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SEARCH AND RESCUE
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Agenda item 10

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LARGE PASSENGER SHIP SAFETY

Annexes to the report of the Correspondence Group

Submitted by the United Kingdom as co-ordinator of the Correspondence Group

SUMMARY

Executive summary:	COMSAR 7/10/1 contains the report of the correspondence group established by COMSAR 6 to consider the radiocommunications and search and rescue issues identified for its attention by the Maritime Safety Committee and its Large Passenger Ship Safety Working Group. This document contains information considered by the correspondence group and referred to in its report.
Action to be taken:	Paragraph 3
Related documents:	COMSAR 7/10/1 and COMSAR 7/INF.5

Introduction

1 The Large Passenger Ship Safety Working Group ('the Working Group'), meeting during MSC 74, developed, as part of its work plan, a matrix of objectives and tasks which identified aspects of large passenger ship safety to be further considered by the Working Group and by appropriate Sub-Committees. The COMSAR Sub-Committee was tasked to consider the radiocommunications and search and rescue (SAR) aspects and, at its sixth session, established a correspondence group to do so.

2 The correspondence group's report, COMSAR 7/10/1, makes reference to various documents considered by the group. These documents, or relevant extracts from them, are annexed to this paper and to COMSAR 7/INF.5

Action requested of the Sub-Committee

3 The Sub-Committee is requested to note the contents of this paper.

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ANNEX 1

Working paper considered by the correspondence group, submitted by the United Kingdom

DEFINITION OF 'LARGE' PASSENGER SHIPS

There has been some debate on the definition of "large passenger ships". It is suggested that this definition varies according to the area under discussion - ship construction, equipment provision, SAR resources, etc - and that a single overall definition is not achievable. In COMSAR terms, the following thoughts are offered.

As all passenger ships - "large" or otherwise - are now required to be fitted to GMDSS standards, it is considered that, in radiocommunication hardware terms, current arrangements for all sizes of passenger ship are adequate, always provided that coastal States in the ship's area of operation are themselves fitted compatibly.

People to actually work the hardware may be more of an issue. Notwithstanding SAR co-operation planning arrangements, communications with passenger ships in difficulty are likely to be triangular: Ship, Company, SAR Service (usually the local MRCC/MRSC). In serious incidents, these communications are likely to be continuous. It is therefore *essential* that all three parties - Ship, Company, SAR Service - should be able to allocate staff to this communications function exclusively. These staff should *not* be the key people in each part of the organisation (eg, Master, SMC), although these individuals should have immediate access to the triangular command communications system, either to relay decisions/proposals or for direct intercommunication for tactical/strategic purposes. But the communicators staffing this triangular linkage should have sufficient knowledge/experience to deal with basic information exchange, and sufficient status/access to gain the key people's immediate attention as required. Again, the *size* of the passenger ship concerned is considered to be of little significance in the radiocommunications context.

"Large" in SAR terms is a more difficult and more important concept, which requires definition and which, moreover, must be defined in a way specific to SAR. The following definition is considered appropriate in SAR terms:

A "large" passenger ship is one which:

- if evacuated, would present a recovery problem beyond the normal capacity of local SAR services, utilising dedicated facilities *and* relevant additional facilities which may usually be expected in the ship's area of operation (where such facilities are defined as being those capable of providing practical assistance in the recovery operation); or

- if not evacuating but otherwise in need of SAR Service assistance (e.g. the provision of fire fighting and/or medical teams, emergency towage etc), would present a problem beyond the normal capacity of local SAR services, utilising dedicated facilities *and* relevant additional facilities which may usually be expected in the ship's area of operation (where such facilities are defined as being those capable of providing practical assistance in the operation).

These criteria are not static for a particular ship or cruising area. By these definitions, a ship may be “large” in one part of her cruising area, and not in another. The largest ships in terms of numbers of persons aboard will be “large” by these SAR definitions in *all* their areas of operation. No SAR Service has the normal capacity to recover thousands of people. In other cases, “largeness” will depend on cruising area, weather, sea state, time of day, seasonal/diurnal/meteorological factors affecting provision of dedicated SAR facilities, or seasonal/diurnal/meteorological additional facility availability patterns.

Passenger ships’ emergency planning arrangements should therefore take *local* provision of SAR facilities, both dedicated & additional, into account at all times.

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ANNEX 2

The ICCL 'Large Passenger Vessel Safety Study: Analysis of Safety Influences, Final Report'

LARGE PASSENGER VESSEL SAFETY STUDY: EXTRACTS

Introduction

The large passenger vessel trade has increased dramatically in recent years and projections are for even greater increases in the future. This increase in business has been accompanied by an increase in vessel size and attendant public exposure. These factors have made the safety of large passenger vessels a growing area of public concern, not only nationally, but internationally as well. Ship safety, including large passenger vessels, has been covered in the past by a myriad of international, national and classification society rules and regulations. The ICCL has contracted with the M. Rosenblatt and Son Group, of AMSEC LLC to perform a holistic study of large passenger vessel safety, reinforced by the vast experience of ICCL ship operators.

This study examines a large number of influences on the safe operation of a large passenger vessel, and the regulations that govern them, in an effort to identify areas that may need additional emphasis. In order to do this the spectrum of influences, as defined by an expert panel of large passenger vessel operators and safety personnel, was divided into Influence Centers, and within those centers, Influence Factors.

Influence Centers are major groupings of elements that are defined as Influence Factors. Influence Factors are items that prevent, detect, constrain, resolve or in some other way influence a Safety Driver. Safety Drivers are the external events that create a safety-related incident. These incidents are such things as groundings, collisions, etc. Each safety-related incident requires some level of response to resolve it.

The level of response was broken into four parts. The first level of response is Prevention. For this level, the intent is to see what influence factors come into play so that for instance, collisions may be avoided all together. The second level of response is defined as Containment. Containment, in this study, basically means stopping the consequences of a Safety Driver (incident) very quickly, before its spreads or creates a larger problem. This may typically be viewed as first response. An example would be putting out a fire out with a portable fire extinguisher before any real damage has been done. The third level of response is defined as Recovery. Recovery would be the response to a Safety Driver that has escalated beyond the effectiveness of initial response and other resources, such as fire fighting teams, repair teams, fixed fire-fighting systems etc. had to be employed to get control of the situation. Finally, the last level of response is defined as Evacuation. Here the incident cannot be contained or managed at the whole ship level or within an area of the ship, so that either a portion of the ship has to be evacuated, or in the worst case, the vessel must be abandoned.

The concept of Influence Centers was chosen to capture and analyze the safety information because it is especially useful for grouping information and depicting interactions among Safety Drivers and their related Influence Factors. An overlay of regulations and operating procedures is then applied to the influence framework to demonstrate how each influence link is currently addressed and highlight areas where there may be opportunities to consider large passenger vessel safety.

Objective

The objectives of this study are to:

1. Support the ICCL initiative to address the expressed concern over the safety of large passenger vessels by determining the areas where to best enhance passenger safety. Take a comprehensive look at the issues and opportunities, as a basis for an ICCL presentation delivered to the International Maritime Organization at their Maritime Safety Committee meeting in May 2001.

2. Analyze the total ship in its environment, including its operations and management, to capture the most significant passenger vessel Safety Drivers, i.e. incidents such as fire, collision and unlawful acts, and their interactions with influence factors.

3. Develop a well-balanced, non-redundant methodology to determine areas where there is extensive regulatory coverage of influence factors and other areas of less coverage where there may be opportunities to further enhance safety. Present this information in a clear and useful manner.

4. Benefit from the participation of industry ship operators, to provide input, review and validation, throughout the process.

Scope

This study addresses the major safety influences onboard large passenger vessels from the regulatory and the ship operations perspective. The study is limited to passenger, crew and inherent ship safety. The study examines passenger ship safety from the operator's standpoint. The examination of regulations is cursory at this stage, at a level sufficient to identify broad coverage, in order to identify influences that merit more detailed analysis.

Approach

The process to evaluate large passenger vessel safety starts by identifying the Safety Influence Centers. Each Influence Center is then broken into as many Influence Factors as can be derived from several iterations of brainstorming by panels of experts. As the panels examine the Influence Factors, the numbers of Influence Centers, the groupings change until a mutually agreeable Master Diagram depicting all the Influence Centers, Influence Factors, and Safety Drivers is achieved. These Influence Factors are then ranked to identify the degree of impact on a particular Safety Driver. This ranking was performed in a two-day off-site meeting of "experts". Finally, overlays of operating procedures and rules/regulations on the applicable Influence Factors are made to determine the extent to which Influence Factors appear to be adequately addressed and which are not.

In an effort to assure validity, the evaluation of the Safety Influences is an iterative process which takes advantage of exchanges between the contractor performing the primary analysis and ship operators and safety experts. The intent is to get a realistic perspective, involving the people who are ultimately responsible for ship safety; those who develop the operating procedures, and most importantly, those who apply the procedures and regulations that correspond to those safety issues. The study process steps are as follows:

5. Identify the Influence Centers. These centers consist of groupings of safety Influence Factors and the list of Safety Drivers that impact large passenger vessel safety.

6. Identify the regulations, rules, and guidelines that impact large passenger vessel safety. This step runs concurrently with the remaining steps.

7. Iteratively derive a Master Diagram depicting all the Influence Centers, Influence Factors and Safety Drivers.

8. Develop Influence Diagrams for each Safety Driver showing the interactions of individual Influence Factors within the Influence Centers for a given response level of a Safety Driver. This provided a mapping of the influence relationships. For example, for the Safety Driver, Collision, there would be four influence diagrams, one each for prevention, containment, recovery, and evacuation.

9. Rank the Influence Factors in each influence diagram. This is done by experienced ship operators and safety experts, taking into account the Influence Factors' possible impact on the associated Safety Driver. Ship operators and safety experts also review the Master Diagram during this step to see if there were any additional Influence factors to be added or deleted.

10. Compile the final Influence Diagrams. This is done by tabulating all of the ranking data from the ship operators and safety experts.

11. Overlay existing regulations, rules, and guidelines, and operating procedures on the influence diagrams.

12. Organize the results of the overlays on the diagrams and in spreadsheets; identify apparent gaps and shortfalls in the coverage of regulations, rules, guidelines and operating procedures.

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ANNEX 3

The United Kingdom Maritime and Coastguard Agency Formal Safety Assessment Branch's

SCOPING STUDY

Introduction

The IMO COMSAR Correspondence Group (CG) on passenger ship safety has been established in support of the IMO MSC Large Passenger Ship Safety Working Group. The remit of the CG is "to evaluate recovery and rescue techniques and equipment and propose measures as appropriate". A scoping paper produced by the United Kingdom is presented summarising both possible incident scenarios and the relevant variables. This paper introduces several issues that could form the basis of future studies and investigations. These studies may or may not require a more formal analytical approach, such as FSA, to be adopted.

Scope

The scope includes the consideration of mitigation measures following the abandonment of a passenger vessel and the crew and passengers are either in lifesaving craft or appliances, or in the sea.

Mitigation measures that would prevent the abandonment or improve the efficiency of the evacuation are outside the scope of the United Kingdom input into the COMSAR CG.

Scenario Development

There are many root causes that could result in a passenger vessel being abandoned. However, two incidents are most likely to lead to abandonment; fire and loss of hull integrity.

The speed of escalation from the initial incident has a significant influence on the eventual outcome. The worst case scenario is where all safety barriers are breached and the disaster phase immediately follows the incident, resulting in rapid loss of the vessel and the high likelihood of persons entering the water due to insufficient time to deploy and/or utilise lifesaving appliances. The second scenario occurs where the disaster phase is reached after the progressive failure of safety barriers. This is liable to result in a more orderly abandonment, and therefore a greater likelihood of people utilising lifesaving appliances. Even so it is also likely that there will be casualties in the water.

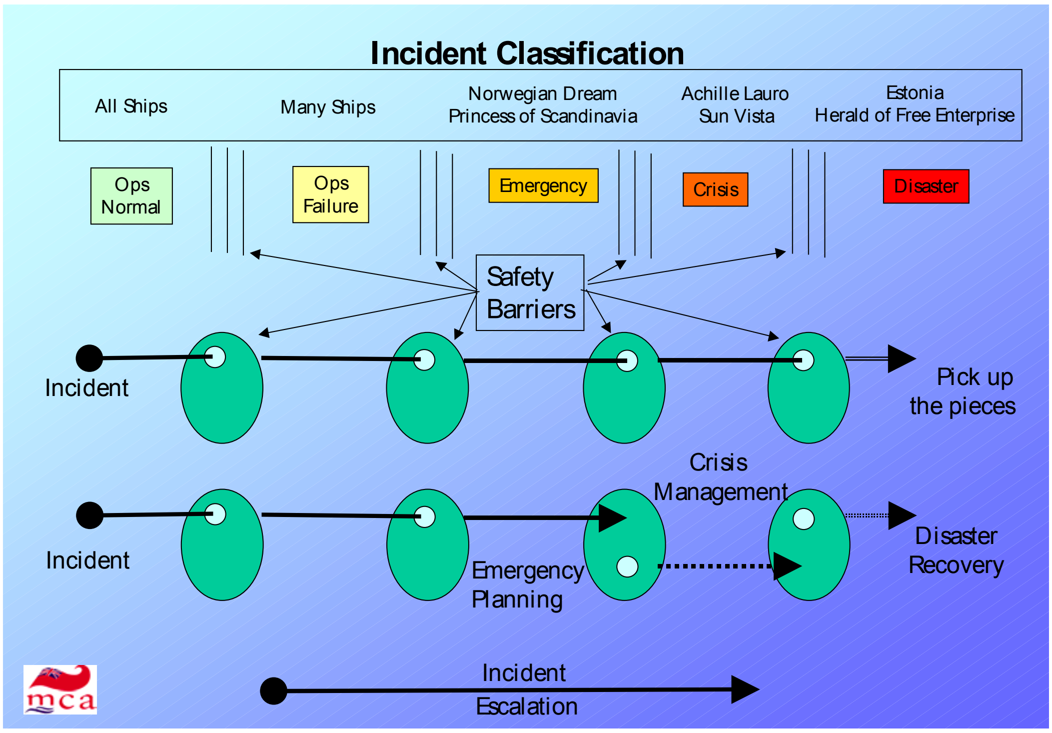

Figure 1 - Incident Classification and Escalation Model

Possible work

1. F-N' (Frequency/Number) diagram is required to display the outcomes of evacuation of large passenger ships to help us understand the possible frequencies and the numbers of people involved.

   1.1 Number of people requiring evacuation

   1.2 Time to Evacuate under different scenarios e.g., fire (reduced visibility), flood (listing), etc.

   1.3 By what means did they come to be in the water e.g., lowered in boat……jumped?

2. Scenario development should include the numbers in boats/rafts/water so the problem can be bounded.

3. A Stakeholder analysis of possible main actors and their roles would assist in identifying their relationships.

4. A 'population at risk' profile would be useful to identify where there are large numbers of passengers, in which geographic areas, and with what traffic frequency.

5. This study would also give an indication of the levels of 'shadowing' vessels that could be called upon in an emergency to supplement other SAR resources.

6. A SAR capability profile (how many can be rescued in what timescale – taking account of likely on-scene conditions) would be useful to marry with the 'population at risk'

profile to identify areas of high risk. This could include both shore based SAR response and the vessel traffic density; (high traffic density may increase the collision risk but also provides mitigation in the form of rescue vessels).

7. Initial discussion of possible areas of solutions:

7.1 Dual purpose LSA/PPE equipment for evacuation or recovery

7.2 Helicopter cross-decking arrangements

7.3 Location of / communication with survivors

7.4 Should all vessels carry Thermal Imaging Equipment to aid location of casualties in the water?

7.5 Should all vessels carry recovery equipment - currently only a SOLAS requirement for ro-ro's?

7.6 Should passenger lifejackets be provided with additional location aids?

7.7 Novel SAR plans – do we need to immediately recover persons from rafts/boats or should we be prioritising those in the water? If we do then what risk is there to those remaining in boats?

7.8 Recovery arrangements and methods from rafts/boats/water.

8. The main design goal of lifeboat/liferaft designers has been the safe and orderly evacuation of passengers from a ship in distress. Such a fixed goal has tended to skew thinking away from the need to (eventually) recover the lifeboat/liferaft and its occupants.

9. Currently, the probability is that people will be rescued on an individual basis e.g., winched to helicopter, and also from lifeboats/liferafts. This is for two reasons:

9.1 Ships, both merchant and passenger, do not have the appropriate lifting capability to recover lifeboats and liferafts of all possible designs from the water.

9.2 Current lifeboat/liferaft design does not necessarily aid the removal of several people from them at one time. Could we develop some novel methods for extracting several people at a time?

10. The suggestion is therefore made that lifeboats, and their ability to be recovered, be studied with the aim of developing a universal standard for lifeboat/liferaft designers to work to.

11. There is a need to study Risk Perception among passengers before any novel ideas for passenger evacuation are taken forward. For example, the idea of protective evacuation modules floating free of a sinking ship may sound good in principle, however, passengers may be reluctant to enter such a module if the perception is that it is still "fixed" to the sinking vessel.

12. There is also a need to improve our understanding of decision making during the implementation of an Emergency Plan. Figure 1 indicates that at this stage the decision makers can prevent the incident from turning into a crisis. Who makes decisions in an emergency? What are the ideal personal characteristics? How can we train such people? These questions need to be applied to both those on-board the casualty vessel, those assisting in ships and aircraft, and those managing the SAR.

Confidence in contingency planning

Recovery of a large number of people who have evacuated from a catastrophic shipboard event.

Would work to increase the efficiency of contingency planning and the confidence of decision makers be aided by the ability to emulate in detail and work through scenarios as desktop computer simulations?

Previous work

In 1994 the then United Kingdom Marine Safety Agency sponsored project (MS92/49/58) #323. This focused on Passenger and Crew Behavioural Analysis in Emergency Situations (PACBAES). One of the outputs of the project illustrated that software manufacturers were not supporting this market at that time.

A pilot project to test the size of the market in the first instance, for a generic scenario building tool, is suggested.

If the way looks clear a stakeholder ID exercise undertaken at the UN / IMO / EU to scale up a project that will define the parameters for a generic suite of software objects with which generic simulations of emergencies and disasters can be undertaken.

Events that suggest market viability for simulation (of emergencies) software.

1. The IMO proposed International Ship and Port Facility Security Code (ISPS Code) to be considered as SOLAS chapter XI.

2. Increased perceptions of security risk arising from the current “homeland defence” attitudes of developed economies may result in opportunities for the development of evacuation software.

3. The everyday efforts of contingency planners, including the military.

The Pilot project should produce enough intelligence about the market to be able to judge whether:

4. Generic modelling of emergency / disaster scenarios is feasible.

5. What degree of (ISO) standardisation is either available or in prospect for software objects involved with simulation of real events?

6. Estimation of producer / supplier interest.

Possible risk control measures

Table 1 shows groups of possible risk control measures, and it should be noted that Column 1, "Don't let it happen", is not within the CG's scope.

Don't let it happen	Limit the consequences	Improve recovery
Unsinkable ships	Routeing and pairing	Location of ships
Prohibitive insurance	Escape modules	Location of survivors
Bad publicity		Communications
Prohibition of unsafe routes		LSA and survival equipment
		SAR equipment
		Recovery equipment
		Cross decking air
		Cross decking ship/boat
		Design/low freeboard recovery

Table 1 – Possible risk control measures

Potential work breakdown structure (WBS)

Figure 2 shows a potential WBS for initial scoping of the LPS survivor recovery problem, and demonstrates that about 20 weeks' analysis might provide some indications of areas for further study. The WBS assumes that at least 2 analysts and external support (by contract) are available to ensure concurrent activities.

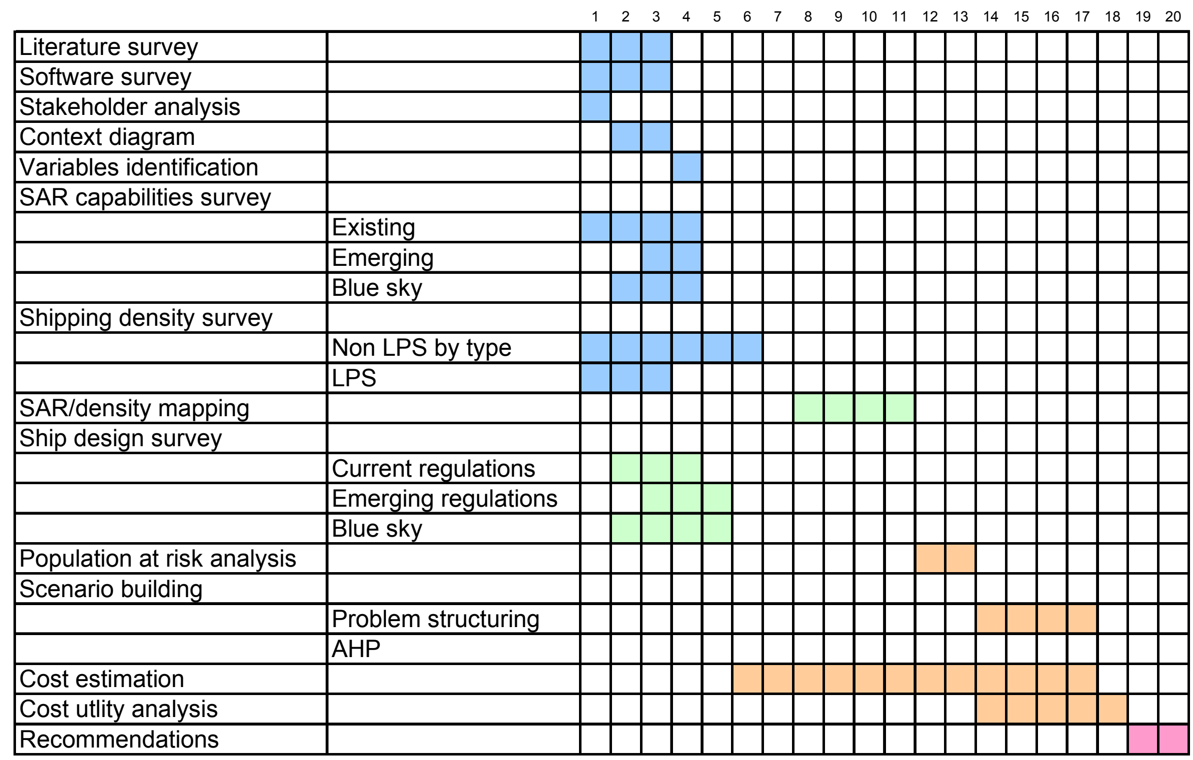

Figure 2 – Work breakdown structure for initial investigation (weeks)

Bibliography and useful links:

The Royal Institution of Naval Architects. (1996). *Escape, Evacuation and Rescue: Design for the Future.* London: RINA. (International Conference Proceedings)

IMO. (1999). *Rescue Techniques for Highsided Ships, IMO LSR 22/INF.9 Annex A*. London: IMO.

International Council of Cruise Lines (ICCL). (2002). *Cruise Ship Safety Forum*. Retrieved June 22, 2002, from www.iccl.org/pressroom/safetyforum.htm.

Fairplay. (2002). Would helipads save lives? Fairplay, August 1, 2002, p24.

Useful links:

www2.crl.go.jp/jt/a114/research/index-e.html (Communications Research Laboratory, Japan)

http://epics.astcorp.com (US military-derived emergency planning software)

www.globalcrisiscenter.com

www.sgi.com/industries/government/homeland/3d_modeling.html

www.onid.orst.edu/~darej/BIBLIO.HTM (bibliography)

http://in3www.epfl.ch/~bulicny/school/vr/emergency/assignmentEmerg.html (virtual reality kit)

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ANNEX 4

Two papers discussing

THE PROBLEM OF RECOVERY OF PEOPLE FROM SURVIVAL CRAFT OR FROM THE WATER

1. *The following is the text of IMO paper LSR 22/INF.9.*

1.1 The recovery of survival craft or individual survivors from the water is never easy. It is made all the more difficult if the rescue ship is high-sided. Both the MERSAR and IMOSAR Manuals[1] draw attention to the problems of high-sided merchant ships if specialised rescue units are not available to effect rescue.

1.2 The purpose of this paper is to identify the existing appliances and equipment which are available for the recovery of survivors directly by ships with large freeboards. The paper also suggests ... how existing life-saving appliances might be adapted for rescue purposes and how additional non-mandatory equipment, if fitted on such high-sided ships, might enhance the chances of success. It is not considered that these vessels would be as suitable as specialist rescue units even though large high-sided ships can provide a relatively stable platform. In heavy weather, such vessels may have difficulty manoeuvring in strong winds which further compounds the problems of recovery.

1.3 Improvements in survival craft design and evacuation techniques - totally enclosed lifeboats, free-fall launching arrangements and on-load-off-load release mechanisms - have been aimed specifically at swift and safe dry-shod abandonment from ships. Unfortunately, many of these improvements, combined with the design characteristics of modern merchant ships, have introduced additional difficulties in the recovery of survival craft and the rescue of survivors by an attending ship, especially if it is high-sided.

1.4 If there are numerous survival craft involved, for example, following a passenger ship abandonment, in the absence of special SAR surface units, helicopter assistance on the scale needed could well prove inappropriate. Circumstances may arise when the only available rescue unit is a high-sided merchant ship and it is this circumstance which this paper addresses.

1.5 <u>Recovery of survival craft including survivors</u>

1.5.1 Merchant ships involved in the recovery of survivors may not be equipped with derricks or other lifting equipment to recover an abandoned ship's laden lifeboat or liferafts in a seaway. Even if such equipment was available, it could be difficult if not impossible for the crew of the survival craft to safely hook-on and secure for hoisting.

1.5.2 Apart from the single point suspension capability of a davit-launched liferaft, other survival craft may only be safely recovered by means of a net or scoop bodily supporting the craft as it is lifted clear of the water. This requires specialised equipment such that the survival craft can be recovered in a secure and upright mode. Substantial lifting equipment and winch power would be required to cope with the bodily lift of, for example, a 25-person laden liferaft weighing

[1] The MERSAR and IMOSAR Manuals have since been replaced by the International Aeronautical and Maritime SAR Manual (IAMSAR)

approximately 2 tonnes. This type of equipment is not normally available on high-sided merchant ships such as ferries, bulkers or container ships.

1.6 Recovery of individual survivors from their survival craft

1.6.1 The MERSAR Manual itemises certain measures to be considered while proceeding to the area of distress. Some of these measures may not be appropriate when related to the specific problems of rescue by high-sided ships. For example, the recovery of elderly and frail survivors by scrambling net up the side of high-sided ships is unrealistic.

1.6.2 The successful rescue of survivors by a high-sided ship will require practical equipment, relying on its own survival craft and other non-mandatory equipment to transfer the survivors.

1.6.3 Mandatory equipment could include:

1. designated rescue boats
2. lifeboat/rescue boats
3. emergency lifeboats
4. throw-over liferafts
5. davit-launched liferafts
6. evacuation slide launching appliances.

1.6.4 Examples of additional, non-mandatory rescue equipment:

1. nets or scoops
2. floating recovery baskets.

1.6.5 Certain high-sided ro-ro vessels may additionally consider artificially reducing the freeboard by opening bow or stern doors, provided the sea conditions are favourable.

1.6.6 Apart from the evacuation slide or the use of ro-ro doors, all of the other equipment relies on being itself lowered and recovered many times during the rescue operation.

1.6.7 A designated rescue boat on a single point suspension is the most adaptable piece of equipment, the best type of craft to deploy away from the rescue ship, and the easiest to achieve rapid recovery. Likewise, an emergency lifeboat fitted with suitable recovery strops and hanging-off pennants can be realistically recovered in a seaway. The use of these boats is however only appropriate for the transfer of a relatively small number of survivors or for man-overboard incidents.

1.6.8 It is suggested ... that rescue boats/lifeboats can be put to better use as lifting and transferring units it they remain secured to the attending high-sided ship. The ship's lifeboats could then prove very effective in this respect although it is recognised that the present SOLAS requirement is only to be able to recover the lifeboat with its crew (regulation III/48.1.10). Given reasonable sea conditions and recovery winch power, it should be possible to utilise the lifeboats as lifting cages, keeping them secured onto the falls and transferring survivors out of their own survival craft and into the lifeboats which would then be raised to the embarkation position, the survivors passed on to the rescue ships, and the lifeboats lowered to repeat the sequence.

1.6.9 Throw-over liferafts cannot be recovered and would be of limited value.

1.6.10 Davit-launched liferafts cannot be recovered when laden except by specialised lifting gear.

1.6.11 Evacuation slides incorporating a platform can provide a useful landing for survival craft to come alongside. Once on the platform, it is possible for large numbers of survivors to be transferred onto the rescue ship via portable ladders deployed down the length of the slide, thereby creating a floating accommodation ladder.

1.6.12 Specialised nets or scoops are available, as are floating recovery baskets, to lift individual groups of survivors. These can be operated from the rescue ship's own cranes, store gantry arms or davits. Scoops can be used for recovering either individual survivors or small survival craft. Floating baskets are designed to hoist between 6 and 18 persons.

2. *The following is an extract from a paper delivered to the Royal Institution of Naval Architects (RINA) conference on 'Escape, Evacuation & Rescue' in London in November 1996*[2].

2.1 Lifesaving appliances

2.1.1 Equipment required to be carried aboard ships at sea for the safety of their own crews may be adapted to the rescue of others. The revised SOLAS Chapter III and the associated International Life-Saving Appliance Code list, *inter alia*, rescue boats (defined as being "designed to rescue persons in distress and to marshal survival craft") with immersion or anti-exposure suits for their crews; marine evacuation systems; lifeboats & liferafts; line-throwing appliances; and lifebuoys (some with buoyant lines). On ro-ro passenger ships one of the rescue boats is to be a *fast* rescue boat, and these ships will also have to be "equipped with efficient means for rapidly recovering survivors from the water and transferring survivors from rescue units or survival craft to the ship". Marine evacuation systems fitted with handlines or ladders are mentioned in this respect. Ro-ro passenger ships will also need approved helicopter pick-up or landing areas - although it must be remembered that having such an area does not mean that it can necessarily be used.

2.1.2 In any event, we can be no more certain of the presence on scene of a ro-ro passenger ship "equipped with efficient means for rapidly recovering survivors" than we can of specialist SAR units. Other developments in evacuation have tended to compound the recovery problem. To quote IMO's paper on 'Rescue Techniques for Highsided Ships', "Improvements in survival craft design and evacuation techniques - totally enclosed lifeboats, free-fall launching arrangements and on-load-off-load release mechanisms - ... aimed specifically at swift and safe dry-shod abandonment from ships, combined with the design characteristics of modern merchant ships, have introduced additional difficulties in the recovery of survival craft and the rescue of survivors by an attending ship, especially if it is high-sided."

2.1.3 How lifesaving equipment can or will be used in any particular incident will depend upon the circumstances at the time - including the judgement and skill of the masters and crews of rescuing craft. The launching and particularly the recovery of rescue boats can be fraught with difficulties. The official operating maximum for the launching of fast rescue craft by the highly trained crews of one standby vessel operator I have spoken to is seas of three and a half metres; and many masters of ordinary ships would look askance at that. The use of standard lifeboats, liferafts and marine evacuation systems will be an even more difficult decision to take as they may not be recoverable in the prevailing conditions. Nevertheless, this equipment may *have* to be used. A ship

[2] 'Escape, Evacuation & Rescue: design for the future' 19-20 November 1996. The *Proceedings* of the conference may be obtained from RINA, 10 Upper Belgrave Street, London SW1X 8BQ, United Kingdom.

finding people in the water, for example, may not be able to recover them herself but, by dropping her own liferafts, may enable them to remain alive until specialist SAR units such as helicopters arrive.

2.1.4 It is to be hoped, of course, that the rescue boat will be able to be launched, recover the casualties, return to the ship, hook on to the falls or recovery strops, and be hoisted aboard complete with its complement ("at least six persons" are envisaged in SOLAS III). This is not an efficient way of handling large numbers of people; and ordinary lifeboats are not designed to be recovered fully laden. It is possible, nevertheless, to use lifeboats or launches as 'elevators'. To quote IMO again: "Given reasonable sea conditions and recovery winch power, it should be possible to utilise the lifeboats as lifting cages, keeping them secured onto the falls and transferring survivors out of their own survival craft and into the lifeboats which would then be raised to the embarkation position, the survivors passed on to the rescue ships, and the lifeboats lowered to repeat the sequence" ('Rescue Techniques for Highsided Ships'). Winch power may dictate that only limited numbers of people can be lifted on each occasion - but this was the means by which the survivors were recovered from the *Achille Lauro* off Somalia in 1994.

2.1.5 Lifebuoys on lines are old favourites, and can still be useful. Contact with people in the water can be established by circling them while towing a lifebuoy. Initial contact can also be established, of course, with line throwing appliances (although these are notoriously inaccurate, especially in crosswinds). The casualties, whether in the water or in survival craft, can then be drawn in to the ship's side - where we are faced once again with the problem of how to get them from the waterline to the deck.

2.1.6 The use of marine evacuation systems to recover people from the water or survival craft has distinct possibilities. It is certainly easier to climb a ladder laid down an evacuation slide than it is to climb a scrambling net. But it is not a universal panacea. Throughout this discussion of recovery systems we must bear in mind that the people being rescued may *not* be fit or capable. The first question that must always be asked when considering systems that presuppose a measure of self-help is 'could an elderly, or cold, or disorientated, or injured person handle this? Could a frightened child handle it? Or a person weighed down by sodden clothing?' And the second question is 'now: what about the helpless?' In United Kingdom waters even the young and fit may be able to do little or nothing to help themselves by the time the rescue unit reaches them.

2.1.7 How, then, do we get people aboard the lower platform of the evacuation slide, or the liferaft, or the rescue boat in the first place? There are ways of doing it, to which we shall return shortly. For the moment let it suffice to say that the use of standard lifesaving appliances may not be the complete answer to the recovery problem.

2.2 Direct access

2.2.1 It can be very difficult to gain direct access to any surface craft, particularly from the water and in any sort of seaway. The aid of various lifting or climbing devices may be required, and we will consider those shortly. The range of possibilities for direct access is limited: low freeboard areas, boarding stations, ship's side doors such as pilot doors, and ro-ro doors.

2.2.2 The idea of opening ro-ro doors at sea to assist in the recovery of casualties may seem foolhardy. IMO comments cautiously that "certain high-sided ro-ro vessels may ... consider artificially reducing the freeboard by opening bow or stern doors, provided the sea conditions are favourable" ('Rescue Techniques for Highsided Ships'). Very clearly, this will be a matter that only the master can decide, granted the prevailing conditions. A similar *caveat* applies to the use of side doors. But if we are fortunate, large numbers of survivors might be transferred rapidly by simply stepping aboard the rescue ship from their survival craft, towed or pushed alongside by rescue boats, lifeboats and launches.

2.2.3 Boarding stations can be used. Some passenger ships have them for handling launches, but access to the openings we have already discussed can be facilitated by mooring liferafts alongside them. Survivors brought in by other craft can be unloaded to these boarding platforms, releasing the rescue craft more quickly, and enabling semi-permanent boarding arrangements such as ladders to be rigged from platform to ship. The rescue boat does not have to manoeuvre directly alongside, and the boarding platform can be cleared in slower time.

2.2.4 Permanent low freeboard areas are, at first sight, an obvious solution to the access problem and one which, it might be suggested, could be designed into any ship without compromising watertight integrity. Some ships operate with a fairly low freeboard in any event when laden. The RNLI find that most casualties can be recovered directly onto the low freeboard walkways on their lifeboats; and standby vessels are all fitted with low freeboard rescue zones. But the problem is that vessels have high freeboards in the first place to keep the water out: where the freeboard is low, it gets in. It can be extremely difficult to handle casualties in a low freeboard area which is being continuously swept by the sea.

2.2.5 Here, as with all the direct access methods we have discussed, ample trained help from the rescue craft's crew is essential. The assistants at the access point have to be properly equipped with lifelines, lifejackets and immersion suits, and some sort of securing system is needed to ensure that casualties brought aboard are not taken off again by the next wave. More assistants are needed to remove the casualties quickly from the rescue zone and into the care of yet more assistants in the handling areas. With many ships these days, we are rapidly running out of hands.

2.3 <u>Ladders and nets</u>

2.3.1 Various sorts of ladders and scrambling nets may be used in conjunction with the access points just discussed, or they can be used independently, to give access to the weather decks.

2.3.2 Pilot ladders are in constant use for the transfer of personnel from small craft - and could be as readily utilised to climb from the water. But all seamen can recount instances in which experienced pilots have found it difficult or impossible to get aboard in this way, and for the recovery of casualties the pilot ladder can only really be considered for the fit, healthy and alert.

2.3.3 The accommodation ladders would be easier to climb, and would enable assistants to help the casualties, possibly to the extent of handling stretcher cases. They might be lowered to, or even below, the waterline, and could be used in conjunction with a liferaft as boarding platform. Once again, however, the sea state will be a limiting factor here.

2.3.4 The scrambling net has a long tradition in rescue terms - but, as anyone who has ever tried to climb one knows, it is not very user-friendly. A net - or a jacob's ladder - laid hard against a ship's side is difficult to get a purchase on at the best of times. I recently viewed a standby vessel's arrangement, in which scrambling nets were stowed at the rescue zones, bent to a folding bracket. When the nets were rigged, the bracket held them a few inches clear of the ship's side, and itself formed a solid handhold at deck level. The crew assured me, however, that practical experience showed that it was *still* difficult to use, even when hanging clear and with a climb of only three or four feet to the deck. As IMO remark: "The recovery of elderly and frail survivors by scrambling net up the side of high-sided ships is unrealistic" ('Rescue Techniques for Highsided Ships').

2.3.5 One advantage the net does have over the ladder, though, is that suitably-equipped assistants can go down it to help casualties up. Alternatively, casualties - including the helpless - can be made fast to the net at the waterline prior to the whole net being lifted inboard.

2.4 Lifting devices

2.4.1 This leads us on to the consideration of how we might *lift* people aboard, and the devices under discussion here may be broadly divided into two categories - point lifting, and parbuckling. Simply manhandling waterlogged and exhausted people, without lifting aids, can be a very difficult job indeed. Natural buoyancy can be used to 'bounce' the casualty over the sponson of a fast rescue craft or liferaft (although this will probably exacerbate any injuries) but for almost any other craft some sort of lifting aid will be required.

2.4.2 There are already many aids to lifting casualties available. All can be readily employed or adapted for use by surface craft, although the carriage of such devices and the means of deploying them are not mandatory.

2.4.3 The rescue strop, or sling, is particularly useful. It can be put on easily, even by people in the water, and its mode of use is self-apparent - or can be readily explained by diagrams on the strop itself. Two strops used together (one under the arms, the other under the legs) help keep the casualty more horizontal, in the so-called hypothermic lift, lessening the risk of hydrostatic shock as the casualty is lifted clear of the sea.

2.4.4 However, it *is* possible to fall out of the strop if the arms are raised, and it offers little or no protection to the occupant while being lifted up a ship's side, for instance. Nor can the strop be used for the injured or disabled. The rescue seat has similar disadvantages. A rescue litter would be required for the helpless, together with assistance in the water or survival craft to secure the casualty into it.

2.4.5 The rescue net can be improvised, using cargo nets and pallets perhaps; but would be relatively inexpensive to manufacture and maintain, and easy to stow, for this specific function. Slightly more cumbersome, but more robust, are the various types of rescue basket. The example shown [in IAMSAR] is designed for helicopter use: larger versions can be readily handled by surface craft. All follow the same basic idea. The basket is essentially a lightweight metal cage lowered into the water, where floats maintain it at a suitable depth for people to pull themselves or others into it easily - an advantage even over liferafts, which can be difficult to board from the water. Such baskets - typically capable of lifting six to eighteen people at once - are used successfully by standby vessels in the North Sea.

2.4.6 The chief drawback with each of these point lifting devices may be the lack of suitable lifting equipment aboard the SAR unit. Even if a ship has cargo or stores cranes, derricks or gantries, they may not be suitable for this task - although consideration of it at the design stage should enable it to be encompassed at little extra expense. Other alternatives include cranes or davits specifically designed for use with rescue nets or baskets. The RNLI's procedure involves an A-frame and hand tackle, with a crew member in the water to assist the casualty - but this is clearly not an option for vessels lacking low freeboard access.

2.4.7 If the lifting equipment is available, it may be possible to recover ships' lifeboats or liferafts fully laden - which would be a quicker and potentially safer option than lifting their occupants one by one or in small groups. But it may be difficult if not impossible in a seaway to safely secure current survival craft for hoisting, either by utilising the craft's own lowering points, or slings or nets beneath it. This option certainly requires relatively heavy lifting equipment: a laden 25-person liferaft weighs approximately two tonnes.

2.4.8 Another problem with point lifting, already alluded to, is that of controlling the load, especially if suspended some distance below the head of the lifting device, with the rescuing craft perhaps moving in a seaway. Control with bowsing lines may be limited, and there is a danger of the casualties striking the ship's side or other hazards while being lifted. The shorter, and the more rapidly achieved, the lift the better.

2.5 Parbuckling devices

2.5.1 Parbuckling is an old method of cargo handling fairly recently - and successfully - adapted to the lifting of people. The effect is that of a double purchase, with the load rolling up the side of the rescuing ship.

2.5.2 Parbuckling rescue scoops like the Jason's cradle or the Dacon scoop ... have been proved to work very efficiently in the rescue situation. The cradle stows neatly when rolled one way (along the sponson of a fast rescue craft, for example) and forms a rigid U-shaped scoop when rolled the other. A person in the water, conscious or unconscious, is manoeuvred over the scoop, which is then lifted outboard of him, rolling him into the rescue boat. One crew member can recover a sixteen stone man with his clothing waterlogged quite easily.

2.5.3 The larger scoop works on precisely the same principle, but with a crane providing the reach and the lift. It can recover relatively large numbers of people at once, or even whole survival craft. Yet even this system is not perfect: a standby vessel master has remarked to me that using the scoop to 'trawl' for casualties, as he put it, can be a little unnerving from the point of view of the people in the water as they watch the rescue ship bear down upon them. Some, it seems, tend to swim away.

2.5.4 It is common to all these lifting devices, of course, that the casualties must be brought close to the side of the ship - or the ship must manoeuvre close to them. With many vessels, the latter operation may be difficult to achieve. The standard advice, in the MERSAR Manual, is to allow for relative drift rates and bring the ship up accordingly - to windward of people in the water or to leeward of liferafts - so that the two will drift together.

2.6 Miscellaneous

2.6.1 The MERSAR Manual includes further advice on the recovery of casualties in particularly heavy weather, which should be briefly mentioned in this context. Attempts to quell the sea using oil - preferably vegetable or animal oils, including fish oils, but lubricating oil in lieu of these - can aid the transfer process; if means exist to spread the oil, of course. Similarly, other vessels may be able to form a lee for the rescue craft (although this is usually better not attempted for helicopters, as it tends only to increase turbulence). If it is too hazardous to approach the casualties, the SAR units' own survival craft can be towed into a position in which the casualties can board them before being pulled clear. In other circumstances it may be safer to leave the casualties where they are - in survival craft, or aboard the distressed vessel herself - and tow or escort them to more sheltered waters.

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ANNEX 5

Extracts from

IAMSAR Volume III

Rescue Action Plan[3]

Although the SMC normally prepares a rescue plan, sometimes the OSC may have to develop it. Factors to consider include risk to SAR personnel; number, location & disposition of survivors; condition of survivors and medical considerations; current meteorological conditions; current sea conditions; time of day; survival equipment on hand; type of rescue craft, etc.

In a distress incident, even uninjured persons who are supposedly able-bodied and capable of logical thought are often unable to accomplish simple tasks and may hinder their own rescue.

Rescue by maritime facilities: general considerations[4]

For survivors in the water, the rescuing vessel may find it necessary to rig scramble nets; launch lifeboats; launch liferafts; have crew members suitably equipped to enter the water to assist survivors; and be prepared to provide initial medical treatment.

For a fire or extremely heavy weather, or where it is impossible for the rescue ship to come alongside, then a lifeboat or liferaft may be towed to a closer position.

In heavy weather, the use of oil for reducing the effect of the sea should be considered […]

In heavy weather, a ship with a low freeboard may be better suited to effect rescue.

A boarding station may be rigged by mooring a liferaft alongside. It is particularly useful when lifeboats are used: survivors can be quickly unloaded into the boarding station, releasing the boat for another trip.

The direction of approach to the distressed craft (or survivors) will depend upon circumstances. Some emergencies, such as a ship on fire, may have to be approached from windward and others, such as liferafts, from leeward. The two key factors are whether a lee-side protection is necessary during the rescue operation and the comparative rates of drift of the distressed craft and the rescuing ship. If time permits, assess the relative rates of drift. This precaution may prevent serious mishaps during the rescue operations. In general, survivors in the water are best approached from the leeward side. If practicable, arrange for injured personnel requiring the attention of a medical officer to be transferred to a ship carrying one.

In ocean incidents, if there is no ship available with a medical officer on board, the rescue facility should request the OSC, if assigned, or the SMC to consider transmitting an urgency message requesting such a ship to a rendezvous. If necessary, a CRS may be contacted for ship reporting systems information on the availability of ships with a medical officer. In coastal incidents, the SMC should arrange for medical assistance to be sent from shore: the local CRS may act as an intermediary.

[3] extracts from IAMSAR Volume III, pp 2-15 – 2.17
[4] extracts from IAMSAR Volume III, pp 2-31 – 2.33

Immediate care of survivors[5]

After a rescue, survivors may require hospital treatment. They must be delivered to a place of safety as quickly as possible. The SMC should be advised if ambulances are needed.

SAR personnel should be alert and ensure that, after rescue, survivors are not left alone, particularly if injured or showing signs of physical or mental exhaustion.

When survivors are delivered to a hospital, the person in charge of the delivering facility should provide information on all initial medical treatment given to the survivors […]

Debriefing of survivors[6]

Survivors should be questioned about the distressed craft as soon as possible. Their input may be able to further assist in the SAR operation, future SAR operations, or the prevention of incidents in the future. The information should be relayed to the SMC […]

Survivors should also be questioned about their medical history […]

Questioning survivors has many purposes: to ensure that all survivors are rescued; to attend to the physical welfare of each survivor; to obtain information which may assist and improve SAR services.

Care must be taken to avoid worsening a survivor's condition by excessive interrogation. If the survivor is frightened or excited, the questioner should assess these statements carefully.

Note: Questions should be asked in a calm voice and the questioner should avoid suggesting answers to the survivor. Explain that the information required is for the success of the SAR operation and may be of great value for future SAR operations.

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[5] extracts from IAMSAR Volume III pp 2-36 – 2.37
[6] extracts from IAMSAR Volume III pp 2-38 – 2.39

ANNEX 6

Extracts from the Final Report of the Joint Accident Investigation Commission of Estonia, Finland and Sweden on the capsizing on 28 September 1994 in the Baltic Sea of the ro-ro passenger vessel

mv ESTONIA

Summary of the operation (7.1)[7]

The *Estonia* sank in international waters in Finland's Search and Rescue Region (SRR), in its Archipelago Sea maritime SRR under the responsibility of the Maritime Rescue Co-ordination Centre (MRCC) in Turku. Consequently, Finland was responsible for the overall co-ordination of the SAR operation.

On the night of the accident there were four large passenger ferries on the Finland-Sweden route, the *Mariella* and the *Silja Europa* sailing westwards and the *Isabella* and *Silja Symphony* eastwards. Another passenger ferry, the *Finnjet*, was sailing from Finland to Germany.

The first distress call was received from the *Estonia* at about 0122 hrs and was answered by the *Mariella*, which was northeast of and closest to the *Estonia*. When the distress call was heard on the *Silja Symphony*, a tape recorder was turned on to record the radio traffic.

A second distress call from the *Estonia* was received at 0124 hrs by 14 radio stations. One of these was MRCC Turku, which assumed control of the SAR operation.

At 0129 hrs the *Estonia*'s position became known, and after receiving the distress message vessels in the vicinity turned towards the scene of the accident. The *Mariella* was by that time about nine nautical miles away from the *Estonia*. The *Silja Europa*, which had direct radio contact with the *Estonia* during the distress traffic, assumed control of the distress radio traffic and at 0205 hrs MRCC Turku designated her master as the On Scene Commander[8] (OSC).

After receiving the distress call MRCC Turku alerted rescue units and those responsible for the management of the rescue services. The first units to be alerted were the coast guard patrol vessel *Tursas* at 0126 hrs and stand-by maritime rescue helicopter OH-HVG in Turku at 0135 hrs. The helicopter took off at 0230 hrs. MRCC Turku formally designated the situation as a major accident at 0230 hrs and the appropriate alarms were initiated.

At 0142 hrs the *Mariella* informed Helsinki Radio about the accident. Instead of transmitting a Mayday Relay Helsinki Radio transmitted a Pan-Pan message at 0150 hrs.

Maritime Rescue Sub Centre (MRSC) Mariehamn informed MRCC Stockholm of the accident at 0152 hrs, whereupon the alerting of Swedish maritime rescue helicopters was initiated. The first of these, stand-by helicopter Q 97, took off at 0250 hrs.

MRCC Helsinki notified MRCC Tallinn of the accident at 0255 hrs.

[7] References in brackets are to the Final Report chapter headings and sub-headings
[8] Now known as 'On Scene Co-ordinator'. The role is defined in IAMSAR.

The *Mariella* was the first vessel to reach the scene of the accident, at 0212 hrs. At this time many persons, liferafts, lifeboats and lifejackets could be seen in the water. People were heard screaming in the sea. At 0230 hrs the *Silja Europa* arrived and by 0320 hrs all five passenger ferries had reached the scene of the accident.

OH-HVG arrived as the first helicopter at the scene of the accident at 0305 hrs, and Q 97 arrived at 0350 hrs.

About 0450 hrs there were four helicopters and eight vessels on the scene, and the number of rescue units continued to increase. The *Tursas* arrived at 0500 hrs. By 1200 hrs 19 vessels and 19 helicopters had arrived to participate. In addition three aircraft assisted in the search and in the control of the radio traffic.

The helicopters used rescue men and winches to pick people up from the sea and liferafts. Two helicopters transferred survivors to the nearest passenger ferries, while the others flew them to land-based assembly points.

The vessels did not launch their own manoverboard boats or lifeboats due to heavy weather. Instead, liferafts were lowered to the sea and then raised with survivors transferred from the *Estonia*'s liferafts. The *Isabella* lowered its rescue slide, and 16 survivors were rescued by being pulled up it.

The last survivor was rescued at about 0900 hrs. After this, the helicopters and vessels searched for and brought up bodies from the sea and from rafts.

The helicopters operated in the area from the early morning for about 15 hours. Most of the vessels searched the whole day and were released from their duties in the evening. The last vessel to be released was the *Silja Europa* which left the area about 2030 hrs, relieved by the *Tursas*, whose master was appointed Co-ordinator Surface Search until 3 October.

The vessels rescued 34 survivors and the helicopters rescued 104 survivors. One rescued person later died in hospital. Ninety-four bodies were recovered from the sea. Missing persons totalled 757.

The rescue operation: introduction (17.1)

The *Estonia* sank only about an hour after the first observations that presaged the accident and only about 30 minutes after the first Mayday call.

About 680-750 people were trapped inside the vessel while at least 237 but probably 310 reached the outer decks. Lifejackets were distributed and liferafts were inflated and launched by the crew and by passengers. None of the ten lifeboats could be launched, but nine broke free and floated up to the surface when the vessel sank.

The people who fell or jumped into the sea without lifejackets, and those who were badly injured, drowned or otherwise succumbed so quickly that no rescue organisation or unit could have reached them in time.

Some 160 people succeeded in climbing onto liferafts or lifeboats. Of them, about 20 succumbed to hypothermia or hypothermia-induced drowning. At least two persons were lost during the rescue operation.

The *Mariella* reached the accident scene 50 minutes after the first Mayday call, ie 20 minutes after the vessel sank. Four passenger ferries and the first rescue helicopter were on the scene within one hour and 10 minutes of the sinking. During the next three hours six more vessels and six more helicopters arrived.

34 people were rescued by the vessels and 104 by the helicopters in the time period between 0330-0900 hrs. Considering the circumstances a high percentage of people on the liferafts could be rescued. Almost all of those missing were trapped inside the vessel or were not able to get on a liferaft.

In the plans and exercises considerable reliance had been placed on rescue vessels and lifeboats from passenger ferries and other vessels. The first rescue vessel, the *Tursas*, arrived at the scene of the accident about three hours after the *Estonia* foundered. No lifeboats or manoverboard boats were lowered by the vessels on scene […]

The rescue operation: action at the accident site

<u>Vessels' on-board preparations</u> (17.6.1)

While proceeding to the scene of the accident the assisting vessels made necessary preparations for the rescue operation and for taking care of survivors.

The helicopter pads were prepared for landings. Reception and treatment facilities for the survivors were readied and nursing staffs prepared. Voluntary medical experts among passengers were alerted to assist the permanent staffs. The preparations on board and the professionalism and willingness of people to help were afterwards highly appreciated by the survivors.

No lifeboats or rescue boats were launched from the vessels participating in the rescue operation. The possibilities of launching boats were discussed between some of the masters, but in the prevailing weather the operation was considered too risky. Instead liferafts were prepared for use and in some ferries the possibilities of using evacuation slides were discussed and the slides prepared.

The masters realised that the rescue operations would be difficult and the possibilities of rescuing people from the water were limited when lifeboats and rescue boats could not be used.

<u>Rescues from vessels</u>

On the *Mariella* an inflated liferaft was placed at each end of the vessel's flat side. The vessel was manoeuvred with that side towards the wind and caught drifting rafts from the *Estonia* in between them. Another raft was lowered and used as a hoistable platform. People from the *Estonia*'s liferafts moved over to the lowered raft and were winched up. The winches on the liferaft davits were manually operated, but during operations electric drilling machines were converted and used to improve the winching speed.

Two volunteers from the *Mariella* were lowered to a liferaft from which they managed to rescue two exhausted persons in another liferaft.

The *Isabella* also lowered a liferaft with volunteer rescuers on board.

They succeeded in getting about 20 people from one of the *Estonia*'s rafts over to their own raft. The weight of the people and the water in the liferaft caused its bottom to rip during hoisting. At least five people fell into the sea, among them the three rescuemen. Four of these people were lifted up by a helicopter. One or more persons were lost during this operation.

To save the 16 persons hanging onto the damaged liferaft, the evacuation slide was inflated and the raft lowered back to the sea. A rescueman was lowered down to the slide platform and assisted people in getting from the raft to the platform and up the slide. The evacuation slide proved to be a good means of rescuing people from the rafts and from the sea. From the platform the people were pulled up the slide itself to safety.

The decision to inflate the evacuation slide was quite extraordinary in the circumstances and testifies to good creative thinking.

Although the participating vessels contributed to the rescuing of many lives, it is established that their suitability for rescue operations in these severe weather conditions was limited. The safe launching of rescue boats or lifeboats was considered impossible, and rescuing people directly onto the vessels proved very difficult. The boat deck on the ferries, in most cases the only open deck, was situated more than 15 metres above the water and lifting the survivors on board proved both risky and difficult. The experience of the rescue highlights the importance of having appliances permitting large ferries to recover people and liferafts from the surface. It also points out the need for liferafts to be strong enough to withstand lifting from the sea with a full load […]

Development of regulations after the accident (19)

[…] The amendments to [SOLAS] Chapter III, which deals with lifesaving appliances and arrangements, include a number of important additions. Requirements for liferafts are more stringent. Liferafts must be served by marine evacuation systems and must be automatically self-righting, or be of the canopied reversible type capable of operating safely whichever way up.

Ro-ro passenger ships will be required to carry at least one fast rescue boat. The ships must also be fitted with means of recovering survivors from the water and transferring them from rescue units to the ship.

Sufficient numbers of lifejackets will have to be provided near the assembly station. Each lifejacket shall be fitted with a light […]

New regulation III/24-2 covers information to passengers.

By regulation III/24-3, all ro-ro passenger ships shall be provided with a helicopter pick-up area […]

Chapter V (safety of navigation) has also been amended.

Obligations and procedures in the event of emergencies have been clarified, a working language is to be established on passenger ships and ships trading on fixed routes must carry a plan for co-operation with appropriate SAR services[9].

Findings (20)

Accident

The ro-ro passenger ferry *Estonia* sank in the northern Baltic Sea during the early hours of 28 September 1994. Of the 989 people on board, 137 survived. All 95 victims recovered from the sea have been identified and 757 people are still missing.

Weather

The wind at about 0100 hrs at the site of the accident was southwesterly, 18-20 m/s [Beaufort Gale Force 8], and the significant wave height was about 4m […]

The wave-induced motion made several passengers seasick but the situation on board was not exceptional.

Ship's condition

The vessel was seaworthy and properly manned […]

Evacuation

The time available for evacuation was very short, between 10 and 20 minutes.

There was no organised evacuation.

The evacuation was hampered by the rapid increase in the list, by narrow passages, by transverse staircases, by objects coming loose and by crowding. About 300 people reached the outer decks. Most victims remained trapped inside the vessel.

The lifesaving equipment in many cases did not function as intended. Lifeboats could not be lowered […]

Rescue operation

Initially the accident was not treated as a major accident. It was formally designated as such at 0230.

MRCC Turku started alerting rescue units at 0126 hrs. One standby helicopter was alerted at 0135 hrs, another at 0218 hrs, and the military helicopters at 0252 hrs.

Assistance by Swedish helicopters was agreed at 0158 hrs.

The master of the *Silja Europa* was appointed On Scene Commander (OSC) at 0205 hrs.

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[9] This Regulation (now SOLAS V/7-3) has since been clarified as applying to all passenger ships trading internationally.

The first rescue unit, the *Mariella*, arrived on the scene of the accident at 0212 hrs, 50 minutes after the first distress call.

MRCC Tallinn was informed of the accident at 0255 hrs by MRCC Helsinki.

The first helicopter arrived at 0305 hrs.

Two Finnish helicopters landed survivors on the passenger ferries. Other helicopters carried rescued persons to land.

An air co-ordinator arrived to assist the OSC at 0650 hrs and a surface search co-ordinator arrived at 0945 hrs.

The participating vessels did not launch lifeboats or manoverboard boats due to the heavy weather. Their rescue equipment was not suitable for picking up people from the water or from rafts.

Winch problems in three Swedish Navy helicopters seriously limited their rescue capacity.

Some helicopters carried journalists during the later rescue flights.

Of the approximately 300 people who reached the open decks, some 160 succeeded in climbing onto liferafts, and a few onto capsized lifeboats. Helicopters rescued 104 people, and vessels rescued 34.

Conclusions (21)

[…] Evacuation

The rapid increase in the list contributed to the large loss of life.

The lifeboat alarm was not given until about five minutes after the list developed, nor was any information given to the passengers over the public address system. By the time the alarm was given, the list made escaping from inside the vessel very difficult. This together with problems in using lifesaving equipment contributed to the tragic outcome.

Rescue operation

The alarming of helicopters was late.

The helicopters had a key part in the rescue operation by rescuing most of the people who had succeeded in climbing onto liferafts or lifeboats.

One rescue man per helicopter was not enough due to the very exhausting rescue work.

It is deemed inappropriate for helicopters to carry journalists in critical situations and where they may encroach on the privacy of survivors.

The main reasons for the delay in issuing alarms in general were that the distress traffic was conducted separately from MRCC Turku, and that there was only one person on duty at MRCC Turku, at MRCC Helsinki and at Helsinki Radio respectively.

In the Finnish MRCCs the instructions regarding distress traffic were inadequate.

The lifesaving equipment of vessels participating in the rescue operation proved unsuitable for rescuing people from the water in the prevailing heavy weather conditions.

Recommendations (22)

[…] Evacuation

A significant factor in the *Estonia* accident was the very quick increase in the list to an angle exceeding 30°, leading to loss of manoeuvrability, to difficulties in getting out from inside the vessel and to the start of progressive flooding. Investigations have shown that relatively small changes in construction could have had a significant effect on the outcome of the evacuation. Therefore all existing passenger vessels should be reassessed with regard to evacuation and all reasonable measures taken to increase the time available and possibilities for evacuation.

Rescue

Serious shortcomings in the effectiveness of the on-board rescue equipment became apparent during the *Estonia* accident and the rescue operation. The equipment fulfilled the requirements and is of standard type common on comparable vessels.

The Commission recommends urgent action to develop new lifesaving concepts and equipment, especially for passenger vessels where large numbers of untrained people are to be rescued.

Systems should be developed for enhancing the ability of passenger ferries to rescue people from the sea in heavy weather.

All-weather systems should be developed for enhancing co-operation between ferries and helicopters in sea rescue.

Distress traffic

No station conducted the distress traffic according to the procedures required in the radio regulations. In the normal work of deck officers and radio operators it is understandably difficult to maintain very firm routines for distress communications. However, good simulators for training in maritime radio systems and communications are available. Therefore certain key persons, such as deck officers on large passenger vessels and rescue centre radio operators, should regularly update their practical knowledge of distress and safety traffic using a maritime radio simulator.

[Additional notes on some of the effects of the disaster, from a United Kingdom Cabinet Office Emergency Planning College paper:

Almost 500 of those who died in the *Estonia* disaster were Swedish; the largest Swedish disaster in modern times. Several groups of victims were from small communities devastated by the loss. As an example, Stockholm Police lost 63 of their staff, the majority administrative personnel, many married to police officers. The trauma affecting an organisation, particularly an emergency organisation that is expected to respond to disaster, can only be imagined. In some cases, officers from the Swedish Identification Commission were required to take ante-mortem details from their own colleagues. The police provided counselling facilities for their staff, using their own in-house professionals. In retrospect they recognise that some groups of people were missed – office cleaners, for example: almost all the personnel working in offices in one corridor were lost that night. The police report having a plan for recovery, but identified feelings of guilt amongst those who were promoted as a result of colleagues being lost in the disaster. In future the police would consider the use of counsellors from outside their own organisation. On this occasion far too many counsellors were also victims.

"Normal police defences are not present when you are the victim."

In addition, there were an unexpected group in trauma – witnesses on the ferries involved in the rescue. Many of these had witnessed the debris following the disaster, had watched the rescue operation, and had been silent observers over some 14 hours…]

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ANNEX 7

The *Norwegian Dream* and the *Princess of Scandinavia*: case studies

WHAT IF…?

The following two case studies were prepared by SAR service personnel involved in two incidents – one involving a cruise ship, the other a ferry – occurring in the United Kingdom SAR Region, the first in August 1999, the second in May 2002. In neither case was evacuation of the ship necessary: both incidents were resolved successfully by the ships' crews. In both cases, however, the SAR service was planning for the 'worst case scenario'. The question underlying these two case studies is: 'What if…?'

The case studies are offered as examples of the sort of response that might realistically be expected from a developed SAR service faced by its own 'worst case scenario': a large passenger ship in distress and evacuating at sea. It is emphasised that the 'What If…?' sections of both studies are speculative in nature. They are offered as general analysis of the SAR service's capabilities, not in any sense as detailed reports on the incidents upon which they are based.

NORWEGIAN DREAM

<u>Incident Overview</u>

On the night of 23 August 1999 the 50,760 gt cruise ship NORWEGIAN DREAM was in the southwest-bound traffic lane of the Dover Strait Traffic Separation Scheme, near the Falls Bank and about 20 nautical miles off the northeast coast of Kent, on passage to Dover. She had 1750 passengers and 638 crew aboard – a total of 2388. The 52,090 gt container ship EVER DECENT had departed Thamesport that evening with 17 crew aboard and was on passage to Zeebrugge, approaching the Falls Gap on a southeasterly heading. Among her containers she was carrying all IMO classes of dangerous goods except explosives. The wind was northeasterly 2-3, with a slight sea running and good visibility.

At 2355 UTC the two ships collided, NORWEGIAN DREAM striking the port side of the container ship a few metres abaft the forecastle. The cruise ship's bow and starboard bridge wing were severely damaged, two of her lifeboats were carried away, and some of EVER DECENT's containers ended up on NORWEGIAN DREAM's foredeck.

At 2356 NORWEGIAN DREAM attempted to call MRCC Dover on VHF Channel 16 but was overspoken by EVER DECENT reporting that she had been in collision with a passenger vessel. NORWEGIAN DREAM then identified herself as the ship concerned. EVER DECENT reported severe damage and a list increasing to 40 degrees to port. (Grounding the container ship on the Falls Bank was considered, to prevent her capsizing, but the list was subsequently stabilised.) She had lost some containers overboard and had a fire in the container stacks forward: it was uncertain whether any dangerous goods were involved.

From the initial exchanges it was clear to MRCC Dover that a very large number of people were potentially at risk and at 0001 UTC (24 August) action was taken to launch Ramsgate, Margate and Dover RNLI lifeboats and to alert rescue helicopters from RAF Wattisham. A maritime patrol aircraft was requested, to act as Aircraft Co-ordinator (ACO) if required, and broadcasts to shipping were made by the MRCC. Vessels in the area began to respond to the radio traffic, offering their services. These included the German warship FGS AUGSBURG and the container vessel DART 8. In total 3 helicopters, 2 fixed-wing aircraft and 4 RNLI lifeboats were deployed and 14 other ships were tasked as potential SAR assets. Major incident plans were activated in Kent, with shore-side emergency services and emergency planning authorities standing by.

At 0011 NORWEGIAN DREAM reported that her collision bulkhead had held and she had no ingress of water. Passengers were going to muster stations. She requested tugs to stand by.

The DART 8 arrived on scene at 0024, the first ship to do so, and by 0021 the first helicopter was airborne from Wattisham. Kent Fire Brigade were informed and opened their air deployment centre at Manston in northeast Kent.

At 0032 NORWEGIAN DREAM reported all passengers and crew accounted for and safe, with only three people suffering minor injuries. By 0050, when the first helicopter arrived on scene, it had been concluded that NORWEGIAN DREAM was not in danger of sinking and had main engine power available. Shortly afterward – just over an hour after the collision - she reported herself underway at slow speed towards Dover. She arrived safely at 0430 UTC.

The fire aboard EVER DECENT continued to burn for 7 days and required the efforts of salvage tugs and firefighting vessels as well as shorebased firefighting teams to bring it under control. The ship was eventually towed to Zeebrugge for repair.

What If…? The SMC's contingency planning

In SAR terms, the NORWEGIAN DREAM incident was over relatively quickly, and before the full SAR plan was put into effect. The incident was handled well by those involved, and, of course, without any need for evacuation of the passenger ship.

But – for the purposes of this case study – it is useful to speculate on what might have happened in other circumstances, and to examine the SAR services' planning and concerns. What would have happened, for example, if, instead of the passenger ship's bow entering the side of the container ship, it had been the other way about? For two ships moving at speed in a crossing situation, the significant time difference is measurable in seconds.

There would undoubtedly have been casualties as a direct result of such a collision. The momentum of the container ship would probably have carried it far into the hull of the passenger vessel, possibly far enough to cause catastrophic damage. The result would have been flooding, a list, and quite probably the emergency evacuation of the passengers using the ship's lifesaving equipment. If damage had also been sustained to hazardous cargo containers aboard the container ship, there would have been the added dangers of cargo leaks, explosions and/or toxic smoke from fires – and if the two ships had remained locked together after the collision, the cruise ship's passengers and crew could have been exposed to these dangers.

The problem then would be assembling passengers just awoken from sleep and evacuating them from a high-sided ship, listing, and possibly without power or lights, while at risk from hazardous substances. Some passengers could have been injured or trapped, or unaccounted for: some could be in the sea. There would probably be fires aboard the passenger vessel herself. Lifesaving equipment might be difficult or impossible to operate in the prevailing circumstances, because damaged or inaccessible, or simply because the other ship was in the way. Further loss of life would have been likely.

The dedicated SAR facilities *actually* deployed in the NORWEGIAN DREAM / EVER DECENT case, all of which were on scene within 1 hour 40 minutes, had a total survivor capacity – in the good weather and sea conditions prevailing – of about 260 on the first lift. (Helicopters in particular would have been able to raise this figure by making repeat sorties.) Taking into account *all* the dedicated facilities within 4 hours of the scene then available in the UK, France and Belgium – 7 rescue helicopters and 20 all-weather lifeboats – the total rises to an estimated 1500 on one lift; and perhaps to about 2000 if repeat sorties are included over the 4 hour period. In bad weather requiring the lifeboats to take aboard only those survivors who could be secured below, the total would be only about 340-500. (Since the accident the UK and France have jointly established an emergency towing vessel in the Dover Strait, which would raise the total survivor capacity, in good conditions, by around 300.) To summarise: in fair weather, the survivor capacity of dedicated SAR facilities in this very well-resourced area would only have amounted to between 60% and 80% of the total number of people at risk as a result of the NORWEGIAN DREAM / EVER DECENT collision. In bad weather that figure might have dropped as low as 25%.

It is clear that, in any circumstances, heavy reliance would have to be placed on additional SAR facilities – primarily shipping in the area. The Dover Strait is, of course, among the busiest shipping lanes in the world, so obtaining sufficient resources would not be a problem. Recovering people into the responding ships, on the other hand, probably would be – as would maintaining safe traffic flow in the Strait while a major SAR operation was underway.

The UK Coastguard officer who acted as SMC for the majority of the incident has offered the following comments as regards his SAR plan, should the worst case scenario have come about. He has also recalled his thoughts in the earliest stages of the incident, when information from the scene was sparse.

Granted the early reports being received by the MRCC, it seemed likely to the SMC that the cruise ship would be evacuating. He wanted to know if this was a controlled evacuation, or an uncontrolled abandonment in the dark, in the busy Dover Strait. His reaction was to “send the cavalry”: task all the SAR facilities to hand, and then to seek for reinforcements from further afield. It was obvious to him that he needed all the resources he could find. He admits to being “mesmerised” by the number ‘2388’ – the total number aboard the passenger ship.

He was also very conscious from the outset of the effect of an evacuation on the ports in the area when survivors were brought to land. NORWEGIAN DREAM had been proceeding to Dover at the end of a cruise: new passengers, for the next cruise, would be arriving in Dover on the morning of the 24th without local accommodation arranged, expecting to go straight aboard the ship (where they were, in fact, able to be temporarily accommodated). If the ship had not arrived, and survivors were being brought ashore instead, the local emergency services and other authorities would have been facing the colossal task of having to deal with a total of some 4000 ‘homeless’ people, many of them injured and distressed.

The SMC was frustrated by a lack of complete information from the scene in the early stages. Both ships’ masters and crews were otherwise engaged – but this lack of information left the SMC uncertain of what eventualities he was planning for.

He also had doubts about the seamanship of those involved and hence their ability to handle the emergency. These doubts proved unfounded: both ships’ crews responded very well. But after a collision at sea the question naturally arises, and the lack of early and reliable information flow exacerbated it.

The SMC's SAR plan was deliberately simple, with a small number of clear objectives. In retrospect he stressed most the value of 'knowing your friends': quickly establishing and maintaining links with other key players on a personal, one-to-one basis. He believes this direct, simple, and mutually understood communication link to be of the highest importance, and cites as an example the excellent relationship he was able to establish with the captain of the FGS AUGSBURG. Neither knew the other beforehand, but each had a clear understanding of the other's role in dealing with the incident and they were able to communicate clearly and fully.

The value of SAR co-operation planning in accordance with SOLAS V/7-3 and MSC/Circ.1000 should also be mentioned here. The revised Regulation and its associated guidelines came into force on 1 July 2002, long after the NORWEGIAN DREAM / EVER DECENT incident – but the early establishment of good communications between passenger ships' Company emergency response teams and co-ordinating RCCs is a primary aim of the revised Regulation.

Returning to the SMC's thinking, it was clear to him that, if a controlled evacuation or an uncontrolled abandonment were to take place, many people were going to end up in the ship's lifesaving equipment, probably a mix of lifeboats and liferafts. (Lacking a SAR co-operation plan also meant that the SMC did not have information on the ship's survival craft readily to hand.) Towing liferafts would have been very difficult, if not impossible, so they would have had to be emptied on scene: another difficulty. Getting from the rafts into an RNLI lifeboat would be comparatively simple, but recovery of survivors from liferafts into other ships could be difficult and dangerous.

The best-equipped vessel to take survivors onboard on this occasion would have been the FGS AUGSBURG, a frigate. With the ability to put two fast rescue boats into the water, rig ladders and scrambling nets over the side, plenty of fit crewmembers to assist survivors out of the water, trained medical personnel and first-aiders, a deck edge height of about 5 metres and operations facilities used to handling complex situations, she would have been a vital asset.

In this case the option to delegate the responsibility for collecting survivors to the AUGSBURG, putting the lifeboats under her co-ordination, would have been attractive. Helicopters could then have been used to transport the seriously injured ashore and to put firefighting and heavy rescue back-up aboard the cruise ship to assist the crew whilst the passengers were disembarked. Additional medical support could have been flown to the warship, which has a flight deck and flight deck crew. In calm weather Sea King and S61N helicopters could put their wheels on AUGSBURG's deck to avoid the need to winch. However, recovering persons from liferafts into the warship and operating helicopters at the same time would probably have been incompatible.

As it is unlikely that the passenger muster would have resolved the whereabouts of all passengers and it would be difficult to know if any had fallen into the sea, it is likely that some assets would have to be diverted to search for possible missing persons in the water, numbers unknown. A controversial question, but one which needs to be addressed by the SMC, is how to balance the rescue and recovery effort with this speculative searching. In a small incident area, both activities – using different resources for each – may not be possible at once.

Shore-side authorities in Kent, including the SAR services, have an agreed joint emergency plan designed to deal with large numbers of persons involved in accidents or natural disaster. Although this plan is updated regularly and practised, as well as it can be with limited budgets, it has not in fact had to deal with numbers as large as those involved on this occasion. It must be anticipated that there would be some confusion and a heavy demand on the MRCC for information, guidance and consultation. There would also be immediate and intrusive interest from the news media. Management and senior officer support would be essential.

Local plans are normally county-based and some counties organise their emergency response more logically and in greater detail than others. The effectiveness of these plans would vary from one area of the coast to another.

An operation to recover such a large number of people, some injured, some dead, some missing either on board the ship or in the sea, would be protracted, lasting for well over 24 hours. A robust staff and management backup plan is required.

PRINCESS OF SCANDINAVIA

Incident Overview

At 2049 UTC on Friday 17 May 2002, the 22528 gt Danish-registered Ro-Ro passenger ferry PRINCESS OF SCANDINAVIA broadcast an all-stations DSC Distress call. PRINCESS OF SCANDINAVIA was on passage from the River Tyne to Gothenburg, Sweden, and was at that time about 150 nautical miles southeast of Aberdeen. The ferry reported an engine room fire (caused, it was later discovered, by oil spraying under high pressure from a fractured hydraulic pipe). She was disabled and drifting. She had 758 passengers (just under half her certificated capacity) and 126 crew aboard – a total of 884. The weather was wind northnortheast force 3-4, becoming light airs, with a moderate swell and good visibility.

MRCC Aberdeen co-ordinated the SAR response, maintaining satellite communications contact with PRINCESS OF SCANDINAVIA and tasking many dedicated and additional SAR facilities.

At 2238 UTC PRINCESS OF SCANDINAVIA reported that the engine room fires had been extinguished but that fire had taken hold in the funnel. Crew and passengers were at assembly stations in preparation for possible evacuation.

At 2352 (a little over three hours after the start of the incident) all fires were reported out, although the ship remained disabled. One engine was restarted at 0150 (18 May) and PRINCESS OF SCANDINAVIA resumed her passage at slow speed. Co-ordination was passed to RCC Stavanger when the ship entered the Norwegian SAR Region at 0449. PRINCESS OF SCANDINAVIA reported three engines running by 0955 and she arrived safely at Kristiansand, Norway, in the early evening.

During the course of the incident MRCC Aberdeen tasked a maritime patrol aircraft and 5 helicopters, with a further 6 helicopters on standby. A total of some 45 surface units responded to the distress alert and MRCC Aberdeen's Mayday Relay broadcast action, of which 29 were tasked for at least part of the incident – 14 offshore oil & gas industry standby and supply vessels, 6 fishing vessels, 2 general cargo vessels and a car carrier, the Ro-Ro passenger ferry JUPITER, and five other ships. Other vessels were immediately discounted as being inappropriate or too distant (ie, more than four hours' steaming away). The first surface unit to arrive on scene was the fishing vessel ST MATTHEW at 2126, with the first helicopter (from the Ekofisk Field) arriving at 2158. The standby vessel BUE TIREE was appointed On Scene Co-ordinator (OSC), and an RAF Nimrod maritime patrol aircraft ACO. Five offshore installations were tasked as potential receptor platforms. Support was received from RCCs and coast radio stations in the Netherlands, Norway, Denmark, the UK and elsewhere, and from Grampian Police and other shore-side agencies in the UK.

A SAR co-operation plan for PRINCESS OF SCANDINAVIA was available to MRCC Aberdeen, and was used to quickly establish direct communications with the ship. Direct communications between the SMC and the Company were only properly established, however, once an agreed schedule of calls had been worked out, on a one-to-one basis between individuals in the Company response team and in the MRCC. This overcame the early problem of contact numbers being constantly engaged or ringing unanswered. Despatching a Company liaison officer to the MRCC, to join a Major Incident Liaison Team (MILT)[10] would have been an even better solution.

As is noted in COMSAR 7/10, the success of PRINCESS OF SCANDINAVIA's firefighting efforts may be put down to her being equipped with a fixed water-based local application firefighting system of similar type to that which will become mandatory for existing ships on 1 October 2005 as part of the revised SOLAS II-2; and to the professionalism of her crew, who fought the fire with determination and persistence, showing that the ship's contingency plans were effective.

What If…? The SMC's contingency planning

There are lessons to be learned from the contingency planning undertaken by the SMC, her team, and other responding organisations.

What if PRINCESS OF SCANDINAVIA's Master had ordered a partial or complete evacuation? At first, the incident being 150nm offshore might appear to present significant difficulties – essentially beyond the range of shorebased lifeboats, and a long run for shorebased helicopters. But the incident occurred in the vicinity of offshore installations, including, crucially, the Ekofisk complex about 38nm away; the floating production unit Janice Alpha at 21nm; the FPSO Uisge Gorm at 25nm; and the production platforms Clyde Alpha (25nm) and Fulmar Alpha (28nm).

Aircraft resources tasked or placed on standby included two winch-fitted Dauphin helicopters on Ekofisk (with a survivor capacity per lift of about 10 each); the Nimrod maritime patrol aircraft tasked as ACO – a vital role if evacuation had occurred, granted the number of helicopters available; a Coastguard S61N; and six dedicated SAR Sea Kings from the UK and Norway.

Of the many surface units whose offers to assist were accepted, most were highly manoeuvrable and had relatively low freeboards for survivor recovery (supply vessels, complete with fast rescue craft (FRC), and fishing vessels); and the standby vessels are, of course, specialist rescue craft, with two FRCs apiece and good survivor capacity and care capability. The weather was such that FRCs could have been deployed safely and to good effect.

The SMC's SAR plan was essentially in two parts: what to do in the event of a controlled evacuation, and what in the event of uncontrolled abandonment.

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[10] A 'MILT' is the term used in the UK to describe the liaison officers from responding organisations – such as the Company, any Port Authority involved, the Police, Fire and Ambulance Services, etc – who gather at the co-ordinating RCC to act, primarily, as communications links between the SMC and their parent organisations.

In a controlled evacuation, helicopters (their movements co-ordinated by the ACO – with whom direct communications were seen to be imperative in these circumstances) would have operated a ‘spoke’ system, as in the spokes of a wheel. Each helicopter was assigned one of the offshore installations to take casualties to and for refuelling / waiting purposes – and, as noted above, each installation make preparations accordingly. Information on installation names and positions, aircraft callsigns, approach and landing frequencies, etc, was exchanged well in advance. This part of the plan was implemented early on in the incident, and proved very successful.

PRINCESS OF SCANDINAVIA does not have a helideck, and ARCC have estimated that an evacuation by helicopter alone, using all units available, would have taken a minimum of five hours.

Use of the ship’s own survival craft would therefore almost certainly have been a factor. It would then be a matter of selecting who should be removed by helicopter and who by boat or raft. This was considered to be a matter for on-board co-ordination by ship’s staff, with any injured or infirm probably being given precedence for airlift.

PRINCESS OF SCANDINAVIA is fitted with an FRC and 6 open 95-person lifeboats, one Means of Rescue and a manoverboard boat. The main means of evacuation is by the open lifeboats and two chute-type Marine Evacuation Systems with four integral 145-person liferafts supported by two droppable 100- and a further four droppable 145-person liferafts (ten large rafts in all).

Surface SAR facilities would have to have dealt with the people in these survival craft. The SAR plan called for smaller, low freeboard vessels to form an inner ring around PRINCESS OF SCANDINAVIA, with the larger ships in another ring further out. A similar ‘spoke’ system would then have operated as necessary, with units unsuitable for holding people aboard for long transferring survivors to the larger ships. The swell would have made these recovery and transfer operations more difficult.

Once aboard suitable ships or on the platforms, survivors would be triaged and, if possible, debriefed for any important SAR information (a measure of confusion during the evacuation process is to be expected, especially granted that it was dark). A wide variety of nationalities were among PRINCESS OF SCANDINAVIA’s passenger and crew complement, and MCA’s translation service would have been offered if language difficulties had been encountered. If people in surface units were found to be injured or otherwise in need of medical assistance, helicopters would be used to transfer them to suitable platforms or – if necessary, and sufficient aircraft were available for the other tasks on scene – directly to land.

Arrangements would then be made to bring the remainder ashore, ferried by helicopters from the offshore installations, but remaining aboard the receptor vessels for the passage if possible. This process would be timed to begin once shore-side arrangements were in place to receive them: close liaison with Grampian Police and local authority emergency planners, and their counterparts in other areas to which people might be taken, and with the Company, would be essential. This is a major reason for the suggestion that a MILT should be established as a precaution: it would have been needed in practice. Shore-side arrangements include reception facilities, further triage and health care, family-and-friends and news media reception facilities, Police casualty bureau arrangements, onward transport, accommodation, welfare issues, etc etc. These things are not set up instantly. A MILT would have instigated the alerting process, preparing the system in case it was required.

In an uncontrolled evacuation it is unlikely that on-board co-ordination of helicopter / surface unit prioritisation would have been possible and a much greater number of people would have left the ship in her survival craft. Bringing helicopters in to winch from the ship during rapid deployment of the survival craft might have done more harm than good because of the effects of downwash and engine noise: helicopters might have been better deployed over the survival craft once they were clear of the ship. It is also possible that, in the confusion, people might have ended up in the water. In the worst-case scenario, with fire on the ferry out of control, large numbers of people might have done so, many of them injured.

While this situation would obviously have been more difficult, the basic plan outlined above would have been the same – it has the distinct advantage of being simple, straightforward, understandable and implementable by the many SAR facilities on scene. A particular benefit of the plan is that, broadly speaking, the various units would only have had to concentrate on their own 'spoke of the wheel'.

On-scene searching would have been required: SARIS was up and running at MRCC Aberdeen in preparation for this eventuality, and some suitable rescue units would have been assigned to this task. Ships would have been asked to deploy their FRCs for this and for survival craft marshalling. Other units would also be used to 'boom' the scene downdrift, with the aim of picking up rafts and/or people in the water 'escaping' in the dark.

Accounting for all 884 people involved, being dispersed in the dark to a wide variety of rescue craft and platforms, would have been immensely difficult. The SMC proposed to dedicate one of her team wholly to this task, working through the OSC and ACO to glean numbers from the receiving units. Recognising that there were so many surface units involved that the OSC, BUE TIREE, might well have been overwhelmed by this task, the SMC was prepared to devolve the tote to one of the platforms.

While it is, of course, absolutely vital to account for everyone at risk, it can also be argued that the usual means of doing so are unreliable. Experience shows that the apparently simple process of counting people is extraordinarily difficult in these circumstances. A good deal of time and effort can be expended passing numbers to and fro without any certainty that the numbers are accurate. Logically, a full-scale search of the area must always be carried out in any event because of this uncertainty – so it is suggested that the main focus of attention should actually be on that search. Numbers must still be collated, of course; but treated with very considerable caution until the search is complete. The acid test is, should the search be suspended as soon as the tote equals the number of people reported to have been aboard the casualty? The answer, surely, should be 'no'. The primary target for the SAR services should actually be that of 100% probability of detection within the search area. Only when that is achieved (and when things are also likely to have calmed down a little on the receptor units) should a proper count be attempted. But keep the search going until everyone is confident that the tally adds up!

One final question discussed as part of the 'What If' process was, 'what if the weather had been worse?' The conclusion was that, apart from the obvious fact that it would have made life even more difficult for everyone concerned, not many changes to the basic SAR plan would have been made. The only significant change identified was the likely removal of the FPSO from the list of destinations for helicopters.

The following comment on the PRINCESS OF SCANDINAVIA case study above was received from the ship's operators, DFDS:

Re: Incident Overview

We agree to the statements regarding observations and registrations. Communications are always difficult and this has been noted. Our SAR manuals contain contacts to the Technical Director, Fleet Manager and Ships Superintendent. Thus it should be possible to agree on specific numbers / lines to be available throughout the emergency. The idea of despatching a company liaison officer to the MRCC has been noted. Today's technology should be capable of ensuring good connections and we suggest if requested that a dedicated email address for use by our emergency committee only is established.

Re: What if…..? The SMC´s contingency planning

Once aboard suitable [rescue] ships, it is suggested to debrief survivors regarding important SAR information. This, if at all done, should be carried out with utmost care. First of all these survivors are likely to be in a mode of mental shock. Therefore the information provided by these people might be of limited use. Secondly seen from the survivors' perspective the debriefing has to be carried out by psychologists or other suitably trained personnel to avoid traumatism.

Additionally we believe this section calls for some general comments:

We think you have covered the scenario where evacuation actually takes place, whether it is a controlled evacuation or an uncontrolled evacuation. We can fully agree to the considerations about the preparedness and the plans for assistance in case of an evacuation.

However we consider that the fundamental philosophy in an emergency is that "the ship is it's own rescue vessel" always should be the dominant philosophy and that maximum efforts should be taken in order to keep the passengers and the crew onboard the vessel in a safe condition. What we are saying is that all SAR operations should focus on rendering assistance to the ship in order to guarantee this situation.

All vessels of today are built and constructed in such a way that it is possible to retain a fire within one fire zone. The integrity of the ships has been proven in several occasions where the fire has been retained within the section without spreading to any of the nearby sections. If the vessel has problems in fighting the fire within the section, maximum efforts should be exercised in order to assist the ship in this respect. We simply believe more effort and resources should be made available from shore to a ship in an emergency. The assistance could cover a wide range of services; for instance, supply of foam generators including liquid foam for firefighting, firefighters, supply of air compressor facilities for breathing apparatus, medical equipment, doctors, nurses, equipment to limit the extent of the damage, etc.

In case of long lasting firefighting by means of water, pumping facilities may be supplied including electrical generators for running the pumps.

In collision cases other kind of supplies may be considered; for instance, pumping equipment, tightening materials etc.

It is not possible for us to give an exhaustive list of all the services and material equipment etc which could assist a vessel in an emergency situation, but we think that the correspondence group should consider this issue much more […]

Talking about defense lines in connection with emergencies we think that the first defense line is the ship itself and that consequently most consideration must be given regarding maintaining this defense line intact as long as possible. This is what the above-mentioned comments really are all about.

Glossary of abbreviations

ACO	Aircraft Co-ordinator
ARCC	Aeronautical Rescue Co-ordination Centre (RAF Kinloss)
DSC	Digital Selective Calling
FPSO	Floating Production Storage and Offload vessel
FRC	fast rescue craft
gt	gross tonnage
MCA	Maritime and Coastguard Agency (executive agency of the UK Department for Transport)
MILT	Major Incident Liaison Team
MRCC	Maritime Rescue Co-ordination Centre
nm	nautical miles
OSC	On Scene Co-ordinator
RAF	Royal Air Force
RCC	Rescue Co-ordination Centre
RNLI	Royal National Lifeboat Institution
Ro-Ro	roll on / roll off
SAR	search and rescue
SARIS	SAR Information System (search planning software)
SMC	SAR Mission Co-ordinator
UTC	Universal Time, Co-ordinated

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ANNEX 8

ICCL's statements and guidelines on

CRUISE SHIP MEDICINE AND MEDICAL FACILITIES

Statement on Cruise Ship Medicine

The International Council of Cruise Lines (ICCL) is a non-profit industry trade association comprised of the 16 largest passenger cruise lines that call on major ports in the United States and abroad. The cruise industry's highest priority is to provide passengers with a safe, healthy, and comfortable cruise ship environment. ICCL and its member lines illustrate this commitment by the shipboard medical infirmaries found on all ICCL member vessels.

The cruise industry has taken a proactive role in addressing the quality of shipboard medical care. In 1995, ICCL and its member lines formed a Medical Facilities Working Group to develop industry-wide guidelines for the facilities, staffing, equipment and procedures in medical infirmaries on cruise ships. This effort coincided with that of the 25-year-old American College of Emergency Physicians ("ACEP"), the nation's leading and largest professional organization of such specialists, representing over 20,000 practicing emergency and other physicians in the U.S. and abroad. ACEP's Section of Cruise Ship and Maritime Medicine, formed over eight years ago, is specifically dedicated to training, education and research in the advancement of shipboard medical care.

The ICCL Medical Facilities Working Group consists of licensed and experienced shipboard physicians, fleetwide medical directors and consultants from most leading passenger cruise lines. These professionals are committed to the continuing review of cruise ship medical care in concert with ACEP. In 1996, both ACEP and ICCL published medical facilities guidelines after numerous meetings among shore-side and cruise ship physicians knowledgeable about the unique needs and limitations of shipboard medical infirmaries.

The guidelines are designed to foster the goals of (1) providing emergency medical care for passengers and crew; (2) stabilizing patients and initiating reasonable diagnostic and therapeutic intervention; and (3) facilitating the evacuation of seriously ill or injured patients when deemed necessary by a qualified physician. All ICCL members meet these qualifications. Facilities and personnel will vary from ship to ship based on several factors, including the size of the vessel, number of passengers and crew, and length and itinerary of the voyage. Passengers requiring more comprehensive or specialized care are referred to a shore-side facility.

The cruise industry's proactive role in promoting appropriate shipboard medical facilities is continuing. Each year, representatives of ICCL's Medical Facilities Working Group meets with the ACEP's Section of Cruise Ship and Maritime Medicine to discuss new needs and developments, as well as revisions, if any, to the existing guidelines. As medical and telecommunications technology grows, so too does the availability of new capabilities aboard cruise vessels. An example which exceeds current guidelines but is already implemented in some of the newer vessels, is "telemedicine" which assists in the management of complex and emergency situations. In addition to providing a live, two-way video link, this virtual emergency room visit allows radiographs, x-rays, EKG's and other physiologic signals to be transmitted via satellite to a hospital from a ship anywhere in the world. Cruise ships also now have widespread availability of thrombolytic therapy for patients with acute myocardial infraction.

Prior to booking a cruise, passengers should assess and consider individual health requirements when deciding on the length and type of cruise. A person with a serious medical condition should consult with their personal physician before taking any vacation.

Medical Facilities Guidelines *(Updated January 1, 2002)*

The International Council of Cruise Lines (ICCL) is a non-profit industry trade association consisting of the 16 largest passenger cruise lines that call on major ports in the United States and abroad. The ICCL is dedicated to helping the cruise industry provide a safe, healthy, secure and caring ship environment for both passengers and crew. Among those services that illustrate this commitment to passenger welfare are the shipboard medical infirmaries found on all ICCL member vessels.

The ICCL member lines have taken a proactive role in addressing the quality of shipboard medical care, and many cruise ship physicians are members of the American College of Emergency Physicians ("ACEP") and serve on that organization's Cruise Ship and Maritime Medicine Section.

As a result of cooperative efforts between experienced cruise ship physicians and ACEP, all ICCL cruise lines have agreed to meet or exceed the requirements of the ACEP Health Care Guidelines on Cruise Ship Medical Facilities as approved on October 23, 2000. ACEP's guidelines address the facilities, staffing, equipment and procedures for medical infirmaries on cruise ships. Patients requiring more comprehensive facilities or treatment are typically referred to a shore-side medical facility.

These guidelines are not intended to constitute medical advice, nor to establish standards of care applicable to the industry as a whole. They reflect consensus among member lines of the facilities and staffing needs considered appropriate aboard cruise vessels, within the recognized limitations of the sea environment. However, the practices of individual cruise lines and shipboard physicians may vary depending upon passenger and crew demographics, itinerary, ship's construction and other circumstances. The guidelines are generally intended to foster the following goals:

- To provide reasonable emergency medical care for passengers and crew aboard cruise vessels

- To stabilize patients and/or initiate reasonable diagnostic and therapeutic intervention

- To facilitate the evacuation of seriously ill or injured patients when deemed necessary by a shipboard physician.

The ACEP guidelines are appended below, or can be viewed at: http://www.acep.org/1,593,0.html.

Health Care Guidelines for Cruise Ship Medical Facilities *(revised October 2000)*

The specific medical needs of a cruise ship are dependent on variables such as: ship size, itinerary, anticipated patient mix, anticipated number of patients' visits, etc. These factors will modify the applicability of these guidelines especially with regards to staffing, medical equipment and the ships' formulary.

Medical care on cruise ships would be enhanced by ensuring that cruise ships have:

1. A ship medical centre with medical staff (physicians and registered nurses) on call 24 hours per day, examination and treatment areas and an inpatient medical holding unit adequate for the size of the ship. A medical centre with adequate space for diagnosis and treatment of passengers and crew with 360° patient accessibility around all beds / stretchers and adequate space for storage.

    - One examination / stabilization room per ship
    - One ICU room per ship
    - Minimum number inpatient beds of one bed per1000 passengers and crew
    - Isolation room or the capability to provide isolation of patients
    - Access by wheelchairs / stretchers
    - Wheelchair accessible toilet on all new builds delivered after January 1, 1997
    - A contingency medical plan defining:
        - One or more locations on the ship that should:
            - be in a different fire zone (from the primary medical centre)
            - be easily accessible
            - have lighting and power supply on the emergency system.
        - Portable medical equipment and supplies including:
            - Documentation and planning material
            - Medical waste and personal protective equipment
            - Airway equipment, oxygen and supplies
            - IV Fluids and supplies
            - Immobilization equipment and supplies
            - Diagnostic and laboratory supplies
            - Dressings
            - Treatment - medications and supplies
            - Defibrillator and supplies
        - Communication equipment for each member of the medical staff
        - A clear procedure in case the primary medical space cannot be used
        - Crew assigned to assist the medial staff

2. Medical staff who have undergone a credentialing process to verify the following qualifications:

- Current physician or registered nurse licensure
- Three years of post-graduate / post-registration clinical practice in general and emergency medicine

  OR

- Board certification in:
  - Emergency Medicine or
  - Family Practice or
  - Internal Medicine
- Competent skill level in advanced life support and cardiac care.
- Physicians with minor surgical skills (i.e. suturing, I&D abscesses, etc)
- Fluent in the official language of the cruise line, the ship and that of most passengers

3. A medical record and communication system that provides:
   - Well organized, legible and consistent documentation of all medical care
   - Patient confidentiality

4. Emergency medical equipment, medications and procedures:
   - Equipment:
     - Airway equipment - bag valve mask, ET tubes, stylet, lubricant vasoconstrictor, suction equipment (portable)
     - Cardiac monitor and back-up monitor (2)
     - Defibrillators, two (2) portable, one of which may be semi automatic
     - External cardiac pacing capability
     - Electrocardiograph
     - Infusion pump
     - Pulse oximeter
     - Nebulizer
     - Automatic or manual respiratory support equipment
     - Oxygen (including portable oxygen)
     - Wheelchair
     - Stair chair and stretcher
     - Refrigerator / Freezer
     - Long and short back boards cervical spine immobilization capabilities
     - Trauma cart supplies
   - Medications – emergency medications and supplies for management of common medical emergencies, to include:

        - Thrombolytics and sufficient quantities of advanced life support medications, in accordance with international ALS guidelines, for the management of two complex cardiac arrests
        - Gastro-intestinal system medications
        - Cardiovascular system medications
        - Respiratory system medications
        - Central nervous system
        - Infectious disease medications
        - Endocrine system medication
        - Obstetrics, gynaecology and urinary tract disorder medications
        - Musculoskeletal and joint disease medications
        - Eye medications
        - Ear, nose and oropharynx medications
        - Skin disease medications
        - Immunological products and vaccines
        - Anaesthesia medications

    - Procedures

        - Medical operations manual as required by international safety management code
        - Medical staff orientation to the medical centre
        - Maintenance for all medical equipment as recommended by manufacturer
        - Code team trained and updated regularly
        - Mock code and contingency medical plan drills on a recurrent basis and as recommended by ships' physician
        - Emergency preparedness plan as required by the international safety management code
        - Internal and external audits

5. Basic laboratory and X-ray capabilities

    a. Haemoglobin / haematocrit estimations, urinalysis, pregnancy tests, blood glucose (all with quality control program as recommended by the manufacturer)

    b. X-ray machine for new builds delivered after January 1, 1997

6. A process whereby passengers (prior to embarkation) are requested to provide information regarding any medical needs that may require medical care on board. (FYI-ACEP Board)

7. A health, hygiene and safety program for medical personnel

    - A regular health, hygiene and safety program for medical personnel

    - An annual TB screening program for all medical personnel.

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ANNEX 9

The SARRRAH Project

sarrrah

Search and Rescue, Resuscitation and Rewarming in Accidental Hypothermia

Improve the chance of survival after severe hypothermia at sea … and on land!

February 2002

The SARRRAH-Project aims for co-operation between international maritime rescue services and land based emergency services to enable the accumulation of important data in the shortest possible time.

How to contact SARRRAH

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Where to find out more
Our website is www.sarrrah.de

The SARRRAH Project

- improves the chance of survival after severe hypothermia at sea
- has transferable principles which can be applied to all victims of hypothermia
- will play an invaluable part in the world-wide understanding by rescue services of the treatment of accidental hypothermia leading to higher survival rates

The SARRRAH project is supported by:
Ministry of Internal Affairs, Schlieswig-Holstein
The ITF Seafarers’ Trust

History of the SARRRAH Project

The project was devised at a medical workshop of the German Maritime Rescue Service (DGzRS) and it is being further developed at the Department of Anaesthesiology at the Medical University of Luebeck. The project partnership includes the German Institute for Naval Medicine, the DGzRS, ten hospitals on the North and Baltic Sea coasts, and the Institute of Forensic Medicine. SARRRAH was initiated by the recognition that procedures for the rescue and medical treatment of victims of life-threatening hypothermia must be changed in order for survival rates to improve.

Aims of SARRRAH

- to create a fully effective rescue service based on the early treatment and transport of hypothermia cases from the incident site to a suitably equipped hospital with prepared staff

- to improve the survival rate of victims of accidents resulting in severe hypothermia

SARRRAH - a basic fact

People with hypothermia have a much better chance of successful resuscitation than critically ill people with normal body temperature, but only if the hypothermia is sufficiently taken into consideration throughout rescue and medical intervention.

It is therefore necessary to establish clear and realistic procedures for emergency response, rescue and medical treatment based on up-to-date and proven knowledge.

All organisations which participate in rescue at sea need to agree to a strategy and establish a clear understanding of procedures in the course of their training programmes.

What does SARRRAH involve?

- Establishing a strategic plan to co-ordinate emergency measures and a syllabus for personnel training for the primary treatment of hypothermia, in partnership with the civilian and national SAR (Search and Rescue) schools, thus achieving continuity among all sectors of the emergency services

- Establishing new or modified procedures for rescue, transportation, resuscitation and monitoring of maritime accident victims, suitable for use even in extreme conditions and by both professional and amateur rescue personnel

- Ensuring hospitals are capable and equipped to effectively treat cases of severe hypothermia

- Informing all rescue co-ordination centres and doctors on call of their respective roles in emergency situations

- Ensuring that co-ordinating medical professionals can make use of an established system and a certain number of special hospital wards in a major incident involving victims of hypothermia

What has SARRRAH achieved so far?

In Germany, there are now several tertiary care hospitals covering the North and Baltic Sea area, capable of the effective medical treatment of severe cases of hypothermia. Each is equipped for the specialised treatment of people suffering from severe hypothermia.

A new resuscitation kit has been distributed, which contains a collection of well researched, up-to-date, and sometimes modified items. Training in the use of this equipment has been provided.

Training resources have been developed to include the presentation and written materials, practical demonstration kits and visual aids. Standardised documentation has been introduced which ensures quality control and establishes a system for understanding and managing emergencies and the medical treatment of accident victims - from the accident to the end of hospital treatment.

This documentation should also be used for patients with hypothermia resulting from non-maritime accidents. The land based rescue services of the five German coastal states are included.

In Germany a 24-hour hotline (07000-SARRRAH) is central to the operational plan and makes it easier for personnel to ensure quality control and effective use of the documentation system.

Method of Monitoring and Evaluation

In Germany the Medical University of Luebeck is the co-ordinator for records and collates all documentation and manages data. Patient records are kept and recorded on a database. This aids technical supervision and monitors the survivor to casualty ratio and provides a basis for project evaluation. This information is disseminated to all interested parties, including institutes of forensic medicine.

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