% of all accidents are either directly initiated by human error or are associated with human error by means of inappropriate human response (Ziarati, 2006). This is in line with the findings of a recent paper (IMO, 2005) that 80% of accidents at sea are caused by human error. The earlier paper notes that mistakes are usually made not because of deficient or inadequate regulations, but because the regulations and standards, that do exist, are often ignored. The (IMO MSC, 2006; Ziarati, 2006) clearly indicates the causes of many of the accidents at sea are due to deficiencies in education and training of seafarers or disregard for current standards and regulations.

There is a clear indication that Collision regulations are either not understood or ignored although it is a primary set of rules for taking actions to avoid collisions. A common interpretation of Colregs from the perspective of seafarers will be promoted in this project and translated and transferred to MET partners in the project in the first instance and later throughout the EU and worldwide by engaging major awarding, accrediting and licensing authorities and well as bodies such as EMSA and IMO. An existing e-learning (www.egmdss.com) and e-assessment (www.martel.pro) will be adapted for delivery and assessment of the intended course which will also be used as an updating/refresher course for Deck officers working in the sector.

The research, as shown in Table 1, shows that almost half of the seafarers are ignorant to COLREG. All in all, these answers confirm the current suspicions engendered by MARS and other sources that the Colregs are often misunderstood, misinterpreted or just plainly ignored on frequent occasions. Although what proportion can be set against each possibility remains open to argument.

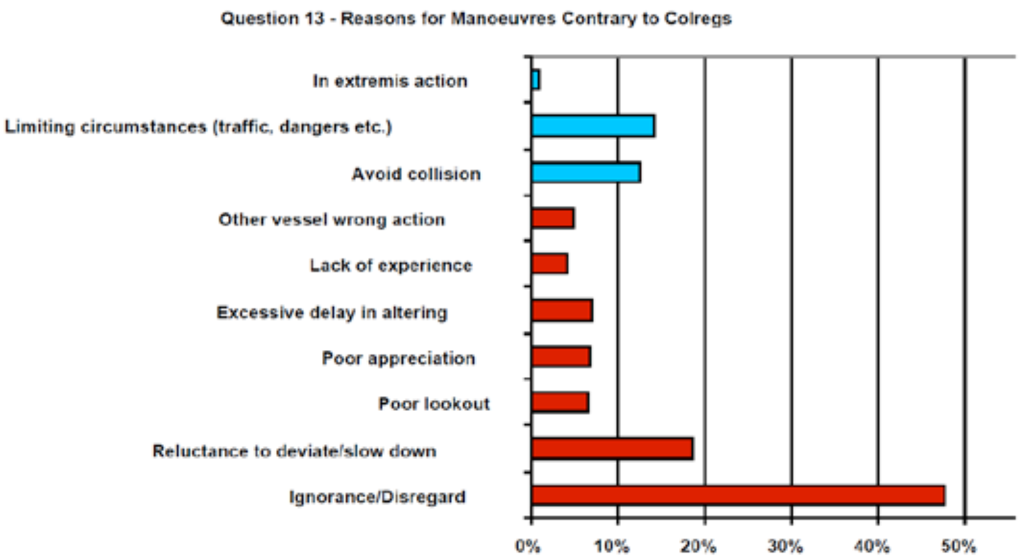


Table 1. Improving the application of Colregs - Captain R. J. Syms, FNI

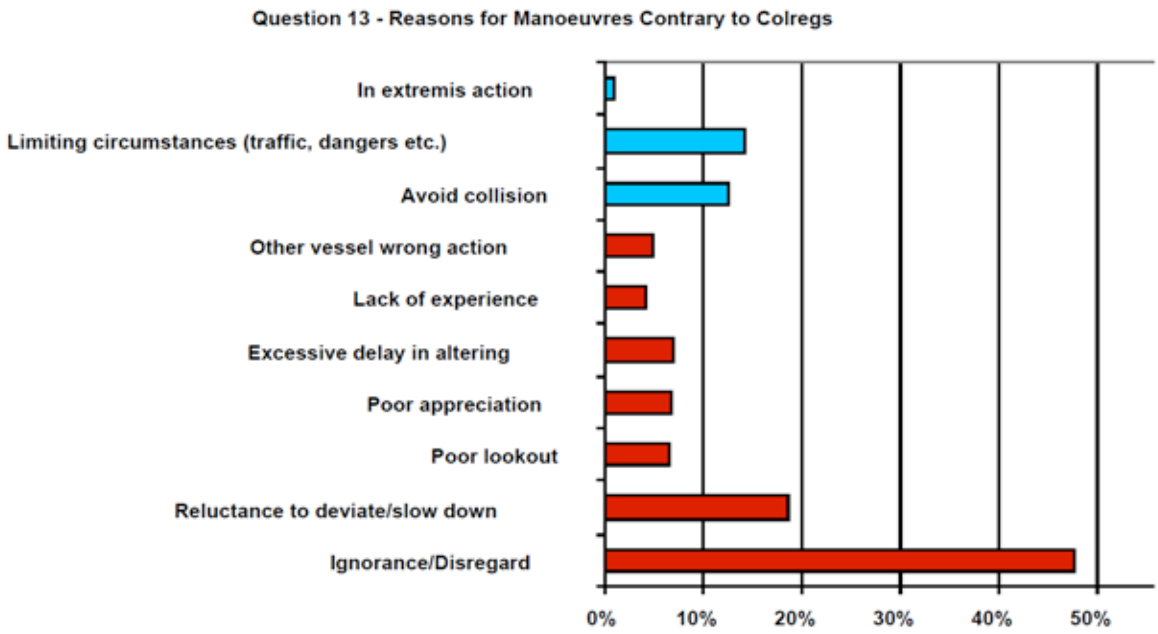


Table 2. Improving the application of Colregs - Captain R. J. Syms, FNI

A survey (Table 2) was also conducted by the Australian Maritime College to test mariner's clear understanding of Colregs

The project will increase cooperation between the training institutions and several social partners because of the labour market needs on overcoming the knowledge deficiency in application of the Collision regulations. Improved learning will be achieved by using real life scenarios extracted from accident case studies for the development of the intended course.
The online course is intended to be recognized by major awarding such as Edexcel/BTEC, accredited by a major chartered professional institution such as IMarEST (and/or Nautical Institute) and endorsed by major licensing authorities such as MCA. The course will also be used as a refresher course for officers working at sea and ports. In parallel, an assessment method (criterion referencing) based on an early system developed as part of the Leonardo SOS (2005-07) which received recognition from Edexcel/BTEC and IMarEST as well as MCA will be established to ensure safe application of Colregs at sea and worldwide recognition for the intended E-COLREGS course in a similar manner to Turkey well known Safety On Sea (SOS) programmes/courses.

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WÄRTSILÄ CONTROL & COMMUNICATION CENTRE 3C

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ABSTRACT

Classification societies and regulators in general are fighting with demons to reduce the amount of accidents caused by human error. It is hard to understand why majority of all accidents are still caused by human influence one way or another despite of all efforts to enhance competence, certification and training. It is easy to point the finger now to the equipment manufacturers and system providers as when the work onboard becomes easier the equipment becomes more complicated. Only way to tackle the problem is to provide more user friendly solutions.

Adaptive learning by “trial & error” does not really fit today’s challenging vessel operations. We do not survive without those electronic aids and software applications. In order to make operations more safe, efficient, ergonomic, and productive we need to understand the vessel as “one”. This is only possible by a total system integration and we are already on that path whether we want it or not. Combining and utilizing all available information in prudent way we optimize the target setting of the operator. Information sharing between the vessel automation and integrated bridge is the key issue for 3C.

Wärtsilä has the leading edge in the industry to bring the system integration into a new level by harnessing the know how within its entire organization and utilizing its extensive portfolio to support the development of 3C. Wärtsilä 3C is not just a bridge but rather a long-awaited link between the engines, the automation, the propulsion and the bridge. Integration is nothing new, but Wärtsilä 3C will provide the optimum performance with minimum fuel consumption and emissions by the exclusive and totally unforeseen system integration.

PRESENTATIONS

I Safe Return to Port

SRTP FERRY DESIGN

Ari Huttunen
STX Finland

June 2011 | Page 1

STX Europe

Topics of today

1. SRTP vessels in STX orderbook
2. SRTP Principe from design perspective
3. Most Important Additional Redundancy
4. Solutions
5. Conclusions

June 2011 | Page 2

STX Europe

SRTP VESSELS IN STX ORDERBOOK.

stx Europe

M/S SPIRIT of BRITAIN
NB 1367
M/S SPIRIT of FRANCE
NB 1368

Length oa	213 m
Breadth	31,4 m
Speed in shallow water	22 kn
Propulsion power	30,4 MW
GT	48000
Passengers	2000
Truck lane metres	2750 m
Additional car lane metres	1000 m

Route		Dover-Calais
Flag		British
Class		LR
Main Engines		MAN 7L48/60CR
Generators		MAN 7L21/31
Building location		STX Rauma, Finland
Delivery	1367	I Quarter 2011
	1368	III Quarter 2011

stx Europe

Safe return to port - Principle

Casualty threshold

Casualty severity

Casualty < threshold

The ship is capable to return to port under its own power

A safe area is provided for passengers and crew members

Essential systems for the safe return to port and the safe area are operational:
- List of 14 points

Casualty > threshold

The ship is evacuated/abandoned in orderly manner

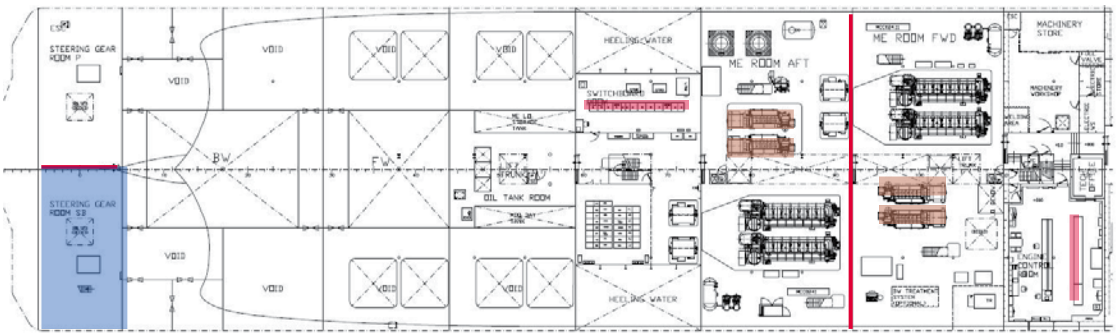
Systems for evacuation and abandonment are operational during 3 hours (fire only)

= Technical Design Standard

stx Europe

SRTP SHIP - Redundancy in Layout

Separate -
- Main Engine Rooms
- Cooling Systems
- Fuel treatment
- Auxiliary power
- Switchboard
- Steering gear rooms



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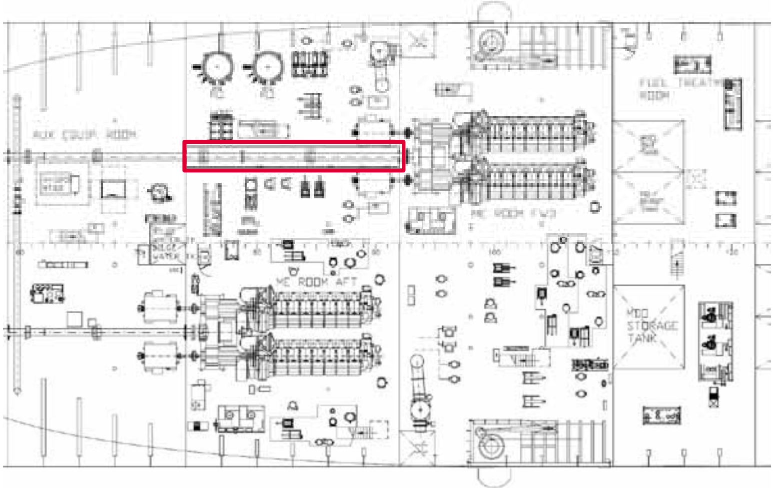
SRTP SHIP - More Battle Hardiness

Tunnel protected through going shaft
- Additional cooling inside
- New guidelines do not require this
- Significant obstacle

Design Challenges
- Bilge system
- Flooding Detection system
- Sprinkler system
- Systems SRTP assessment



SRTP with NB 1367-8 Spirit of Britain & Spirit of France

- P&O Ferries decided to adopt the new rule, although not mandatory (keels laid before 1.7.2010).
- No interpretations or guidelines how to adopt the rule
- Discussions 2007/2008 between P&O Ferries, MCA and Class
- At contract phase meetings between the Owner, Yard, MCA and Class
- A set of interpretations was agreed with Flag approval.
- The agreement was successfully carried out during the project.

NB 1367-8 SRTP APPLICATION 1(2)

Flooding was excluded from SRTP as there were no IMO rule yet.

SRTP time was agreed as 6 h due to the special sailing area of the ferries.

Ballasting with SRTP was excluded, proven with calulations.

No minimum speed was specified because even one engine gives enough.

No AC was deemed necessary

PSMR* notation requires 50% Propulsion power system redundancy.
- Fire or flooding
- Requirements with SRTP not completely parallel

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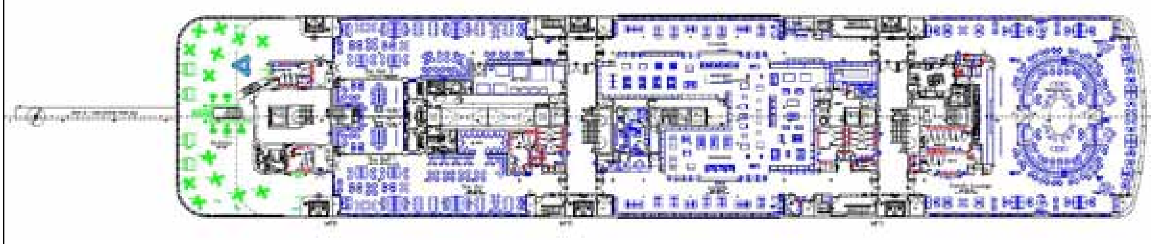
NB 1367-8 SRTP APPLICATION 2(2)

SAFE AREAS FOR PASSENGERS
- Toilet system redundant (!)
- Potable water to be stored in bottles, one for each passenger
- No requirement for food on this short route
- A second doctors bag to be located outside the medical centre
- Thermal blankets for each passenger stored
- Safe Area Lighting
- No heating requirement



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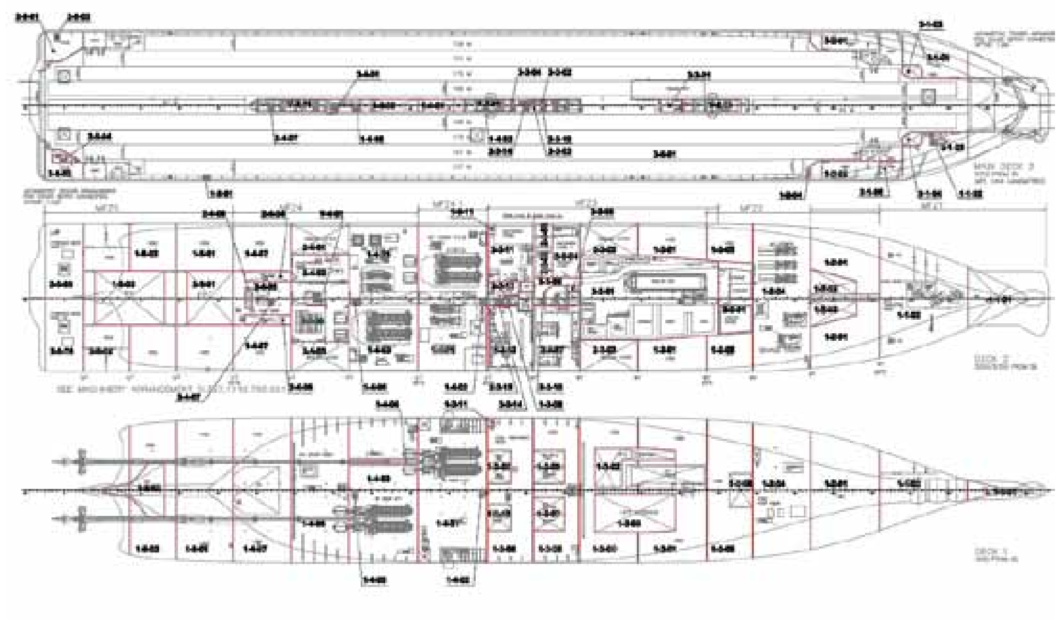
Casualty Scenarios Assessment – Lower decks only



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NB1369 - DEA POLAR SUPPLY AND RESEARCH VESSEL

Length over all, about	134.0 m
Length between perpendiculars	121.25 m
Breadth moulded	22.0 m
Breadth, max., about	23.0 m
Height to Main Deck	10.55 m
Draught, design	7.65 m
Deadweight at design draught, about	5020 t
Service Speed	14.0 knots
Speed at 1.0 m level ice	5.0 knots

Passengers	100
Crew	44
Cargo hold capacity	4000 m3
Flag:	South Africa

Class notation: DNV + 1A1 PASSENGER SHIP, PC5, WINTERISED BASIC, DAT(-35), EO, RP, HELDEK-SHF,CLEAN DESIGN,COMF V(2)/C(2),NAUT-AW, TMON, BIS, DYNPOS-AUT, DE-ICE, LFL App:(ICE 10 for HULL)

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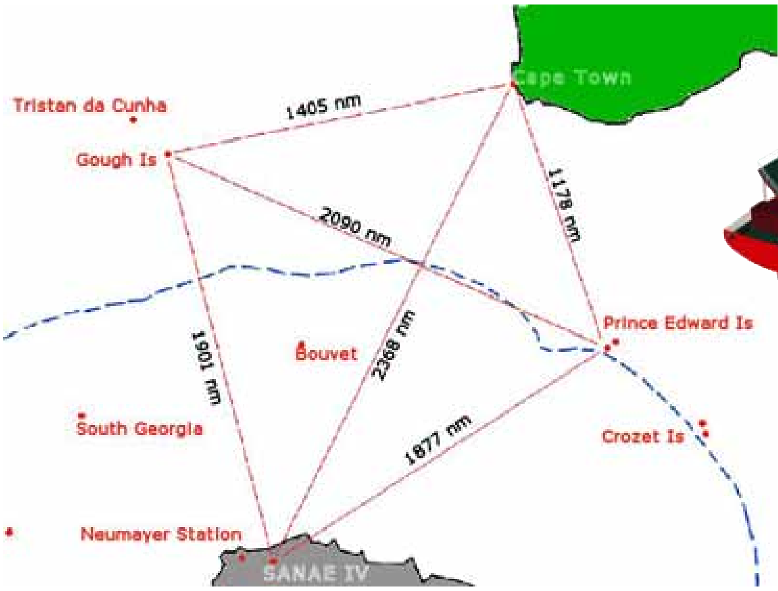
Operational Area of the Vessel (NB 1369 DEA)



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NB 1376 VIKING LINE 57.000 GT CRUISE FERRY + option

LNG powered
Diesel electric
Turku-Åland-Stockholm route.
Length 218 m
2800 passengers, 880 cabins, 200 crew
Lanes 1275 m + 500 m car garage

stx Europe

SRTP comparison between projects at STX Finland

	P&O Ferries	DEA	Overnigth Ferry
	Short International	International	Short International
Distance/speed	6 h	1000 nm 12 kn 83 h	max 200 nm 10 kn 24 h
Provision	No requirement, bottled water	Galley & stores divided	Usually several stores & galleys
Toilets etc	Divided	Divided	Divided
Scenarios	126	175	?

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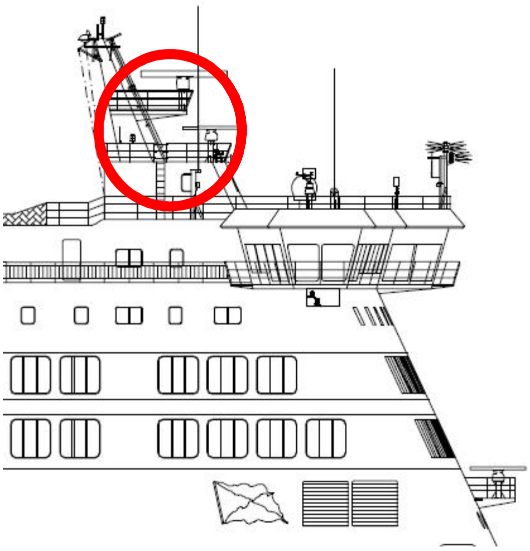
NB 1367 P&O FERRIES Emergency steering position



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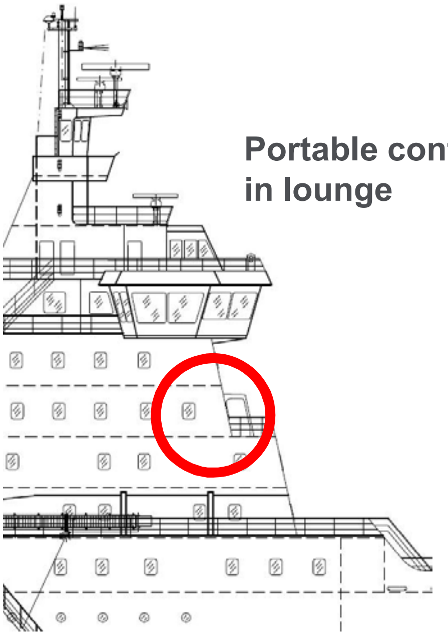
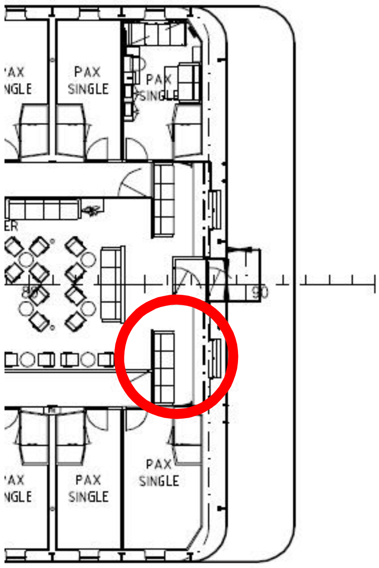
NB 1369 DEA Emergency steering position



Portable control panel in lounge



Conclusions regarding SRTP

1. **DESIGN PHASE**
   - More routeing design work
   - Inconsistencies with old SOLAS such as “Safe Area” m2, speed, toilets, hospital
   - Guidelines MSC.1/Circ 1369 helpful
   - Plentiful assessment scenarios => stage design changes risk.

2. **PRODUCTION PHASE**
   - More cabling and pipe work

3. **COMMISSIONING PHASE**
   - No official guidelines
   - Testing procedures must be agreed on for quay side trials and sea trial

4. **MAINTENANCE, CHANGES?**
   - Some guidelines MSC.1/Circ 1369

5. **HAVE LIVES BEEN SAVED?**

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thank you for your attention

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Contents of SRTP Regulations

Topics Addressed:

1 Background
2 Concepts and terms
3 Casualty threshold
4 Safe return to port
5 Orderly evacuation
6 Documentation

Bridge 2011 / Rauma SRTP Requirements - Contents of the Regulations DELTAMARIN™

1 BACKGROUND

IMO Maritime Safety Committee

Passenger ship safety initiative (November 2000)

Prevailing safety regulations

versus

Large passenger ships, casualties and emergency situations

→ The Big Question:

- Is SOLAS duly addressing all the safety aspects ?

BACKGROUND

1.1 Basic philosphy

(1) The ship itself should be the safest place for all passengers in all situations

(2) Avoid evacuation as long as possible

(3) In case of evacuation:
Time and technical systems must be available for
executing the evacuation in good order

BACKGROUND

1.2 Implementation

SRTP Regulations valid for passenger ships:

(a) constructed on/after 01-Jul-2010

(b) lenght ≥ 120,00 m
or
number of MVZs ≥ 3

Regulations:	SOLAS	II-1 / 8-1	Flooding
		II-2 / 21	Fire - restricted
		II-2 / 22	Fire - extensive
Explanatory notes:	MCS.1 / Circ.1369		

2 CONCEPTS AND TERMS

Extents of casualty:

- Casualty threshold

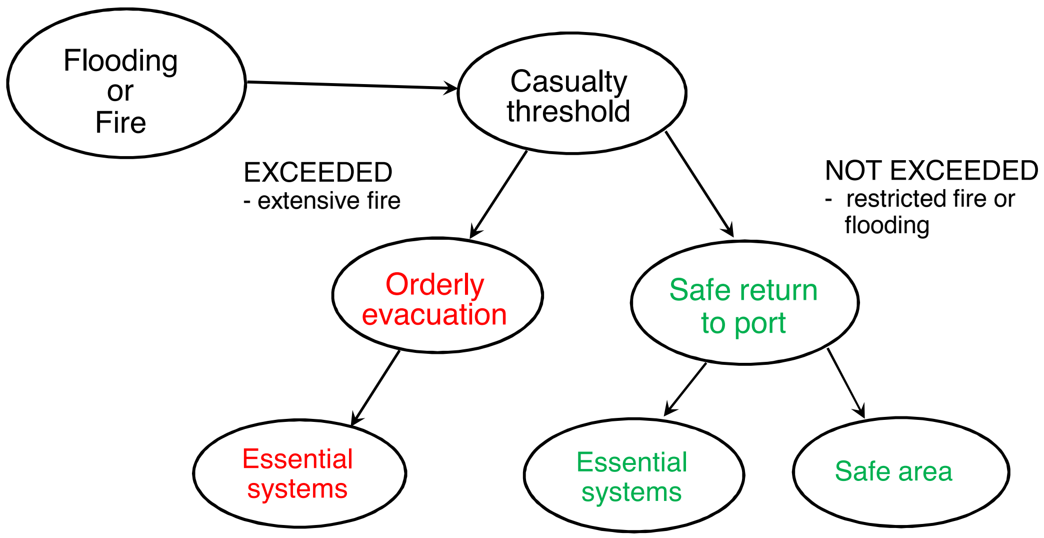
Operational modes:

- Safe return to port
- Orderly evacuation

Systems and facilities

- Essential systems
- Safe areas

2 CONCEPTS AND TERMS

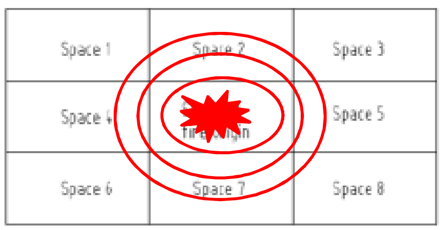


3 CASUALTY THRESHOLD

Casualty threshold = Criteria for maximum damage extents leading to safe return to port situation

(1) FLOODING
- Any single watertight compartment filled with water

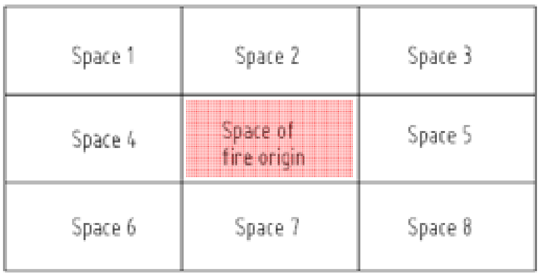
(2) FIRE
- Loss of space up to the nearest class `A` boundaries
- Loss of adjacent spaces up to the next class `A` boundaries



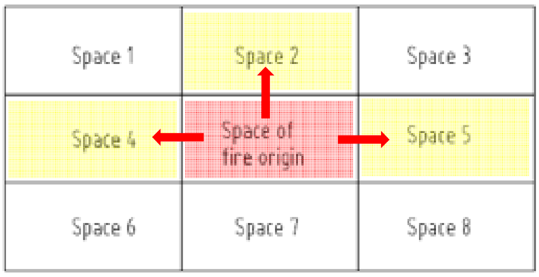
CASUALTY THRESHOLD

3.1 Fire casualty

Space of fire origin protected by fixed fire-extinguishing system



Space of fire origin having no fixed fire-extinguishing system



4 SAFE RETURN TO PORT

After a fire or flooding not exceeding the casualty threshold:

(a) the ship shall be capable of returning to port by own power

while

(b) providing safe areas to accommodate all persons onboard in habitable conditions

and

(c) having essential safety systems operational

Bridge 2011 / Rauma SRTP Requirements - Contents of the Regulations

SAFE RETURN TO PORT

4.1 Essential systems

After a fire or flooding not exceeding the casualty threshold:

(a) the ship shall be capable of returning to port by own power

while

(b) providing safe areas to accommodate all persons onboard in habitable conditions

and

(c) having essential safety systems operational

Propulsion
Steering and steering control
Navigational systems
Fuel oil systems

Systems serving safe areas

Internal communication
External communication

Fire main
Fixed fire-extinguishing systems
Fire and smoke detection system

Bilge and ballast pumping systems
Power-operated watertight doors
Flooding detection system

SAFE RETURN TO PORT

4.2 Safe areas

Criteria for location:

(a) not flooded

(b) outside of the affected MVZ

(c) access to LSA

Required services or systems

(1) sanitation

(2) water

(3) food

(4) alternate space for medical care

(5) shelter from the weather

(6) cooling and/or heating

(7) light

(8) ventilation

5 ORDERLY EVACUATION

After a fire exceeding the casualty threshold:

(a) the systems shall remain operational for supporting orderly evacuation and abandonment of the ship

based on the criteria that

(b) any one main vertical zone is lost due to fire

and

(c) the systems referred to in (a) with LSA and other arrangements shall be capable of operation for at least 3 hours

ORDERLY EVACUATION

5.1 Essential systems

After a fire exceeding the casualty threshold:

(a) the systems shall remain operational for supporting orderly evacuation and abandonment of the ship

based on the criteria that

(b) any one main vertical zone is lost due to fire

and

(c) the systems referred to in (a) with LSA and other arrangements shall be capable of operation for at least 3 hours

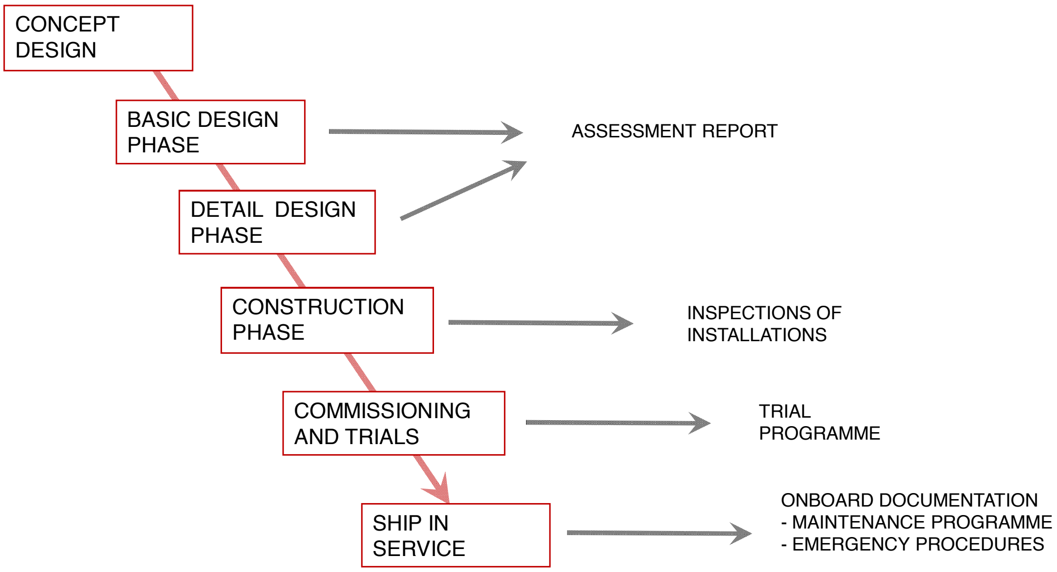
(a):

- Internal communication
- External communication
- Fire main
- Bilge pumping systems

(c):

- Production of electric power
- Fuel oil systems

6 DOCUMENTATION



P&O Ferries P&O Ferries

SRTP
Operator's Perspective

Presentation by: Vincent L. Todd C/E/O Spirit of France (Owners Inspector, Machinery, New Build)

P&O Ferries

So Why SRTP/PMSR*?

- The Keels for both Spirit of Britain and Spirit of France were both laid before 1st July 2010

SRTP	Safe Return to Port
PSMR*	Propulsion and Steering Machinery Redundancy (Separate Compartments)

- P&O Ferries is the United Kingdom's leading ferry operator.
- We carry a huge range of passengers - nearly ten million a year - from children on school trips, and families going on holiday, to business travellers and freight drivers.
- Our Short Sea Route trades from the Port of Dover, which is arguably the busiest passenger Port in the World, and crosses the English Channel, the busiest international seaway in the world.

- P&O Ferries prides itself on its Safety Management Systems and strives to be at the forefront of passenger ship safety.
- With all of this in mind P&O Ferries wanted to build the safest possible passenger ferries and hence adopted SRTP rules ahead of time as well as voluntarily adopting Lloyds PSMR* notation.

Spirit of Britain / Pride of Calais (foreground)

P&O Ferries

SRTP and Design

- The basic design concept behind SRTP is that there should be minimal operator required actions when a casualty scenario occurs.
- SRTP is part of the design of the vessel.
- Operator actions should only be required when they cannot be designed out or construction costs are proved to be prohibitive.

Systems

Essential Systems

- Systems that are required to remain operational after a fire or flooding casualty case as described earlier.

Critical Systems

- Essential systems having the potential to fail to operate as a consequence of a casualty case.

Systems

- Each essential system was assessed during the design phase.
- From the assessment of each essential system within a space, or passing through a space, of fire origin, a list of manual actions for that space has been formulated.
- Some critical systems are protected by design.
  - i.e. Fire main fully welded and lagged where it transits an area of fire origin that it does not serve.
- Other critical systems are protected by manual operator intervention.
- Spirit of Britain and Spirit of France each have 126 casualty scenarios that require manual operator actions to protect critical systems.

Manual Operator Actions

- These manual actions can be as simple as closing one valve for scenario 103.
  - i.e. For a fire in wet weather gear locker 10 04 02 sprinkler valve 5274V907 would need to be closed.
- Or as complicated as the multiple actions required for scenario 012.
  - i.e. For a fire in the aft Main Engine Room there are 42 separate actions including opening and closing valves and disconnecting shaft generator couplings.

- Of the 126 casualty scenarios for Spirit of Britain and Spirit of France only 11 of these are considered as "big", involving 10 or more actions.
- That is not to say that any one scenario is more important than another.
- Scenarios involving only one action are deemed as important as those involving multiple actions.

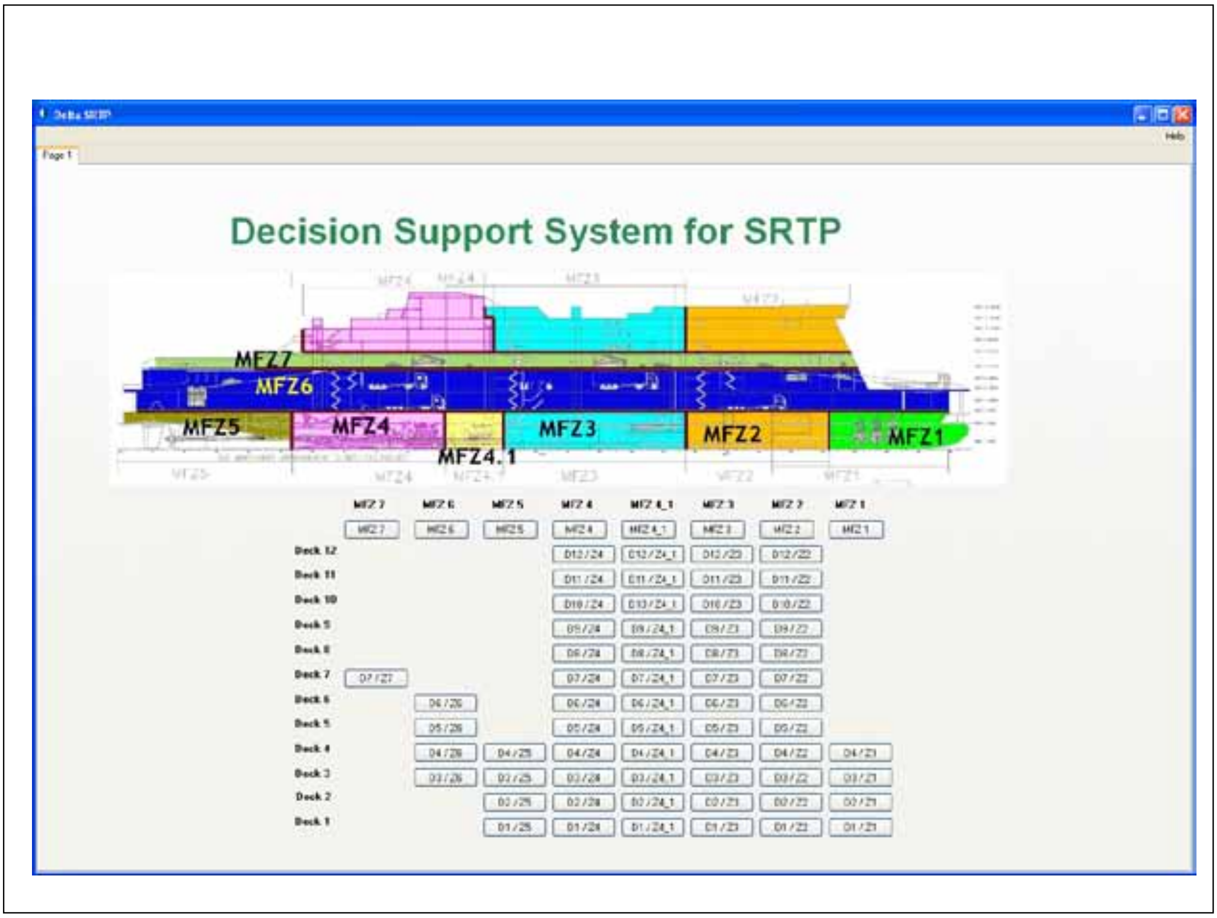
SRTP Actions

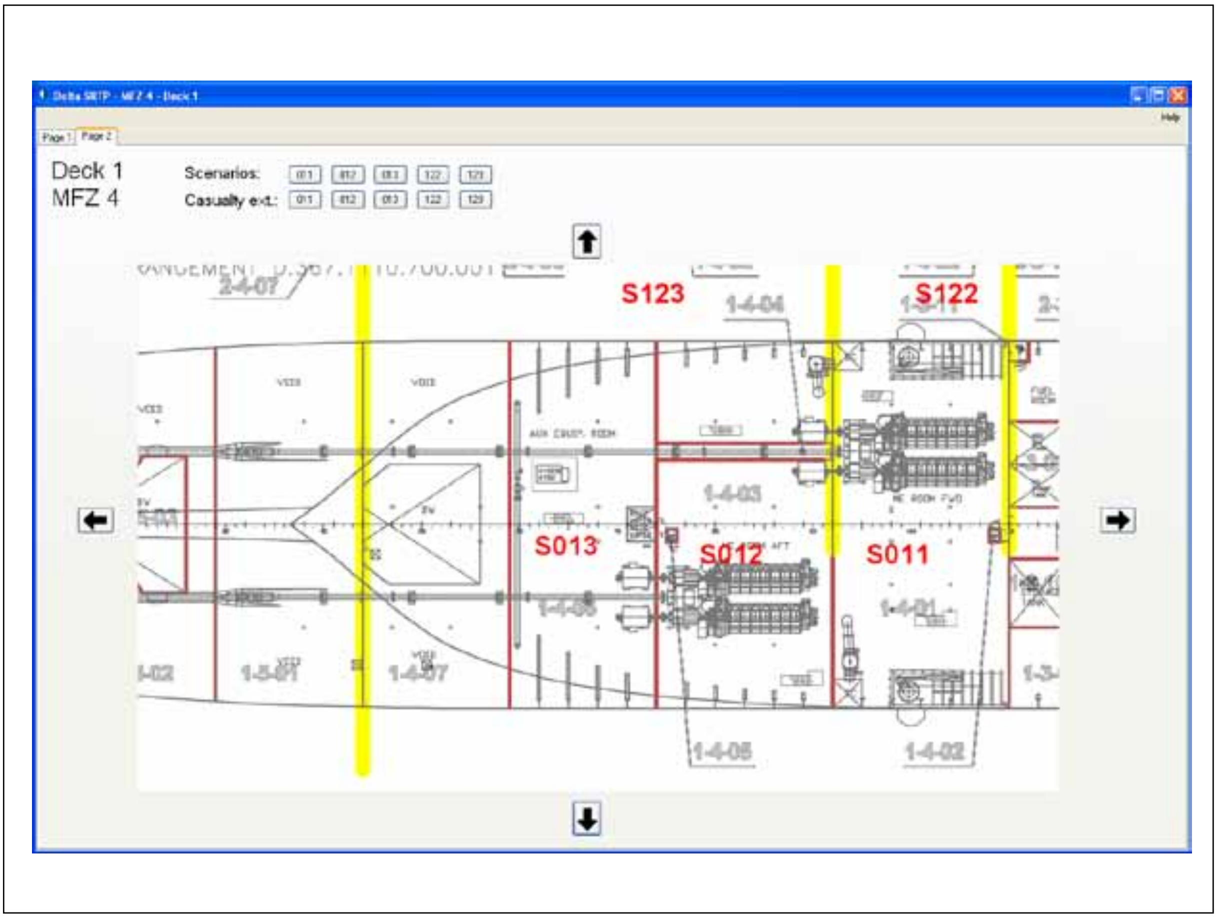
- At what stage does an incident in a space become a casualty scenario?
- This is at the discretion of the Master.
- If there was an incident in a space then all normal counter measures would be used before declaring a SRTP situation.
  - Use of fixed fire fighting equipment.
  - Fire and damage control parties.
  - Quick closing valves.
  - Ventilation control.
  - Etc.

- Once a decision has been made to isolate a space due to a casualty scenario the operator needs to know which critical systems would be affected and what manual actions are required for the vessel to safely return to port, or for an orderly evacuation to take place.
- To do this one would normally refer to the paper based SRTP documentation supplied by the ship building yard.
- This consists of 3 large A4 size binders containing multiple assessment tables that need to be cross referenced to find out what systems are affected and what actions need to be taken.
- These assessment tables are not very "user friendly" and without intimate knowledge of how these documents were constructed they would prove to be very difficult to use in an emergency.

Decision Support System for SRTP

- To overcome the user interface problems with the SRTP documentation, Delta Marin, in conjunction with STX, have produced a computer based DSS program for SRTP.
- This computer program gives a pictorial representation of the information contained within the assessment tables showing what operator actions are required in each casualty scenario.
- The computers loaded with this software are situated on the Bridge and in the Engine Control Room on Spirit of Britain.


Delta SRTP
Page 1
Help
Decision Support System for SRTP
MFZ7
MFZ6
MFZ5
MFZ4
MFZ4.1
MFZ3
MFZ2
MFZ1
Deck 12
Deck 11
Deck 10
Deck 7
Deck 4
Deck 3
Deck 2
Deck 1


Delta SRTP - MFZ 4 - Deck 1
Page 1
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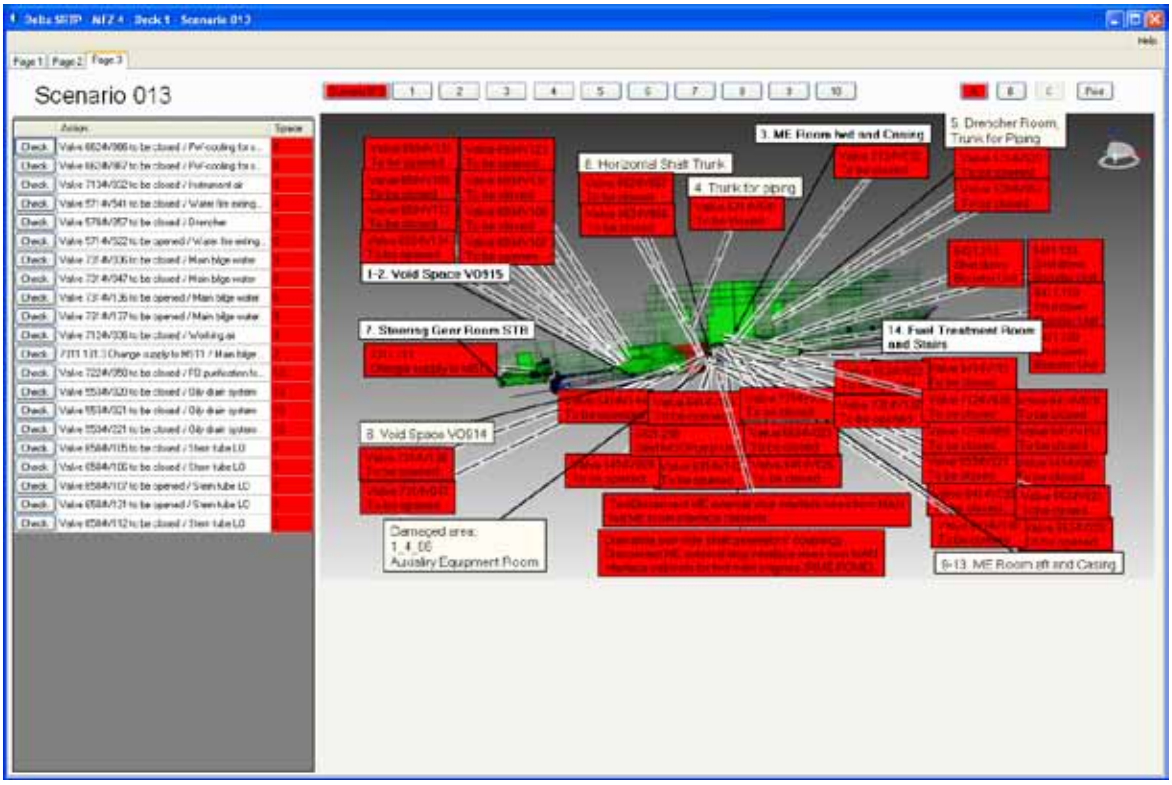
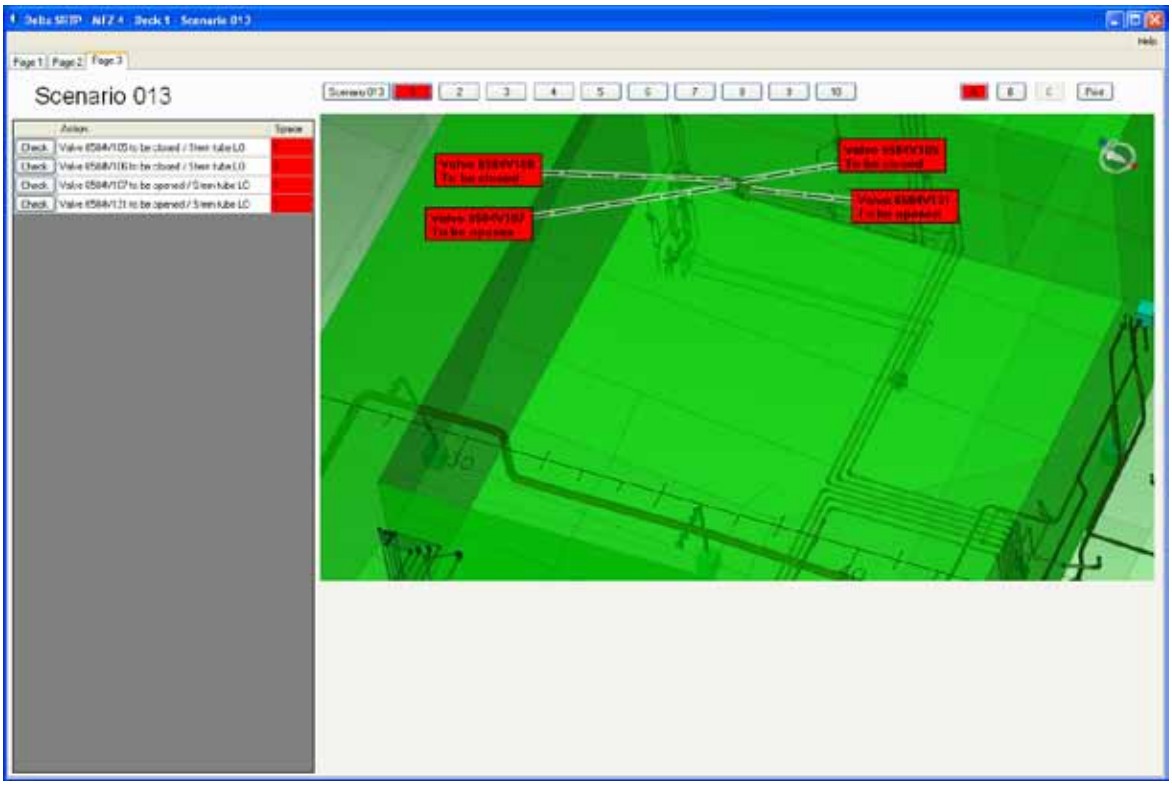
Help
Deck 1
MFZ 4
Scenarios:
Casualty ext:
S123
S122
S013
S012
S011


Scenario 013
Page 1
Page 2
Page 3
1-2. Void Space V0915
3. ME Room fwd and Casing
4. Trunk for piping
5. Drencher Room, Trunk for Piping
6. Horizontal Shaft Trunk
7. Steering Gear Room STB
8. Void Space V0914
14. Fuel Treatment Room and Stairs
9-13. ME Room aft and Casing
Damaged area:
Auxiliary Equipment Room


Scenario 013
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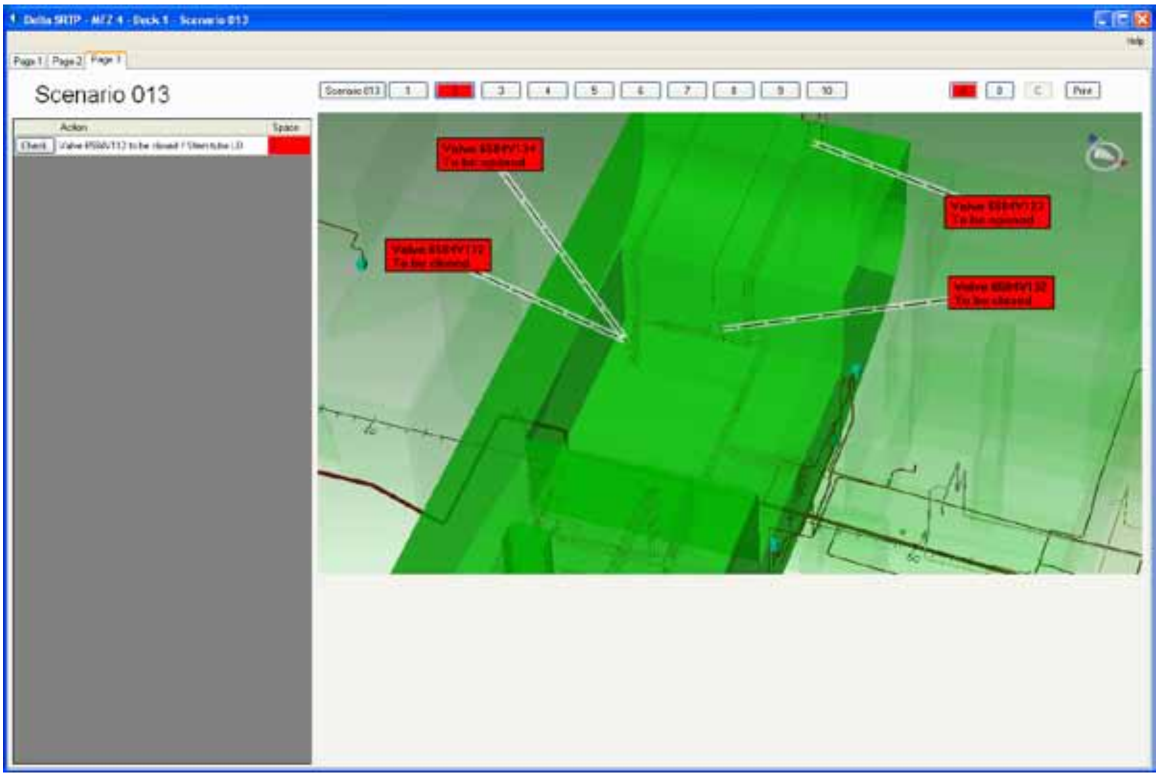
Scenario 013
Page 1
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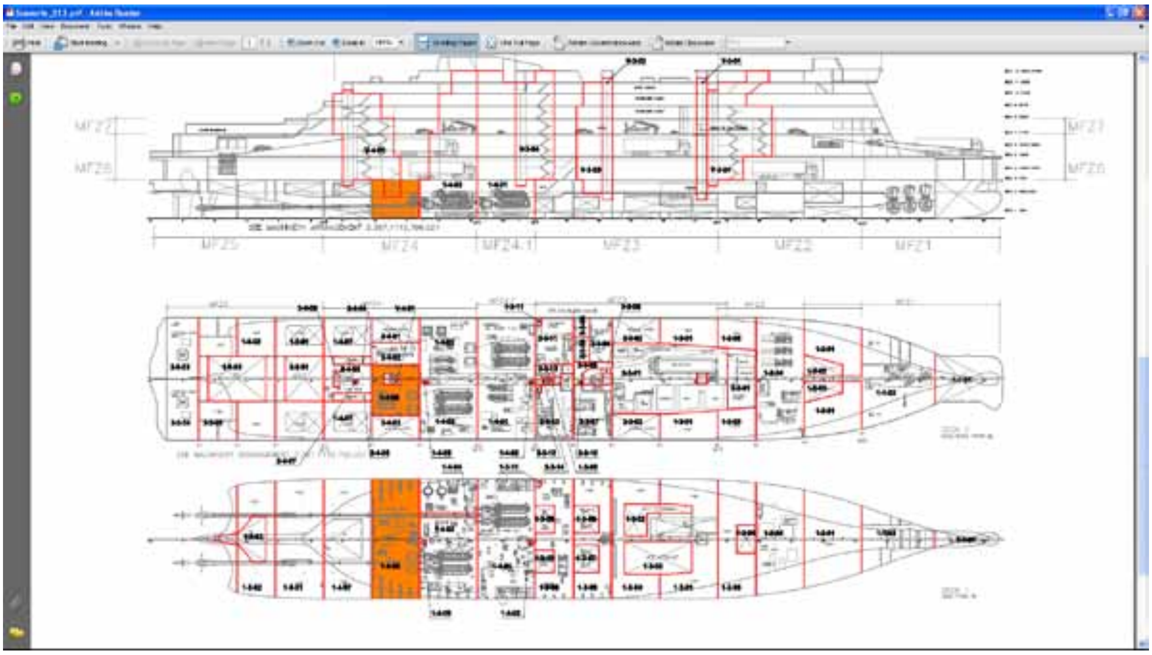
Scenario 013
Action
Space
Check
Print
Help



Valve labelling, identification and access

All SRTP valves must be correctly labelled as such and be identified with a valve tag corresponding to the SRTP assessment and relevant drawings.

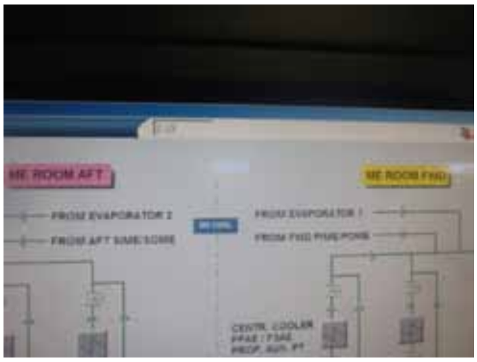
Access to all SRTP valves must be reasonable and not obstructed.

Water Mist Panel in ECR

Emergency Stop Panel in ECR

Forward and Aft Engine Rooms Colour Coded

On Spirit of Britain Engine Rooms have been colour coded to aid identification on CCTV monitors so that correct quick closing valves, emergency stops and water mist systems can be operated quickly in an emergency.



Integratated Automation System Screens

These have been colour coded to match to try and minimise the risk of shutting down wrong equipment.

Watch keeping in SRTP Situation

- It must be noted that in certain SRTP casualty scenarios watch keeping practices must be observed with regards to specific equipment.
- The specific watch keeping operations can be found in the SRTP documentation.
- Hopefully a future development will be to include these practices within the computer based DSS tool.

PO RoPax Ferry, NBs-1367 and -1368
Documentation for Safe Return to Port

Appendix 8
Table 84-01

Version date:
01-Jan-2010

Event n:o	Watchkeeping / operation enchancement	Operation restrictions / Not allowed operation	Notes
01-107	Check that feeder breakers from main switchboard MS11 to starting air compressors in forward main engine room is closed.	Power supply cable from emergency switchboard ES11 to starting air compressors in forward main engine room may be damaged.	
01-120	No cooling water circulation for intermediate shaft bearing G3: - back-up cooling from sprinkler system, see Note	Cabling for bearing G3 temperature sensor may be damaged.	Refer to Table 84-08.3 (event n:o 08-307)
01-207	Check that feeder breakers from main switchboard MS12 to starting air compressors in aft main engine room is closed.	Power supply cable from emergency switchboard ES11 to starting air compressors in aft main engine room may be damaged.	
01-218A	Special attention: - monitoring of starboard side stern tube bearing temperatures		
01-301	It is expected that scenarios listed in Table 80-01 may involve damages in working air distribution piping. It is possible that also other scenarios may have similar effect. Air pressure in compressed air systems should be monitored in cases where valve 7124V036 is left open.	In scenario n. 99 valve 7124V036 must not be closed. Working air to riser line in engine room funnel is required for pneumatic typhoon. It should be noted that when valve 7124V036 is closed air supply to the following items is down: (1) Fire main hydrophore tank in forward main engine room (2) Technical water hydrophore tank in aft main engine room (3) Toilet flushing hydrophore tank in forward pump room	Pipe routes of working air distribution network have been verified onboard the ship only partially. Information provided here is based on a limited analysis of the piping diagrams of As-Built state: - D.367.7120.701.001 - D.367.7120.701.002 - D.367.7120.701.003 There is no formal assessment prepared regarding this event. The above listed limitation should be considered when applying information in Table 80-01.

Table 84-01
page 1 (1)

Testing of SRTP Equipment

- The testing of SRTP equipment should be incorporated into the planned maintenance system of the vessel.
- Testing of equipment will range from checking local and redundant steering position operation of steering gear, to checking redundant navigational lights to testing of isolation valves etc.
- Again items that need checking/testing can be found in the paper version of the SRTP documentation.

PO RoPax Ferry, NBs-1367 and -1368
Documentation for Safe Return to Port

Appendix 8
Table 81-01

version date:
01-Jan-2011

Event n:o	Item	Location deck	space	frame	from CL	Notes
01-102	Testing of sea chest cross-over valve in aft main engine room: - 661OV134	D1	1 - 4 - 03	# 91 - 92	PS - 1,5	
01-107	Testing of power supply from main switchboard MS11 to starting air compressors in forward main engine room. Secondary power supply from emergency switchboard ES11 must be down.	D2 D2	2 - 3 - 13 1 - 4 - 01	 # 103	 PS - 13,0	Main switchboard MS11 feeders 7Q11, 7Q12 Compressor control panel
01-108 01-208	Testing of instrument air isolation valve to forward pump room: - 7134V071	D2	1 - 3 - 08	# 121 - 122	PS - 1,0	
01-110	Testing of instrument air system isolation valve to aft main engine room: - 7134V032	D2	1 - 4 - 01	# 92 - 93	PS - 1,5	
	Testing of redundant instrument air supply from forward main engine room starting air system by opening valve: - 7134V013	D2	1 - 4 - 01	# 95	PS - 11,5	
01-112 01-211	Testing of instrument air system isolation valve to trailer decks forward section: - 7134V044	D2	1 - 4 - 01	# 96 - 97	PS - 1,5	
01-113 01-212	Testing of instrument air system isolation valve to trailers decks aft section: - 7134V045	D2	1 - 4 - 03	# 80	PS - 1,5	
01-114B	Testing of instrument air isolation valve to forward main engine room ventilation damper control unit: - 7134V030	D2	2 - 3 - 12	# 112 - 113	PS - 3,5	
01-118	Checking of operation/condition of pneumatic tool intended for dismantling of port side shaft generators' couplings	D1	1 - 4 - 01	# 92 - 93	PS - 10,0	
01-121B	Testing of port side stern tube emergency tank system valves 6584: - close / open: V112 / V134 - open: V123 - close / open: V105 / V131 - close / open: V106 / V107 - close / open: V132 / V103, V122	D1 D2 D2	1 - 5 - 01	# 32 - 33 # 32 - 37 # 30 - 40	PS - 6,0 PS - 6,0 PS - 14,0	Near forward stern tube seal Below trailer deck D3

Table 81-01
page 1 (3)

How good is SRTP?

- SRTP for a vessel is only as good as the original assessments undertaken and design of equipment.
  - On Spirit of Britain it was found on sea trials that the emergency MDO fuel system for Aft Main Engines ran at too high a pressure.
  - When in service it was found that if bearing lubricating oil pumps for shaft alternators in Aft Main Engine Room (driven by the engines in Forward MER) were disconnected then the Forward Main Engines could not be started.
  - Both of these problems have now been rectified but assessment tables and DSS program have had to be updated.

- Ships crew have to be fully conversant with both SRTP principles and practices.
- Casualty scenario drills have to be undertaken at regular intervals (126 scenarios on Spirit of Britain).
- Ships crew have to be fully aware of the consequences of modification to any essential systems as it could affect the original SRTP assessment.
- Ships crew have to be aware that when maintaining equipment it could affect the SRTP status of the vessel.
- Ships crew also have to be aware that if certain equipment should fail then the vessels SRTP status could be compromised.
  - On Spirit of Britain if the forward bilge pump were to fail, then bilges forward of the Forward MER may not be able to be pumped if there was a casualty scenario in the forward MER.

- At present P&O Ferries are working, in conjunction with STX, on an essential equipment out of service matrix with regards to its' affect on the SRTP status of the vessel.
- This will help us to quickly identify to the authorities any failure of equipment that could affect the Vessels SRTP status
- It will also help us to identify what critical spares the vessel needs to carry.


P&O

II Human factors

Enhancing bridge simulation training programmes with the application of maritime aids for emergency responses

Part II: implementation of accidents scenario and observing the results

Initial situation.

Initial Settings of the simulator.

Own Ship Type Dimensions (m)	"Willem Barentsz" PIPZ General Cargo vessel (129.0 * 20.5 * 8.7)
Area Destination	Dover Strait Antwerp
Chart(s)	BA 323, BA 2449
Course / Speed	112° / 12 kn (Full Seaspeed)
Wind	NW 3 Bft.
Visibility	> 10 M
i.c.	0.0°
Tidal Stream	To be determined
Starting Position Date / Time	51°24'.4 N, 001°50'.1 29/10/2008 at 03.15 UTC

Student characteristics

- Mainly students from nautical institutes in the Netherlands.
- Students have already followed 2 years of education.
- Students most probably start their time at sea in the next few months.
- Students have followed a short course on radar observation and navigation.
- Students should have knowledge of the collision rules.

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Preparing stage for the simulation process

- Exercise has a duration of 2,5 hours and consist of:
  - Briefing
  - Simulation
  - Debriefing (evaluation)

Briefing simulation (preparation by students).

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Bridge simulation

Instructor interaction during simulator exercise

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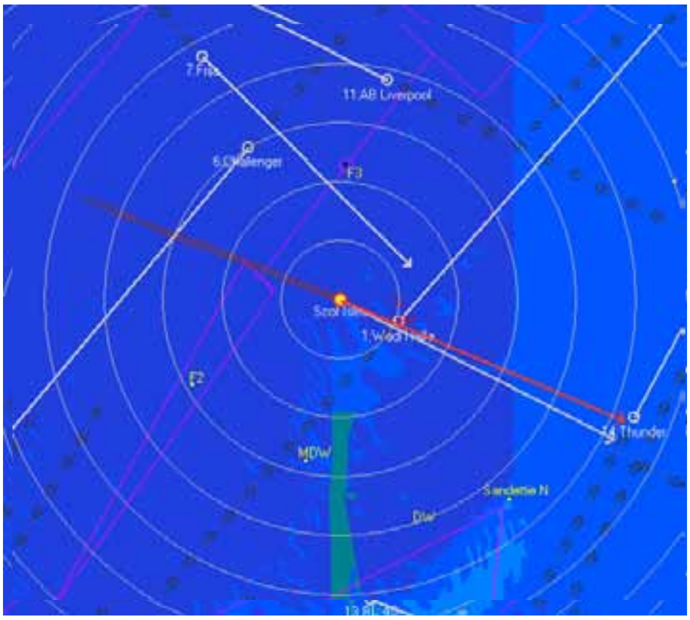
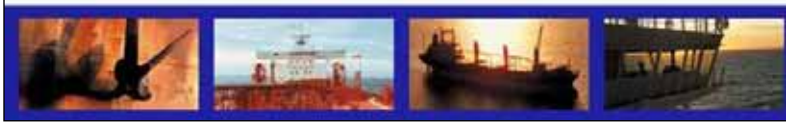
Debriefing of exercise





Evaluation of exercise

- Students own opinion about their performance
- Exercise results
- Discussion about performance of team.
- Performance of students on the bridge, (exercise video)
- Showing additional video of QPS, with AIS data of the real accident
- Discussion with students about real scenario when ships collided.
- Maritime Resource Management

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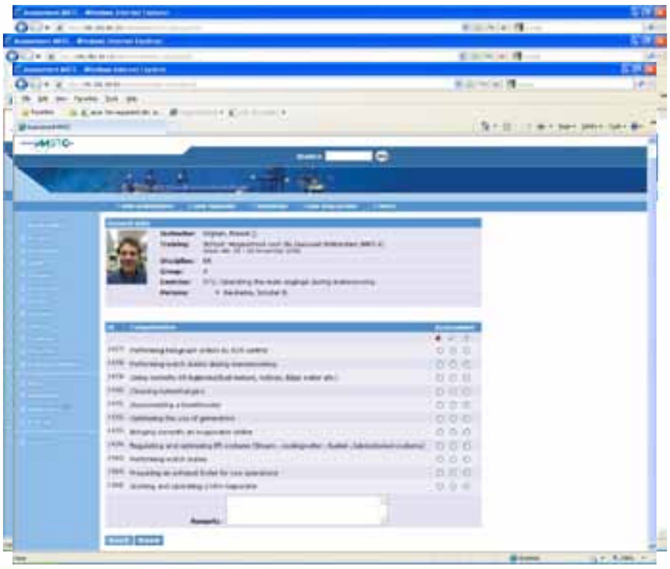
Assessment of students

- Group of students consist of 4 persons
- Tasks are divided in:
  - Head of Watch
  - Watch officer
  - Assistant watch officer
  - Helmsman

Assessment system



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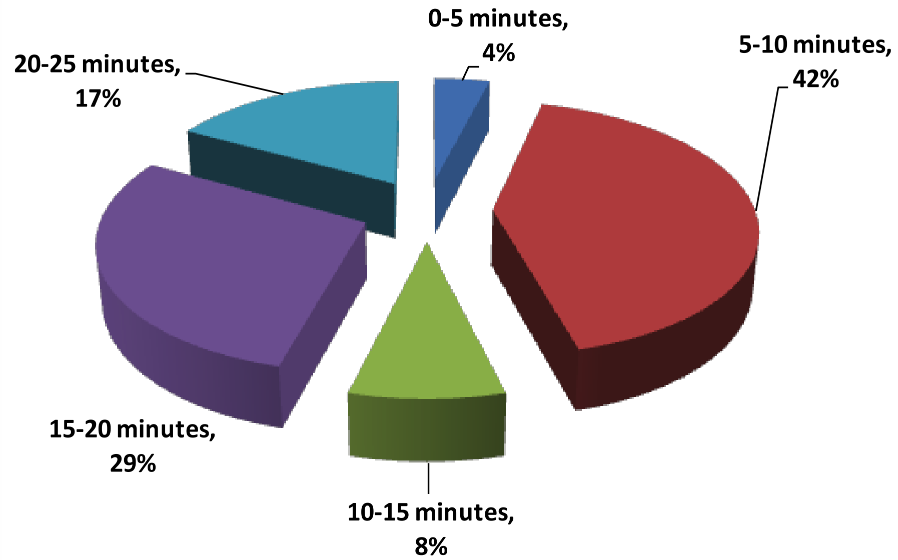
Results of exercise

- When do students notice the target for the first time?
- When do students first recognize the risk of collision?
- When do students start avoiding the target?
- Which actions are taken to avoid the target?
- What will be the CPA?
- Finally, when do students return to the original course?

First detection of target.



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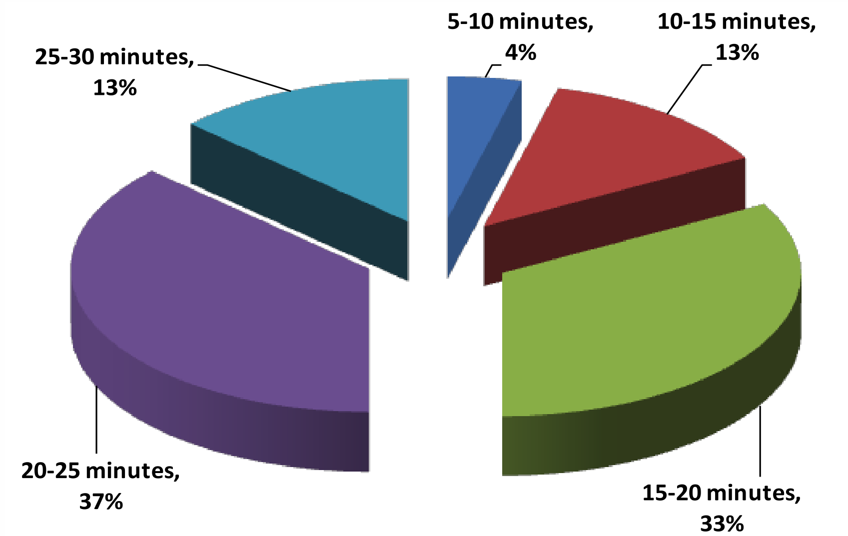
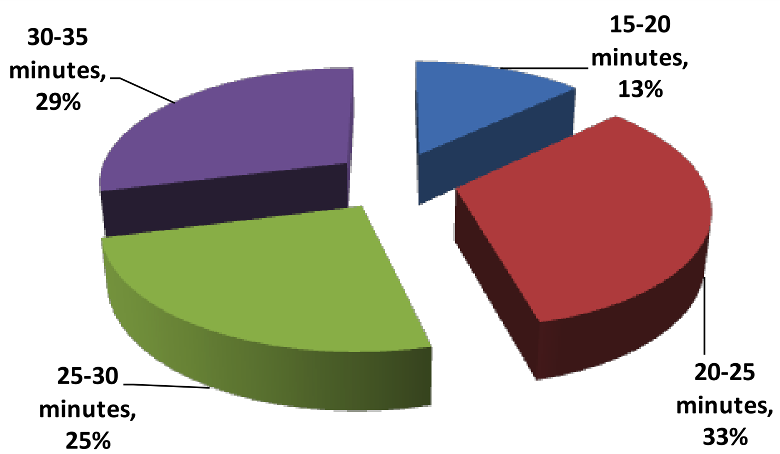
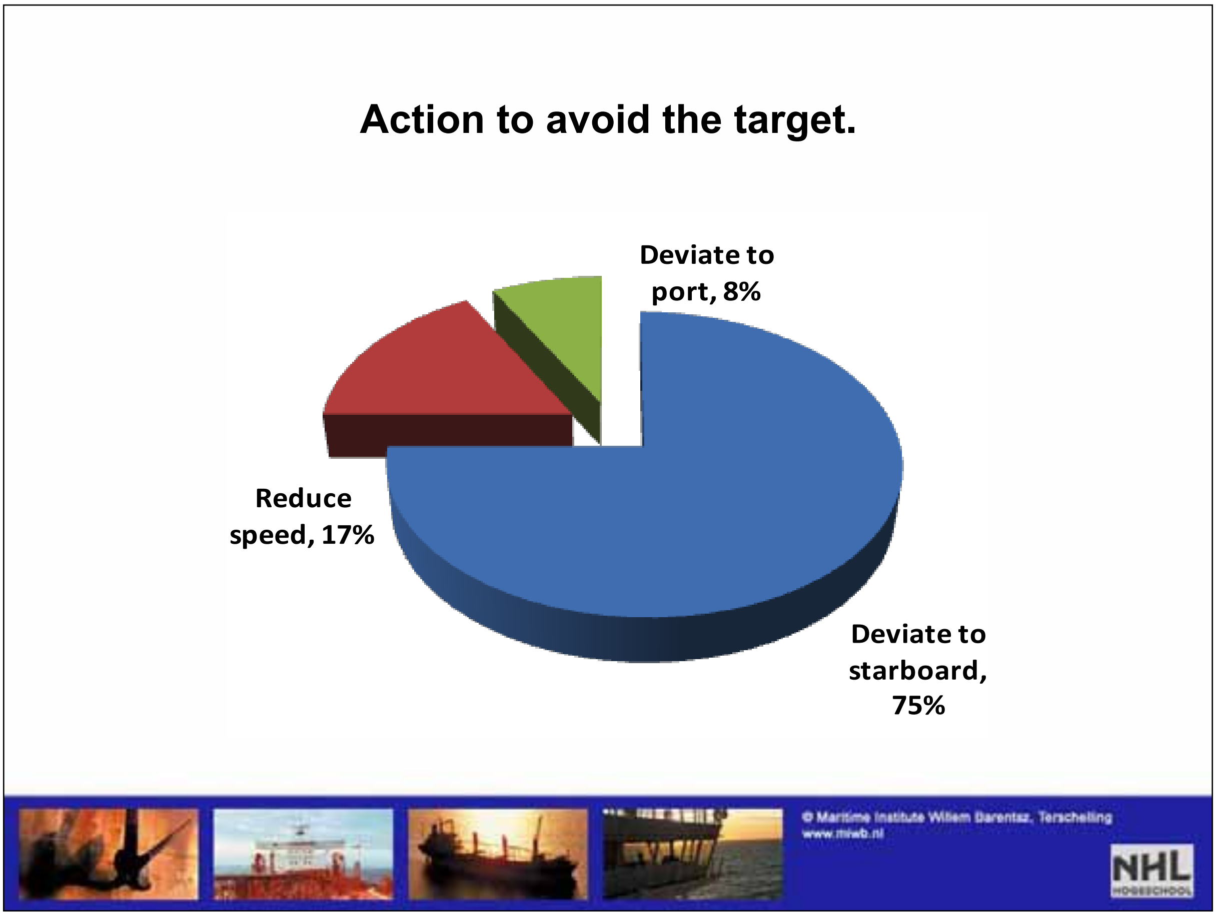
First recognition of target.



Timing the action taken so as to avoid the target.




Action to avoid the target.
Deviate to port, 8%
Reduce speed, 17%
Deviate to starboard, 75%
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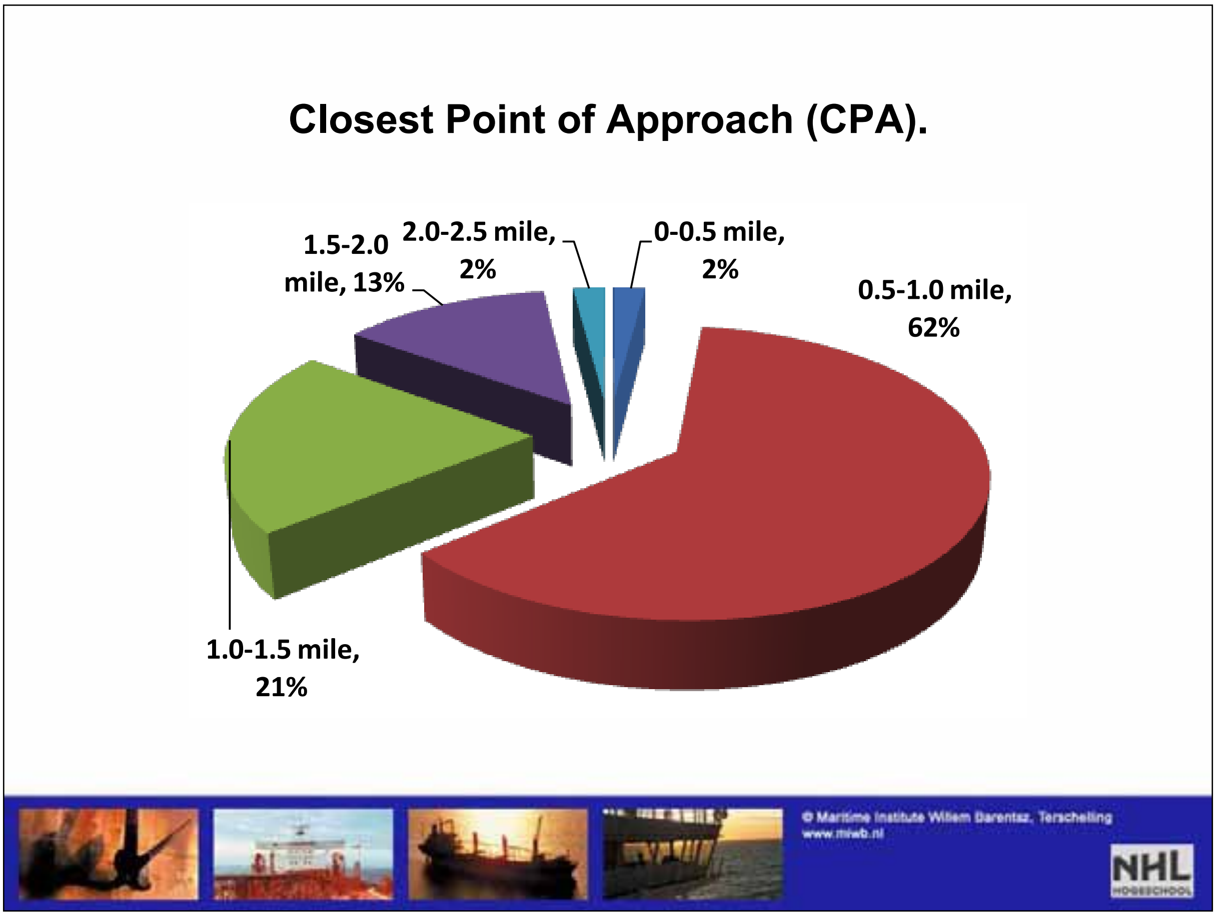
Closest Point of Approach (CPA).
1.5-2.0 mile, 13%
2.0-2.5 mile, 2%
0-0.5 mile, 2%
0.5-1.0 mile, 62%
1.0-1.5 mile, 21%
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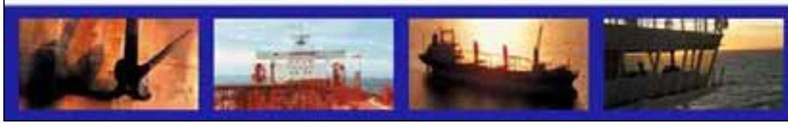
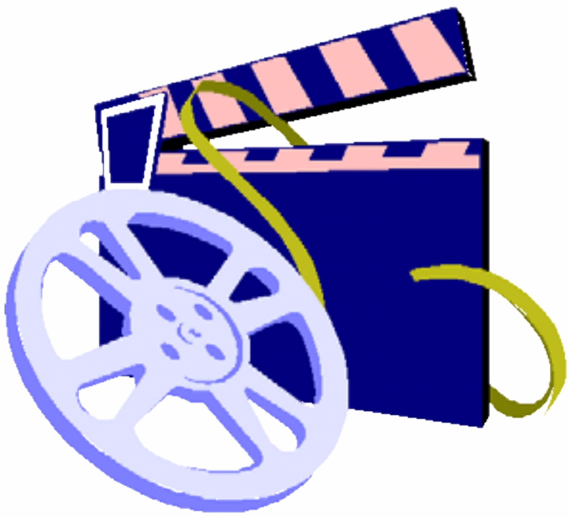
Conclusions of simulation scenario.

- Students had been well aware of the risk of collision with the target.
- Results are influenced by students knowledge of radar plotting and trial manoeuvres.
- The majority of students started to deviate to SB to avoid the target.
- Average CPA was between 0.5 – 1.0 mile



Movie AIS information from QPS.



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Discussion with students experiences

- Plotting of ship positions on radar and chart.
- Advantages of AIS information
- Possibility of fatigue.
- Information from lookout about other shipping.
- Need of Maritime Resource Management.

Questions?

If not, thank you for listening

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TraFi
Maritime

Co-operation on the bridge

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Introduction

Ensuring Safety

Safety is a critical issue for maritime industry, and there are significant safety, environmental and economical risks for vessel traffic. The main task of bridge personnel is to control these risks while operating the ship. This is a challenging task, and indeed, most maritime accidents result from the errors of bridge personnel (IMO, 1999).

It is impossible to completely eliminate the risk of accident, but the likelihood of accident can be reduced by decreasing the risk level of operations. It is difficult to estimate the risk level for normal operations, as the operational weaknesses are not obvious and only become apparent in such situations and circumstances that may lead to accidents. Routine operations may seem safe until a situation emerges where routines do not provide protection from risks. A central part of risk management is to spot the weaknesses in normal operations and to choose compensatory routines. Usually, everyday risk management refers to verification routines which are used to confirm that everything functions normally. Indeed, risk management practices may sometimes feel like frustrating repetitions or tasks that are obvious or already checked. However, the value of these practices is measured in situations where deviant observations are made or corrective measures carried out. The safety level of operations cannot be measured by how much the personnel think about safety. Safety is measured by risk management practices and the priorities that guide decision making. From the worker's point of view, safety means safe routines.

An accident is always a sum of many events, and it is easier to perceive the chain of events retrospectively. There are many underlying events where the personnel could have affected the chain of events, but the factors affecting the accident and their significance were not understood. Hence, the bridge operations were not adjusted to meet the demands of the situation, even though there was a chance to do so. In other words, the accident could often have been avoided, had the working practices better supported the making of observations and the forming of better situation awareness.

In addition to external risk factors, there are often errors underlying the accidents made by bridge personnel as well. It is natural to make errors, and it is impossible to completely remove them from human activities. Circumstances also have an effect on the making of errors. The more demanding the task and the working conditions, the more errors are made, the harder it is to identify them, and the more serious their consequences will be. Being a professional in risk management does not mean that you are capable of performing your task without errors, but rather that you are able to identify situations where errors are made and choose working practices that can affect the identification of errors and their consequences.

Seafarers have always been successful in managing risks, and safe working methods and the identification of the issues relevant for safety are not novel inventions. The ability to identify risks, to distinguish between relevant and irrelevant observations and the ability to modify one's routines according to the situation at hand are the hallmarks of experiential knowledge. Risk management skills that have been accumulated with experience are often instinctive, and top professionals often find it hard to explain the reasons underlying their methods of operation in detail. This complicates teamwork and the formation of shared situation awareness on the bridge. Moreover, the transfer of knowledge and good practices to the inexperienced employees will be slower. The definition of risk management skills will offer extra value to the development of the overall safety of the operations, and it will also provide tools for communication-based teamwork and thus for efficient resource management as well. Moreover, it makes it easier to transfer experiential knowledge and knowhow, and to learn from even smal operational deviations.

Safe co-operation on the bridge is intended as a handbook for bridge personnel. The purpose of the handbook is to help the bridge personnel to apply work regulations to their own work in order to ensure safety.

Background and Aims of the Application Handbook

Maritime legislation places requirements on the development of the working methods on the bridge as well as the training of personnel. These requirements are intended to prevent accidents that are caused by human errors. The instructions and requirements can be found from several sources. This application handbook is a compilation of practices, instructions and regulations related to risk and human error management. It also introduces ways to apply the methods required by law. The general risk and error management principles covered in the handbook can be applied in different operational environments, although the actual working method will always depend on the properties of the actual working environment.

The requirements for the practices discussed in the application handbook are introduced in the following international regulations, for example:

The STCW Code (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers). In part A of the code that introduces the mandatory training requirements, there is a requirement of having a secure lookout to maintain efficient operations of the bridge. Part B of the code contains recommendations and specifications for the requirements, including, for example, instructions for shipping companies regarding lookouts. The shipping companies are recommended to provide instructions of the appropriate operational practices on the bridge and to promote the use of checklists. Additional instructions are also provided, and these include topics such as the sufficient manning of the bridge, division of labour and clear communication.

SOLAS ISM Code requires the shipping companies to compile a safety leadership protocol for the vessels. The aim of the protocol is to make the shipping company define safe working methods and security protocols for all identified risks and also to continually improve the personnel's safety leadership skills. (1.2 Objectives).

Instructions related to the topic can also be found in several other sources. This application handbook refers to the following ones:

IMO's circular that provides instructions for the integrated use of the bridge (MSC/Circ. 1061) recommends, for example, that shipping companies register the practice of the integrated use of bridge automation to the vessel operating manuals (VOM). The circular also discloses several important concepts, including bridge procedures and standard operating procedures.

IMO's guidelines for voyage planning (Res. A.893(21)), which define requirements concerning the contents and execution of a voyage plan. An annex to the guideline (Annex 24) emphasises the role of risk management as part of the planning and execution of the voyage.

IMO's model course for ship simulator and bridge teamwork (1.22) describes co-operation practices concerning the briefing of the personnel, workload management and decision making.

In 2003, IMO compiled the so-called Human Element Vision principles and goals whose aim is to take into account the effect of human factors in the areas related to maritime safety as comprehensively as possible. In the principles of the programme it is mentioned that all material related to the topic should aim at reducing the human errors as quickly as possible (Principles, h).

The main goal of the application handbook is to improve maritime safety by reducing operative risks and the number of accidents and hazardous situations caused by human errors. The guide aims at increasing awareness on the practices applied to risk and error management and providing instructions for their application in different situations. The handbook is intended to be used by maritime professionals, from the operative personnel to management, and by those in charge of the development of safety management schemes.

Composition of the Application Handbook

The application handbook is divided into three parts: risk management, human error management, and bridge resource management.

Risk Management. This section covers risk factors typical of maritime navigation and sea transport as well as risk management procedures and principles. The application handbook concentrates especially on voyage planning and the practices associated with the sharing of the plan.

Error Management. This section focuses on the different types of human errors related to work on a bridge as well as error management procedures and principles. The application handbook covers the following procedures related to error management: monitoring, task sharing, checklists, communication practices, practices for abnormal situations, and co-operation and resource management.

Bridge resource management. All procedures for risk and human error management are based on the efficient use of resources available for the bridge personnel. Bridge resource management also includes principles that cannot be defined as working practices. Bridge resource management and the related principles are discussed in the fourth part of the handbook.

Risk Management on the Bridge

Introduction

From the bridge personnel's perspective, the safety risks of operational work can be divided into two parts: external and internal risk factors. The internal risk factors refer to errors made by the bridge personnel. Consequently, the personnel's activities can also be divided into two parts: risk management and error management (Figure 1).

External risk factors refer to situations and circumstances in maritime navigation and sea transport that are beyond the personnel's influence. These factors can either be very familiar and frequently occurring, or surprising and not experienced before. External risk factors include all circumstances and situations that in some way elevate the risk level of operations. External risk factors are a natural part of operations.

Risk management procedures refer to the bridge personnel's decisions and actions that are used to eliminate or minimise the effects of the external risk factor on operations. A prerequisite for the management of external risk factors is to identify them and understand their significance.

Internal risk factors refer to the errors made by the personnel. Making errors is part of human activities and cannot be completely eliminated. However, it is possible to affect the number of errors as well as their detectability and consequentiality by operational methods that are called error management procedures. A prerequisite for efficient error management is to identify the situations and actions where errors are made and where the consequences of the errors are significant.

External and internal risk factors are interrelated. The more external risk factors there are in a task, the more significant the management of internal risks becomes. In other words, the more demanding the circumstances and the task, the more probable it is to make errors, and the more difficult and slower it is to detect them. Moreover, in more demanding circumstances the consequences of errors are often more severe, and they are also realised more quickly after the error has occurred. Good risk management could be described by quoting an old adage: "Good bridge personnel will avoid the situations that can only be handled by skilled bridge personnel".

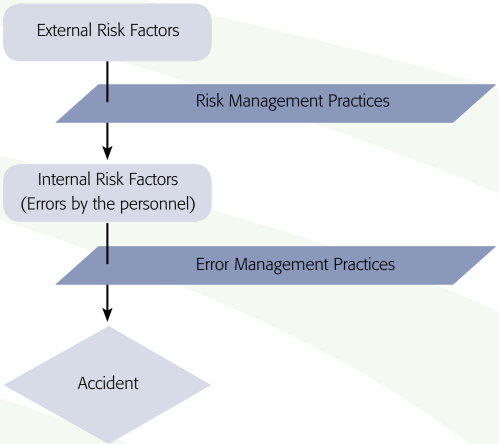


Figure 1. Risk Management on the Bridge (Adapted from Helmreich, R.L. et al. 1999).

External Risk Factors in Maritime Navigation and Sea Transport

External risk factors in maritime navigation and sea transport include all the stages, conditions and situations of the voyage where the risk level has increased (this application handbook does not consider the risk factors included in cargo operations or the transfer of cargo). Examples of the different stages of the sea voyage include ports, archipelagos and other narrow and tight passages as well as congested routes. In these areas, the margin for detecting and managing errors is small. Conditions, on the other hand, include deteriorated weather conditions, darkness, ice conditions and other conditions where it is more difficult to steer the vessel, such as streaming water and other conditions that create suction (squat, bank effect etc.). Risk-increasing situations include locks, towing, support situations in icy conditions and abnormal and emergency situations on the vessel.

A study conducted in Finland in 2007 investigated the effect of risk factors on the accidents that happened in Finland's territorial waters in 1995–2005 (Merenkulkulaitos, 2007). The report found that the accidents or hazardous situations where at least one of the underlying factors was a human error made by bridge personnel had usually occurred in the increased-risk conditions mentioned above. Of the 52 accidents and hazardous situations selected as examples in the report, 94% (49) took place in the archipelago or port area, 38.5% (20) in poor visibility and approximately 60% (31) in dim or dark conditions. Wind was a factor in the accident or the hazardous situation in 35% of the cases. Cases that occurred during dim or dark conditions and/or poor visibility comprised 81% (42) of the cases. 65% of all cases included two or more risk factors (e.g. ice conditions, other traffic, busy radio communications etc.). The report also found that 60% of the chosen accidents and hazardous situations took place during the autumn/winter season, i.e. between October and March.

As underlying causes of human errors, risk factors have an effect on the safety of operations both directly and indirectly. The starting point of safe operations is to identify the risks in the working environment and to modify the operations to meet the challenges in the environment. These risk management principles are discussed in the next section.

Risk Management Practices

The starting point of risk management is the identification and recognition of risks. However, even this is not enough in a complex and changing operational environment, as the status and the significance that the identified issues have on safety must be followed and assessed regularly. More generally, one can talk about forming a view of the situation and actively updating it. The more demanding the conditions are and the more risk factors are identified, the more actively the view of the situation needs to be updated through one's own actions.

However, it is not enough just to form a general view of the situation, i.e. just to be aware of the present risks. The identification of risk factors should always be followed by the question: "How should I act in order to minimise the effects of this risk factor?" In principle, each observation should lead into conscious deliberation concerning the way operations are organised. It is, of course, acceptable that in some cases the result of the deliberation may be that there is no need to modify the current operations. In such cases the situation will be monitored more carefully, if necessary, and the operations modified at a later time (Figure 2).

Risk management on the bridge is based on co-operation. It is important that the bridge personnel shares the same view of the situation, i.e. has shared situation awareness, and understands the current risks. The observations and the actions related to them will be discussed among the crew so that everyone will understand the risks and participate in their management.

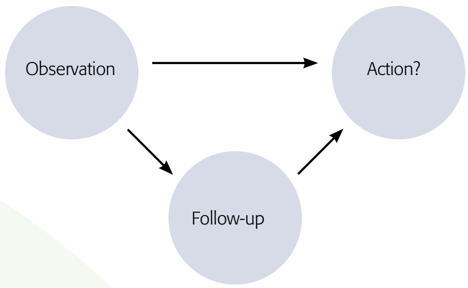


Figure 2. Principle of Risk Management

Once the external risk factor is recognised, there are basically two ways to manage it: its effects can be completely eliminated or they can be reduced. In some cases, such as severe wind conditions in port, the risk factor can be removed simply by delaying entrance to port until the conditions have improved. Similarly, the risks associated with poor visibility or heavy traffic can in some routes be eliminated by choosing another route, if possible.

However, it is often not feasible to remove the external risk factors, which means that the personnel must adapt to the situation. In these cases, the central task in risk management is to define the effects that the risk factor has on operational safety and to modify the personnel's routines in order to minimise these effects. External risk factors often increase the risk level of operations because the operations become more susceptible to errors made by the personnel. This is why error management practices based on conditions are included as part of risk management.

Principle of Anticipatory Risk Management

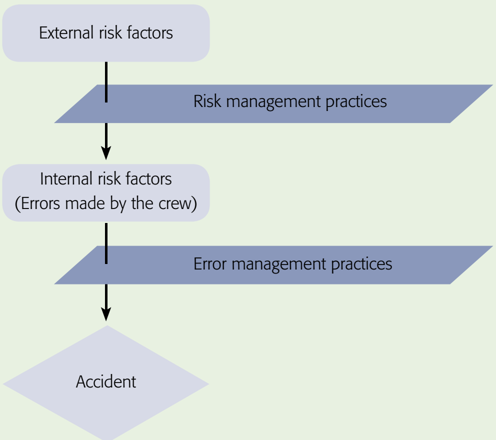
Several external risks that have an effect on the operations are already known before the voyage. It is therefore possible to consider these risk factors beforehand and to decide which of them require special actions in terms of risk management. These actions can then be documented in a checklist, for example, as recommended in the IMO guidelines. The purpose of the checklist is not to describe the actions related to risk management as such, but rather to help the bridge personnel to be sure that every necessary operational modification has been considered when the risk level changes.

EXAMPLE ACCIDENT 1.

A vessel was grounded after passing the turning point, as the officer of the watch made a mistake on the sector lights. The vessel had travelled through the archipelago after midnight. It was dark, but the visibility was good. The officer of the watch had been working on the vessel only for two weeks and had not travelled the route before. The ship's electronic nautical chart had broken down a little earlier after the vessel had left port. Based on these issues, the captain had decided that the conditions were demanding for the officer of the watch, and had remained on the bridge as a lookout. When the captain considered the situation to be peaceful, he went to rest on the bridge's couch.

The officer of the watch paid attention to the VHF traffic just before the next turn. As he started to prepare for the next turn, he thought that he could not match the lights he saw, and therefore informed the captain that the situation seemed to be a little unclear to him. The officer of the watch had mistaken a beacon light for a buoy light after missing the turning point. When the captain arose from the couch, the situation had already escalated to a point where grounding was imminent.

It is possible to recognise several risk factors as well as two human errors contributing to the accident:



Risk factors
- The officer of the watch was inexperienced on the vessel
- The chief watchman was not familiar with the route
- The vessel was operated in the archipelago
- Night-time
- The captain was tired
- A technical fault made navigation more difficult
- External distraction (radio traffic)

Errors
- Missing the turning point
- Incorrect interpretation of the lights

Several external risk factors made operations demanding. The risk for a navigational error had increased, and the detectability of an error had become more difficult. When the officer of the watch was momentarily distracted by radio traffic, he missed one of the turning points. This error was detected too late, as the circumstances made its detection difficult.

External risk factors were partially taken into account when the captain decided to stay on the bridge. However, the task sharing was not agreed upon, and the captain did not take part in steering the ship, nor did he monitor theofficer of the watch. While the captain was on the bridge, he was not utilised as a resource. A clear task sharing and the utilisation of the captain in cross checking navigation would have helped in detecting the navigation error and to prevent grounding.

PRACTICAL EXAMPLE 1.

Dividing the stages of the voyage in different areas according to risk level

The risks related to the voyage that are known beforehand can be taken into account by dividing the different stages of the voyage into risk classes: high risk, increased risk and low risk. Each class can be defined according to the following topics, for example:

- Manning of the bridge
- Task sharing
- Working practices
- Use of automation and other equipment
- Manning of the engine room
- Operations of the main engine and auxiliary engines

In addition to these, further constraints can be put in place for different risk levels. For example, it can be decided that outsiders are not allowed on the bridge in high risk zones, or that it is only allowed to talk about issues related to the steering and navigation of the vessel. These zones can be marked into the route plan beforehand. When moving from one zone to the next, the procedures can be ensured by using a checklist and standardised communications.

The same operating principle can also be used in situations where, for example, weather or other operating conditions result in the change from one risk level to another.

Voyage and Route Plans

Planning forms a central part of risk management. The purpose of planning is to ensure that all future actions are coordinated and that every relevant factor affecting operations is taken into account and recognised by the personnel. In the planning phase, the prospective situation is discussed along with the necessary procedures, risks associated with the situation and their control as well as the co-operation between the personnel during the situation.

Traditional tools for this purpose include voyage and route plans. Standardised planning can also be applied to exit and entrance situations, piloting and other special situations.

"The need for voyage and passage planning applies to all vessels. There are several factors that may impede the safe navigation of all vessels and additional factors that may impede the navigation of large vessels or vessels carrying hazardous cargoes. These factors will need to be taken into account in the preparation of the plan and in the subsequent monitoring of the execution of the plan." (IMO Res. A.893(21) Guidelines for voyage planning, 1.2)

From the point of view of risk management, the most important tasks in planning include:

- Identification of the external and internal risks affecting operations
- Definition of those stages of the voyage that are affected by the identified risk factors
- The possible effects of the risk factors on the personnel's performance
- A risk management plan (manning, use of equipment etc.)
- Procedures and practices related to the monitoring and verification of operations

If the plan is not made jointly, it is important that it will be discussed with all those who are taking part in the operations included in the plan. The aim of planning is to ensure that the whole personnel have shared situation awareness and to allow different perspectives to be expressed and considered during the drafting phase of the plan. In addition to choosing the passage and other issues related to the voyage, it is important to justify the decisions and the risks associated with them during planning and ensure that everyone is aware of them.

Briefing of the Plan

Master shall lead a pre-departure briefing which includes:

- *Presentation of the route plan*
- *Interaction with the bridge team*
- *Setting of stipulated requirements*
- *Identification of possible weak links on the route*
- *Establishing standards and guidelines to be met during the passage*
- *Setting the environment for an effective team oriented operation*
- *Brief the pilot on the ship's characteristics and equipment using the pilot card*
- *Ask the pilot to present his route plan and give information on local conditions*
- *Demonstrate responsibility to brief and coordinate operational factors with the bridge team*

(IMO, Model Course, 1.22, 7 Briefing and debriefing)

Whether there is a documented voyage plan or only an idea about the activities in a prospective situation, it is at least as essential to brief the plan to everyone involved in the activities as it is to make the plan itself. Briefing of the plan will provide the personnel with an opportunity to comment on the safety of the plan and to raise issues that the person drawing up the plan may have missed. Briefing the plan in a standardised form, i.e. introducing all aspects always in the same order, will facilitate the monitoring of the plan in the agreed manner and also ensure that all relevant issues have been taken into account.

Planning and anticipation do not always need to – and indeed, often cannot – be based on a written plan of future activities. There are many situations, such as planning for a meeting with another vessel, that are based on a short briefing among the crew. The question is about the identification of the risks and a plan for their management in these cases as well.

From the co-operative point of view, the briefing should determine:

- The activities and intentions related to the plan
- The planned order and timing of the activities
- Task sharing for the planned activities
- Responsibilities related to the monitoring of the operations
- Critical phases and deviations that require a change in the plan
- Alternative plans and reasons for their deployment

EXAMPLE ACCIDENT 2.

A vessel was grounded during a turn. The master and the pilot were on the bridge. There was a thick fog, and the pilot made a mistake on the starting point of the turn. The master could not help the pilot because he had made a voyage plan for a different route from the one the pilot eventually took. The route taken by the pilot was not familiar to the master.

Before leaving port, the master had introduced his plan to the pilot. At this point, the pilot had not mentioned that he planned to use another route because of the ice conditions. The master found this out only when the vessel diverted into the detour the pilot had planned.

The co-operation between the master and the pilot was insufficient especially in relation to the briefing of the plans. A briefing before the piloting voyage would have provided the master with a better opportunity to help the pilot in navigating the vessel and to monitor the pilot's actions. Better co-operation and a clearer task sharing on the bridge would also have facilitated safe operations in demanding conditions.

Master shall during the voyage, brief the team on any significant situations encountered (IMO, Model Course, 1.22, 7 Briefing and debriefing)

Summary

Active risk management creates the prerequisites for safe operations. The most important issue is to try to identify the operative risks beforehand and to form a clear plan that will help to minimise the consequences of the risks. The majority of external risks can be identified well in advance, and they can be taken into consideration as part of normal operative planning. The traditional planning practices, such as formulating a voyage plan, can be complemented with the identification and management of those risk factors that can be anticipated efficiently.

Human Errors and Their Management

Introduction

"To err is human."

Errors are a natural part of human activities. The strength of human activities lies in their flexibility and adaptability to changing conditions, but the price of this is the chance of failure. This section aims at answering the question: what kinds of human errors are there and how can we manage them?

Humans will always make errors, but it is possible by one's own actions to try to ensure that they will not endanger the safety of others. These actions are called error management procedures. Thus, successful error management does not refer to error-free operations, but rather to the fact that errors are recognised on time and their impact on safety is minimised. Understanding this is a prerequisite for the personnel to be motivated to develop and apply error management practices in their work.

Human Errors on the Bridge

Errors can occur in diverse ways, and they can also be classified accordingly. Understanding different kinds of errors will provide a basis for perceiving weaknesses in human activities. This is important as different factors are relevant for the emergence of different kinds of errors. Moreover, errors are of a different kind in different tasks, and consequently, different kinds of errors can be managed in various ways.

Errors may seem similar at a first glance even if they have occurred for different reasons. An erroneous choice of speed may, for example:

- be intentional, yet erroneous, if the choice is based on an incorrect assessment of the situation (mistake)
- be a result of a slip during the speed selection task, which means that the choice was not deliberate (slip)
- be a result of a deliberate choice to proceed at a speed that breaches regulations, which may mean that the decision is based on a general practice, or that it is a circumstantial decision not to comply with the regulations (violation)

All three errors mentioned above will lead into different actions to prevent or manage errors in the future. Therefore, it is essential for the development procedures to understand the types and background of the different errors.

The starting point for the definition of the error type is always to find out whether the chosen action was intentional or not. Next, the error can be classified further into one of the four categories depicted in Figure 3.

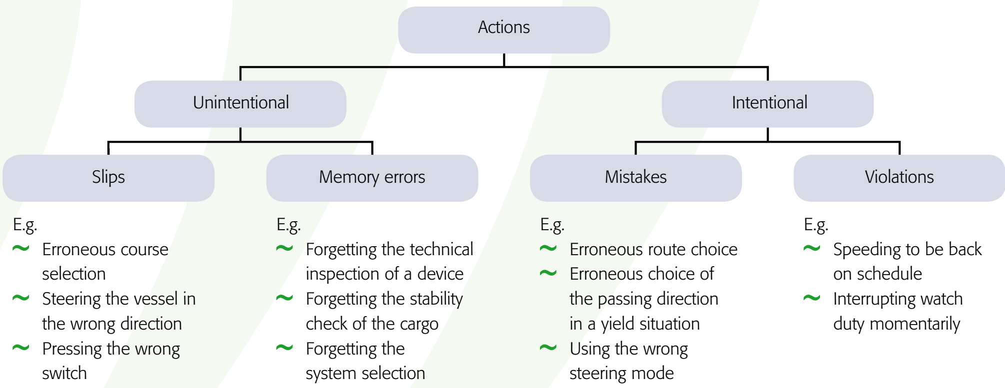


Figure 3. The Basic Error Types (Adapted from Reason, J. 1990).

Different error types require different procedures to avoid and identify the errors. An erroneous choice of direction in a planned route resulting from a slip can be identified and corrected by good monitoring. If the choice of direction was a result of a misunderstanding, the proper error control method can be found in the development of planning practices. The next chapters focus on each of the error types, the factors related to them and their management.

Slips and Memory errors

Slips and memory errors occur in normal and routine activities. A slip refers to an error where a person tries to accomplish a result through their activities, but they fail in their performance. Slips occur even in activities that have been learned well. Advanced skills will lead into fluent, fast and effortless activities, but they will also result in decreased awareness of the activities and the concentration required for them. This, in turn, will make the skills vulnerable of slips.

Slips are probably the most common type of error on the bridge. Typical slips include, for example, incorrect expression or execution of helm orders (or setting the autopilot). Perception errors form another common group – other vessels or other objects, such as sea marks are not detected early enough for one reason or another.

A memory error is a dysfunction of performance that results in omitting a task, one part of the task or a single issue. Memory errors occur both in well-mastered routine tasks and new tasks. Sometimes they may have fatal consequences for safety. For example, an omission has caused an accident in a situation where the personnel forgot to transfer the controls of the vessel from one wing to another (or to midship) and also in another situation where steering was not transferred from autopilot to manual steering.

There may be several factors affecting a person's performance that underlie slips and memory errors, such as too low (monotonous) or high (busy) workload, stress or fatigue; all of which are recognised problems for work on bridge. In addition to the factors mentioned above, the probability of routine errors is affected by the difficulty of the work, ergonomics of the work environment and external distractions, among others.

Slips and memory errors cannot be completely avoided, which means that their possibility must be taken into account when assessing the safety of operations. Consequently, the procedures that are critical for safety should be assured with verification procedures that will help to detect a slip or a memory error quickly enough. These procedures typically include:

- X-checking
- Call-outs
- Checklists

Mistakes

A mistake refers to a situation where a person successfully performs a task, but the outcome of the task is different from the person's expectations. Underlying the mistake, there is often a misconception of the situation at hand, which can be based on insufficient information or a false interpretation. Mistakes may also occur because the consequences of the chosen action are assessed incorrectly or all affecting factors are not taken into account.

On the bridge, mistakes may occur, for example, when setting the radar scale or interpreting the lights on safety devices. In the example accident discussed under Risk Management Procedures (Example accident 1, p.6), the immediate cause of the accident was a mistake concerning the lights marking the fairway.

As mistakes are usually related to an incorrect assessment of the situation or erroneous decision making, they should primarily be avoided by using all available information in ensuring good situation awareness and decision making. This requires effective communication and co-operation among the crew. The follow up of decisions and actions that have been made is also a fundamental part of mistake management. In practice, avoiding mistakes is primarily based on good planning and the briefing of the personnel as well as active checking of activities and assertive intervention if a plan or a decision is not deemed to be safe or their outcomes are not as expected.

Violations

This error type refers to the intentional noncompliance with orders or regulations. What is essential when it comes to violations is that the actions are undertaken knowingly and purposefully. There may be different motives and reasons underlying a violation that can be related either to the individual or to the organisation. The person committing the violation may think, for example, that the regulation that is broken is not relevant for the particular situation, or they may commit the violation because it is necessary for the task at hand. The person committing the violation may also think that it provides them with a possibility to perform the task better and faster, or that the organisation expects that violations are committed in order to secure smooth operations. Although violations should not be accepted at the organisational level, it is however important to understand why violations do occur in certain situations in order to prevent them.

The number and properties of violations serve as an indicator of the prevailing working culture. Certain orders may be ignored routinely, and in such cases the question is not about a deviation caused by an individual person or situation, but rather a structural problem in the operational system. The safety issues caused by violations usually include the fact that the significance of the ignored order is not understood or the consequences of noncompliance are not considered. Effective co-operation and open communication have a central role in managing violations. It is more likely that through co-operation and communication others that have noticed the situation will intervene in the violations and raise questions about the reasons behind the deviant activity.

Error Management Practices

"Master shall establish specific preventive measures to guard against external and internal errors." (IMO, Model course 1.22)

Human errors can never be avoided in operations, but they can be managed so that there will be no hazardous situations or accidents.

The first phase of human error management is to reduce their number. Here, the relevant issue is to predict the risks that affect operations. If the potential risk and the criticality of a certain task can be identified beforehand, the error can probably be avoided. This can be accomplished, for example, by focusing on a task where errors are especially common and minimising all distractions while performing the task.

The second phase of error management is to ensure that the error will be detected when it occurs, or at least before the possible consequences of the error start affecting the safety of the operations. Typical methods used in error identification include the monitoring and checking of operations, which in team work includes communication during the tasks. For example, the people involved in the steering of the vessel should be notified of a change in course. In this way, another person can confirm whether the action was appropriate or not (detecting a possible mistake), and the correct selection of the new course can be verified from the vessel's equipment (detecting a possible slip). In order to detect errors it is important to have a clear task sharing about who is in charge of executing an action and who of their verification.

In the third phase, the focus is on the identification and correction of the error induced situation. If the error is not identified early enough, it will usually lead into the deviation from expectations (the vessel will not have the expected course, for example). In these cases the situation may have reached a point where the error cannot be repaired using normal procedures; abnormal procedures, such as using alternative steering systems, must be used instead. From the point of view of identification and management of error critical situations it is important to be well aware of the threshold requiring the use of abnormal procedures as well as the actions that these procedures comprise. For example, in a turning situation in a narrow passage, everyone involved in steering should know what the safe tolerance for staying on the route line is and the amount of deviation that should be reported clearly, as well as the alternative actions that must be applied if the vessel cannot be kept inside the safe area by normal procedures.

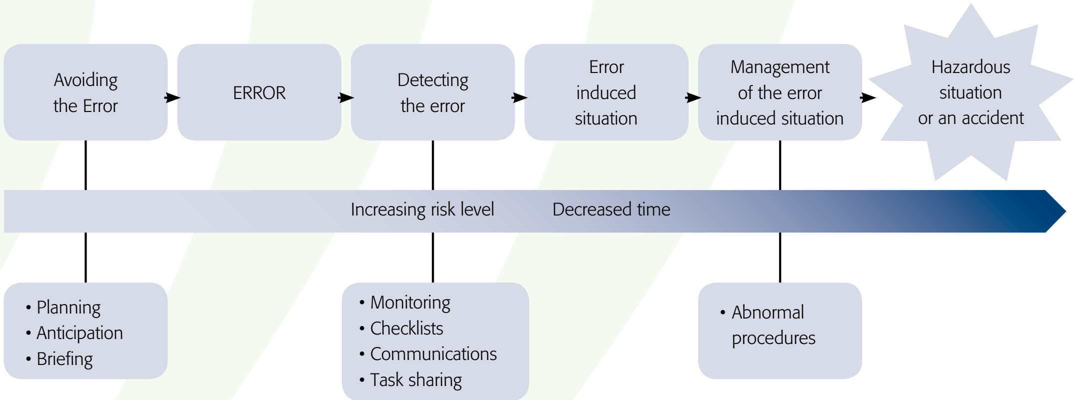


Figure 4. Phases of error management

Activities on these three levels may be based on documented working methods, procedures, or undocumented working methods used by the personnel and developed through training and experience (Figure 4). The following sections describe the most typical methods of error management as well as practices in abnormal situations.

Monitoring

"All essential information should be collected, processed and interpreted, and made conveniently available to those who require it for the performance of their duties."
(STCW Section B-VIII/2, Part 3–1, 5.12)

By monitoring is generally understood an activity that is especially related to the monitoring of the location of the vessel and the execution of the voyage plan. Indeed, from the perspective of maritime safety, monitoring and checking related to navigation are central tasks on the bridge. 80% of the accidents related to navigation are caused by human errors. In many cases, the information that could have prevented the accident would have been available, but for some reason it was not used. Therefore, IMO recommends that all decisions are cross-checked so that potential errors could be detected and corrected as early as possible. Moreover, deck officers should ensure that all available information is used in a systematic way.

"Masters, skippers and watchkeepers should ensure that optimum and systematic use is made of all appropriate information that becomes available to the navigational staff."
(STCW Section B-VIII/2, Part 3–1, 5.12)

However, monitoring is not only limited to following the planned route; it is rather applied to the verification and follow-up of all critical tasks. The aim of monitoring is to provide the relevant information to all who need it.

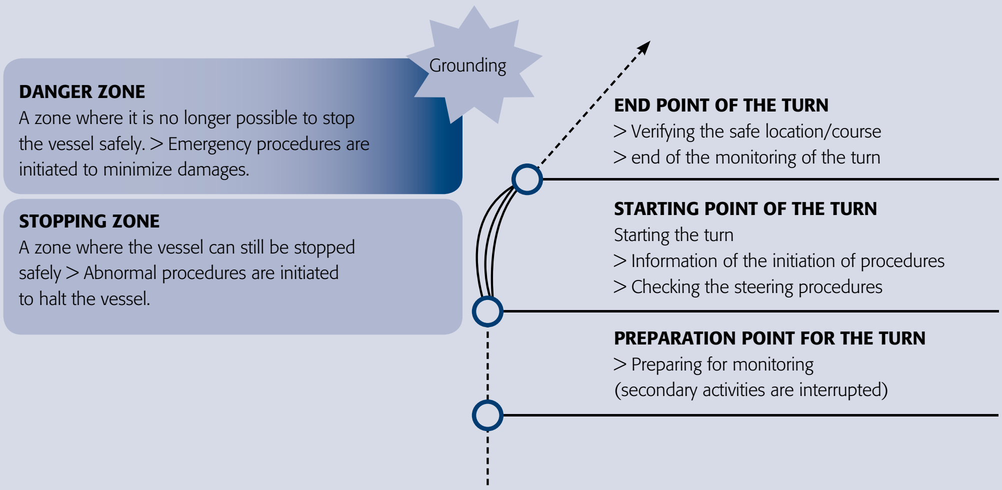
For monitoring to be successful, the following issues should be considered:

~ Which functions should be monitored at the given moment?
~ Who is responsible for the monitoring of these functions?
~ Which observations should be communicated to other personnel?

PRACTICAL EXAMPLE 2.

Efficient monitoring while proceeding in a narrow passage

It is extremely critical for the vessel to stay on the planned route line when proceeding in a narrow passage because straying from the line may quickly lead into a situation where grounding cannot be avoided. Therefore, the monitoring of the turns is a relevant part of safe navigation in narrow passages. The targets of monitoring in turning situations include the location of the vessel in relation to the route line, direction of steering, course, speed and the correct functioning of the devices and steering systems used in the turn. Below you will find an example that is based on the monitoring of a critical turn. The example includes three phases, which are used to ensure that all the aforementioned factors are monitored until the critical turning phase is completed.



The three phases to the right of the picture ensure the monitoring during the turn. Preparations for monitoring can be initiated by using a standard call-out (e.g. "Approaching"), which directs the attention to the most significant monitoring targets of the turn. As the turn begins, it is important to communicate clearly the choices and procedures related to steering; their validity should be confirmed by other personnel. The final phase is the conclusion of monitoring where it is ensured that the vessel has obtained the desired course and location, and that the turning phase is completed. Attention can now be shifted to other operations on the bridge.

On the left side of the picture, there are two zones that are related to the vessel drifting away from the safe route line during the turn. The first of these is the "stopping zone", which starts from the point where the vessel can no longer be kept within the desired route. In this case the only way to prevent grounding is to stop the vessel either by using the main or alternative steering systems. If the vessel cannot be stopped, the vessel enters the "danger zone" where the collision cannot be avoided; it is only possible to minimise the damages caused by the collision by slowing down the vessel's speed as much as possible and/or steering the vessel to a direction that best helps it to withstand the collision.

The aim of monitoring and the related exchange of information is to maintain the shared situation awareness of the personnel. If the available information is not used to maintain the situation awareness, as has been the case in several accidents, the following three questions can be used to approach the problem:

- Did someone detect the issue in question?
- Was the issue considered to be important enough to be presented?
- Was the issue communicated in a way that resulted in a shared situation awareness?

Good monitoring practice will ensure that the confusions described above will not prevent information exchange to those who need it. Hence, the basic prerequisite for successful monitoring can be considered to be a task sharing that clearly defines whose current responsibility it is to monitor the function in question, which observations are relevant to the operations and how they should be reported.

Monitoring can be divided into passive (i.e. reactive) and active (i.e. anticipatory) monitoring. The difference between passive and active monitoring methods is whether monitoring is general monitoring of the activities or conscious checking of specific functions.

Passive monitoring refers to the monitoring of the general level of activities. General level monitoring is based on the presence of the monitoring officer and on stimulus-based reactions in situations where a deviation from the normal situation or another corresponding event causes the monitoring officer to take notice of the situation. A stimulus of this kind may be a system warning, for example. The weaknesses of passive monitoring include the incapability to detect small and slowly occurring deviations, the inability to react early to quickly evolving situations and the decrease of vigilance in a monotonous environment that includes only few stimuli.

Active monitoring refers to activities where a member of the bridge personnel knowingly pays attention to predetermined targets, whose expected status or functions he attempts to follow or ensure at a certain moment. When the person monitors several things, he will change the target of monitoring regularly.

Active monitoring requires that the targets requiring attention are known in advance and that the responsibility for their monitoring is clearly determined. The personnel should therefore know where to pay attention in different situations or during different procedures, and which changes are included in the plan and which are not. The following phases, which will result in communication, are included in several monitoring principles:

1. Preparing for monitoring
   (the situation requiring monitoring is approaching)
2. Initiation of activities (the monitored phase begins),
3. Checking of activities
   (changes according to plan) and
4. Ending the monitoring
   (attention can be shifted to other matters).

Communication is a central part of monitoring. It is not possible to maintain shared situation awareness and to ensure that attention is paid to the correct matters in co-operative monitoring if communication among personnel does not work.

Moreover, a protocol for reporting deviations needs to be defined in order to ensure that reactions to the observed deviations from the plan are sufficiently fast. Example 3 depicts how the different monitoring phases are shown during a turn in a narrow passage.

Procedures for active monitoring and communicating of deviations need to be in place for all situations where the detection of error is critical in terms of time, as in:

- Turn situations
- Port areas
- Archipelagos
- Narrow places (e.g. shallows and nearby areas, straits, rivers, locks etc.)
- Streaming water
- Conditions where the vessel is subject to pull (squat, bank effect)
- Busy regions
- Demanding conditions
- Other special situations, such as ice conditions, with a tugboat, abnormal and emergency situations etc.

To summarise, general observations (passive monitoring) do not necessarily guide the attention to the issues that are important for operations. Therefore, monitoring practices should be developed in such a way that focus will be on ensuring the matters relevant to the situation. This requires that the issues that are monitored are known by the personnel, the task sharing is clear concerning monitoring responsibilities, and the way the observations and deviations are communicated is agreed upon.

Task sharing

"Duties should be clearly and unambiguously assigned to specific individuals, who should confirm that they understand their responsibilities." (STCW Section B-VIII/2, Part 3–1, 5.3)

Excessive workload and unclear task sharing have often been discussed with reference to accidents. Any confusions regarding the task sharing will easily lead to memory errors caused by the workload, misunderstanding in co-operation based on assumptions, insufficient checking of critical procedures and poor utilisation of resources. These problems can be avoided by clear task sharing.

The starting point for functional co-operation should be a clear division of responsibilities, roles and tasks among all the operators in the group at all times. In this case, roles refer to predefined basic activities that include many responsibilities concerning procedures and their checking. Roles can be assigned and changed depending on the situation.

The manning of the bridge may vary for several reasons. In the offing, the bridge may be manned by one person only, whereas when proceeding in a fairway in poor weather conditions, the helm may be occupied by a helmsman, a lookout, the first mate, the master and a pilot. Many vessels have regulations for the minimum manning of the bridge for different stages of the voyage or different conditions. However, the mere presence of these people is not enough; rather, the task sharing in different manning conditions should be clear as well. For example, a situation where the master is called to the bridge should not automatically result in a change in the current task sharing. The change in the task sharing should be communicated clearly when the change is deemed necessary and the task sharing is altered. Manning changes will pose a challenge for the definition of standardised task sharing. Usually, tasks cannot be preassigned to certain people; instead, the task sharing must be defined individually for each manning situation according to the "working roles". Because of this, the most important starting point is to identify which tasks should be assigned and which person is the best choice for each task in each manning situation from the perspective of efficient use of resources. The most important questions from the point of view of efficient resource management include:

1. Who has the best qualifications to carry out the task?
2. How can it be ensured that the task sharing is clear for everyone?

In functional task sharing models, the activities and responsibilities are clearly coordinated at least for the following operations:

- Steering and control of the manouevring area
- Positioning and choosing the course
- Confirming the positioning (monitoring)
- Monitoring of the traffic situation
- Planning for meeting with other vessels
- Lookout
- Communication with people outside the bridge (bow, aft, engine room, tugboats etc.)
- Communication with other vessels and the VTS centre

In other words, the task sharing is not only about the division of the tasks to be performed, but also about the monitoring activities. The task sharing for both the monitoring of the external operating environment and the checking of performed activities should be clear. In connection with task sharing, it is possible to define the ways that the group members can take part in the tasks and responsibilities of another group member. The monitoring of activities should be based on clear communication about the planned procedures and a clear way of expressing the occurrence of deviations if the procedures are not completed according to plan.

EXAMPLE ACCIDENT 3.

A vessel was on its way to port in hard wind conditions. Two tugboats were assisting the vessel. There were five people on the bridge: the master, the pilot, the staff captain, the chief mate and the helmsman. The master was steering the ship, while the pilot was taking care of communications with the tugboats, and the chief mate was observing the distance between the vessel and buoys from the other wing. The staff captain did not have a specific task. The master and the pilot had jointly agreed on the way to enter port.

They had decided to drive the vessel to port backwards. This failed, however, as the wind pushed the vessel off the passage. The people on the bridge did not detect the drifting of the ship, even though the electronic nautical chart would have shown it. In the dark, perceiving distances is optically difficult.

The investigation reported that the unclear task sharing on the bridge contributed to the accident. Although the bridge was sufficiently manned, the drifting of the vessel was not detected because the monitoring of positioning and wind direction from different devices was not clearly agreed upon, and the relevant information about the drifting of the vessel that was observable from the electronic nautical chart was not used.

In order to avoid unclear situations, changes in the task sharing should always be performed using a procedure based on standardised routines. Especially the responsibilities concerning the steering of the vessel should be confirmed by standardised call-outs. For example, the shift of steering from the wing to midship can be confirmed by using standardised call-outs: “steering to midship” (call-out by the person on the wing) and “steering at midship” (confirmation by the person at midship).

Workload Management

“Non-essential activity and distractions should be avoided, suppressed or removed.”

“Tasks should be performed according to a clear order of priority.”

“No member of the navigational watch should be assigned more duties or more difficult tasks than can be performed effectively.” (STCW Section B-VIII/2, Part 3–1; 5.4, 5.5 ja 5.10)

Workload management is based on sufficient anticipatory measures, task-specific task sharing, the management of available time, the prioritisation of relevant activities and the effective resource management.

The amount of workload will differ during the operation depending on conditions. By anticipatory measures and planning it is often possible to shift part of the workload-increasing tasks from a recognisable heavy workload situation to be performed before the highest workload peak. In this way, the workload can be kept reasonable for human performance during the entire operation.

The pressure caused by high workload may often result in a person trying to perform several tasks at once. This will often, however, slow down the overall performance, as shifting one’s focus and orientation between tasks takes time. Moreover, the number of errors will increase, as performing one task will have a negative impact on performing another. Because of this, it is important to structure the work in high workload situations in a way that the performance and the disturbances caused by simultaneous tasks are minimised. This requires active decision making concerning the order of performing the tasks and guiding the activities so that the tasks or their parts are performed one at a time.

The management of available time is a crucial part of workload management. Under time pressure, it may go unnoticed that it would be possible to gain more time to perform the task by suitable solutions, such as slowing down the speed, changing the route, or other solutions that are feasible in the situation. As the workload increases to a high level, the ways to gain more time to perform the tasks should become the focus of active consideration.

If no extra time can be gained to perform the tasks in the situation and the workload increases to a level that is too high for the situation, activities will need to be prioritised. This refers to active decision making about which tasks are the most important ones in the situation and which tasks can be disregarded. The collapse in performance caused by high workload and stress can be avoided by efficient prioritisation. Efficient resource management is the most central part of workload management in a teamwork situation. This includes the utilization of the personnel, equipment and the available information when handling the situation. Resource management is discussed in more detail in a separate chapter.

Checklists

“Companies should issue guidance on proper bridge procedures, and promote the use of checklists appropriate to each ship taking into account national and international guidance.” (STCW Section B-VIII/2, Part 3–1, 4)

“The Company should establish procedures for the preparation of plans and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of the ship and the prevention of pollution.” (ISM Code Part A, 7)

“A description of the checklists and purpose of the specific items should be included in the Vessel Operation Manual.” (MSC/Circ. 1061)

Checklists are used to ensure that the most important tasks in a situation are performed, thus minimising the risks caused by memory errors. Checklists are typically used after the preparation phase to ensure that all relevant tasks have been performed before the critical working phases. There are two kinds of checklists: a work list (so called read-and-do list) and a confirmation list (the so-called do-and-verify list). A work list refers to a list that guides the work and that is designed to be used as a memory aid as the work proceeds. Here, the worker will carry out the tasks while reading the list. Confirmation lists are used after certain working phases to ensure that the tasks that are the most critical and the most difficult to detect have been performed. Both kinds of checklists can be used either individually or in a team.

When using checklists, it should be defined who will request the list and when this will be done. Typically, the person requesting for the list as well as the person reading the list are defined, and the list will then be performed jointly.

A practice concerning work lists and confirmation lists for pre-departure procedures on the ship is described below. The operating model is based on the idea that each person has a work list guiding the procedures of his own area of responsibility, according to which the preparatory activities are performed. When the preparations are finished, the personnel will use the confirmation list to check the most central procedures. The articles in the confirmation list can be used to verify whether the activities based on the task lists have been accomplished.

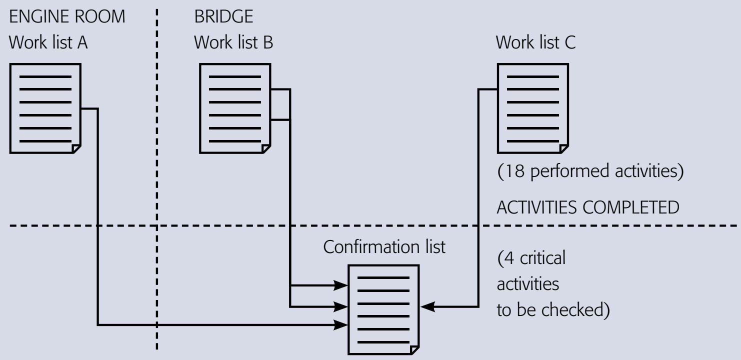
In terms of usability, the confirmation list should be short and concise so that it can be gone through at a single time without interruptions. The activities included in the work list may take a significant amount of time, but operations can be made flexible by a good task sharing and timing of the separate tasks, as the activities included in the different work lists are independent of each other.

PRACTICAL EXAMPLE 3.

Pre-departure checklists

In the example below, the vessel's pre-departure preparations include altogether 18 preparatory activities or checks that are performed in the engine room or on the bridge. These procedures are managed by work lists that can be reviewed by different persons. When the preparatory tasks have been completed, a confirmation type checklist will be read just before departure.

The confirmation list will then be used to check the most critical preparatory activities. This will be performed quickly; for example, the master will read aloud each item that needs to be checked according to the list, and the person who carried out the task will then confirm that the task has indeed been completed.



By using the described practice, it is possible to carry out the activities efficiently and with a clear task sharing. Moreover, the most important activities are checked twice.

Checklists can be applied to many different situations. ICS's Bridge Procedures manual includes examples of checklists and their contents. The manual provides examples of the checking of the following situations, for example:

- Preparing for departure
- Departure and arrival situations
- Initiation of piloting
- Moving from one navigation area to another, e.g. from the high sea to the archipelago, or from the archipelago to port area
- Special situations, such as anchoring, passing through ice, or towing
- Changing the lookout
- Abnormal and emergency situations

Using a checklist to support memory is an excellent way to avoid human memory errors, but its usability should be considered carefully when planning the list. List structures that are too heavy or impractical will easily lead to people ignoring the list. Moreover, the longer the list, the more likely it is to overlook an item included in it. The division to work lists which guide different activities, and to short and concise confirmation lists helps to avoid this problem. Work lists may be long if needed, and they also include activities that are not relevant for safety. Confirmation lists, on the other hand, only include issues that are critical for safety, and they are short enough to guarantee easy use.

Communications Practices

"Communications among members of the navigational watch should be clear, immediate, reliable, and relevant to the business at hand." (STCW section B-VIII/2, Part 3–1, 5.9)

"Terminology for standard Call-Outs should be developed by the Company and presented in the Vessel Operation Manual." (MSC/Circ. 1061)

Communications practices are standardised ways that are intended to convey information that is critical for safety among the personnel so that the risk of misunderstandings in communication has been minimised. Call-outs (short standardised words or word pairs) and standard phraseology (standardised ways of expressing critical messages) are the most common ways to avoid misunderstandings. Moreover, in a safety critical environment it is important that the sender of the message ensures that the receiver of the message has indeed received the message and understood it correctly. This is verified by a practice where the receiver indicates that he has received the message, and shows that he has understood it correctly by repeating the central contents of the message. In this way the sender may be assured that the communication was successful. This practice is referred to as closed loop communication (Figure 5).

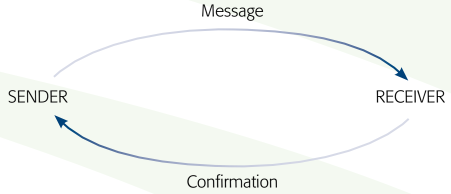


Figure 5. The closed loop communication principle

The need for standardised communication practices as well as suitable means of communication need to be defined separately in each operating environment and situation. Nevertheless, standardised communication practices should be utilised at least in the following situations:

- Situations that immediately affect the steering and the navigation of the vessel, such as
- Changes in the steering orders
- Speed changes
- Steering changes
- Changes in the level of automation
- Turning situations
- Yield situations
- Changes in roles and responsibilities, e.g. changing the officer of the watch, changing the lookout etc.
- When reporting sightings, e.g. of another vessel, a sea mark (especially on fast vessels)
- VHF traffic, e.g. VTS communications or arranging a meeting with another vessel (SMCP Standard Marine Communication Phrases)
- Certain communications with other groups on the vessel, such as deck groups (e.g. mooring and unmooring commands) and the engine room, and
- Other special situations, such as starting and ending pilotage, towing, assistance in ice conditions etc.

The starting point of a standardised message is to define the message and the following answer in a way that minimises the risk of misunderstanding. In practice, the most usual way is to repeat the entire message, which ensures that the receiver heard the message exactly as it was sent. Repetition is especially used in conveying messages that concern steering. These messages often include numerical values, the correct hearing and understanding of which can only be confirmed by repeating the contents of the message. On the other hand, standardised call-outs should not be too rigid, as this will increase the risk of not using them. Repeating the entire message is certainly not necessary in all situations. In situations where there is no risk of misunderstanding the action related to the request or a command, the form of communication can be a general acknowledgement like "ok" or "roger", which will only confirm that the message has been received. Often, the communication chain also contains "two phases". In the first phase, the command is conveyed and its reception is confirmed. In the second phase, the completion of the requested activity is reported and the reception of this information is confirmed, as in the example below (Figure 6).

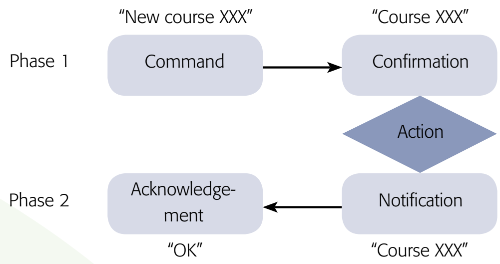


Figure 6. Communicating a helm order

Table 1 includes examples of the standardised call-outs used on the bridge.

The examples are not necessarily in use everywhere in the same form; there are many variations. Standardised call-outs are usually used in connection to the steering of the vessel, engine orders and VHF traffic.

"Steady as she goes"	Helm order ; directs the course at the time of command
"Full ahead"	Engine order; full speed
"Stand by bow and aft"	Message to the deck groups to start preparations for mooring or unmooring the vessel
"Untie the aft spring"	Command to untie the aft spring
"Steering to midship"	Notification of changing the vessel's steering to midship
"Autopilot track mode"	Notification of setting the autopilot to track mode
"A vessel 10 to the right"	Notification of a detected ship 10 degrees right of the bow
"Port area"	Notification of moving into port area. This means that bridge operations are changed to correspond to a critical port area (manning, tasks, device and engine settings etc.)
"How do you read me"	A question in VHF traffic to find out about the coverage of the radio communication
"Steer ... degrees to make a lee"	The pilot is asking the vessel to make a lee
"Passing buoy number one"	VTS announcement of a required passing point (in this case buoy 1)

Table 1. Examples of call-outs in use

IMO's Standard Marine Communication Phrases is a good guideline for unifying communication in English.

Practices in abnormal situations

"The Company should establish procedures to identify, describe and respond to potential emergency shipboard situations."
(ISM Code, Part A, 8.1)

An abnormal situation may occur on the bridge for several different reasons. The reason may be an unexpected change in the vessel's course caused by the conditions, a mistake, and a malfunction in the bridge systems or, for example, an emergency on the ship caused by a fire. Clear procedural guidelines that include directions for the personnel's actions should be in place for the foreseeable abnormal situations.

In an abnormal situation, the workload usually increases temporarily to a high level, and there may not be much time to perform the tasks. For this reason, the procedures related to the management of abnormal situations should be especially clear and well rehearsed. This emphasises the need to define the operating procedures related to foreseeable abnormal situations, and furthermore, maintain the preparedness through training (see the section "Maintaining Preparedness for Abnormal Situations").

Procedures for abnormal situations can be divided into abnormal procedures and emergency procedures. An abnormal situation requires attention either immediately or soon, but it does not necessarily cause an immediate danger for safety. An emergency situation, on the other hand, demands immediate attention and immediate action to avoid damages. This distinction is important for the correct prioritisation of activities. If the operations are in a critical phase when the abnormal situation emerges (e.g. a device warning signal during a turn in a narrow passage), the activities related to the turn should be completed before attention is shifted to, say, a small device malfunction that has no effect on the vessel's steering and navigation capabilities. However, if the malfunction leads to a loss of steering in a corresponding situation, the actions leading to restoring the vessel's steering should of course be prioritised, and hence avoid drifting away from the passage.

Examples of abnormal situations include:
- Malfunction in the communications system
- Malfunction in a single navigation device
- Bout of illness (for someone who does not take part in the vessel's steering)

Examples of emergency situations include:
- Loss of steering capability
- Grounding
- Blackout

Procedures used in abnormal and emergency situations can be described in procedures whose form and structure should be as clear as possible for optimum usability. Similarly to checklists used in normal operations, the procedures for abnormal and emergency procedures can be documented in loose-leaf books or a laminated guideline kept in the working area (if the instructions cover only a situation related to a particular working area). The instructions can be encoded by a colour and content scheme to facilitate its usability (e.g. abnormal procedures can be kept separate from emergency procedures), and the contents can be classified by different situations and devices, which will help in finding the correct procedure.

Equally important to the availability and usability of the procedures is the principle underlying their application. Workload will increase in critical situations, and therefore the task sharing must be as efficient as possible in order to ensure sufficient resources both for the accomplishment of the procedures and their checking. Moreover, when the procedures are being defined, the persons responsible for the continuation of normal operations (e.g. steering, navigation) should also be defined along with those responsible for the initiation, performing and checking of abnormal procedures. It can be considered a general practice that the person in charge of the operations will give the order to initiate the procedures, after which one person will read the procedure from the abnormal (work list type of) checklist while another person performs the tasks. Going through the procedures in a coordinated way is ensured by using standardised communication related to the performance of the activities.

As mentioned before, the initiation of the procedures may require quick reactions to avoid grounding, especially in emergencies related to the steering of the vessel. In these situations there may not be time even to consult an abnormal checklist that is easily available; instead the procedures need to be initiated immediately. For these situations, the so-called "by-heart procedures" should be defined. There procedures are performed from memory immediately when the situation is noticed, and verified from the relevant procedure after their execution. These kinds of situations are not common, and they are usually related to the vessel's steering and navigation ability. The example below shows how the procedure would work in a situation where the vessel does not turn to the expected course due to a failure in the steering system.

PRACTICAL EXAMPLE 4.

Failure in the steering system

STEERING CONTROL FAILURE
MANUAL CONTROL...APPLY*

ENGINE EMERGENCY STEERING ....ENGAGE*
ANCHORING (if shallow water) ....PREPARE

If unsuccessful to gain steering control:
ANCHORING ....APPLY

In case of grounding, see TAB 5: "GROUNDING"

(Adapted from ICS Bridge Procedures Guide, 1998)

The first items in the procedure are marked with an asterisk (*), which means that they must be performed immediately by memory. After this, they are checked using the emergency checklist. Only those activities that are critical for time should be performed by memory. In practice, the above activities should be performed so that the person who is in charge of steering and who noticed the problem would report "steering control failure", after which he would perform or give orders to perform the immediate activities. After this, he would give the order "emergency checklist". At this point another person should take the emergency checklist and read aloud the tasks included in it step by step. While going through the first two tasks that have already been performed, the person responsible for these tasks would confirm the tasks to be completed ("applied", "engaged"). Following tasks would then be continued in accordance with the procedure. The procedure will also guide the user ahead depending on whether the situation can be managed by determined procedures or if it leads to a subsequent emergency (grounding).

When it comes to the procedures, the example is not perfect for the situation in question, and cannot be directly adapted to the bridge. Nevertheless, it can be used to show the form of the lists of emergency procedures and their central principles of use.

Maintaining Preparedness for abnormal situations

The ability to act in accordance with the procedures in abnormal and emergency situations requires that the situations in question are practiced regularly. In training, special attention should be paid to the use of the procedures and co-operation in abnormal and emergency situations, and not only to the technical understanding of the consequences of the procedures.

In addition to regular repetitive training, especially the knowledge of the most critical activities performed by memory should be ensured before each voyage. In practice, this will be accomplished so that one phase of the normal departure preparations should consist of going through the critical procedures in accordance with the corresponding task sharing. The procedures are not actually performed, but the necessary procedures are practiced, for example, by placing a hand on an emergency switch etc.

Summary

Error management is based on the detection of potential errors and the application of the procedures related to their management. The most important starting point for successful error management is to understand the critical phases in the operations, the potential errors related to them as well as their consequences. In this way, it is possible to develop procedures for checking the tasks relevant for safety and for avoiding errors. As human memory errors and slips can never be completely avoided, the routines on the bridge should be developed so that all errors are detected early enough. Different checking procedures are the most important part of the activities related to the detection of errors. As it is very unlikely that the same mistake is made at exactly the same time by several persons, the cross-checking of the critical activities is a central part of error management.

Co-operation and Resource Management

"Companies should also issue guidance to masters and officers in charge of the navigational watch on each ship concerning the need for continuously reassessing how bridge-watch resources are being allocated and used, based on bridge resource management principles such as the following." (STCW Section B-VIII/2, Part 3–1)

Resource management training was initiated in commercial maritime in the 1980's as Bridge Resource Management (BRM) training, which was based on Cockpit Resource Management (CRM) training developed in aviation. The training takes into account the fact that insufficient technical knowhow was not the problem underlying the accidents that were caused by a human error, but rather problems related to co-operation, decision making or leadership. Recent developments have expanded the point of view to also include co-operation between people outside the bridge. The aim of Maritime Resource Management training is to develop resource management for the entire operational system.

BRM training covers the limitations of human performance, the mechanisms behind human errors and the procedures for co-operation and resource management. An example of the topics included in the course is given below (Figure 7).

Content of the BRM course

The BRM course covers the following topics:

~ Human Performance & limitations
~ Attitudes
~ Situational Awareness
~ Cultural Awareness
~ Communications and Briefings
~ Authority & Assertiveness
~ Challenge & Response
~ Short Term Strategy
~ Workload
~ Humans and Automation
~ Team State
~ Error Management
~ Leadership Styles
~ Decision Making
~ Crisis Management
~ Crowd Management
~ Critical Incident Debriefing

Figure 7. An example of the contents of a BRM course

Resource Management as Practical Activity

Resource management refers to the maximally efficient use of all human and technical resources in order to ensure safe and efficient operations. In practice, these resources refer to the skills and knowledge of the personnel, third party assistance, and technical devices, such as automation, that can be used both in workload management and as a source of information.

The management of these resources is an active process that is manifested primarily as communication between the personnel. In other words, communication is not only a part of resource management, but rather a tool for all sorts of resource management. In decision making situations, all available information cannot be used without interpersonal communication. Moreover, it is not possible to anticipate risks or maintain situation awareness if related information, observations or plans are not communicated among the personnel.

The aim of this application handbook is to describe how co-operation and resource management are manifested in operations. Resource management can be divided into different parts that each has their own co-operative goals. There are also clearly identifiable working methods in the personnel's operations that are aimed at achieving a certain goal. The four most important parts of resource management are described below (Figure 8).

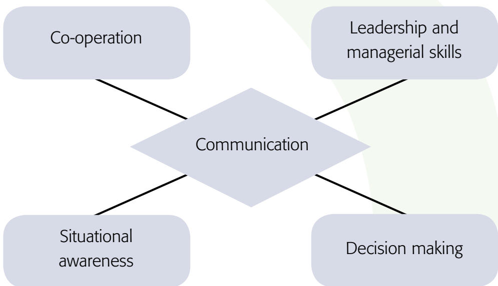


Figure 8. Parts of co-operation on the bridge

"Master should establish an open, interactive and closed loop communication style." (IMO, Model Course 1.22)

The first part of successful resource management is to support active co-operation, whose aim is to create an open climate for communication and a motivation to work towards a common goal. As a result, people will be more active in exchanging information, voicing their interpretations of different situations and potential deviations.

Another important part of co-operation is leading of a situation and a task. Efficient leadership is based on sufficient planning and anticipation, an effective task sharing and active direction of operations. For co-operation to be successful, all activities that are related to leadership should include active communication, which helps to ensure that everyone has a shared situational awareness of the planned activity and their roles in it.

The third part of co-operation, maintaining situational awareness, has often been mentioned in the investigations of hazardous situations in maritime. Situational awareness is mainly related to the positioning of the vessel, the conditions affecting operations and the status of devices and systems. From the point of view of resource management, the maintaining of situational awareness refers to an effective process of acquiring information from several sources in order to combine and analyse it to construct and maintain a realistic view of the situation.

The third part of co-operation is decision making. In decision making, resource management aims to produce the best prerequisites possible for making a safe decision by offering enough information, alternatives and risk assessment to support decision making. The decision making process will be manifested as communication during the different phases of decision making.

Several different practices that can be related to the aspects of co-operation mentioned above can be identified in the actions of different bridge staffs. These practices may also be grouped more specifically for each sub-part according to different aims. These practices are described for each sub-part in the following:

Supporting Co-operation

Co-operation is understood broadly as referring to all co-operative interpersonal activities on the bridge. Co-operative practices, however, refer here to the measures that are taken to encourage the personnel to report more actively about deviations and their observations, to be involved in other people's activities and to express their personal interpretations of situations. The following table includes examples of this (Table 2).

Practices related to the creation of a co-operative climate	Examples of communication between members of the personnel
Encourages to participate	"Let's look at it together."
Encourages to express one's opinion	"What do you think?" "Please tell me if you disagree."
Takes other people's comments into account	"Thank you for pointing that out."
Emphasises the group, not the individual	"So, have we done everything now?"
Takes other people's knowhow into account before taking action	"How would you feel if I handled this?"
Avoids personalisation of conflicts	"Let's focus on this problem here…"
Has a problem-solving mentality	"I think that these are the alternatives we have…"

Table 2. How a co-operative climate is reflected in communication

Leadership

"The crew are allocated duties and informed of expected standards of work and behaviour in a manner appropriate to the individuals concerned." (STCW Table A II/2 Organize and manage the crew, Criteria for evaluating competence)

Leading a task is one of the key parts of co-operation as far as operational safety is concerned. The significance of leadership is especially emphasised in situations where the workload on the bridge is increased along with the probability for errors on the personnel's part. Workload management is based on sufficient anticipatory measures, a task-specific task sharing, management of the available time and prioritisation of relevant tasks as well as correct allocation of resources. For example, by proper anticipatory measures and methodical re-assignment of workload it is possible to perform some of the workload-increasing tasks already before the workload peaks, and thus keep the workload reasonable for human performance during the entire operation. In high workload situations, the working situation is made more transparent by structuring the work carefully, minimising the number of unnecessary interruptions and making sure that there is enough time to perform the task without interference.

From the point of view of risk management, it is possible to take into account the potential risk factors affecting the operations early enough by using efficient anticipatory measures, and create a plan which the personnel can use to minimise the risks related to these factors or their effects. The following table (Table 3) includes leadership practices that describe how a member of personnel works.

Practices related to the leadership of a situation and a task	**Examples of communication between members of the personnel**
Discusses the upcoming situations	"We need to start preparing in a minute..."
Brings out factors affecting the operations	"At least those vessel's seem to become relevant in a moment"
Communicates plans and intentions clearly	"I thought that I'd slow down a little so that the vessel beside us can overtake us well before that turn"
Prepares for alternative methods of action	"If that vessel won't turn to the right before we get there, let's take..."
Uses all resources effectively	"Could you please use the VTS to ask if they know..."
Ensures a clear task sharing	"Confirm steering at midship?", "steering at midship"
Prioritises the issues that are operationally the most important ones	"Let's first put some distance between us and this place, and after that we can..."

Table 3. Practices related to management of personnel

Maintaining Situational Awareness

Situational awareness can be approached by considering which operative functions of the personnel it concerns. These functions are the positioning of the vessel, the conditions affecting the operations and the status of the devices and systems on the vessel or the bridge. As these three functions are different from each other, the procedures that are used to maintain situational awareness also fall naturally into three parts, as can be seen in the following table (Table 4). The situational awareness of the personnel, i.e. the forming of a realistic view of the situation, should not be seen only as a process taking place in the individual's mind, but rather as a product of communication between the members of the personnel. Even if everyone shares a common view of the situation, this will not be obvious before this common view is ensured via communication. The following includes a description of the practices related to the maintaining of situational awareness, including examples of the ways in which a member of personnel may act.

Practices related to the maintaining of situational awareness	**Examples of communication between members of personnel**
Anticipates the signs for positioning the vessel (Awareness of the vessel's position)	"Next we should see a buoy to the right."
Confirms the position of the vessel (Awareness of the vessel's position)	"We just passed..."
Confirms the position from several sources (Awareness of the vessel's position)	"We are now on this position according to the radar. Can you see..."
Introduces the threats to the operations in advance (Awareness of the conditions affecting the operations)	"Visibility is becoming worse." "The traffic on that part of the passage seems to be exceptionally heavy."
Collects information about the factors affecting the operations (Awareness of the conditions affecting the operations)	"Can you see anything on the radar that we should take into account?"
Communicates the choices concerning the use of devices (Awareness of the vessel's devices and systems)	"Changing to manual steering" – "You have manual steering."
Communicates the perceived changes in the status of the systems (Awareness of the vessel's devices and systems)	"Changing speed to seventeen." (Automatic activation of a pre-programmed change)

Table 4. Maintaining situational awareness and related communication

The role of the practices related to maintaining situational awareness is naturally emphasised in conditions that are the most challenging for navigation as well as other critical stages of the voyage, such as mooring or port operations. Therefore, there should be a clear change in the activity of maintaining and communicating situational awareness when a more challenging phase is entered. Likewise, as the margins for positioning are increased, it is natural that communication related to position will decrease, at least as far as active monitoring of position is concerned. It is difficult to define a critical minimum level for safety, but a starting point could be that all navigational procedures should always be communicated on the bridge to ensure that all members of the personnel maintain a shared view of the vessel's current movement.

When it comes to devices and systems, communication should primarily be concerned with the actions and choices that have an immediate impact on the reliability and safety of the operations. One can wonder why not communicate every action and choice that takes place on the bridge. While this approach is basically positive, it is not recommended because it includes the risk that when everything is verbalized the line between extremely significant and less significant information becomes blurred. As the members of the personnel limit the communication to the issues they personally deem relevant in any case, it is a challenge to achieve a unified communicational policy.

Decision Making

For decision making, the key question concerning co-operation is to use all available information for defining the problem, assessing alternatives and executing the decision, so that all the people involved in the operations remain aware of what is going on and for what reason. The co-operative principles related to decision making describe a process which is consistently used to achieve the best possible outcome for the situation with those resources that are available for decision making. From the co-operative point of view, decision making cannot be evaluated only with reference to the outcome, i.e. the safety and validity of the chosen course of action. The quality of the decision will naturally depend on the personnel's experience and knowhow to operate in the given situation. Co-operation and the decision making process itself may be apparently successful; however, a decision that is made based on insufficient experience and knowhow is not the best possible decision in terms of the requirements for the situation. A good decision making process is a means to ensure that the personnel is able to make sustained decisions that are the best ones possible considering the circumstances and their knowhow. The following table (Table 5) describes practices related to decision making, showing how a member of personnel works.

Practices related to decision making	Examples of communication between members of personnel
Defines the problem clearly	"The vessel isn't reacting to manual steering."
Collects information to double-check the situation	"Could you also check..?"
Discusses alternative modes of action	"We can move straight ahead a little further, or slow down and..."
Encourages people to participate in decision making	"Can you think of other alternatives?"
Evaluates the risks included in the alternatives	"If we continue this way, we will come quite close to the shallows over there."
Confirms the chosen course of action	"Okay, we will do so that..."
Assesses the effects of the decision and, if necessary, changes the plan by a new decision	"It seems that we may not be able to turn before that, so we can either..."

Table 5. Decision making and communication

Summary

Co-operation on the bridge is a central part of risk and error management. Efficient resource management is based on open communication, explicit leadership and coordination, active maintaining of the situational awareness and the use of all available information when making decisions.

Interpersonal communication is a prerequisite for efficient co-operation, and therefore all parts of co-operation, from planning to problem-solving, should result in communication between people. The amount and quality of communication is a good predictor of human error management on the bridge. Groups that communicate only little about the factors affecting operations will usually regard as surprising the factors that could be anticipated, which means that they end up making the decisions in these situations quickly and without proper consideration. This will increase the workload, complicate the maintaining of the situational awareness and increase the risk of errors.

Resource management is basically about the efficient use of the available information and workforce. In additions to the people present in the situation, information can be obtained by following the system displays or from external sources. Workload can be divided among the personnel, but it can also be assigned to the systems on the bridge by the proper use of automation, for example. Traditionally, the manning of the bridge is strengthened when the conditions become more challenging, but having more people on the bridge does not automatically result in improved safety. The task sharing should also be defined efficiently and clearly.

The group can function more efficiently and safely than an individual only when its resources are used efficiently. The aim of the practices described above is to ensure that this goal can be achieved.

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"RISKY COMBINATIONS OF CRITICAL SAFETY FACTORS ONBOARD SHIPS"

- Jan Hedegard -

"Bridge 2011", Rauma, Finland, 9-10 June 2011

- PURPOSE OF SPEECH-

To describe a number of "critical safety factors" and some combinations of these factors which increase the risk of incidents and accidents.

- OVERALL COMPANY GOALS -

- THREATS TO OVERALL COMPANY GOALS -

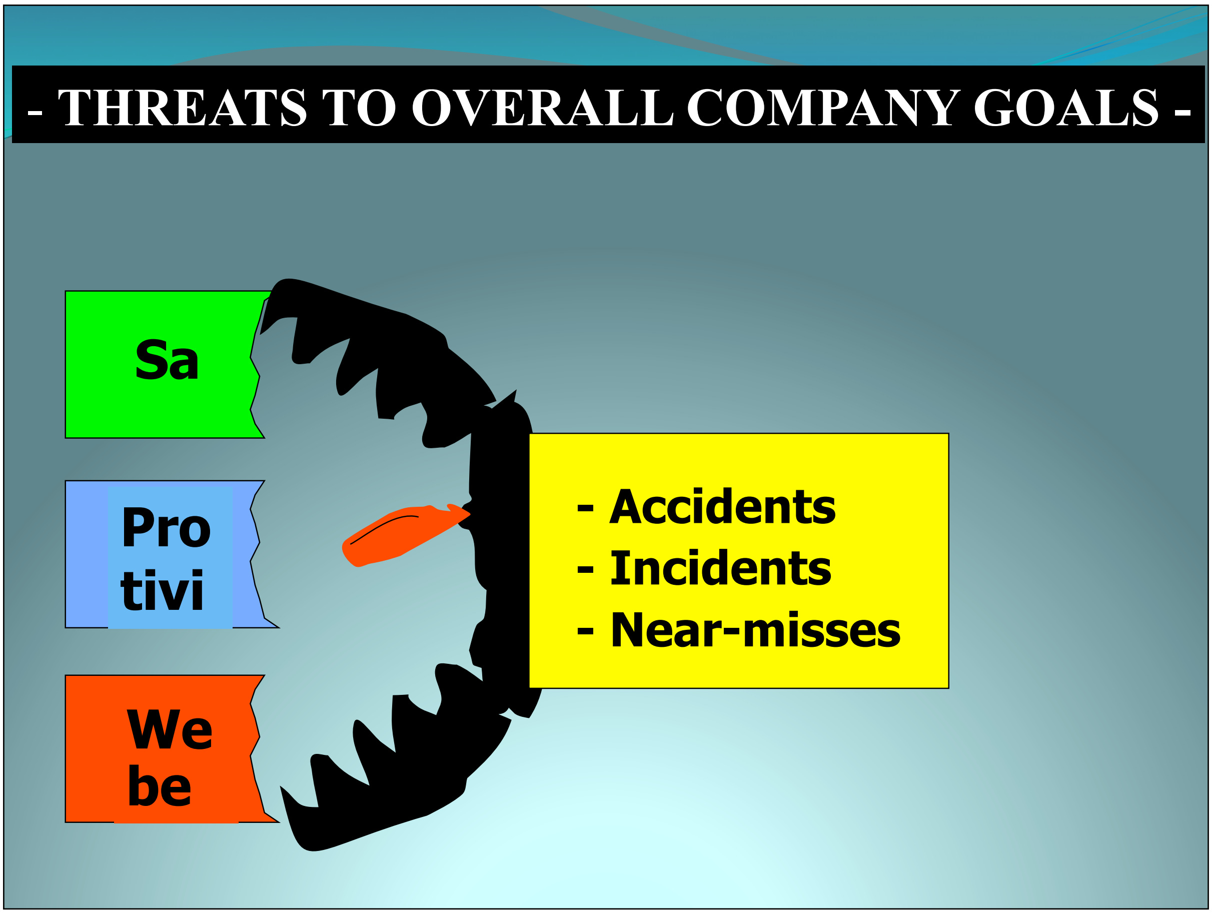
Safety

Produc-
tivity

Well-
being

- Accidents
- Incidents
- Near-misses

-4


- THREATS TO OVERALL COMPANY GOALS -
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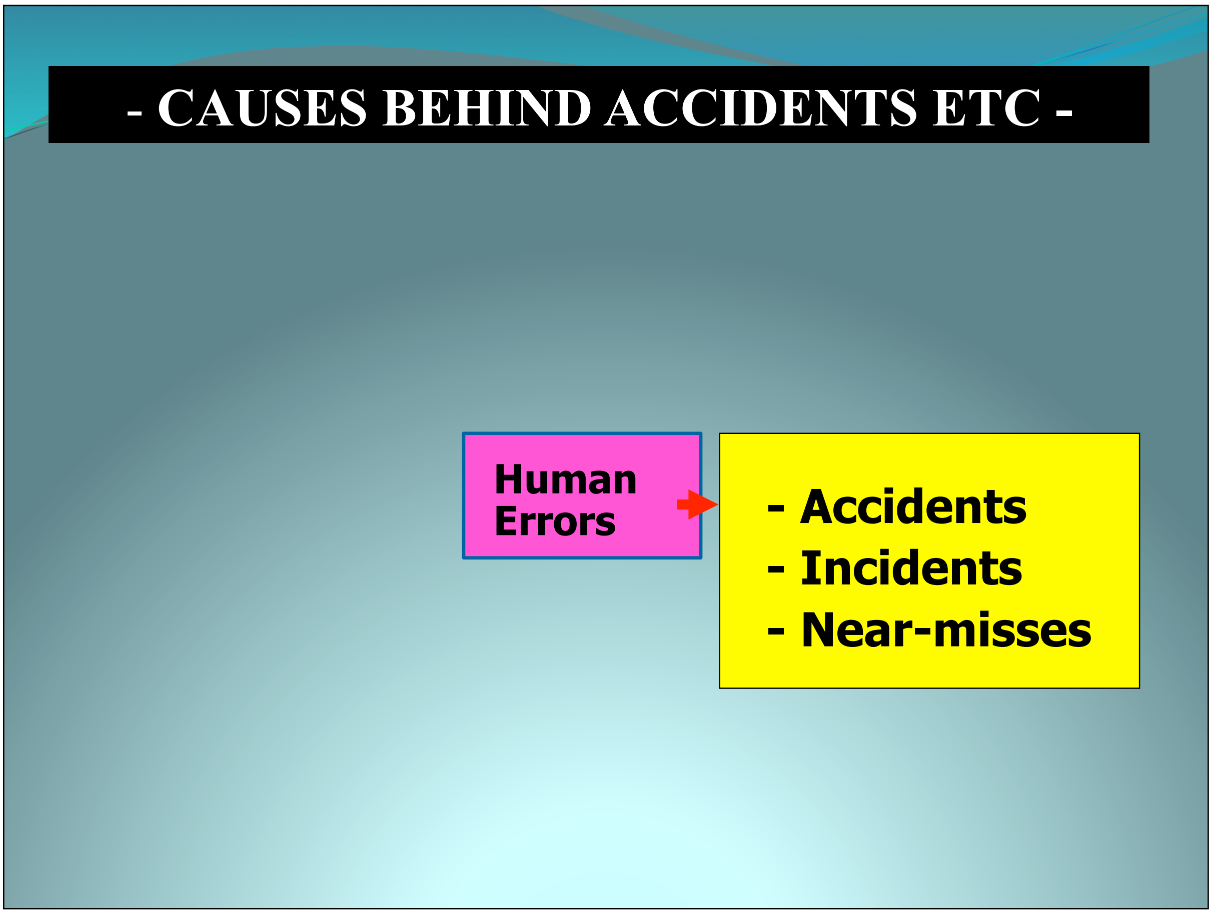
- Accidents
- Incidents
- Near-misses


- CAUSES BEHIND ACCIDENTS ETC -
Human
Errors
- Accidents
- Incidents
- Near-misses

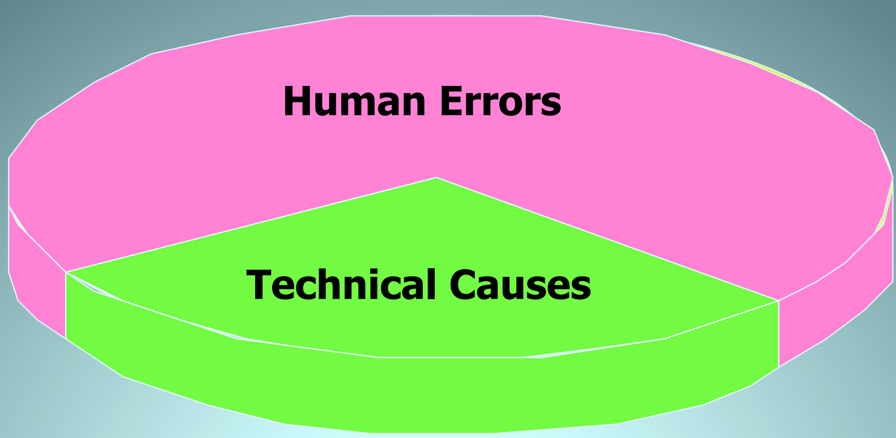
- HUMAN ERRORS -

Percentage of all accidents etc:

-Aviation	**60 - 85 %**
-Chemical industry	**80 - 90 %**
-Off-shore, On-shore	**70 - 90 %**
-Nuclear power	**38 % (USA)** **63 % (Germany)** **5 % (Ex Soviet Union)**
- Ships	**60-70 %**

- CAUSES BEHIND ACCIDENTS ETC -

-Human Errors and Technical Causes in Civilian Maritime Accidents



- HUMAN ERRORS -

Human Error Types (Reason):

Slips — **Errors are made despite the fact that the person has a correct mental picture of the situation and knows what to do and how to do it.**

Mistakes — **Errors are caused by the fact that the person has a erroneous mental picture of the situation.**

Violations — **The person choses consciously to violate regulations or a stipulated work routine etc.**

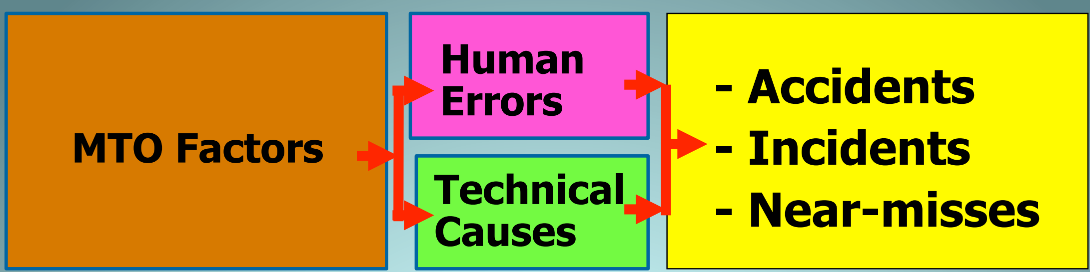
EXAMPLE: HERALD OF FREE ENTERPRISE -

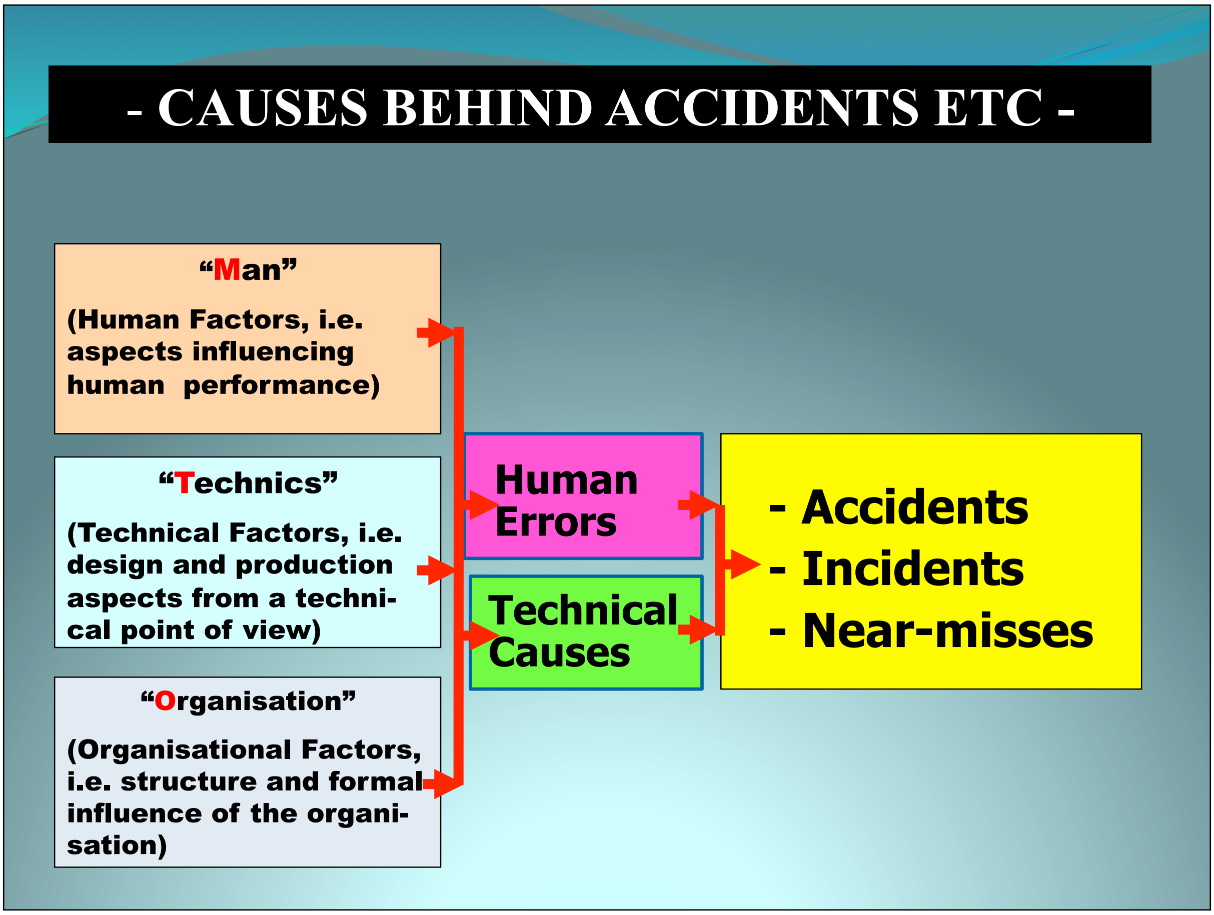
1. **Bow tanks were filled with water to adjust the bow to the car ramp due to high tide (i.e. the bow was low in water)**
2. **The assistant bosun was asleep in his cabin after extra maintenance work (should have closed the bow doors)**
3. **The bosun did not regard closing the bow doors as his job,**
4. **Great pressure from company management to sail on time**
5. **Unclear bow doors closing procedures and reporting.**
6. **No bow door warning lights were installed despite many requests from the crew**
7. **With the bow doors open the car deck was flooded and the ship listed heavily and finally turned on its side in shallow water - 188 people lost their lives.**

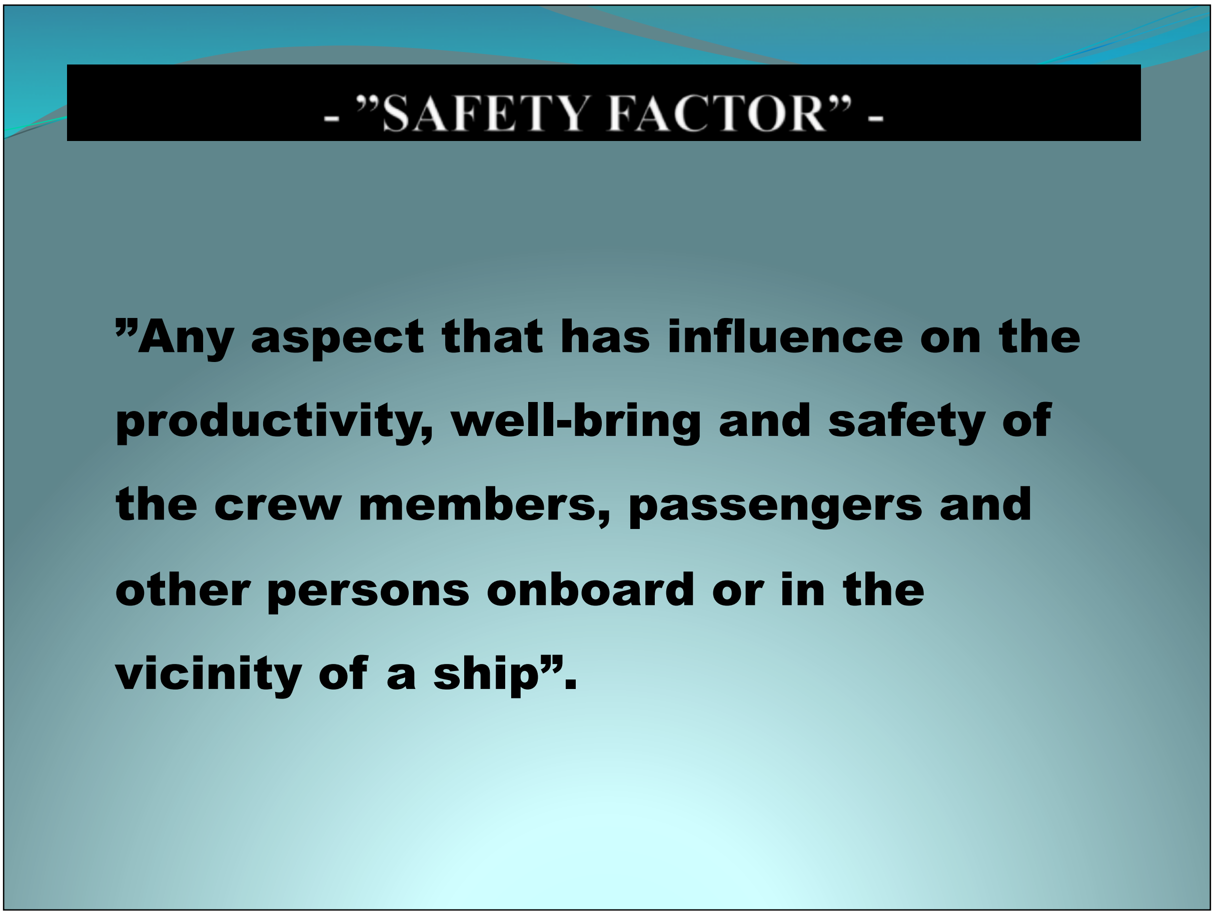
EXAMPLE: HERALD OF FREE ENTERPRISE -

a. No complete check whether the bow doors were closed	Mistake	- Lack of explicit work methods /ground rules - High workload
b. Lack of proper reporting procedure about bow door position when leaving harbour	Mistake	Lack of explicit work methods/ / ground rules
c. No bow door warning lights	(Violation)	Company avoiding expenses

- CAUSES BEHIND ACCIDENTS ETC -




- CAUSES BEHIND ACCIDENTS ETC -
“Man”
(Human Factors, i.e. aspects influencing human performance)
“Technics”
(Technical Factors, i.e. design and production aspects from a technical point of view)
“Organisation”
(Organisational Factors, i.e. structure and formal influence of the organisation)
Human Errors
Technical Causes
- Accidents
- Incidents
- Near-misses


- ”SAFETY FACTOR” -
”Any aspect that has influence on the productivity, well-bring and safety of the crew members, passengers and other persons onboard or in the vicinity of a ship”.

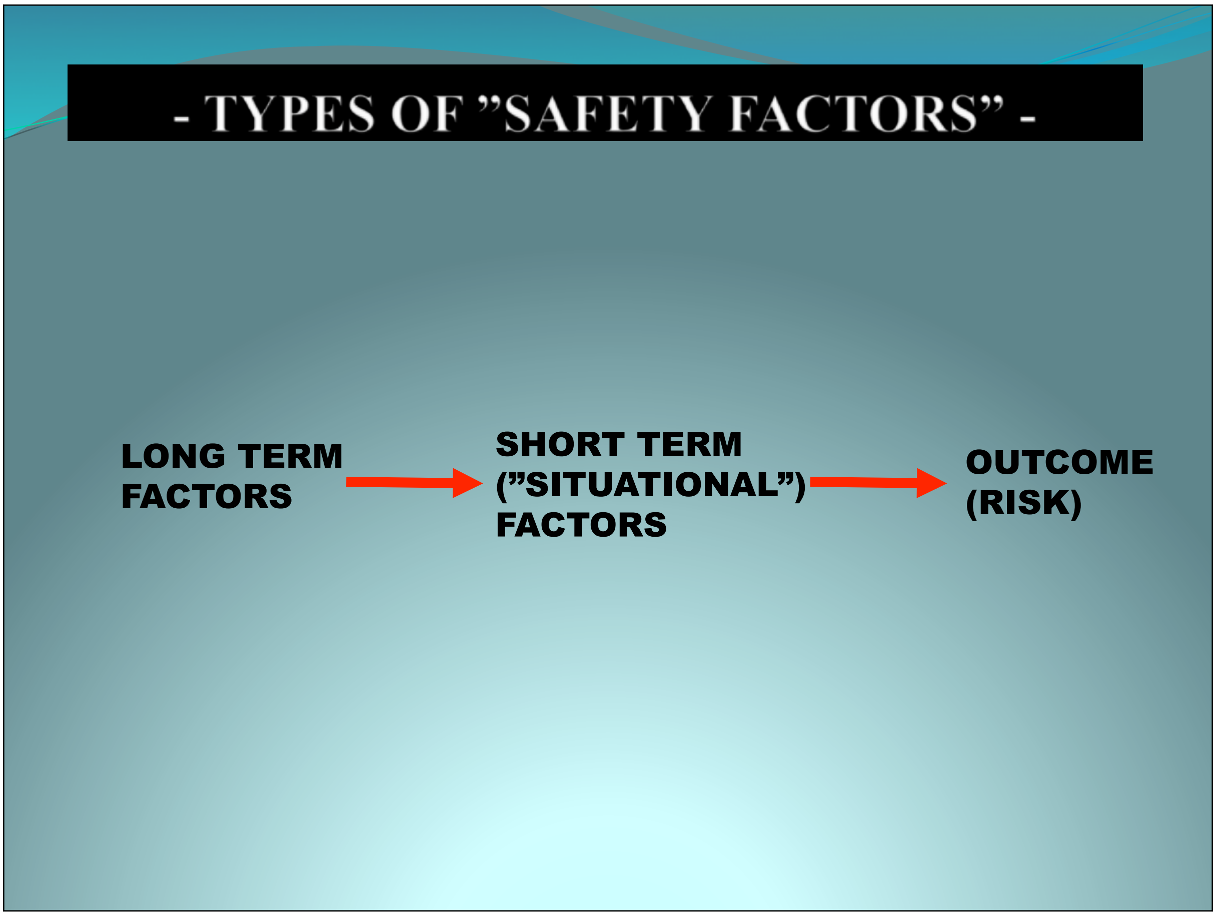
- A SAMPLE OF SAFETY FACTORS -

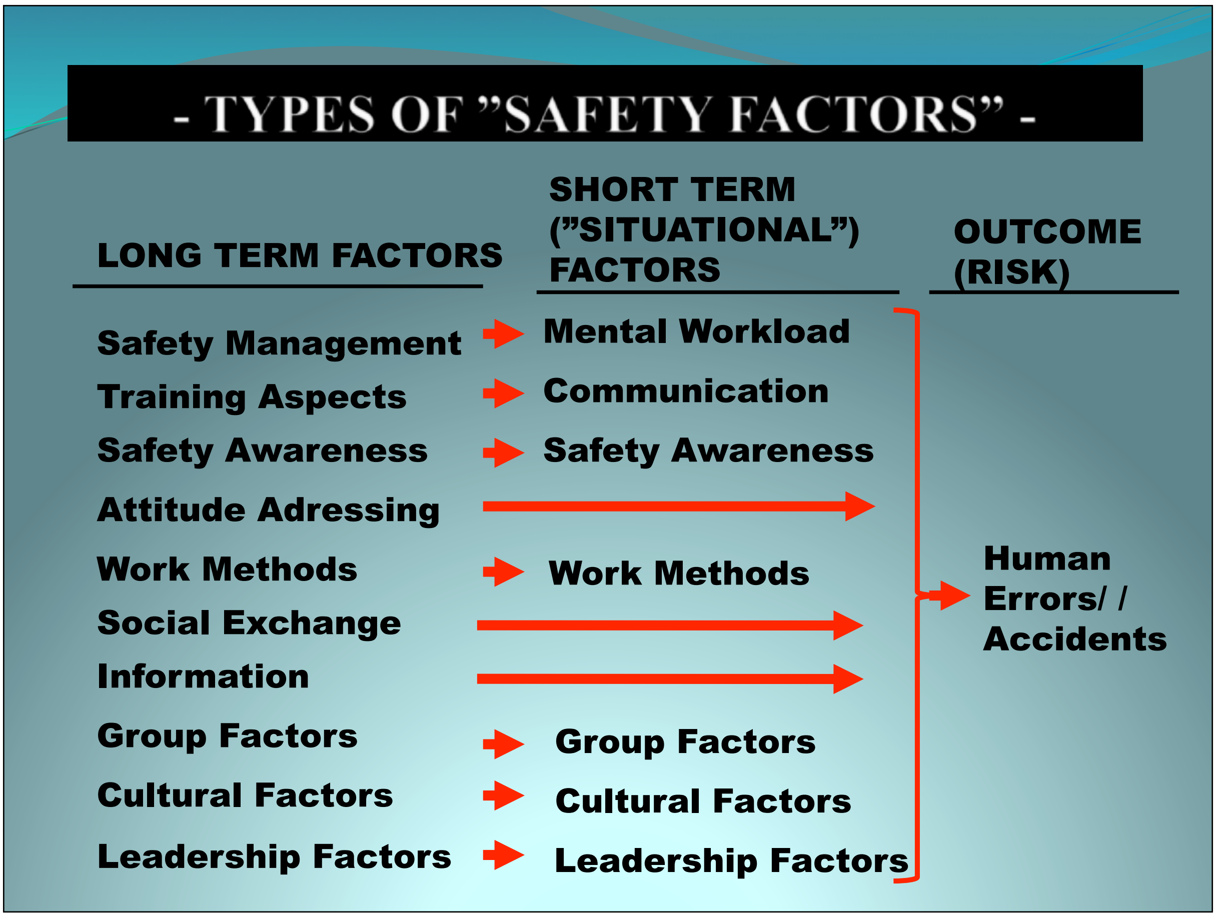
1. Safety Management
2. Training Aspects
3. Safety Awareness
4. Attitude Adressing
5. Human Errors
6. Work Methods
7. Leadership Factors
8. Mental Workload
9. Group Factors
10. Social Exchange
11. Cultural Factors
12. Communication
13. Information

- A SAMPLE OF "SAFETY FACTORS" -

1. Safety Management
2. Training Aspects
3. Safety Awareness
4. Attitude Adressing
5. Human Errors
6. Work Methods
7. Leadership Factors
8. Mental Workload
9. Group Factors
10. Social Exchange
11. Cultural Factors
12. Communication
13. Information

52 sub-factors


- TYPES OF "SAFETY FACTORS" -
LONG TERM FACTORS
SHORT TERM ("SITUATIONAL") FACTORS
OUTCOME (RISK)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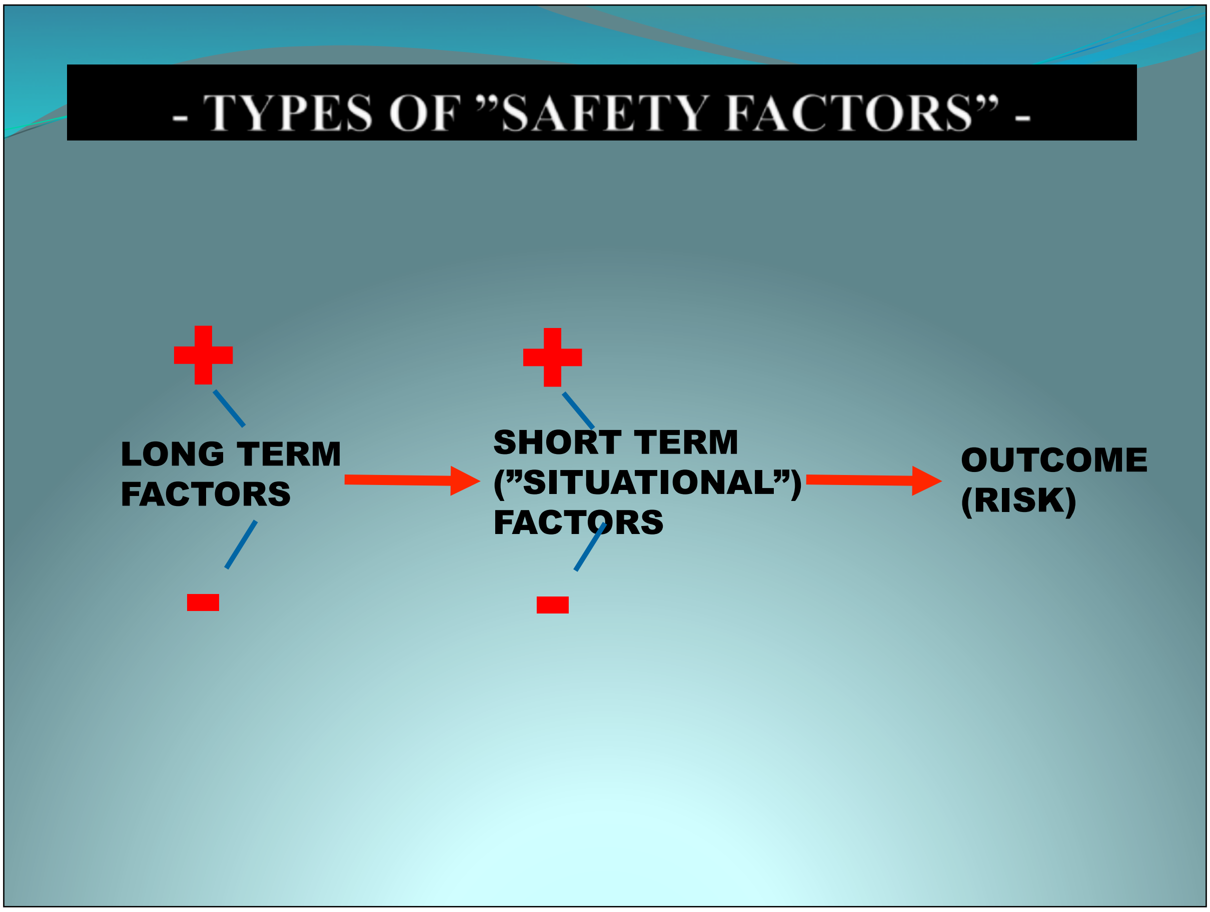
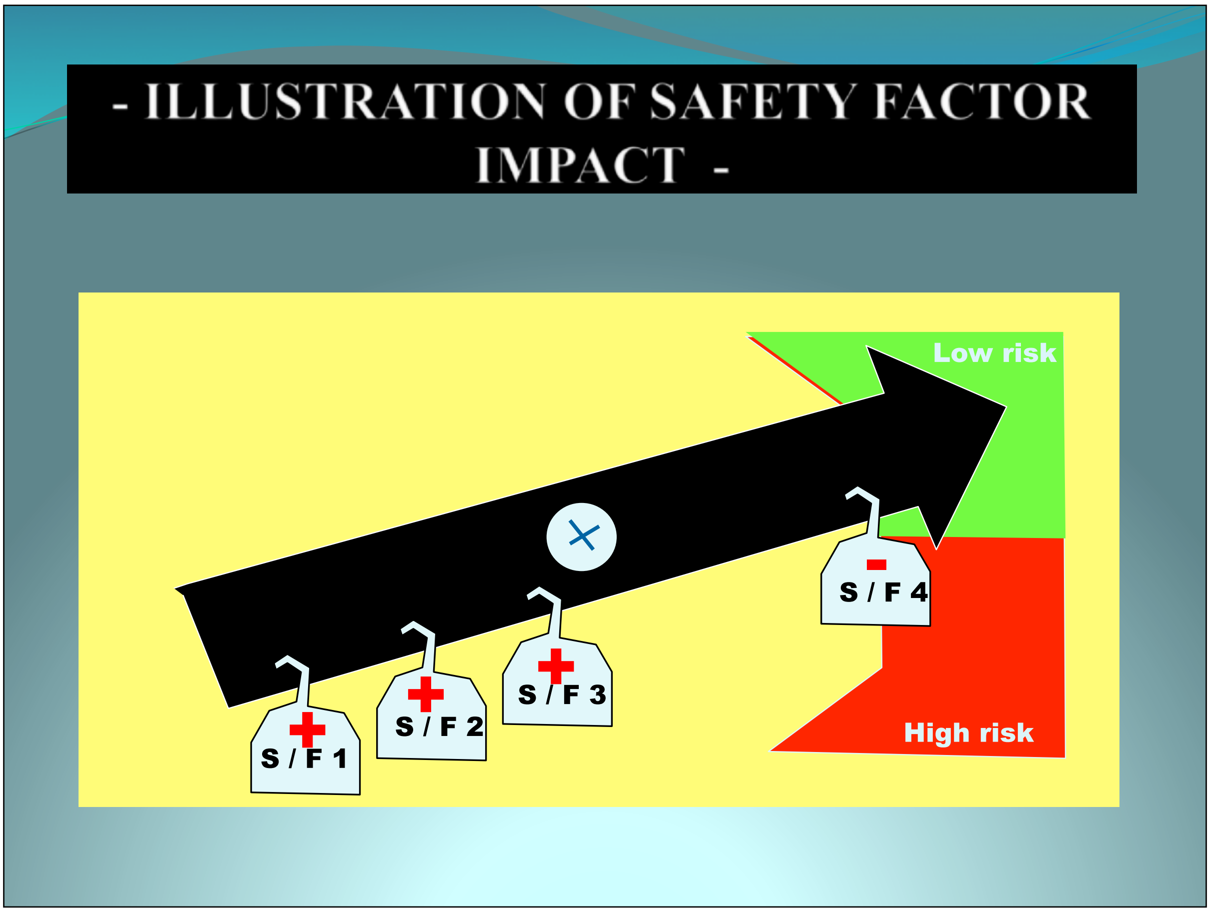
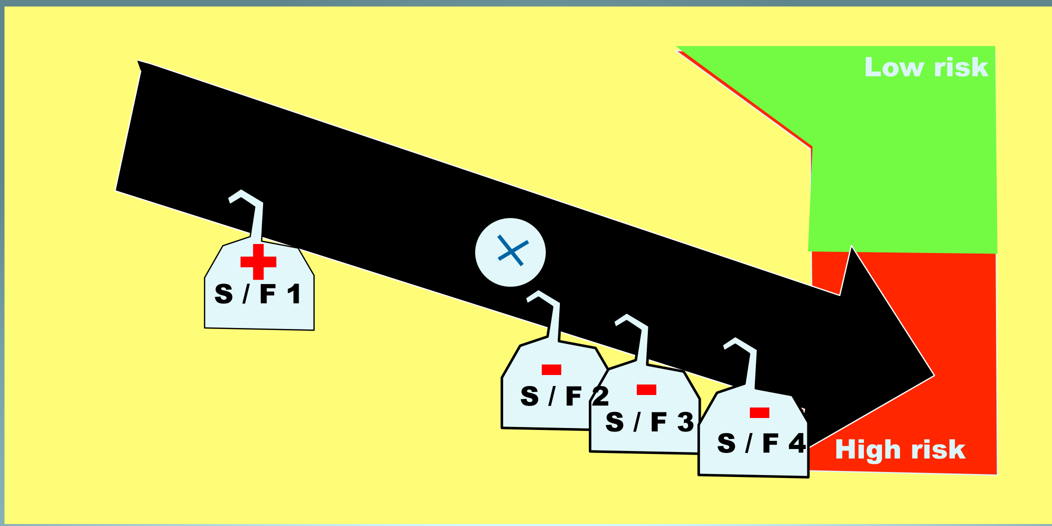
Work Methods
Work Methods
Social Exchange
Information
Group Factors
Group Factors
Cultural Factors
Cultural Factors
Leadership Factors
Leadership Factors
Human Errors/ / Accidents


- TYPES OF "SAFETY FACTORS" -
+
LONG TERM FACTORS
-
+
SHORT TERM ("SITUATIONAL") FACTORS
-
OUTCOME (RISK)


- ILLUSTRATION OF SAFETY FACTOR IMPACT -
Low risk
High risk
S / F 1
S / F 2
S / F 3
S / F 4

- ILLUSTRATION OF SAFETY FACTOR IMPACT -



- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

First example:

Social norms

or

”ground rules”

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

i. **Official ground rules**
   Formal Work methods (e.g. SOP/EOP)

ii. **Explicit ground rules**
   Agreed work methods within a group

iii. **Implicit ground rules**
   Unoutspoken work methods within a group

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

The idea behind ground rules:

Development of ground rules in advance for work situations → Each group member knows how act when these work situations occur →

* Productivity
* Wellbeing
* Safety

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

Development of an efficient work group:

PHASE	PHASE CHARACTERISTICS	EFFICI-ENCY	WELL-BEING	LEADER DEPEN-DENCY
Forming	Uncertainty, insecurity, tendency to try to get to know each other	Low	Low	Great
Storming	Somewhat increased security, getting to know each other better	Low	Low	Great
Norming	Tendency to try to work together, ground rules develop, definition of roles and tasks	Higher	Higher	Less
Performing	Optimizing ground role develop-ment and work efficiency and well-being	Highest	Highest	Least

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

Conclusions:

i. Official and explicit ground rules are far more efficient than implicit ground rules.

ii. To develop official ground rules (=SOP/EOP, checklists etc) takes a fair amount of work, money and skill.

iii. To develop explicit ground rules takes a fair amount of time together with the members and is hampered by change of group members.

iv. To enhance the development of explicit ground rules it is advantageous that the group members have frequent informal and formal social exchange.

v. The bigger the difference between the group members´ attitudes and social values (e.g. cultural factors), the more social exchange is required to develop explicit ground rules.

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

In other words:

Keep the crew intact as long as possible →

Have formal frequent meetings within and between departments to discuss work methods etc →

Create formal and informal forums for crew members to socialize frequently →

Develop and maintain a healthy set of official and explicit ground rules

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

Second example:

SQEP

or

Suitable, Qualified Experienced Person

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

Suitable – mental abilities, personality, social skills, leadership aspects

Qualified – formal qualifications, further training requirements etc

Experienced – required and desirable experience of relevant positions

Person – required age, gender, physical status and bodily shape etc

- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

In other words:

- Structured and systematic employment procedure
- Structured overall training system
- Proper introduction to a new ship
- Systematic training onboard incl. "on-the-job" training

→ **SQEP**

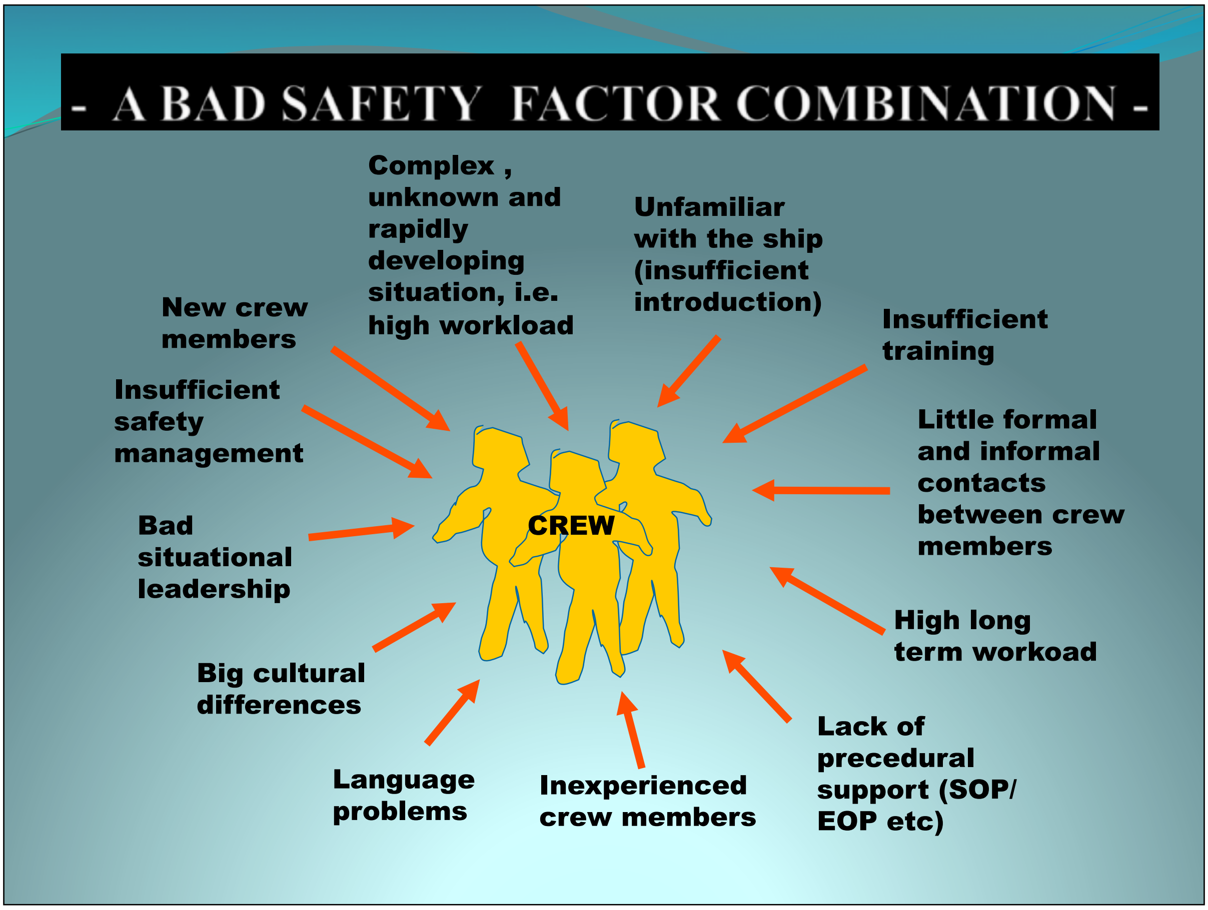
- EXAMPLES OF CRITICAL LONG TERM SAFETY FACTORS-

Conclusions of the two examples:

Cirumstances which deminish competence, experience and ground rule development → **Accident risk increase**

- ACCIDENT RISK INCREASE -

Long term factors		Situational factors		
Cirumstances which deminish competence, experience and ground rule development	→	Cirumstances which increase workload and hamper com-munication	→	**Drastic accident risk increase**



- REAL CASE: POSITIVE IMPACT -

1. Safety management awareness
2. Awareness of negative effects of increased workload
3. Communication procedures between ECR and bridge
4. Technical knowledge and experience of senior engineers
5. Dedication of crew members to safe operations
6. Willingness to put in extra work when required
7. Positive attitudes amomg senior engineers to inauguration of formal procedures

- REAL CASE: NEGATIVE IMPACT -

1. Lack of formal communication procedures in ECR
2. Lack of training in communication
3. Too short posting onboard
4. Lack of structure for training onboard
5. Missed training opportunities due to work schedule
6. Increasing number of inexperienced 2nd engineers
7. Insufficient introduction to a new ship
8. Lack of structure for formal meetings
9. Insufficient social exchange

- REAL CASE: RECOMMENDATIONS -

"High Priority Improvements":

1. Inauguration of a formal communication structure in ECR
2. Inauguration of a proper introduction to a new ship
3. Increase of senior watchkeeper competence
4. Increase of duty period onboard the ships
5. Increase of formal and informal contacts between especially the engine and deck departments

- SAFETY INVESTMENTS? -

Quotation of an unknown:

”If you think investments in safety are expensive, try an accident!”

- … AND FINALLY ….-

Any questions?

III Education, teaching and research

TALLINK SILJA LINE

INTEGRATED BRIDGE / NAVIGATION SYSTEMS - TRAINING NEEDS, AS SEEN BY SHIPOWNER

ver. 08.06.2011

Vahur Ausmees

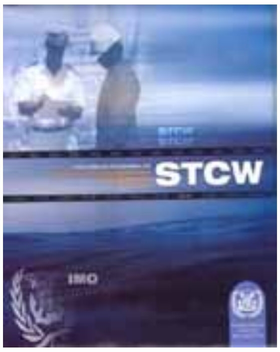
- Captain, graduated in St.Petersburg Maritime Academy
- Master of m/s Baltic Queen
- Previously: Victoria I, Fantaasia, HSC AutoExpress 2, Regina Baltica, Baltic Kristina, Normandy, Georg Ots
- Worked on cargo vessels, sailing …
- Lecturer / Instructor of IBS-INS in Estonian Maritime Academy and Maritime College

2

TALLINK SILJA LINE

Shipowners interest, based on STCW

- Crewmembers qualification to be equal and predictable – challenge to educational institutions
- Onboard training and refresment training to be with high(est) standards and not cost to much - challenge to educational institutions and developers of training materials (incl. Manufacturers) and shipowners
- Shipowners wants more than minimum competency and do not want pay for that!



3

TALLINK SILJA LINE

To whom we will receive onboard?

- Below average?
- Meeting STCW competencies?
- Above average?

4

TALLINK SILJA LINE

What can do educational institutions?

- Cooperate with Shipowner and teach to the student proper roles (i.e. equal and predictable professionals)

Employer (Shipowner)

JOB
-Responsibilities
-Tasks

JOB ANALYSIS
-Knowledges
-Skills

JOB DESCRIPTION
-Tasks / Functions
-Responsibilities
-To whom report
-Qualifications
-Etc.

To perform a roles >
(Job description can include sereral roles)

Education institution

COMPETENCY

QUALIFICATION

(HAVE TO BE MEASUREABLE!)

< To perform a roles
-Abilities

ROLE

Set of:
-Expected results
-Responsibilities

5

TALLINK SILJA LINE

Simulation as tool to teach a roles

Exercise
To get experience and knowledge

Reality
To use experience and knowledge

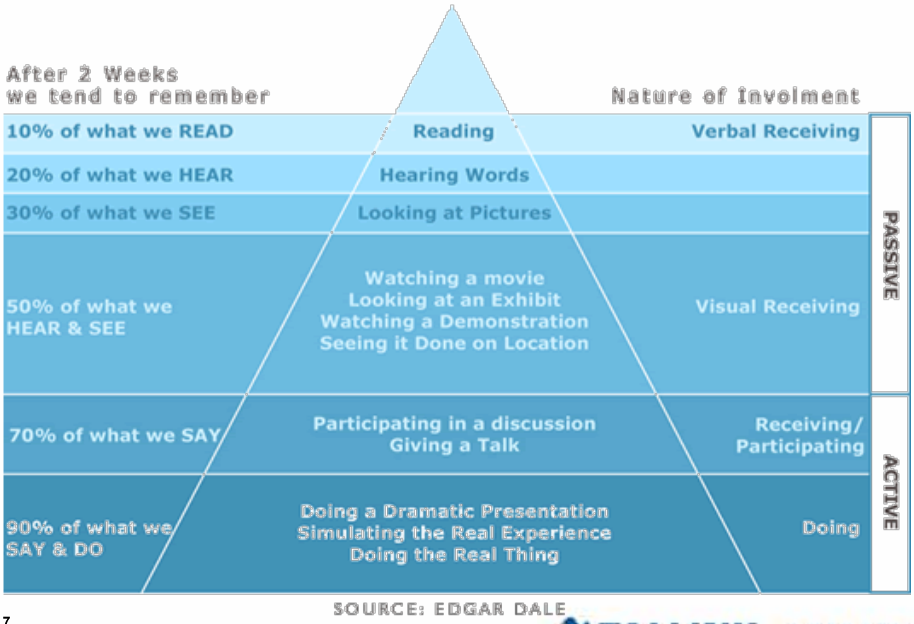
How to transfer learning outcome?

- **Technically perfect simulator** have no value, if there is working skill-less instructor
- **Technically non-perfect simulator** is valuable, if there is working skilled instructor

6

TALLINK SILJA LINE

Cone of learning



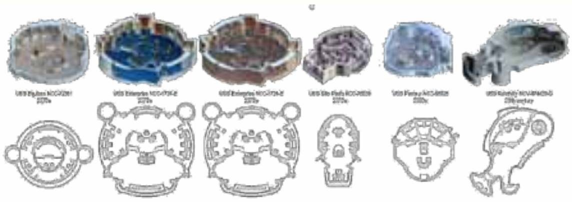
SOURCE: EDGAR DALE

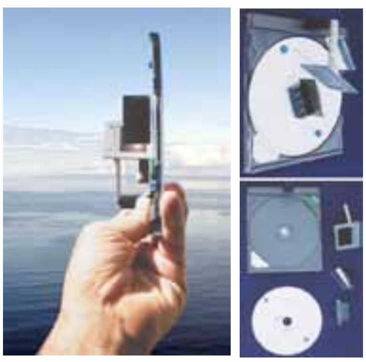
7

TALLINK SILJA LINE

How to achieve more effective learning

- Star Trek bridges from 22nd to 29th century!
- Use available AIS info to create excercises!
- Doing by own hands (sextant)!
- Computer is not only possible simulator!





http://www.tecepe.com.br/nav/CDSextantProject.htm

8

TALLINK SILJA LINE

What can do developers of training materials?

- IBS-INS Onboard familiarization training ?&%%%#!

Bridge Familiarisation Cheklist

A	**EQUIPMENTS**	Y	N	N/A
1	Has location and operation of following equipment's been familiarized			

	Y	N	N/A		Y	N	N/A
Fire Alarm				General Alarm			
Fire detection system				Gas detection system			
Watertight Door Indicators				Gas tight door indicators			
Navigation Lights				Smoke Detection Systems			
Navigation Shapes				Emergency Navigation Lights			
Deck Lights				Gong			
Over side Lights				Pilot Boarding Lights			
SSAS alert buttons				EPIRB			
Aldis Lamp				SART's			
Radar/s				Pyrotechnics			
Echo Sounder				Lifejackets			
ROT Indicator				VDR			
Sound Reception Unit				AIS			
Line throwing Apparatus				GPS's			
Spare Bulbs				Power Source			
Arpa				ECDIS			
Chart Plotter				Course Recorder			
Rudder Angle Indicator				Bow Thruster Indicator			
MOB Combined Light/ Signal				Wind Indicator			

		Y	N	N/A
2	Steering gear in manual, auto pilot, NFU and emergency change over			
3	Off course alarm and auto steering			
4	Internal, external and portable communication			
5	Gyro compass, repeaters, magnetic compass, azimuth circle			
6	Engine telegraph, telegraph indicator / printer, engine control unit			
7	GMDSS equipment's			
8	Flags, binoculars, sextants, chronometer, stopwatch			
9	Charts nautical publications and tables, publications required by flag			
	Other ship specific equipment (Please specify):			

B	**ROUTINE PROCEDURES / DUTIES**	Y	N	N/A
1	Are Master's Standing Instructions read and understood			
2	Are STCW Ch.8, standards regarding watch keeping and the COLREG's understood			
3	Are Company navigational and bridge procedures SI Chapter 6 read and understood			
4	Are 'Hours of Rest' requirements STCW A-VIII/1 & ILO 178 understood			
	(MC218)			
5	Is speed log operational, connected to ARPA and for requirements to use ARPA with speed through water input understood			
6	Has chapter 6 of the Standing Instructions been read and understood			

C	**EMERGENCY PROCEDURES**	Y	N	N/A
1	Has location and function of all audible alarms sounded by equipment in bridge been identified and familiarized			
2	Has location and function of 'Off Course Alarm' been identified and familiarized			
3	In case of black out has the procedure for continued steering been identified including, • Which steering gear pump powered by the emergency generator. • Which tele-motor/ steering unit powered by the emergency generator or batteries • Identified if the above mentioned units startup automatically or manually.			
4	In case of steering failure (in the FU mode) has the joiner been familiarized with the corresponding step's to be taken i.e. first steering by NFU mode to be tried failing which emergency steering at steering gear room will be engaged			
5	Using of main engine in emergency familiarized including emergency stop and/ or crash stop, slow down or speed up procedures by passing / canceling engine computer / program. Also company's policy on engine use in emergency (SI chapter 6).			
6	Has location and contents of company's 'Emergency Procedures Manual' been identified and familiarized.			
7	Has location and contents of SOPEP/ SMPEP been identified and familiarized.			

D	**SECURITY**	Y	N	N/A
1	Has ISPS requirements applicable to current security level been familiarized			
2	Has location of restricted areas, requirements of locking identified			
3	Has location of restricted areas keys box and padlocks identified.			

Upon joining a vessel the Master, every Deck Officer and Cadet shall familiarized by master / deck officer with the vessels navigational aids, bridge equipment, layout and procedures. To assist in this matter the above list must be used and followed, then signed accordingly.

Joining Deck Officer (name and sign) ________

Familiarized by (name and sign) ________

Master (name and sign) ________

Date – time and place ________

9

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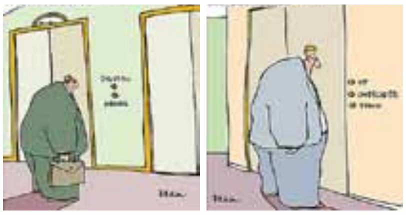
What can do developers of training materials?

The supplier of an IBS or INS system should work with the Company to provide material suitable for familiarization training of mariners who will be using the equipment as part of their OOW duties. The level of training required is dependent on the complexity of the system. For very complex systems it may be necessary for all users to undergo specific shore-based training, prior to joining the vessel. In many cases, it is expected that users who have satisfactorily completed an IBS/INS course based on this model course will only need to take a short period of on-board familiarization training, based on the material defined in this Appendix. Such familiarization training must meet the standards required by ISM.

- User manual can not be used as familiarization training material
- Familiarization by service / installation engineer ☺ ☺ ☺ ☺
- **Web-based (free?) tools? >** good story to make a decision for buying equipment!



10

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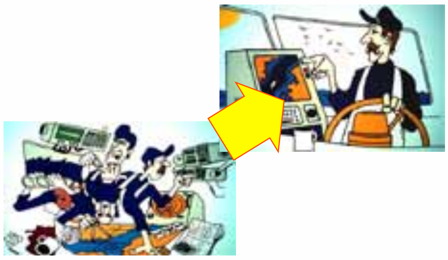
Educational institutes, system developers and shipowners common goal

- To put in this picture well trained, i.e. fullfilling the role, professional



11

TALLINK SILJA LINE

Teaching INS

Bridge 2011 Rauma 10.6.2011
Hannu Martikainen
Deputy Principal Lecturer

samk
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Satakunta University of Applied Sciences | Faculty of Technology and Maritime Management

What is Integrated Bridge System ?

- The IBS defines the navigation system to be a complete working concept comprising all navigation sensors, interfaces to different navigation sub-systems in an appropriate way and also takes into consideration bridge design and ergonomic factors
- ”One-man bridge” is commonly used name for the IBS
  - even though the technical applications could make it possible, manning rules and regulations issued by flag authorities in most of the countries still oppose to having the bridge watch carried out by one man only

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Purpose of an integrated navigation system

- The purpose of an integrated navigation system (INS) is to provide “added value” to the functions and information needed by the officer in charge of the navigational watch (OOW)

OOW to plan, monitor or control the progress of the ship
(MSC 86(70) Annex 3, 1.1)

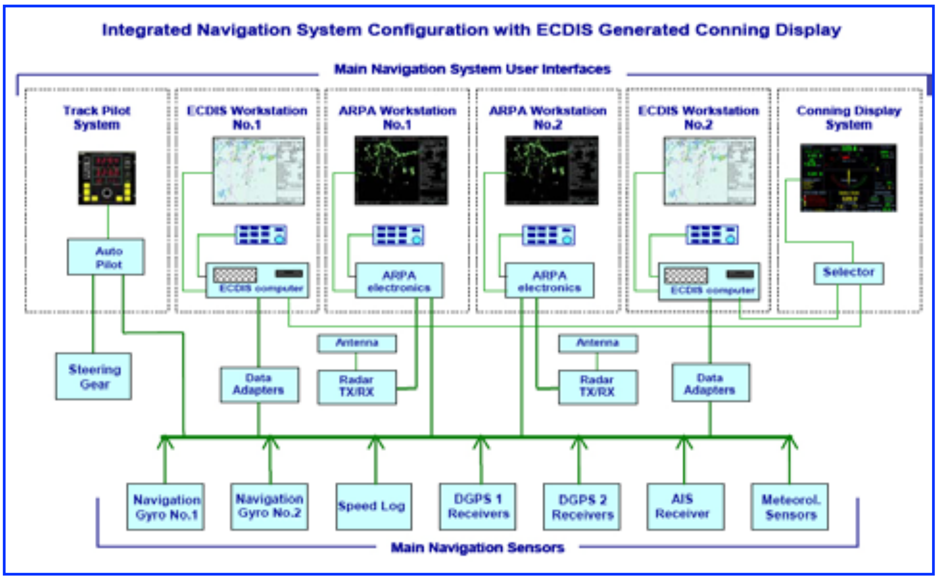
INS as part of IBS supports safety of navigation by

- evaluating inputs from several independent and different sensors
- combining the inputs to provide information giving timely warnings of potential dangers and degradation of integrity of this information

Basic INS configuration consists of

- Multi sensor Navigation radar
- Dual ECDIS
- Track-steering system
- Positioning equipment
- Duplicated heading source
- Speed log
- Echo sounder
- Conning system
- AIS
- SSAS
- VDR
- BNWAS
- WSS
- GMDSS

Conventional way to present INS



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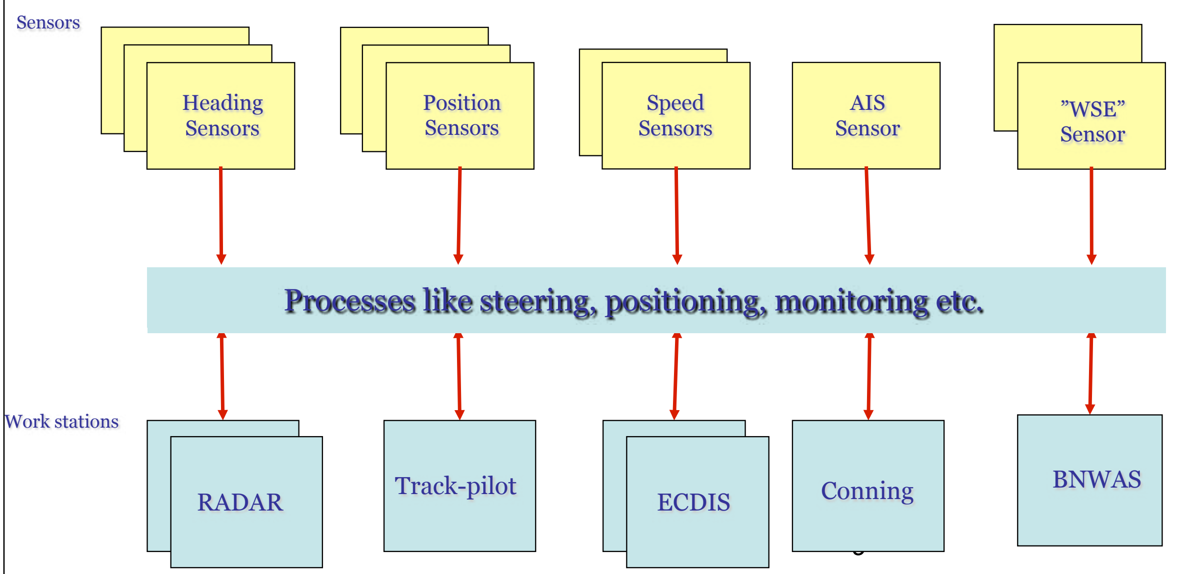
INS seen by the processes



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- some most important processes
  - position calculation
  - position accuracy control
  - heading determination
  - speed determination
- the most important sensor infos
  - primary heading
  - primary position
  - primary speed
  - primary depth

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Some history

”From stand-alone equipment to networked INS”

- still in late 1970´s (even 80´s) the bridges for newbuildings were designed and furnished with stand-alone eqpt
  - separately installed and furnished in wheelhouse and in equipment rooms
- radars, echo sounders, gyro compasses, pressure logs and all kind of repeaters, even satellite navigators and other sensors in use
  - no electrical connection elsewhere than primary power
  - No I/O ports - no interfacing
  - main unit + control unit

What happened then ?

- R & D in components, computer technologies etc. brought some benefits to Maritime business too
  - first commercial ARPA was delivered in year 1969 by NORCONTROL
  - RAYCAS I had 1978 TM presentation with target tracking and 7 synthetic drawing lines
  - Sensor "data" was born – what to do with it ?

What to do - we had. . .

- whole bunch of interesting navigation "data" available
  - speed from log
  - position from Decca/Loran-C/Transit/GPS navigators
  - heading from gyro
  - depth from echo sounder
- interfacing started slowly
- manufacturers added I/O ports on rear panels and created their own standards
  - home made converters and interface boxes started to spread out

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and we ended up. . .

- various proprietary protocols were hanging like *"TROPICAL LIANAS"* in the jungle
- the word INTERFACE became swearword until common understanding was found with NMEA
- in mid 80´s integration started when almost all equipment started to talk same language – NMEA

Today we have networked INS

- networking has also climbed up to the bridges and the latest system integration are done by secured and doubled BUS connections, even with fiber-optics and such

- MANUFACTURERS´ FORUM 9.6.

We need to remember, that. . .

- all operational acts related to watch keeping on the bridge requires a human operator despite of automation, integration, orbiting satellites and high speed data
- GLOBAL maritime transportation of goods cannot be done virtually via the satellite or broadband lines, but new technologies can support safe navigation on the bridges

Worldwide Maritime ”ruling” order

- several operators and organizations together with manufacturers and suppliers continuously research and develop for new rules and standards to increase the safety of Navigation (?)
- on the highest top there are IMO, IEC and Classification societies all in co-operation, including Flag authorities

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”ruling” order cont.

- IMO, IEC / ISO and classification societes give:
  - carriage requirements, performance standards, technical requirements for testing, type approvals, training
- flag authorities follow what has been said by the above

Training is a LIFETIME project

Target group

- Course name : Integrated Bridge Systems

  MK04218 *Integroidut komentosiltajärjestelmät*
- part of the Master´s studies as specified in STCW
  - intended for ship´s nautical officers, cadets and other bridge team members with responsible duties in navigation operation work with INS

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Course content:

- carriage requirements and performance standards
- classification societies´s standards for IBS/INS
- examples of different system configurations and applications
- operation +basic functions of INS sensors
- INS processes and safe operation

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- interconnections and Data transfer between the sensors and INS
- examples of Failure analysis and actions in failure situation
- use of INS delivery documentation and fault finding procedures

Target of the IBS/INS course

- to gain general understanding and operation of integrated navigation system
- strengthen the knowledge of the system configuration and applications
- reading and understanding of the operating manual
- using and understanding technical documentation and fault finding instructions provided for INS on possible failures

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- In addition to the completed and accepted written exam the trainee has participated in following courses and done separate tasks:
  - Shipbuilding theory
  - Documentation; reading the diagrams and manuals
  - Route planning exercise
  - Simulator training
  - Personal Study work on given subject

Training specified by IMO/IEC

- *manufacturers/suppliers of integrated bridge systems shall provide training possibilities for the ship's crew*
- *training shall take place ashore or on board*
- *shall be carried out by means of suitable material and methods to cover the following topics :*
  - *general understanding and operation of the system*
  - *knowledge and understanding of the system's configuration and application*
  - *reading and understanding of the operating manual*
  - *usage and understanding of brief descriptions and instructions provided on the bridge*

Who needs INS training and when ?

- Cadets/OOWs/Masters ?
- Basic training/refresh/
- Pilots
- Old school mates
- Retrofit vessel´s team

What happens after the the school ?

- New MATE from the school

Who takes care of those ”Old school men” ?

- Old masters and mates from stand-alone bridge

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Co-operation on the bridge – is there ?

- Has the BRIDGE TEAM common understanding
- DO not forget to introduce INS to the watchman !
- How about on-job training ?
- Are the pilots´ skills adequate and up-to-date ?

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Could engineers sail/navigate the ships ?

- See today´s INS + add-on tasks !
  - Vision of tomorrow
- There is no SHORE-based pilotage how about shore based navigation
  - Value added features can be good
  - Shore-based supprot can be aacepted, but decisions are made ON BRIDGE
- METRo trains become remotely controlled, but vessels ?
- Masters/Mates need more than just traditional navigator ´s tasks
  - Adminstrator

In which direction we should develop the training ?

- MAINTAINER
- ADMINISTRATOR
- ELECTRICIAN
- FIRST-AID NURSE

Don´t be afraid – Be prepared !

Thank You !

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Intelligent Navigation Data Evaluation for Integrated Ship's Bridge Systems

Prof. Dr.-Ing. Reinhard Mueller, Capt.
Dipl.-Math. Michaela Demuth

Funded by German Federal Ministry of Business and Technology

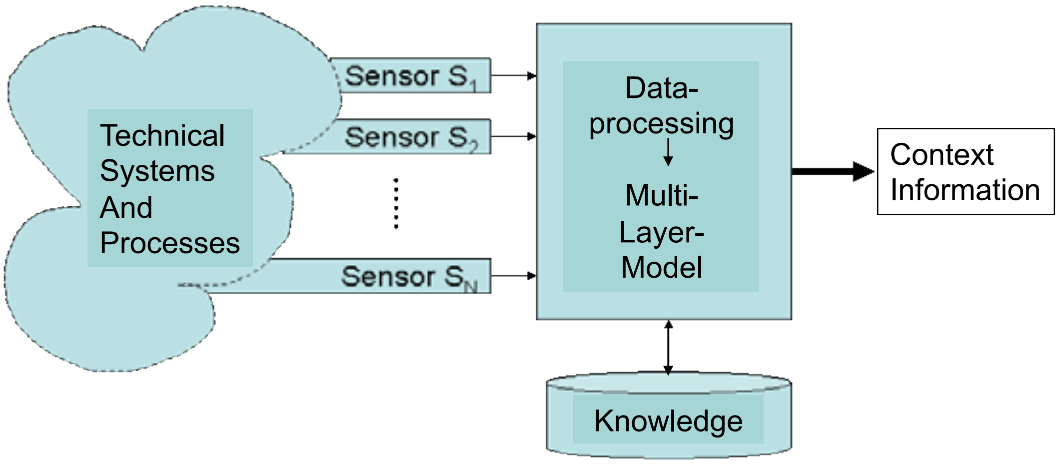
Current Alarm Signals Layout

- Bridge equipment signals are not harmonized
- Alarms have to be acknowledged individually
- Alarms are sorted chronologically
- Often Alarms are not situational

Approach

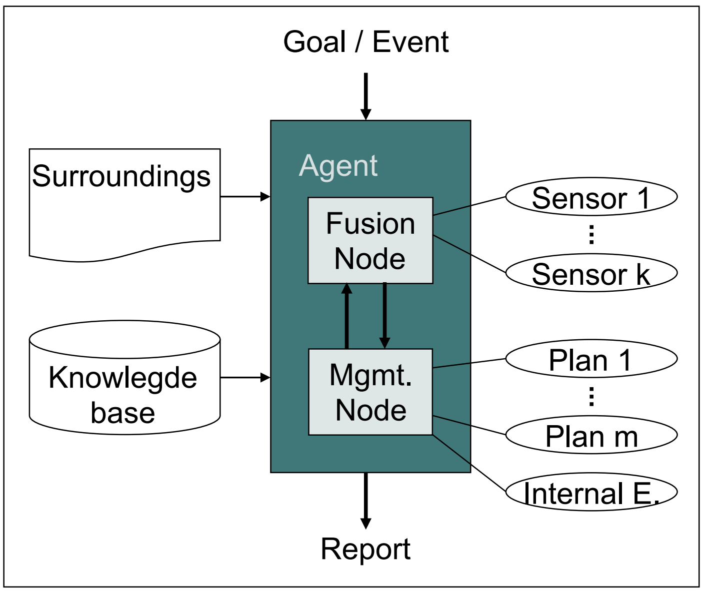
- Bridge-wide, overriding data processing
- Situation-dependent assessment and evaluation of data
  - Context definition
  - Context classification
- Layout of ship's bridge sensor architecture
- Implementation of an agent-based data fusion method

Data Fusion on Ship’s Bridge



Sign → Data → State Vectors → Labels → Information

The Structure of an Agent



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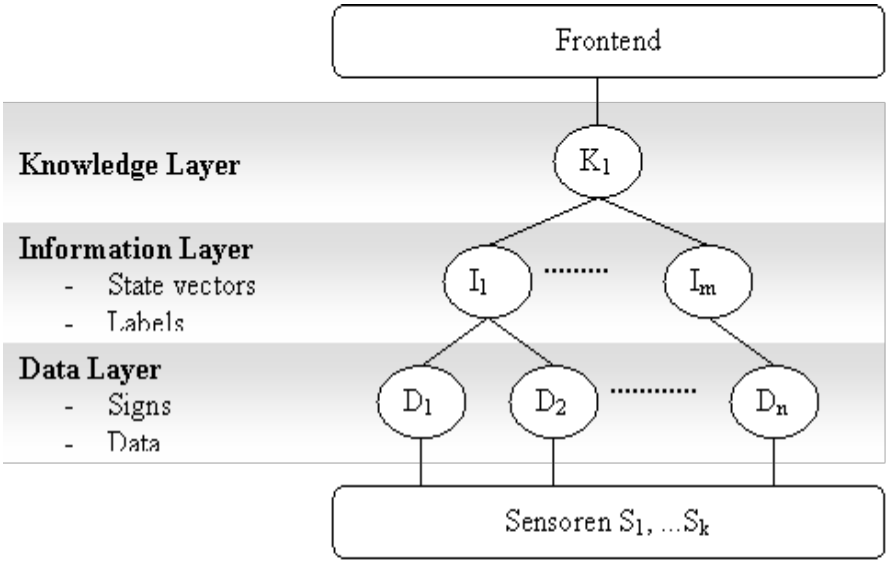
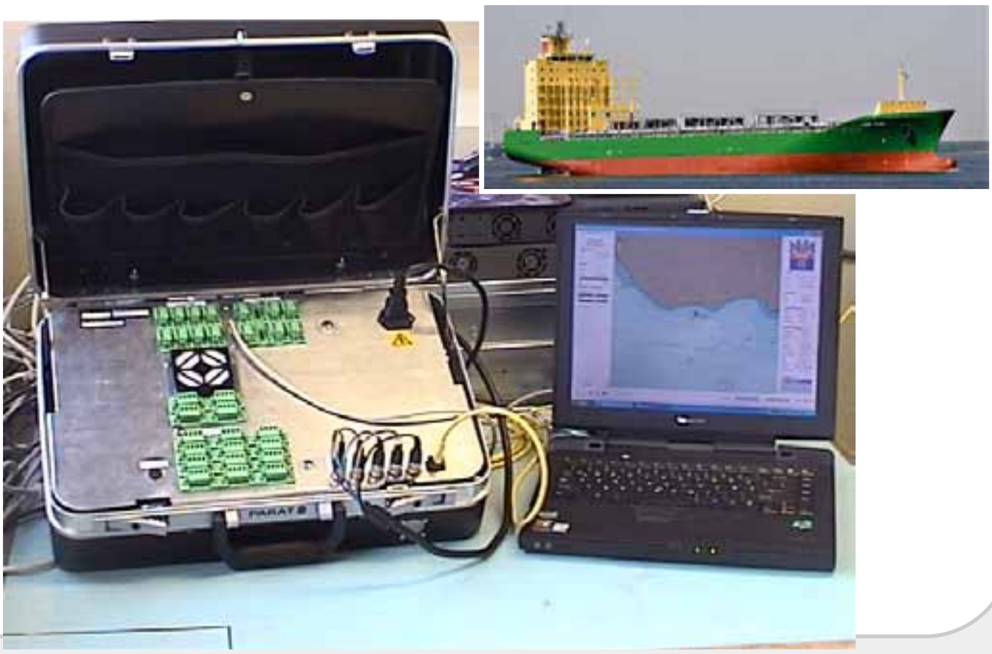
BRIDGE 2011, Rauma

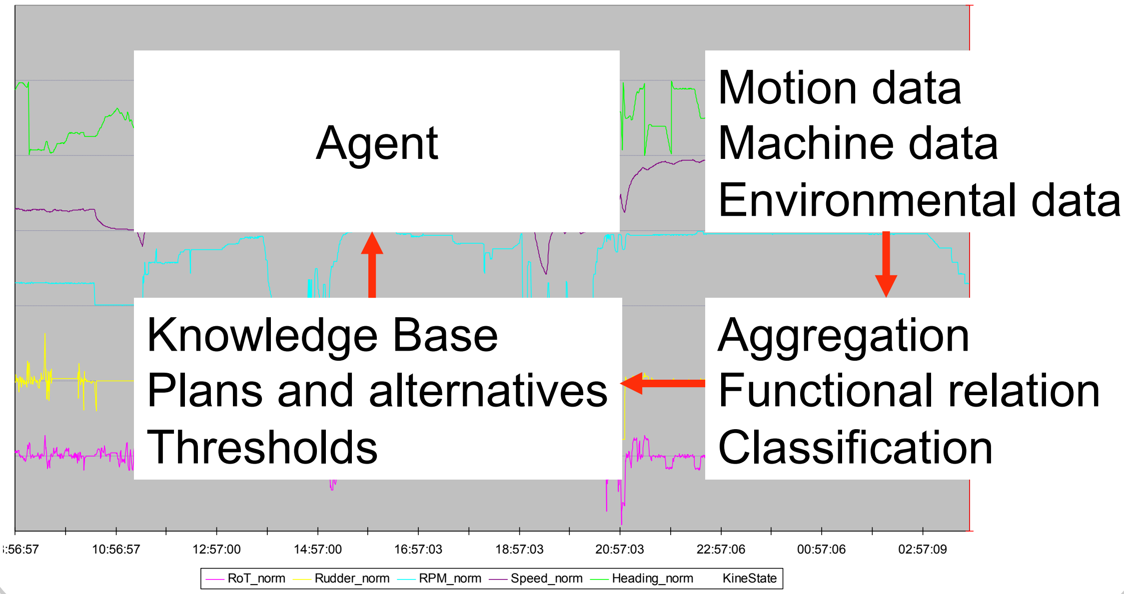
Hierarchical Multi-Layer-Model



Field Study on MS „Cape Flint“



Data Exploration



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Data Processing

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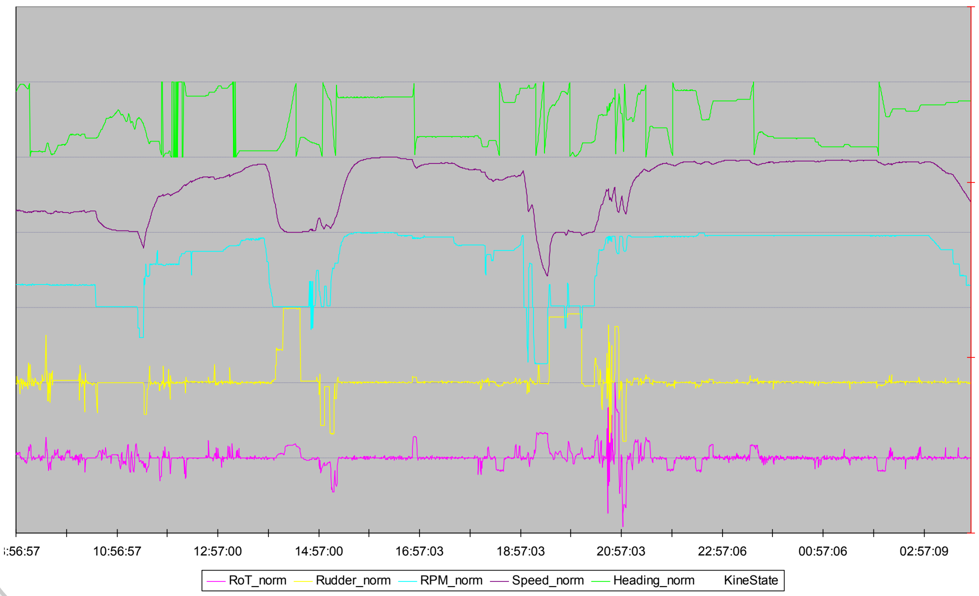
Context Definition



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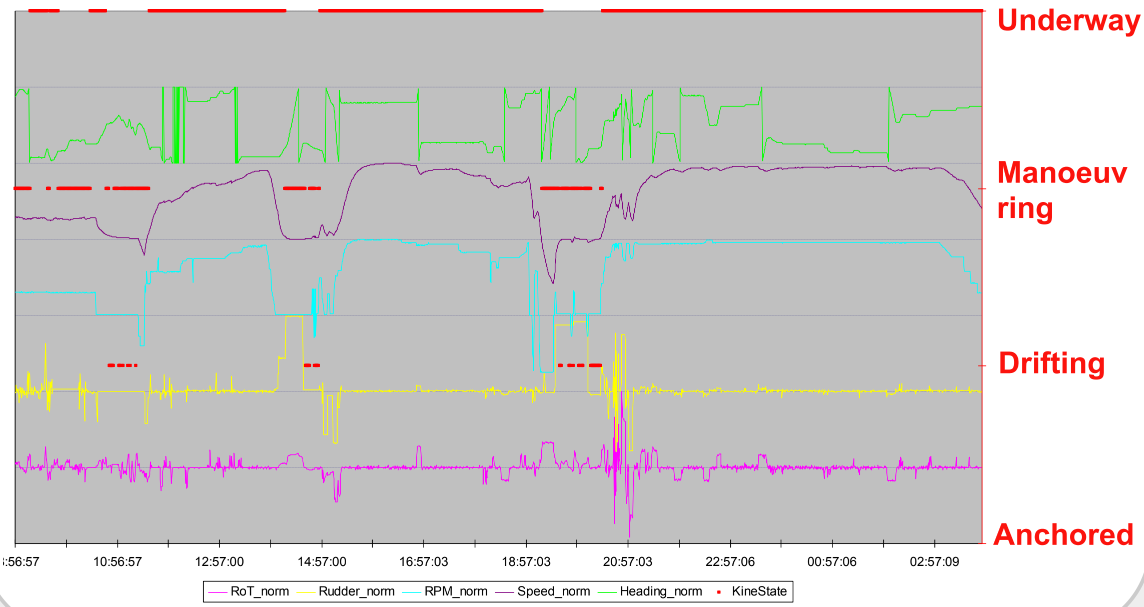
Context Identification



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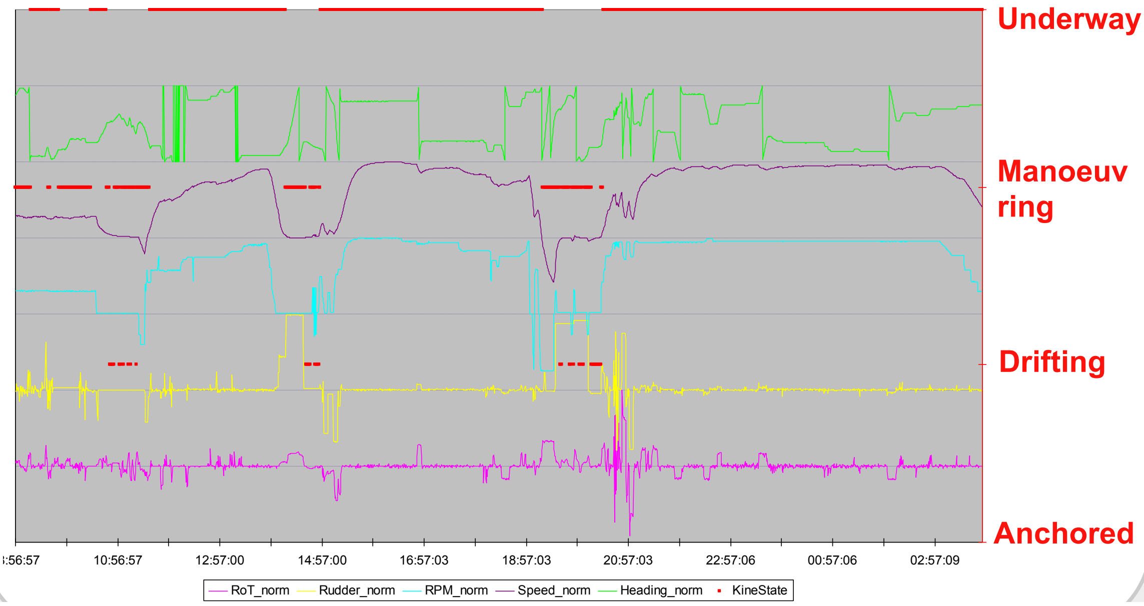
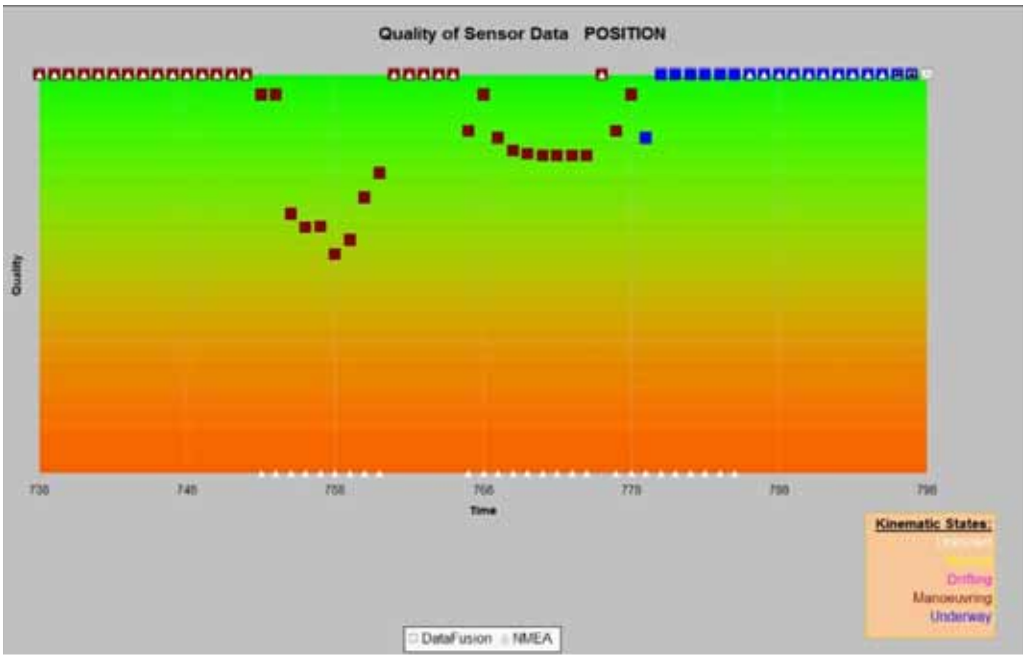
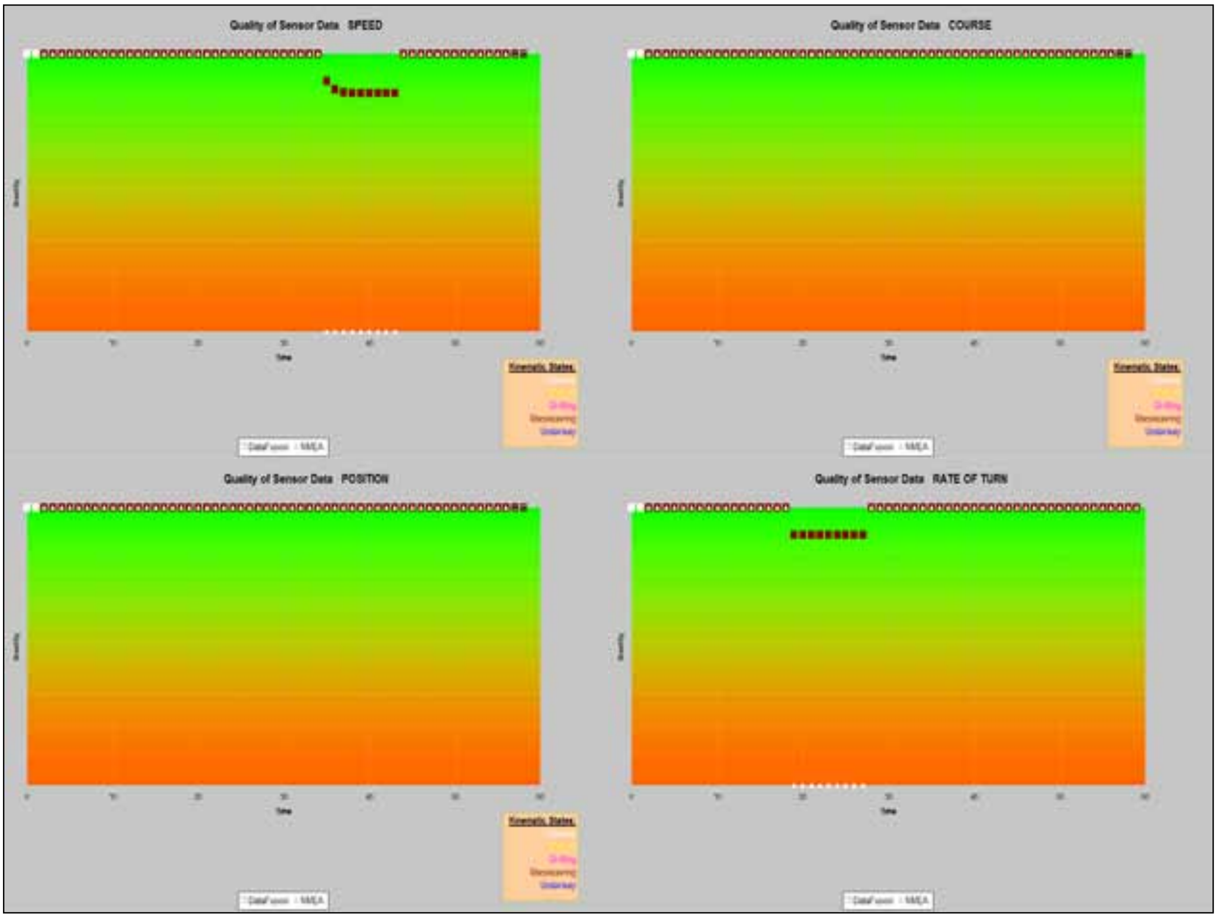
Context Identification



Context based Information Evaluation





Conclusion

- A **networking sensor** architecture offers an enhanced information management.
- An information evaluation has to be dynamical designed according to a **context**.
- The methods of **Data Fusion using agents** are suitable exceedingly in view of:
  - **hierarchical** structure of data processing
  - enhancement of information quality by **knowledge**
  - dynamical **classifying** and sorting of data
  - online data investigation in **real time**
- **Reducing** the information overflow aboard by a Data Fusion approach is a well-promising solution.

CAFE } COMPETITIVE ADVANTAGE BY SAFETY

BRIDGE 2011 10.6.2011

Mirva Salokorpi, Kymenlaakso University of Applied Sciences

Euroopan unioni
Euroopan aluekehitysrahasto

Vipuvoimaa EU:lta 2007–2013

The results of METKU project

The influences of the ISM code

- Incident and near miss reporting is weak (shipping companies varies a lot)
- The information collected of incident and near miss cases has not been used or shared efficiently (example statistics)
- There is no systematic safety improving in the maritime domain (compare to continuous improving philosophy of ISM code)

The results of METKU project

Best practices for mariners

- Safety management systems should be based on risk assessment (the ISM code don´t support that at the moment)
- From reactive safety management level to proactive level (and predictive)
- More resources for shipping companies
- More training
- Guidance and good examples

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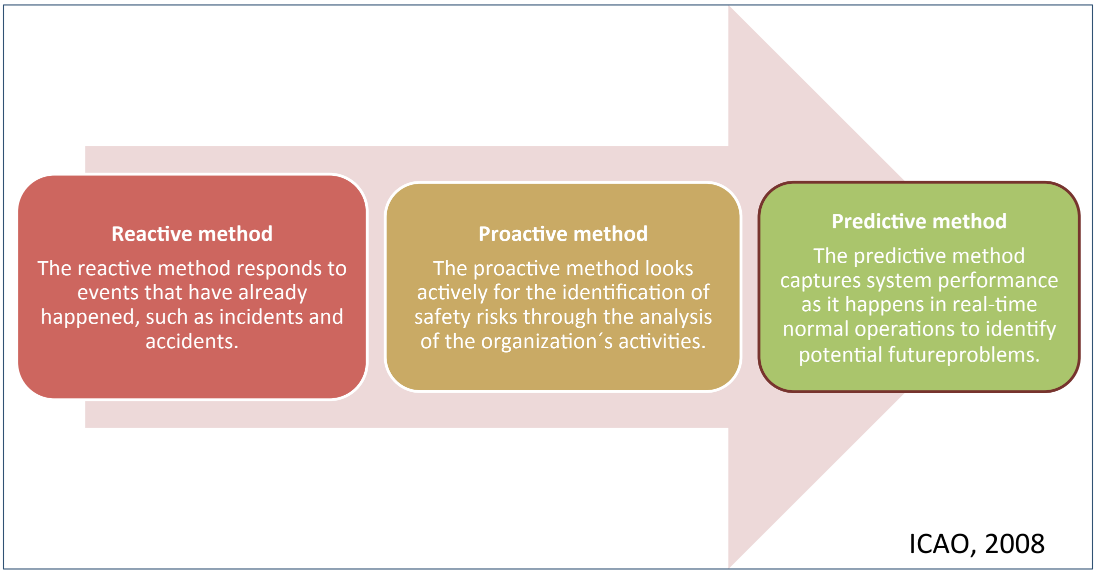
Safety management levels



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CAFE project

- Main themes:
  - Improving operational maritime safety and developing proactive safety with international co-working
  - The influence of safety management for competitiveness of a shipping company
- 5 subjects:
  - Developing near miss reporting
  - Developing OHS indicators
  - Modeling of safety management
  - CSR Corporative Social Responsibility
  - Networking internationally – co-working with maritime safety experts

Developing near miss reporting

- The information collection continuing
  - Address the main problems
  - Collecting experiences
  - Collecting best practices and good examples
- Preparing training material for maritime schools
- Workshop and seminar on September
  - Aim to determine the most important improving steps
- Co-working with authorities (Finland)
- Influencing and co-working on international level

Reasons for lack of reporting

1. Fear of what the bosses will think and do.
2. Embarrassment with respect to what peers will think and do.
3. Lack of "real" management follow-thru on previous reported near misses.
4. Lack of company commitment to getting near misses reported and investigated, including lack if training of staff on investigation.
5. The workers or management perceive there to be much more effort involved in investigating near misses that in gains received.
6. Lack of understanding of the value of learning from near misses.
7. Not knowing what is a near miss -- most know the difference between NM and a loss of any kind.
8. Poor reporting system for near misses.
9. Disincentives to reporting near misses.

Bridges, W. 2011

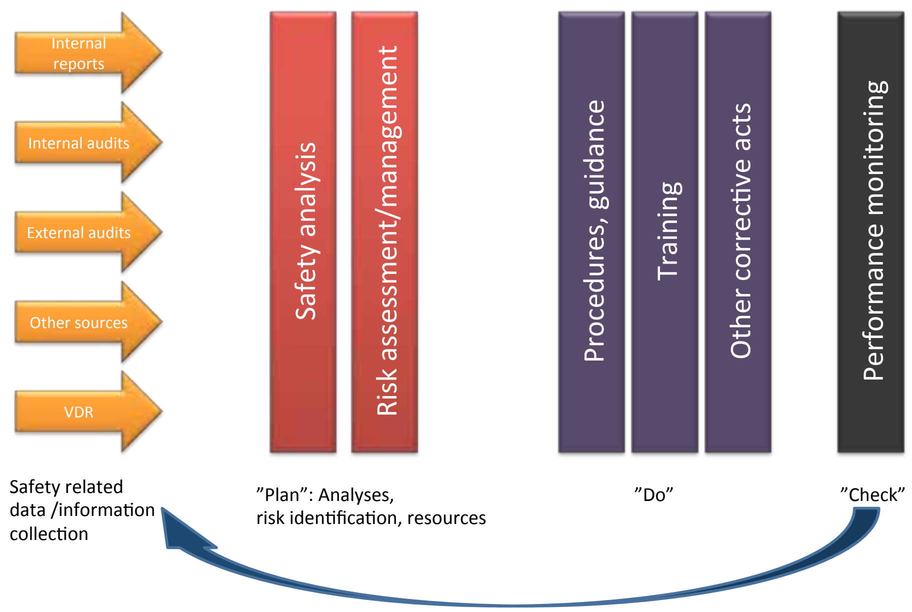
Reasons continued

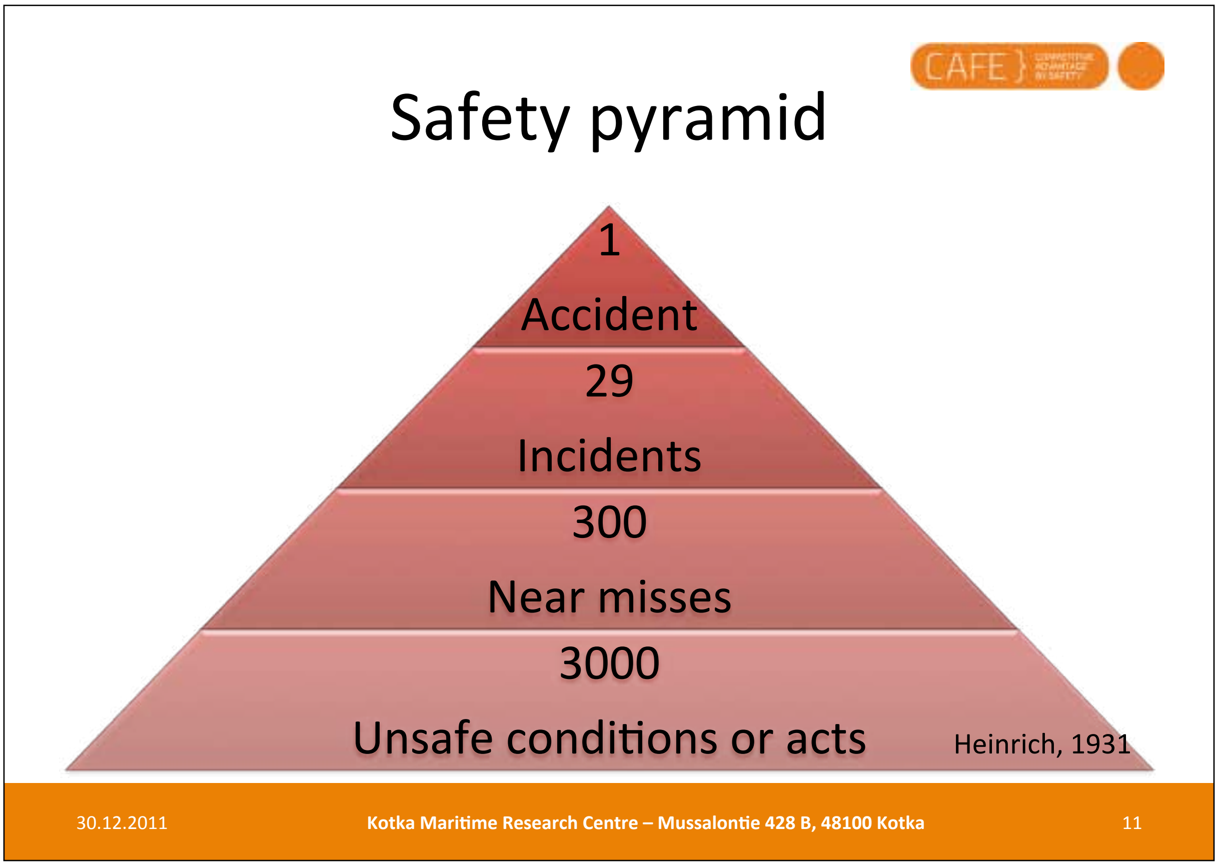
- Easy to report
- Feedback
- The report really influences
  - Something changes
- No blaming or punishment

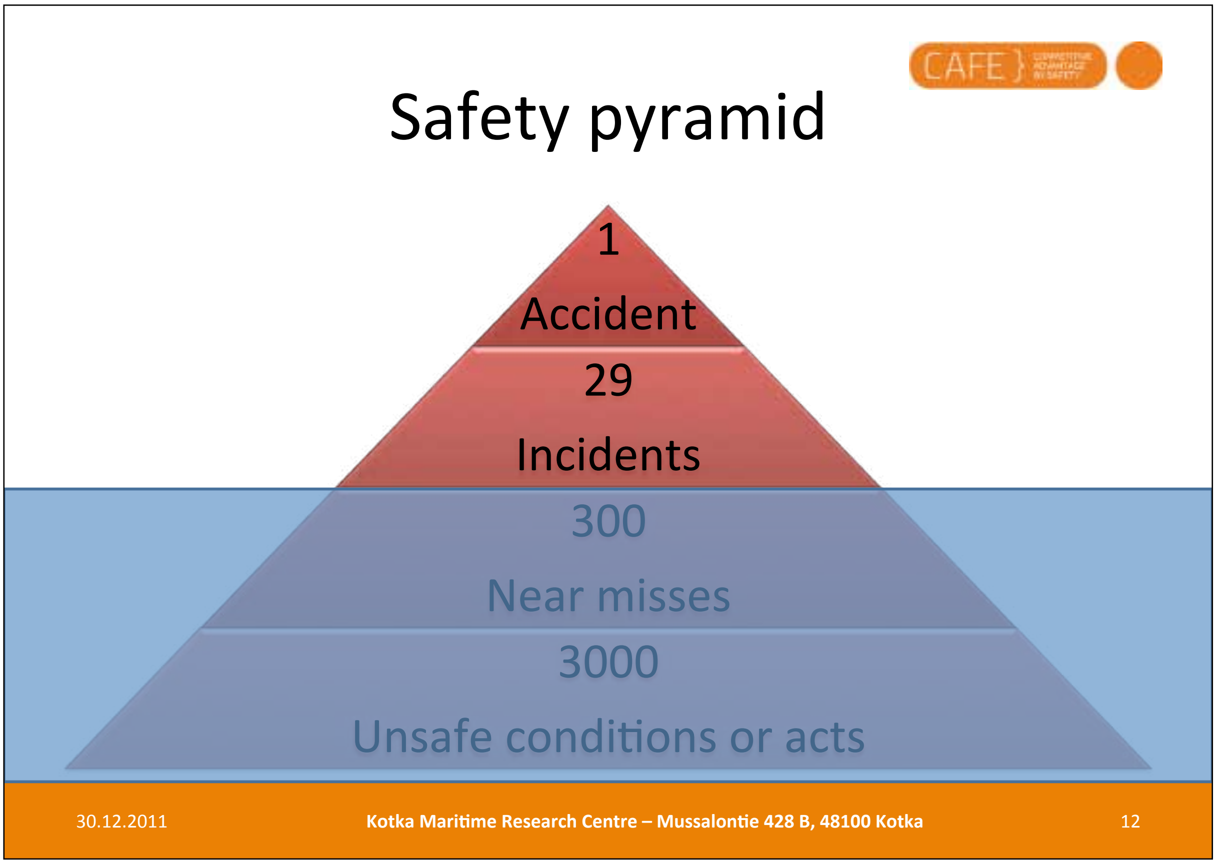
How the reporting system works?

- How many reports (per year, per month, etc.)?
- The quality of the reports / the ratio of the total number of the reports
  - How many accidents/incidents/near misses/safety ?
  - Technical problems / <u>performance of humans</u>?
  - Concerns of the performance of fellow workers / <u>mistakes of the reporter´s own</u>?
  - Concerns of the issues that are able to observe in all cases, or the issues that are <u>difficult to get known without the reports</u>?

Safety ensuring system




Safety pyramid
1
Accident
29
Incidents
300
Near misses
3000
Unsafe conditions or acts
Heinrich, 1931
30.12.2011
Kotka Maritime Research Centre – Mussalontie 428 B, 48100 Kotka
11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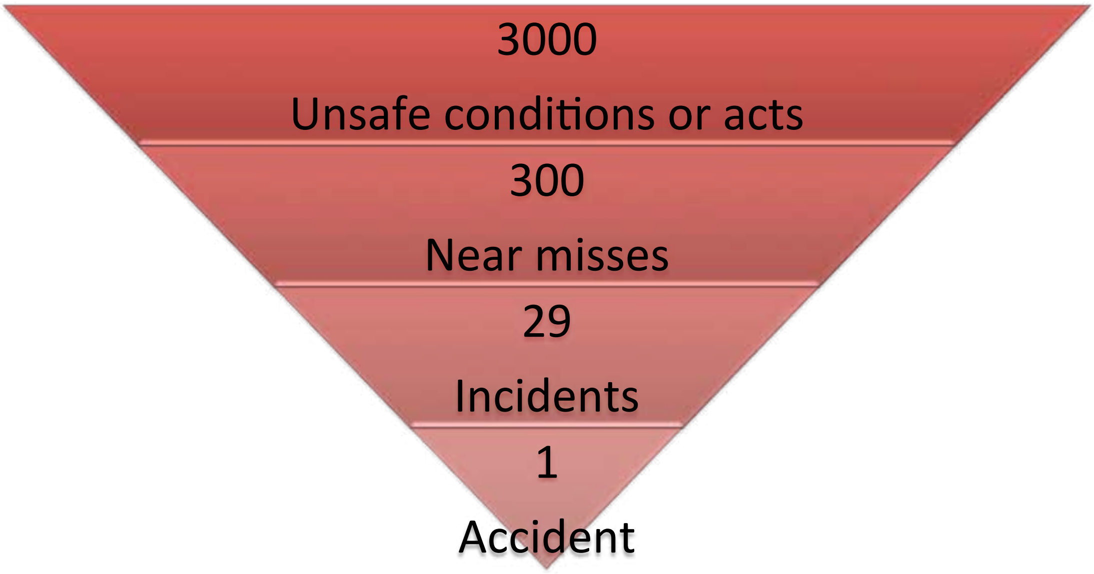
Safety pyramid



Welcome to IMISS!

- International Maritime Incident and Near Miss Reporting Seminar (www.merikotka.fi/cafe)
- 1.-2.9.2011 in Helsinki
- First day:
  - Presentations experiences of shipping companies and other domains
  - Workshop: Plan, how to improve
- Second day:
  - How to use incident reports in safety modeling
- ForeSea meeting

Thank you!

Mirva.salokorpi@kyamk.fi

www.merikotka.fi/cafe

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MarTEL PLUS

Dr Martin Ziarati

www.martel.pro

Lifelong Learning Programme

MarTEL PLUS

Lifelong Learning Programme

Maritime English

- http://www.youtube.com/watch?v=clL1pO_vJ0A
- http://www.spike.com/video-clips/ttkn9t/berlitz-sinking-ship
- http://www.jokeroo.com/videos/yt/4bkd1-berlitz-learn-english-ad.html

Background

- The first MarTEL Project (2007 – 2009) created a set of maritime English tests for seafarers.

Phase 1

Phase 2

Phase 3

MarTEL European Partners

- Centre for Factories of the Future
- TUDEV Institute of Maritime Studies
- Satakunta University of Applied Sciences
- Spinaker d.o.o.
- University of Strathclyde
- University of Tromso
- Maritime University of Szczecin
- Glasgow College of Nautical Studies

MarTEL PLUS

Education and Culture DG
Lifelong Learning Programme

New Funding Awarded

- In August 2010, the MarTEL Plus project was awarded funding by the European Union.
- The MarTEL Plus project will build upon the successfully concluded MarTEL project with a range of new features and functionalities.
- The project will run for a period of two years.

MarTEL PLUS

Education and Culture DG
Lifelong Learning Programme

MarTEL Plus Core Partners

- Centre for Factories of the Future (UK)
- TUDEV Institute of Maritime Studies (TR)
- Satakunta University of Applies Sciences (FI)
- Spinnaker d.o.o. (SL)
- Nicola Vaptsarov Naval Academy (BG)
- World Maritime University (SE)
- University of Cadiz (ES)
- Centre of Development Works / OPR (PL)
- National Maritime College of Ireland (IE)

MarTEL Plus Associated Partners

- Maritime Office in Szczecin (MOS)
- Finnish Ship Officers' Union
- Finnish Engineer´s Officers Association
- WinNova West Coast Education
- Port of Rauma
- Irish Institute of Master Mariners
- 1st Evening Vocational Senior School of Egaleo
- Finnish Shipowners Association
- Glasgow College of Nautical Studies
- Transport Safety Agency (Trafi)
- Bureau of Vocational Training , Ministry of Education and Lifelong Learning
- University of the Aegean
- ASAP English Courses
- Kiev State University

The Project

- Enhanced speaking test, with one-to-one examination.
- Test of maritime English for ratings.
- Teachers' Guidelines for all MarTEL tests.
- Mobile phone application with practice tests.

Enhanced speaking test

- Developed by experts at Nicola Vaptsarov Naval Academy; the same people who developed the STANAG 6001 test for NATO.
- Multi-level test, guided by the interviewer.
- Based on extensive research into tests such as RELTA, SEW, OPI, and STANAG 6001.

Enhanced speaking test

- The IMO requirements for English language competence needed for work in the maritime environment have been stipulated in SOLAS, Chapter 5 and the STCW convention and code. To sum them up, they can all be expressed as the ability to communicate:
  - with other ships and coast stations
  - with multilingual crews in a common language
  - information relevant to the safety of life at sea , pollution prevention, etc.
- The ISM Code, in addition, emphasizes the need for effective communication in the execution of crew's duties, which in practice is usually made in English.

Velikova, G; Toncheva, S; Zlateva, D: *'On the Way to Developing a MarTEL Plus Speaking Test'*

MarTEL PLUS

Lifelong Learning Programme

Test of maritime English for ratings

- Developed by subject specialists at TUDEV, SUAS, and OPR, with support from NMCI.
- Will feature a range of tasks appropriate for testing the effective communication of ratings.
- Entitled ‘Phase R’.

MarTEL PLUS

Lifelong Learning Programme

Phase R - Deck

Read the question choose the correct picture.

Q. Which picture shows ‘a mooring line around a bollard’?




Phase R - Engineering

Read the question choose the correct picture.

Q. Which one is a turbocharger?




Teachers' Guidelines

- Developed by maritime English Teachers at UCA, NMCI, C4FF, and OPR.
- Follows a 'task based' approach.*
- A functional and topic oriented syllabus has been devised after pairing into one structured syllabus IMO's model course learning outcomes, SMCP chapters, tasks, and skills' typology.*

* Prof Araceli Losey Leon, *'MarTEL Plus Teachers' Guidelines; A Theoretical Framework'*

Teachers’ Guidelines

- Includes:
  - Syllabus design for teachers
  - Teaching tips
  - Skills based tasks for reading, listening, speaking and writing

Teachers’ Guidelines

A LESSON PLAN SHEET

TEST TAKERS’ PROFILE: DECK OFFICERS	IMO MODEL COURSE 3.17 (2009) Core Section 2: Intermediate Level English for all Functions and Levels								
CONTENT-BASED TOPIC	SMCP Proficiency task	Score	Reading Skill task	Score	Listening Skill task	Score	Speaking Skill task	Score	Writing Skill task	Score
Ship’s Operations.- Pilot on the bridge	Develop a guided role play on the information exchange between the bridge team and a pilot when entering port. Ref. A2/3 Pilot on the Bridge	20%	Read the passage. According to the information given, answer by a single multiple choice question. 30 minutes are allowed to complete this part. (two parts)	20%	Part one: Listen to an audio record on a VHF communication in which Vessel Mefaniope asks Algeciras port Control if it is compulsory to take a pilot for entering the port. Part two: She also asks for details regarding...	25%	Part one: Simulate a conversation between the pilot and the deck officer about embarkation details. Part two: Simulate a conversation between the pilot and the deck officer about the	25%	Fill in the requested information in the Ship to Shore Master/Pilot Exchange form and Shore to Ship Pilot/Master Exchange form. (one part)	10%

MarTEL Plus teachers’ guidelines also provide sample lesson plan sheets

MarTEL PLUS

Education and Culture DG
Lifelong Learning Programme

Mobile Phone Application

- Developed by Spinaker d.o.o., the largest maritime education company in Slovenia.
- SPIN's previous work, 'www.egmdss.com' was chosen as one of 9 best from 443 e-learning resources in the "My favourite e-learning resources" contest*

*(16.6.2006 - an European Commission initiative elearningeuropa.info).

MarTEL PLUS

Education and Culture DG
Lifelong Learning Programme

Mobile Phone Application

- Self assessment application for mobile phones, directly connected to the Learning Management System
- Several mobile learning software packages were tested, and the best was selected for use in MarTEL Plus.
- Content will be developed by maritime education specialists and made available in the coming months.

MarTEL PLUS

Lifelong Learning Programme

Mobile Phone Application

Screenshot of download page

MarTEL PLUS

Lifelong Learning Programme

MarTEL Website

www.martel.pro

MarTEL Plus Website

www.plus.martel.pro

CAPTAINS

COMMUNICATION AND PRACTICAL TRAINING APPLIED IN NAUTICAL STUDIES

Summary

A recent study found that almost 65% of all commercial ships have multinational crews. Over 10% of the fleet has crews with members from five or more nationalities.

(Kahveki, E. Lane T. and Sampson, H., (2001), Transnational Seafarers Communities, Cardiff University, Seafarers International Research Centre, Cardiff.)

Summary

The STCW convention, which specifies the minimum standards for training and certification of seafarers in 133 countries worldwide, specifies that seafarers should be able to speak English.

Summary

The CAPTAINS project will provide computer based English language training materials and courses for non-native speakers of English, aimed specifically at the seafaring vocation.

Summary

The materials and courses will be designed following a thorough needs analysis of seafarers and maritime English teachers from all around the world, and will be created in collaboration with experienced captains, chief engineers, and maritime English experts.

Main Goals

- To contribute to an enhanced safety at sea culture by improving English communication skills, oral or written, through the identification of safety issues based on existing real-life critical situations emerging from English communication problems and diverse cultures due to multi-national ship crews.
- To create a respective knowledge base of such real-life scenarios of ineffective English communication and their relevance to potential critical situations.
- To develop attractive rich media interactive virtual simulators of identified real-life scenarios taking place on ship (bridge, engine, deck and social interaction) to allow for effective learning of functional communication of maritime English and avoid culturally originated communicative incompetence or misunderstandings.
- To achieve transfer and evolution of knowledge by merging advanced learning/collaboration and evaluation software that already exists (AIT) and the rich media interactive learning simulations resulting from aims 2 and 3.

Main Goals

- To develop an assessment method which will lead to some form of certification, thereby allowing professionals to establish a meaningful and well-established as well as standardised way to carry out safety critical procedures based on a communication on meaningful topics.

- To increase cooperation between the training institutions and several social partners for overcoming linguistic and cultural deficiencies, resulting in the need to develop new vocational skills such as communicative English competence. Optimized learning will be achieved by using real-life scenarios for preparation of innovative rich media simulations that will motivate learners, defining a scenario-based learning approach.

- To enhance maritime VET by integrating innovative Information and Communication Technology (ICT) together with the latest refinements in Communicative Language Teaching (CLT) in maritime VET.

Partners

- **University of the Aegean (AEGEAN)**
- **Centre for Factories of the Future (C4FF)**
- **Athens Information Technology (AIT)**
- **TUDEV Institute of Maritime Studies**
- **1st Evening Vocational Senior School of Egaleo (EPAL)**
- **Osrodek Prac Rozwojowych (OPR - Centre for Development Works)**
- **University of Cadiz (UCA)**
- **Bureau of Vocational Training, 3rd Sector of Athens, Ministry of Education and Lifelong Learning (BVT)**

Work Packages

- WP1 Project Management
- WP2 User Requirements Collection and Needs Analysis
- WP3 Novel Learning Approaches
- WP4 Course Design and Development
- WP5 Learning Platform
- WP6 Training Events and Evaluation
- WP7 Dissemination
- WP8 Exploitation and Sustainability

WP2 – User Requirements Collection and Analysis

- To come in close contact with stakeholders and target user groups in the maritime sector in order to fully understand the nature of the problem of ineffective English communication.
- To form up questionnaires, contact interviews, run user workshops, etc. so as to gather appropriate feedback and analyse the needs of target user groups based on the initial discussions with them.
- To define a knowledge base of maritime accidents where poor communication in English was a contributing factor.

WP2 – User Requirements Collection and Analysis

Deliverables

- User workshop results report.
- Knowledge base of maritime accidents due to ineffective English communication.

WP2 – User Requirements Collection and Analysis

Knowledge Base

- A knowledge base containing reports of maritime accidents contributed to by failures in communication was formed by C4FF.
- Two examples came from questionnaire participants.
- The knowledge base has been sampled in the course design process (which is ongoing).

Completed Steps

- Research on maritime accidents due to communication failures
- Online Surveys
  - Seafarers' questionnaire
  - Maritime English Teachers' questionnaire
- Analysis of Surveys - learning needs
- Workshops with Academia, Industry and Stakeholders
- Syllabus design - content and level setting

Future Steps

- Syllabus review
- Training scenarios
- E-learning system
- 2D/3D Animations
- Implementation
  - initial training sessions
  - Evaluation
  - Final training session
- Dissemination and Exploitation
- Sustainability

CAPTAINS

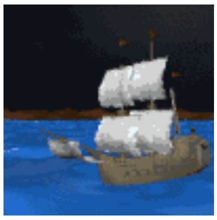
COMMUNICATION AND PRACTICAL TRAINING
APPLIED IN NAUTICAL STUDIES

www.captains.pro

M'AIDER

(MAYDAY)

Prof. R. Ziarati
Dr. Martin Ziarati
Officer Ugurcan Acar

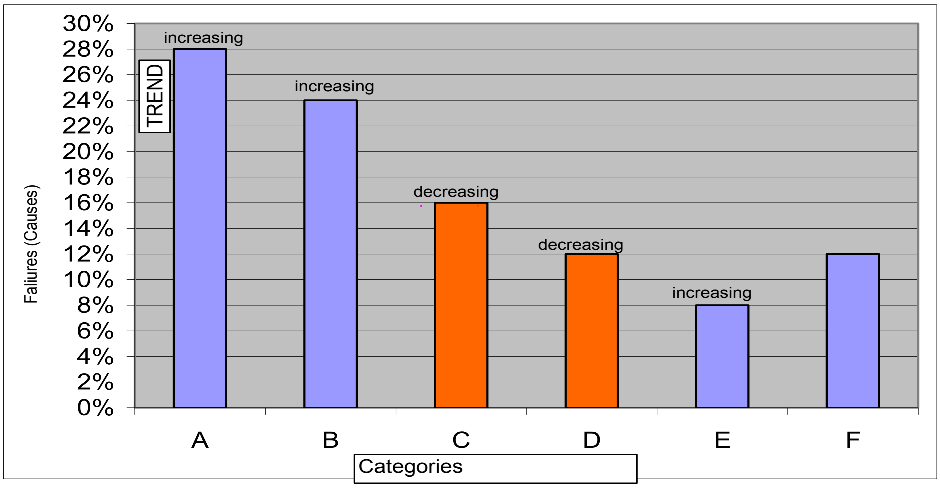


Bridge 2011 – Rauma, Finland

STCW was introduced in 1995. This is some 15 years ago

Research at TUDEV has shown that STCW has a number of deficiencies.

B	Communication	24%
C	Equipment failure including engines	16%
D	Confusion due to standards and regulations	12%
E	Inadequacy of standards/applications by third	8%
F	Unknown	12%

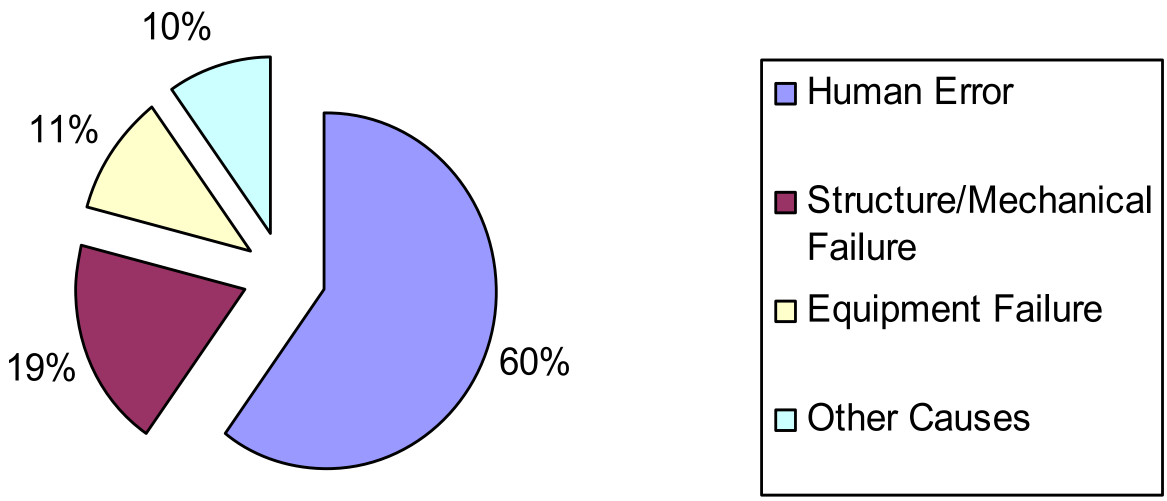


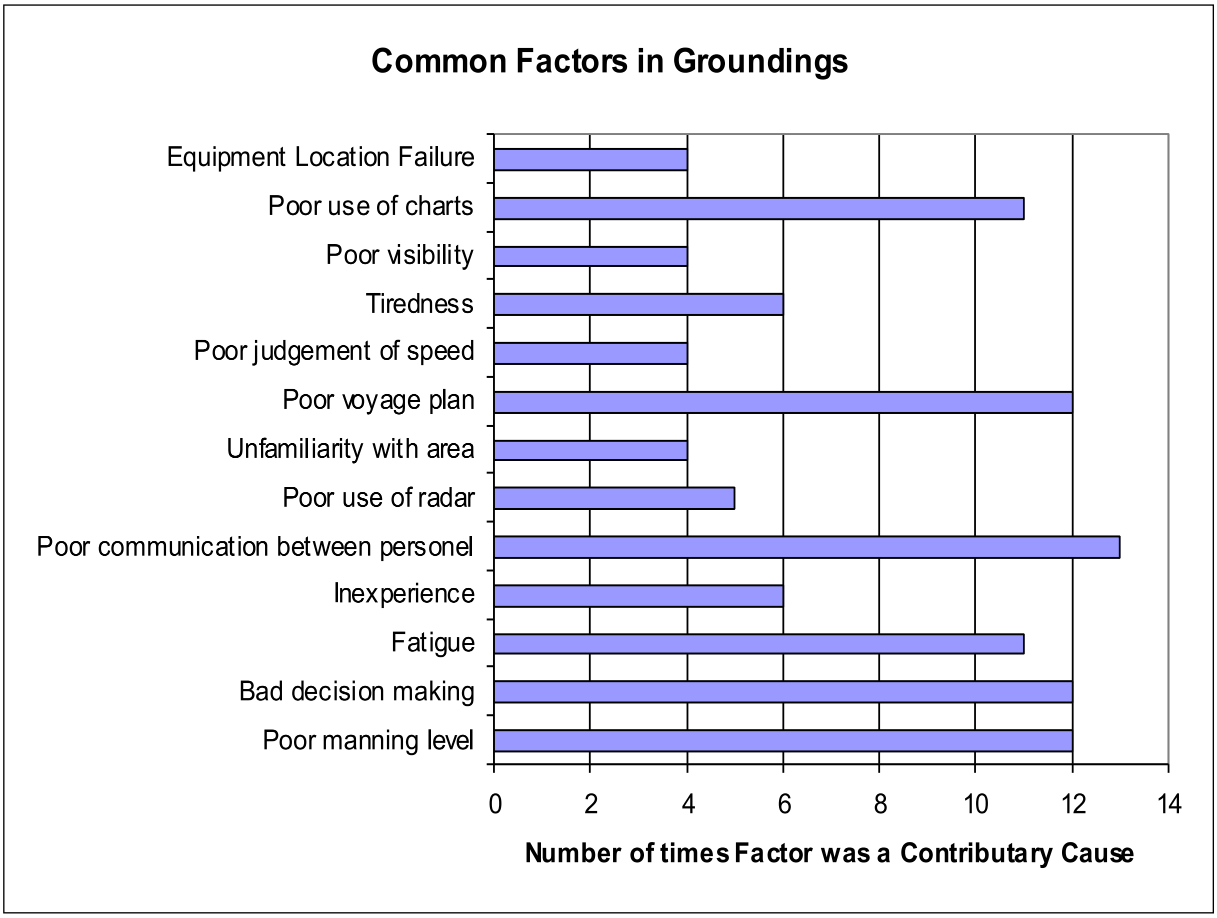
Mainly human error

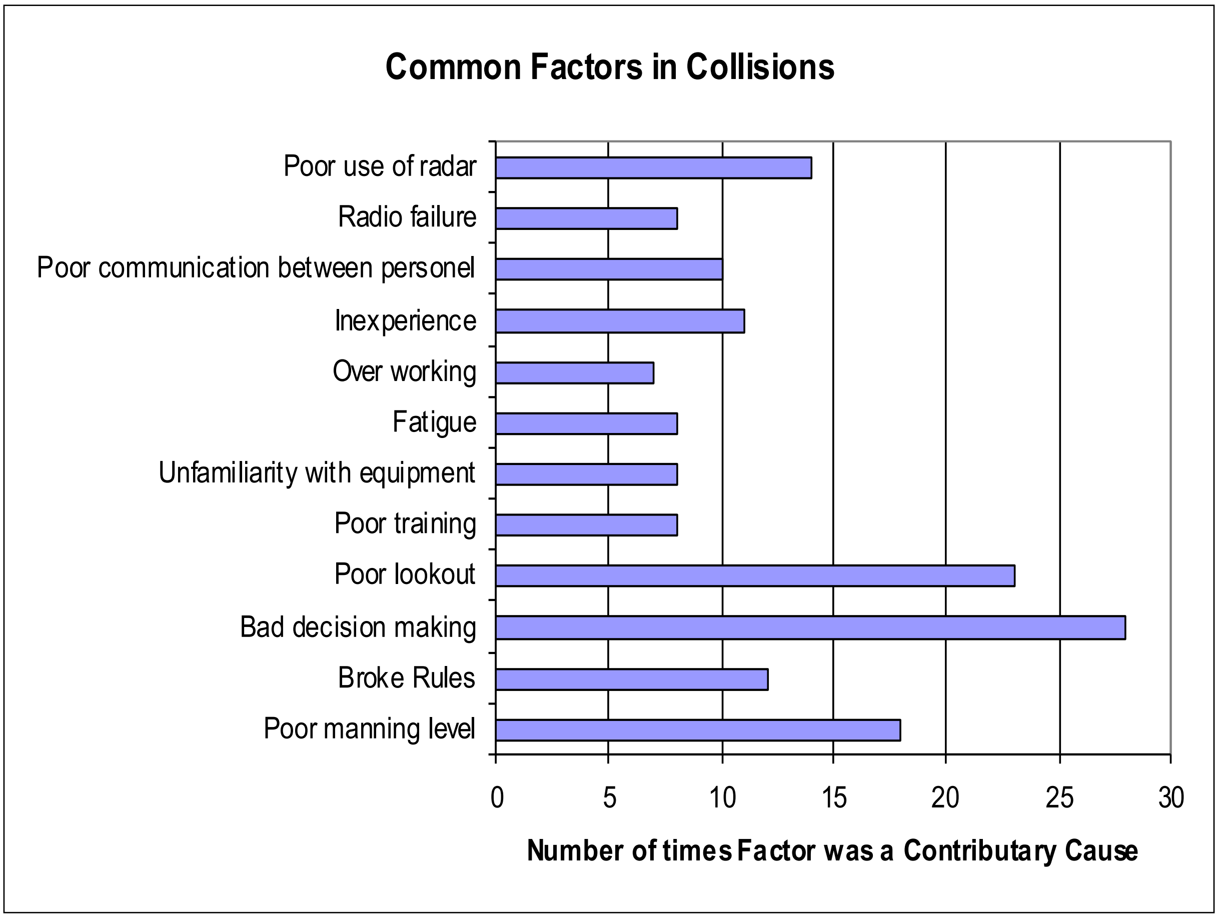
Mainly disregard for current standards & regulations.

Partly human error
Partly disregard for current standards & regulations.

Disputed/Vague




Common Factors in Groundings
Equipment Location Failure
Poor use of charts
Poor visibility
Tiredness
Poor judgement of speed
Poor voyage plan
Unfamiliarity with area
Poor use of radar
Poor communication between personel
Inexperience
Fatigue
Bad decision making
Poor manning level
0
2
4
6
8
10
12
14
Number of times Factor was a Contributary Cause


Common Factors in Collisions
Poor use of radar
Radio failure
Poor communication between personel
Inexperience
Over working
Fatigue
Unfamiliarity with equipment
Poor training
Poor lookout
Bad decision making
Broke Rules
Poor manning level
0
5
10
15
20
25
30
Number of times Factor was a Contributary Cause

Identified Deficiencies

1. STCW content – SOS (2005-07)

2. Language Competence – MarTEL (2007-09)
(International standards for Maritime English)

3. Automation – SURPASS (2009-11)

4. Emergency situations – M'aider (2009-11)

5. Environment - Clean Diesel (2010-13)

6. Compliance - EMSA

Address Deficiencies

Wait for IMO vs. Take action

TUDEV and C4FF choices:

Find means to address deficiencies

Approach IMO, UN, EU, National Government, Industry?

- IMO has passed the responsibility for delivery and assessment of Merchant Navy Officers programmes to member countries and does not take part, in any shape or form, in the inspection, evaluation or delivery of these programmes (ibid).

- IMO cannot work alone. Governments, and related industries should show the same determination to implement these standards.

IMO – Can be sluggish and reactive

UN – Lacks resources

EU – Progressive, proactive and willing

National Government – a mix bag

Industry – Aware of problems and willing

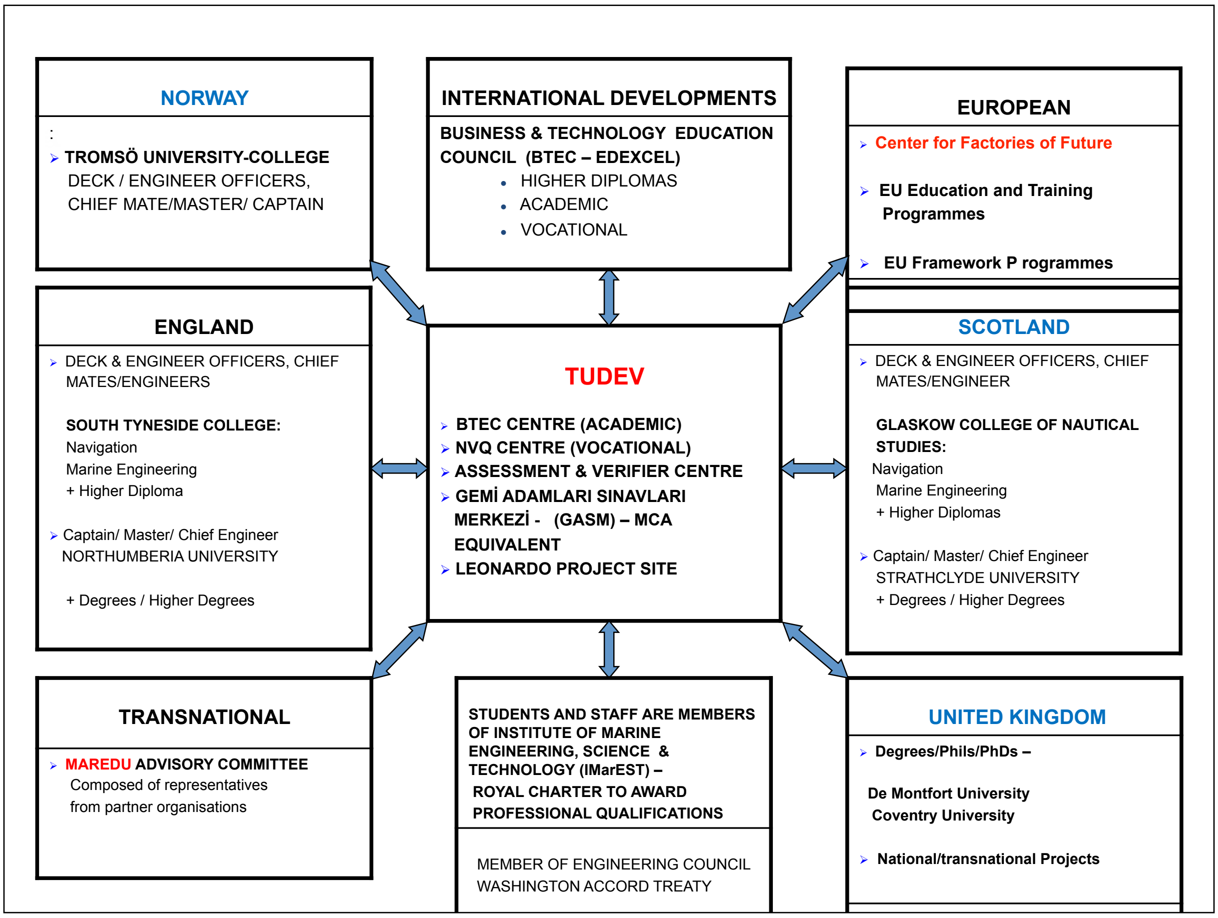
Professional bodies – Very supportive

Awarding bodies – Very Supportive

Licensing authorities – At times can be difficult, but willing

MarEDU (TUDEV and C4FF initially) Choice

- Form consortiums
- Seek support from major bodies
- Conduct serious research into identified problems
- Develop serious proposals
- Develop and motivate staff
- Publish papers in conferences and journals
- Seek partners



Main education and training problem areas :

- Knowledge of English

- Correct application of maritime terms and terminologies

- Ability to use navigation tools and automation

- Conformance with standards or rules and conventions

- Application of current standards or conventions by third parties

-Inadequate standards

Source: ziarati (2006)

EDUCATION AND CULTURE

- EU Leonardo SOS (Safety on Sea) Project, TR/05/B/P/PP/178 001, 2005
- EU Leonardo TRAIN 4Cs Mobility Project, TR/06/A/F/PL1-132, 2006
- EU Leonardo E-GMDSS Project, SI/06/B/F/PP-176006, 2006
- EU Leonardo MarTEL Project, UK/07/LLP-LdV/TOI-049, 2007
- EU Leonardo TRAIN 4Cs – II Project, 2008-1-TR-LEO01-00681, 2008
- EU Leonardo E-GMDSSVET Project, 142173-LLP-1-2008-1-SI
- EU Leonardo EBDIG Project, UK/09/LLP-LdV/TOI-163_262, 2009
- EU Leonardo MarEng Plus Project (Maritime English Programmes)
- EU Leonardo M'Aider Project, 2009-1-NL1-LEO05-01624, 2009
- EU Leonardo SURPASS Project_ 2009-1-TR1-LEO05-08652, 2009

M'AIDER (MAYDAY)

- To improve safety at sea and at ports by identifying emergency situations known so far and create knowledge based scenarios for training of seafarers at officer level and higher ranks.
- To develop exercises based on scenarios created for application in bridge, engine room, propulsion areas as well as in integrated and full mission simulators.
- To transfer the knowledge that already exists in the form of a software suite together with an existing internet e-learning/assessment to integrate the scenarios and exercises created based on above aims.

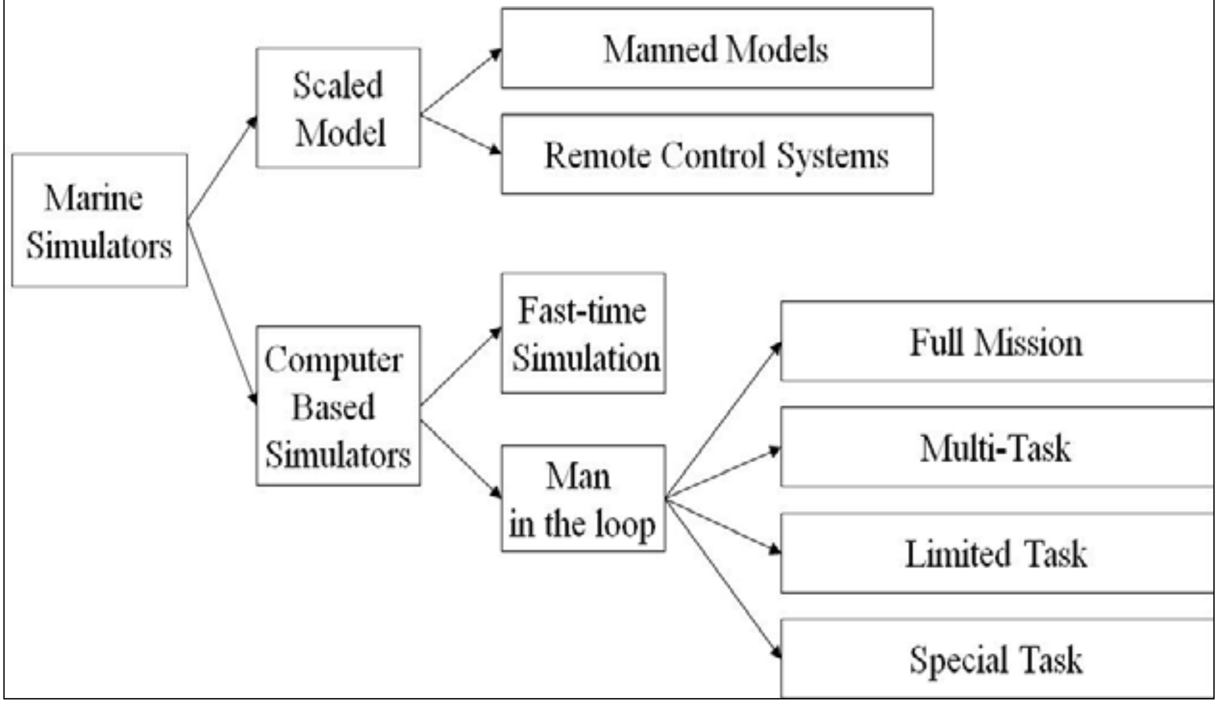
Partners: Satakunta University (SUAS), FI; Glasgow College of Nautical Studies (GCNS), Scotland; Tromsø University College (TUC), NO; Maritime University of Szczecin (MUS), PL ; Spinaker (SPIN), SL ; Centre for Factories of the Future (C4FF) UK

Research Findings

The majortity of accidents at sea and ports are mainly due to either disregard for rules or inadequate training and their assessment, particularly relating to use of navigational equipment and issues concerning survival at sea and fire-fighting.

Crews were found not to be prepared or trained for emergency situations

Marine Simulators



Development of Scenarios

- MET Experience
- Case Studies – Accidents and Incidents
- Surveys/Questionnaires
- Representative samples
- Scenarios
- **Exercise Format**
- **Text**
- **E-material: Text, Picture, Video, Animation**
- **Simulators**

Exercise Format

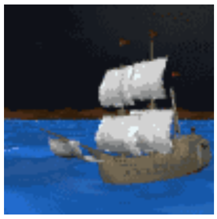
- Objective
- Subject Area
- Initial Conditions
- Instructor's Notes
- Briefing
- Simulation Exercise
- De-Briefing
- Analysis
- Evaluation of training exercise
- Conclusion

Right First Time

Thank you for your attention

M'AIDER

MAY DAY

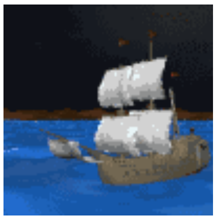


Prof. R. Ziarati
Dr. Martin Ziarati
Officer Ugurcan Acar

THANK YOU FOR YOUR ATTENTION

MariFuture

Prof. Reza Ziarati
Dr. Martin Ziarati



Bridge 2011 – Rauma, Finland

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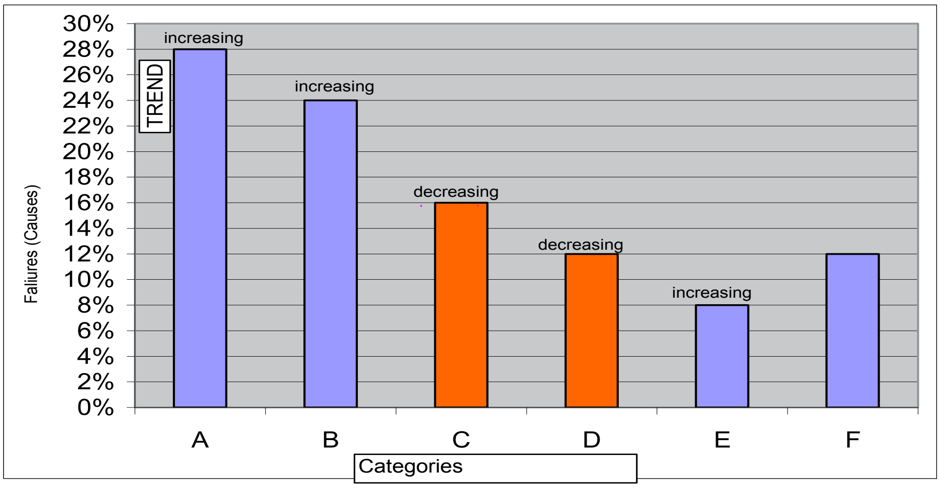

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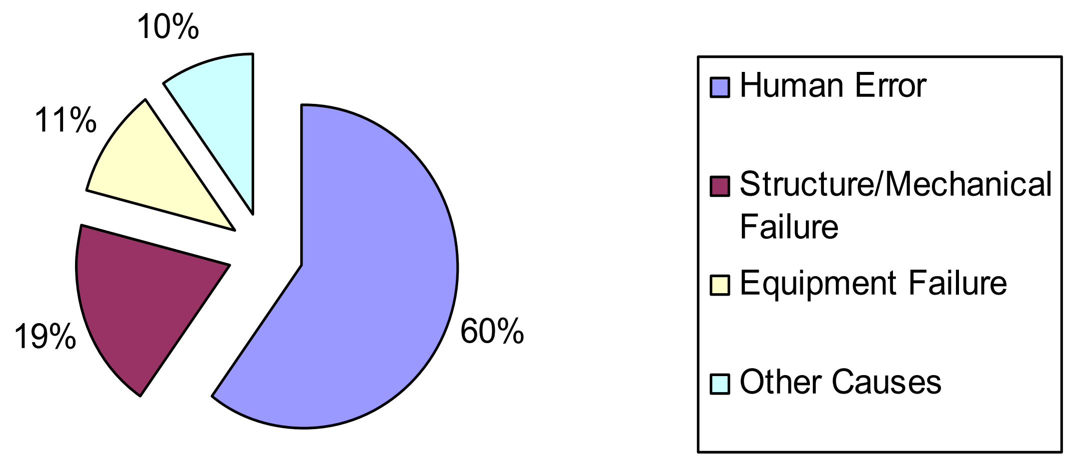

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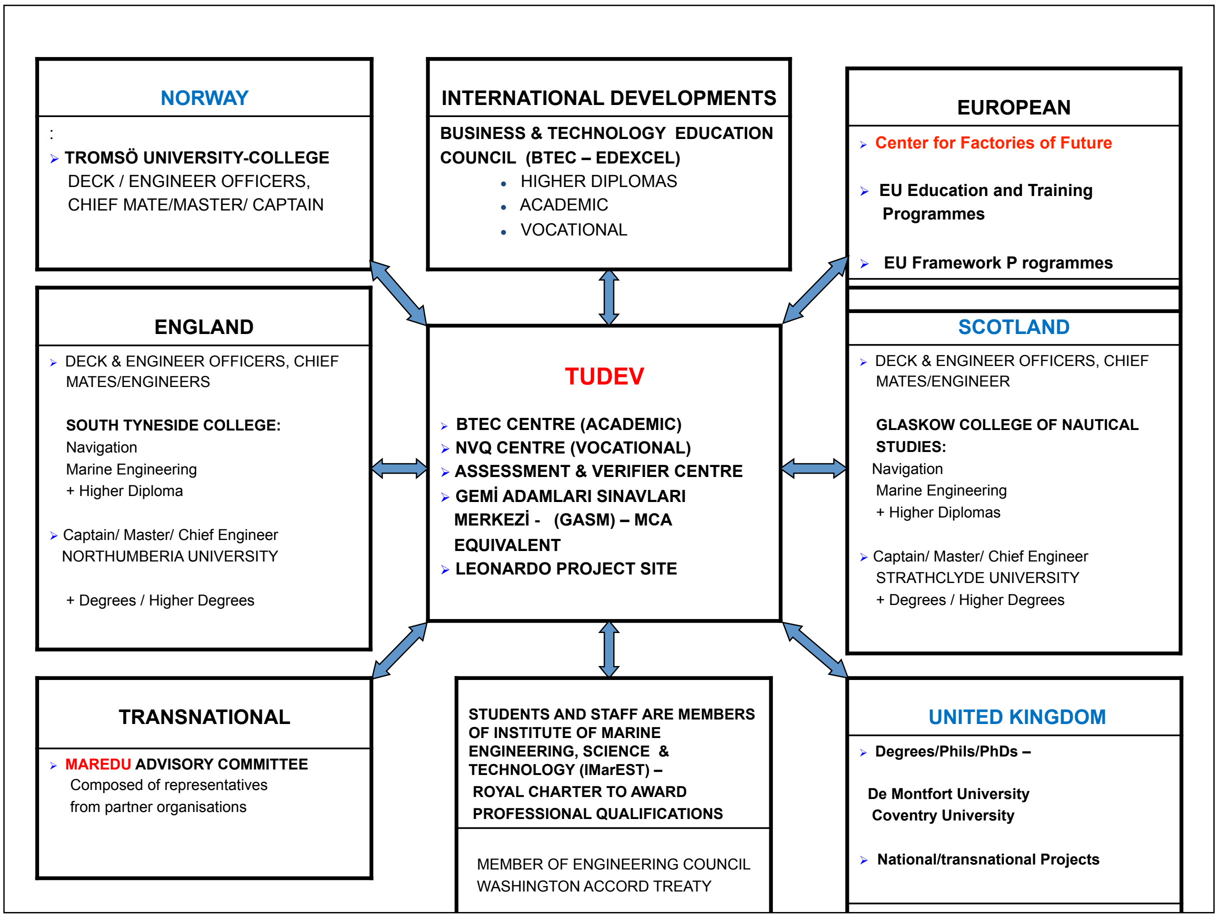

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- EU Leonardo M'Aider Project, 2009-1-NL1-LEO05-01624, 2009
- EU Leonardo SURPASS Project_ 2009-1-TR1-LEO05-08652, 2009
- www.marifuture.org

Research Findings

The majortity of accidents at sea and ports are mainly due to either disregard for rules or inadequate training and their assessment, particularly relating to use of navigational equipment and automated systems on board vessels

MariFuture

- **MariFuture is an extensive network of maritime organisations**
- **MariFuture is primarily involved with identifying the research, education and training needs of the maritime industries**

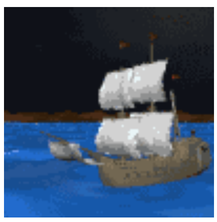
MariFuture Objectives

- Identifying education and training needs of the maritime industry
- Identifying the research and development needs
- Looking for solutions to problems faced by maritime education and training organisations
- Looking for R&D solutions or initiating new research and/or development work.
- Promoting good practice in maritime education and training.
- Seeking funds for Education and research projects
- Supporting projects involved in maritime education and training.
- Offering advice and guidance to the maritime education and training institutions.
- A Point of contact for national and EU bodies/organisations/ institutions regarding maritime education and training.
- Representing the interests of its members i.e. the interests of maritime education and training organisations in Europe.
- Working with professional, industrial, commercial organisations to improve maritime education and training and maritime research and development

Right First Time

Thank you for your attention

MariFuture



Prof. R. Ziarati
Dr. Martin Ziarati

Centre for Factories of the Future

UniMET

Unification of Marine Education and Training

AIMS AND OBJECTIVES

Prof. Dr. Reza Ziarati
Dr Martin Ziarati

UniMET

Bridge 2011 – Rauma, Finland

Centre for Factories of the Future

List of Partner Organisation

Partner no	Role	Organisation Name	City	Country
P 1	APP	Centre for Factories of the Future	Coventry	GB - United Kingdom
P 2	PA	TUDEV (Turk Deniz Egitim Vakfı) - Deni	Tuzla/Istanbul	TR - Turkey
P 3	PA	Satakunta University of Applied Scienc	Rauma	FI - Finland
P 4	PA	Osrodek Prac Rozwojowych	Szczecin	PL - Poland
P 5	PA	Maritiem Instituut Willem Barentsz van	Terschelling West	NL - Netherlands
P 6	PA	Spinaker d.o.o.	Portoroz	SI - Slovenia
P 7	PA	Consorzio Armatori per la Ricerca	Napoli	IT - Italy
P 8	PA	POLYTECHNIC UNIVERSITY OF CATALO	Barcelona	ES - Spain
P 9	PA	Lietuvos aukštojoje jūreivystės mokykl	Klaipeda	LT - Lithuania

UniMET

Bridge 2011 – Rauma, Finland

C4FF Developing the Future

Centre for Factories of the Future

Project Summary

- IMO STCW Standards
- STCW 78 - Amended in 1991, 1995, 2003 and 2010
- EMSA monitoring of STCW implementation
- SOS Project (2005-7) and TRAIN 4c 1, 2 & 3
- IMarEST , MNTB, MCA and EDEXEL , NVQ and SVQ collaborations
- MarTEL (2007-09), MarTEL (2010-12) EGMDSS and E-GMDSS VET achievements

UniMET

Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Project Summary

- UniMET is in line with and supports the priorities and objectives of Lisbon treaty and Bologna accord - harmonisation and standardisation of HE in Europe

- UniMET will ensure VET in the MET are in line with the STCW compliant but set gold standards by meeting the local and international requirements of the industry for all ranks and types of seafarer and promote good practice

UniMET

Bridge 2011 – Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Why UniMET?

- Varied MET practices
- Shortage of seafarers , estimated to grow
- Partners to use cross-referencing techniques to fill the identifying Good practices and differences
- IMO Model programmes not applied and not monitored in many countries
- Building on the outcomes of the previous projects such as MASSTER/METNET /METHAR

UniMET

Bridge 2011 – Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Aims and Objectives

- To embed the UniMET programme within the partner countries through cross-referencing and review of the IMO Model programmes and courses as well as inclusion of good practices
- To ensure that seafarers are compliant with IMO requirements
- To make seafarers more mobile and employable

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Aims and Objectives

[Sample of Cross referencing in IMO Model course 7.04 at TUDEV on Marine Engineering Programme]

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Aims and Objectives II

- To inform local, national and international maritime organizations, awarding, licensing and professional bodies about the UniMET programme and seek their support in the harmonisation of MET provisions

- By disseminating UniMET programme to key decision makers within maritime and government bodies it is hoped that they will accept and support the programme therefore enabling the expected changes to policies regarding MET to be made

UniMET

Bridge 2011 – Rauma, Finland

Lifelong Learning Programme

Centre for Factories of the Future

Aims and Objectives III

- To establish a quality assurance and control system for the delivery of UniMET Programme based on an existing good practices such as BTEC/ Edexcel system

- C4FF was involved in the development of the BTEC system and will provide valuable contacts and assistance in enhancing the system for the use in the delivery of the UniMET Programme

UniMET Bridge 2011 – Rauma, Finland

Centre for Factories of the Future

Aims and Objectives IV

- To spread UniMET further across Europe both during and after the project's completion, raising awareness and transferring good practices with the ultimate aim of improving the quality of MET and safety at sea worldwide.

UniMET Bridge 2011 – Rauma, Finland

C4FF Developing the Future

Centre for Factories of the Future

Impact and Sustainability

- The UniMET to be promoted through MET centers
- Cross referencing will be developed
- Quality management model will be developed
- EDEXEL and partners own systems will be reviewed
- UniMET will address the EU Youth and Citizenship programme aged between 16 and 30 will have increased employability within shipping industry. This will increase the attractiveness of profession by reducing the shortage of seafarers

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Impact and Sustainability

- UniMET - partnership consortium then wider audience
- Questionnaires to the target group
- IMarEST accreditation
- Seminars with the staff and cadets in each institution and representatives from various stake holders particularly from industry
- Articles, papers and workshops to be published for conferences such as IMLA, IMEC, IMAM and so forth.

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Impact and Sustainability II

- Presentations to be made to IMO sub-committee and major awarding, accreditation and licensing bodies
- Each partner will support the expansion of UniMET across EUROPE.
- UniMET will encourage young people to undertake career in the merchant navy.
- EMSA will be a major incentives for UniMET to be promoted and sustained

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Impact and Sustainability III

- Programme will be supported and will lead to qualifications recognised internationally
- Having international recognitions for officers has a tremendous impact for shipping companies such as those in Turkey
- Acceptance of SOS programme which is the core of the UniMET has already been tested through mobility programmes such as TRAIN 4Cs I and II
- The approach adopted in the SOS was to find the common denominators through cross-referencing methods which developed in a previous EU project (EUTOTECNET). These methods will be used in UniMET

UniMET

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Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

Impact and Sustainability IV

- **MarTEL, which standardises the English language for non-native speakers, will be included in UniMET**
- **EGMDSS e-platform developed will enable MET institutions to adapt online learning materials for cadet in UniMET programme**

UniMET

Bridge 2011 – Rauma, Finland

Education and Culture DG Lifelong Learning Programme

C4FF Developing the Future

Centre for Factories of the Future

UniMET

Unification of Marine Education and Training

Thank you for your attention

Prof. Dr. Reza Ziarati
Dr Martin Ziarati

UniMET

Bridge 2011 – Rauma, Finland

Education and Culture DG Lifelong Learning Programme

Bridge 2011

Deficiencies versus Innovations TUDEV Institute of Maritime Studies

Prof. Dr. R. Ziarati

Identifying a methodology for effective improvements

- Torkel (2004) reports that 25% of the world fleet was responsible for more than 50% of shipping accidents around the world. The study notes that the top 25% of the safest ships were involved in just 7% of all accidents.

- NTNU (2005) published by the University of Technology and Science (NTNU) in Norway, reports that by improving the quality of the world fleet to the same level as those in the safest 25% category, there might be an overall reduction of 72% in shipping accidents.

Human Resource Planning - Officer Shortage

- 5000 Shortages in TR and 100000 worldwide by 2020
- The BIMCO/ISF 2005 - there could be a lack of 27,000 senior officers by 2015 worldwide". Officer shortage 10,000 in 2005.
- Drewry Shipping Consultants (2008) - Officer shortage may be 34,000, a figure that could reach 83,900 2012.
- Economic Crisis! - New BIMCO/ISF figures 2010/11 – Discussions.

The reason for review of STCW Convention and its codes

STCW 78/95, is now almost 15 years old -

Many practices in ship management,

operations , and

technology have changed and these changes are now playing a major role in ship operations.

STCW Changes - Ziarati and Yongxing 2009

- Retain STCW1995
- Clean up up the inconsistencies, misleading interpretations and outdated provisions
- Make communication more effective
- Flexibility for compliance and take account of innovation in technology
- Address special circumstances of short sea shipping and offshore industry
- Address the maritime security
- Amend the articles of the Convention – Still Minimum.

www.marifuture.org – Development Paper for Oct 10.

Amendments to the International Convention on STCW (78) 1995

- New requirements
- Demands on, administrations, ship-owners and maritime institutions
- Shift from a knowledge-based to competency-based
- Need for updating and recertification
- Simulators - training or assessing competence (compliance with provisions in Section A-I/12 of the STCW Code

Other Changes

- **Security training and related issues**
- **Simplifying navigation calculations**
- **Adding training requirements for VTS**
- **Introducing electrical-electronic officers**
- **Making BRM and ERM training compulsory**
- **ILO Maritime Labour Convention 2006**

Revising the Chapter V - This Chapter of the Convention deals with such Regulation as

- Requirements for the training and qualifications of masters, officers and ratings on oil, and chemical tankers
- Same as above but for liquefied gas tankers
- Competence requirements for Dynamic Positioning
- The training requirements for:

  - ice-covered waters
  - anchor-handling operations
  - offshore supply vessels

Updating model courses

Including:

- Basic training in marine environment awareness
- IBS
- Liquefied Petroleum Gas (LPG) Tanker Cargo and Ballast Handling Simulator,

Conclusions 1

- STCW 2010 – significant
- Many deficiencies remains
- MariFuture: Three major areas

1. Stricter and tougher standards for Maritime English (MarTEL, 2007-09 and MarTEL Plus, 2009-11)
2. Reducing automation failures (SURPASS, 2009-11)
3. Prevent emergencies (M'AIDER, 2009-11).

EDUCATION AND CULTURE

- EU Leonardo SOS (Safety on Sea) Project, TR/05/B/P/PP/178 001, 2005
- EU Leonardo TRAIN 4Cs Mobility Project, TR/06/A/F/PL1-132, 2006
- EU Leonardo E-GMDSS Project, SI/06/B/F/PP-176006, 2006
- EU Leonardo MarTEL Project, UK/07/LLP-LdV/TOI-049, 2007
- EU Leonardo TRAIN 4Cs – II Project, 2008-1-TR-LEO01-00681, 2008
- EU Leonardo E-GMDSSVET Project, 142173-LLP-1-2008-1-SI
- EU Leonardo EBDIG Project, UK/09/LLP-LdV/TOI-163_262, 2009
- EU Leonardo MarEng Plus Project (Maritime English Programmes)
- EU Leonardo M'Aider Project, 2009-1-NL1-LEO05-01624, 2009
- EU Leonardo SURPASS Project_ 2009-1-TR1-LEO05-08652, 2009

Edexcel International | Right First Time | GCNS | South Tyneside College | HØGSKOLEN I TROMSØ

EDUCATION AND CULTURE

- EU Leonardo SOS (Safety on Sea) Project – Now UniMET

-EU Leonardo MarTEL Project now MarTEL Plus

-New Project CAPTAINS

-New Project Sail Ahead

-All projects have led to a new major European Network called:

-MariFuture (www.marifuture.org)

Edexcel International | Right First Time | GCNS | South Tyneside College | HØGSKOLEN I TROMSØ

Why?

- Responding to identified deficiencies
- Reducing officer shortages
- Offering our Cadets Maximum Opportunity
- Staff Development
- Supporting the maritime industry
- Creating jobs
- Creating wealth
- Achieving Gold standards
- Learning from others
- Attracting young people to our profession

EDUCATION AND CULTURE

Completed Projects

SOS (Safety On Sea)

- The SOS project is designed to improve safety at sea through improved education and training by using the syllabuses developed by northern European countries.

- This also satisfied the requirements of a major international awarding body (Edexcel) for the award of a Higher National Diploma (HND).

- Graduates from these programmes can continue their education and enrol on the final year of appropriate degree programmes.

HND PROGRRAMME
APPROVED by
BTEC
BUSINESS & TECHNOLOGY
EDUCATION COUNCIL

ACCREDITATED by
EDEXCELL
EXCELLENT EDUCATION

TUDEV HND
NAV ENG & Marine ENG

SEA TRAINING PROGRAMME
MNTB
MERCHANT NAVY TRAINING BOARD

VOCATIONAL
QUALIFICATION
NVQ/SVQ
NATIONAL/SCOTISH
VOCATIONAL
QUALIFICATION

MCA

15

- BTEC HND → DEGREE
- OOW UNLIMITED CERTIFICATE
- GOC CERTIFICATE
- ALL STCW CERTIFICATES
- BTM & SHIPHANDLING CERTIFICATE
- ELIGIBILITY TO FURTHER MCA EXAMS

PREPARATIONS FOR SVQ & MCA EXAMINATIONS IN SCOTLAND

MCA (Maritime Coastguard Agency)
SVQ (Scottish Vocational Qualification)
MNTB (Merchant Navy Training Board)

EDUCATION AND CULTURE

Completed Projects

TRAIN4Cs

12 cadets on the pilot SOS programme were sent to Scotland for their post diploma studies and preparation for

Maritime Coastguard Agency of England (MCA) Oral Examination

Right First Time

THE UNIVERSITY OF PLYMOUTH
FACULTY OF SCIENCE

BSc (Hons) Marine Studies (Merchant Shipping)
Stage 3   2007 / 2008 (120 credits)

Compulsory modules

EOE3501	Ocean Navigation	20 credits
EOE3502	Marine Industrial Issues	20 credits
EOE3503	Problem – Solving in the Marine Environment	20 credits
EOE3504	Marine Management and Law	20 credits
EOE3505	Marine Honours Project	40 credits

INTERNATIONALLY RECOGNIZED CERTIFICATION & EXAMINATION SYSTEM

LEONARDO MOBILITY AND PILOT PROJECTS

TRAIN4CS

&

SAFETY ON SEA (SOS)

TUDEV

CFF/U.K

GCNS

HND

PLYMOUTH U.
DEGREE PROG.

Completed Project

MarTEL (Maritime Tests of English Language)

-To overcome the problem of not having international or European standards for Maritime English through transfer of innovation from existing English language standards and maritime English model courses

-Maritime language competency assessment for the language certification

Partners : Factories of the Future (C4FF); Satakunta University (SUAS), Tromsø University College (TUC); Maritime University of Szczecin (MUS), Spinaker (SPIN) ; MarEdu

Completed Projects : E – G M D S S

The project focuses on the provision of vocational education and continuing vocational training for Short Range Certificate (SRC) which is mandatory for mariners operating vessels of up to 300 GRT within 30 Nautical Miles from coast.

All mariners with adequate professional qualification must also obtain the SRC, however, access to the required knowledge is limited which doesn't encourage regular refreshing of knowledge – life-long learning.

The project outcome will be a GMDSS e-learning system accessible on the Internet web site www.egmdss.com in all EU languages

Partners : Spinaker Si ; CFF (Centre for Factories of the Future); Facultad de Sciencias Nauticas; Cetemar; C.S.S.; SE.MA2; Maritime Institute Willem Barentsz; Maritime University of Szczecin;TUDEV

Ongoing Projects : 2008 - 2010

TRAIN4Cs – II Mobility

TRAIN 4Cs II is a follow-up of the former project and is intended to apply the findings of the TRAIN 4Cs and also those from the SOS project by developing an integrated mobility proposal. The proposal will give TUDEV cadets the opportunity to acquire qualifications which will be recognised throughout the EU and worldwide

NEW PROPOSALS 2008 - 2010

SURPASS

(Short Course Programmes in Automated Systems in Shipping)

(Budget : 377 147 €)

The main aim of this project is to fill the gap created as the result of emergence and application of the automated systems in the education and training of seafarers by provision of a training course enabling them to have a full understanding of automated systems, and these systems' weaknesses and limitations

Partners: Satakunta University (SUAS), FI; Glasgwo College of Nautical Studies (GCNS), Scotland; Tromsø University College (TUC), NO; Maritime University of Szczecin (MUS), PL; Spinaker (SPIN), SL; Centre for Factories of the Future (C4FF) UK; Plymouth University (PLY), UK

SURPASS

(SHORT COURSE PROGRAMME for AUTOMATED SYSTEMS in SHIPPING)

1)RATINGS AND CADET OFFICERS ON AUTOMATION COMPONENTS

2) DECK CADET OFFICER ON AUTOMATED NAVIGATION SYSTEMS AT SUPPORT AND OPERATIONAL LEVELS

3) ENGINEERING CADET OFFICERS ON AUTOMATED PROPULSION SYSTEMS AT SUPPORT AND OPERATIONAL LEVELS

4) CHIEF MATES, ON INTEGRATED NAVIGATION ON OPERATION AND MANAGEMENT LEVELS

5) SECOND ENGINEERS ON AUTOMATED PROPULSION AND POWER TRANSMISSION SYSTEMS

6) CHIEF ENGINEERS ON FULLY INTEGRATED AND COMPUTER CONTROLLED PROPULSION SYSTEM

7) MASTERS/CAPTAINS ON FULLY INTEGRATED BRIDGE-PROPULSION-POWER TRANSMISSION SYSTEM AND

8) ON TEAM OPERATION, DECK-ENGINEERS INTERACTION AND COMBINED SCENARIOS.

EDUCATION AND CULTURE

M'AIDER (MAYDAY)

- To improve safety at sea and at ports by identifying emergency situations known so far and create knowledge based scenarios for training of seafarers at officer level and higher ranks.
- To develop exercises based on scenarios created for application in bridge, engine room, propulsion areas as well as in integrated and full mission simulators.
- To transfer the knowledge that already exists in the form of a software suite together with an existing internet e-learning/assessment to integrate the scenarios and exercises created based on above aims.

Partners: Satakunta University (SUAS), FI; Glasgow College of Nautical Studies (GCNS), Scotland; Tromsø University College (TUC), NO; Maritime University of Szczecin (MUS), PL ; Spinaker (SPIN), SL ; Centre for Factories of the Future (C4FF) UK

Ongoing Projects

EBDIG

(European Boat Design Innovation Group)

Aims; to provide marine industry professionals with the skills and infrastructure to understand and exploit the opportunities presented by design, ergonomics, sustainable materials and ICT so that they may assist, excite and capture the imagination of consumers and respond to societal issues and a more demanding powerful customer base.

Objectives; to use on line courses and an interactive e-learning environment to transfer existing innovation in the automotive industry and education in ergonomics, design, new technologies, materials and technology application within the work environment so that the European marine work force develop world class skills and competencies to ensure the continued growth and competitiveness of the European Marine industry.

Partners:Coventry University – ; KKG ; Ladida International; TU Delft ; University of Genoa ; Ricardo ;TUDEV - The Institute of Maritime studies Turkey)

NEW PROPOSALS

Piri Reis University - Budget 75 Million EUR

Marine Engineers Conversion Course

Conversion of 50 Mechanical Engineers to Marine Engineers after 6 months compensation courses and one year vocational sea training

Budget :373 000 EUR

TURKISH Maritime Centre of Excellence – Budget 41 Million EUR

Partners: Chamber of Shipping and many major shipping companies

EDUCATION AND CULTURE

NEW PROPOSALS

PICK-UP

Professional, Industrial, Competence and sKills – UPdating (Budget: 400000 Euros)

This is a pilot project to update the knowledge, skills and understanding of those working in the water transportation sector. The proposal responds to the needs of the sector for training of employees and employers, paying particular attention to the training and re-training needs of smaller companies and self-employed.

PICK – UP

Professional, Industrial, Competence and sKills – UPdating

GROUPING VARIOUS SHORT COURSE PROGRAMMES UNDER SPECIFIC HEADINGS:

SAFETY, SECURITY, SPECIALISED, LEGAL, MANAGEMENT, ENVIRONMENTAL e.t.c.

SHARING OF RESOURCES AND VALUE ADDED ACTIVITIES MANIFESTED IN JOINTLY PLANNED AND/OR JOINT DELIVERY OF THESE COURSES

SPECIFIC TRAINING AND RE-TRAINING COURSES ON NEWLY EMERGING REQUIREMENTS

NEW PROPOSALS

MariFuture

This Framework 7 proposal aims to reduce 'human related errors' due to the use of complex navigational systems in shipping through a new intelligent training method based on simulations as a training support tool that bridges the gap between the operational and human factors in pilots' and masters' training. The rationale being that despite having modern technologies, well equipped and seaworthy ships with qualified crew, accidents continue to occur at undesirable level.

EDUCATION AND CULTURE

ACADEMIC RESEARCH – With De Montfort

"Activity Based Costing for Small and Medium sized Maritime Enterprises in Turkey"

To investigate the needs for costing systems for SMEs in the maritime sector in Turkey.

To design, develop and test a generic costing system which is capable of associating costs and margins with products, processes and customers.

MPhils/PhDs in collaborations with De Montfort University, UK and Centre for Factories of the Future, UK

ACADEMIC RESEARCH – with De Montfort

Sustaining competitive advantage through co-operative decision making

- To study competitive advantage and how it can be sustained through co-operative decision making processes

- To look into the reasons why family businesses are not competitive and why they go out of business after a few generations.

- To develop a checklist as a basis for constructing a model for family businesses in shipping industry, particular in Turkey with a view to help them to remain competitive for generations to come.

ACADEMIC RESEARCH – TUDEV and De Montfort

An Investigation into the design, manufacturing and management processes considering modern lean and total quality principles to improve demand and capacity forecasting for merchant navy vessels

The initial aim of the investigation was how maritime small and medium manufacturing enterprises manage the design and manufacturing processes in order to develop an improved manufacturing management system using modern lean and total quality principles that is capable of reacting responsively to changes in the competitive global market place

ACADEMIC RESEARCH

- Quality in Higher Education
  - Oxford Brookes University
- Marketing Mix – Coventry University
- Clean Diesel – Coventry University

Research Project

Clean Diesel II

This project is based on the successful EU funded Clean Diesel project. The project comprises an Engine management system called Main Diesel Program which provides real-time simulation of a diesel propulsion unit in parallel with actual Engine Finger-print software (Heat release and Rate of Injection Programs)

TUDEV, C4FF and Coventry University

ACADEMIC RESEARCH

Application of Neural and Expert Systems in Capacity Requirement and Ship Building (Budget: 4M Euros)

- To use novel tools to predict capacity requirement and apply neural and expert systems to build ships at a minimized cost
- An activity based costing system to be adapted to ship construction and maintenance process and the dismantling arrangements.
- The project would involve importing knowledge, cognitive and learning systems, simulation and visualisation techniques as well as technology enhanced learning, adaptive and active learning. Dismantling would be a corner stone of the intended areas for particular attention and recycling of dismantled components would be a priority area in the knowledge solicitation of the intended expert system.

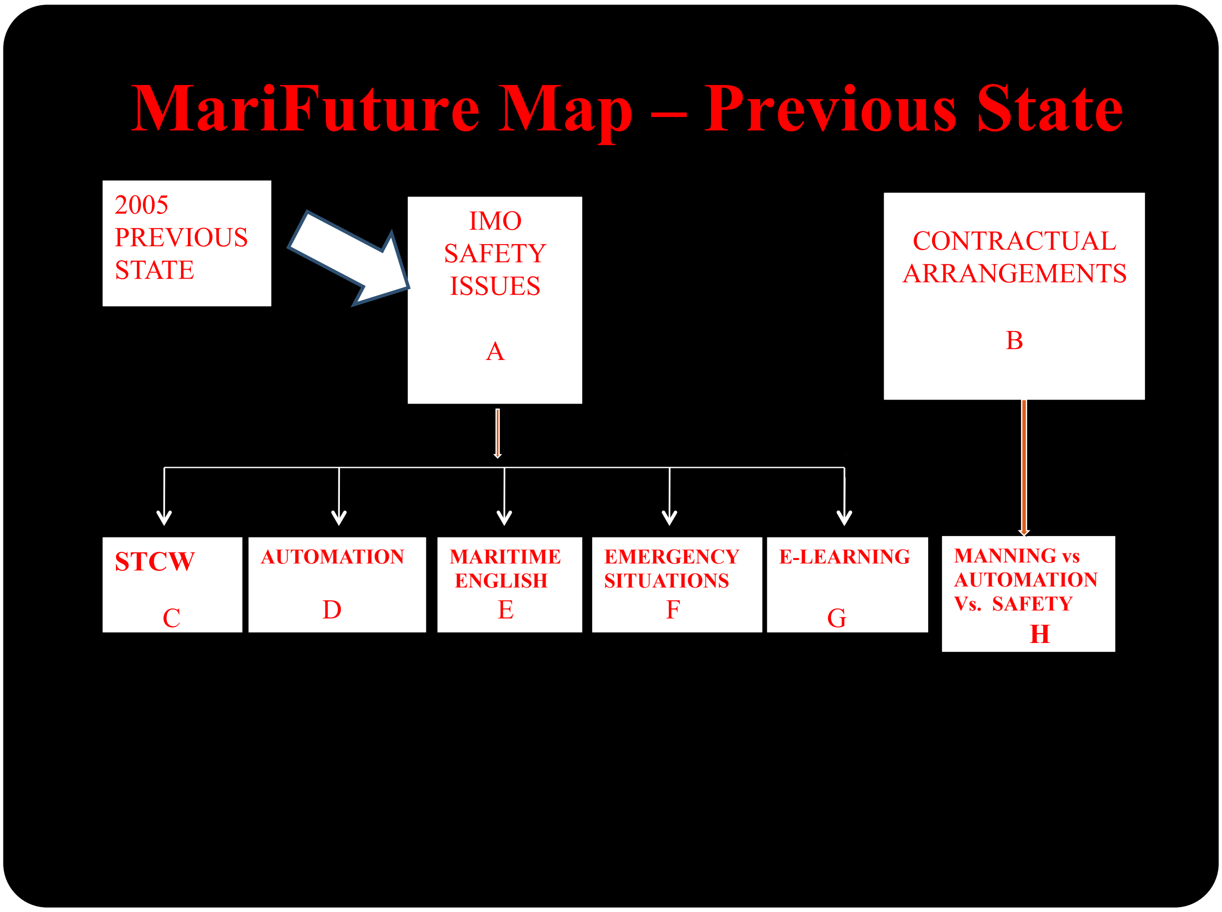
ACADEMIC RESEARCH

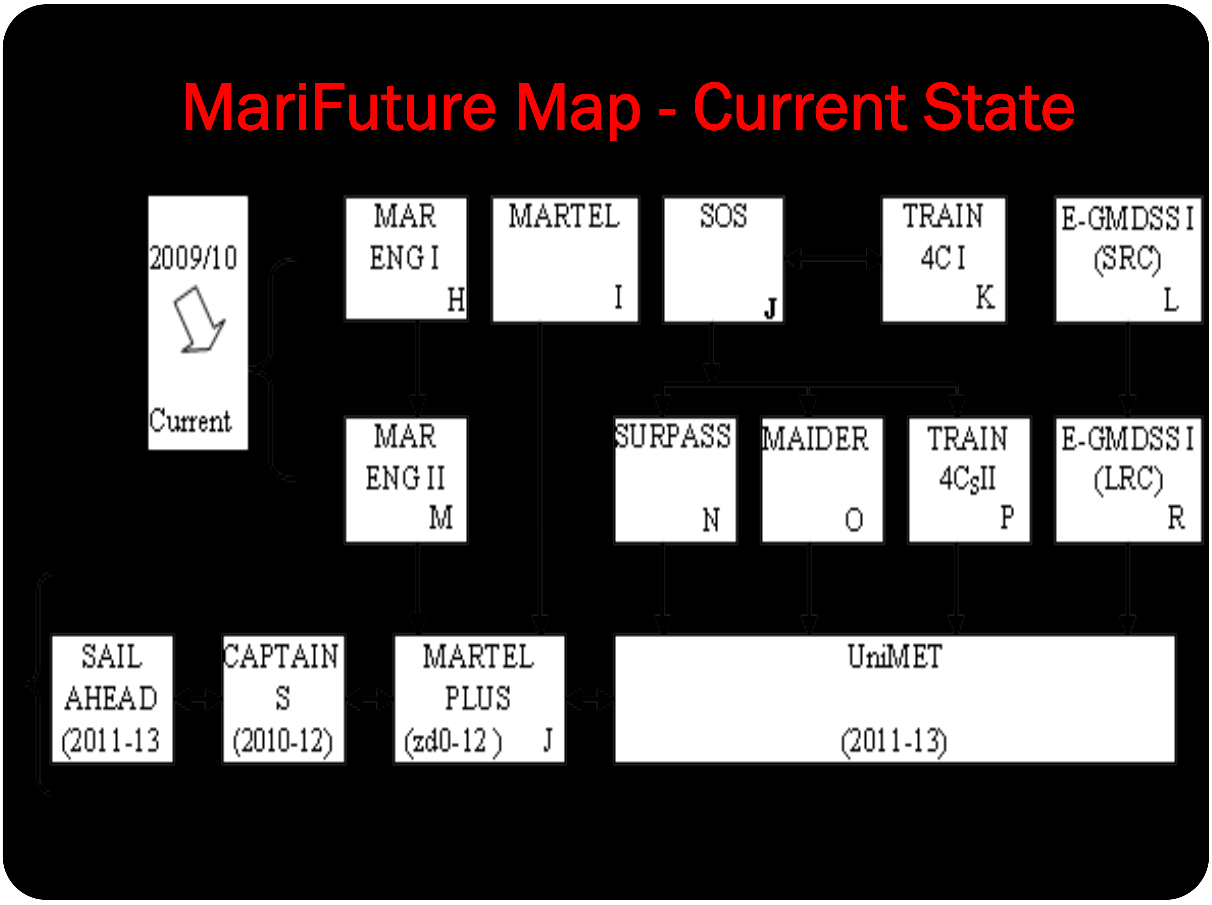
Improving estimating and forecasting model development processes

(Budget: 1.2 Million Euros)

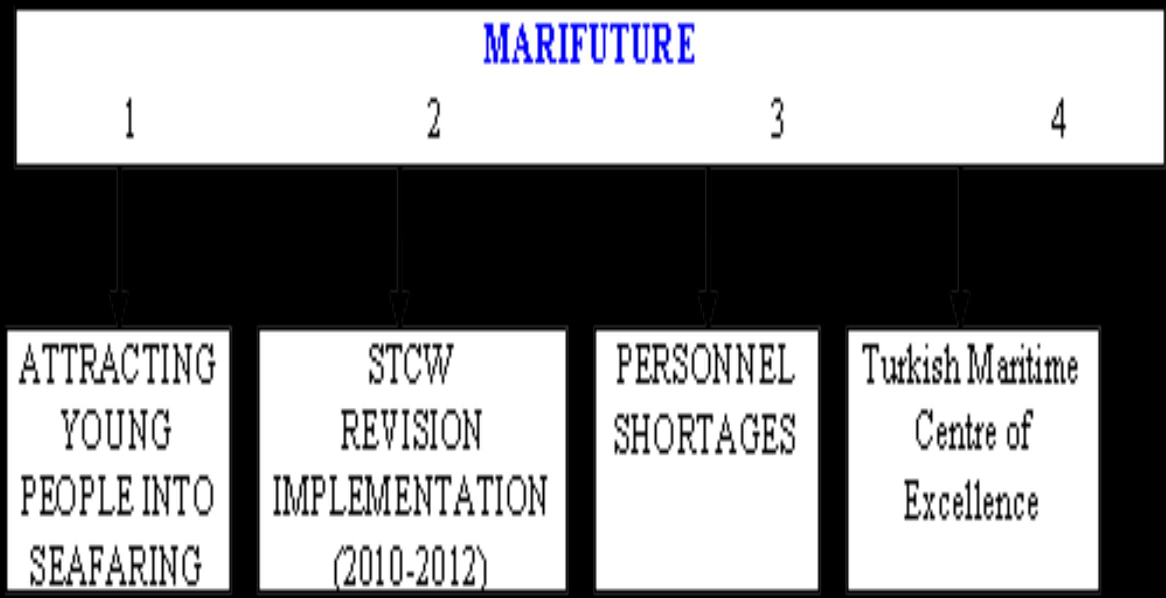
C4FF, De Montfort, Unipart, Preactor and Trellberg

The proposed project is intended to assist those business organizations who make frequent use of quantitative and/or qualitative models for making a variety of business decisions. It will achieve this aim by automating the data identification, collection and analysis tasks involved in the modelling process hence considerably reducing the high levels of cost, expertise and time resources required.

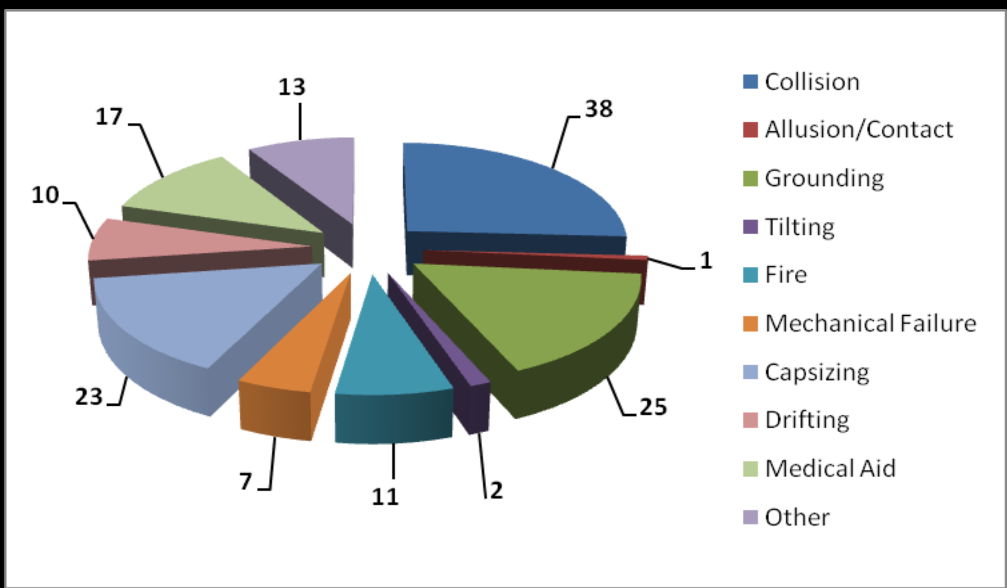

MariFuture Map – Previous State
2005 PREVIOUS STATE
IMO SAFETY ISSUES A
CONTRACTUAL ARRANGEMENTS B
STCW C
AUTOMATION D
MARITIME ENGLISH E
EMERGENCY SITUATIONS F
E-LEARNING G
MANNING vs AUTOMATION Vs. SAFETY H


MariFuture Map - Current State
2009/10
Current
MAR ENG I H
MARTEL I
SOS J
TRAIN 4C I K
E-GMDSS I (SRC) L
MAR ENG II M
SURPASS N
MAIDER O
TRAIN 4CsII P
E-GMDSS I (LRC) R
SAIL AHEAD (2011-13
CAPTAIN S (2010-12)
MARTEL PLUS (zd0-12) J
UniMET (2011-13)

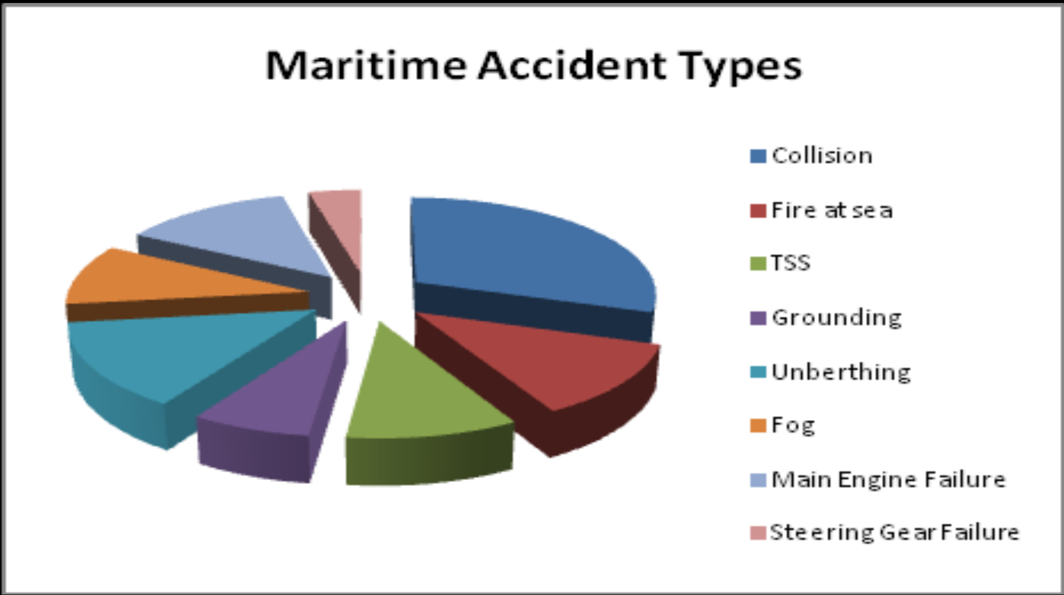
MariFuture Map - Future State



TR or UK?



TR or UK?

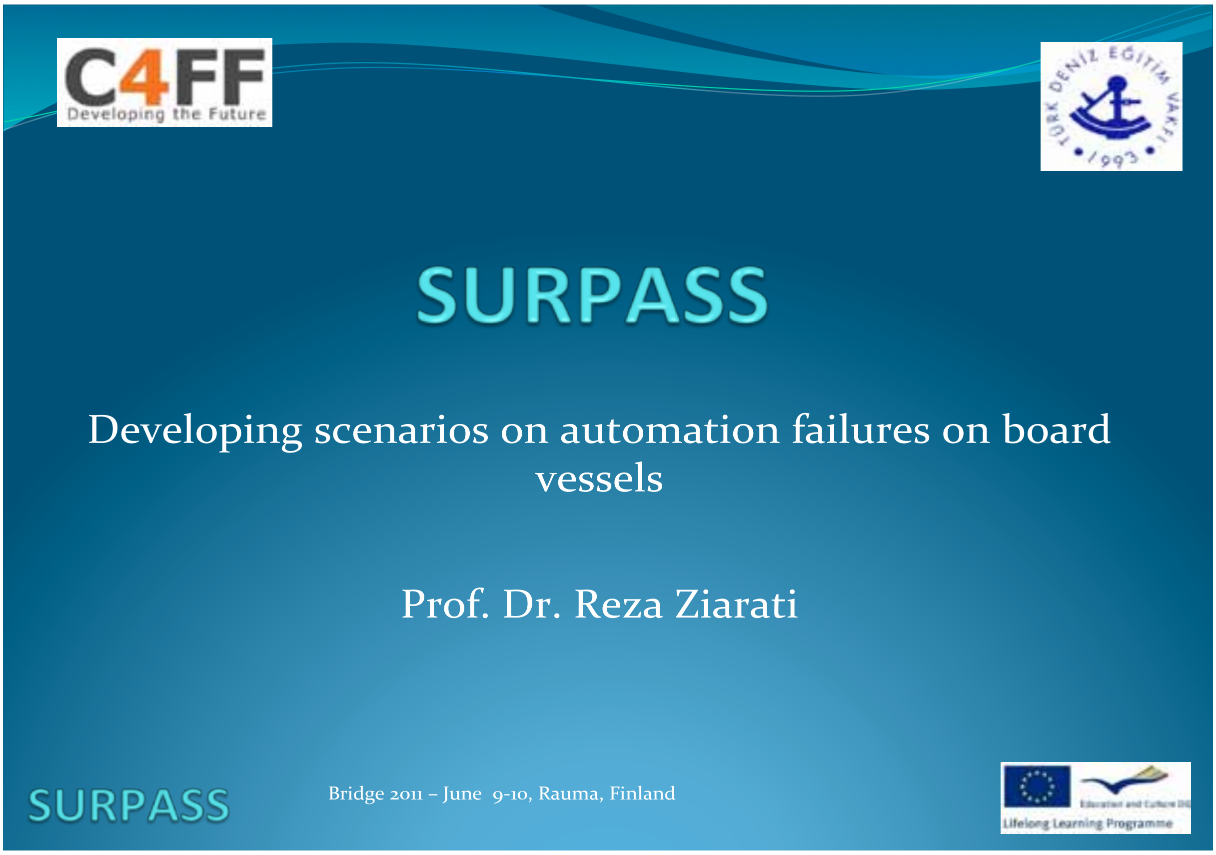


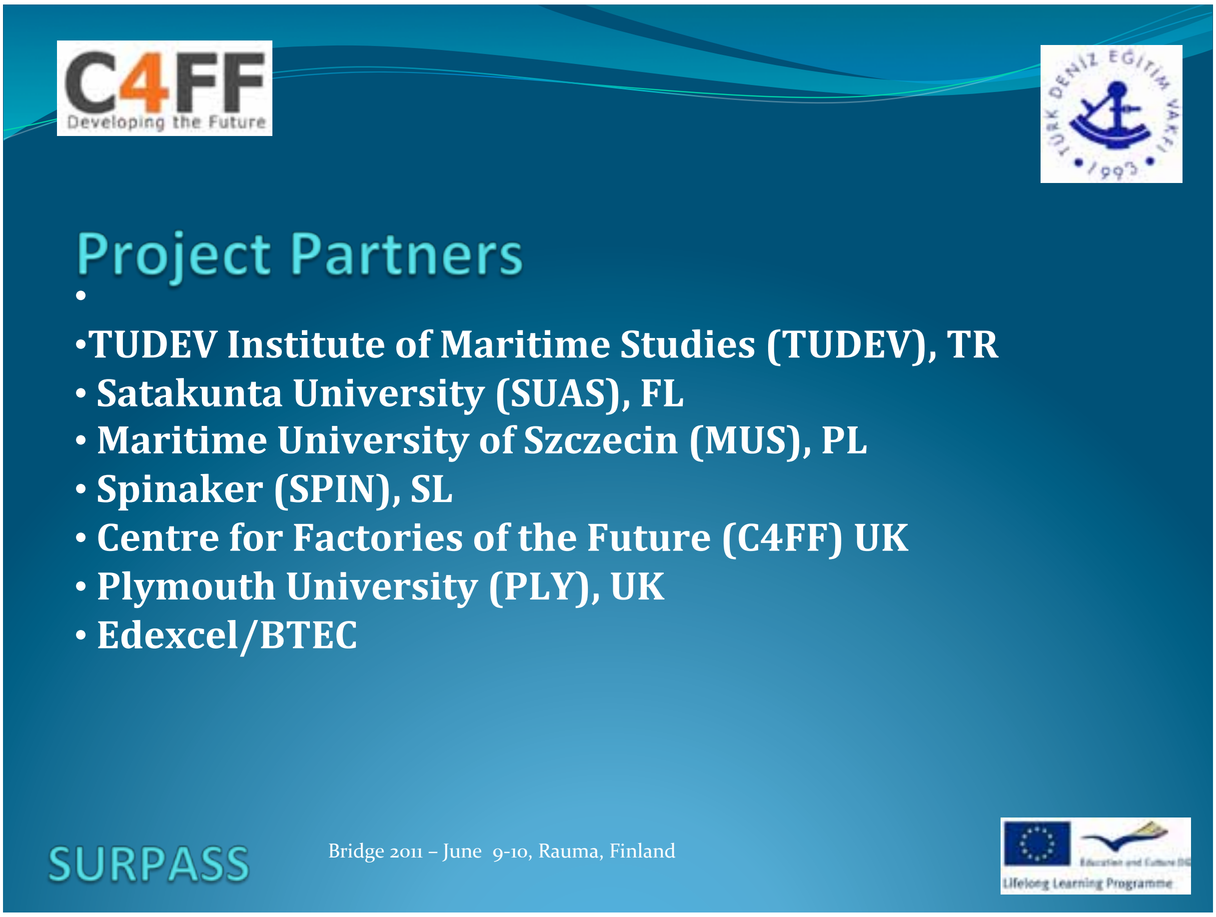
For full paper on Changes to STCW in 2010 See October Development Paper 2010

www.marifuture.org

THANK YOU FOR YOUR ATTENTION

Prof. Dr. Reza Ziarati


C4FF
Developing the Future
SURPASS
Developing scenarios on automation failures on board vessels
Prof. Dr. Reza Ziarati
SURPASS
Bridge 2011 – June 9-10, Rauma, Finland
Lifelong Learning Programme


C4FF
Developing the Future
Project Partners
•TUDEV Institute of Maritime Studies (TUDEV), TR
• Satakunta University (SUAS), FL
• Maritime University of Szczecin (MUS), PL
• Spinaker (SPIN), SL
• Centre for Factories of the Future (C4FF) UK
• Plymouth University (PLY), UK
• Edexcel/BTEC
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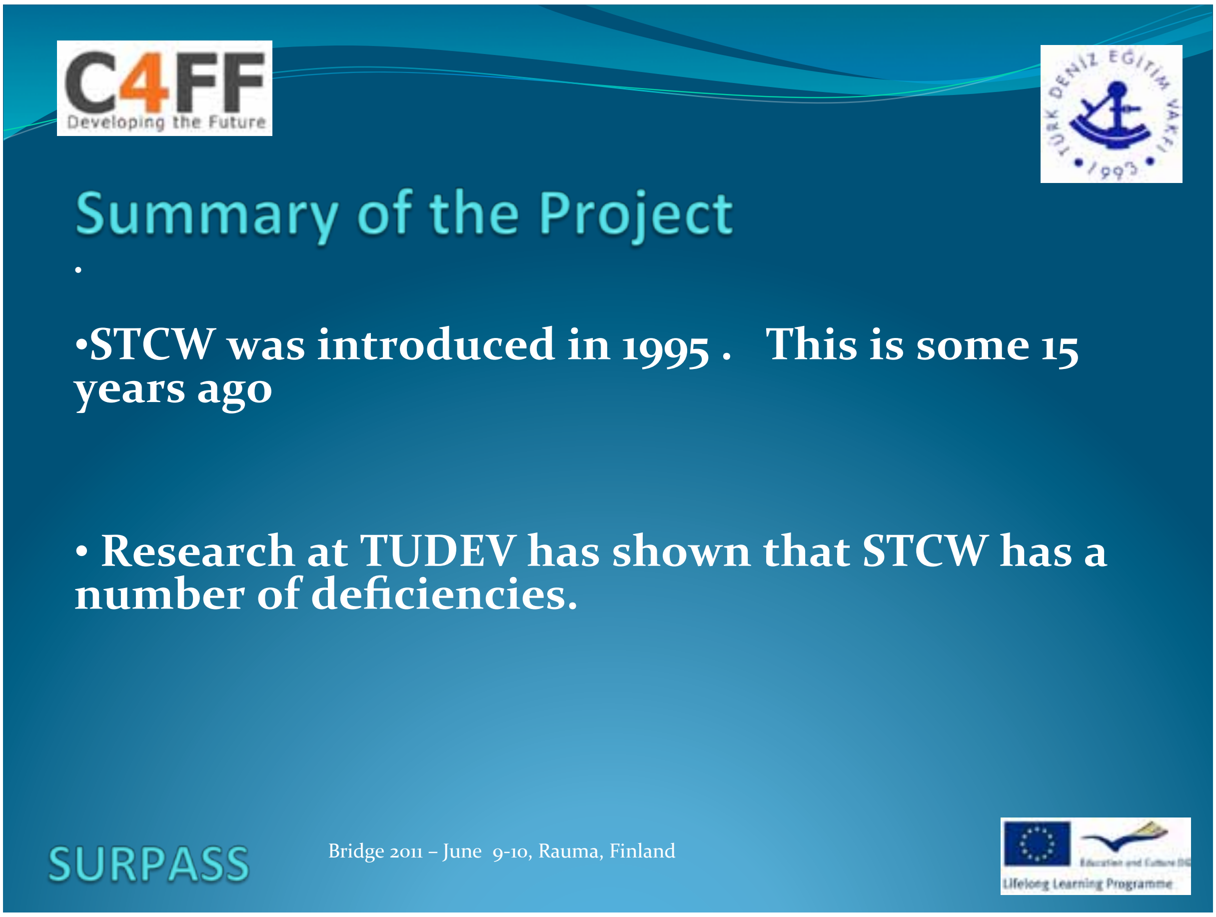
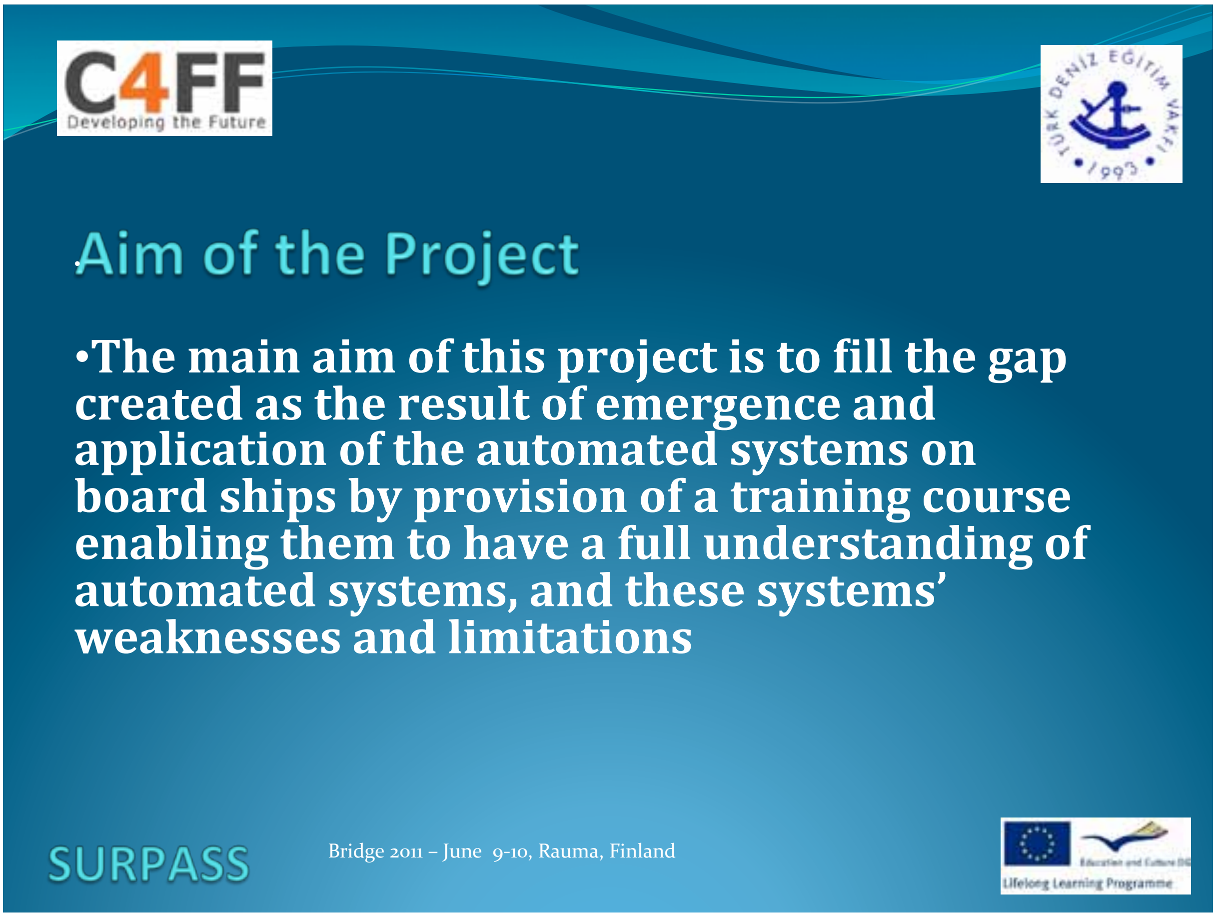

C4FF
Developing the Future
Summary of the Project
•STCW was introduced in 1995 . This is some 15 years ago
• Research at TUDEV has shown that STCW has a number of deficiencies.
SURPASS
Bridge 2011 – June 9-10, Rauma, Finland
Lifelong Learning Programme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SURPASS
Bridge 2011 – June 9-10, Rauma, Finland
Lifelong Learning Programme

C4FF Developing the Future

Identified Deficiencies

1. STCW content – SOS (2005-07)

2. Language Competence – MarTEL (2007-09) (International standards for Maritime English)

3. Automation – SURPASS (2009-11)

4. Emergency situations – M'aider (2009-11)

5. Environment - Clean Diesel (2010-13)

6. Compliance - EMSA

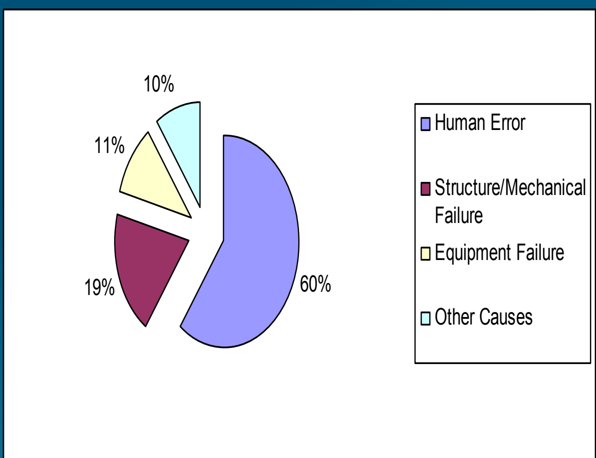
SURPASS

Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Reason for accidents



SAIL AHEAD

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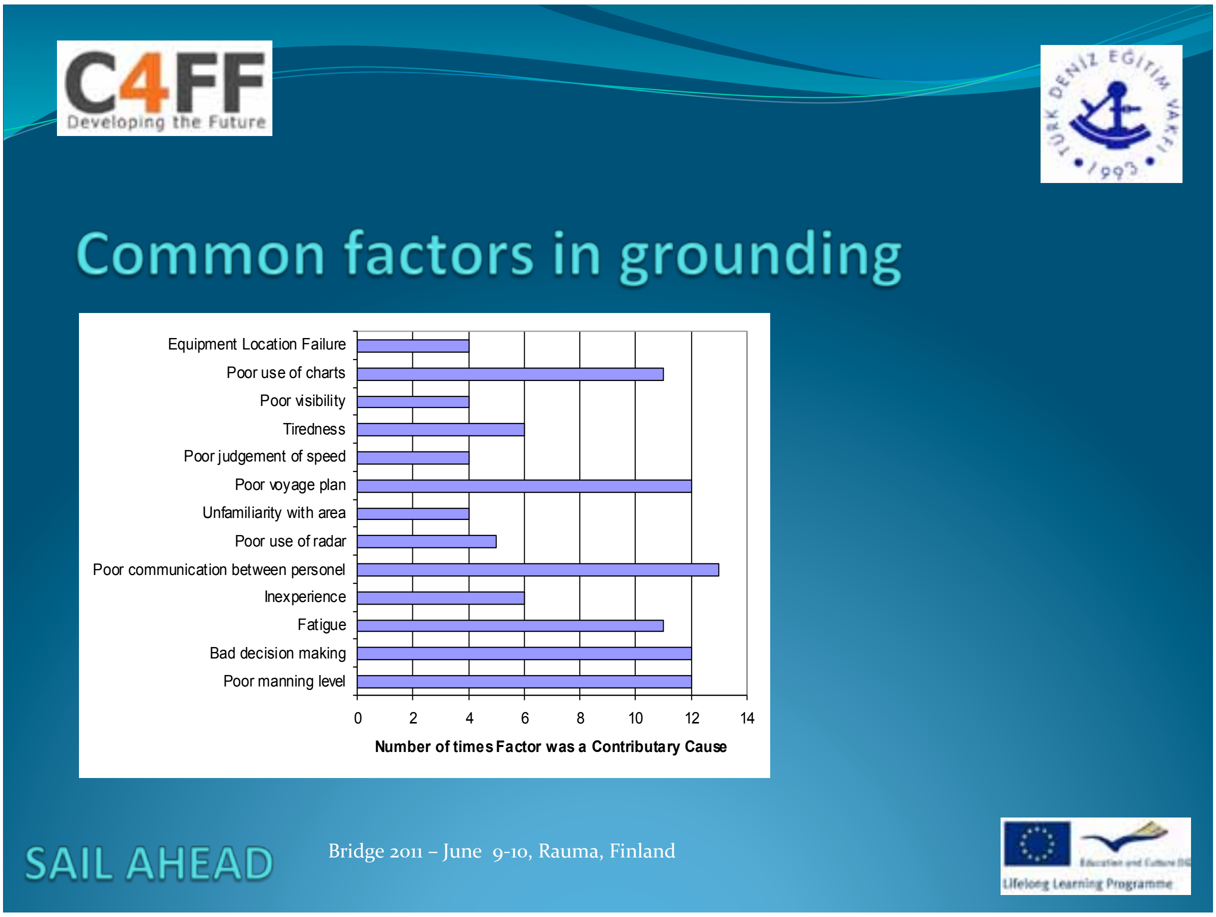
Lifelong Learning Programme


C4FF
Developing the Future
TÜRK DENİZ EĞİTİM VAKFI 1993
Common factors in grounding
Equipment Location Failure
Poor use of charts
Poor visibility
Tiredness
Poor judgement of speed
Poor voyage plan
Unfamiliarity with area
Poor use of radar
Poor communication between personel
Inexperience
Fatigue
Bad decision making
Poor manning level
0 2 4 6 8 10 12 14
Number of times Factor was a Contributary Cause
SAIL AHEAD
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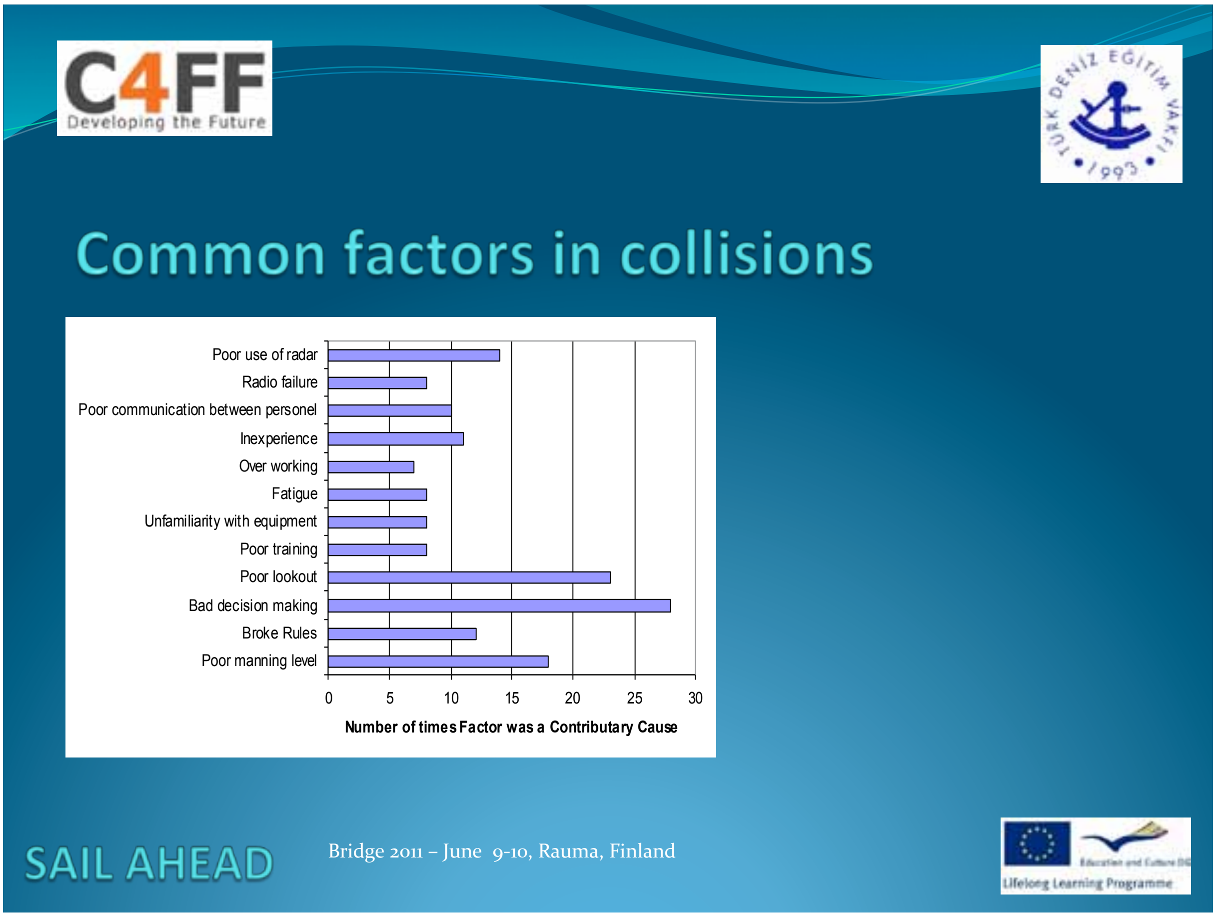
Lifelong Learning Programme


C4FF
Developing the Future
TÜRK DENİZ EĞİTİM VAKFI 1993
Common factors in collisions
Poor use of radar
Radio failure
Poor communication between personel
Inexperience
Over working
Fatigue
Unfamiliarity with equipment
Poor training
Poor lookout
Bad decision making
Broke Rules
Poor manning level
0 5 10 15 20 25 30
Number of times Factor was a Contributary Cause
SAIL AHEAD
Bridge 2011 – June 9-10, Rauma, Finland
Lifelong Learning Programme

C4FF Developing the Future

Surpass Content Development


PROFESSIONAL SHORT COURSE IN:

INSTRUMENTATION AND AUTOMATION CONTROL SYSTEMS IN COMMERCIAL SHIPS

Learning hours: 120 hours

Description of the course:

[A capture from the introduction part]

SAIL AHEAD

Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Scenario Development for full mission simulators

- **Over 300 accident report synopsis were reviewed**
- **Questionnaire developed and the results were reviewed**
- **6 of them were chosen for scenario development**
- **Scenarios are developed to use in full-mission simulators**

[Source : Surpass 2009]

SAIL AHEAD

Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Scenario Development for full mission simulators

Exercise Format
Objective
Subject Area
Initial Conditions
Instructor's Notes
Briefing
Simulation Exercise
De-Briefing
Analysis
Evaluation of training exercise
Conclusion

SAIL AHEAD

Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Scenario Development for e-platform

Over 300 accident report synopsis were reviewed

Questionnaire developed and the results were reviewed

6 of them were chosen for developing scenarios

Scenarios are developed to use in full mission simulators

[Source : Surpass 2009]

SAIL AHEAD

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Lifelong Learning Programme

C4FF Developing the Future

Scenario Development for e-platform

[Development of interactive tests for Surpass course]

SAIL AHEAD Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme

C4FF Developing the Future

Diesel Research

Clean Diesel I

Clean Diesel II

Optimisation

- Variable Geometry Diesel
- Weight Reduction
- System Management
- Lubricants
-High inlet pressures
-High fie Pressures

SAIL AHEAD Bridge 2011 – June 9-10, Rauma, Finland

Lifelong Learning Programme


C4FF
Developing the Future
SURPASS
Thank you for your attention
Prof. Dr. Reza Ziarati
SURPASS
Bridge 2011 – June 9-10, Rauma, Finland
Lifelong Learning Programme

IV Manufacturer'e forum

Welcome to BRIDGE 2011

9th June 2011 Commercial Equipment Bent Mitens

Bridge 2011

KELVIN HUGHES

BRIDGE 2011

AGENDA

- Corporate
- Integrated Navigation Solutions
- MantaDigital Product Line

Bridge 2011

KELVIN HUGHES

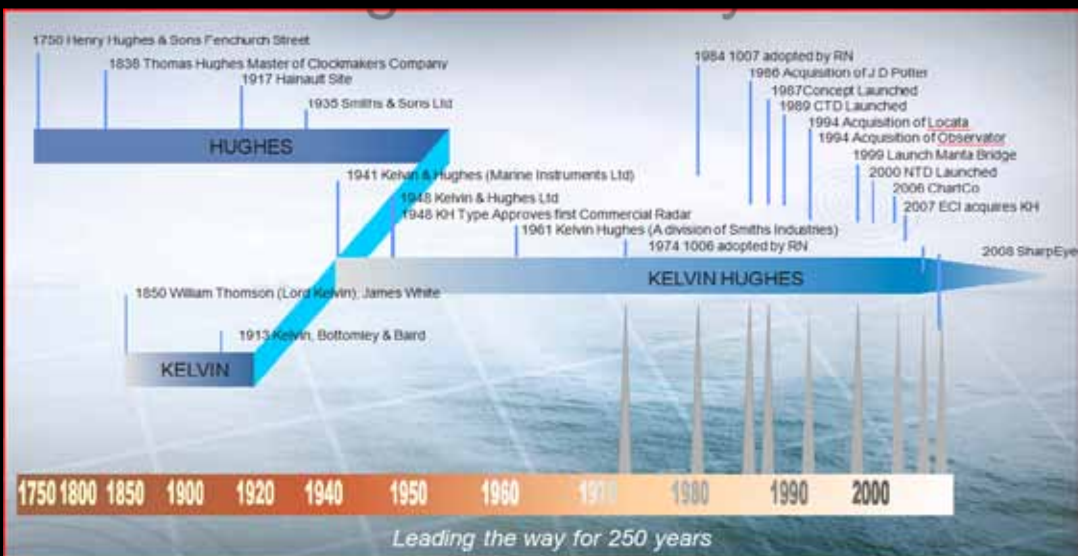
The Founders

Thomas Hughes
Master Clockmaker 1750

William Thompson - Lord Kelvin
1830 - 1907

Bridge 2011

Kelvin Hughes' History



Bridge 2011

Group Activities

World leader in marine data and electronics

- Supplier of navigation electronic solutions to the commercial shipping fleet
- Bespoke integrated solutions to over 30 navies worldwide
- Supplier of high-end surveillance radar systems
- World's leading supplier of nautical charts, publications and associated updates, both electronic and paper

Bridge 2011

KELVIN HUGHES

Consistent Leaders in Innovation

Responsible for many of the industry's key developments

- First commercial radar
- First chart tracing service
- First slotted waveguide array
- First colour widescreen bridge system
- First commercial solid-state radar system
- First global update service

Bridge 2011

KELVIN HUGHES

The Kelvin Hughes Difference

We believe that we have all of the attributes you require of a trusted long term partner

Bridge 2011

KELVIN HUGHES

BRIDGE 2011

INTEGRATED NAVIGATION SOLUTIONS

Bridge 2011

KELVIN HUGHES

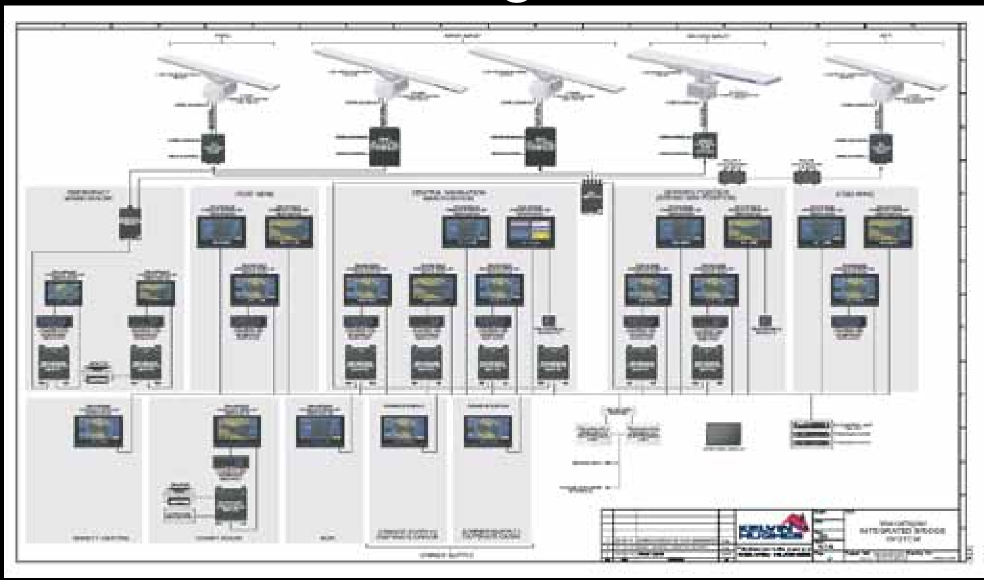
Integrated Navigation Systems

KELVIN HUGHES

Integrated Navigation Systems

KELVIN HUGHES

MantaDigital IBS



Bridge 2011

KELVIN HUGHES

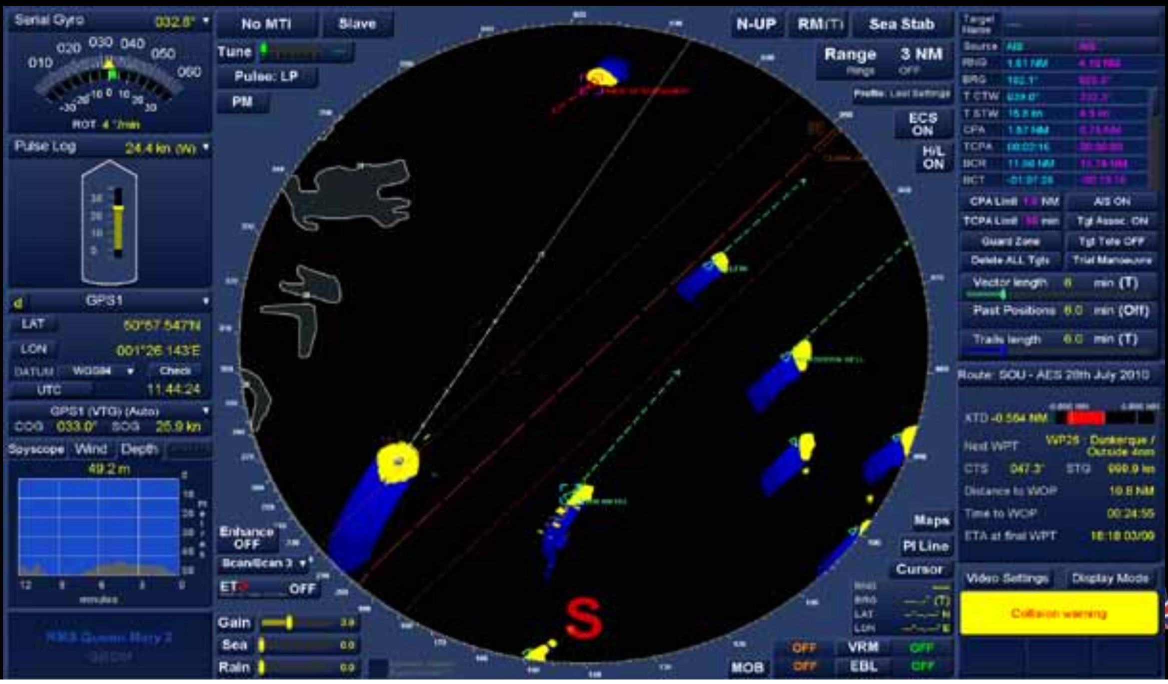
BRIDGE 2011

MantaDigital Product Line

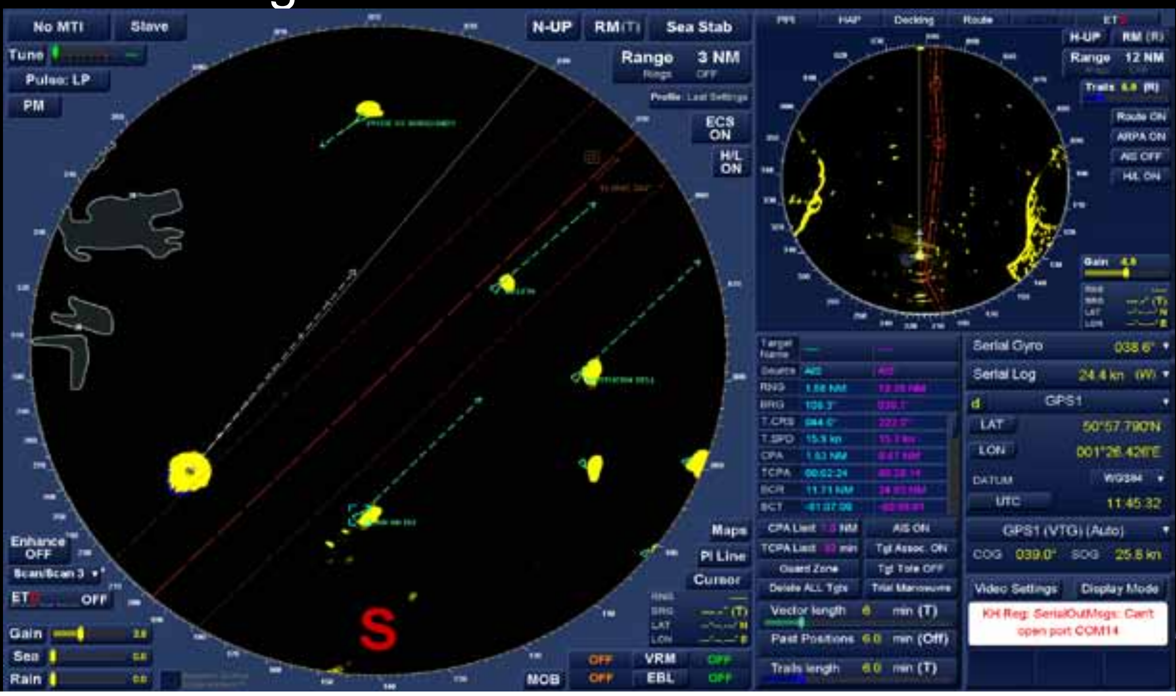
Bridge 2011

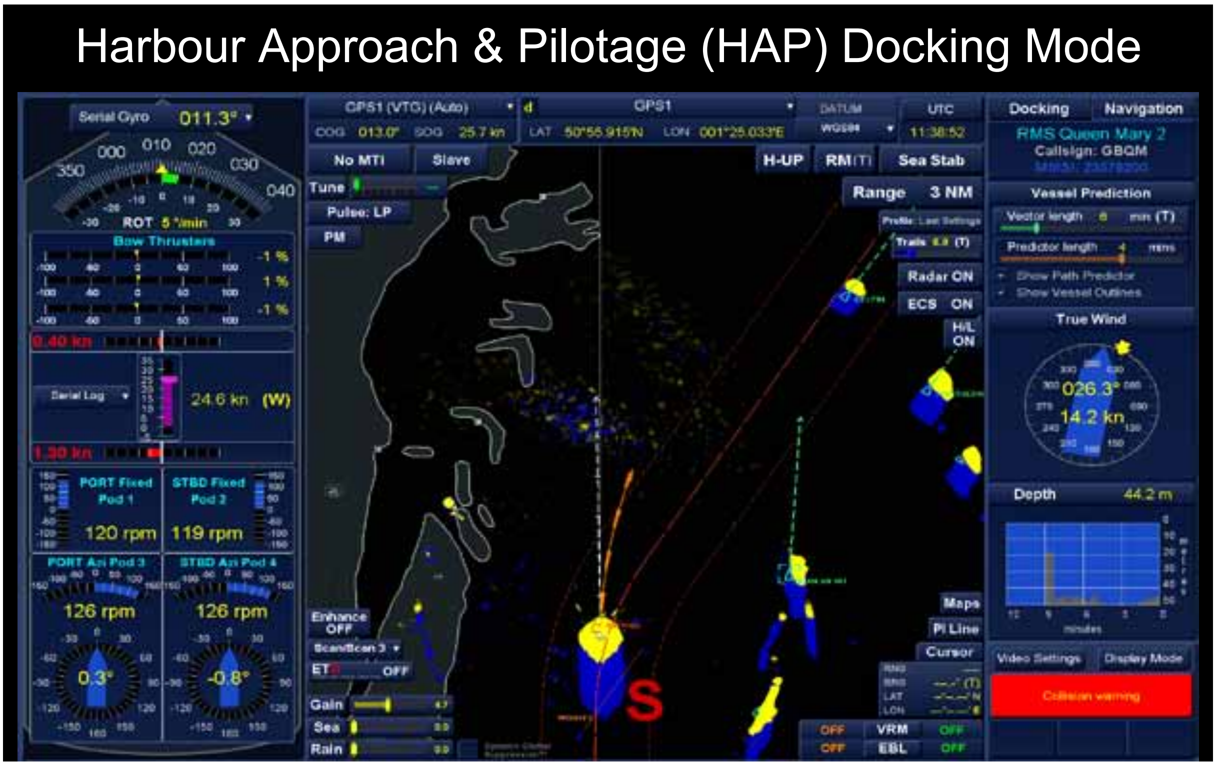
KELVIN HUGHES

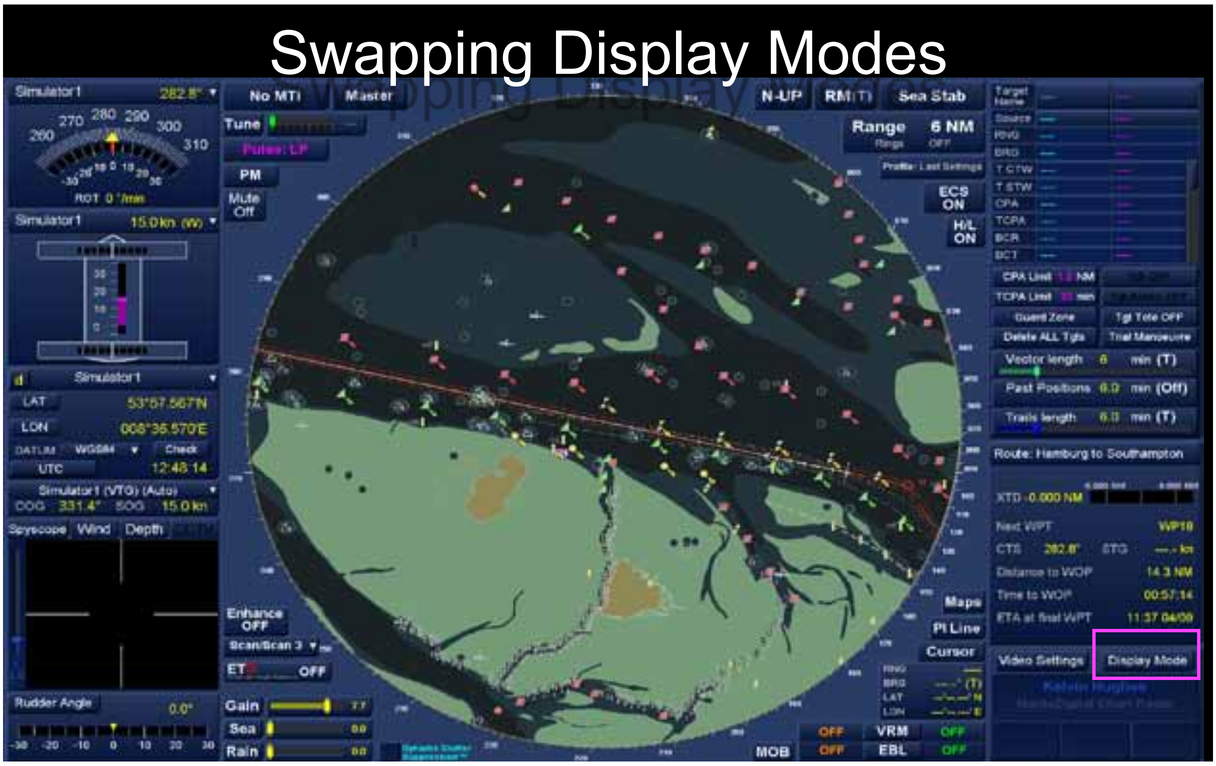
MantaDigital Chart Radar – Single PPI Mode



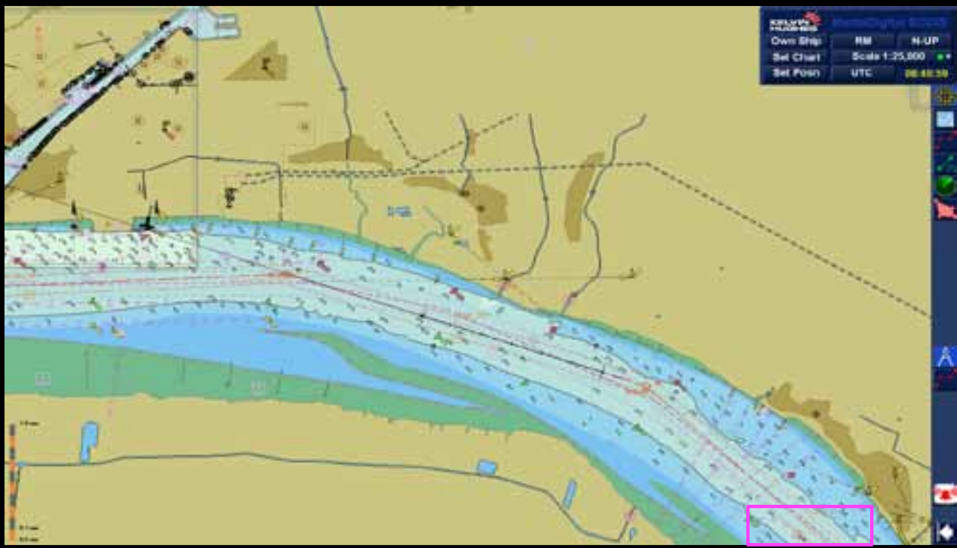
MantaDigital Chart Radar - Dual PPI mode




Harbour Approach & Pilotage (HAP) Docking Mode
Serial Gyro
011.3°
Bow Thrusters
PORT Fixed Pod 1
STBD Fixed Pod 2
120 rpm
119 rpm
PORT Azi Pod 3
STBD Azi Pod 4
126 rpm
126 rpm
No MTI
Slave
H-UP
Sea Stab
Range
3 NM
Radar ON
ECS ON
Docking
Navigation
RMS Queen Mary 2
Callsign: GBQM
Vessel Prediction
True Wind
Depth
44.2 m
Video Settings
Display Mode
Collision warning
Gain
Sea
Rain
VRM
EBL

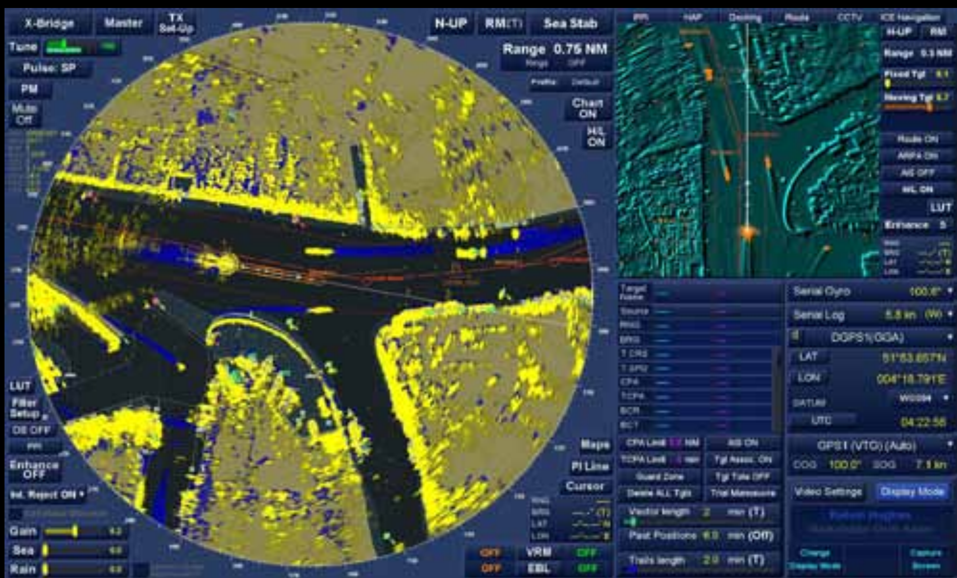

Swapping Display Modes
Simulator1
No MTI
Master
N-UP
Sea Stab
Range
6 NM
ECS ON
H/L ON
Enhance OFF
Maps
PI Line
Cursor
Gain
Sea
Rain
MOB
VRM
EBL
Route: Hamburg to Southampton
Video Settings
Display Mode
Rudder Angle

ECDIS Maximised Chart Area



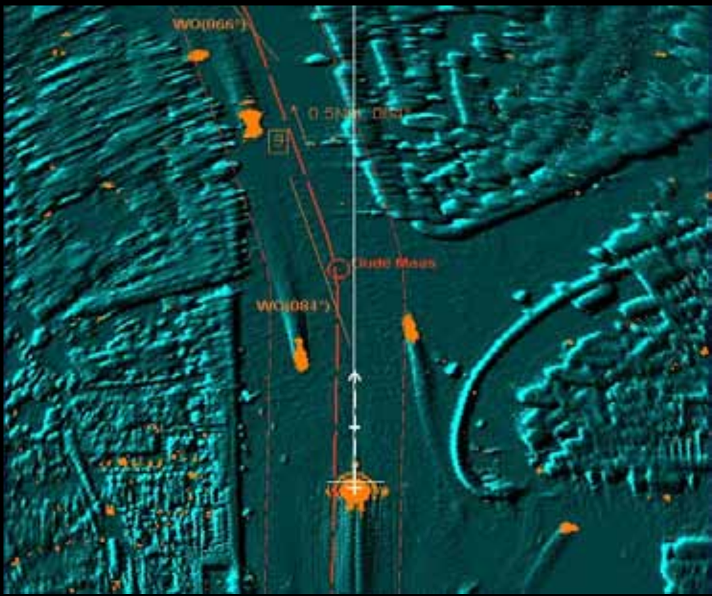
Bridge 2011

ETD in Secondary PPI



Bridge 2011

ETD in Secondary PPI (cont)



Bridge 2011

KELVIN HUGHES

ETD / Ice Mode

Improved Manoeuvrability in Icy Waters

Highlights the safest route

Bridge 2011

KELVIN HUGHES

Success Stories

"This is the best radar I have ever used, I can tell the difference between the waves and the buoys even in bad weather. Navigation is usually very difficult in the West Scheld in bad weather but this radar is amazing!".

Captain Peter den Herder - Swalinge Scheepvaart

Captain Gijs Dijkdrenth, AHTS Blizzard

Bridge 2011

KELVIN HUGHES

SharpEye

World's 1st Solid State Marine Navigation Radar

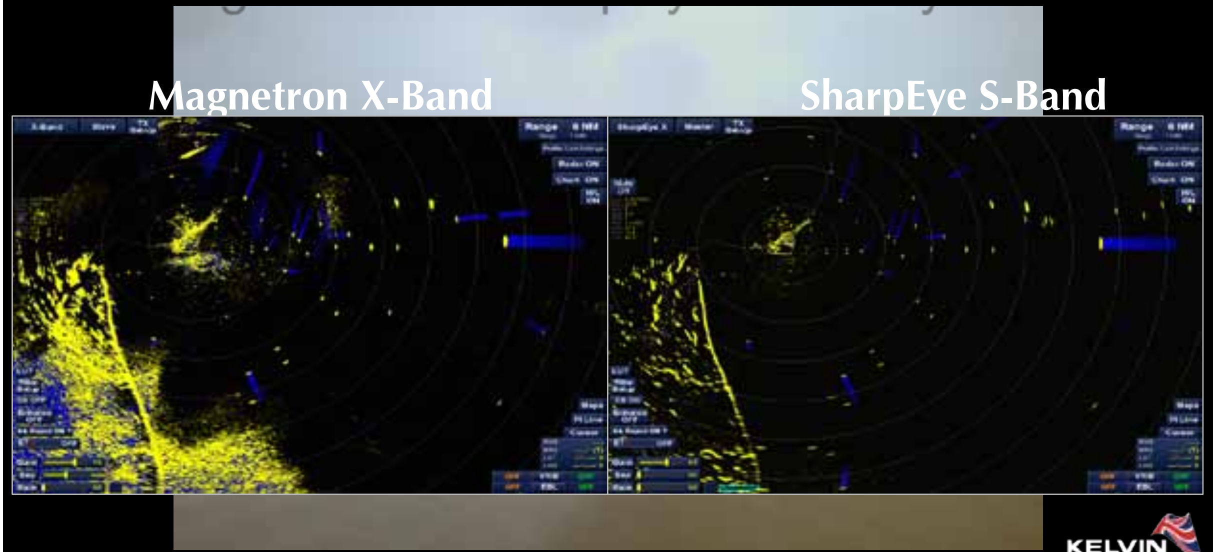
- **Improved performance**
- **Improved reliability**
- **Low maintenance**
- **Low through life cost**

SHARP Eye™

Bridge 2011

KELVIN HUGHES

Comparative performance of Magnetron vs SharpEye in Heavy Rain



Bridge 2011

Summary

- MantaDigital Chart Radar is the **BEST** Radar…
- Multi Display Modes
  - Single PPI, Dual PPI, HAP, ECDIS
- Intuitive User Interface
- Advanced Clutter Reduction & Processing techniques
- Enhanced Target Detection (ETD)
- SharpEye

Bridge 2011

Global Support

9 Kelvin Hughes Service Locations
100+ Service Agents Globally
300+ Trained Engineers

Bridge 2011

KELVIN HUGHES

Why work with Kelvin Hughes ?

We are the best in innovation, reliability and affordability.

We believe that we are ideally placed to work with you.....

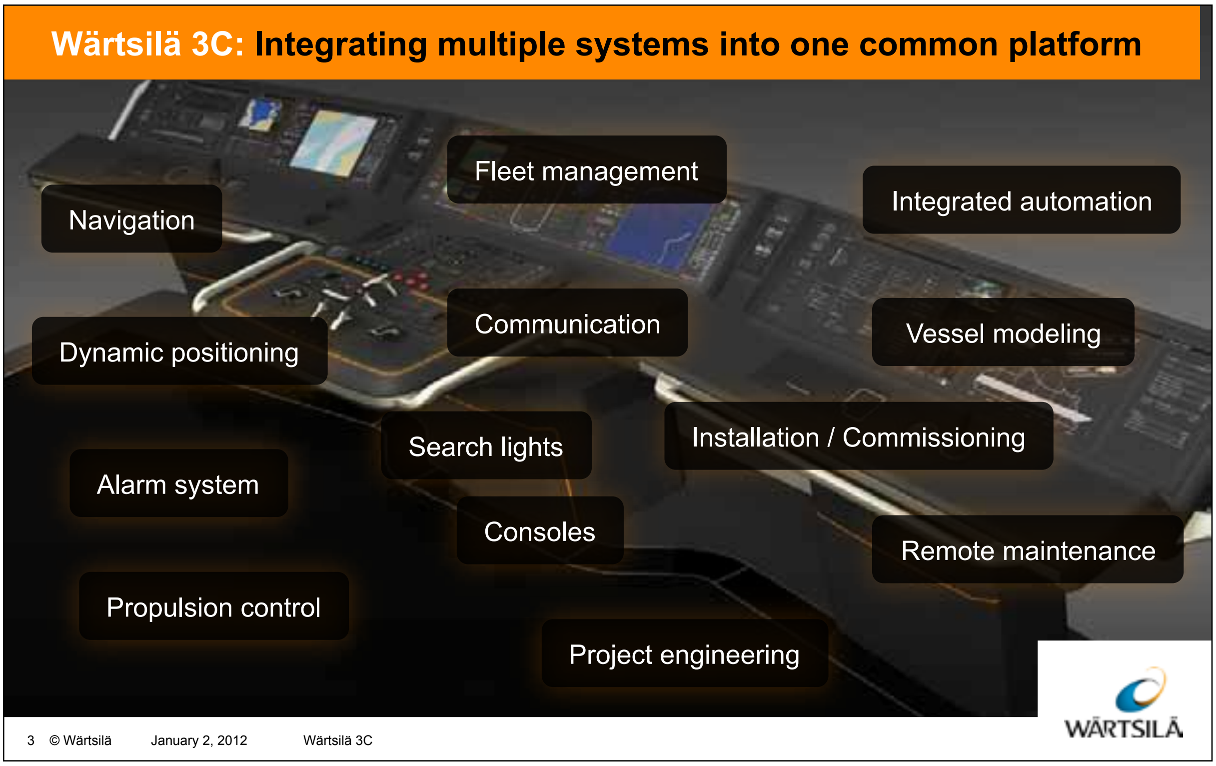
- ✔ We understand your requirements
- ✔ Absolute commitment to the Market
- ✔ A collaborative approach will enable us to provide the best possible solution
- ✔ Excellent radar performance and high level built-in redundancy
- ✔ A belief in, and an eagerness to assist with the implementation of IBS

Bridge 2011

KELVIN HUGHES


WÄRTSILÄ 3C
GATEWAY TO ULTIMATE INTEGRATION
REIJO GRANQVIST
1 © Wärtsilä
January 2, 2012
Ship Power Technology / Reijo Granqvist
WÄRTSILÄ


The marine industry's leading provider of integrated solutions is launching the Wärtsilä Control and Communication Centre: Wärtsilä 3C.
2 © Wärtsilä
January 2, 2012
Wärtsilä 3C
WÄRTSILÄ


Wärtsilä 3C: Integrating multiple systems into one common platform
Navigation
Fleet management
Integrated automation
Dynamic positioning
Communication
Vessel modeling
Search lights
Installation / Commissioning
Alarm system
Consoles
Remote maintenance
Propulsion control
Project engineering
WÄRTSILÄ
3 © Wärtsilä January 2, 2012 Wärtsilä 3C


Wärtsilä 3C – Scope of Supply
Navigation System
Dynamic Positioning
System Integration
✓ INS (Integrated Navigation System)
✓ IAS (Integrated Automation System)
✓ AMS (Alarm Monitoring System)
✓ PCS (Propulsion Control System)
✓ PMS (Power Management System)
Consoles
Project Engineering
Fleet management
Additional Systems according to specification
• Search Lights
• CCTV
• Etc.
"Plug & Play"
WÄRTSILÄ
4 © Wärtsilä January 2, 2012 Wärtsilä 3C

Wärtsilä 3C Changing the market

- This decade can be considered the most chaotic in the history of the maritime industry.
- The key market drivers for the future will be:
- Environmentally friendly, fuel strategies
- Optimized vessel and energy management systems
- Integrated solutions
- Wärtsilä has taken the pole position in total system integration providing additional value by innovative solutions and life cycle services.

WÄRTSILÄ

Energy Management aproach

- Current navigation system offerings are not fully-integrated with machinery controls, preventing ship owners/operators from realizing the maximum benefits of an optimized energy management approach.
- The Wärtsilä 3C will be a key enabler to leverage energy management and integrated navigation solutions

Wärtsilä positioned for global leadership in optimized power management!

7 © Wärtsilä January 2, 2012 Wärtsilä 3C

WÄRTSILÄ

Wärtsilä 3C Strategy

- Wärtsilä's EL & Automation strategy supports an Integrated Bridge Platform 3C to develop a competitive all in one solution by a total integration package.
- Wärtsilä's current market position for engines and propulsion equipment provides leverage and credibility to move into full scope EL & Automation supply.

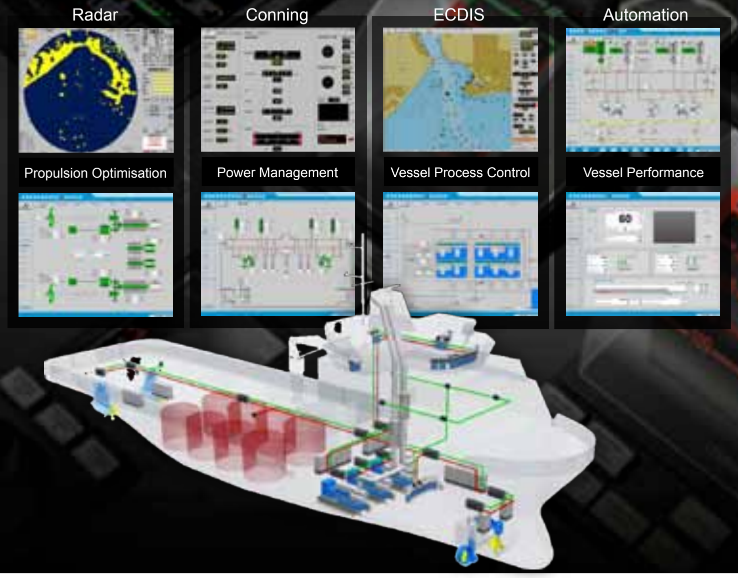
Wärtsilä 3C concept fully in-line with EL & Automation strategy

8 © Wärtsilä January 2, 2012 Wärtsilä 3C

WÄRTSILÄ

Wärtsilä 3C Enhanced data exchange

Control & Communication Center = **3C**



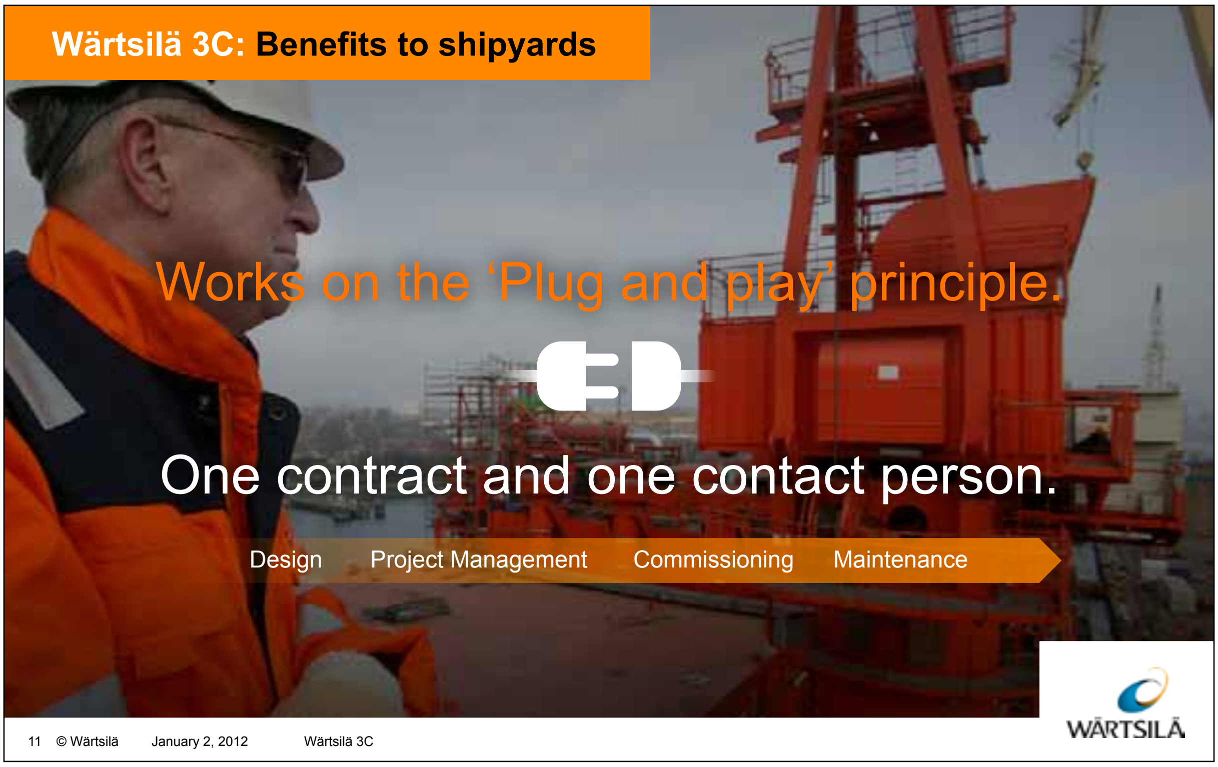
- Navigation
- Automation
- Propulsion
- Power
- Performance
- Efficiency
- Environment
- Safety

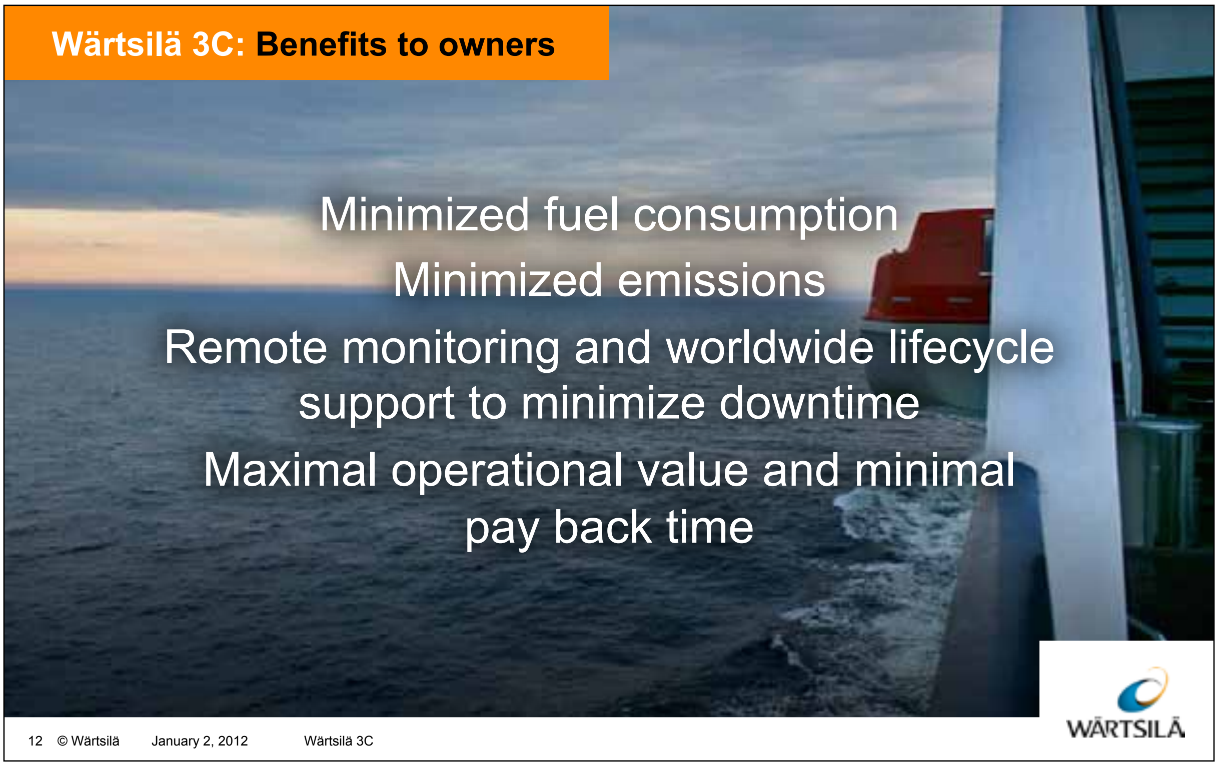
WÄRTSILÄ

3-C User friendly controls

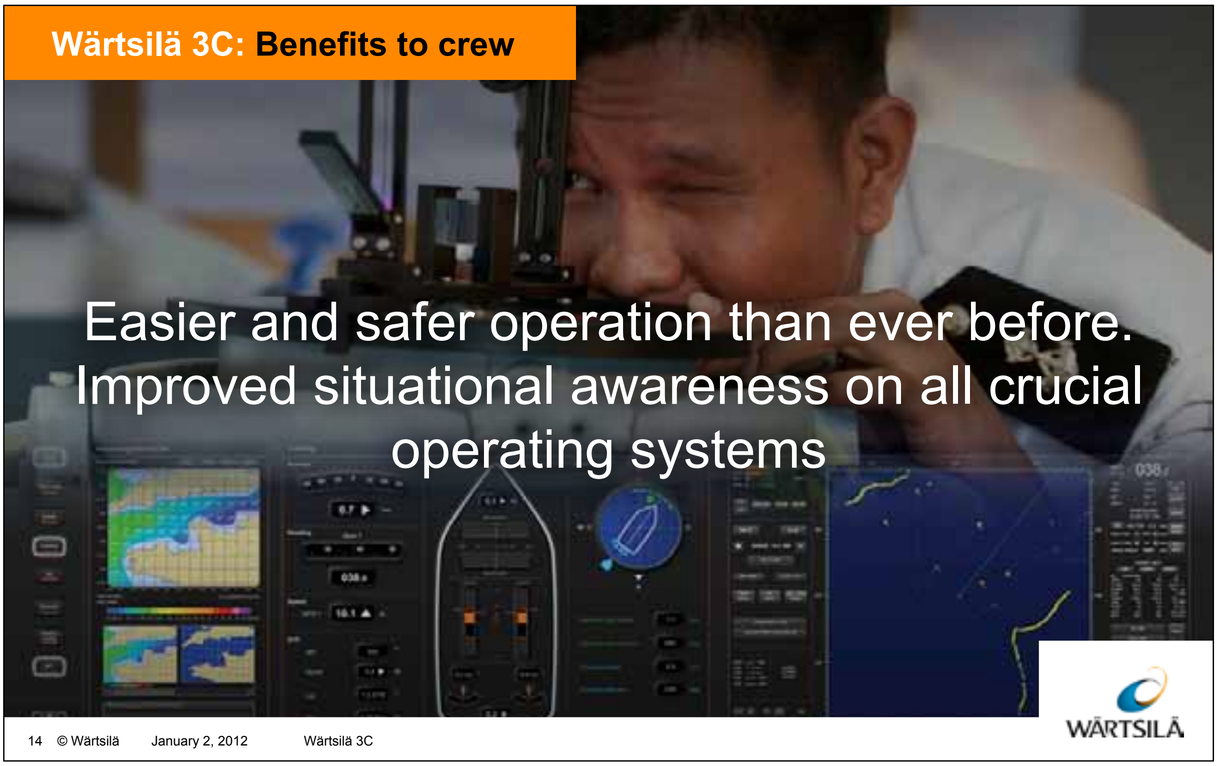
- Control and monitoring devices and their arrangements onboard are becoming increasingly complex and their final location and positioning are not always the best possible due to limited space.
- Wärtsilä has foreseen this problem with an innovative new panel design that provides user friendly environment to achieve optimum performance with enhanced safety and decision support.

WÄRTSILÄ

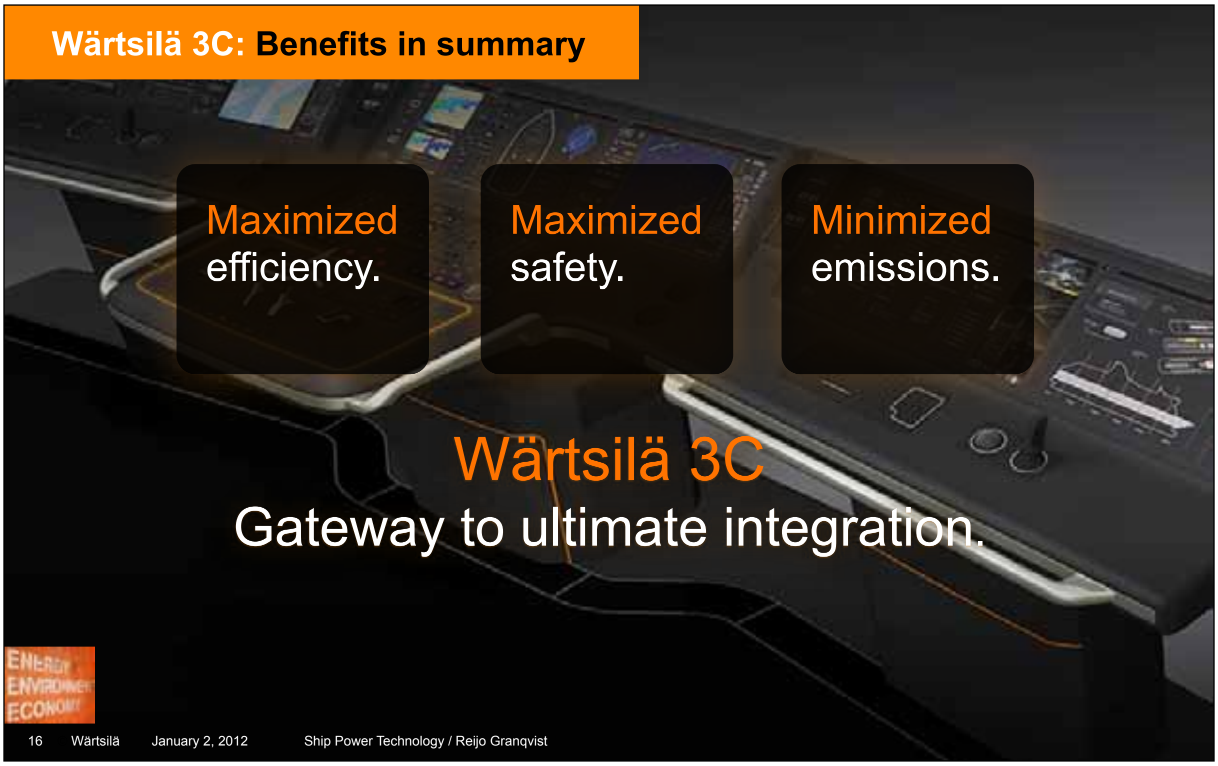

Wärtsilä 3C: Benefits to shipyards
Works on the 'Plug and play' principle.
One contract and one contact person.
Design
Project Management
Commissioning
Maintenance
WÄRTSILÄ
11 © Wärtsilä January 2, 2012 Wärtsilä 3C


Wärtsilä 3C: Benefits to owners
Minimized fuel consumption
Minimized emissions
Remote monitoring and worldwide lifecycle support to minimize downtime
Maximal operational value and minimal pay back time
WÄRTSILÄ
12 © Wärtsilä January 2, 2012 Wärtsilä 3C


Wärtsilä 3C: Benefits to environment
Minimized emissions and maximized safety.
Derived from combining optimized fuel efficiency and route planning with risk avoidance.
13 © Wärtsilä January 2, 2012 Wärtsilä 3C
WÄRTSILÄ


Wärtsilä 3C: Benefits to crew
Easier and safer operation than ever before.
Improved situational awareness on all crucial operating systems
14 © Wärtsilä January 2, 2012 Wärtsilä 3C
WÄRTSILÄ


Benefits to Ship Yards and Owners
Ship Yards
Owners
Project Execution
• Optimized interfacing
• Full scope responsibility
• Reduced yard oversight
Reduced Risk
• Fewer delays/penalties
• Works right first time
• Proven partnerships
Integration
• Single source supply
• Fewer Components
• Simplified installation
Wärtsilä 3C
Safety
• Vessel modeling
• Propulsion control
• Advanced conning (combined automation + navigation)
Ergonomics
• Integrated controls
• Multi-function interface
• Dynamic Positioning integration
Performance
• Fleet management
• Remote maintenance
• Vessel routing
WÄRTSILÄ
15 © Wärtsilä January 2, 2012 Wärtsilä 3C


Wärtsilä 3C: Benefits in summary
Maximized efficiency.
Maximized safety.
Minimized emissions.
Wärtsilä 3C
Gateway to ultimate integration.
16 Wärtsilä January 2, 2012 Ship Power Technology / Reijo Granqvist


Thank you
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www.wartsila.com
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Business Sales Manager 3C
+47 47451003
More information from
eirik.holm@wartsila.com
ONE WAY
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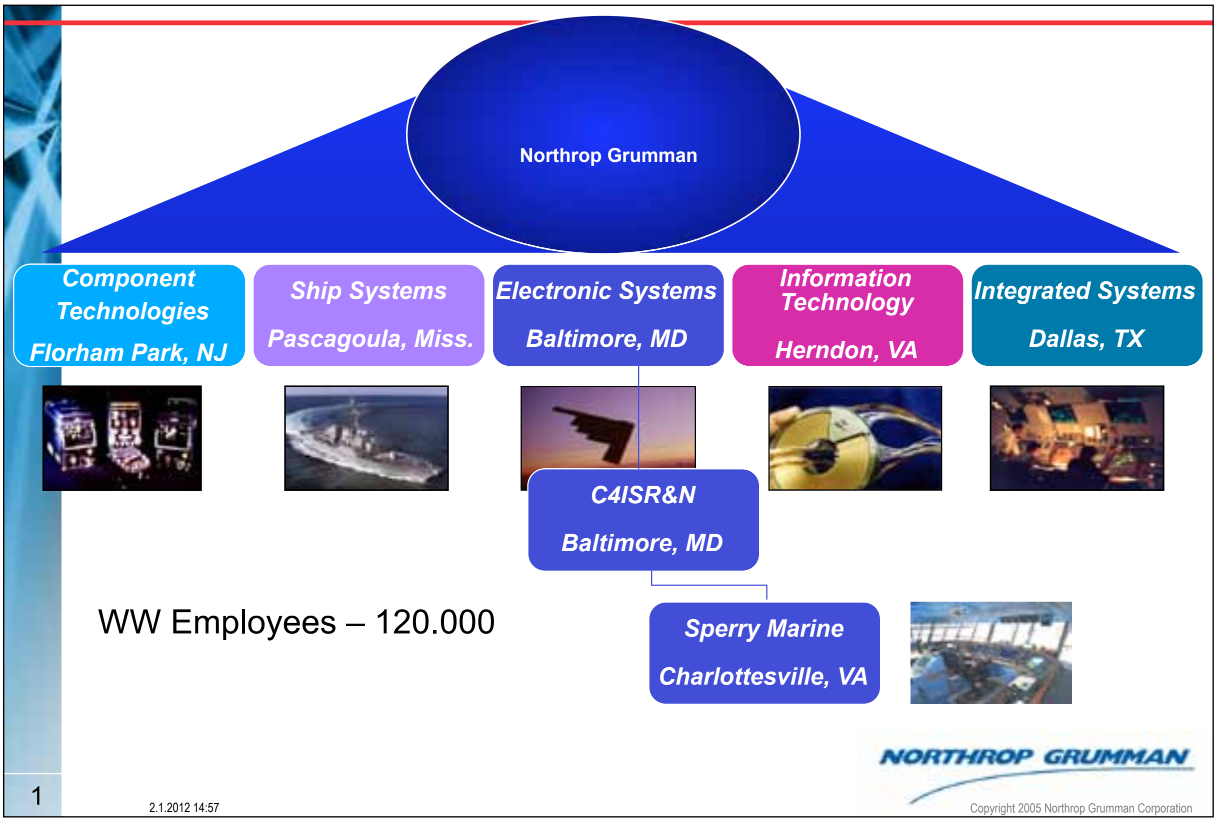
WÄRTSILÄ


Northrop Grumman
Component Technologies
Florham Park, NJ
Ship Systems
Pascagoula, Miss.
Electronic Systems
Baltimore, MD
Information Technology
Herndon, VA
Integrated Systems
Dallas, TX
C4ISR&N
Baltimore, MD
WW Employees – 120.000
Sperry Marine
Charlottesville, VA
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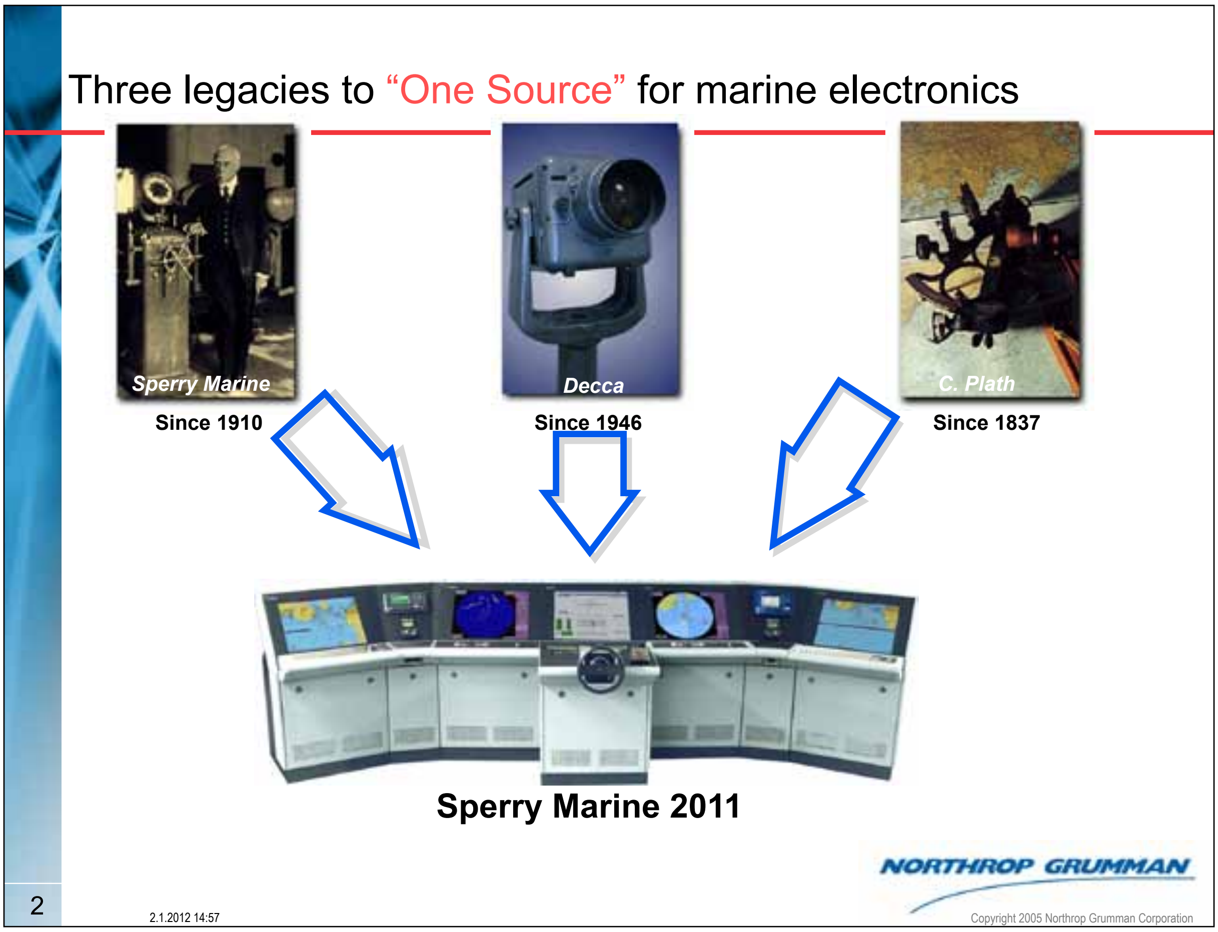
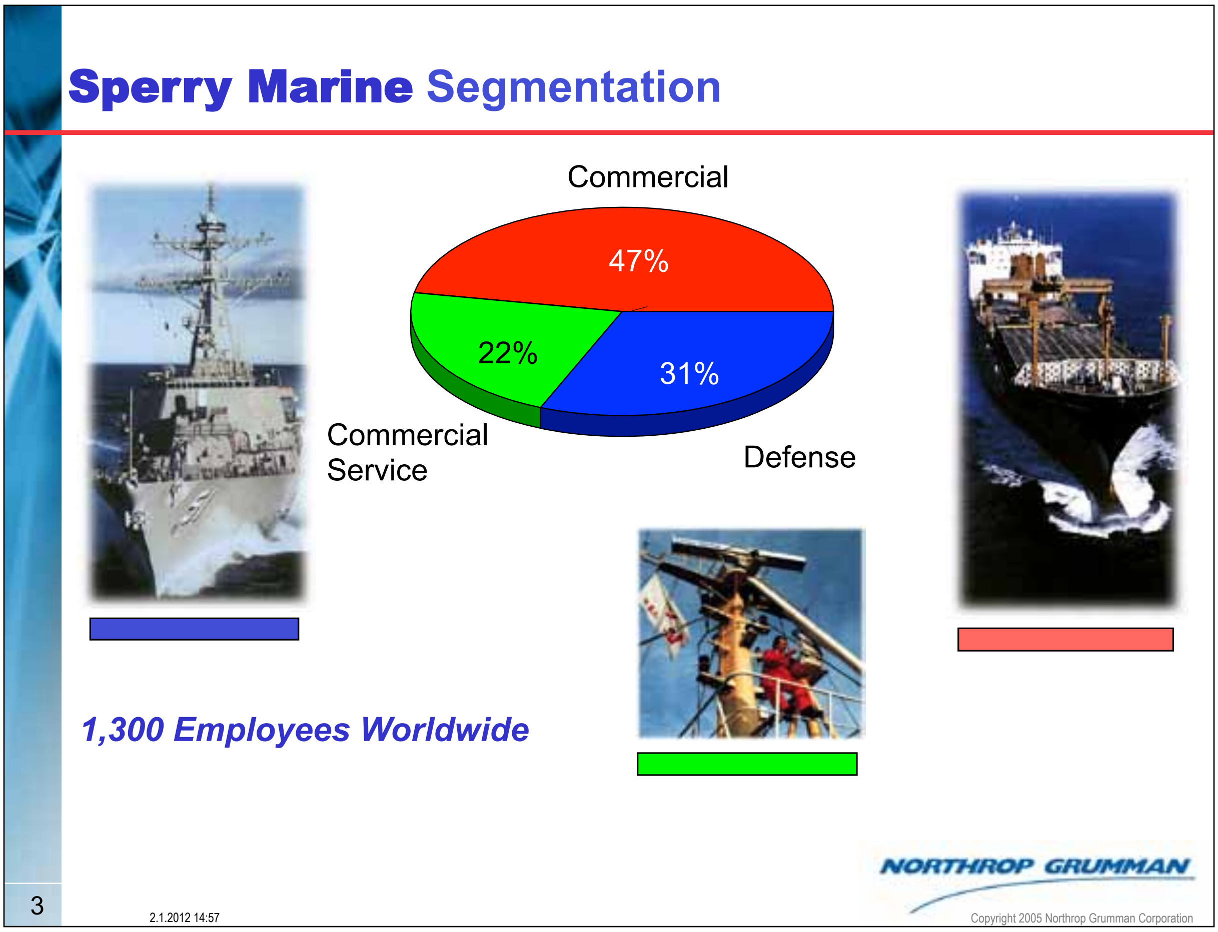
1
2.1.2012 14:57


Three legacies to “One Source” for marine electronics
Sperry Marine
Since 1910
Decca
Since 1946
C. Plath
Since 1837
Sperry Marine 2011
NORTHROP GRUMMAN
Copyright 2005 Northrop Grumman Corporation
2
2.1.2012 14:57


Sperry Marine Segmentation
Commercial
47%
22%
31%
Commercial Service
Defense
1,300 Employees Worldwide
NORTHROP GRUMMAN
3
2.1.2012 14:57
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Integrated Bridge System - Commercial Applications
Sperry Marine
RCCI - Freedom of the Seas
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Sperry Marine Commercial Business Portfolio
SYSTEMS
VISIONMASTER FT Integrated Bridge
ECDIS
Machinery Control
Ship Stabilizers
Vessel Traffic & Coastal Surveillance
Voyage Data Recorder
PRODUCTS
Radar
Gyrocompasses/
Autopilot
Steering Control Systems
Speed Log
Comm/Nav Sensors
CUSTOMER SERVICE
Global Coverage
Repair
Spares
PBL
Performance Based Logistics
Training
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VisionMaster FT WideView Series
VisionMaster FT ARPA Radar
VisionMaster FT Chart Radar
VisionMaster FT ECDIS
VisionMaster FT Multi Function Workstation
VisionMaster FT WideView Integrated Bridge
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6
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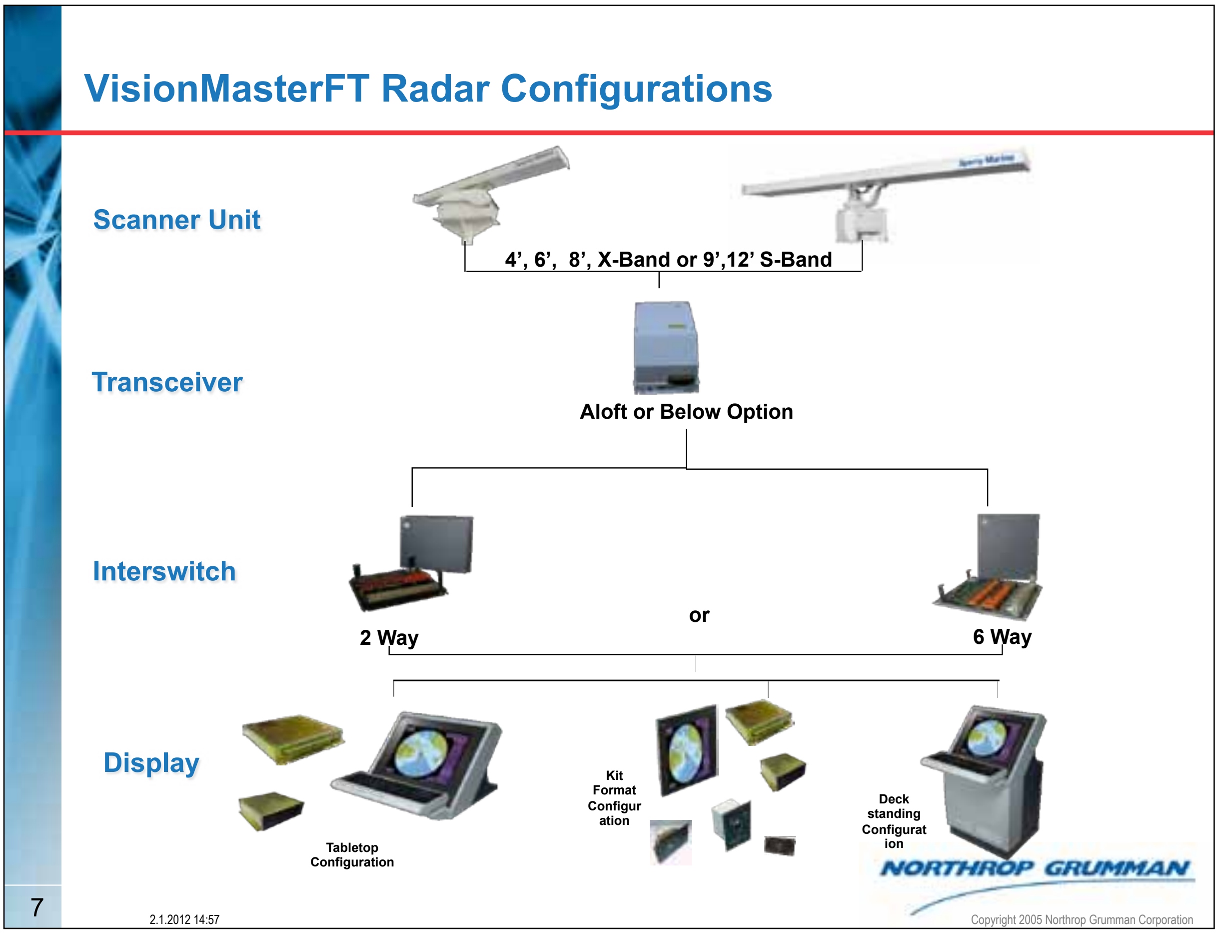
VisionMasterFT Radar Configurations
Scanner Unit
4', 6', 8', X-Band or 9',12' S-Band
Transceiver
Aloft or Below Option
Interswitch
2 Way
or
6 Way
Display
Tabletop Configuration
Kit Format Configuration
Deck standing Configuration
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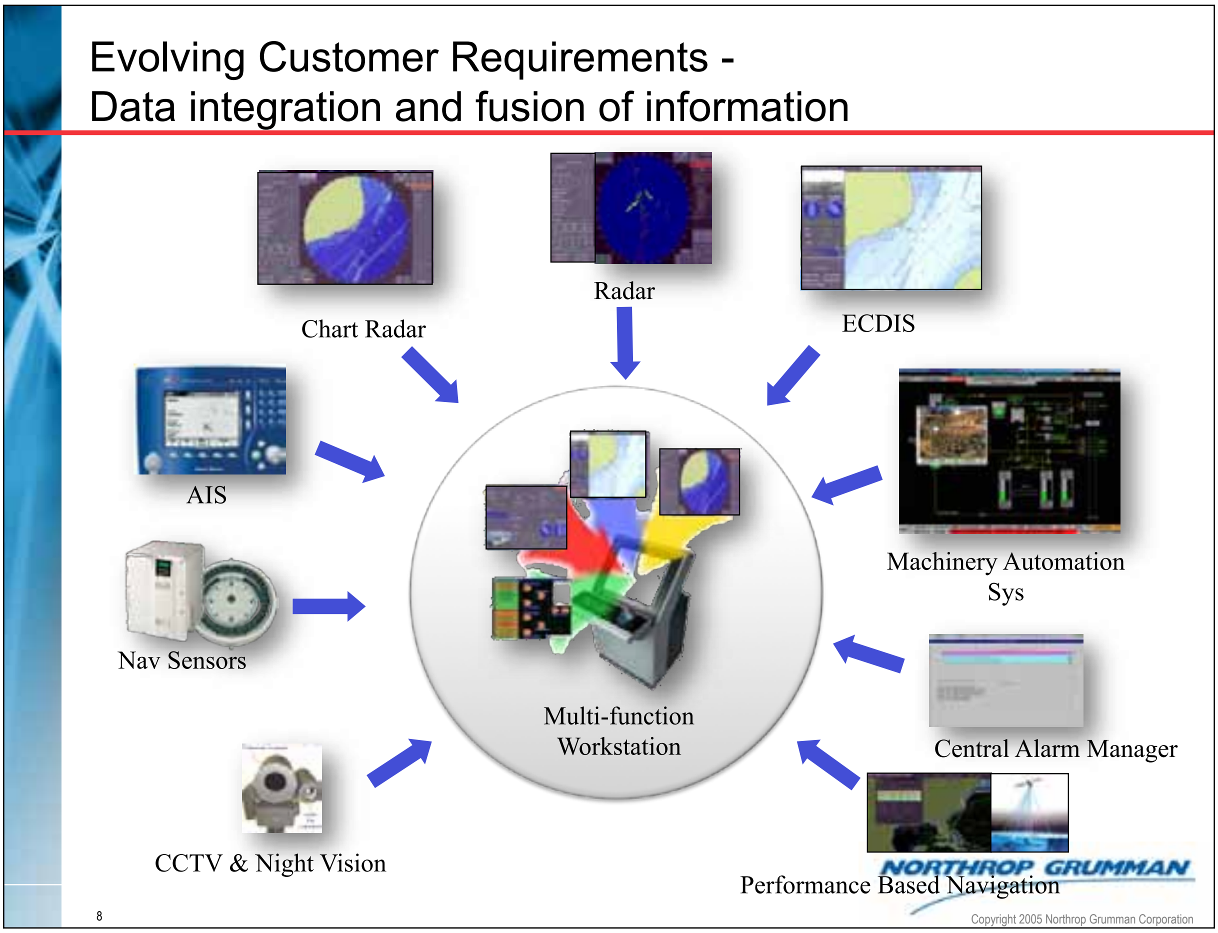
Evolving Customer Requirements -
Data integration and fusion of information
Chart Radar
Radar
ECDIS
AIS
Machinery Automation Sys
Nav Sensors
Multi-function Workstation
Central Alarm Manager
CCTV & Night Vision
Performance Based Navigation
NORTHROP GRUMMAN
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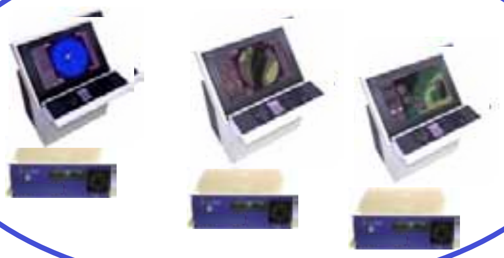
VisionMaster FT WideView Series
Benefits from Common hardware / Network

COMMON INSTALLATION & COMMISSIONING

REDUCED TRAINING NEEDS

COMMON DIAGNOSTICS TRAINING

SHARED SENSOR DATA



REDUNDANCY

COMMON SPARES ACROSS ALL PRODUCTS

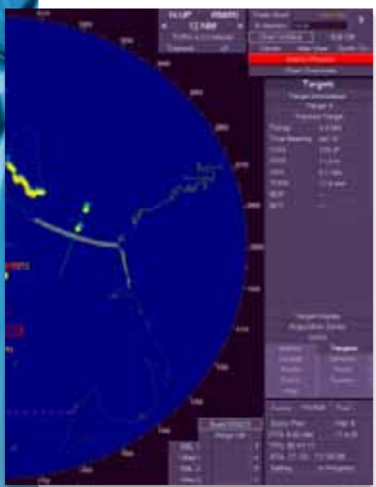
COMMONALITY OF INSTALLATION DRAWINGS

COMMON UPGRADE PATHS

SHARED TARGET & ROUTE PLANS ACROSS RADAR & ECDIS

9

VisionMaster FT WideView Series Common User Interface



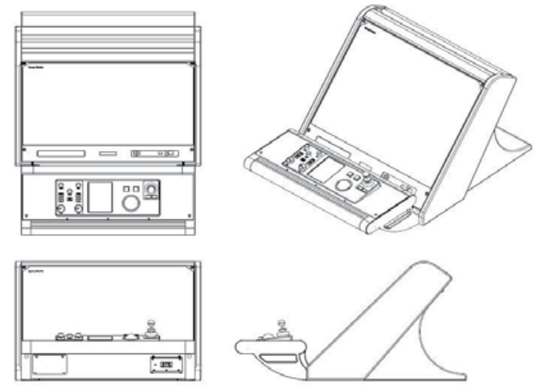
VisionMaster FT Radar

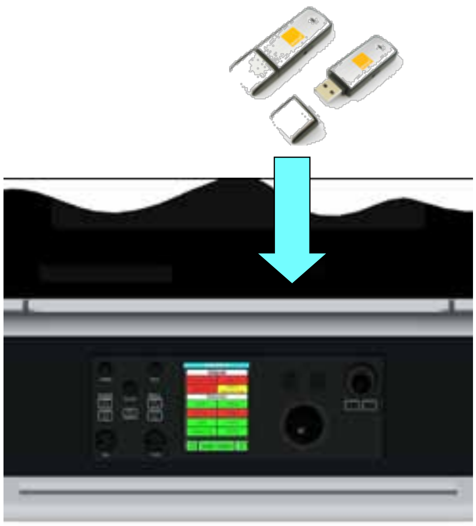
VisionMaster FT Chart Radar

VisionMaster FT ECDIS

10

VISIONMASTER FT Series – Advanced Control Panel





11

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VisionMaster FT Series
Radar / ARPA Highlights

- New innovative user interface with commonality VisionMaster products
- Multi View / Operator Selectable Conning Information Display
- Interactive Advanced tracker performance in clutter
- Target tracking capability of 100 ARPA and 200 AIS targets
- Advanced target correlation with tracked ARPA and AIS targets
- Operator selection of target views (ARPA only or ARPA/AIS)
- Integrated voyage plan and radar maps
- Automatic transfer of target data and voyage plan to
- VisionMaster ECDIS and / or TotalWatch Workstation
- User savable settings and removal storage media (USB flash drive)
- Innovative context sensitive iHelp facility – Cursor, Standard and Advanced (browser) modes
- Extensive diagnostics capability. Sensor integrity checking for improved fault detection & safety
- Playback Module
- Built-in upgrade path to Chart Radar, ECDIS and TotalWatch Workstation
- Backwards compatibility with legacy BME & VMS products

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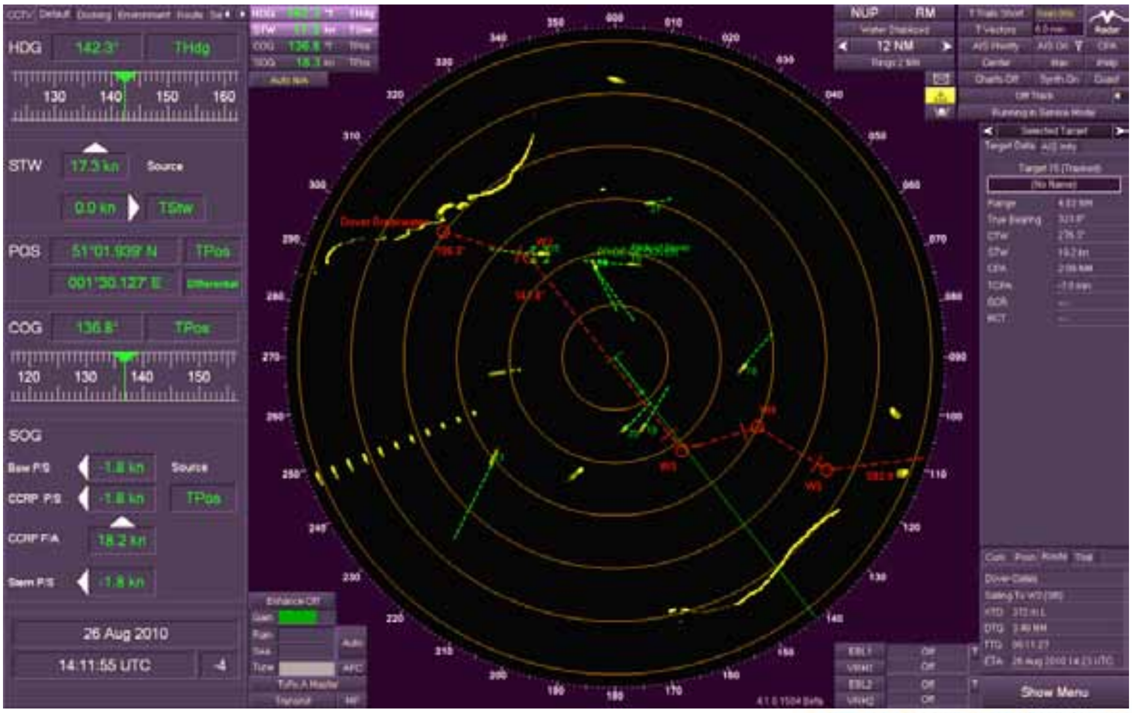
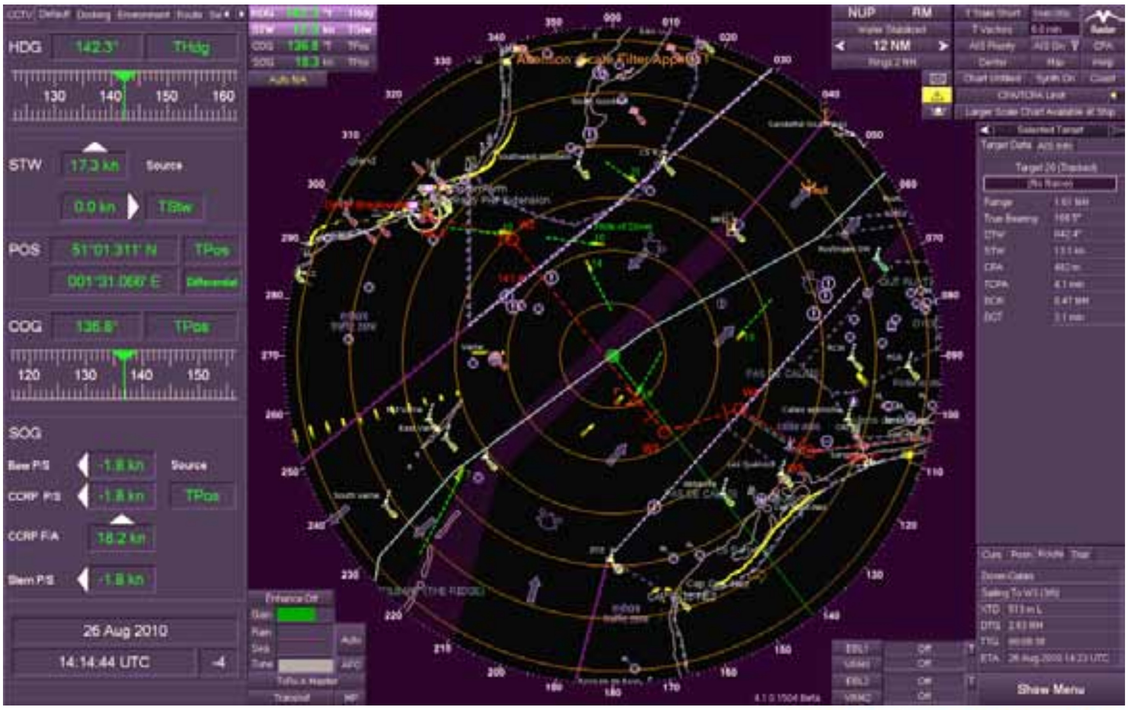
12

VisionMaster FT Series
Radar / ARPA



13

VisionMaster FT Series –
Chart Radar – Unfilled w/ CID – Basic View



15

VisionMaster FT Series – Chart Radar Highlights

- Baseline features of VisionMaster FT Radar
- Complies with Chart Radar Standard
- Built-in DVD reader for electronic charts
- Superimposition of voyage plan graphics
- Displays official ENC (S57 & S63) and C Map (ENC & CM93)
- Operator selection of Radar or Chart Radar modes
- In Chart Radar mode, operator control of electronic chart density
  - Low (Base)
  - Medium (Standard)
  - High (Custom)
- Built-in upgrade to ECDIS and TotalWatch Workstation
- Playback Module (Optional)

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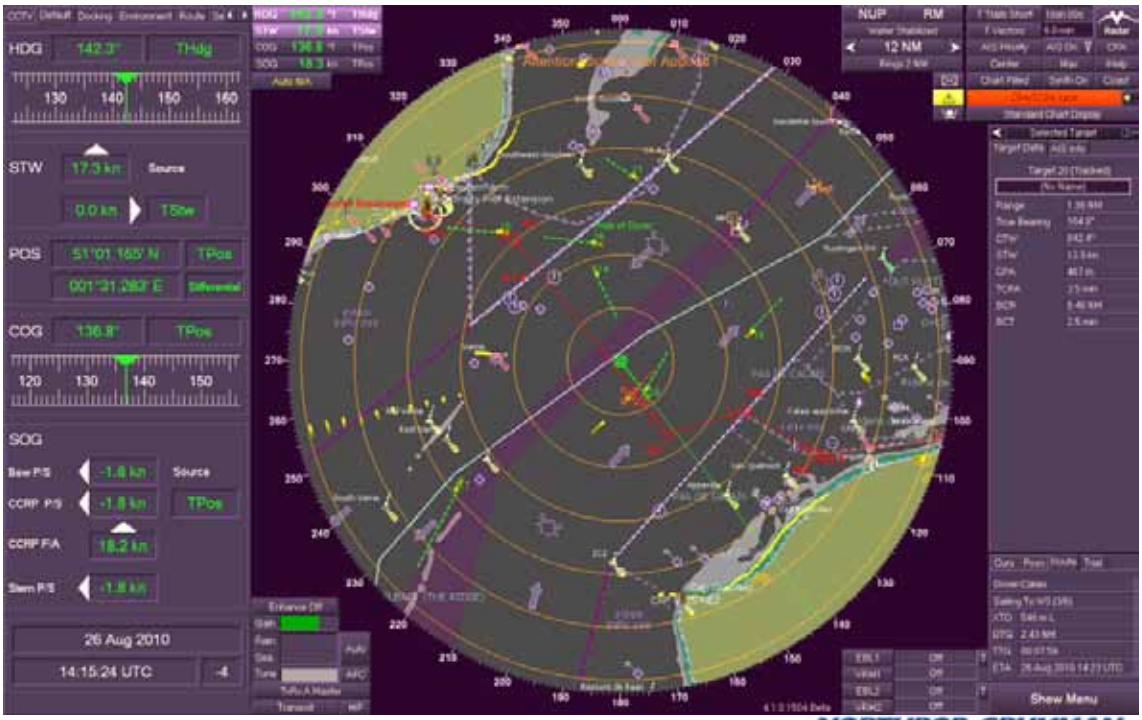
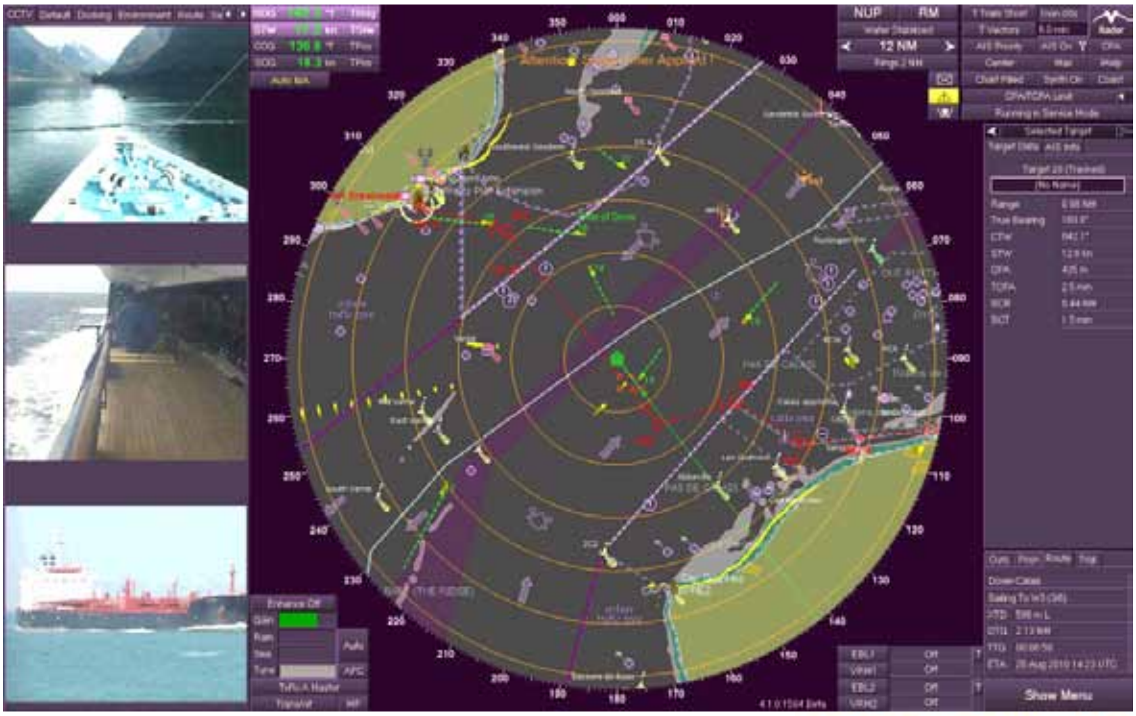
VisionMaster FT Series – Chart Radar: Filled w/ CID – Basic View



NORTHROP GRUMMAN

VisionMaster FT Series – Chart Radar: Filled w/ CCTV CID View



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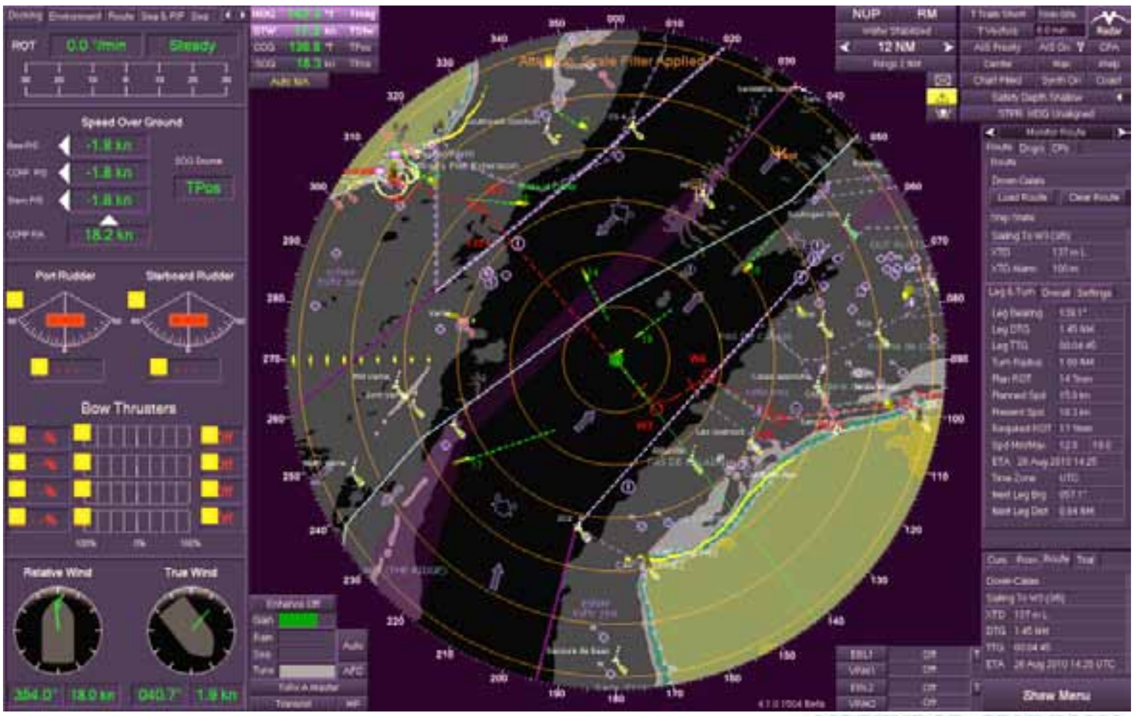
17

VisionMaster FT WideView Series – Chart Radar: Filled w/ CID – Docking View



NORTHROP GRUMMAN

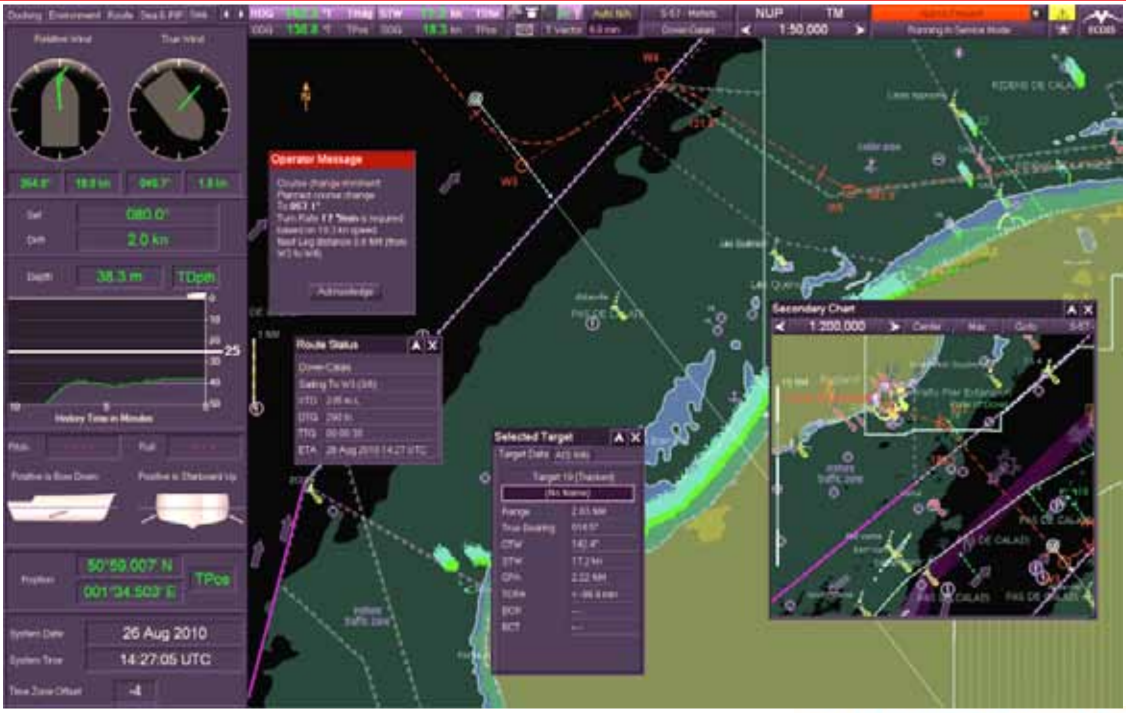
18

VisionMaster FT
ECDIS Highlights

- Innovative user interface with commonality with other VisionMaster products
- Multi View / Operator Selectable Conning Information Display
- Direct target tracking (built in ARPA facility)
- Operator movable system menu controls with hide facility
- Advanced track-keeping module
- Chart portfolio management and voyage planning capability
- Split screen (vertical & horizontal) and Picture in Picture display modes
- Multiple Conning Information Display Pages
- User-Defined Chart Additions
- Data Logging and Playback
- Powerful options
    - Central Alarm Manager
    - Playback Module
    - i3DView
    - Performance Based Navigation
    - Trim Module

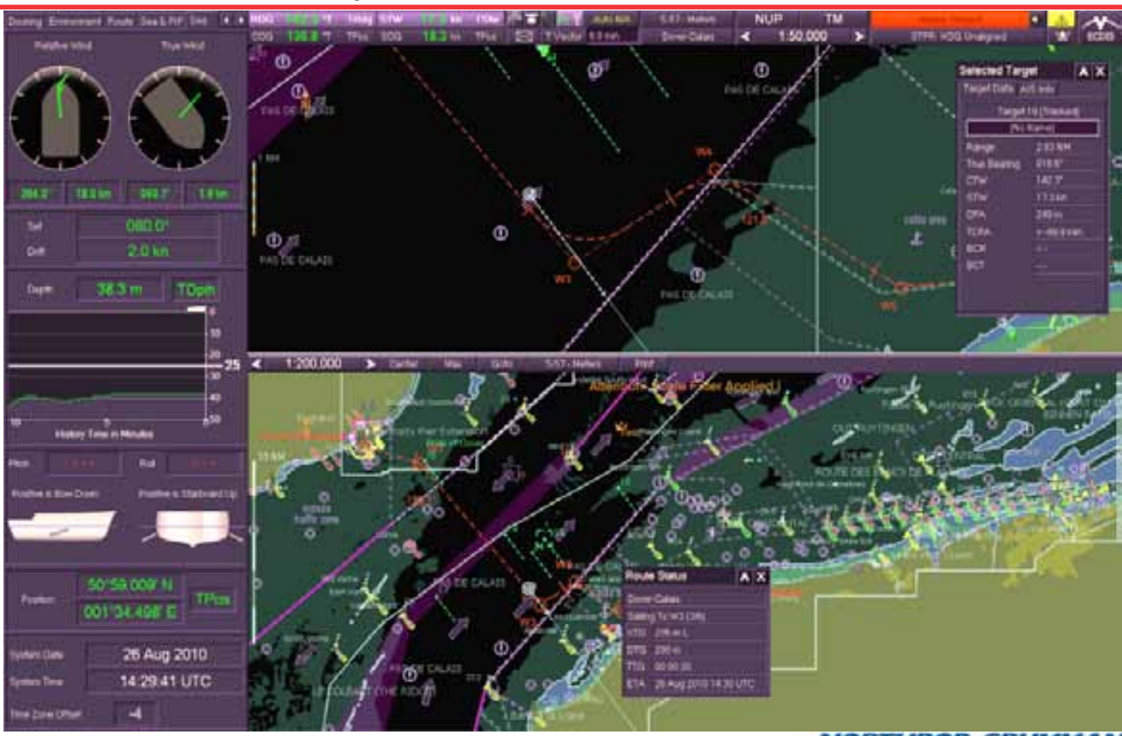
NORTHROP GRUMMAN

VisionMaster FT ECDIS –
With Movable Windows & Picture in Picture Feature



NORTHROP GRUMMAN

VisionMaster FT ECDIS – With Horizontal Split Screen



21

VisionMaster FT ECDIS – With Vertical Spilt Screen

22

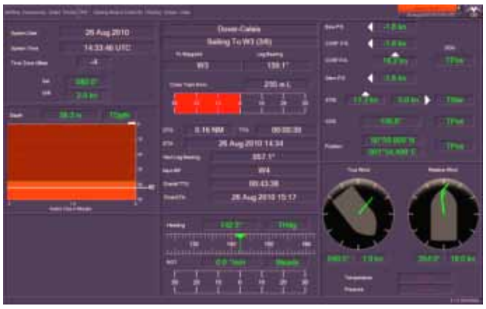
VisionMaster FT ECDIS –
With Horizontal Split Screen & CID – CCTV View

NORTHROP GRUMMAN

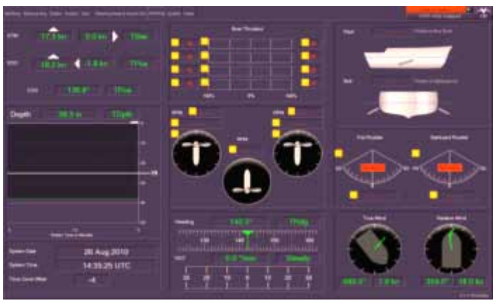
23

VisionMaster FT - Conning Information Display w/ Selectable Viewing Pages

Routes Mode



Sea Mode



Steering Mode

Autopilot Mode

NORTHROP GRUMMAN

24

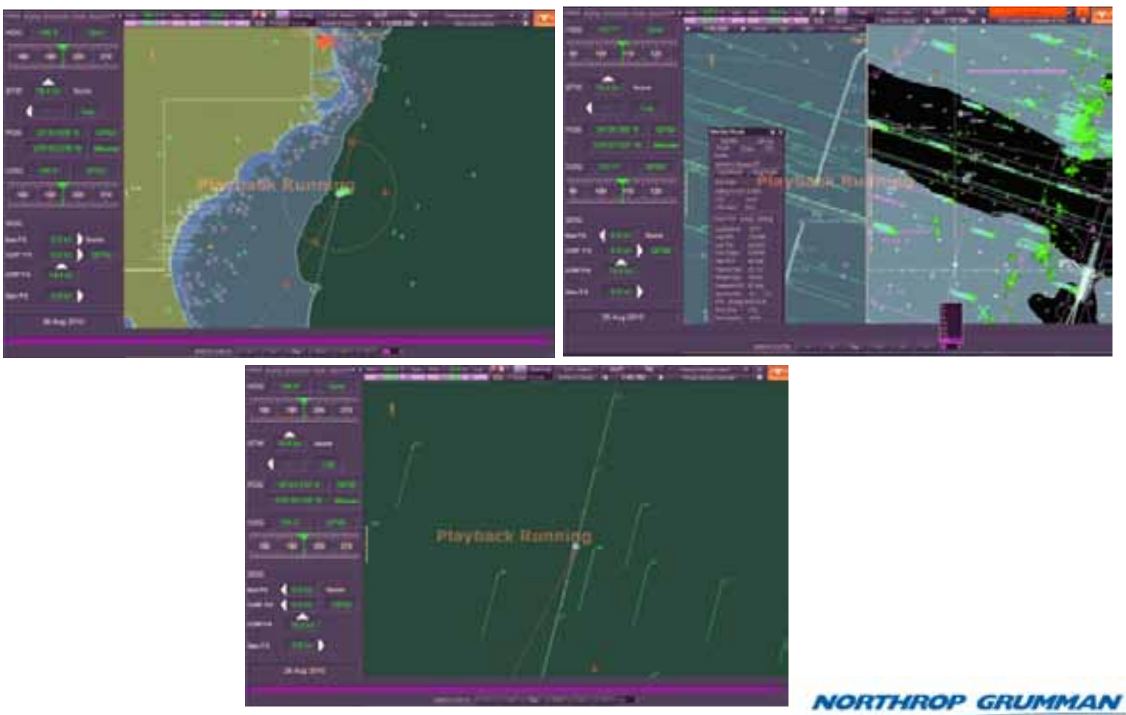
VisionMaster FT Series –
Record & Playback Feature Highlights

- Record
  - Comprehensive default screen capture facility (x = 1 frame / 2 sec)
  - Basic recording memory 8-12 hours
  - Expandable storage via USB connection
- Playback
  - Activation via through mode selection
  - Operator selectable playback speeds (1X,2X,4X,20X,50X,100X)
  - Playback timeline bar with complete functionality (start, stop, point, etc.)
  - Files exportable via USB for onshore review at VMFT Workstation
- Benefits
  - Minimum training via easy to use menu’s
  - Excellent onboard tool for training and incident review

NORTHROP GRUMMAN

25

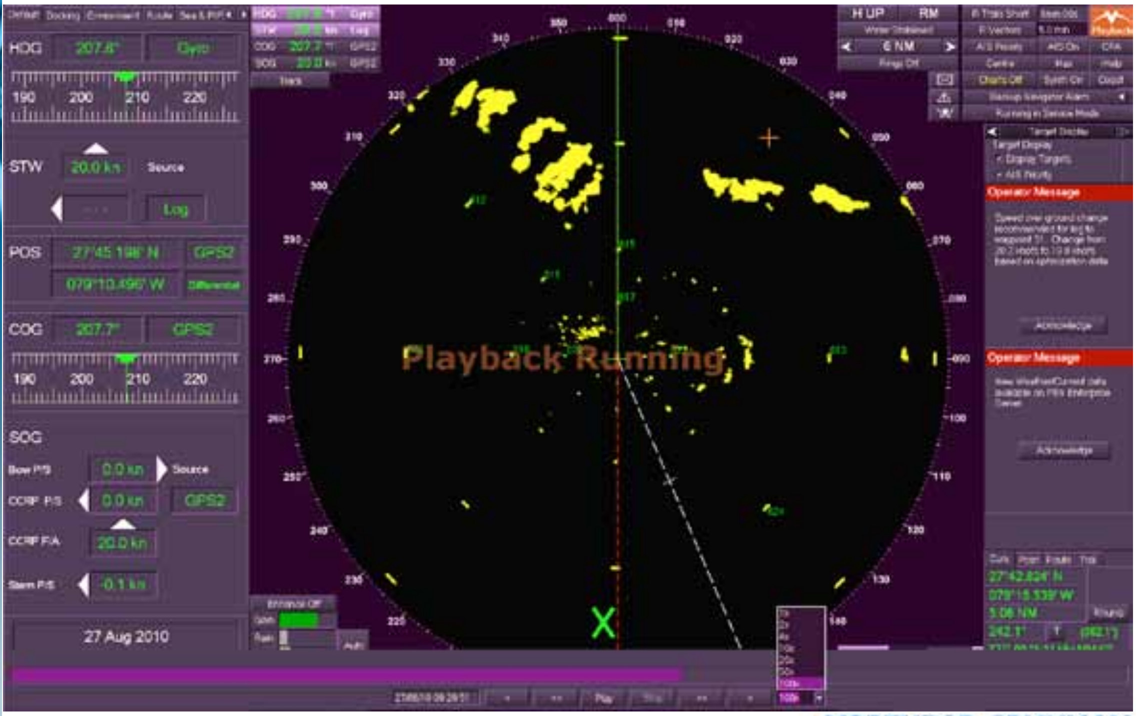
VisionMaster FT – Playback Feature



NORTHROP GRUMMAN

26

VisionMaster FT – Playback Feature



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2.1

27

VisionMaster FT Series
Dual Channel Radar Highlights (Optional)

Problem: Blind Arcs & Blanked Sectors

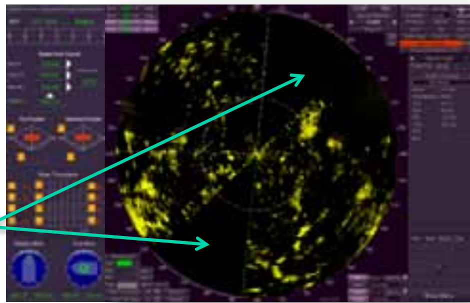
- No radar or ARPA information from the blind arcs or blanked sectors
- Poor situation awareness and vulnerability

Solution: **Dual Channel Radar**

Highlights

- Two independent asynchronous radars displayed on a single screen
- Two independent VisionMaster FT radars controlled from a single screen
- Seamless operator view from two radar heads
- Targets seamlessly tracked across the two radars
- Virtually no limit to the separation of the radar heads

Sector Blanked Areas



Note: The clutter has been enhanced to make it easier to see the sector blanked areas

Independent Gain, Rain and Sea Clutter control

Independent Tuning Control

Channel 1
Channel 2

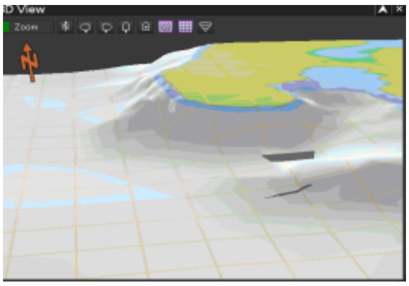
Transceiver Control

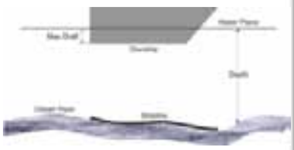
NORTHROP GRUMMAN

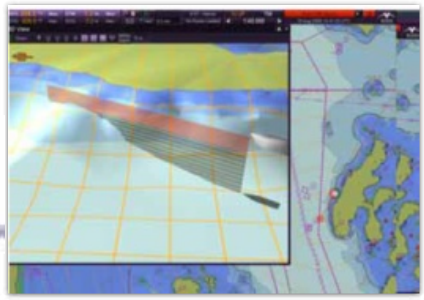
28

VisionMaster FT – ECDIS w/ iView3D Display (Optional)

- iView3D Display
  - Additional aid to navigation that improves situational awareness
  - Multi color 3D representation of ocean floor is produced from S57 chart data
  - Lighting effects used to emphasis changes in ocean floor depths
  - Simple user controls to change 3D perspective, zoom and ownship orientation
  - Red translucent vertical rectangle shows operator selected safety depth







Oasis of the Seas

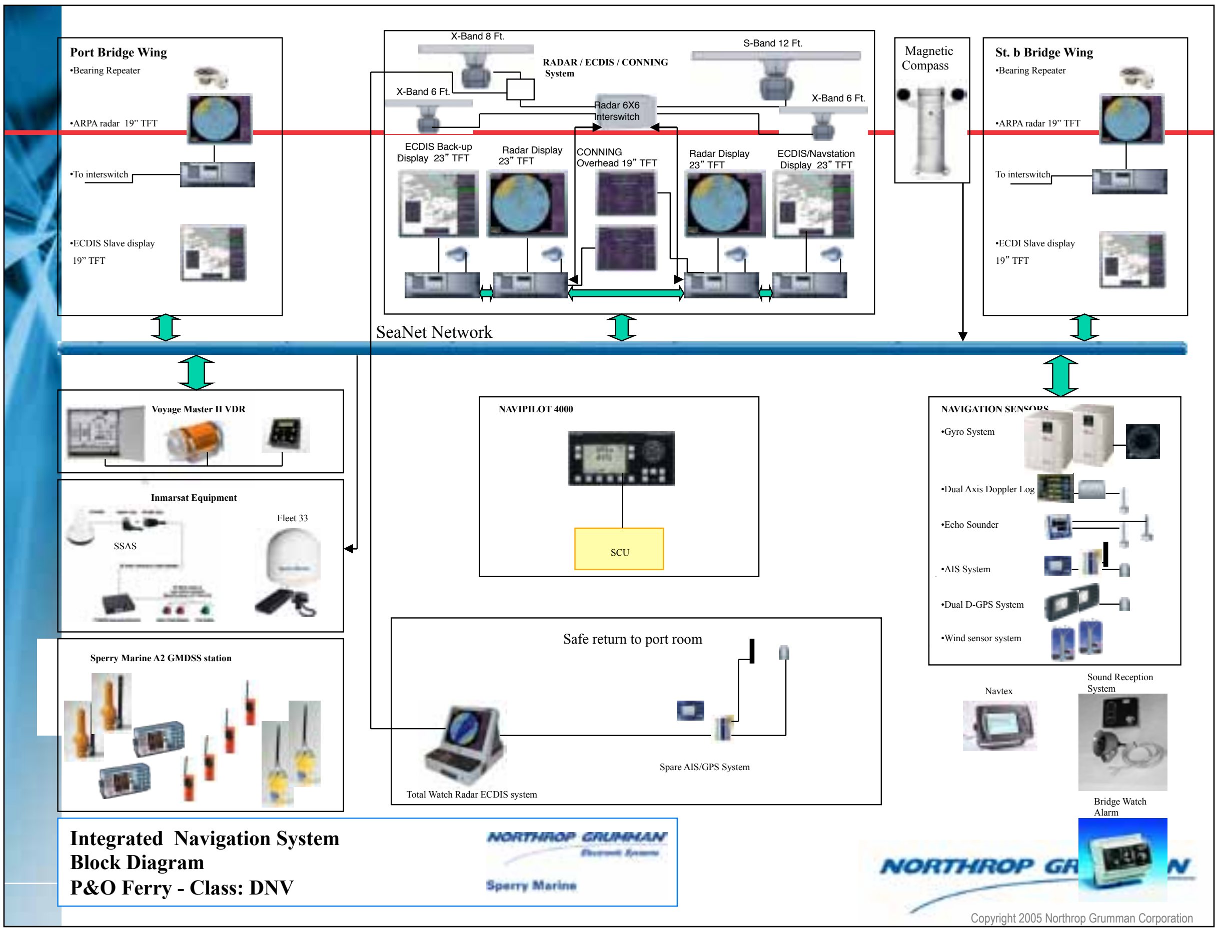
30

2.1.2012 14:57

VisionMaster FT Series – RCI Allure of the Seas – Integrated Bridge

Sperry Marine Scandinavian Ferry Radar References

Color line	DK/NO + NO/Ger	4 ships
Scandlines	Gedser/Rostock	4 ships
Nordic Ferry Services	Domestic ferry	1 ship
P&O Ferries (Dover)	Dover/Calais	7 ships
Mols Linien	Odden/Aarhus	4 ships
P&O Ferries	Irish Sea	4 ships
Sea France	Dover/ Calais	4 ships
Brittany Ferries	Portsmouth/Caen	6 ships
Stena Line	Harwich/Hook	4 ships
DFDS	Esbjerg/Immingham	3 ships
Condor Ferries	Poole/Channel Islands	4 ships
Wightlink	Portsmouth/Isle of W.	3 ships
Red Funnel	Southampton/Isle of W.	4 ships
Caledonian McBrayne	Scottish Islands	6 ships


Port Bridge Wing
•Bearing Repeater
•ARPA radar 19" TFT
•To interswitch
•ECDIS Slave display 19" TFT
X-Band 8 Ft.
RADAR / ECDIS / CONNING System
S-Band 12 Ft.
X-Band 6 Ft.
Radar 6X6 Interswitch
X-Band 6 Ft.
ECDIS Back-up Display 23" TFT
Radar Display 23" TFT
CONNING Overhead 19" TFT
Radar Display 23" TFT
ECDIS/Navstation Display 23" TFT
Magnetic Compass
St. b Bridge Wing
•Bearing Repeater
•ARPA radar 19" TFT
To interswitch
•ECDI Slave display 19" TFT
SeaNet Network
Voyage Master II VDR
Inmarsat Equipment
SSAS
Fleet 33
Sperry Marine A2 GMDSS station
NAVIPILOT 4000
SCU
Safe return to port room
Total Watch Radar ECDIS system
Spare AIS/GPS System
NAVIGATION SENSORS
•Gyro System
•Dual Axis Doppler Log
•Echo Sounder
•AIS System
•Dual D-GPS System
•Wind sensor system
Navtex
Sound Reception System
Bridge Watch Alarm
Integrated Navigation System
Block Diagram
P&O Ferry - Class: DNV
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Sperry Marine
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DEFINING THE FUTURE
Thank You

INTEGRATED BRIDGE SYSTEMS IN SIMULATION

TRANSAS SETS THE STANDARD

STCW'10 MANILA AMMENDMENTS

The amendments to the STCW suggest **84 new competence areas** where Methods for demonstrating competence is approved simulator training, where appropriate.

STCW^{10}

The proposed revision contains:

- upgrade of the existing sections for
  - bridge operation
  - machinery operation
  - communication
  - cargo handling
  - dry cargo
  - DP operations
  - safety & security
  - VTS simulators
- in addition, 3 new sections are added, covering
  - survival craft and rescue boat
  - offshore crane and
  - remotely operated vehicle (ROV) simulators

The STCW text implies the following **mandatory simulator-based trainings** for:

- GMDSS operator
- Radar observer
- ARPA operator
- **ECDIS operator (NEW!)**

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REVISED DNV STANDARD

The proposed revised/extended standard is divided into 13 sections, with the following main changes in Section 3 *BRIDGE OPERATION*

- Updated the competence tables to reflect the new STCW
- Added new Physical realism requirements to meet the new STCW
- Added new Behavioural realism requirements to meet the new STCW
- Added new Operating environment requirements to meet the new STCW
- Removed requirements no longer appropriate

Slides 6 – 12 reflect these changes


DNV

STANDARD FOR CERTIFICATION
No. 2.14

MARITIME SIMULATOR SYSTEMS

JANUARY 2011

DET NORSKE VERITAS

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INTEGRATED BRIDGE SYSTEMS IN SIMULATION

IBS

- Combination of interconnected systems
- Centralized access to sensor information
- Command/control from workstations
- Increasing safe and efficient ship management

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IBS BRIDGE ERGONOMICS

All workstations are completely multifunctional, and may be used for any IBS function at any time.

3D layout studies are offered to ensure the best possible working environment and compliance with IMO/DNV standards and Class Rules.

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WORKSTATION FOR NAVIGATING AND MANOEUVRING

New requirements in revised standard DNV

- MFD 4000 ECDIS / Radar X-Band / Conning Display / AMS (Master station)
- Manoeuvring console with controls and indicators for main engine(s), propulsion and steering systems
- Overhead navigation displays for indication environmental conditions and ship moving parameters
- Night vision and searchlight equipment
- Ship's signals transmitter
- Automatic device for emergency alarm (BNWAS)
- VHF point with channel selector
- Internal communication equipment
- Watch and internal alarms panel

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1 – 1.3; 1.1.6-1.1.21, 1.3.1, 1.3.8

NEW i. 1.1.1, 1.1.13, 1.1.18, 1.1.21, 1.3.1

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WORKSTATION FOR MONITORING

New requirements in revised standard DNV

- MFD 4000 ECDIS / Radar S-Band / Conning Display /AMS (Backup station)
- NTPRO Conning Display
- Ship's signals transmitter
- VHF point with channel selector
- Internal communication equipment
- Watch and internal alarms panel

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1, 1.1.9 – 1.1.21; 1.3.2, 1.3.8

NEW i. 1.1.1, 1.1.13, 1.1.21, 1.3.2

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WORKSTATION FOR STEERING (HELMSMAN'S)

New requirements in revised standard DNV

- Steering wheel / steering lever
- Steering mode selector switch
- Rudder pump selector switch
- Autopilot
- Gyro and Magnetic repeaters
- Rudder order and angle indicators
- Rate of turn indicator
- Talkback to bridge wing workstation

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1, 1.1.6 – 1.1.8; 1.1.12, 1.3.3, 1.3.8

NEW i. 1.1.1, 1.1.18, 1.3.3

TRANSAS SETS THE STANDARD

WORKSTATION FOR DOCKING (BRIDGE WING)

New requirements in revised standard

- Steering position selector switch
- Controls and indicators for main engine(s), propulsion and steering systems
- Indicators for wind direction and velocity
- VHF point with channel selector
- Internal communication equipment
- Night vision and search light equipment
- Watch and internal alarms panel

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1 – 1.1.21, 1.3.4, 1.3.8

NEW i. 1.1.1, 1.1.13, 1.1.18, 1.1.21, 1.3.4

TRANSAS SETS THE STANDARD

WORKSTATION FOR PLANNING AND DOCUMENTATION

New requirements in revised standard

- Chart table with drawing instruments
- MFD 4000 ECDIS (Slave station) with Chart Assistant, Route Planner and Weather chart plotter
- NavAids Conning Display
- Command printer
- VHF point with channel selector

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1, 1.1.12, 1.1.13, 1.3.5, 1.3.8

NEW i. 1.1.1, 1.1.13, 1.3.5

TRANSAS SETS THE STANDARD

WORKSTATION FOR SAFETY

New requirements in revised standard

- Fire alarm, Fire-extinguishing, Air condition and Ventilation, Refrigerating, Bilge and Ballast systems
- SEPS control panel, Bridge distribution switchboard
- Fin Stabilizer Control panel
- Strength Load Monitor
- Monitor of SOx and NOx emissions, CO concentration and unburned fuel contents, fuel consumption
- Internal communication equipment
- Two-way VHF radiotelephone (walkie-talkie)

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1 – 1.1.3, 1.1.5; 1.1.11, 1.1.12, 1.3.6, 1.3.8

NEW i. 1.1.1, 1.3.6

TRANSAS SETS THE STANDARD

WORKSTATION FOR COMMUNICATIONS

New requirements in revised standard

- VHF-DSC, radiotelephone
- MF-DSC, radiotelephone
- MF/HF-DSC, NBDP, radiotelephone
- Inmarsat-SES
- NAVTEX/EGC/HF direct printing telegraph
- EPIRB trigger
- Main station for two-way VHF radiotelephone (walkie-talkie)

* DNV Standard for Certification No.2.14 Table C1 i. 1.1.1, 1.1.10 – 1.1.12, 1.3.7

NEW i. 1.1.1, 1.3.7

TRANSAS SETS THE STANDARD

IMO STCW 78 CODE WITH MANILA AMENDMENTS (JUNE 2010)

New Competencies

New Bridge Resource Management requirements:

.1 allocation, assignment, and prioritization of resources;
.2 effective communication on board and ashore;
.3 assertiveness and leadership, including motivation;
.4 obtaining and maintaining situational awareness

New competence: "Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision making":

.5 create and maintain route plan files in accordance with established procedures
.6 use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses
.7 use ECDIS playback functionality for passage review, route planning and review of system functions

New competence: "Use of leadership and managerial skill". Additional requirement for effective resource management:

.5 decisions reflect consideration of team experiences

Knowledge and ability to apply decision-making techniques:

.1 situation and risk assessment
.2 identify and generate options
.3 selecting course of action
.4 evaluation of outcome effectiveness

TRANSAS SETS THE STANDARD

IMO STCW 78 CODE WITH MANILA AMENDMENTS (JUNE 2010)

The scope of courses and trainees is going to expand:

- Special training courses for personnel on certain types of ships, including large ships with Azipod propulsion system
- Joint ship and port Security Officer courses
- Electrical Department personnel courses for the additional maintenance of electronic navigational and GMDSS equipment
- Members of the ship's deck crew other than the master or an officer (deck ratings) will have to demonstrate their ability to perform elementary navigator's duties: course plotting, course selection for a helmsman, etc.

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MFD 4000 INTEGRATED NAVIGATION SYSTEM

Transas Integrator utility

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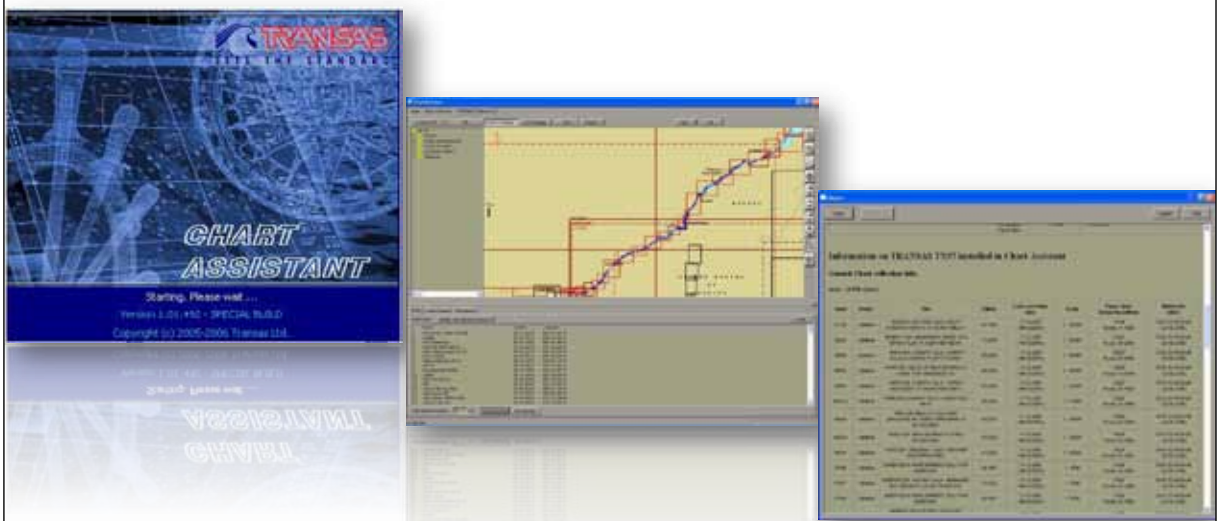
MFD 4000 INTEGRATED NAVIGATION SYSTEM

Transas Chart Assistant utility



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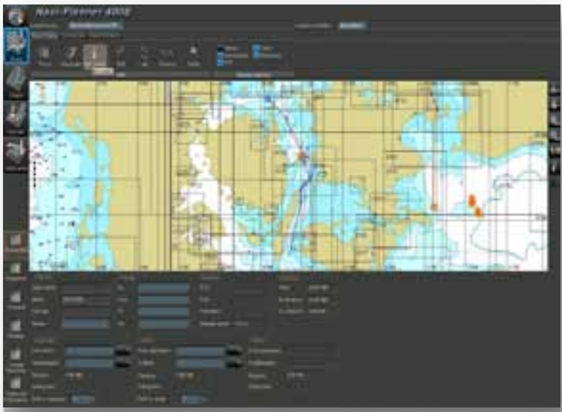
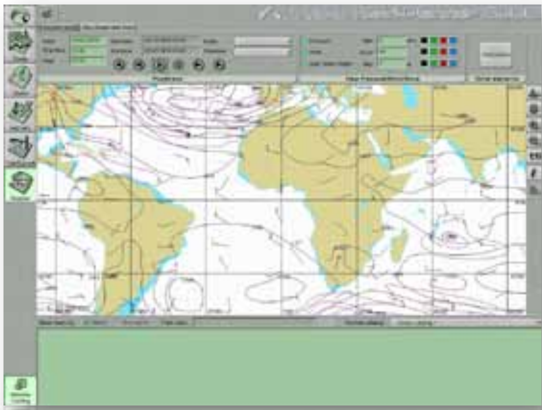
MFD 4000 INTEGRATED NAVIGATION SYSTEM

Transas Navi-Planner





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MFD 4000 INTEGRATED NAVIGATION SYSTEM

ECDIS Multi-Function Display

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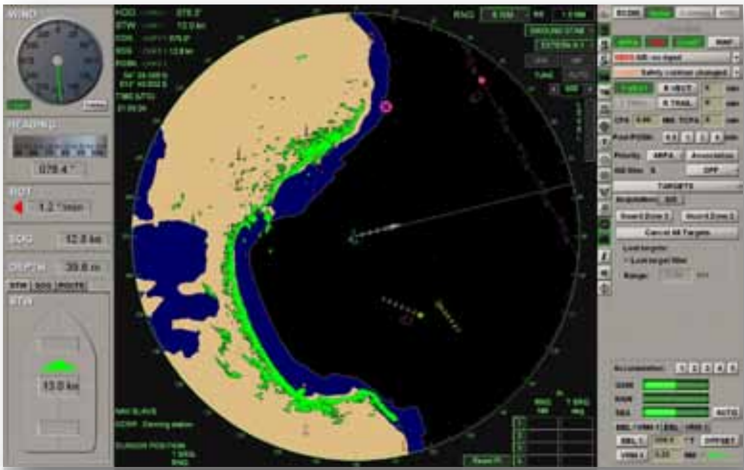
MFD 4000 INTEGRATED NAVIGATION SYSTEM

RADAR Multi-Function Display



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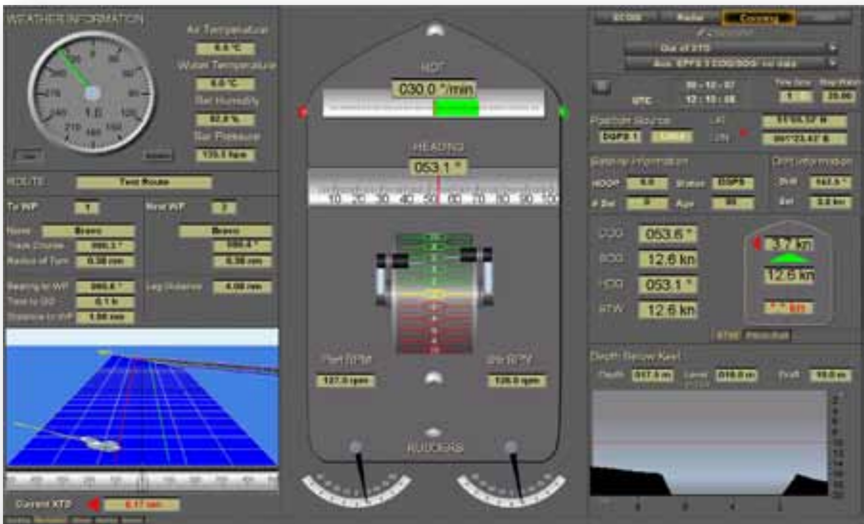
MFD 4000 INTEGRATED NAVIGATION SYSTEM

CONNING Multi-Function Display (Standard View)



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MFD 4000 INTEGRATED NAVIGATION SYSTEM

CONNING Multi-Function Display (Charts with CCTV)

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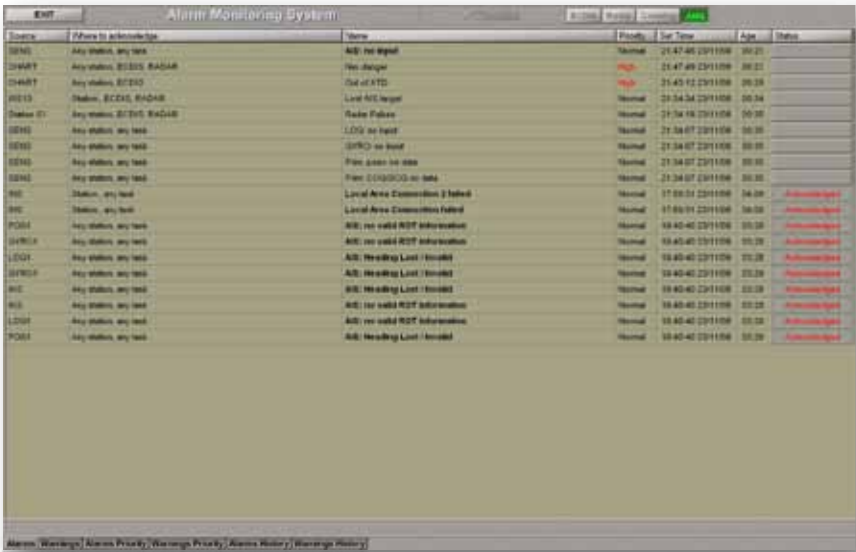
MFD 4000 INTEGRATED NAVIGATION SYSTEM

Alarm Monitoring System



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MFD 4000 INTEGRATED NAVIGATION SYSTEM

MFD Playback

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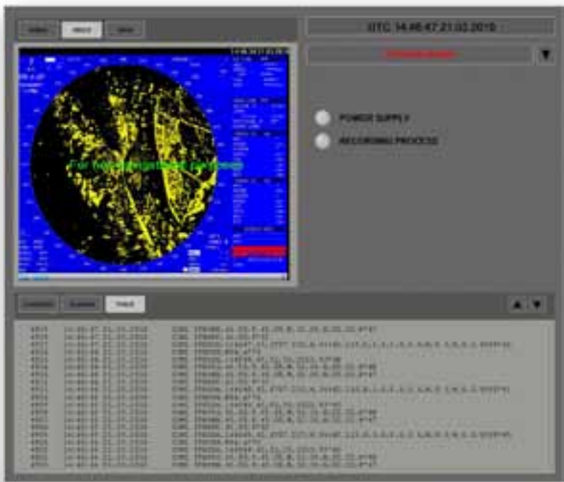
MFD 4000 INTEGRATED NAVIGATION SYSTEM

Voyage Data Recorder



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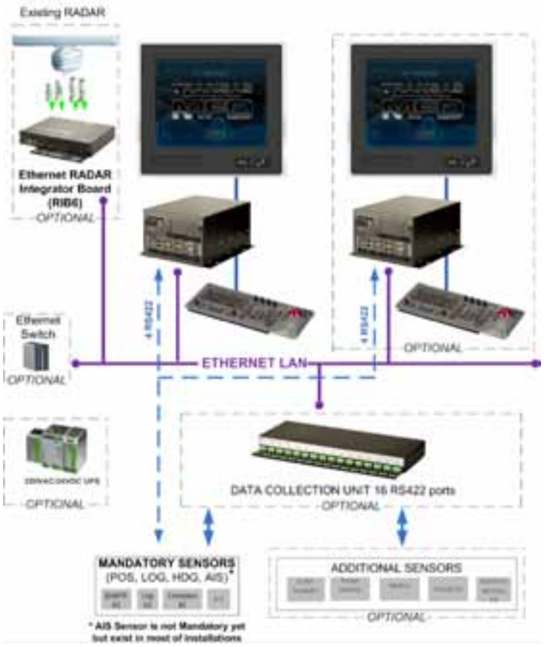
MFD 4000 INTEGRATED NAVIGATION SYSTEM

MFD 4000 Sensors



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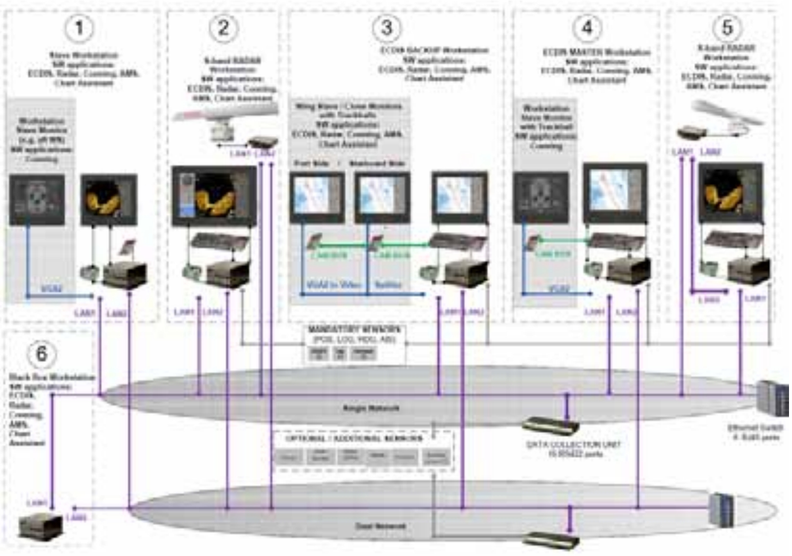
MFD 4000 INTEGRATED NAVIGATION SYSTEM

MFD Interconnection Diagram



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INS-NTPRO INTEGRATION

NTPRO 5000

TRANSAS INS

1. Training on various vessel models
2. Training using real and simulated time
3. Possibility to configure an exercise

3d PARTY INS

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BENEFITS OF NTPRO – TRANSAS INS INTEGRATION: VARIOUS MODELS

Normally INS is a customised product, specifically adjusted for a given vessel

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BENEFITS OF NTPRO – TRANSAS INS INTEGRATION: VARIOUS MODELS

...but in simulator you would like to conduct the training on number of models

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BENEFITS OF NTPRO – TRANSAS INS INTEGRATION: TIME SYNCRONISATION

Real Time

Simulated time,
many sessions

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BENEFITS OF NTPRO – TRANSAS INS INTEGRATION

From operational point of view:

- NTPRO allows performing procedural training in ordering new charts via Chart Assistant software (part of MFD software)
- On the stage of exercise loading NTPRO Instructor automatically transfers the following information to all MFD stations: exercise date and time, own ship's dimensions, own ship's route (including SAR Route), all ship's sensors position and its settings
- MFD Log Books keep real data for each NTPRO session automatically
- Radar, UAIS, IAIS and Chart Overlays are applied automatically in all MFD Stations (including SVDR)
- TrackControl
- NAVTEX
- Navi-Conning with customized templates
- Common worldwide database on currents and tides

California Maritime Academy, USA

Royal New Zealand Navy

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BENEFITS OF NTPRO – TRANSAS INS INTEGRATION

From technical point of view:

- Data Collection Unit (DCU) allows abandoning COM-Ports and tranfering bigger amounts of data in comparison with NMEA format

From configuration point of view:

- Transas INS automatically uses charts from NTPRO folder installed along with areas (both TX97 and S57 format)
- Transas INS stations may work in either Master or Slave mode

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CONCLUSIONS

All systems related to the IBS include failure control(s) and method(s) to train and assess the learner in the use of advanced equipment, technology and enable familiarization and training to understand the limitations of automatic systems.

The IBS bridge operation simulators with 7 workstations described above are perfectly suited for the seafarers' training and certification at the management, operational and support levels of responsibility.

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THANK YOU FOR YOUR ATTENTION!

samk

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Series C, Study Materials 1/2011
ISSN 1457-0718