

Lifeboat Safety

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Introduction

Accidents during the maintenance and operation of davit-launched lifeboats fitted with on-load release mechanisms continue to cause concern. Common factors in accident reports include operational errors during the launch and recovery process, critical component failure, inadequate levels of on-board supervision and poor planned maintenance.

On-load release mechanisms are a mandatory requirement for all ships built after 1 June 1986. The on-load release function was designed to permit the release of the lifeboat from fall wires when the ship was still making way through the water or in a rough sea. Some maintenance texts appear to suggest that to mimic this load, boats should be lowered to just above the water, the hydrostatic interlock should be by-passed and the lifeboat 'dropped' from the falls into the water. There appears to be a common misconception, therefore, that the on-load release system is to allow a lifeboat to be released while suspended from the fall wires. It is unlikely that this was the intention of the regulations, as when a lifeboat is dropped, even from as little as one metre above the water, there can be serious personal injuries and possible structural damage.

About 80 different types of hook have been approved for use since the introduction of compulsory on-load release mechanisms and accident investigators have described some of the designs as 'inherently unsafe' or 'unstable'.

Since their introduction, on-load release hooks may have killed more people than they have saved. This briefing is intended to explain the problems associated with on-load release systems and the precautions that should be taken when in use.

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On-Load Release Hooks

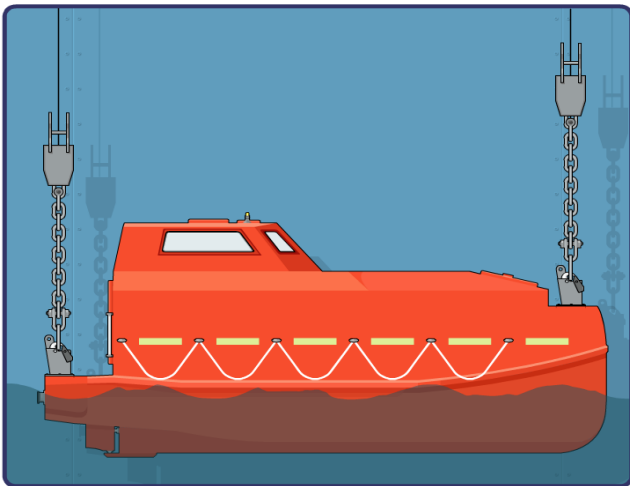
What does 'on-load' mean

On-load release hooks were apparently originally introduced following an incident where the offshore rig *Alexander L Kielland* capsized in a severe storm and three out of seven lifeboats could not be released from the conventional hooks before being smashed against the rig legs.

Although not immediately apparent in guidance notes or manufacturers' instructions, the on-load release function was designed to permit the release of the lifeboat from fall wires when the ship was still making way through the water or in a rough sea.

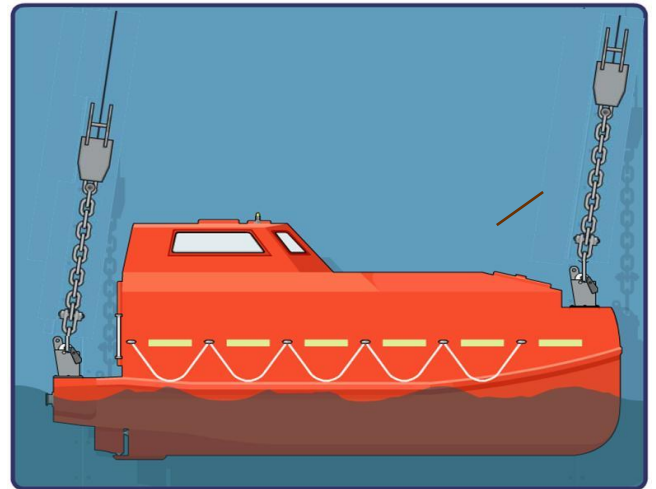
In the figure below the lifeboat is lowered into water where there is no current or tidal stream and the ship is not making way.

- The lifeboat hooks are 'off-load'.
- The hydrostatic interlock has been activated by immersion in water.
- The falls can be released.
- The painter can be released.



In the next figure, the life boat is lowered into rough water or there is a current or tidal stream and/or the ship is making way (up to 4 knots).

- The lifeboat hooks are 'on-load'.
- The hydrostatic interlock has been activated by immersion in water.
- The falls can be released 'on-load'.
- The painter may be difficult to release.



Problems with on-load release hooks

Even if the on-load release system may have been a response to the *Alexander Kielland* incident - where it is allegedly reported that lifeboats were left hanging in their falls and could not be launched - it appears that little thought has been given to the enclosed lifeboat structure's resistance to dropping into the water or the survivability of the people inside. Whether a lifeboat is dropped from 1 metre or from 20 metres there can be serious personal injuries, deaths and possible structural damage. In many cases the structural damage is sufficient to cause flooding and in some cases has been sufficient to cause the lifeboat to sink.

Common contributory factors which emerge from lifeboat accident reports are:

- Many moving parts in the hook release mechanism.
- Complex maintenance requirements.
- Wastage or parts missing.
- Complex operating instructions.
- Use of hanging-off pendants.
- Crew in boat.
- Lifeboat structure.

As mentioned earlier, there are reported to be about 80 types of on-load release hooks and some of these systems are described by accident investigators as 'inherently unsafe' or 'unstable'. Investigators describe some release mechanisms with large numbers of critical components as over-designed and highly technical, requiring a degree of maintenance difficult for ship's staff to achieve on board. Safety margins may also be too

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small to stand up to harsh operating conditions in a marine environment.

The terms 'inherently unsafe' and 'unstable design' are used to describe hooks that, on failure, re-position to the open setting – in other words, when they fail the hooks open – causing catastrophic and often fatal consequences.

Complex on-load systems have correspondingly complex instructions – in many cases these may have been supplemented by instructions translated into the language of the crew. Some deaths can be directly attributable to the failure to use the hanging-off pendants which suggests that many crews may not appreciate this critical safety issue when hooks need to be reset or examined, or when the crew suspect that the hooks are incorrectly re-set.

Many of the original manufacturers of these systems are no longer trading and this leads to a situation where spare parts are not available. Under these circumstances, ships may substitute 'home made' components which do not meet the same critical tolerances as the original or components may be allowed to corrode or wear beyond design tolerances. Planned maintenance schemes are difficult to verify as being adequate because – with manufacturers not trading – original manuals are not available or have not been updated.

Testing the on-load release mechanism is work that must be carried out by equipment manufacturers or their authorised representatives during the annual thorough examination by the manufacturer's representative or the five-yearly operational load test.

Measures to Prevent Accidents

Understanding hook release system

With so many different designs of on-load hook mechanism in service it is essential that seafarers are familiar with, and understand, the type fitted to the lifeboats on their ship. Ship operators should ensure that a clear and concise manual and instructions are provided and made available to all crew members operating such systems.

Persons in the lifeboat during drills

In July 2006 an amendment to the International Convention for the Safety of Life at Sea (SOLAS) allowed lifeboats which have to be manoeuvred at abandon ship drills by an assigned crew to be launched without the crew on board.

SOLAS chapter III, regulation 19.3.3.3, previously stated '*....each lifeboat shall be launched with its assigned operating crew aboard....*' but the text was amended to '*....each lifeboat shall be launched, and manoeuvred in the water by its assigned operating crew....*'.

Regulations 20.6 (weekly inspections) and 20.11 (periodic servicing of launching appliances and on-load release gear) were also amended to allow procedures without persons on board.

This amendment gave rise to problems of interpreting whether '*each lifeboat shall be launched, and manoeuvred in the water by its assigned operating crew....*' meant that the crew should or should not be in the lifeboat when launched – and if not then how where the crew to board the lifeboat once waterborne to complete the launch and carry out the manoeuvring.

IMO circular MSC/Circ.1206, annex 2, paragraph 2.3.2, which contains advice on safety during abandon ship drills using lifeboats, stated:

'Before placing persons onboard a lifeboat, it is recommended that the boat first be lowered and recovered without persons on board to ascertain that the arrangement functions correctly. The boat should then be lowered into the water with only the number of persons on board necessary to operate the boat'.

Many reported accidents have involved failure of the brake system (which has been incorrectly re-assembled after maintenance on board) and this initial 'test' lowering may test the brake system but there is considerable doubt as to whether this lowering and raising of the lifeboat confirms that 'the arrangement functions correctly'.

IMO circular MSC.1/Circ.1326 (11 June 2009) clarified the situation as follows:

'SOLAS regulation III/19.3.3.3 requires each lifeboat to be launched, and manoeuvred in the water by its assigned operating crew, at least once every three months during an abandon ship drill. However, the regulation, whilst requiring each lifeboat to be manoeuvred in the water by its assigned operating crew, does not require the

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assigned operating crew to be on board when the lifeboat is launched.the assigned operating crew should not be required to be on board lifeboats during launching, unless the master, within the authority conferred to him by paragraph 5.5 of the ISM Code, considered, taking into account all safety aspects, that the lifeboat should be launched with the assigned operating crew on board'.

However, with the increasing promotion and use of **fall preventer devices (FPD)** this situation may now have been superseded.

Hydrostatic release mechanism

As mentioned earlier there appears to be a common misconception that the on-load release system is to allow a lifeboat to be released while suspended from the fall wires. Doing so may cause structural damage to the lifeboat and injury to persons on board. There should be no circumstances – other than perhaps a failure of the hydrostatic interlock to activate when the lifeboat enters the water – when the crew need to by-pass the hydrostatic interlock.

Never override the hydrostatic release mechanism and drop the boat from the falls during a drill.

Use of fall preventer devices (FPD)

IMPORTANT NOTE
IMO Circular MSC1/Circ.1327 states:

Fall preventer locking pins should not be used for any other purpose and should be fitted to the lifeboat **at all times.**

Fall preventer strops or slings should not be used for any other purpose and should be fitted to the lifeboat **at all times.**

The IMO are now promoting temporary arrangements that provide a physical barrier to inadvertent on load release. These fall preventer devices (FPD) can be strops attached to a strong point other than the hook on the boat and to the fall block during launching and recovery procedures (hanging-off pendants must not be used for this purpose) or an approved metal pin inserted in the hooks to prevent release.

The risk of inadvertent on load release can be significantly reduced by:

- Using an interlocking pin device for lifeboat drills such as the SAFELAUNCH safety pin (right) - an approved metal pin inserted in the hooks to prevent rotation.
- This type of modification will normally be achieved by replacing the existing lifeboat hooks with new hooks designed to accept the metal locking pin.
- Using purpose-made or dedicated nylon strops which link fixed points on the blocks or chains to fixed points on the lifeboat – these effectively isolate the on-load release system. Nylon loop strops of sufficient safe working load are recommended as fall preventer devices. Wires could be used, but the advantage of using nylon is that it can absorb shock loads and can be easily cut in an emergency – the advantage of a loop strop is that only ONE standing part needs to be cut to release it.

IMO MSC.1/Circ.1327 (11 June 2009) gives guidelines for the fitting and use of all fall preventer devices.

The UK Maritime and Coastguard Agency marine guidance note MGN 388 gives guidance on the 'fitting of FPD to reduce the danger of accidental on-load hook release'.

The ship operator and relevant authorities including Flag State must be consulted for advice and any necessary approval on the fitting and use of fall preventer devices.

Releasing the painter

The UK Marine Accident Investigation Branch (MAIB) report on the investigation of the structural failure of MSC Napoli in the English Channel on 18 January 2007 noted the following relating to lifeboats:

The lifeboat smoothly descended the 16 metres to the sea. Once waterborne, the bosun released the fore and aft falls from inside the lifeboat. However, the crewman sitting nearest the forward painter release could not pull the release pin sufficiently far to allow the painter to disengage.

He was squeezed between two other crew and his movement was restricted by his immersion suit. The painter was eventually cut by the chief engineer, who



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had a knife, and was able to reach the painter via the lifeboat's forward hatch.

If each lifeboat has been equipped with an additional serrated blade knife this would probably provide a quick and safe method of cutting not only the permanent painter but also a nylon fall preventer device in an emergency.

Training

Ship's crew should be trained to;

- understand that on-load release hooks were introduced to enable lifeboats to be released from falls when the ship is making up to 5 knots. The hooks were never intended for dropping the boat from any height
- appreciate the safety benefits of using FPD to isolate the risk of component failure and improve the safety of crewmembers during the required launch-and-recovery training procedures
- anticipate that they may encounter problems in releasing the lifeboat painter after the on-load hooks have been released
- operate the particular on-load release system fitted to the lifeboat on their ship.

New IMO Regulations

At the 89th session of the Maritime Safety Committee (MSC 89) in May 2011, the IMO adopted amendments to SOLAS Chapter III and the LSA Code, as well as related Guidelines for the Evaluation of Existing On-load Release and Retrieval Systems (OLRRS).

SOLAS Chapter III

1 January 2013 Resolution MSC. 317 (89) entered into force - new OLRRS requirements under SOLAS Regulation III/1.5 applying to all ships (new and existing cargo and passenger ships). The Regulation takes effect on 1 July 2014.

At the first scheduled drydock after 1 July 2014 – and not later than 1 July 2019 – OLRRS must comply with paragraphs 4.4.7.6.4 to 4.4.7.6.6 of the LSA Code or be replaced with equipment that does comply.

LSA Code

1 January 2013 Resolution MSC. 320 (89) revising the LSA Code (Chapter IV) is expected to enter into force. The main purpose of the revision of Chapter IV of the Code is to prevent unexpected accidents during lifeboat drills and/or inspections.

Existing OLRRS must comply with the following design criteria in Chapter IV:

4.4.7.6.4 – To provide hook stability, the release mechanism shall be designed so that, when it is fully in the closed position, the weight of the lifeboat does not cause any force to be transmitted to the operating mechanism.

4.4.7.6.5 – Locking devices shall be designed so that they cannot turn to open due to forces from the hook load.

4.4.7.6.6 – If a hydrostatic interlock is provided, it shall automatically reset upon lifting the boat from the water.

These are to ensure that the hooks 'fail' in the closed position unlike the majority of hooks currently in use which open when they fail.

Guidelines for the Evaluation of Existing On-load Release and Retrieval Systems (OLRRS)

Manufacturers are required to make an assessment of their OLRRS before 1 July 2013. Ship operators should have identified the type of OLRRS on board their ships **and ensure that suitable fall prevention devices (FPDs) are fitted.** OLRRS which are found not to comply will have to be replaced.

MSC.1/Circ.1392 Guidelines for Evaluation and Replacement of Lifeboat Release and Retrieval Systems suggests that the evaluation process should be:

Before 1 July 2013:

1. Design review by manufacturer
2. Results of design review submitted to Flag State (marine administration relevant to the manufacturer)
3. Performance test by manufacturer to evaluate compliance with LSA Code 4.4.7.6.4 to 4.4.7.6.6
4. Marine administrations report to IMO the results of each evaluation

Not later than first scheduled dry-dock after 1 July 2014 but not later than 1 July 2019:

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5. For compliant OLLRS – a one-time follow-up overhaul examination (see MSC.1 Circular 1206/Rev.1)
6. For non-compliant OLLRS – replace or modify to comply with the LSA Code 4.4.7.6.4 to 4.4.7.6.6

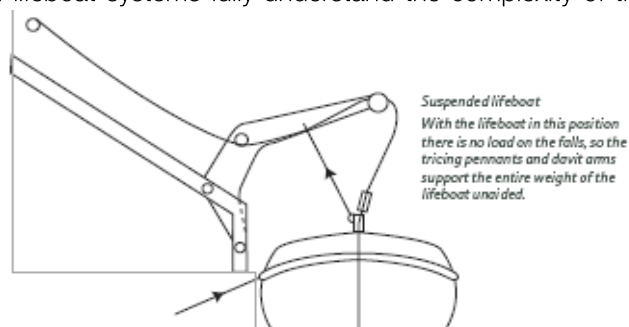
Use of fall-preventer devices

IMO also recommends that fall-preventer devices are fitted on systems which are not compliant with the new LSA Code requirements until such time as the system is modified or replaced for compliance.

Lifeboat Wires

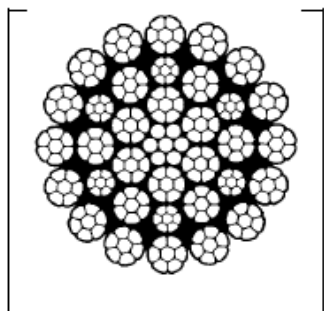
Lifeboat systems have been subject to a great deal of scrutiny and investigation recently following accidents during statutory drills and maintenance procedures.

Several independent investigations have been carried out by Flag State administrations and other organisations, such as the UK Maritime and Coastguard Agency (MCA) and Marine Accident Investigation Branch (MAIB). Their conclusions concur that although causation may not be directly linked to fall wire fatigue, its integral role in the overall function of the system demands that those involved with the maintenance, inspection and operation of lifeboat systems fully understand the complexity of the



design and the contribution of each component.

Tricing pennants, gripe wires and hanging-off pendants are subject to similar sources of fatigue and misuse as fall wires and must not be overlooked during inspection and maintenance programmes. Tricing pennants in particular have been



identified by several research projects as being subjected to increasing levels of misuse by poorly supervised crew members who overload them during drills by lowering boats to a point where the weight of the boat is mostly transferred from the fall wire to the tricing pennant. This dangerous practice can lead to slack fall wires, tricing pennant failure and the potential for the consequential failure of the entire davit structure.

These risks highlight the importance of a responsible officer supervising all activities that involve movement of the boat and maintenance activity conducted by ship's crew. Robust risk assessment procedures must precede all examination and maintenance work.

Construction

Fall wires are required to be both flexible and stable in order to withstand the shock-loading and rotation that can be present during lowering and recovery, this requires a larger number of small diameter wires within the structure of the rope. Fall wires may be certificated to remain in service for up to five years. Lubrication and the corrosion resistant quality of its construction are therefore very important.

Principle causes of damage

Corrosion

Persistent exposure to environmental extremes attacks the construction of fall wires. This is compounded by restricted access to long lengths of wire spooled on winch drums prohibiting penetrating dressing and lubrication.

Abrasion

Seized davit sheaves and poor rope leads will accelerate the extent of damage to the larger number of exposed wires associated with this type of rope.

Crushing

High freeboard vessels with a large amount of fall wire can suffer from "cutting in" during bad spooling with low back tension resistance increasing the likelihood of crush damage.

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Jamming

Uneven movement of davits and fall wires can lead to slack wire and bights forming between sheaves, unchecked this can result in misalignment and slippage of the fall wire off the sheave blocks jamming fall wires between sheave and davit structure.

Care and handling

The accident investigations referred to earlier established that many of the incidents associated with lifeboats involved falls, sheaves, blocks, tricing pennants, and gripe arrangements.

Davit alignment relies on the precise tensioning of fall wires. During lowering and recovery operations due diligence must be exercised to ensure even spooling on winch drums. Smooth operation of the winch control is necessary to avoid sharp juddering movement of the davits and boat. Sheaves are often set at angles other than vertical. Slippage of wire off sheave blocks may result in the wire jamming between the sheave and cheek plate.

Crew members should be made aware of the dangers associated with lowering the boat to embarkation level beyond the point of weight transfer from fall wire to tricing pennant. Larger capacity lifeboats that are bowsed-in alongside the vessel close to the davit head produce fall wire angles that are increasingly removed from the vertical. This produces increasingly large horizontal moments and transfers unacceptable loads on to both the davit arm and tricing pennant.

Maintenance and inspection

All lifeboat wires are required to be inspected weekly to ensure immediate readiness and monthly to ensure they are maintained in good order. Current regulations require wires to be turned end-for-end at intervals not exceeding 30 months and replaced at intervals not exceeding 5 years, subject to the condition of the wire. An alternative arrangement removes the need for 'end-for-ending' if wires are inspected frequently and renewed at intervals not exceeding four years, subject to wire condition.

More detailed maintenance and servicing guidelines than previously available have been promulgated by the International Maritime Organization (IMO) in the annex to IMO circular MSC/Circ.1206. This includes:

- Release gear, including testing procedures for on-load mechanism.
- Davit limit switches, sheaves and lubrication of moving parts.
- Winch power supply, controls and braking arrangement.

On vessels that are exempt from the launching requirements specified in the SOLAS chapter III, regulation 19, planned maintenance schedules should take account of periods of inactivity. Discussion with manufacturers should determine suitable dressings and lubricants to reflect these time intervals.

Reports and records

Detailed records of inspection and maintenance work must be maintained and signed by the maintenance company's representative, ship's master and those involved in conducting the maintenance programme. When repairs and servicing have been completed a statement confirming that lifeboat arrangements remain fit for purpose should be issued by the manufacturer's representative or individual certificated by them.

Lifeboat Maintenance

In an attempt to resolve some of the issues relating to maintenance of on-load release hooks, the Maritime Safety Committee (MSC) of the International Maritime Organisation (IMO) published two important circulars in May 2006 to clarify guidance on the safe operation and maintenance of lifeboats with on-load release mechanisms.

IMO Circular MSC/Circ.1205 - Guidelines for developing operation and maintenance manuals for lifeboat systems

MSC/Circ.1205 promotes the idea of more user-friendly manuals and instructions with greater emphasis on the use of a simplified common technical vocabulary for lifeboat and launching equipment. It makes sense to produce one document encompassing the requirements of the entire lifeboat system, simplifying matters for those

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on board and incorporating relevant aspects of MSC/Circ.1206.

IMO Circular MSC/Circ.1206 – Measures to prevent accidents with lifeboats

MSC/Circ.1206 places responsibility for carrying out lifeboat maintenance with ship operators and it quotes SOLAS, chapter III, regulation 20 (Operational readiness, maintenance and inspection) and regulation 36 (Instructions for on-board maintenance) as the regulatory framework to be adhered to.

To clarify the detail and scope of maintenance work, MSC/Circ.1206 distinguishes between work that should be the responsibility of equipment manufacturers or their authorised representatives, and work that can be performed by the ship's crew as part of routine weekly and monthly life saving appliance (LSA) checks.

Concerns have been raised by organisations such as Intertanko, BIMCO, Intercargo, Oil Companies International Marine Forum (OCIMF) and Flag States about the difficulties of establishing a global network of service agents to carry out work that should be the responsibility of equipment manufacturers as part of an annual inspection.

Licensing of too few independent service agents and a requirement to use only original spare parts, are suggested as reasons why ship operators may not have access to an effective global network of service agents. This can mean insufficient inspections are completed – possibly jeopardising the safety of the crew which the regime was meant to protect in the first place.

A proposed amendment to MSC/Circ.1206 guidelines would allow Administrations and their Recognised Organisations to authorise independent service agents without prior consent from equipment manufacturers.

Routine weekly and monthly inspections conducted as per the manufacturer's manual and under direct supervision of a senior ship's officer are also recommended. On completion of the work, records should be kept on board to be referred to as part of the annual examination procedure. Statements confirming readiness of lifeboat equipment should be issued on completion of any repairs, servicing and maintenance work.

The importance of correctly attaching the hanging-off pendants to isolate the on-load mechanism before any inspection takes place is also emphasised. The guidance notes draw attention to the singular function of these pendants – suspending the boat to allow maintenance checks to be carried out – and not to be left attached at any other time.

Although not immediately apparent in guidance notes or manufacturers' instructions, the on-load release function was designed to permit the release of the lifeboat from fall wires when the ship was still making way through the water or in a rough sea. Many maintenance texts appear to suggest that to mimic this load, boats should be lowered to just above the water, the hydrostatic interlock should be by-passed and the lifeboat 'dropped' from the falls into the water. This is a very dangerous practice, which can result in serious spinal injuries to anyone left in the boat and significant damage to the boat – even from heights as little as 0.5 m.

Testing the on-load release mechanism is work that must be carried out by equipment manufacturers or their authorised representatives during the annual thorough examination by the manufacturer's representative or the five-yearly operational load test. There should be no circumstances – other than perhaps a failure of the hydrostatic interlock to activate when the lifeboat enters the water – when the crew need to by-pass the hydrostatic interlock.

MSC/Circ.1206 recognises that the accident record of on-load release hooks has resulted in a widespread loss of confidence in lifeboat launching among ships' crews. It suggests that increased levels of risk identified during launching and recovery procedures could be further controlled by the use of locking pins retro-fitted by equipment manufacturers or manufacturer-approved training pennants. These additional physical barriers should isolate the risk of component failure, allow a safe environment for crew training and, it is hoped, help to restore some of the lost confidence. See Measures to prevent accidents below.

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Further Information

UK Maritime and Coastguard Agency – Marine Guidance Note MCN 388

Lifeboats: Fitting of 'fall preventer devices' to reduce the danger of accidental on-load hook release

IMO – Resolution MSC.317(89)

Adoption of amendments to the International Convention for the Safety of Life at Sea, 1974

IMO – Resolution MSC.320(89)

Adoption of amendments to the International Life-saving Appliance (LSA) Code

IMO – Circular MSC.I/Circ.1205

Guidelines for developing operation and maintenance manuals for lifeboat systems

IMO – Circular MSC.I/Circ.1206

Measures to prevent accidents with lifeboats

IMO – Circular MSC.I/Circ.1326

Clarification of SOLAS regulation III/19

IMO – Circular MSC.I/Circ.1327

Guidelines for the fitting and use of fall preventer devices (FPDs)

IMO – Circular MSC.I/Circ.1392

Guidelines for evaluation and replacement of lifeboat release and retrieval systems

IMO – Circular MSC.I/Circ.1393

Early application of new SOLAS regulation III/1.5