Sea Fish Industry Authority
Seafish Technology

Liferafts for the Fishing Industry

Seafish Report No. SR533

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Summary

Recently there have been instances of liferafts failing to deploy when vessels sank. Investigations have revealed a high number of vessels with incorrectly installed liferafts and a study using models into the capsize situation has shown problems of tangling and fouling on the vessel preventing the liferaft deploying.

The extent of the problem is described and the actions being taken to combat it. Mounting a liferaft on the bow of the vessel is a measure that would give the liferaft a clear passage away from the vessel but could it withstand the waves coming over the bow? A trial is proposed to assess the practicality of bow mounted liferafts.

A proposal by Seafish is for a new approach to the liferaft system, using the inflation of the liferaft to eject it away from the vessel. How effective this may be and its possible development is considered with view on the needs of industry and the restrictions of regulations. Industry support is requested to instigate research into advanced liferaft systems for those vessels on which they will be appropriate.

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1 Object

To report the situation regarding liferaft failures on UK fishing vessels, the action being taken and to suggest the development of advanced liferaft systems for future vessels. This report is to provide a discussion document for industry and to introduce the development of improved liferaft deployment systems as a subject for research.

2 Introduction

As a result of the 'WESTHAVEN' enquiry following the loss of the 19m trawler 'WESTHAVEN' with four lives in March 1997, the Marine Accident Investigation Branch (MAIB) recommended that a study be made into the liferaft deployment arrangements on fishing vessels. The Maritime and Coastguard Agency (MCA) awarded the contract for the study to the Wolfson Unit of Southampton University who carried out model tests in the Sea Fish Industry Authority's Flume Tank facility in Hull. These model tests showed that in a capsize situation there was a significant risk of a liferaft failing to deploy correctly due to the canister fouling in the vessels rigging or the painter tangling around obstructions. An overall failure rate of 19% was found with a model representing the 'WESTHAVEN' type vessel and 48% on a model beam trawler. Recommendations from the study included the mounting of liferafts in locations on the vessel where they will be clear of any overhead obstructions and as far as practicable from bulkheads, railings and other vertical structures.

Another serious problem that has been highlighted by MAIB reports, is the failure to correctly install liferafts on vessels, particularly the attachment of the weak link at the hydrostatic release unit (HRU). A check made of liferafts on 23 small vessels found that only two had been correctly installed. The high level of failure, both from incorrect installation and fouling/tangling as indicated by model tests, is substantiated by real vessel incidents. The 'WESTHAVEN' inquiry report points out that in the same year 1997, liferafts failed to deploy on three other fishing vessels when they sank. Recently, the loss of the 'SOLWAY HARVESTER' resulted in the liferafts being on the surface but not inflated.

3 Action Being Taken

To pursue improvement in the deployment of liferafts MCA have approached the Inflatable Safety and Survival Equipment Trade Association (ISSETA) for their advice and assistance. ISSETA represents the major manufacturers of liferafts and holds regular meetings with MCA to update on standards and developments. They have addressed the problem of incorrect mounting and have agreed to co-operate with MCA to achieve a trial installation of a liferaft on the bows of a fishing vessel.

3.1 Installation of Liferafts

Automatic deployment of the liferaft in a vessel sinking scenario relies upon the hydrostatic release unit (HRU) functioning, usually at a depth of four metres, to release the liferaft canister from its cradle. The canister floats upwards, drawing the painter rope out of the canister until it becomes tight and activates inflation of the liferaft. As it inflates it bursts open the canister and the buoyancy of the inflated liferaft is then sufficient to break the 'weak link' that attaches the painter to the vessel. Thus, the liferaft is free to float up to the surface. Critical factors are that the liferaft is not held down in its cradle, other than by the HRU released straps and that the HRU is correctly installed such that the weak link will release the painter when inflation has been activated.

In consultation with ISSETA, MCA have raised awareness of the importance of correct liferaft installation and Marine Guidance Note MGN 104 (M+F) was issued in March 1999 giving guidance on the stowage and float free arrangements for inflatable liferafts. This gives illustrations of the commonly fitted HRU's and shows how they are to be correctly fitted with examples of the mistakes made that result in incorrect fitting. In addition, MGN130 (F) was issued in December 1999 to provide guidance for suitable stowage positions of liferafts on fishing vessels. (A copy of each MGN is given in Annex 1).

To further simplify the installation, the manufactures of some HRU's are to colour code the components thus making it easier to instruct how to correctly install it. Another valuable advance is an installation service being offered by the liferaft service agents to the vessels. In the past, the liferaft would be returned from servicing and lifted from a lorry on to the vessel for the crew or shore labour to install it in the cradle, thus mistakes could easily be made. Trained personnel specialising in liferafts will ensure that installations are correct.

3.2 Liferaft on Bow Project

Following the Wolfson study ISSETA agreed to co-operate with MCA to achieve a trial installation on the bows of a fishing vessel where the liferaft would not be restricted by overhead rigging although, it would be subjected to heavy seas impacting on it.

The trial is intended to last for two years with the object to assess if the bow of a vessel can be considered a suitable location. The model trials in the tank resulted in 100% reliable deployment for a bow-mounted liferaft when the model sank in various attitudes. However, whether a liferaft can withstand the sea conditions that it will encounter on the bow is not known. Hence, this is the object of the trial.

MCA requested through the Fishing Industry Safety Group (FISG) for a suitable vessel to be used for the trials and the 23.8m beam trawler 'CARHELMAR' operating out of Plymouth has been volunteered. A recent meeting of ISSETA discussed the trial with MCA and Seafish were also invited to attend and contribute. Concern was expressed that the bow of the vessel is not totally unrestricted, as the tubular stays

for the heavy bi-pod mast structure that carries the beam trawl derricks do pose an overhead obstruction. Also discussed was the type and size of liferaft and the mounting cradle.

A six-man liferaft was considered necessary with the full 'A' pack as per SOLAS requirements although, SOLAS 'B' may be considered for under 24m vessels. A 'flat pack' design was chosen to offer a reduced area to waves coming over the bow. The cradle would probably need to have a deflector as part of its design to protect the liferaft. Setting of the HRU may be increased from the standard 4m depth to safeguard against the hydrostatic pressure of waves over the installation.

A visit is to be made to the vessel to further consider the practicality of mounting a liferaft on the bow prior to designing a suitable cradle and proceeding with the trial. Consideration is being given to widening the trial to include more than one vessel, perhaps one in Scotland if funding can be found.

3.3 Hinged Liferaft Cradle

A possible approach that has been experimented with in the Netherlands is to mount the liferaft on a cradle such that it can be hinged outboard for deployment. ISSETA are to seek further details with a view to investigating if this could be advantageous on UK fishing vessels.

4 Seafish Proposal

From consideration of the Wolfson study and MAIB reports it is very apparent that the existing liferaft system has features that are quite susceptible to potential failure. The key areas of weakness in the existing arrangements are:

- possible incorrect mounting of the HRU
- canisters fouling in the rigging as they float free of the sinking vessel
- painters tangling around obstructions resulting in the liferaft not breaking free
- most liferafts will need two men to be able to manually launch them.

These areas of weakness seem to be largely unavoidable with the current designs of liferafts that rely on a lanyard being pulled to trigger inflation. However, if a different approach is taken, it is possible that a more effective system can be achieved, with less possibility of failure through incorrect installation.

Proposal

- Liferafts are to be designed for inflation to be activated by hydrostatic pressure.
- The housing is to be designed for side deployment and would be set into the vessel's rails.
- In addition to hydrostatic activated inflation, a manual activation control is to be part of the housing. Also, remote wheelhouse operation may well be a facility.
- Inflation would cause the liferaft to eject sideways out of the housing as it inflates.
- A painter with a weak link would retain it to the vessel.

Description

As shown in Figure 1 overleaf, the concept is; to have the liferaft contained in a housing set into the vessel's rails. This may be open handrails as per on a raised deck, or even into the gunwale at main deck level. The housing would have a 'burst off' GRP cover on the outboard side and in an appropriate position would be a manual activator, either a lever or a pull ring, but protected by some form of cover to prevent accidental activation. A remote control, from the wheelhouse, would also be a possible facility.

Operation of the activator would cause the liferaft to inflate, firstly, pushing off the outer cover and then ejecting itself out of the housing to fall clear into the sea. A painter with a weak link would retain it to the vessel. A rope ladder or chute could even extend from the housing down to the raft. In those situations where it can be mounted reasonable close to water level, it is very likely that the liferaft would always be the right way up after launching.

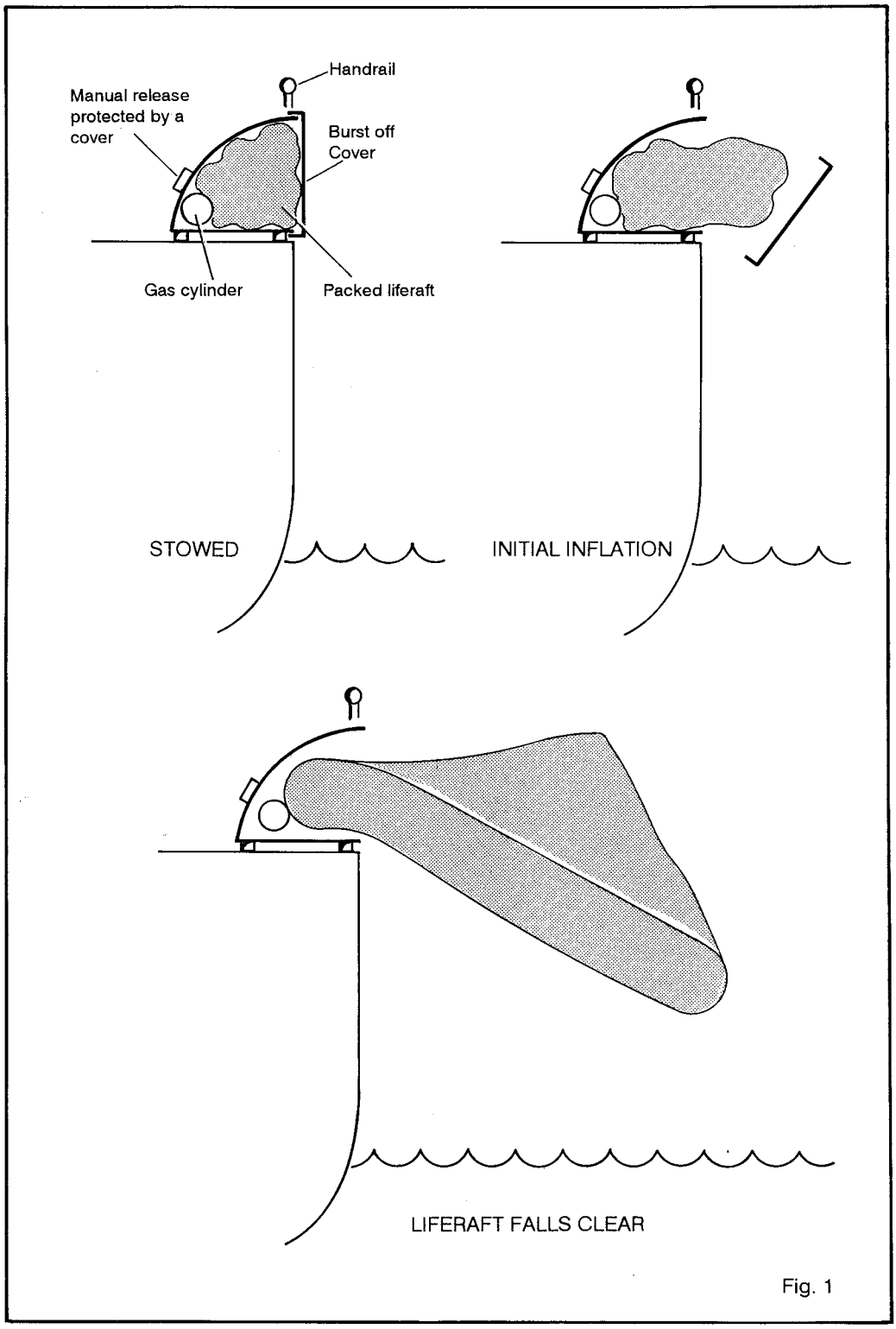

Figure No. 1 – Proposed Liferaft System

In a vessel sinking scenario, the liferaft would be activated by the hydrostatic inflator. (These items have recently been introduced on automatic lifejackets to provide a more reliable means of activation than the normal 'soluble bobbins'). Whether the vessel sank in an upright position, or capsized and inverted, the liferaft would still eject sideways and float upwards. Sinking vertically, either bow or stern first, should not impede the free escape of the liferaft.

Aside from providing a means of deploying liferafts, which would not suffer the problems of entanglement experienced with the present liferaft system, the concept offers other advantages:

- rapid deployment, possibly all rafts could be activated at a touch of a button in the wheelhouse,
- no manual lifting; existing liferafts typically need two men to launch them,
- no complicated HRU system to give concern about incorrect mounting,
- security on the vessel, as the housing will be rigidly fixed and hence not as easily portable as the existing liferafts.

This concept obviously needs a lot of development to prove it and hence, it will be some time before it could be applied on vessels. However, the existing liferaft system has changed little from the initial designs of inflatable liferafts, where the lanyard was the only sensible means of activation. With current technology and reliable hydrostatic units, mariners should not have to simply hope that the liferaft would float free, without the lanyard tangling. The cylinder of compressed gas, essential to each liferaft, has the potential to be used to **eject** as well as **inflate.**

4.1 Consultation

The Seafish proposal was circulated around the Fishing Industry Safety Group (FISG) and MCA brought it forward for discussion by ISSETA. Comments received are as follows:

- The concept would be difficult or expensive to install on existing small vessels.
- Two liferafts would be needed, one either side.
- The liferaft, without the protection of a canister, may be damaged as it ejects away
  from the vessel.

4.2 Discussion with ISSETA

In order to gain direct technical comment on the proposal a meeting was arranged with Mr Anthony C.G. Raggett O.B.E., the Secretary of ISSETA. Mr Raggett has vast experience of liferafts and plays a leading role in the international negotiations with respect to the SOLAS requirements for liferafts.

Technical concerns with respect to the Seafish proposal are; the activation of inflation by a hydrostatic device, the possible damage to the liferaft as it clears the vessel and the restrictions imposed by regulations. These are discussed as follows:

4.1.1 Hydrostatic Inflation

This would require some development to prove it but as it is currently being successfully used on inflatable lifejackets it is to be expected that it can be used on the bigger scale of a liferaft. In essence, the existing HRU's could simply be adapted to pierce a cylinder or to open a valve to initiate inflation. Manufacturers would be able to develop a successful hydrostatic inflator without difficulty and may even have existing products that are used for this purpose in other applications. Even so, the hydrostatic inflator would need rigorous testing to prove that it would not fail.

4.2.2 Liferaft Damage

It is not possible to be so confident that this will not be a significant problem. Evidence from MCA is that in incidents in which the liferaft inflated but became fouled on the vessel, the liferaft became badly damaged. Obviously, there is much in the rigging and mast structure on fishing vessels to tear a liferaft if it is unable to float free due to a tangled painter. In its canister the liferaft is protected as it hopefully clears the vessel. The proposal is to utilise the inflation of the liferaft to eject it sideways away from the vessel and thus hopefully clear of obstructions. Of course, a vessel capsizing on to one side would obstruct the liferaft at that side. However if fully inverted, the liferafts would simply eject sideways clear of the vessel. This would not be the case with the existing liferaft system as both liferafts would attempt to float upwards to be fouled by the upside down vessel. It is understood that most fishing vessels will sink in a vertical attitude, stern first due to the mass of the engine. Thus sideways ejection of the liferafts should result in them clearing the vessel structure. Only practical trials will prove this but it is reasonable to consider that the chances of the liferaft successfully reaching the surface would be at least as good as the existing system and potentially considerable better.

4.2.3 Regulation

Where liferafts are carried by regulation, as is the case with all UK fishing vessels over 12m, those liferafts have to conform to the standards laid down by the regulatory authority, which in the UK is the MCA. As part of the international maritime community, Britain has adopted the SOLAS convention and hence any new approach would be outside SOLAS. Achieving a change in the standards would have to be instigated at government level and subject to protracted international discussion. A five year period would probably be necessary to achieve a change.

ISSETA are very receptive to advances in liferaft design but can only achieve this within the envelope of the regulations. To pursue a new concept it would firstly be necessary for the national government to desire it and be prepared to include it within the regulations and indeed, to consider international conventions such as SOLAS and Torremolinos. This is the biggest single factor with respect to changes in the design of liferafts.

5 Discussion

The existing liferaft system has become widely accepted by the fishing industry and by all maritime users. It is adaptable to suit various vessel sizes and types and is simply an 'add on' wherever a suitable location can be found on the vessel. No special provision needs to be made for it and it does not require structural changes. Whether a vessel carries one or several liferafts, the installation is just a cradle to carry each liferaft canister with a strap to retain it secured by a HRU. The carriage of a liferaft cannot be made much simpler, but does the system work?

5.1 Failures

MAIB investigations have all too often revealed that liferafts have failed to deploy correctly when vessels sank. Quoting from the 'WESTHAVEN' report, three other vessel losses occurred that year in which liferafts failed to automatically deploy. The cause of the failure is often attributed to incorrect installation on the vessel, particularly the HRU. Statistics quoted with the MGN 104 (M+F) on stowage and float free arrangements for liferafts state that one in five vessels, both merchant and fishing, have an incorrectly secured liferaft. Indeed, a survey of 29 small vessels found only two correct installations. The issuing of the MGN and the publicity about HRU mounting are currently addressing this problem, further more, the installation of liferafts on the vessels by the service agents will significantly reduce the errors in installations. Even so, given that the installation is correct, what happens when a vessel capsizes?

The Wolfson report about the model vessel tank tests indicated an overall failure rate of 31% simply because the liferaft canister became fouled on the vessel or the painter snagged on an obstruction. The likelihood of failure was dependent on where the liferaft was mounted. On the 'WESTHAVEN' model, mounting the liferaft on the galley, the shelter aft or the shelter forward gave failure rates of 27%, 25% and 29% respectively. Mounting it on the gallows stays gave a failure rate of only 7% and mounting on the forecastle resulted in no failures. The results for a beam trawler model were significantly worse. Mounted on the aft section of the galley resulted in an 80% failure rate. Mounting on the galley forward and the wheelhouse gave failure rates of 50%. Again, the only failure free location was the forecastle. It should be remembered that these failures are with a correctly installed liferaft and HRU.

This level of failure is not surprising when one thinks about the obstructions that vessel capsize presents to the liferaft. If the vessel is inverted the path of the liferaft is straight into the deck or the vessels structure. Handrails now provide a barrier to prevent it escaping sideways and upwards and of course, the fishing gear may now be hanging over the liferaft. With the vessel inverted, or perhaps laid on its side on the surface, it is likely that the liferaft will be held in its cradle by its buoyancy or, if not at sufficient depth, the HRU will not yet have activated. However, as water fills up the vessel it will typically sink by the stern, taking a vertical attitude. The HRU's will release at four metres and if not blocked the liferafts will attempt to float forward towards the bow, passing through aerials, rigging and mast structure, trailing their painter around any obstruction. The painter passing around obstructions results in friction. Thus, even if the liferaft canister clears all obstructions and the 20-30 metres of painter have been pulled out, causing inflation to be activated. The frictional drag may result in the painter not being able to exert sufficient pull on the weak link back at the cradle to break it and allow the liferaft to float free. Also, if the liferaft fails to inflate quite early in the sinking process, the water pressure at depth will prevent it ever inflating sufficiently to create enough buoyancy to part the weak link.

Capsize is possibly the worst scenario with respect to the deployment of the liferafts, but given that the vessel simply sinks, perhaps as a result of collision or being overwhelmed, the angle of sinking will affect the clear passage of the liferafts. They are unlikely to be able to simply float vertically upwards but will have to float off at an angle and clear rigging and masts etc. Even with the manual deployment situation when the crew have time to launch the liferaft problems can still occur. Lifting the liferaft from its cradle will require two persons who may have to get it down from a constricted area on the wheelhouse top. How many vessels have made any provision to aid the launching of the liferaft; a knife on hand to cut the lashing or a suitable tool to strike open the slip hook; a suitable length of rope to lower it down or, perhaps a pound board to guide it clear of the vessel's rail. It is very likely that the sinking vessel will have assumed a list, making it impossible to launch the liferaft on the 'up' side and necessitating the liferaft being manoeuvred to the 'down' side of the vessel.

5.2 Possible Improvements

The Wolfson report discusses possible changes that may improve the situation such as placing the weak link at the liferaft end of the painter thereby ensuring that it will break despite any tangling of the painter. However, when the liferaft is manually deployed there would be a risk of it breaking away in severe sea conditions. Another option is to have the HRU cut the painter allowing the liferaft canister to float to the surface where inflation could be triggered manually. The recommendations of the Wolfson report have been considered by MCA, FISG and ISSETA to identify how best to improve the situation. In addition to the issuing of the MGNs, the proposal to carry out a trial installation on the bow of a vessel is expected to proceed.

The bow area was the only location in the model trials that always allowed successful liferaft deployment. As has been discussed in section 3.2 when looking at the bow of an actual vessel the area is not as clear as perhaps the models implied. Trials on one

vessel over a two year period may not necessarily prove the practicality of bow mounted liferafts as it very much depends on the sea conditions encountered. Expanding the trials to include vessels working NW Scotland would help prove the concept.

5.3 Seafish Proposal

This requires a radical change to the system of deployment and would necessitate considerable development to prove it a reliable life saving system. The key advantage it offers is in utilising the inflation of the liferaft to eject itself sideways away from all the obstructions on the vessel. This will vastly improve the chances of any crewmen who are foundering in the water after a sudden incident, such as capsize or being run down, having a liferaft to climb into.

The system does away with the problems of the correct mounting of the HRU; where to attach the weak link etc. Inflation is activated at the liferaft by hydrostatic pressure and does not depend on the deployment of a long painter before inflation is triggered. In the manual deployment situation no lifting is involved, simply pull the trigger and the liferaft inflates into the water alongside the vessel. It is even quite feasible to launch all liferafts via a button in the wheelhouse.

However, the system has to be installed into the rails of the vessel and this may not be easy on many existing vessels. Two liferafts, one either side would be desired as the system is fixed and cannot be lifted to another location for launching. Many vessels currently carry only one liferaft and would not wish to incur the expense of two. These are the obvious drawbacks that may deter vessel owners from supporting the development of the system. Technically, the likelihood of damage to the liferaft as it leaves the vessel has to be tested and proof will be necessary that it is indeed a more reliable method than the existing system. The cost of the proposed system is not expected to be greatly more than the existing system and hence this should not be a factor in judging viability.

To prove the concept it will be necessary to build a prototype system and to undertake tests. This should be possible at a reasonable cost as it is simply a matter of packing an existing liferaft into a new design of housing and fitting a hydrostatic inflator mechanism. Tank test would be necessary to prove the correct inflation and deployment followed by manually activated launchings from a vessel. Model tests would be needed to assess the vessel sinking and capsize scenarios to enable a decision to be made on the success of the system.

5.4 Development Project

In reality, any change in the liferaft system cannot happen overnight. Given a willingness to develop a new approach, it will be a year or two in development and perhaps several years before it is internationally accepted. Currently, the existing system will have to continue, with the improvements that are being pursued by MCA, though it should also be possible to look to the future and develop advanced systems to be installed on the new vessels. It would seem sensible to retain the existing system

whilst at the same time developing advanced systems for those vessels on which they are suitable.

Government or EU funding will be needed to pursue any developments in liferaft deployment and provision needs to be made to investigate ideas that may result in significantly improved lifesaving equipment. Research and development needs to be encouraged, not only to consider new approaches but also to ensure that the existing equipment is appropriate and correctly installed.

5.5 Regulations

Liferafts are strictly governed by regulation and any change will have to be with the backing of the regulatory body. In order to pursue any departure from the regulations MCA do need the support of industry to request and put forward justification for changes to be made. The requirements of international conventions also have to be considered. Obviously, the regulatory requirements have to be met but they should not stifle developments that may enhance safety. Research and development should take place and then if justified, the regulations should be changed.

6 Conclusions

6.1 In recent years there has been a number of liferaft deployment failures and this has possibly resulted in lives being lost. Many failures are considered to be due to incorrect mounting of the HRU but other failures are likely to be due to the canister fouling or the painter tangling on the vessel.

6.2 MCA have publicised the need to correctly mount the HRU and advised on the location of the liferaft; MGN 104 (M+F) and MGN 130 (F) have been issued. Through ISSETA, improvements in the liferaft system have been considered and service agents are to offer a liferaft installation service to try to ensure correct installation on the vessel.

6.3 To address the failures due to fouling/tangling on the vessel, that are especially possible in a capsize situation, a trial to investigate the practicality of locating a liferaft on the bow of the vessel is being planned. Industry comment on this would be welcomed. Also being contemplated, is a hinged cradle that would facilitate outboard deployment of the liferaft.

6.4 A proposal has been put forward by Seafish for a new approach to liferaft deployment, utilising the inflation of the liferaft to eject it sideways away from the vessel to avoid fouling with the vessel structure. This proposal also eliminates the problems of HRU mounting and makes manual deployment very simple. However, it requires that the liferaft be installed at the rail side and may not be suitable for some existing vessels.

6.5 It is suggested that research and development effort be placed into this and other ideas to develop an improved liferaft system for use on those vessels on which it

will benefit.

6.6 The existing liferaft system may possibly best continue to meet the needs of many existing and especially the smaller vessels therefore, this should continue to be used. However, advanced systems with enhanced reliability and ease of deployment are needed for the vessels of the future.

6.7 It is essential that vessel operators ensure that the current liferafts on vessels are correctly installed and they should consider if the location of the liferaft can be improved to aid deployment.

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