M'AIDER: MARITIME AIDS' DEVELOPMENT FOR EMERGENCY RESPONSES

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ABSTRACT
This paper reports on the outcomes of recent research carried out on accidents and incidents instigated to create a range of scenarios for training applications in full-mission simulators relating to emergency situations. In the IMO MSC 82 [2006] meeting a great deal of emphasis was placed on the role human elements play in the cause of accidents at sea, focusing particularly on how human errors have led to great losses of life and property. It has also been acknowledged that emergency situations and the use of simulators have not been fully taken into consideration in the training of merchant navy officers. This industry would benefit immensely from a user-friendly/accessible training tool and programme for its sea-going and port personnel that would focus on emergency situations; the causes for these situations and how they are handled.

The research presented here makes special references to the Leonardo Safety on Sea project [SOS, 2005-07], which concerned the updating of Merchant navy Education and Training (MET) programmes for deck and engineering officers. The SOS project identified deficiencies in maritime education and training, which M'AIDER intends to remedy by considering emergency situations specifically for navigation to avoid collisions, grounding and some other dangerous situations.

Special references are made to the plans to gather existing knowledge regarding accidents and incidents [Ziarati, 2008; Turan, 2006] in a systematic manner from each member of the partnership and break them down into several categories, which will prepare a knowledge-base of selected scenarios to train and assess two pilot groups composed of those working onboard vessels (including trainee cadets) using advanced bridge as well as integrated and full-mission simulators. The plans for these scenarios and how they are to be developed are included in this paper.

M'AIDER will adapt earlier e-learning and e-assessment platforms developed by some of the partners involved in this project. This project is funded by the EU and the core partners are: Maritime Institute Willem Barentsz (MIWB), Centre for Factories of the Future (C4FF), TUDEV, Lithuanian Maritime Academy, University of Strathclyde, Spinaker d.o.o. and IDEC.

Keywords: Merchant navy education and training (MET), Safety at sea, e-learning

1.INTRODUCTION

The systematic attempt to develop accident or incident scenarios for the training of young cadets and seafarers working at sea and in ports in emergency situations is considered novel and has not been done before. The IMO MSC [Ziarati, 2006] has placed a great deal of emphasis on the part human elements have to play on the cause of accidents at sea, particularly focusing on how human errors have led to great losses of life and property. It has also been acknowledged that emergency situations and use of simulators have not been taken into consideration in training merchant navy officers and this industry would benefit from a training tool and programme for its sea-going and port personnel focusing on emergency situations. The study of accidents & incidents at sea will identify the emergency situations and provide adequate information as to how various scenarios could be prepared and simulated in various types of simulators including integrated and full-mission ship simulators.

The intention of this project is to gather the existing knowledge regarding accidents and incidents [Ziarati, 2008; Turan, 2006] and break them down into several categories preparing a knowledge-base of the selected scenarios to train and assess two pilot groups composed of those working onboard vessels (including trainee cadets) using advanced bridge as well as integrated and full-mission simulators. This project intends to prepare a whole range of scenarios simulating actual accidents, incidents and near-misses focusing on emergency situations and incorporate these situations into the existing MET programmes in the partner countries and later Europe-wide. A training programme on the scenarios would also be prepared for seafarers working at sea and in ports. The intention is that the

scenarios will lead to identification of the causes of accidents and incidents as well as near-misses including grounding, and with appropriate training these causes could be removed as such training will enhance the awareness of dangerous situations significantly and what actions to take to avoid them.

2. ORIGINS OF THE PROJECT

It has been claimed in no uncertain terms that *"The history of navigation is actually the history of human error"* [Bennet, 2002]. In a paper published by the Parliamentary Office of Science and Technology [2001] it was stated that human capacity has limitations; this is inevitable but human error can be reduced through a good/intelligent training system designed with the feedback from its potential users for improved safety and making good decisions.

While the trend over the past decade is a steady decline in the number of marine accidents, the public is becoming more concerned about the consequences of these accidents which are often loss of life, loss of property and environmental damage [Transportation Safety Board of Canada, 2001].

Larossi [2003] believes that the magnitude of damage inflicted by a major shipping accident increases the public attention paid to those accidents, and negatively influences the perceived safety of shipping. Findings so far show that while the reduction of accidents has been substantial over the last 10 years, the number of accidents occurring at sea is still unacceptable. The psychology of 10 years ago and the level of tolerance for accidents are very different to the psychology of today and the high value put on human lives. Considering the technological developments and investments made in human resources as well as infrastructure and equipment, the level of tolerance for accidents is getting less and less. Furthermore, while the number of accidents overall is decreasing, those attributed to human element is actually increasing [Ziarati, 2003]. According to the IMO [2005], 80% of accidents at sea are caused by human error. In a research report [Turan, 2008], it is reported that the accidents are due to human error, poor design or equipment failure. However, the number of accidents due to human error is by far shown to be greater than those caused by poor design or equipment failure. It is now believed that the majority of human errors could have been prevented by adopting a (more) human oriented approach.

The partnership is composed of well known MET providers for different types and ranks of merchant navy officers and has been organised in such a manner as to be complementary to each other and also have the capabilities necessary to satisfy the project objectives. The project will be carried out corroboratively by seven partners, from six different countries. The expertise necessary for this project cannot be found in a single country in Europe, but requires the establishment of a consortium at European level. These aspects are mirrored in the composition of the consortium: each of which have reached a high level of recognition and expertise within maritime education and training and maritime related research to tackle the issues addressed. Three partners are involved in Leonardo projects concerning e-learning [E-GDMSS, 2006-08] and three are involved with another Leonardo project (SOS) concerned with the development of an integrated programme for education and training for merchant navy officers.

3. PROJECT AIMS AND OBJECTIVES

The main aim is to improve safety at sea and in ports by developing a series of scenarios which can be included in the Maritime Education and Training of seafarers by provision of a training course in the application of simulators and through both e-learning and e-assessment. This will enable those at sea and others to have a full understanding of emergency situations with a view to identifying the causes of accidents, incidents and near-misses at sea.

In addition there are non-technical skills which are equally important. In many incidents and accidents, the complexity of the automation is the error enforcing the condition. To prevent such errors, it has been found that it is important to consider resource management, skills such as situational awareness, decision making and work-load management [EUREKA, 1996 – Factory of the Future report]. Combined Master-Chief Engineer emergency team operations [SOS, 2005] could also lead to a more effective response to a given failure. All these are included in the proposed course consisting of eight modules of training, one for each class of seafarer and one for team building. Each module has several exercises, these will be developed to cater for known situations and possible scenarios and each partner will bring one specific expertise to ensure a whole range of skills are available.

Harmonisation and recognition are an important aspect of the intended work because some certificate courses may be acceptable in one country, but are not acceptable to other relevant authorities in other countries. The methods applied in the SOS project to receive recognition will be used for certification of the proposed course.

This project intends to use benchmarking and promote good practice throughout the partnership and beyond. The majority of accidents and incidents on automated vessels are due to

automation and in over 80% of the cases studied these are due to human error or lack of adequate standards. In recent years the number of accidents and incidents relating to automation systems and their failure has been sharply increasing and this trend is expected to rise [IMarEST, 2006].

4. TRANSFER OF INNOVATION

The innovation is to develop a new training programme based on a set of scenarios and mount these on to an already developed PC based software [MarEng, 2005] as well as an already tested e-learning and e-assessment platform [EGMDSS, 2006]. Representatives from both projects are involved in this aspect of the project.

The e-learning and use of PC based software will assist the partnership to use the tools in design, delivery and assessment of other learning units including short courses.

A further transfer of innovation concerns the inclusion of the training programme in the existing MET programme. IMO in its recent Maritime Safety committee proceeding has repeatedly promoted the idea of safety first time and novel use of simulators in training of seafarers of various types and ranks.

The training of seafarers relies heavily on the use of simulators. In many countries this use is limited to various demonstrations rather than using the simulator as a tool. To have a full range of these simulators, for a whole range of applications, was an important consideration in seeking the right partners. It should be noted that any one country alone, in a given geographical location, cannot claim to know all the problems associated with emergency situations. This has consequently led to the involvement of other countries with these specific capabilities and was an important consideration in the selection of the partners and transfer of innovation from sectoral, national as well as ship system simulators and individuals who have a contribution to make.

The application of automated, and in recent years a fully automated system, is relatively new. The European maritime authorities are aware of the increasing number of accidents and incidents emanating from automation system failure as a result of the lack of training on the use of these systems and awareness of what action to take if part of or the whole system fails. Not every one partner on its own has full knowledge and resources to resolve the problems identified above. However, collectively the partnership has resources to identify the training needs and by sharing each other's resources can make a serious attempt to include accidents and incidents with automated vessels.

In summary European members of the IMO, MCA and partners in this project are aware that emergency situations are a topical issue throughout the shipping industry in Europe. They are all in agreement with the project partnership that this one important area requires urgent attention and that the partnership presented in this project will be able to make a significant contribution in resolving it at source within the shipping operation arenas.

5. EUROPEAN DIMENSION

The proposed project is in line with a European strategy as stated in UNISCE's (UNIone laurati in SCinze Economiche e Commerciale) seven priorities and directly supports the work of the EU namely, i) Competitiveness, ii) safety, iii) higher academic learning, iv) lifelong learning, v) collaboration of stakeholders vi) employment/mobility, and vii) adaptation to needs and conditions.

The project addresses the recent decisions made by the European Council. The EU expects countries like Turkey to raise the standards of Community technical norms particularly regarding maritime safety. The project could assist Turkey to acquire expertise through transfer of good practices from some of the other partner countries and vice versa.

There are concerns in the partner countries about the lack of training courses in key areas such as emergency situations and their causes. In the UK, there are references to the shortage of seafarers of different ranks [ISF and BIMCO sponsored IER report, 2005] and the role automation may play to reduce manning as reported in a paper entitled British Shipping [1999]. The project team intends to benefit from the previous work of the EU Leonardo NETOSKAR [2003] project which developed a Standard Training and Certification of Watchkeeping (STCW) database which will be employed to support the new course and its content. The intended Internet portals will also be linked to the database. The feasibility of including the course content in NETOSKAR and other similar databases will be explored. The E-GMDSS and e-learning experience of two of the partners in the partnership in the maritime sector will also be beneficial to the project.

The collective weight of the partnership is expected to standardise the content of the scenarios and ensure the importance of team building. The project aims to build on the success of the original Leonardo SOS Project. M'AIDER also aims to respond to a question posed in the EU Green Book on maritime matters, which is: how can the decline in the number of Europeans entering certain maritime professions be reversed and the safety and attractiveness of jobs ensured? The answer is a targeted effort at European, national and local

levels first to inform young people of the opportunities available in a career at sea and/or onshore, and secondly to ensure they feel safe by choosing a career in the sea transportation sector. Their safety and well-being should also be improved by well-designed education and training courses in identified problems areas. They should also be supported by the provision of courses leading to recognised certificates both for career progression as well as for job diversification.

6. RESEARCH INTO EMERGENCY SITUATIONS

The partners have developed a questionnaire to seek the view of the target groups before commencing work on identifying scenarios and case studies for consideration in the M'AIDER course. In parallel other surveys supported by short questionnaires are being developed to find out the causes of accidents and incidents at sea in order to find training material to overcome the resulting emergencies.

At the same time partners commenced revisiting the findings of the earlier work which the led to results presented in Figure 1-3 in order to try pin point the main causes of accidents.

The reviews led to visits to several centres and many productive discussions with partners in associated EU funded projects to verify the results shown in Figures 1 and 2.

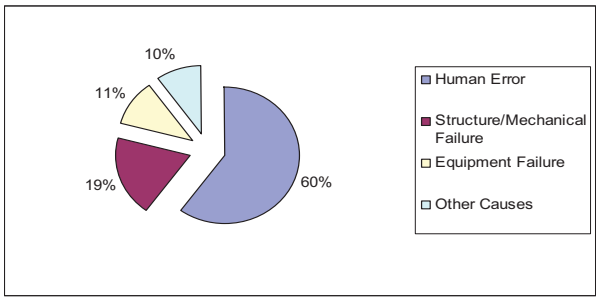

Figure 1. Main types of accidents [source: UK Protection and Indemnity Club, 2007]

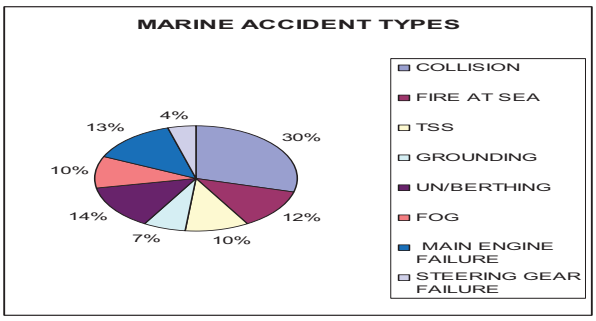

Figure 2. Variation and Causes of Accidents [source: UK Protection and Indemnity Club, 2007]

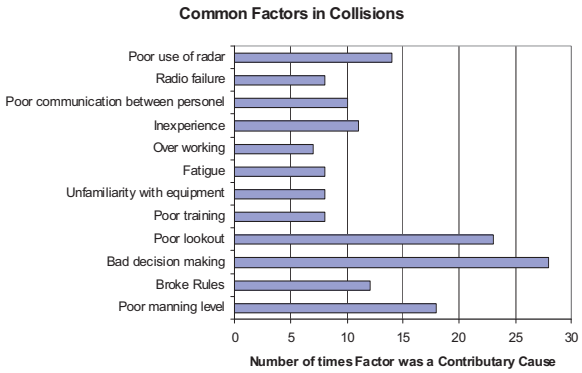

Figure 3a. Common Factors in Collisions [source: ABS Projects, 2005; SPIRIT Project, 2006]

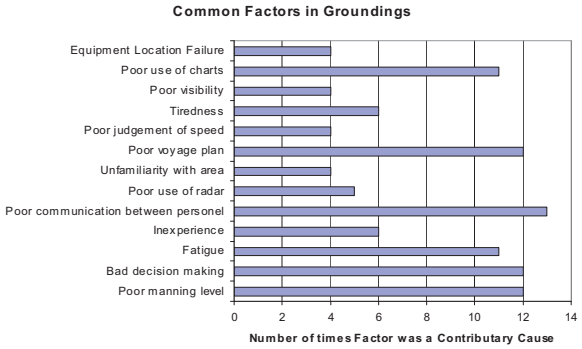

Figure 3b. Common Factors in Grounding [source: ABS Projects, 2005; SPIRIT Project, 2006]

The above diagrams clearly substantiate the earlier findings that problems [Ziarati, 2006] with and use of navigation equipment and poor communication are major causes for concern. The latter as reported earlier was a main area of concern reported in the Human Element Group of IMO [MSC, 2006]. What is new is, as shown in the above diagrams, that bad decision making is the most dominant cause of accidents. There are also issues concerning the crew such as fatigue, tiredness, manning levels and so forth that requires careful consideration.

The key question in this programme of research was how could those concerned with education and training and/or well being of seafarers respond to these identified causes and complement and supplement the existing arrangements with a view to reduce the number and severity of the reported accidents in the future? The M'AIDER project was instigated to address a core aspect of this key question. A new project called SURPASS was also initiated to primarily respond to automation failure and how a training course could be developed to proactively prevent accidents and incidents on automated vessels.

To respond to the above question fully it is essential that the partners study how training takes place in progressive maritime education and training

institutions. It was found that without exception, and despite the fact that the use of simulators is not mandatory under the existing regulations (STCW 95), all centres visited use sophisticated bridge and/or engine simulators with various degrees of complexity. Some institutions, such as TUDEV, include Bridge Resource Management (BRM) and Ship Handling courses in their training and education programmes in addition to main programme units and the IMO mandatory ancillary courses. They also expect all of their officer cadets to take the additional courses required by the UK' Maritime Coastguard Agency (MCA). Simulators can be subdivided as depicted below:
The most popular simulators use computer-based simulators with the 'man-in-loop' for a range of applications as shown in Figure. 4.

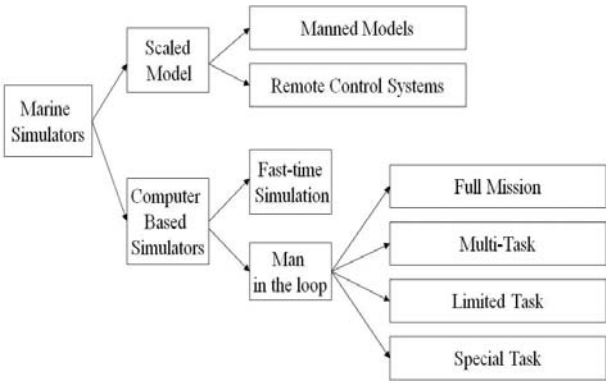

Figure 4. Types of Marine Simulators [Source: Ziarati, 2007b]

A typical arrangement for the training of seafarers using simulators often commences with the selection of an appropriate scenario followed by trainees using the simulator under the supervision of an instructor. The trainees' progress is monitored by training staff and the process is concluded by a briefing session which could include informal or formal assessment or feedback and/or debriefing activities. Most of the scenarios involve developing and assessing skills in navigating a vessel with little or no attention to human element issues other than offering training in the correct use of navigation equipment and/or rules and conventions. In some of the observed cases, fault analysis played a major part: the instructors encouraged the trainees to identify and then rectify faults of various complexities. The research [SURPASS, 2007] has shown that the trainers themselves are often unable to overcome the problems created or questions raised when considering scenarios dealing with failure in aspects of automated systems. The training instructors were noted not to be familiar with weaknesses and limitations of such systems. Furthermore, problems with poor communication are often overlooked and no distinction is made between mistakes and/or slips. The latter issue is an important one because mistakes are rule- or knowledge- based whereas slips are lapses due to tiredness, forgetfulness, etc.

In the training scenarios and briefings intentions, human actions and subsequent consequences are often analysed, again with a different degree of sophistication and in some cases feedback and feed forward provided an opportunity for arguing the actions by the crew. However, issues related to human failure only encompassed those relating to navigation matters. To support the activities in making the seas safer, directly in connection with the four main problems, four proposals were formulated and three were presented to the EU for consideration.

7. CONCLUSIONS

The M'AIDER programme is a major breakthrough for the improvement and modernisation of maritime education and training across Europe. Its implementation will not only help to save lives but will raise awareness about the importance of emergency situation training. The programme will be up to date and meet the local, national and international requirements of the countries in which it is implemented. Its introduction will pave the way for improvements in other areas of merchant navy officer training as well as provide solutions to the causes of many accidents that are currently taking place at sea.

The consortium to undertake the creation and establishment of this course have many years of experience in maritime education, training and assessment and are of the view that the M'AIDER course is imperative to the campaign to improve the levels of safety at sea.

The course will consist of some ten major scenarios comprising of a representative of most widespread causes of accidents and incidents which will lead to the development of case studies to support planning for and improving the management of emergencies when they occur with a view to save lives and reduce damage to and loss of property. The ten cases will be selected based on the careful study of the research results summarised in Figures 1 to 3 as well as the outcome of the survey which is expected to provide additional causes of accidents or incidents but also likely causes and most importantly those which have led or are likely to lead to future accidents such as incidents or near-misses viz., accidents that did not happen but could occur in the future. For every accident there are at least 10 major incidents [Ziarati, 2003] and hence the importance of studying near-misses through surveys/questionnaires is extremely high.

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