# Developing Scenarıos Based on Real Emergency Sıtuatıons

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## Abstract

*This paper reports on the outcome of the recent research carried out on accidents and incidents to develop a range of scenarios in full-mission simulators as well as on the development of e-learning/assessment platform for ship crew skill development primarily to prevent emergency situations and to manage emergencies when they occur. In the IMO MSC 82 meeting a great deal of emphasis was placed on the role of human factors in accidents at sea, focusing particularly on how human errors have led to great losses of life and property. It has also been acknowledged that the simulator exercises have not focussed on real emergencies at sea.*

*The research presented here makes special references to the Leonardo Safety On Sea (SOS) project (2005-07), which updated and harmonised the Maritime Education and Training (MET) programmes for deck and engineering officers in several EU countries. The SOS project identified deficiencies in maritime education and training, identifying training in emergency situations at sea an area for serious consideration. M'AIDER addresses this deficiency specifically to avoid collisions, grounding and other dangerous situations and what needs to take place once these situations arise.*

*The scenarios are being developed by carefully studying past maritime accident reports focussing on the most critical/dangerous emergency. Prior to creating the scenarios, a survey was conducted to identify the reason of the emergency situations and to identify the most frequent occurred emergencies. What is novel in M'AIDER is that trainees will*

*undertake exercises in both a full mission simulator and/or in an e-learning platform, where the scenarios are based on past maritime accidents which took place in different locations of the world.*

*M'AIDER is funded by the EU and the core partners are: Maritime Institute of William Barents (MIWB), Centre for Factories of the Future (C4FF), TUDEV Institute of Maritime Studies (TUDEV), Lithuanian Maritime Academy (LMA), University of Strathclyde (SU), Spinaker d.o.o. and IDEC.*

**Key words:** *Maritime Training and Education, Safety at sea, accident investigation, e-learning*

## 1. Introduction

There has not been a systematic attempt to develop accident scenarios for the training of cadets/officers working at sea and in ports to prevent emergency situations. IMO (Ziarati, 2007a) places a great deal of emphasis on human factors and has developed measures to avoid human errors and prevent accidents. This has been supported in a research report (Ziarati and Ziarati, 2007b) stating that the accidents are usually due to human error, poor design or equipment failure or a combination of these factors. It has also been acknowledged that simulator exercises are not often based on real accidents and hence training of cadets and officers would benefit from a set of scenarios focusing on emergency situations and how they can be avoided in future.

The M'AIDER project primarily concerned accidents and near misses which were reviewed in the Maritime Accident Investigation Branch (MAIB) during the years 2004-2011. The research included a questionnaire which was developed and distributed to seafarers in the maritime sector to identify the most frequent occurred emergency situations and the prevailing conditions (M'AIDER proposal, 2009-11). The outcome of the review of the accidents reports and papers coupled with results of the questionnaire were studied and carefully analysed. The outcome was used in creating the scenarios for application in bridge full mission simulators in the development of the online e-learning platform.

The Maritime Safety Committee (MSC) of International Maritime Organisation (IMO) as noted by Ziarati (2007a) has repeatedly promoted the idea of safety first time and novel use of simulators in training of seafarers. It is believed that the majority of human errors could have been prevented by adopting a more human oriented approach. Appropriate training is crucial in this respect. In the same report (Ziarati 2007a) it was also reported that training is the most efficient way of preventing/reducing accidents at sea.

The M'AIDER project specially aims to remedy issues relating to human error at sea. Several accident reports have been used as a basis to review and develop scenarios on various emergency situations based on real cases where an accident has taken place, or an incident has been reported as well as scenarios for a whole range of near-misses which were not considered in the past. This is expected to improve safety at sea and ports by developing a series of realistic scenarios based on real life situations viz., involving real accidents. The M'AIDER will enable ship crews and those working in ports to prevent emergencies and to respond to emergency situations when they occur. M'AIDER scenarios are being designed for full mission simulators supplemented by e-learning exercises for those who do not have or have limited access to these simulators.

This paper commences with a brief introduction to M'AIDER project and its main aims and objectives followed by explanations on how the scenarios were planned and are being developed. The outcome of the analyses of questionnaire and how the results were used to develop the scenarios is described. Special references are made to the M'AIDER e-learning platform.

## 2. Scenario development

Prior to the M'AIDER project, research had been carried out into the results of hundreds of accident and incident reports by the partnership. In the scope of the M'AIDER project, several accidents covering the main causes of accidents were also carefully studied when reviewing MAIB database. The methodology developed to identify the causes of the accidents was a fault tree (FTA) approach which was used to identify the most critical and relevant accidents cases/ situations, etc. (Ziarati, 2006, 2007b). A survey using a questionnaire was conducted to obtain feedback from the field to complement the outcome of the investigations and reviewing of accidents at sea. The previous technical papers, MAIB accident reports and the survey provided a complementary triangulation in deciding what scenarios to develop which could cover the main causes of emergencies at sea and how to manage emergencies when they happen.

What is unique about M'AIDER project is that the scenarios relating to near-misses which are often ignored are taken into consideration. It is reported that there are generally about 100 plus incidents and 10 to 100 near misses to every accident (Bea, 1999). It is inevitable that a cause of a near–miss at sea or port could be the cause of a huge disaster in the future. The method used to identify, collect, analyse and collate the knowledge of accidents in the development of training material for seafarers was as novel as the method applied to develop the scenarios.

In the near future the intention of this project is to complement the existing knowledge on previous accidents gathered as part of the M'AIDER project with other data on accidents and incidents such as those reported in Ziarati (2008) as well as by Turan and Ziarati (2007) and break them into several categories and prepare a knowledge-base of the selected scenarios, and train the trainers as well as officers working on board vessels (including trainee cadets) using advanced bridge as well as integrated and full-mission simulators. Prior to Bridge training, the trainers will undertake training in the application of M'AIDER e-learning platform that consists of simulation of real accidents and the on-line tests. The e-learning platform can be used independently for those with no or limited access to bridge simulators.

This project is primarily a preventive approach to understand the causes of accidents and incidents as well as near-misses and use this understanding in the development of learning materials in the form of scenarios which would make learning and teaching more effective and at the same time more interesting.

In this project it is also intended to prepare a whole range of scenarios simulating actual accidents, incidents and near-misses focusing on emergency situations and incorporate these in the existing MET programmes in the partner countries and later Europe-wide. A training programme on the scenarios is also being prepared for seafarers working at sea and in ports. The intention is that the scenarios would lead to identifications of the causes for accidents and incidents as well as near-misses including grounding. The identified causes could lead to avoidance of similar accidents in the future. This type of training is expected to enhance the awareness of dangerous situations significantly and help in identifying what actions should be taken to avoid them; and manage them when they occur.

## 3. Results analyses of maib database

An accident database was carefully reviewed to identify the most critical and or dangerous cases to use in developing scenarios so that the intended training could be effective. The review of accident cases in the M'AIDER project is primarily based on accidents involving UK flagged vessels between 1991 and 2009. This included the review of several accident reports investigating collisions, near misses, groundings, etc. This review helped to develop further case scenarios using several accident reports from other accident investigation agency (Ziarati, 2008).

It is noted that that most accidents/incidents and near misses take place in coastal waters. These accidents are often due to disregard of bridge procedures, or actions taken contrary to the rules and/or as a result of poor decisions.
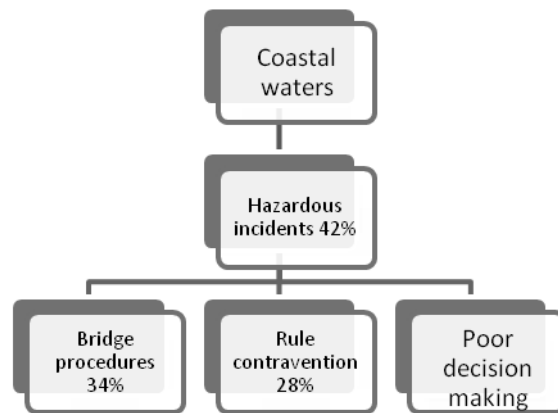


**Figure 1 – Human Errors attributed in Coastal waters**
*(Source: M'AIDER proposal, 2009-11)*

It was also interesting to note in the MAIB database that on high seas communications/orders were found to be additional factors reported as the cause of human error. 'Contrary actions to rules' and 'poor decision making' were noted to be the other main causes of accidents.
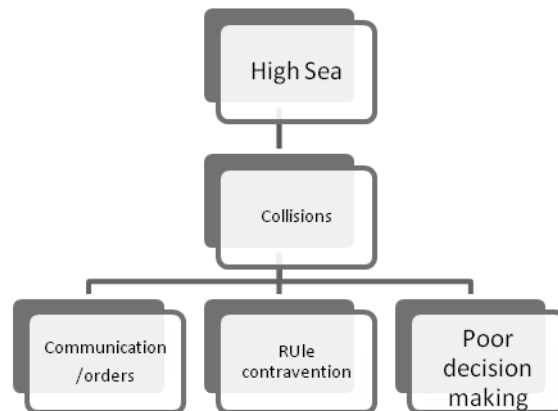


**Figure 2 – Human Errors attributed in Port harbour area**
*(Source: M'AIDER Proposal)*

In harbour areas, the restriction to manoeuvrability was found to be the common reason for accidents and the other causes were due to inappropriate human response; mainly due to poor decision making and/or disregard of bridge procedures.
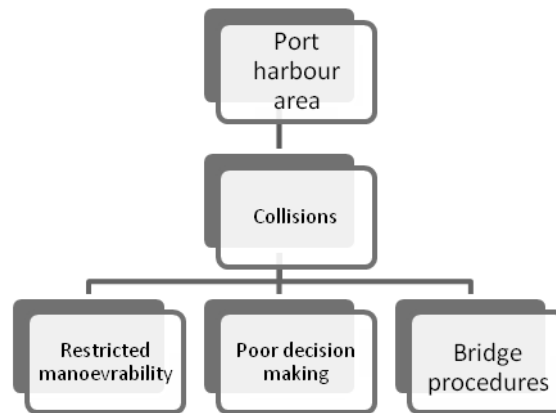
**Figure 3 – Human Errors attributed in high Seas**
*(Source: M'AIDER Proposal)*

Analysis concluded that the most critical scenarios for consideration were those involved collision involving passenger and Ro-Ro ferries.
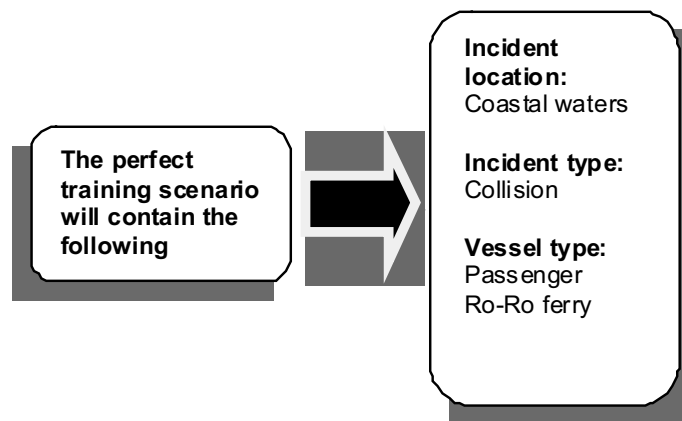


**Figure 4 – Most appropriate cases for development of scenarios**

## 4. Analyses of the questionnaire

The outcome of the M'AIDER survey questionnaire is briefly presented in this section. The main aim of developing the questionnaire was to find out the deficiencies in maritime training and education related to emergency situations as well as to find out seafarers understanding of the current regulations, especially those that if correctly applied would lead to decrease in the number of collisions at sea. The total received questionnaire was 145.

Distribution of the contribution of participants in terms of responders was as follows: Lithuania (30%), UK (21%), the Netherlands (19%), Turkey (11%) and Slovenia (4%).

The target groups were mainly cadets with sea experience and officers and masters.

With regards to Bridge simulator training practice, it is found that 70% of the participants have some sort of training on the bridge simulators whereas 30% did not. Looking at Figure 5, it can be seen that the bridge simulator training in Lithuania and Slovenia were almost non-existent. This might be due to either there are not enough simulators or there is no money to train them on the bridge simulators.
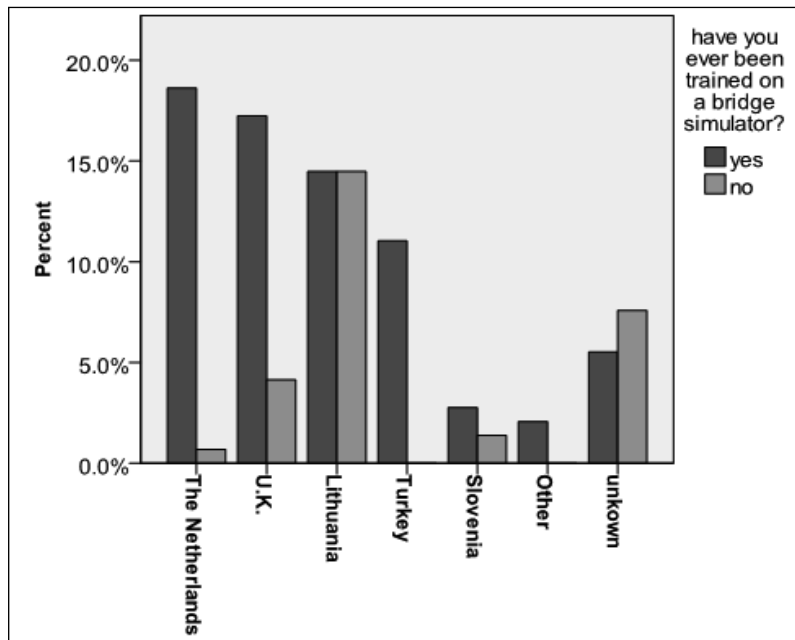
**Figure 5 – Percentage of Bridge Simulator Training**

Another finding of the questionnaires was that most existing bridge simulation training methods usually covers "communication issues on the bridge among bridge team members".

Another finding of the questionnaire is that more than 60 percent of the participants were not aware of accident database system and the associated procedures and reports of past shipping accidents so as to simulate the real accident scenario. In parallel to this, more than 65% of the participants agreed that creating scenarios based on previous accidents would be very useful in order to raise awareness of the bridge watch-keepers and avoid future accidents.

**Table 1 – Responders choice for the most effective methods to learn Colregs**

| Training methods | Familiarised with the COLREGS | Most effective methods |
|---|---|---|
| Theory sessions 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 Simulation Training | 60 | 71 |

It is apparent that bridge simulation training especially for learning about COLREGs is the third preferred option after theory sessions in classrooms and onboard training. This may be because bridge simulator trainings are very recent practice and some of the responders may not have had an opportunity to have training in bridge simulators. In addition to this, not many training providers have sufficient bridge training facilities to suffice for all their training needs.

## 5. Development of scenarios for full mission simulators

Based on realistic events and cases, training scenarios are being created and tested in full mission environment which will be available for training of both deck cadets and ship officers. In this way both deck cadets as well as ship officers will learn to anticipate the unexpected situations. It is known that with simulators, the testing of the scenarios and the subsequent fine tuning are relatively simple as all conditions can be re-enacted over and over again. Student learners as well as experienced seafarers will be invited to take part in test user groups.

Some ten scenarios were chosen from hundreds of accident reviews. At first, those chosen cases were reviewed one-by-one and transformed into real exercises to be used in the full mission simulators. Each developed scenarios were tested to identify that they are appropriate exercises for the identified needs (M'AIDER survey). The scenario format that is used in full mission simulators were already chosen after thorough discussions within the partnership which led to a common format to be agreed to transform the selected cases into full-mission scenarios. The format agreed is as follows:

- Place of Exercise
- Duration
- Objectives
- Prerequisites
- Training materials
- Initial conditions
- Targets
- Briefing
- Student action
- Instructor action
- Debriefing and
- Evaluation



**Figure 6: Full mission scenarios format.**
*(Source: M'AIDER Proposal)*

## 5. Development of e-learning platform

In parallel to the scenarios developed for full mission simulators, e-learning and e-assessment platforms are being developed for PC based use for the training of deck officers. This will be a novel approach to the training of deck officers where they will be practising the real case scenarios on a PC whenever and wherever they are. The intention is to let the deck cadets and officers to have prior training in online environment before the training in full mission simulators. The e-learning and e-assessment platform may also be used in the institutions a sole training where full-mission simulators either do not exist or are not readily available. The e-learning and e-assessment platforms will enable students to learn from past accidents where they will be able to develop their navigational watch skills as it will help them to learn about emergency situations.

The systematic method for development of scenarios to implement in e-learning environment is sequenced as follows:

- Developing e-learning and e-assessment methods
- Establishing links to search engines
- Installing and setting online facilities
- Validating e-learning platform
- Adding learning material to the platform after each trial
- Providing textual content with pictures
- Expanding a question database and providing e-assessment
- Validating e-assessment

To develop the e-learning and e-assessment platform, the chosen scenarios are thoroughly analysed piece by piece and a self-assessment test was developed for each selected scenario. These tests will enable students to practise and learn from past mistakes at their own time and pace.
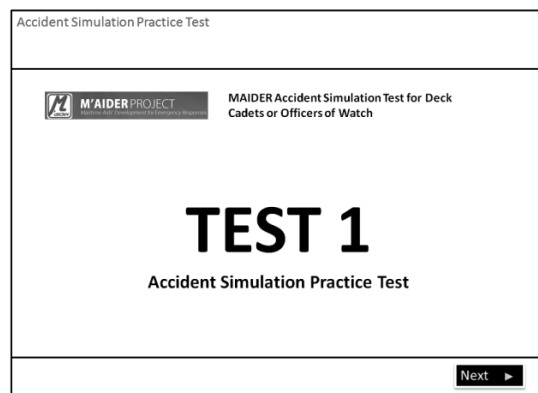


**Figure 7 – Online test for e-learning platform**
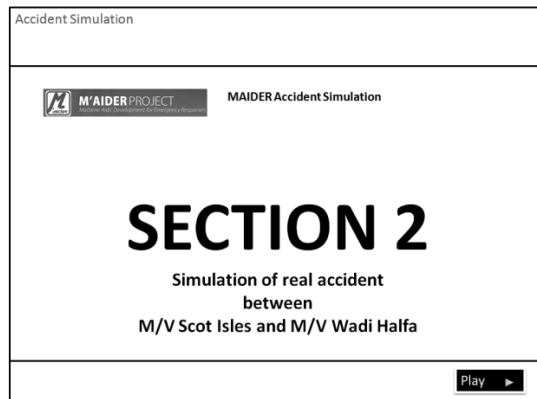*(Source: M'AIDER Proposal)*

**Figure 8 – Online simulation for e-learning platform**
*(Source: M'AIDER Proposal)*

Real AIS records will also be made available to students who wish to see and learn from the accidents from the perspective of AIS data.



**Figure 9 – AIS record of accident between Scot Isles and Waldi Halfa for e-learning platform Source:**
*(Leonardo M'AIDER project, 2009-11)*

## 6. Conclusion

What is being done in M'AIDER Project is the transformation of several accident investigation reports into a set of bridge and e-learning scenarios.

It is expected that there will be less accidents and incidents which can be very costly in human life, injuries and loss of property. The research has shown that the approach implemented in M'AIDER course is considered necessary by many maritime organisations and shipping companies in the EU. The partnership is convinced that the EU and national agencies responsible for maritime affairs will be promoting the course in the future.

The M'AIDER project will enable ship officers particularly deck cadets and officers to learn from the past accidents/incidents and near misses to prevent accidents in the future. This will be either in a full-mission simulator environment or as e-learning environment. In this way, similar mistakes will be prevented and by learning from the causes of past accidents/incidents and near misses the quality of maritime education and training will be enhanced in real terms.

The project will also help MET institutions that do not have access or limited access to the full mission simulators to use the knowledge provided in the M'AIDER e-learning platform and from the e-assessment tests. The provision of the self-assessment section in the e-learning exercises is expected to enhance learning and motivate the cadets and ship officers to experiment with tests at their own time and pace which creates additional opportunity for learning about accidents and their causes.

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