Newsletter

September 2009 Issue 1

Dear Reader,

Welcome to the first SAFEGUARD newsletter which will be issued annually until the project finishes in 2012.

SAFEGUARD is a focused research project with nine partners from the UK, France, Norway, Greece and Canada which aims to address the requirements from the IMO Fire Protection Sub – Committee for further information on additional scenarios and full scale data for maritime evacuation analysis.

I hope you will find this newsletter informative. If you have comments or questions, please do not hesitate to contact us through our website:

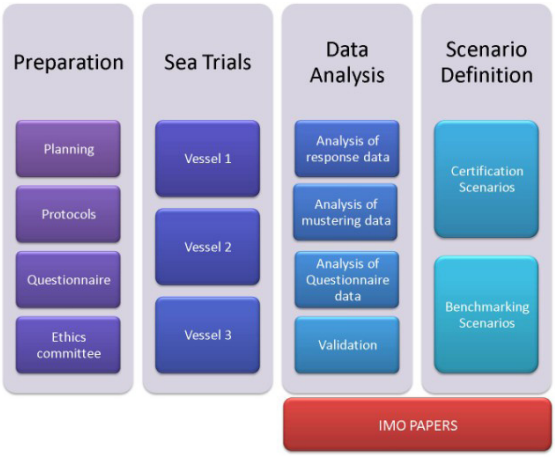
www.safeguardproject.info
which will be updated with news on our progress.

Jenny Gyngell
Project Manager
BMT Group Ltd

What is SAFEGUARD?

Professor Ed Galea, University of Greenwich

The purpose of SAFEGUARD is to collect human performance data in full scale ship trials and use this to provide calibration and validation data for ship based evacuation models and to also propose and investigate additional benchmark scenarios to be used in certification analysis.



Passenger response time data is fundamental to ship based evacuation analysis and is a key parameter specified in the IMO evacuation analysis protocol MSC Circ 1033 and its successor MSC Circ 1238. Recent research work conducted under the European Union Framework 5 project FIRE EXIT (G3RD-CT-2002-00824), demonstrated that the response time data used in MSC Circ 1033 was not rich enough to accurately represent reality and as such did not provide a suitable basis either for the use of evacuation simulation programs or for their validation.

The FIRE EXIT sea trials data relating to response times was submitted to IMO and incorporated within the new evacuation analysis protocol MSC Circ 1238 which replaced the earlier MSC Circ 1033. This updated IMO document made clear the fact that many of the assumptions used at present are in urgent need of revision. The data produced by FIRE EXIT, while limited, was of great use in showing the short comings of present data and the way forward. It is the main objective of SAFEGUARD to continue this work and acquire a large corpus of sea based data on passenger response times and assembly times during ship evacuations, of a sufficient size and richness to permit model calibration (in terms of response time distributions) and verification and validation (of assembly process) and serve as the basis for improved evacuation analysis protocols beyond MSC Circ 1238.

Partners:

- **BMT Group Ltd**
- **Bureau Veritas Group**
- **Color Line**
- **Marine Institute**
- **Minoan Lines**
- **Principia**
- **Royal Caribbean International**
- **Safety at Sea Ltd**
- **the University of Greenwhich**

Sea Trials Data Collection (OSSC & UoG)

Rob Brown, OSSC and University of Greenwich and Professor Ed Galea, University of Greenwich

Collaboration between the University of Greenwich (UoG) and BMT in the UK and the Marine Institute's Offshore Safety & Survival Centre (OSSC) in Canada began with the EU Framework 5 Project FIRE EXIT.

FIRE EXIT examined aspects of passenger safety on ships, from a design perspective, and resulted in important changes to international regulations that govern the design of these vessels – the IMO MSC Circ 1238. Continued collaboration in SAFEGUARD was a natural fit between these organisations again, given the niche areas of expertise each brings to the project.

Building on the significant experience gained in FIRE EXIT and other research projects aimed at understanding the performance and behavior of people in emergency situations, UoG and OSSC have been working closely together in SAFEGUARD to develop the protocols and methodologies for effective data collection in order to successfully meet the project goals.

Collecting representative human performance data in complex environments, such as onboard ships, requires careful planning to ensure the correct data are captured and recorded in a manner that can allow analysis to be repeatable and carried out as efficiently as possible.

To this end, UoG and OSSC have planned for data collection by three distinct means. Each provides a unique dataset to help provide as complete a picture as is possible of the human factors associated with the ship based assembly process:

a) Passenger response to the alarm: A total of 30 digital video cameras will be positioned throughout the vessels to be tested in SAFEGUARD. These cameras will record video and audio in areas throughout the ship where passengers are expected to be located when the alarm is first sounded.

Analysing the video recordings subsequently will provide the research team with new data relating to how passengers respond to the alarm and call to assemble onboard passenger ships. In certain environments, video cameras can be used quite effectively to collect passenger movement throughout a ship however; tracking specific individuals from one camera to another can be extremely difficult and time consuming as it is a manual process.

Tracking hundreds of individuals in this way would be a daunting task, if not impossible! To this end, the video record will be used to identify passenger response times only.

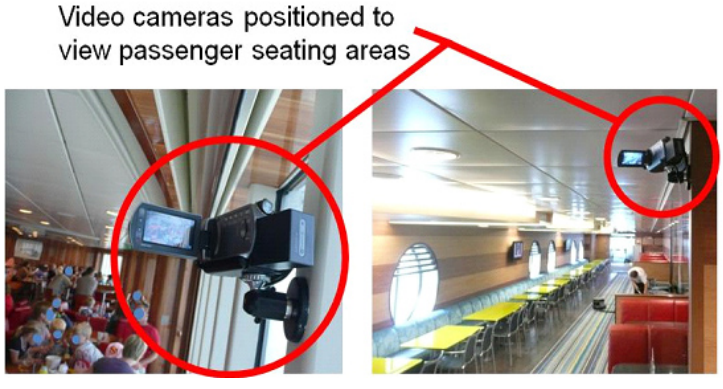
b) Passenger assembly route and time: UoG and OSSC have expended considerable time and effort testing technologies that are capable of automatically logging passenger routes and times during the assembly process.
Since the start of the project, the team has setup various configurations and scenarios in the corridors at UoG and onboard Color Line's SuperSpeed 2 ferry during its regular crossing between Larvik (Norway) and Hirtshals (Denmark). Two technologies have been the focus of the team's efforts - one based on radio frequency identification (RFID) and the other on infra-red (IR) light.

The basic premise of each system is similar - the research team positions components of either the RFID or IR system at various points of interest throughout the ship, thereby creating a series of uniquely identified "gates"; prior to boarding the vessel, each passenger is given a uniquely identified tag that they are asked to wear throughout the voyage.

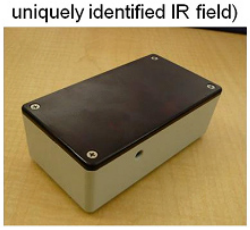
When a tagged passenger passes through a gate, the time and ID for that passenger are recorded for that specific location. While each technology (RFID and IR) has positive and negative features in relation to the SAFEGUARD project, following months of testing, the decision was made to procure the IR-based system.

Use of such technology will allow the research team to follow the movement of hundreds of tagged passengers during the assembly trials and easily capture information such as start time and location, end time and location, path chosen, average walking speed and flow rates through certain regions. Tracking of hundreds of passenger paths throughout each trial does not pose the same problem as do video-based systems. In addition, if properly planned, analysis of data is a considerably easier process when using such technology.

c) Additional passenger information: The final means of data collection in SAFEGUARD is through the use of a questionnaire that will be administered immediately following the assembly



IR Beacon (creates a uniquely identified IR field)



IR Tag with lanyard (worn by PAX & logs ID for each beacon it sees)

exercises onboard each ship. UoG and OSSC have designed a set of questions that will collect key psychological and human factors information that cannot be determined from video or IR tracking of passengers. If properly completed, questionnaires provide the possibility to fill gaps in the knowledge about specific passengers such as; the level of risk they perceived when they heard the alarm, what aided/hindered the passenger during the assembly process and whether they were travelling in a group or not and if so, the size and nature of the group. In addition, basic information about the passengers such as age, gender and travel experience will be collected. Linking these data to specific IR tag ID numbers would also provide very useful information and possibly allow the research team to draw correlations between detailed passenger characteristics and assembly time and route data described in (b) above. The research team will make every effort to ensure that passengers complete a questionnaire, which includes adding their unique tracking ID Tag number to the dataset.

An important part of the trial planning process has been ensuring the safety of both the passengers and research team that will take part in these trials. To this end, the SAFEGUARD trial methodology has been vetted by the UoG Research Ethics Committee – an independent body that reviews all proposed UoG research projects dealing with human interaction. The Research Ethics committee also reviews the proposed data protection process and ensures that adequate measures have been taken so that the collected data will be anonymous and irreversible in nature so that information obtained from the trials cannot be traced back to a particular passenger. A serious effort has been made early in the project to ensure that data collection during SAFEGUARD is as complete as it can possibly be. The project team is quite confident the data objectives will be met, allowing the project outcomes to be completed as planned.

SAFEGUARD from a Ship-owners viewpoint

Jan Helge Pile, Color Line Marine

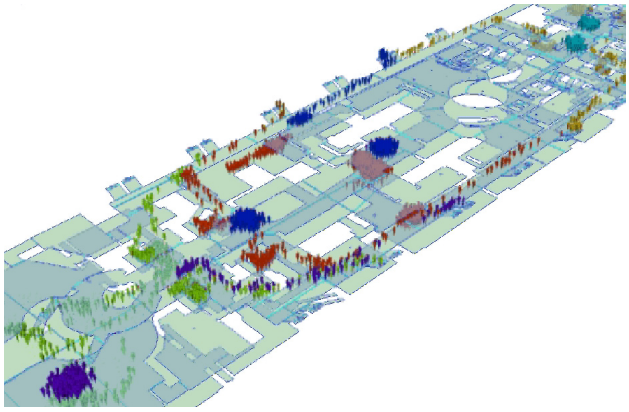
Color Line has for a number of years participated in EU financed research projects looking at safety and innovation within our field of operations. We realise that there will always be room for improvements based on more and better knowledge. Knowledge that very often cannot effectively be brought forward by ourselves alone, but only in larger research project together with other stakeholders such as now in SAFEGUARD. For passenger ships operating with less than 24 hour crossing time, which are not by law required to hold mustering drills for it's passengers, this project will be very interesting and useful. We have for many years based our ship's evacuation planning on analysis by approved software programs which we have all reasons to trust. Still, for Color Line, and I believe the whole European ferry industry, SAFEGUARD provides an opportunity to demonstrate the effectiveness and accuracy of these programs as well as providing us with better knowledge, possibly allowing us to improve these programs in the future to better describe the real situation in an onboard emergency.

Superspeed 2 vessel which is being used in the project trials

This may be of benefit for us both as a ship-owner by allowing us to design more effective vessels for the future, and of course for the international ferry passenger as well by providing a safer muster and evacuation situation. The Superspeed II ferry will be used for in the sea trials for data collection.

Ship Evacuation Modelling

Nicolas Besnard, Principia



Advanced simulation of evacuation in progress

The idea that a ship is the best lifeboat is wide-spread, and the evacuation of the passenger ships is always a last resort. Yet, sometimes evacuation becomes unavoidable, and in such cases human lives can depend on the good organisation and validation of procedures.

To ensure a safe evacuation in a real emergency, international regulations require an evacuation trial to be performed before the delivery of new-built ships. Frequent exercises are also performed by the crew and passengers during the operation of the ship. Furthermore, the International Maritime Organisation (IMO) requires the evacuation of passenger ships to be assessed by computational means during the design phase to provide information on the duration of an evacuation and passenger flows throughout the ship.

However, the specifications of the simulation tools used for these assessments except a very limited number of benchmark cases, and the software developers have to choose a number of assumptions to reflect reality.

The SAFEGUARD project aims at improving existing evacuation simulation tools by providing developers with detailed information on real-condition evacuation trials designed and conducted by the project itself. The objectives of the simulation is to check that the evacuation of the ship complies with the rules in terms of overall duration and flow along the evacuation routes. In particular the appearance of congestion is an important output. The simulations are generally performed during the design process. Therefore, depending on the results, the arrangement of the ship still can be optimised to improve the evacuation performance. For instance the width of doors or corridors can be modified to control the flows going through certain areas.

The simulation can also be used to adapt the evacuation procedures, for instance optimising routes to muster stations and lifeboats. Two types of simulation exist, according to IMO: the simplified and the advanced simulation. The simplified one is based on a deterministic approach. Knowing the distances between the different areas of the ship (cabins, muster stations, lifeboats), and the average passenger walking speeds, the duration of the evacuation can be computed.

This simplified approach cannot account for the behaviour of the flow of passengers between the different areas, and in particular cannot capture the occurrence of congestion. The advanced simulation is based on a detailed modelling of the geometry of the evacuation routes, on a model of the motion of people, and on a numerical computation of the simulation. The rules give no indication on the way to model the passenger motions, only some general characteristics, mainly gender and age.

Different approaches can be adopted to build a motion model. The macroscopic approach compares the passenger flow to a fluid flow. With this approach the overall evacuation duration can be assessed, but the local analysis of the flow is difficult. Indeed, the differences in the physics of a crowd and a fluid, such as the possible creation of gaps within a crowd, which cannot be represented by a fluid, limit the possibilities of this approach. In the microscopic approach, on the contrary, the people are modelled as individual autonomous agents.

By nature these multi-agent methods can take into account the interactions between the different agents, and offer the possibility of more evolved behaviour models. Walking speeds and directions, reactions to external events, etc. are parameterised according to the encountered situation: terrain, level of interaction between the agents and environmental conditions.

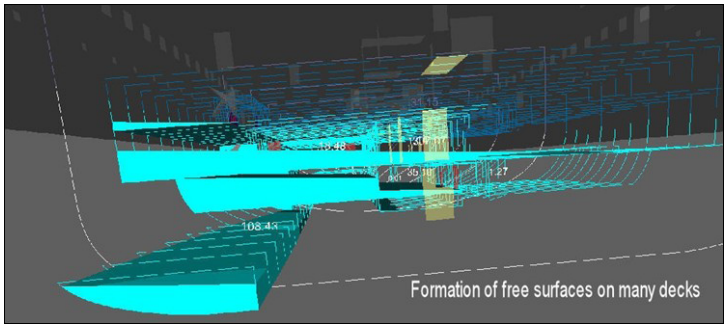
One of the main issues of simulation is the comparison with real figures coming from calibrated trials. Few of these figures are available, and the exact conditions of the trials are often only partially known (initial conditions, degree of awareness of the participants, degree of involvement, gender and age of participants etc.). The objective of SAFEGUARD is to calibrate existing tools for advanced simulation of evacuation on well characterised trials that will be organised and assessed by the project itself.

Flooding and Evacuation

Luis Guarin, Safety at Sea Ltd

Since 1999, Safety at Sea Ltd has been supporting the maritime industry, in particular the cruise and ferry sector, in the development and implementation of innovative design concepts, hand in hand with new safety legislation and best practices.

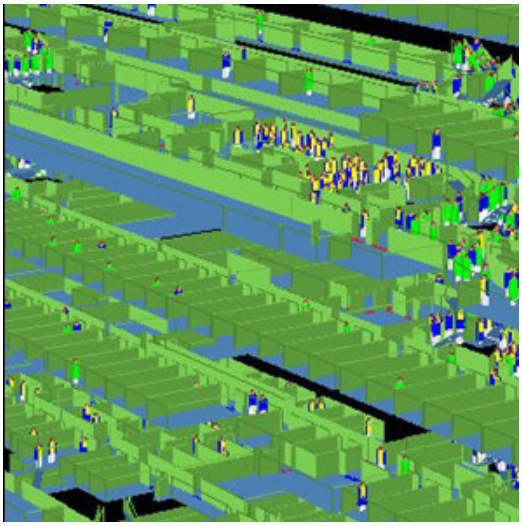
The extensive involvement in consulting and R&D activities over this period has allowed the company to develop unique expertise and advanced capabilities for ship design safety and performance evaluation, using in-house state-of-the-art, first-principles tools.



Simulation of progressive flooding through a ship's internal compartments after water ingress following a collision

Safety at Sea will bring expertise on performance-based safety assessment to the SAFEGUARD project, with particular emphasis on ship stability and survivability.

Since its creation, the company has been extensively involved in offering safety products and services in these two areas, ranging from traditional stability analysis and physical model testing (e.g., Stockholm Agreement) to off-design innovative solutions using advanced numerical (computer) simulation tools.



Instant of the simulation of passenger assembly onboard a large cruise vessel

Related to this, the company has been involved in the development and implementation of advanced evacuation simulation tools to ship design and operation, and in particular the application of the IMO advanced evacuation analysis guidelines to more than 30 passenger ships, including some of the largest and most innovative cruise and RoPax vessels.

The participation of Safety at Sea in SAFERGUARDS is a further step in the development, integration and validation of these capabilities.

Passengers in embarkation station

Of particular relevance is the development of realistic and relevant flooding scenarios and assumptions under which the assembly and abandonment performance of passenger vessels must be evaluated for design purposes with focus on emergencies.

In this respect, aspects that will be explored as part of the activities in the project include the influence of waves on the vessel response, the presence and progression of floodwater/smoke on the availability of escape routes, and other factors related to human behaviour in such conditions, for benchmarking purposes and for use in the development of suitable standards.

Realistic Evacuation Scenarios

Antoine Breuillard,
Bureau Veritas

Bureau Veritas has always cared about enhancing safety whilst allowing greater design flexibility through the use of advanced numerical models.

As a result Bureau Veritas has worked on advanced evacuation analysis for more than a decade and is constantly on the lookout for new and improved simulation tools and ways to enhance state of the art techniques for the use of these tools in a regulatory framework.

The current regulation, MSC/Circ. 1238 Annex 3, has two areas where improvement is possible: the inclusion of a validation dataset for benchmarking software; and the scenarios used in the approval process are lacking some realism. The second area, lack of realism in the approval scenarios, is being addressed by Bureau Veritas and its partners in SAFEGUARD.

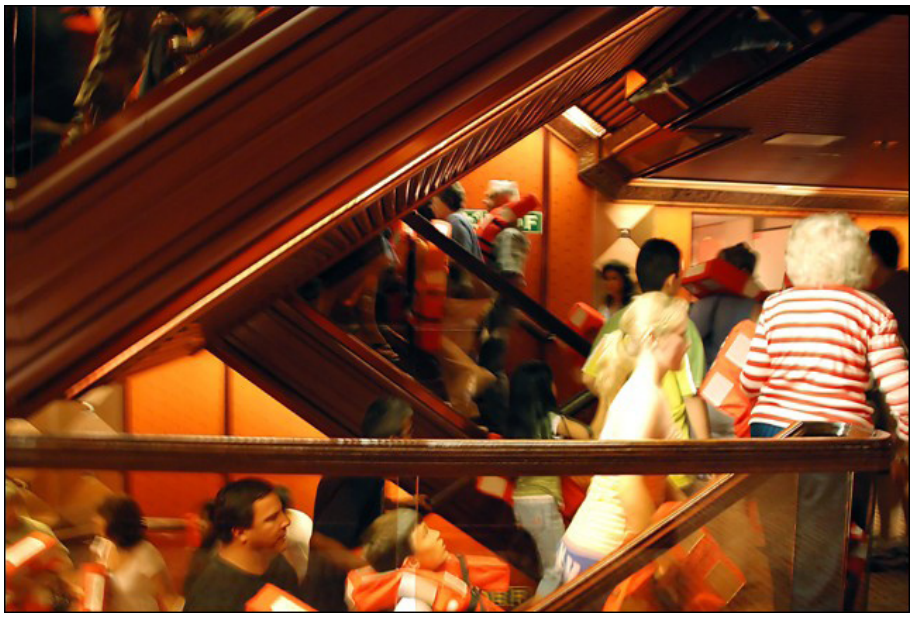
The process involves a detailed look at all available historical data, from databases and accident reports. This is a fairly typical process, however where the work differs is that the partners are also taking a good look at the procedures onboard the vessels, including large cruise ships, and are interviewing crew who have been involved in evacuation incidents.

Getting feedback from professional mariners is very important because it brings realism and credibility to the scenarios being enhanced.

Previously the software and hardware limitations of simulation have been a major hindrance to the possible complexity of scenarios used in the approval process.

However, with developments in the latest evacuation analysis software and vast increases in computation performance these scenarios can now be realistic but still feasible.

It is expected that this will lead to enhanced scenarios including methods to take in to account the effects of fire and flooding.



Passengers en route to assembly station

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