Single Cable Capsule Systems in Contrast to Twin Fall Lifeboats

Purpose of this Document

The purpose of this document is to record the significant difference in the accident record between lifeboats that use the Two Hook arrangement and lifeboats/capsules launched using a Single Hook system.

Why is One Hook Safer?

The table below outlines the principle differences between a Single Hook system and a Two Hook system that have created the greater safety track record for the Single Hook system.

	Single Hook	Two Hooks
Design	Simple design	Complex design required to allow for simultaneous release
	Leads to . . .	**Leads to . . .**
Operation	simple operation such that if it is not correctly locked the hook automatically removes itself from view thus preventing attaching to an unsafe hook	complex operation allowing for the possibility of the hook being not properly locked inside the boat, leading to the potential for accidents
	and . . .	**and . . .**
Maintenance	designed so that it has no cams, no internal springs, no cables and no need to be adjusted by maintenance personnel.	complex maintenance with internal cams, springs and cables that require adjustment, leading to the potential for accidents.

Single Hook -A Perfect Safety Record

The Single Hook method of launching is in use in thirty countries around the world, and for over twenty years has not been involved in a single accident. ***Our records confirm zero injuries and zero deaths***.

Two Hooks - Incident Reports

Attached to this document are three independent accident reports that address the many accidents in recent years, involving injury and death, with lifeboats using Two Hooks.

Note: Not just for Emergencies

Most of the recorded incidents involving Two Hook systems have occurred when the crew has been engaged in routine maintenance and training drills, and not in real life emergency evacuations.

More than Just Equipment

Investing in single cable launched capsules not only provides superior equipment, but also provides the following additional benefits:

- A track record of safe evacuations in emergency, almost two thousand people in over sixty incidents, a record unequalled in the offshore industry.
- Benefit of worldwide support bases that have over thirty years of continuous experience focused on inspection and training with survival systems.
- Recognition by Loss Prevention departments of the dollars saved in Major oil companies around the world.

Marine Accident Investigation - Improving Evacuation Systems' Safety

Stuart Withington
Principal Investigator, Maritime Accident Investigations Branch, UK (MAIB)

1. Introduction

"I didn't evacuate passengers using lifeboats simply because I was afraid that people would get injured. Instead, they were transferred through the car deck shell door into waiting tugs."
Quotations by masters in discussion with accident investigation inspectors.

Such lack of confidence in lifeboat launching equipment among ships' masters and crews is widespread. They have a right to be.

Scrutiny of data held by MAIB suggests that anyone using a lifeboat, be it in a drill or genuine evacuation, runs the risk of being injured or even killed. The lifeboat launching and recovery operation is the one activity that posses the highest risk to crew safety.

The MAIB database shows that over a 13-year period, 13 people were killed and 138 injured in 125 lifeboat accidents. Most accidents occur during the launching and recovery operation. The 13 lives lost represent 15% of all those killed in reportable accidents to the MAIB. These figures reflect only a small proportion of total accidents that have occurred worldwide. A global perspective indicates that more than 100 seamen were killed operating lifeboats during the 1990's.

This is an alarmingly high proportion of accidents. It is hardly surprising that an atmosphere of fear of lifeboat drills exists: a situation that does not contribute to the promotion of safety at sea.

The concern for safety in the lowering of lifeboats during emergency drill is clearly illustrated with the call to IMO for a change in the SOLAS requirement that specifies that during drills the lifeboat crew must be lowered with the lifeboat.

It is thought that the master should have the option to lower the lifeboat empty. This concern is a sad reflection on a system considered satisfying SOLAS requirements, yet is too risky to operate fully for training purposes.

The reality is that the removal of crew during launching benefits the master and management in their efforts to reduce risk to crewmembers being killed and injured. But the fact remains that, should a real emergency occur, passengers would be exposed to the same risk. Life-saving equipment, or installations, are tested to ensure fit for purpose. The risks to people should be no different, whether it is being tested or being used for real in an emergency.

There is equal lack of confidence of masters and crews involved in the launching and operation of fast rescue crafts (FRCs) and a reluctance to test them in the severe environment expected.

Incidents investigated show an extreme reluctance of masters to launch the craft in heavy weather. Masters are equally concerned with the safety of retrieving the craft back on board.

Over the last three years 24 accidents involving FRCs and injuries to crewmembers have been reported to MAIB Accidents. The number of accidents with these craft is much less than with lifeboats. However, this is probably because they are operated far less frequently than lifeboats.

Scepticism that emergency escape and embarkation systems can be tested safely is not confined to lifeboats and fast rescue craft.

The operation of suspending, inflating, people loading and lowering of liferafts is often avoided by surveyors and crews simply because they think the operation is too risky.

What underpins this lack of confidence in these systems? The maring industry, including IMO, sides with Jim Reason and others, who advocate that an accident is not caused by a single factor. It is caused by a variety of reasons.

They decry the past tendency to blame the accident on operator error. Controlling factors, which are often outside the operator's control, influence the operator's error.

Lessons learned from accident investigation show that operator error with emergency disembarkation and recovery systems is reduced significantly by better training, maintenance, procedures etc. The lessons also tells that good design is the barrier most likely to succeed to prevent accidents.

Deficiencies in design are the handicap that hinders masters' endeavours to ensure crew safety and to instill confidence in emergency embarkation and recovery drills.

The purpose of this discussion is to show that for these systems to operate safely and with confidence, they must be designed with the aim of making them inherently safe.

To achieve this, the design process must be managed effectively to ensure that the human factor is considered at design conception, and throughout all the design stages, including final installation and testing.

Emergency evacuation systems must be designed to support the people who are expected to use them.

2. Investigations that have identified design related root causes of accidents

The design made it hard for people to carry out reasonable tasks and vulnerable to predictable human failings.

.1 Ergonomic principals have not been properly considered in the design is highlighted by the difficulties experienced in bowsing and tricing operations of lifeboats.

.2 In one accident investigation, modifications to the operation were made using a band bowsing system (BBS), designed to replace an existing conventional method of tricing and bowsing. During installation tests of the system two crewmen were killed.

.3 The two men were stationed in the forward and after hatches of the lifeboat. They attempted to release the BBS brakes. The intention was to move the lifeboat away from its embarkation position to its lowering position. During the operation, the aft end of the lifeboat swung suddenly away from the ship's side. Progressive collapse of the davit followed.

.4 Post accident investigation tests found that the brake was sensitive to incorrect operating procedure. The seamen found it difficult to simultaneously operate the brakes in a controlled manner when the lifeboat was fully loaded. Brake operation required a level skill not recognised at the time of the accident.

.5 The investigation also found that the wearing of lifejackets restricted the seamen's movements compounded their difficulties in operating the BBS brake from the lifeboat hatch openings.

.6 Davits, lifeboats, rescue craft and winches are often supplied by a diverse number of sources, resulting in a fragmented approach to system design development. Once installed on board, geometrical mismatches are uncovered, making launching and retrieval of a rescue boat or lifeboat difficult and dangerous.

.7 The irony of this situation is that the BBS has global acceptance as an alternative to traditional bowsing tackle and tricing penitents to avoid the hazard create by this geometrical mismatch.

.8 The BBS was also designed to overcome the difficulties for seamen overcoming the heavy loading applied to bowsing tackles as they reposition a fully loaded lifeboat from embarkation position to vertical lowering position of the falls.

.9 The consequence of using the BBS is the replacement of old hazards with new ones. In the accident described above, two seamen lost their lives.

<u>The design was vulnerable to predictable human failings.</u>

.10 Simultaneous operated on-load release lifeboat hooks have been mandatory since 1st July 1986. Lessons learned from the accident on the offshore platform, Alexander Kieland, in the North Sea in 1978 was the spur that brought about the requirement. Because of rough seas, lifeboats were prevented from becoming waterborne long enough to enable release of the fixed hooks of the lifeboat from the lifeboat falls. Consequently, lives were lost as lifeboats crashed against the platform, with one lifeboat ending up side down in the sea.

.11 The first design of on-load release hook did not have any interlock to prevent unintentional release of the lifeboat when not water-borne. Indeed, SOLAS did not recognise the need for such an interlock until recently.

.12 The consequence of not having an interlock has resulted in numerous accidents due to inadvertent release of hooks. These accidents could have been prevented had an interlock been fitted.

.13 Investigations have found that on-load release systems can be complex and difficult to understand. Consequently, to maintain and operate release mechanisms safely requires in-depth knowledge, specialised skill and relevant, clear and unambiguous operating instructions.

.14 Often the lifeboat hooks have not been located properly in their reset position. As the lifeboat is retrieved and landed on the davit stoppers, the consequent jerking of the lifeboat opens the hooks resulting in the lifeboat falling down causing serious injury and fatalities.

.15 Hook mechanism have been found to be susceptible to failure given small changes in tolerances due to operational wear, corrosion and fretting, machining deviations during manufactured and deteriorating effect of salty air, weather and vibration.

.16 Such unsafe conditions are difficult to detect by seaman during their normal routine inspections. Seamen need to be constantly aware of the complications of on-load release hook mechanisms, and assured that the hooks are properly secured, and that the release and interlock systems work effectively.

.17 Given wear on the reset mechanism, interlock indicating lights and hook reference marks on the hooks have been found to give a false impression that hooks and locked when they are not. The user is given a false sense of security as a result.

<u>The design was inadequately specified for the required duty.</u>

.18 From lessons learned of the loss of the Estonia, IMO's panel of experts suggested that ro-ro ships should be equipped with a means of rescuing (MOR) people from the water. In this accident, the vessel's escape chute was used as a MOR when rescue boats could not be launched. Consequently the new SOLAS regulation 26.4.3 confirms that the ship's own evacuation slide can be modified to make it easier to pick up people from the water.

.19 The intention of IMO's panel of Experts was that, in the case of a disaster, a ro-ro ship could use a fast rescue craft to collect people from the water, and bring them to the MOR. The MOR would then be used to embark the survivors.

.20 However, the regulation permits the FRC to be used as a MOB. Since the FRC can carry only a small number of people, the craft would have to be retrieved on board many time over in the case of a major accident with many people in the water. The delay in retrieving survivors from the water could be considerable.

.21 Given the difficulties of launching and retrieving FRCs in stressful conditions of heavy weather, procedures are prone to errors when releasing painters and suspension hooks. Exercises, which can be conducted safely, are so far proving to be impractical.

.22 Concerning vertical chute marine evacuation systems, during one evacuation drill an evacuee became stuck in the "piked position" in one of the cells of the chute. The evacuee was rescued from the chute, but later died.

.23 The riding up of the lifejacket worn by the victim probably contributed to her becoming stuck in the chute. Designers had not accounted for this possibility. No proper account had been made of the means of preventing undue delay in the evacuation should a blockage of the chute occur.

3. Action taken to prevent accidents

A better understanding of why accidents happen has resulted in IMO's Design and Equipment Sub-committee proposing significant changes in operating and servicing requirements for lifeboat installations.

One proposal calls for specific guidelines for periodic servicing and maintenance of lifeboats, launching appliances and on-load release gear. As important, is another proposal to use the manufacturer's representative, or persons properly trained and certificated to carry out inspections, maintenance and repairs.

The proposals reflect what is, already, good practice of a number of outstanding companies. Global acceptance of them would be an important step towards improvement of safety of seamen and passengers.

For training purposes, companies have put on board ship; working models of on-load release and marine escape systems. Crew-members, port State and flag State inspectors have reported that these models are useful in helping significantly their understanding of the systems' operation and maintenance needs.

There is a strong mandatory case for such models and related specialised equipment to be placed on board ship for training purposes.

Where ships are fitted with emergency vertical escape chutes, management is reducing risk of injury to crew and passengers by selecting those people who can use chutes safely based on their age, fitness and physical build.

Some companies are starting to standardise lifeboat launching systems and equipment throughout their fleet, thus improving crew familiarity and confidence with their use.

IMO advocates medium to long term consideration of alternative technologies, such as "safe-haven" refuge, comprising parts of the ship that may float free in the even of a casualty. Alternative types of survival craft and under consideration.

It is proposed that any alternative system developed should be capable of being routinely exercised by the crew.

4. An inherently safer design is good for us

A human factor approach to design is a perquisite to good design. Good design has an impact on preventing the initiating event of an accident. This view is reflected at IMO whose work plan is committed to examining measures to avoid accidents by better design of emergency escape systems.

There are several definitions of human factor. One that is relevant to the design function is:

"Human factor is a professional discipline concerned with improving the integration of human issues into the analysis, design, development, implementation, and the operational use of works systems"

With this approach to design, health and safety considerations are integrated into the design process, from the initial design concept to installation and testing.

The present tendency is to focus on the safety need for people once the system has been made, rather than during the design process leading up to the product's final installation and use. The design process offers the opportunity to ensure that the end product is inherently safer than emergency installations now in use.

Such an approach can ensure that risk reduction measures adopted to address one hazard do not disproportionately increase risks due to others. Such an approach could have identified the safety problems with the concept of on-load release hooks when considered against the lessons learned from the Alexander Kieland accident.

To achieve an inherently safer design, the human factor must have central role in design development thinking. It should be at the heart of the design process. It is in the design process, leading from design concept to final product testing where key human factor safety issues can be addressed.

The greatest opportunity to reduce risk is during the initial design concept stage. This is the best time to identify hazards. This is the time to make informed choices, either to design hazards out of the system or to identify realistic control measures to mitigate the hazards.

The ability to change a design decreases with time as design concepts are selected and design details are finalised. The vertical escape chute accident involving incompatible lifejackets, and the BBS accident, are examples of many where difficulties of operation have been uncovered only after the system has been installed and tested.

Safety problems such as these could have been avoided if careful attention had been given to ergonomic design of systems during the design process.

The consequence of not addressing the issues of human factor is the probability that inherent safer design will not be achieved. Risks associated with human activity addressed as an afterthought increases the demand for more exacting operating and maintenance skills and a higher level of knowledge. The likelihood of operator error is increased, and the confidence of the user to operate the system decreased.

5. A Safety Management System Code for Inherently Safer Design

Following the Cullen report into the Piper Alpha disaster, the offshore industry has recognised that risk reduction at the design stage is one of the most effective means of achieving safety of personnel.

The UK's Health and Safety Executive, for example, has placed duties and principles on designers and design teams to have a key role in ensuring that a human factor approach is taken throughout the design process. The aim is to achieve an inherently safer design.

Linked to this, is an offshore industry initiative to improve safety performance of the design process by developing useful performance indicators. The indicators will measure the effectiveness of management and application of health and safety in the design process.

These initiatives for achieving inherently safer designs could be applied to emergency escape systems.

In its focus on the safety and effectiveness of emergency escape systems, IMO is well placed to develop a safety management system code for inherently safer design, aimed to ensure that human factor issues are an integral part of the design process, and that the design process is managed effectively. The Code could emphasis the importance of a holistic approach to design.

When integrating human factors throughout the design process, the following domains could be considered.

• Manning: How many people are required to operate the system?
• Personnel: What experience aptitudes and other human characteristics are necessary to operate the system?
• Training: How to develop and maintain the requisite knowledge, skills and abilities to operate and maintain the system.

• Ergonomics: How to integrate human characteristics into design to optimise performance within the human/machine system.
• Health hazards: What are the health hazards resulting from normal operation of the system?
• System safety: How can safety risks be avoided due to humans operating or maintaining the system abnormally.

With its work programme to review emergency escape systems, IMO's Design and Equipment Sub-committee is best placed to develop such guidelines.

6. For the future

IMO is well placed to develop a safety management system code for inherently safer design of emergency evacuation systems.

A Code could encourage a well managed and structured human factor design process which follows well-defined principles to achieve an inherently safer design.

The effectiveness of the design process could be monitored and audited by a competent authority.

Confidence in the design process will facilitate effective evaluation of equipment and system maintenance practices, policies and procedures.

Inherently safer designs will reduce the number of accidents to seamen and instill confidence in their use.

Acknowledgements
I want to thank ship management colleagues, colleagues at the MAIB, MCA, HSE and IMO, for their contribution to this discussion about the safety of emergency evacuation systems.

Stuart Withington, Principal Investigator MAIB
Carlton House, Carlton Place,
Southampton SO15 2DZ
United Kingdom

Lifeboat Incident Survey - 2000

Results from a Joint Industry Survey carried out
by
OCIMF, INTERTANKO AND SIGTTO

SIGTTO

OCIMF

Introduction

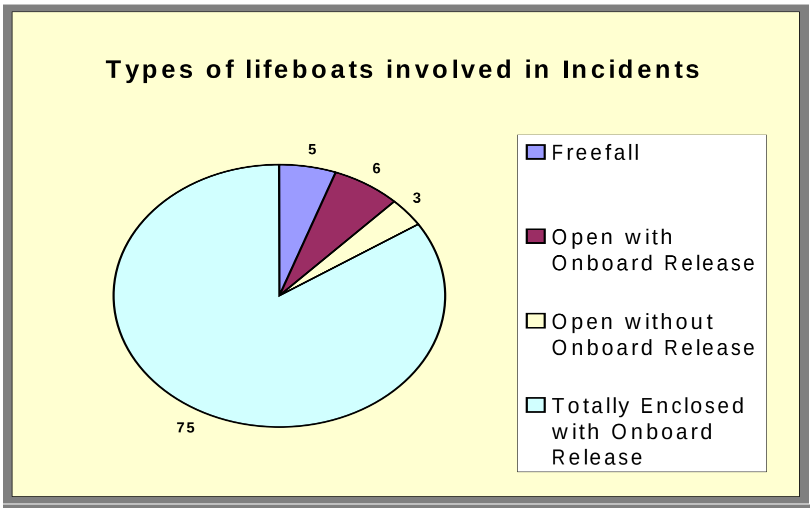
In 1994, OCIMF in conjunction with ICS, produced a report entitled “Results of a Survey into Lifeboat Safety”. This report highlighted some major concerns over equipment and the availability on board of appropriate technical information and documentation; similar concerns evidently remain. During recent years there has been continued concern among the Membership of our organisations over the number of incidents that involve lifeboats. One possible benefit from the earlier survey may well have been to make seafarers more aware of the inherent dangers of lifeboat launching and recovery procedures.

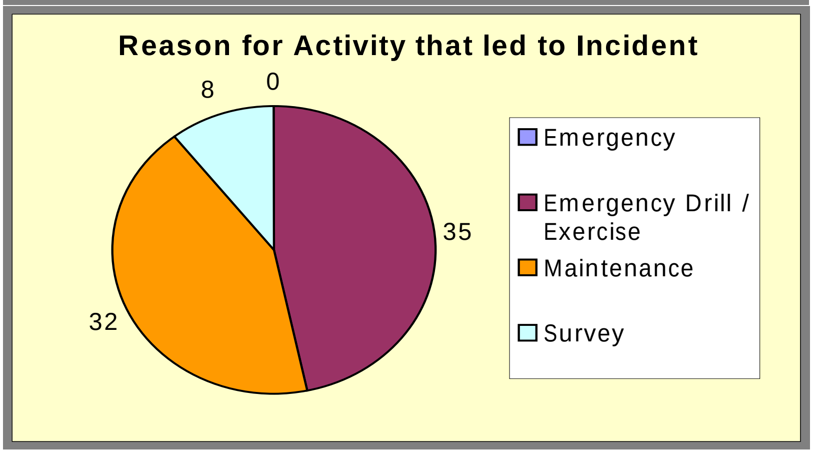
To ascertain current understanding of lifeboat issues, a questionnaire was developed and issued to all Members of INTERTANKO, OCIMF and SIGTTO. This questionnaire was not targeted at any specific type(s) of lifeboat, but it was anticipated that the majority of incidents involved totally enclosed boats and their associated hook release systems due to the comparative complexity of the design. In addition, the views of serving seafarers were sought on the practicality and suitability of designated, specialist rescue craft. Concensus and response on this latter were inconclusive and are not included in this report.

The 89 completed questionnaires returned varied in standard of detail, so some minor inconsistencies exist with incident numbers. However, the relative proportions of data shown in the charts are unaffected.

Findings

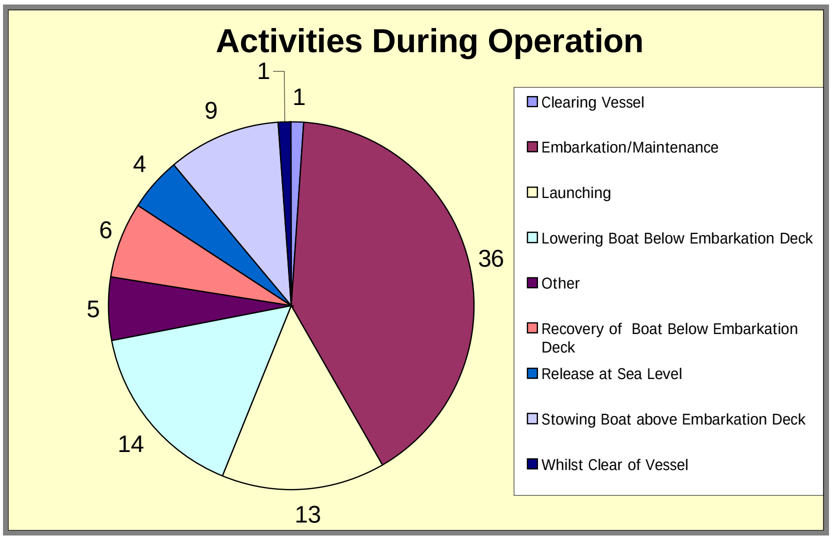
The charts below show the proportions of different lifeboat types involved in the reported incidents.





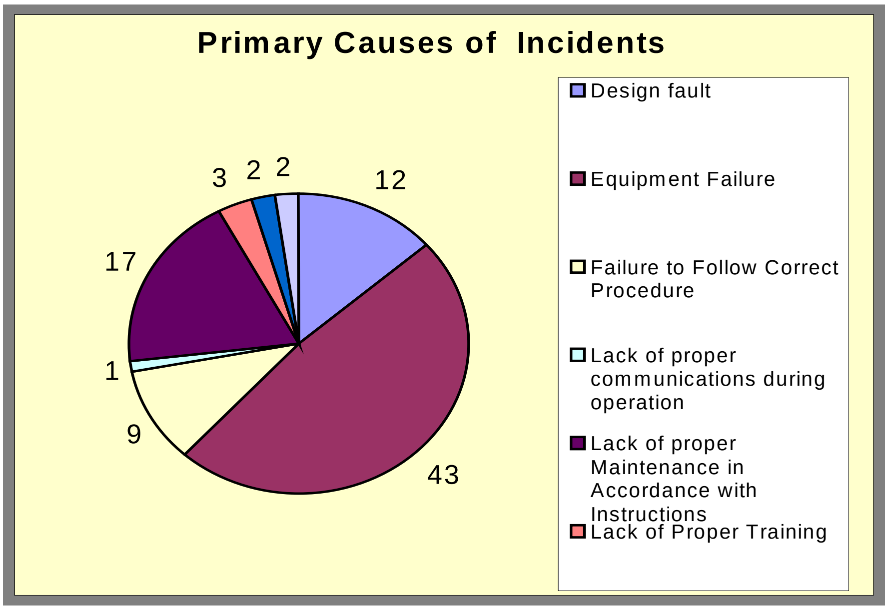
All reported incidents were associated with either testing or maintaining the boats, training exercises/drills or Surveys.

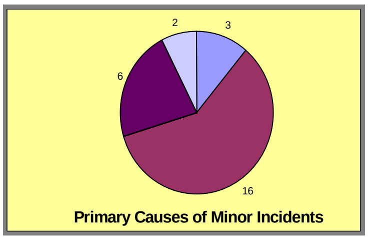
The majority of incidents involved personnel being within the boats.

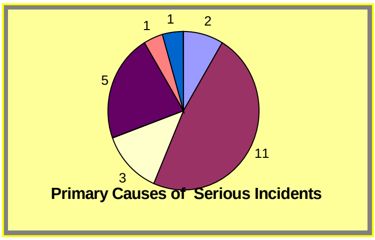


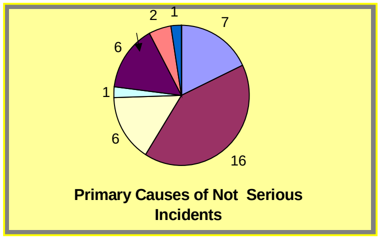
Primary Causes of Incidents

In the charts below, an attempt has been made to classify the incidents into three categories; Serious, Non-Serious and Minor.



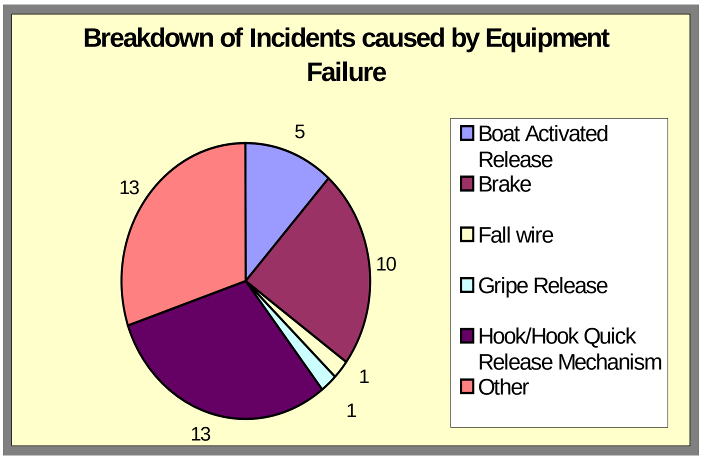






Equipment failure is the greatest cause of incidents in all categories, followed by lack of proper maintenance, design faults and a relatively small number of Procedural faults.

Incidents directly caused by poor training and communication errors are minimal.



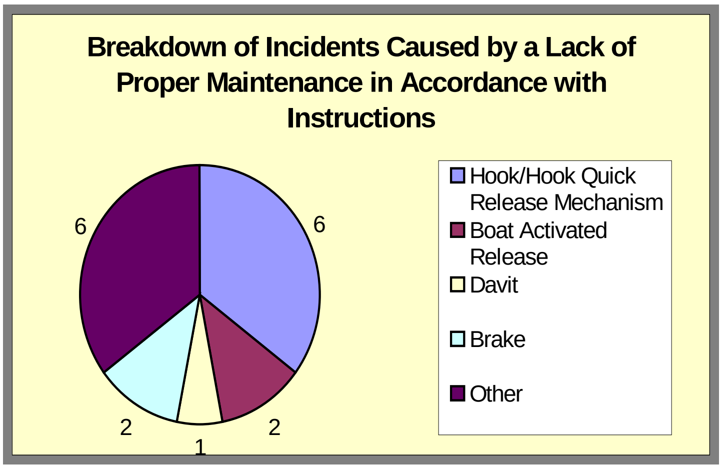
Equipment Failure

Hook/Hook Quick Release Mechanism failure is the largest group, relating to inability to engage or release hooks correctly due to cable failure or mislocated safety mechanisms.

Other major types of failure are winch brake related, caused by internal mechanism or remote controls for brake releases.

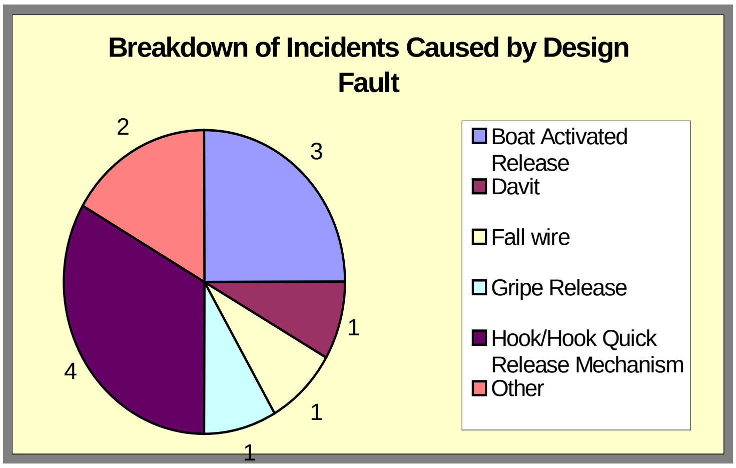
"Others" includes retrieval of free-fall lifeboats.

Lack of Proper Maintenance



Problems with Hook/Hook Quick Release Mechanism top this grouping. Usually attributable to wastage of critical parts within safety mechanisms.

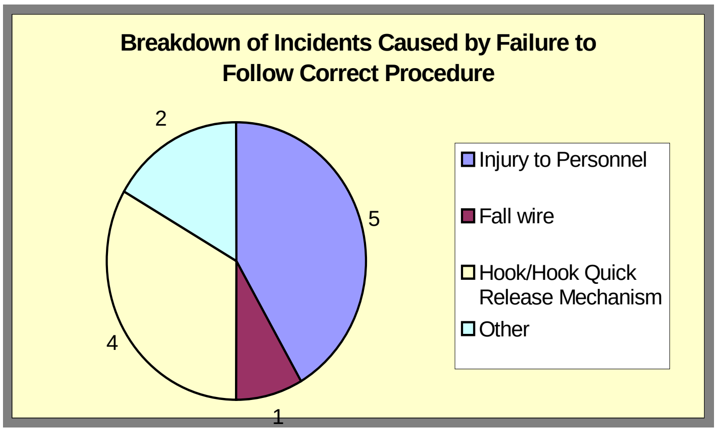
Design Faults



Again, the majority of incidents have occurred with Hook/Hook Quick Release Mechanisms followed closely by Boat Activated Release. The Lifesaving Role of the lifeboat may be compromised by an inability to launch it safely and efficiently.

The design faults reported may not have become apparent without regular training exercises.

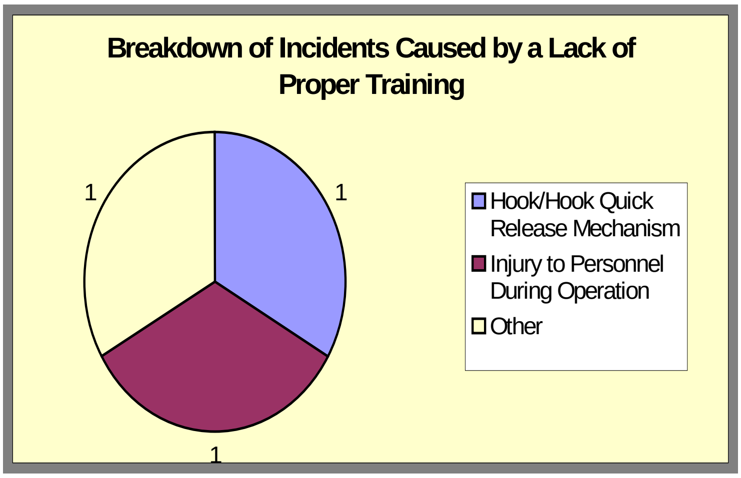
Failure to Follow the Correct Procedure



A number of incidents from failure to follow the correct procedure resulted in injury to personnel. Others resulted mainly in damage to boat or launching apparatus. Again, the Hook/Hook Release Mechanism is a substantial contributor to this type of incident.

Lack of Proper Training

Few incidents can be attributed to lack of proper training and no valid conclusion can be drawn.



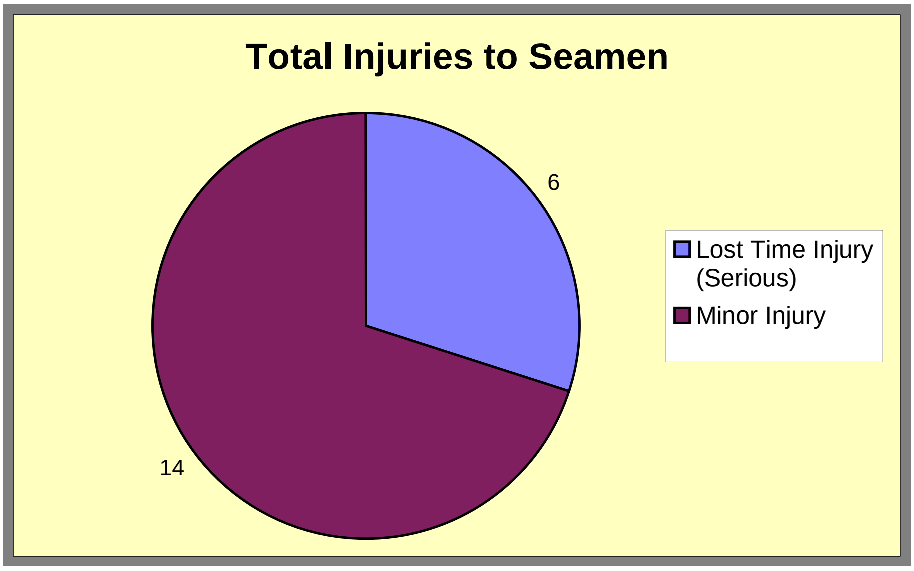
Lack of proper communication /Physical Condition Affecting Operation/Others

These 3 categories have so few incidents that no valid conclusion can be drawn from them.

Primary Causes of Injuries

Fortunately there were no fatalities reported in this survey. However, that potential existed where boats were seriously damaged or lost.

The number of injuries in comparison with the number of incidents is low. It can be assumed that a deep mistrust of lifeboats has developed on board vessels, resulting in operation of the boats in a manner that limits as much as possible any exposure to potential injury, such as a minimum number of persons in the boats when being lowered and lifted.



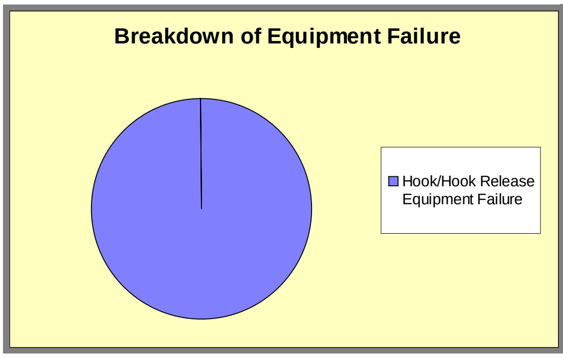
20 injuries were reported, 6 being serious, requiring at least several days off work and 14 were minor, requiring first aid or medical treatment before continuing work.

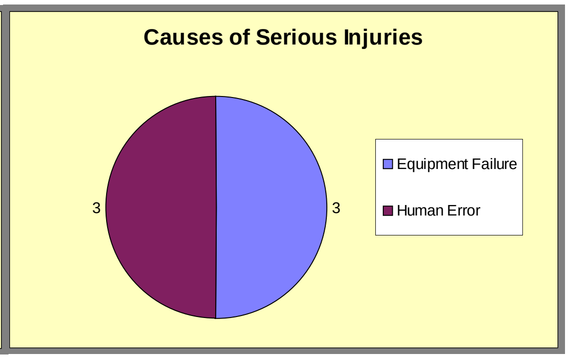
These 20 injuries occurred in 13 separate incidents, 4 of which accounted for the serious injuries.

Serious Injuries

- A major incident was a lifeboat releasing itself and falling to the water from the embarkation deck level. The height above the water was relatively small at 12 metres and three members of the lifeboat crew incurred leg and/or back injuries. Had the freeboard been greater, fatalities would have been likely.

- The other incidents were all caused by human error - failure to follow correct procedure or lack of proper training. These included a thumb crushed by a closing lifeboat door and wrist fracture whilst starting a lifeboat engine.



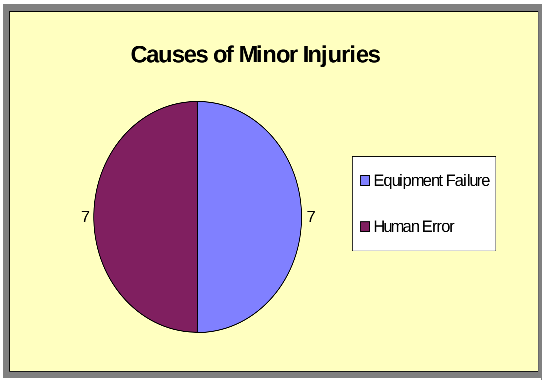


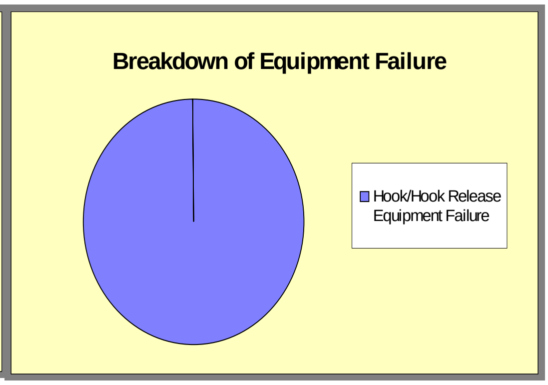
Minor Injuries

9 incidents involved minor injury. Two had potential for serious injury: -

- During a boat launch, the forward quick release hook released itself with the boat five metres above the waterline. This resulted in minor injuries to 4 seamen. The nature was not reported but the potential for more serious injury existed.
- A lifeboat was lowered to sea level but the launch aborted when one hook did not release. The other released but was reconnected and the boat recovered above embarkation deck with the crew onboard. When the boat reached the davit head the hook that failed released itself, resulting in the boat swinging from one fall. The three crew received cuts and bruises. Great potential existed for serious or fatal injuries. The one fall and davit proved sufficiently strong to hold the total weight of the boat on this occasion.

- Some incidents include injuries incurred whilst attempting to “hook on” to the falls for boat recovery. In one incident a seaman was struck by the swivel block and in the other a seaman incurred pinch cuts to his hands whilst holding the hook in place as the release system was engaged. The connection of waterborne lifeboats to falls has always proven a hazardous operation, but is exacerbated by release mechanisms which are difficult to engage correctly. A similar minor injury was incurred when trying to reconnect a quick release hook after maintenance. This resulted in cuts to fingers.
- Other incidents include gripe releases under tension where a seaman was struck heavily by the freed end of the gripe and one where a seaman caught his finger in the gripe release mechanism.
- More minor incidents include a seaman attaching his safety harness to the davit and being pulled off balance when the davit was lowered and a seaman losing balance whilst attempting to start a lifeboat engine. The seaman struck his head, rather than fracturing a wrist as noted in Serious Injury section.





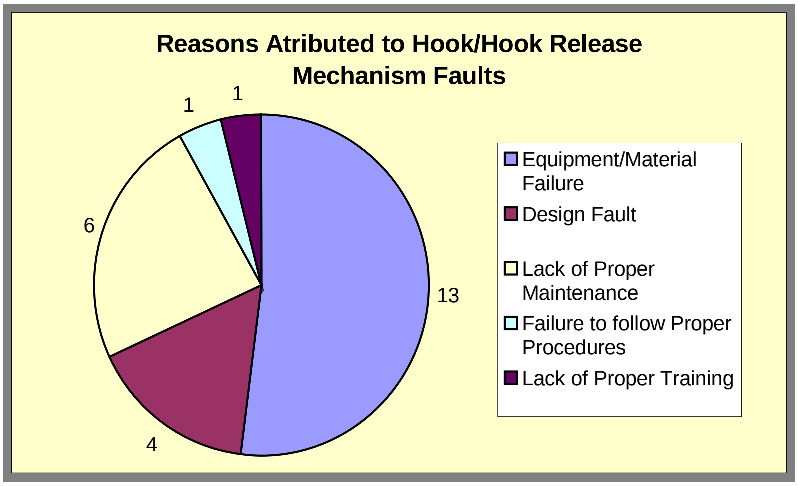
Summary of Incidents leading to Injury.

All injuries caused to personnel due to equipment failure relate to the Hook/Hook Quick Release mechanisms on totally enclosed lifeboats. These incidents account for 50 percent of the reported injuries and had potential to incur fatalities.

Many of the other injuries could have been avoided with more care, but the present equipment design and operation creates inherent risk, such as the means to reconnect the lifeboat to falls prior to recovery and the means of starting lifeboat engines by hand.

N.B The charts in the Serious and Minor Injuries sections assume that “Equipment Failure” relates directly to a failure of the equipment and “Human Error” relates to following incorrect procedures or taking insufficient care.

Hook/Hook Quick Release Mechanisms



As previously noted, incidents attributed to faults with the Hook/Hook release Mechanism are the greatest single group. Of these 25 incidents, over 50% are due to failure of the equipment or of the material. When Design Fault is added some 68% of these incidents can then be grouped as a single "Design factor". If at the design stage the requirement for non-critical maintenance was addressed, the incidents categorised under Lack of Proper Maintenance may not have occurred. Therefore, all but 2 of these incidents can be attributed to poor design of the Hook/Hook Release Mechanism.

Lessons Learned

It appears that little has changed in the incident types reported between this survey and that conducted in 1994 by OCIMF and ICS. The main difference is that in this report no fatalities are noted. This may be due to the fact that seafarers are now more aware of the risks inherent with lifeboat operations and in drills or exercises personnel are often excluded from risk where possible. Unfortunately this may reduce the effectiveness of some training exercises such as simulating a real emergency situation and therefore fully familiarising crew in the designed use and limitations of the equipment.

Both this report and the 1994 survey show that the design and construction of lifeboats and their auxiliary equipment, such as hook and hook release equipment and winch brakes continue to play a significant part in incidents involving lifeboats. The purpose of a lifeboat is designed to evacuate personnel from a ship and save life. Retrieval of the boat is a secondary factor almost entirely confined to the mechanics of training exercises/drills. However, it would appear that the designers of such boats and their securing methods have not addressed this secondary factor with sufficient thought. This can be illustrated by the design of complicated hook release equipment. Once assembled and maintained correctly such equipment can be very reliable, however, should a small error in the location or a reduction of clearance occur with even seemingly minor parts, disastrous consequences can ensue. Making minor adjustments to these complicated arrangements is prone to error when securing a boat on its falls in a seaway. Design factors also apply to types of materials used. Should the hook release equipment be manufactured from a material susceptible to wastage then reliability and maintenance can be severely affected.

Another example of the poor design of equipment (i.e. the assumption that recovery is of limited importance) is the report of a Freefall lifeboat that took a full day to recover. The equipment was unable to recover the boat in a single pull, necessitating the crew evacuating the boat from a hazardous position to reduce the winch load.

Operational human error does not appear to be a direct cause of many incidents. Human error in design and not adequately specifying launch and recovery equipment standards for practical eventualities is apparent.

One positive note is that a lack of supervision or training during drills does not appear to be a major factor.

Recommendations

The reported incidents and findings show that the marine community needs to further improve standards for the design, manufacture and maintenance of lifeboats in a bid to ensure that not only can they be used in an emergency but can also be operated regularly at drills in a safe manner.

Some of the recommendations that follow reiterate recommendations made in the 1994 report. Their validity can only be strengthened by the apparent need for repetition.

It is recommended that Ship Operators and Owners should:

- In the case of totally enclosed lifeboats with a hook release mechanism, review the correct operation of the hook release and draw up instructions and drawings detailing the correct components, their location and method of operation. These instructions to be specific to the equipment fitted on board the vessel and to be provided to all seamen who are likely to be involved in the maintenance and operation of such equipment.
- Incorporate procedures requiring the boat recovery process to be suspended once the boat is clear of the water and ensure that the hook release mechanism is correctly secured prior to recovery of boat to embarkation deck.
- Review maintenance procedures in light of these reported incidents. Particular component failures to consider are: -
    1. Hook/ Hook release mechanisms to be inspected to ensure that all components are within tolerance, there is no build of scale, and that there is no wastage that could either weaken the equipment or cause it to operate incorrectly. This includes the release cable, which has been subject to a number of incident reports.
    2. Winch brake linings to be regularly inspected for contamination and lining thickness. The associated remote lowering wires are checked to be in good condition and to operate correctly, both on the stowage drum and within the boat.
    3. Lifeboat falls should be lubricated and inspected regularly. At appropriate intervals they are to be renewed or end for ended.
    4. Cut outs for recovery winches should be regularly checked for correct operation to prevent over stressing falls and davits.
- Consider installation of a secondary manual override lock to the hook release mechanism that can be released from a central point in the boat but ensures that there can be no inadvertent release of the hooks, either through human error or a hardware fault, during maintenance or drills.
- Further ensure that training includes personal safety specifically with regard to lifeboats, ensuring that seafarers are made aware of hazards such as releasing gripe wires under tension.

Lifeboat and associated equipment Designers / Builders / Installers should: -

1. Simplify the design of operating equipment with a view to increasing reliability, easing maintenance ensuring simplicity of operation with regard both to launching and recovery. Components requiring fine tolerances should be avoided or constructed of material not prone to wastage.
2. Provide hatchways in enclosed boats of sufficient size to enable easy access for connection of hooks. This should take into account that the reconnection may be required in a seaway, not in still water.
3. Ensure that hatchways are suitable for evacuating injured and/or stretchered personnel either to another boat or by helicopter.
4. Provide a means of positive indication that hook release systems are fully engaged and locked for recovery, preferably from the coxswains conning position. This should be mechanical, directly connected to the hooks and not involve secondary indication such as lights, the position of the release handle, etc.
5. Simplifying the brake system for the davits/falls to improve ease of maintenance and increased reliability. Increasing brake capacity to well above the weight of a fully laden lifeboat would help ensure that braking ability is maintained even if the system weakened.
6. Provide a method of indicating brake lining wear or contamination external to the winch to alert ship staff of a problem.
7. Ensure that remote brake release systems from within the lifeboat are reliable and not inherently liable to snag within the boat.
8. Ensure that the recovery systems, especially the winches, are sufficiently strong to enable a lifeboat to be recovered easily and quickly with a normal drill complement onboard.
9. Ensure that boarding at the stowed position can be undertaken easily and safely for maintenance, whilst also ensuring safe and quick access can be achieved at embarkation level (if different) in an emergency.
10. Ensure that there is a suitable method such as a hose connection for testing/flushing water-cooled lifeboat engines and spray systems with freshwater when boats are in the davits.

Flag States, IMO and Classification Societies

1. Review and qualify the existing requirements under SOLAS Ch3 Regs 51 and 52 – The SOLAS Training Manual and Maintenance Information/Records. In many cases the current details of lifeboats and their equipment provided are inadequate or generic. Flag States should compel owners/operators to ensure that such information is specific to each individual vessel and sufficiently detailed for vessel crews to operate easily and identify, assess and repair any individual component with ease.

2. Review other existing regulations to consider if changes may be necessary to ensure the safe and efficient launching and recovery of lifeboats during drills/training exercises (and for rescue if the lifeboat is a designated rescue boat) bearing in mind the points raised in this report.
3. In the case of Free-fall lifeboats, review the existing test launch and recovery requirements with particular regard to permitting simulated launches such as unmanned release onto a stop-chock after a few centimetres of travel and ensuring the recovery mechanism has sufficient excess power to lift cradle and laden boat easily and rapidly.
4. Review maintenance and survey requirements to confirm that lifeboats and their associated systems fully meet the level of assurance required in (2) and (3) above with regard to launching and recovery in regular drills and exercises.

Brief Description of the Incident	Established Cause	Type of boat
Serious Incidents		
The lifeboat was in the process of being lowered to embarkation deck for survey. A rope became entangled in the after davit release mechanism causing it to release. The boat became suspended from forward hook distorting the davit arm, which required landing for repair. **The boat was seriously damaged.**	Design Fault	Totally Enclosed with Onboard release
When lowering the boat the forward davit arm became momentarily delayed in release due to the forward retaining clamp being partly still in place. When freed the forward arm lined up with aft arm the shock to the system caused the forward hook to release. **The boat was seriously damaged.**	Design Fault	Totally Enclosed with Onboard release
Whilst lowering boat to embarkation deck the brake failed to hold and the lifeboat proceeded to sea level in an uncontrolled manner. The vessel had to stop engines and take all way off. The winch brake was overhauled prior to recovery of the boat**. The lifeboat suffered minor damage**.	Equipment/material Failure	Totally Enclosed with Onboard release
During launching of port side lifeboat, the forward quick release hook opened whilst boat was about 5m above water line. **This caused substantial damage to the lifeboat and minor damage to the aft davit.**	Equipment/material Failure	Totally Enclosed with Onboard release
Both boats were being lowered to the embarkation deck as part of a drill. Both lowered with minimal braking as the remote wires from the boats were incorrectly adjusted. A turn was taken off the remote wire for starboard boat, which had the effect of stopping it. The port boat continued to sea level and, as the vessel underway at full sea speed at the time **the lifeboat was a total loss. Davits on the port side also suffered considerable damage**.	Equipment/material Failure	Totally Enclosed with Onboard release

Brief Description of the Incident	Established Cause	Type of boat
During an in water test of the starboard lifeboat engine in the water, the lifeboat's motor stopped after approximately 10 minutes of running due to overheating and impossible to restart. The port lifeboat was lowered to the water to rescue the starboard lifeboat, but its engine also seized for the same reason. Both boats recovered by vessel heaving anchor and manoeuvring into position.	Equipment/material Failure	Totally Enclosed with Onboard release
The starboard lifeboat was being lowered on brake. When lifeboat reached embarkation deck it would not stop lowering. When boat hit water, the weight came off of falls & the brake then moved to stop position. The surging of boat in seaway first released forward fall & then the after fall**. The lifeboat was a total loss.**	Equipment/material Failure	Totally Enclosed with Onboard release
During the hoisting of the lifeboat, just prior to reaching stowed position, the aft hook released causing the boat to fall on the structure below. One sheave mounting and both hooks were damaged. **The boat was badly damaged.**	Equipment/material Failure	Totally Enclosed with Onboard release
During recovery of the lifeboat the winch motor was stopped but the lifeboat had inertia and touched to the davit. The forward fall parted. The boat was kept on the aft fall. The outside of the fall appeared good but the inside was found to be badly corroded. **The boat suffered minor damage.**	Equipment/material Failure	Totally Enclosed with Onboard release
Whilst lowering boat the brake was unable to stop the boat at deck level. It continued lowering to sea level. The vessel was underway at the time and had to be stopped and all way taken off. The boat was found to be badly damaged after it had been recovered by ships crane. The davits also sustained damage.	Equipment/material Failure	Totally Enclosed with Onboard release
The starboard lifeboat lowered to deck level. When tried to lift it, was not possible to do it either by winch electric motor or by hand. Found winch 2nd step shaft broken. Provisional repairs done to be able to recover the boat.	Equipment/material Failure	Totally Enclosed with Onboard release
During port life boat brake loading capacity test, the brake failed and the boat lowered uncontrollably to the water. **The boat suffered minor damage.**	Equipment/material Failure	Totally Enclosed with Onboard release

Attachment 1

Brief Description of the Incident	Established Cause	Type of boat
During routine maintenance the forward remote release cables on both boats failed due to internal corrosion of the wires.	Equipment/material Failure	Totally Enclosed with Onboard release
The crewmember responsible for taking safety pin out on aft davit arm did not do so. When the brake was released only the forward davit arm went down. The brake was applied as soon as crew attending the lowering observed the fault. However the forward part of the boat swung against the deck below **sustaining minor damage.**	Failure to follow correct procedure	Totally Enclosed with Onboard release
During a drill the lifeboat was hoisted up to its final position when it was observed that the bow was in place but the stern still a few centimetres away from its final position. Air motor restarted and the aft fall parted causing the after end of the boat to fall damaging both the boat and davits. **The boat was a total loss.**	Failure to follow correct procedure	Totally Enclosed with Onboard release
During survey the port lifeboat was lowered to water. Prior to recovery a failure in the forward securing device was found. The release pin was manually secured with spanner and rope lashing. Whilst stowing the forward hook released, the boat fell to the water. **The boat was seriously damaged.**	Failure to follow correct procedure	Totally Enclosed with Onboard release
The lifeboat was lowered below embarkation deck and stopped. At that moment both the fore and aft hooks released and boat fell into the water. **The boat was seriously damaged.**	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
A lifeboat remote lowering wire parted due to corrosion and erosion of handle. The failure of the handle caused wire to run out and could have had disastrous consequences had the equipment failed in use, especially in an emergency.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
During lowering of the lifeboat the self-unlocking forward release hook released. The dynamic loading on the aft hook caused this to break and release and the boat fell to the water. **The boat was a total loss.**	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Brake failed to hold after 5 men boarded boat at embarkation deck. Forward tricing pennant released and the forward part of boat lowered on its own. Men evacuated prior to any injury occurring. **The boat suffered minor damage.**	Lack of proper maintenance in accordance with instructions	Open with onboard release

Brief Description of the Incident	Established Cause	Type of boat
Whilst launching a lifeboat one of the hooks did not release. It was not repaired on water but the released hook was reconnected and the boat was recovered. Crew did not disembark at embarkation deck and when boat reached the davit head previously unreleased hook let go. **The boat suffered minor damage.**	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Seaman was hit on the head under his hard hat by the swivel block to hooks whilst trying to reconnect at the end of a drill. The swivel had not taken out the twist in the fall wires.	Lack of proper training	Open with onboard release
Starboard lifeboat due for launching and trials. The boat was waterborne, motor running and shaft engaged. After reaching full speed the motor suddenly stopped. The gripe wire had fouled the propeller. **The boat suffered minor damage.**	Physical condition affecting operation	Totally Enclosed with Onboard release
Non Serious Incidents		
When hanging the boat off on strops to carryout maintenance the boat toppled in the davits causing punctures to the hull of the boat where it contacted the davits.	Design Fault	Totally Enclosed with Onboard release
Damage to lifeboat engine caused by testing in davits. The arrangement for supplying cooling water led to water siphoning into exhaust.	Design Fault	Totally Enclosed with Onboard release
Lifeboat release arm and lead blocks were damaged when plastic covered remote lowering wire became kinked and snagged in lifeboat deckhead on lowering.	Design Fault	Totally Enclosed with Onboard release
Safety lock on the release mechanism not correctly reset after a previous drill.	Design Fault	Totally Enclosed with Onboard release
Lifeboat hook safety locking handle failed to re-engage after resetting the disengaging gear.	Design Fault	Totally Enclosed with Onboard release
The boat was being retrieved when the release wire became snagged causing the brake to release and lower the boat uncontrollably.	Design Fault	Totally Enclosed with Onboard release
Lifeboat remote release mechanism failed to release boat due to misalignment of brake winch release handle.	Design Fault	Totally Enclosed with Onboard release

Attachment 1

Brief Description of the Incident	Established Cause	Type of boat
Morse cable for release gear parted during testing.	Equipment/material Failure	Totally Enclosed with Onboard release
When the port lifeboat was launched and in the water it was attempted to release the hooks. It was found that only aft hook would release, the forward hook cam was not opening. When release lever re-set, aft hook cam was found to be closing properly; the forward hook would not open or close although indicator was indicating either open or closed.	Equipment/material Failure	Totally Enclosed with Onboard release
While trying to rehook the wire falls, an officer suffered from a wound caused by pinching by the hook mechanism. Difficulty is always experienced in trying to succeed to rehook both falls, forward and aft, in the same time and to engage both simultaneously from the inside with the pneumatics.	Equipment/material Failure	Totally Enclosed with Onboard release
During routine maintenance of the hooks to port lifeboat, the lever release gear broke.	Equipment/material Failure	Totally Enclosed with Onboard release
The lowering brake malfunctioned. Holding efficiency was found to be moderate and would not have been sufficient to safely lower a fully loaded boat in an emergency.	Equipment/material Failure	Open with onboard release
Water Sprinkler Pump clutches were found not to be properly coupled to engine thus the water spray system was inoperative.	Equipment/material Failure	Totally Enclosed with Onboard release
The hoisting/recovery winch had insufficient power to recover boat properly. The power pack had to be restated several times to recover the boat. Crew manning the lifeboat had to disembark from a very precarious position.	Equipment/material Failure	Freefall
After quarterly maintenance to the starboard lifeboat during brake testing, once releasing both retaining lashings, the lifeboat lowered by itself very gently and rested on the maintenance strops.	Equipment/material Failure	Totally Enclosed with Onboard release
The forward port lifeboat gripe wire was found broken in two pieces. The gripe was corroded and rotten inside plastic sheathing. The rupture position was in the wire located at forward end. The lifeboat was restrained by the aft gripe.	Equipment/material Failure	Totally Enclosed with Onboard release

Brief Description of the Incident	Established Cause	Type of boat
While recovering the port lifeboat from the water, the brake failed lowering the boat back to the water. The lifeboat was recovered using the parts of the starboard winch brake. No damage to either lifeboat. Both lifeboats secured.	Equipment/material Failure	Totally Enclosed with Onboard release
During routine drill, lifeboat lowered to embarkation to embarkation deck without any problem. After hoisting the boat for about 6 inches, with motor, the brake failed causing the boat to lower down until it stopped on maintenance strops.	Equipment/material Failure	Totally Enclosed with Onboard release
Port lifeboat engine hand starting spur gear broken.	Equipment/material Failure	Totally Enclosed with Onboard release
Lifeboat engine failed to operate during a routine test.	Equipment/material Failure	Totally Enclosed with Onboard release
Starter for lifeboat engine failed during weekly test of engine	Equipment/material Failure	Totally Enclosed with Onboard release
It was attempted to release the lifeboat when one foot above water. Release system failed to operate when onload. Drill was aborted.	Equipment/material Failure	Totally Enclosed with Onboard release
Lifeboat was lowered to sea level, but not into the water, with no crew in the boat. The remote control wire was used by activating remote control lever on deck. When boat was at release level the boat release wire parted as it had become tangled and subsequently snagged in the boat.	Equipment/material Failure	Totally Enclosed with Onboard release
During an emergency drill the remote control wire came under heavy load which caused the pulley to break. This was caused by the triangular handle on the release wire becoming snagged. The counter weight on the wire swung and broke the side window.	Failure to follow correct procedure	Totally Enclosed with Onboard release
The seaman clearing gripes had his safety harness attached to davit. He signalled that he was clear but when the lifeboat was lowered towards embarkation deck the davits pulled on safety harness pulling the seaman off his feet into the davit.	Failure to follow correct procedure	Open without onboard release
During preparation to lower the port lifeboat when releasing the slip hook turnbuckle of the gripe a seaman was injured when the slip hook released with great force due to a tension build up in	Failure to follow correct procedure	Totally Enclosed with Onboard release

Brief Description of the Incident	Established Cause	Type of boat
gripe and associated gear.		
When trying to hand start lifeboat engine the Officer fell forward injuring his wrist.	Failure to follow correct procedure	Totally Enclosed with Onboard release
A seaman injured his finger, which required one stitch, while releasing the pelican hook of lifeboat lashings. The finger was trapped between pelican hook and locking device.	Failure to follow correct procedure	Totally Enclosed with Onboard release
During the Safety Equipment Survey the starboard was lowered into the water. A rating was standing in the door entrance and steadied himself by holding the door edge. The door shut trapping his thumb.	Failure to follow correct procedure	Totally Enclosed with Onboard release
Aft gripe was not properly released when lifeboat was lowered. This caused a turn fall wire to jump from the drum. This could have had serious consequences.	Lack of proper communications during operations	Totally Enclosed with Onboard release
The sprinkler system ineffective due to an accumulation of salt in the system.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Lifeboat hooks failed to re-engage after drill. The problem was traced to burred hooks, caused by rust and scale, and a seized release cable	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
It was found that an onload cam release pin was seized and thus not operational thus the release would have not have been operational in an emergency.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Davit and gripe securing hooks and lever pins corroded with a build up of paint not enabling a smooth operation	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Water Sprinkler Pump found seized with Salt accumulation. Preventative maintenance procedures not followed	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
On trying to release hooks only the forward hook was activated - aft seized with paint	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release

Brief Description of the Incident	Established Cause	Type of boat
When trying to manually start a lifeboat engine insufficient engine speed had been built up prior to engaging compression levers. The engine 'kicked back' causing the seaman to lose balance and strike his head	Lack of proper training	Open without onboard release
During retrieval of starboard lifeboat from the water, the forward and aft releasing gears were connected. The boat was lifted just clear of the water on the lifeboat falls. Checks were made on the releasing gear hooks prior to hoisting the lifeboat fully home and it was observed forward hook was not properly locked in. Lowered lifeboat to reconnect properly.	Lack of proper training	Totally Enclosed with Onboard release
During recovery of the boat the Chief Officer was hit by aft block	Physical condition affecting operation	Totally Enclosed with Onboard release
Minor Incidents		
Both gripes were found to have nearly parted under protective PVC coating on the wires.	Design Fault	Totally Enclosed with Onboard release
The boat did not stow squarely on retrieval. When attempting to level the boat the locking pawl on one drum did not properly engage resulting in the aft end of the boat falling in an uncontrolled manner.	Design Fault	Open with onboard release
Chief Engineer caught his finger in the quick release mechanism whilst reconnecting hook after maintenance.	Design Fault	Totally Enclosed with Onboard release
Release gear Morse cable parted whilst boat was waterborne.	Equipment/material Failure	Totally Enclosed with Onboard release
Pull wires of the release mechanism of both lifeboats found to be unsuitable for further use.	Equipment/material Failure	Open with onboard release
Fall wires of both lifeboats found to be unsuitable for further use.	Equipment/material Failure	Open with onboard release
During recovery after routine lowering (drill) of starboard lifeboat, the remote control lowering wire became jammed between cheek and sheave of one of the leading blocks and parted.	Equipment/material Failure	Totally Enclosed with Onboard release
During routine 3 monthly inspection of the lifeboats winch brakes & gear case, it was discovered oil from gear case had leaked into brake housing of port lifeboat limiting its effectiveness.	Equipment/material Failure	Totally Enclosed with Onboard release

Attachment 1

Brief Description of the Incident	Established Cause	Type of boat
During testing and preventative maintenance the release gear was found to be worn. Equipment replaced and adjusted as necessary prior to testing for correct operation.	Equipment/material Failure	Totally Enclosed with Onboard release
During routine weekly test of the starboard lifeboat, it was not possible to start the lifeboat engine using the hand start device. The lifeboat engine could only be started electrically.	Equipment/material Failure	Totally Enclosed with Onboard release
The starboard lifeboat engine failed to start after becoming increasingly difficult over a period of time. Further investigation revealed damaged drive gear for the balance shaft.	Equipment/material Failure	Totally Enclosed with Onboard release
The electric motor of the lifeboat recovery winch was found to be inoperative due to a short circuit.	Equipment/material Failure	Open without onboard release
During testing pull-chain for the release gear parted at weld. Replaced by new one.	Equipment/material Failure	Freefall
The lifeboat was lowered & released. The boat was exercised and then recovered. When the free wheel unit housing was removed to inspect the conical brake lining, oil was found within the housing.	Equipment/material Failure	Totally Enclosed with Onboard release
Both lifeboats were lowered to the water and released. The lifeboat hook release system was delayed (previously experienced this problem)	Equipment/material Failure	Totally Enclosed with Onboard release
During inspection to enclosed port lifeboat, it was noted that forward stopper for cradle holding lever (also named cradle hook) was cracked and slightly bent. Crack looks old. Stopper is welded on plate for 3/4 of its length.	Equipment/material Failure	Totally Enclosed with Onboard release
During weekly routine inspection, found pressure controller of port lifeboat air cylinder system defective (no air flow through controller)	Equipment/material Failure	Totally Enclosed with Onboard release
While lowering starboard lifeboat to the water, the remote control wire did not pay out in line with the falls but coiled undetected, bending and finally breaking the bracket.	Equipment/material Failure	Totally Enclosed with Onboard release
A routine lifeboat engine check revealed the crankshaft pulley was broken in way of key-way.	Equipment/material Failure	Totally Enclosed with Onboard release

Attachment 1

Brief Description of the Incident	Established Cause	Type of boat
Testing the air system main valve stuck. Opened and brought into operation.	Lack of proper maintenance in accordance with instructions	Freefall
Lack of proper maintenance - no description given.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Port lifeboat winch brake slipped, when found cradle released, cradle moved halfway down to rest position slowly on free fall arrestor.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Testing the air system the main valve was found to be seized. It was opened and brought into operation.	Lack of proper maintenance in accordance with instructions	Freefall
Morse cables found to be unsuitable for further use	Lack of proper maintenance in accordance with instructions	Freefall
Lack of proper maintenance. Failure to follow preventative maintenance after each use.	Lack of proper maintenance in accordance with instructions	Totally Enclosed with Onboard release
Winch Motor Burnt out - Physical wear of insulation. Short circuit.	Others	Totally Enclosed with Onboard release
During tests winch mechanism found to be faulty. A worn bearing was found. Cause unknown.	Others	Totally Enclosed with Onboard release