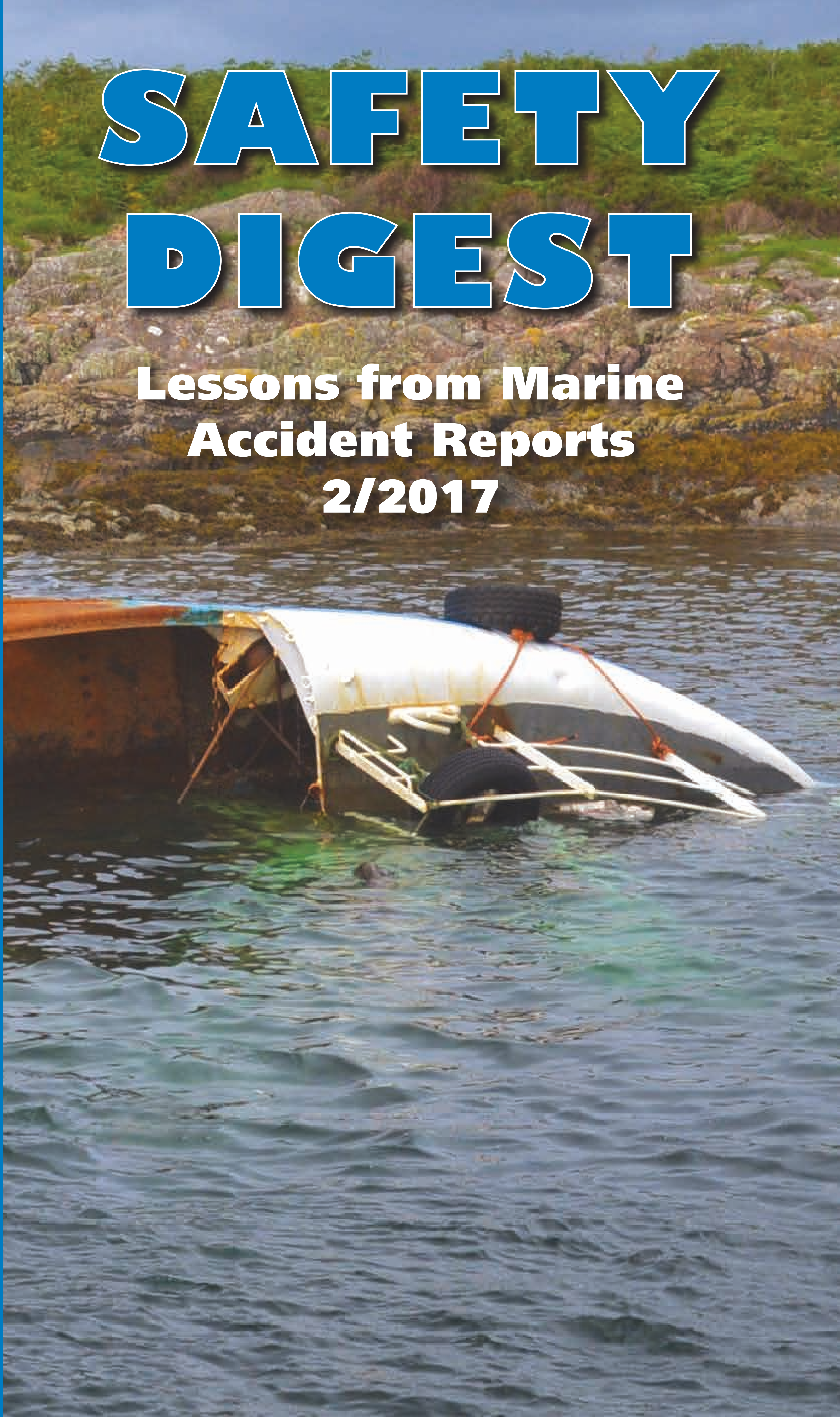
MAIB

MARINE ACCIDENT INVESTIGATION BRANCH



# SAFETY DIGEST

## Lessons from Marine Accident Reports 2/2017

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## Lessons from Marine Accidents

## No 2/2017

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is an
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October 2017

# MARINE ACCIDENT INVESTIGATION BRANCH

The Marine Accident Investigation Branch (MAIB) examines and investigates all types of marine accidents to or on board UK vessels worldwide, and other vessels in UK territorial waters.

Located in offices in Southampton, the MAIB is a separate, independent branch within the Department for Transport (DfT). The head of the MAIB, the Chief Inspector of Marine Accidents, reports directly to the Secretary of State for Transport.

This *Safety Digest* draws the attention of the marine community to some of the lessons arising from investigations into recent accidents and incidents. It contains information which has been determined up to the time of issue.

This information is published to inform the shipping and fishing industries, the pleasure craft community and the public of the general circumstances of marine accidents and to draw out the lessons to be learned. The sole purpose of the *Safety Digest* is to prevent similar accidents happening again. The content must necessarily be regarded as tentative and subject to alteration or correction if additional evidence becomes available. The articles do not assign fault or blame nor do they determine liability. The lessons often extend beyond the events of the incidents themselves to ensure the maximum value can be achieved.

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The Editor, Jan Hawes, welcomes any comments or suggestions regarding this issue.

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MAIB

MARINE ACCIDENT INVESTIGATION BRANCH

**The role of the MAIB is to contribute to safety at sea by determining the causes and circumstances of marine accidents and, working with others, to reduce the likelihood of such causes and circumstances recurring in the future.**

**Extract from**
**The Merchant Shipping**
**(Accident Reporting and Investigation)**
**Regulations 2012 – Regulation 5:**

*"The sole objective of the investigation of a safety investigation into an accident under these Regulations shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."*

# INDEX

## Glossary of Terms and Abbreviations

| | | |
|---|---|---|
| AB | - | Able Seaman |
| C | - | Celsius |
| $CO_2$ | - | Carbon Dioxide |
| COLREGS | - | International Regulations for the Prevention of Collisions at Sea 1972 (as amended) |
| COSWP | - | Code of Safe Working Practices for Merchant Seamen |
| DSC | - | Digital Selective Calling |
| ECDIS | - | Electronic Chart Display and Information System |
| EPIRB | - | Emergency Position Indicating Radio Beacon |
| GPS | - | Global Positioning System |
| HSE | - | Health and Safety Executive |
| ICS | - | International Chamber of Shipping |
| IMO | - | International Maritime Organization |
| kt | - | knot |
| m | - | metre |
| "Mayday" | - | The international distress signal (spoken) |
| OOW | - | Officer of the Watch |
| PFD | - | Personal Flotation Device |
| PTW | - | Permit to Work |
| RIB | - | Rigid Inflatable Boat |
| Ro-Ro | - | Roll on, Roll off |
| SMS | - | Safety Management System |
| TEU | - | Twenty-foot Equivalent Unit |
| UMS | - | Unmanned Machinery Space |
| VHF | - | Very High Frequency |

# Introduction

A fire is one of the most frightening things that can happen at sea. Often, seafarers have no ready access to the emergency services when a fire breaks out and will need to rely on their own resources, courage and training to tackle and extinguish the blaze quickly to ensure the safety of the ship and everyone on board. After reading one of the cases while editing this edition of the Safety Digest, I found myself thinking about the recent fire that engulfed Grenfell Tower, a west London residential tower block. This was an horrific incident; 80 people are currently presumed to have died but the ferocity of the fire means that the final death toll may never be known for sure. Why the Grenfell Tower fire spread so quickly is the subject of intense debate but its source was attributed to a domestic fridge/freezer that overheated. Case 10 provides a reminder that fires can quite easily start in a similar way on a ship. In that case a fire was caused when a travel fridge was placed on the carpeted area of the deck in a cabin; the lack of air circulation around the unit caused the fridge to overheat… fortunately the crew were able to extinguish the fire without too much damage being done.

Mobile phones, computers and other electrical devices have become an integral part of modern life but can be lethal if not used responsibly. The risk of fire from malfunctioning or misused portable electrical equipment can be substantially reduced or even eliminated if you ensure that portable equipment testing (PAT) becomes routine on your ship and that periodic examinations are made of personal electronic items to ensure they are being used sensibly.

In Case 10, when the emergency occurred the ship's crew reacted quickly and professionally because they had trained and drilled for the situation they found themselves in. The same point is also made in Cases 11 and 24. Being prepared to deal with scenarios such as fire, flooding or man overboard, is a practical prerequisite of going to sea, whatever sector of the industry you work in. Because the emergency services we take for granted ashore will likely not be there to help you when the worst happens, the importance of conducting regular drills, that are as realistic as practicable, cannot be understated. It is all very well for seafarers to receive instruction on how to deal with a range of foreseeable emergencies in theory, but they also need to be given the regular opportunity to put the theory into practice under safe, controlled but challenging circumstances. In this way, clear goals, procedure and practice will instinctively come to the fore to prevent panic and confusion at a time of very high stress. Sadly, MAIB investigators find that the emergency drills required by the SOLAS convention or domestic regulation are seen by some as a bit of a chore – something to be endured on a Saturday afternoon simply because it's needed to fill in the official log. In these circumstances, drills are conducted at best in a cursory manner with little learning value for the crews involved. If this is a situation you recognise I would ask you to think carefully how the safety culture within your company/on your ship or boat needs to change.

In closing, I would like to thank Adrian Hibbert, Robert Casson and Jonty Pearce for their excellent introductions to the merchant, fishing and recreational vessel sections of this edition.

Until next time, keep safe.

**Steve Clinch**
**Chief Inspector of Marine Accidents**

**October 2017**

# Part 1 – Merchant Vessels

Having spent three years as an Inspector with the MAIB, I was delighted to be asked to write the forward to the latest edition of the *Safety Digest*. The Branch produces excellent reports in scrupulous detail of the accidents that it investigates and from those reports seafarers, shore management and sadly on occasion next of kin get a full understanding of what happened.

However, it is probably the *Safety Digest* that is the most widely read of the MAIB publications; the style and size of reports are perfect for the seafarers' '*smoko*', quick read in the mess room or sharing lessons at Health and Safety Committee meetings. Of course, if you so wish you can now read these reports on line, but there is something reassuring when I visit one of my ships and see a well dog-eared copy in the engine control room or on the bridge.

Sadly, although the format of the MAIB reports may have changed, the nature of the accidents has, to a large degree, not. Complacency and overconfidence remains a common theme and both might be considered human factors related to the individual seafarer's character rather somewhat out of the control of the ship owner; but is there more the ship owner can do?

Now that I sit firmly on the side of the ship owner, I would argue that there is much that those of us based in shore positions can do to support our colleagues at sea beyond hiding behind the ISM Code or relying on STCW to dictate the standards.

To create a Safety Management System (SMS) that is overburdening on the end user; that requires form after form to be filled in before the most simple tasks can be started; that keeps an officer at a desk rather than overseeing his crew; that is used by the head office as a tool to protect them from any possible blame relating to an accident at sea; that relies on checklists to initiate skill, seamanship and best practice rather than have those values as part of the day to day working environment misses the point of the ISM Code.

As you will read in the report concerning the rescue boats that flipped when being hoisted on their lifting strops, a good SMS used correctly and coupled with open and honest reporting of any incident will not only help prevent accidents at the time, but will also help others learn and prevent potential accidents elsewhere. You will also read accidents such as a tug and tow collision that could have been avoided with a simple team discussion or 'tool box talk' – no paperwork required.

However, if a company is operating with an SMS that isn't fit for purpose, the blame cannot be laid solely at the ship owner or manager's door. The ISM Code allows ample opportunity for the officers and crew of a vessel to raise their concerns to the highest level within any organisation. If a vessel is working to an SMS that is not suitable or is not capable of being followed as required and yet the master has not raised this as part of his Master's Review or as a non-conformance with the DPA, then there is little that the shore manager can do.

Similarly, if an internal ISM audit involves merely checking that documents, records and checklists are complete and up to date but the auditor does not take the time to stand back and observe if the records reflect the true working practices on board, this too is a wasted opportunity and against the original intention of the Code. The best SMS will always be the result of inputs from both ship and shore and will be a living document – constantly under review and challenge.

Accidents at sea will happen. By nature it is a dangerous environment and it is the duty of us all to minimise the likelihood and severity of it happening to us or any of the people under our care. If it happens it is also our duty to ensure that our crew are trained and prepared to deal with it. Again, there are good and not so good examples of this in this *Safety Digest*.

Given that accidents will happen and therefore must be investigated, I'd like to take the opportunity to pay tribute to my former colleagues at the MAIB who take enormous responsibility when deploying to an accident scene, often in difficult to get to locations and always at short notice.

Most in the shipping industry do not get visibility of the small support team that makes that deployment happen; the diligent approach to investigation and peer review that ensures that the reports are accurate and recommendations appropriate; the work of the publications team to create a report that is easy to read and supported by suitable graphics; and the follow up work of the Inspectors who show great empathy when dealing with those directly involved in the accident or their relatives and friends.

**ADRIAN HIBBERT**

Adrian began his sea going career in 1990 with a cadetship at P&O and Princess Cruises. Trading in all major cruising areas including three full world cruises, he left P&O Princess after 10 years as First Officer of the company's new build *Aurora*.

After a short period outside of the industry, Adrian returned to cruising with First Choice Holidays' start-up operation Island Cruises. Initially as Chief Officer and then as Deputy Captain, he spent 3 years spending summer in the Mediterranean and winter in Brazil but, like many seafarers, a new marriage and the demands of family life had him looking for opportunities a little closer to home. In 2004 Adrian was appointed as Master on a new fast ferry service operating between Dover and Boulogne where he remained for two and a half years. However an opportunity to please his wife even more came along when his former employers at First Choice knocked on his door and offered Adrian his first shore based position as Fleet Manager for Island Cruises (with a short stint as relief master), based in his home town of Brighton. Two years later, the merger of Thomson and First Choice saw the relocation of Island Cruises Head office to Luton. This was the catalyst that allowed Adrian to fulfil a long held ambition to join the Marine Accident Investigation Branch (MAIB) as a Nautical Inspector.

In 2012, after three years with the MAIB, an offer to re-join the cruise industry as Operations Director for Thomson Cruises was too good to miss and Adrian made the difficult decision to leave the Branch. In his first years in the role he has worked hard to restructure the Operations department and its practices and procedures to reflect many of the best practices seen in his work with the MAIB but without burdening the seafarer with extra, unnecessary administrative responsibilities.

# Fuel System Maintenance – No Sparks Without Fire

## Narrative

A UK registered vessel operating in coastal waters suffered an engine room fire that resulted in the death of an engineer officer.

The vessel normally operated with its machinery space unmanned (UMS), but at the time of the accident it was performing a task that required the engine room to be manned. The UMS patrol alarm was not deemed practical for use with the engine room manned and, as a result, an ad hoc system of communication between the duty engineer and the deck OOW had been developed to maintain contact. Over the course of several years the frequency of communication had reduced to such an extent that the lone engine room worker could operate for several hours without contact with the rest of the crew.

On the day of the accident, the duty engineer had completed the required operational tasks and was attempting to carry out repairs in the engine room. He had informed neither the OOW nor the chief engineer of the task.

Having discovered a fuel leak on the low pressure fuel return from the main engine, the duty engineer decided that he could complete a temporary repair without needing to shut down the engine. He collected tools from the workshop and began the task. It became apparent that to access the leak he would need to remove a pipe support bracket. The pipe run was under the engine room floorplates, and on inspection the pipe, bracket and securing bolts were found to be in poor condition. In order to remove the bracket, he decided to crop the support using a portable angle grinder (Figure 1).

In order to progress the repair, the engineer climbed into the bilge to access the bracket. Fuel from the leaking pipe atomised on contact with the surrounding structure (Figure 2) and soaked the engineer's coverall with diesel. Sparks generated during the cutting process ignited the atomised diesel, setting light to the engineer's coverall and starting a fire in the engine room.

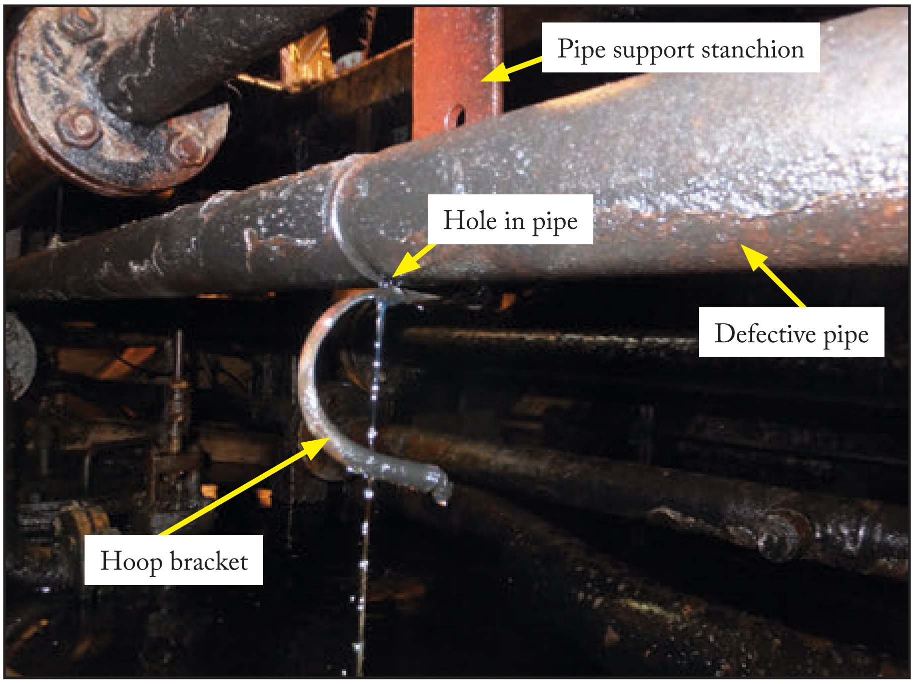


Figure 1: Leaking low pressure fuel pipe

The engineer officer died as a result of the fire, and the vessel was out of service for more than a year.


Figure 2

Figure 3

## The Lessons

1. Lone working in an engine room can be particularly hazardous. The Code of Safe Working Practices for Seafarers 2015 (COSWP) highlights precautions to be taken when working on UMS vessels. This includes regular contact with the OOW.

2. COSWP also details maintenance requirements, including the need to carry out risk assessments and complete PTWs when appropriate. This also emphasises the requirement to inform the OOW when working on machinery that could affect the operation of the vessel.

3. Although not specifically identified as a 'hot work' process, cutting and grinding with abrasive discs generates high energy sparks that are capable of igniting an available fuel source. An HSE research project commissioned in 2004 specifically investigated the risk of coveralls being ignited by sparks from angle grinders. The resulting report (HSE Research Report 222) highlighted that only coveralls with fire retardant treatments offer protection from ignition. It demonstrated that natural fibre garments (i.e. cotton) have very little benefit over coveralls constructed from man-made fibres (i.e. polyester/cotton mixtures) (Figure 3).

4. Like on board many other vessels, the low pressure fuel pipework ran beneath the engine room floorplates and was therefore out of normal sight. The contents of IMO circular MSC.1/Circ.1321 - a paper aimed at reducing the risk of fires in pump rooms and engine rooms - recommends a 6-monthly inspection of all low pressure fuel system components to be included in a vessel's SMS.

# A Gap in Knowledge Leads to a Gap in the Shell Plating

## Narrative

A sea-going tug was towing a hulk off the UK coast (Figure 1) when the towed vessel developed a list of about 10° to port. The tug's master called the coastguard to request permission to seek shelter in a local bay so that the list could be investigated. This was granted and he altered course for the bay, reducing the scope of his tow as he went.

Once in the shelter of the bay, the master put the tug alongside the towed vessel, stem to stern. However, safe access to it was not possible, so he proceeded further into the bay with the intention of anchoring and taking the tug's rescue craft over to the towed vessel. The tidal stream in the bay was about 0.9kt, it was dark, but visibility was good with light winds and slight seas.

Once clear of his tow, the master drifted for some time before ordering the anchor to be dropped. Satisfied that he was secure, he started to use the tug's searchlight to find the towed vessel, only to see it bearing down on the tug. He immediately took evasive action using the tug's engines and bow thruster, but was unable to avoid the towed vessel, which struck and holed the tug just aft of midships. The damage was below the waterline and in way of the engine room (Figure 2).

The master immediately raised the alarm and attempted to run the tug aground to avoid sinking. With significant assistance the tug was saved but, several hours after the collision, the towed vessel sank.

The tug's master was not familiar with operating in tidal waters and had inadvertently anchored down-tide of the towed vessel, leading to the collision.

## The Lessons

1. **There was no need to act quickly once in the shelter of the bay. Had the master held a planning meeting with the bridge team before going stem to stern with the towed vessel, it is possible that a safe means of access could have been rigged, avoiding the need to anchor.**

2. **Don't allow yourself to become focused on any one aspect of an operation. Had the master discussed with the bridge team his intention to anchor, team members more familiar with tidal effects could have recognised the dangers and brought them to his attention.**

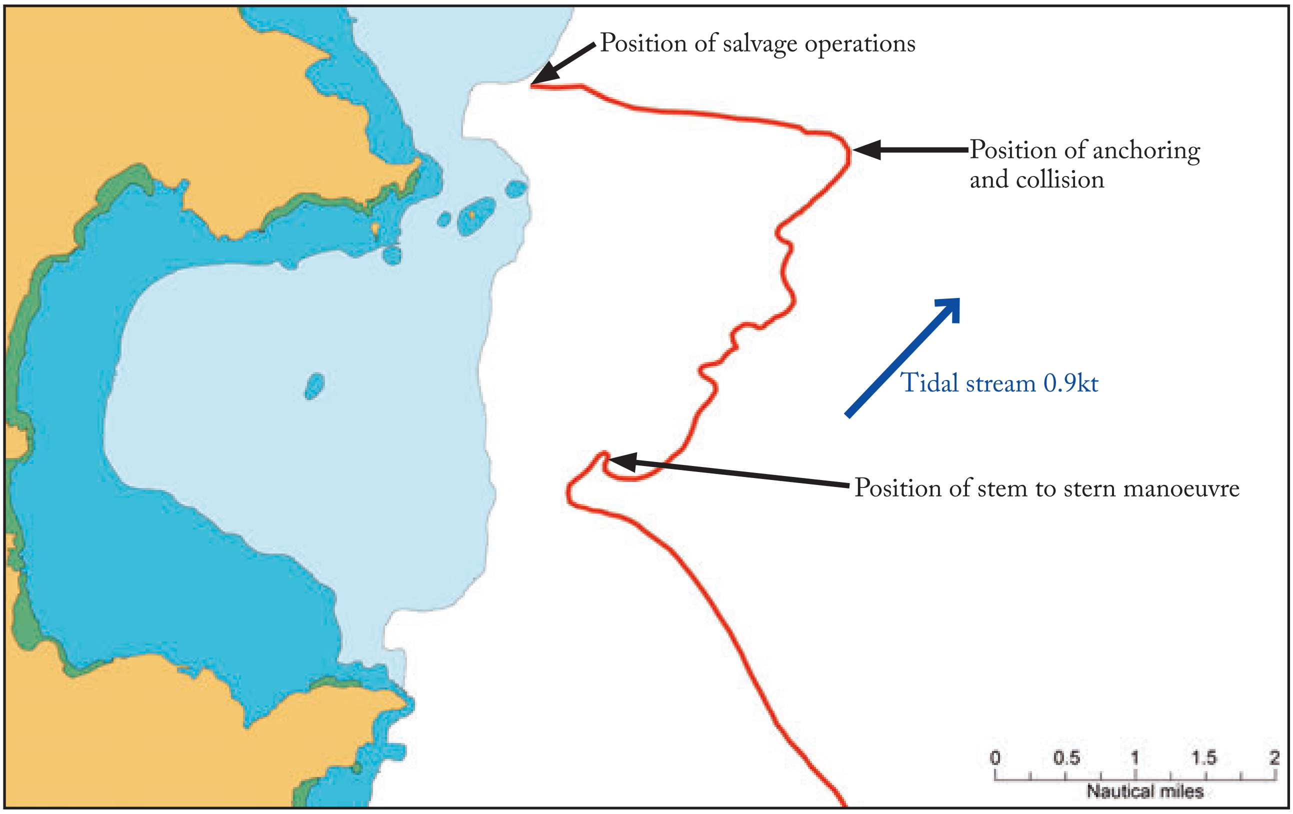



Figure 1

Figure 2: Damage to shell plating in engine room

# Oh Flip

## Narrative

Whilst alongside, the crew of a high speed ferry changed the lifting strops on the vessel's port and starboard rescue boats. Needing to prove the boats' operation and train the crew before the ferry returned to sea, it was decided, in accordance with company procedure, to raise and lower both boats without personnel embarked and with the fall prevention device fitted.

The port rescue boat was lifted first. However, having swung the boat over the ship's side and then having lowered it a few metres, the boat's bow suddenly flipped up (Figure 1). Unsure of what was causing the boat to become unbalanced, and keen to determine whether or not it was an issue that affected both boats, the crew repeated the procedure using the starboard boat. The result was the same. On further investigation it was found that this class of inflatable rescue boat was fitted with multiple lifting points, and discussions with the senior master of a similar ship revealed that the new lifting strops had been fitted incorrectly. Specifically, the rear pair of strops had been connected to the lifting points on the boats' decks rather than the boats' transoms.

The crew reattached the strops to the correct lifting points and both boats were lowered and recovered without incident (Figure 2).

## The Lessons

1. Replacing or repairing equipment without reference to technical documentation is always fraught with risk. In this instance the crew attached the strops to what they genuinely thought were the correct lifting points, inadvertently creating a dangerous situation. The owner has now addressed this by reviewing the ship's documentation to ensure that details, such as how to attach the rescue boat strops, are properly recorded. The lifting points within the boat have also been clearly marked.

2. However, whilst the crew made a mistake fitting the new strops, they are to be commended for:

   - Their adherence to the safety management system requiring that boats be first lowered and recovered empty during drills, which undoubtedly prevented a more serious accident; and,

   - Their swift, open, honest reporting of this incident, which has allowed other personnel operating with similar inflatable rescue boats, to learn from their experience.

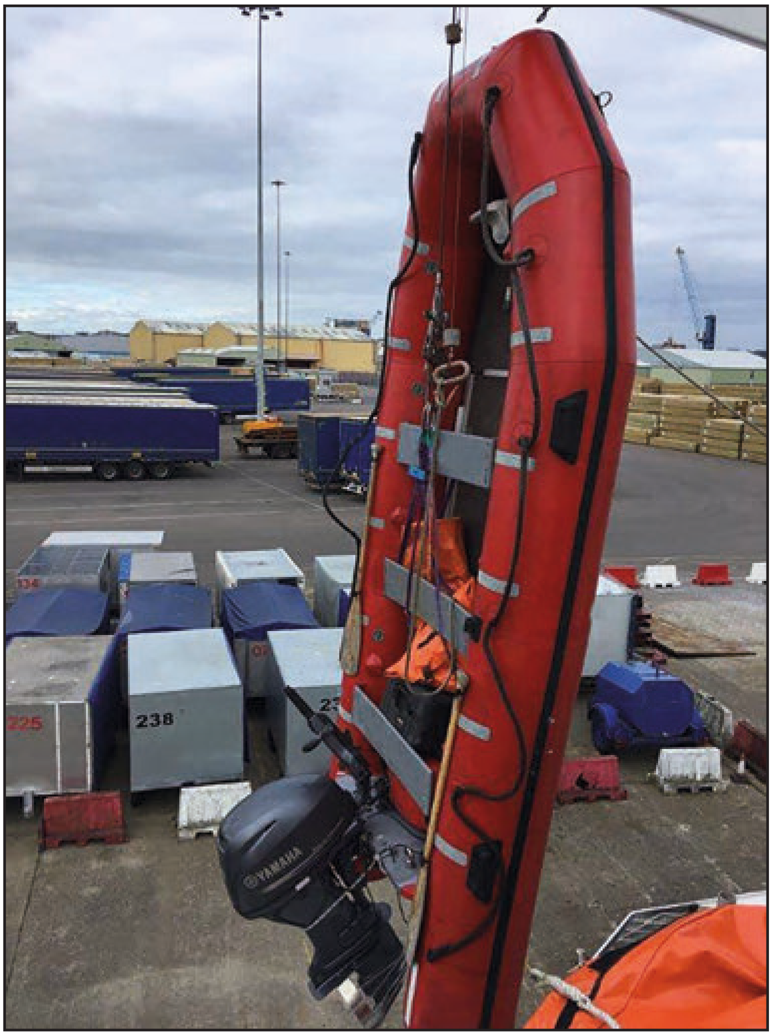



Figure 1: Lifting strops incorrectly fitted unbalance the boat and cause it to flip up

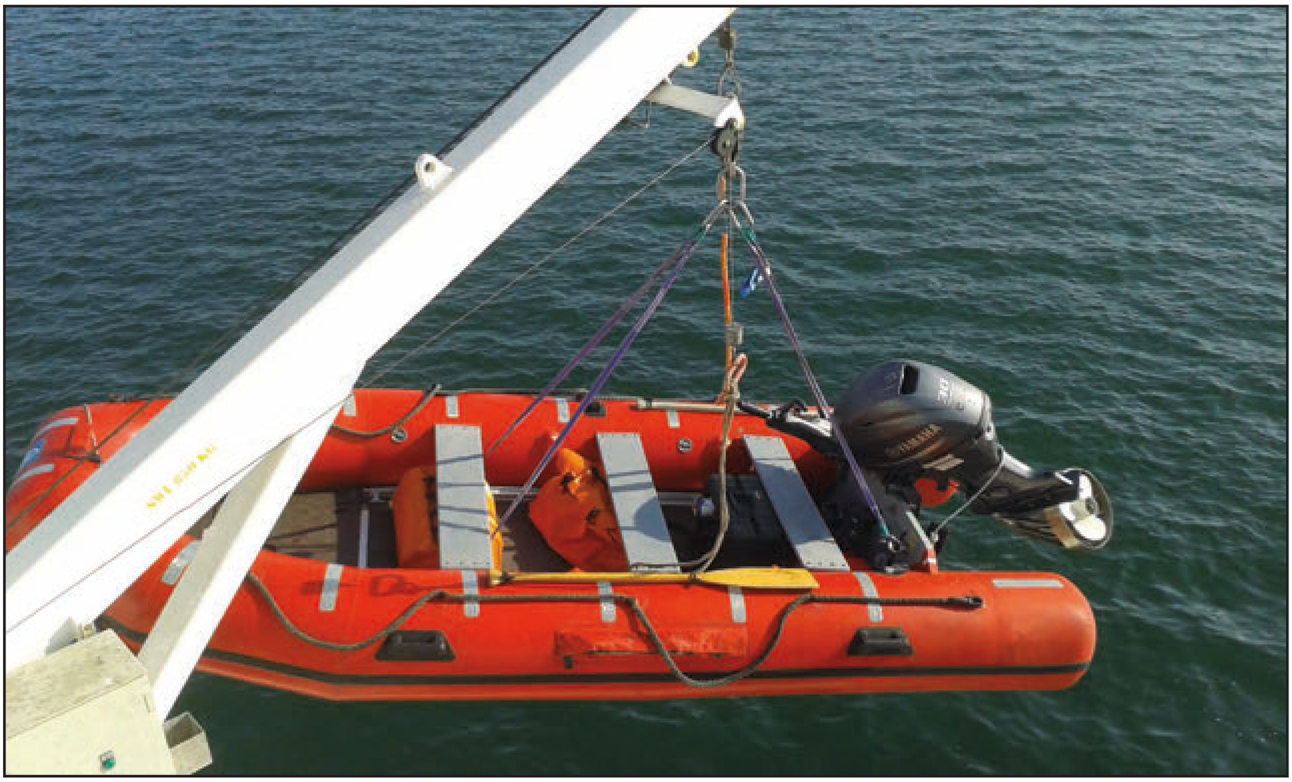



Figure 2: Lifting strops correctly fitted to inflatable rescue boat

# All For a Few Centimetres

## Narrative

While a general cargo ship was alongside in an Asian port, nine 1.2m high heavy steel cargo units had to be shifted from the aft to the forward hold in order to adjust the ship's trim. The crew successfully transferred eight of the units using one of the ship's cranes. However, when the ninth unit was landed on the deck in the forward hold, it was too far from the ship's side for it to be properly lashed, and had to be moved a few centimetres closer.

The chief officer climbed onto the cargo unit and directed the crane driver by using hand signals and VHF radio to hoist the unit. As the crane took up the weight, the chief officer held onto one of two webbing strops that were being used to lift the unit (Figure 1). Suddenly, the unit and/or a strop shifted, causing the chief officer to lose his balance and fall through a hole in the steel unit and onto the deck (Figure 2).

The chief officer was clearly badly injured, and the ship's crew reacted quickly to administer first-aid and lift him from the hold to the quayside. The chief officer was taken to a local hospital by ambulance, accompanied by the second officer. The oxygen bottle provided in the ambulance was empty and the chief officer became unresponsive. The second

Figure 1: Position of chief officer prior to fall (simulation)

officer checked his vital signs and commenced cardiopulmonary resuscitation, which was continued by medical staff on arrival at the hospital. Tragically, the chief officer died shortly afterwards from bleeding and pneumothorax in his right chest cavity. He also suffered broken ribs and a broken humerus.

Figure 2: Position of chief officer after fall (simulation)

## The Lessons

1. Although hazardous, it is not unusual for crew members to stand on top of cargo during loading and discharge in order to get a job done. However, standing on the top of cargo that is being lifted is inherently unsafe and unnecessary.

2. A 'can do' attitude is invariably seen as a positive personal quality, but a 'can do safely' attitude is far better. When a problem arises while working the cargo, take time to weigh up the options and decide on the most efficient and safe course of action. The forces at play are too considerable to rush.

3. Every fall from height is potentially life-threatening. Internal injuries are always possible, no matter the distance travelled.

4. Healthcare varies considerably in different parts of the world; it might not always be up to the standard you are used to.

# A (Fire) Triangular Error Chokes an Engine Instead of a Fire

## Narrative

A ship was on passage when a fire developed in the engine room. The ship was approximately 20 miles from its destination and in a relatively busy shipping area.

The ship's propulsion and generating plant consisted of a main engine coupled to a shaft alternator, two auxiliary alternators and an emergency generator. At the time of the fire, the ship was running with the shaft alternator providing electrical power.

A fire alarm sounded, which was quickly followed by the ship losing electrical power and blacking out. The standby generator then cut in, restoring power to the ship. The chief engineer investigated and reported to the master that there was a fire and a large volume of smoke in the engine room. The master decided to evacuate the engine room, shut down ventilation and operate the fixed $CO_2$ fire extinguishing system. As the ship was in a busy traffic area he decided to keep the generator and main engine running at slow speed in order to maintain the ship's course.

Approximately 50 minutes after the $CO_2$ system was activated, ventilation of the space commenced and a ship's fire-fighting team, wearing breathing apparatus, entered the engine room to investigate. The fire-fighting team found that the fire had not been fully extinguished, so used fire hoses and dry powder extinguishers to fight it.

On arrival in port, the local area fire and rescue service inspected the engine room and confirmed that the fire had been extinguished. It was noted that the seat of the fire was a rubber coupling between the main engine and the shaft alternator. There was very little collateral damage and the ship was able to proceed to its next port following minor repairs and cleaning.

The master's decision to shut down the engine room and use the fixed fire extinguishing system was prudent. However, continuing on passage, even at slow speed, compromised the effectiveness of the $CO_2$ system.

$CO_2$ smothering requires 40% by volume to be effective. Fixed fire extinguishing systems are designed to provide sufficient fire-fighting medium to achieve the required coverage. However, this is based on a complete shutdown of the engine room.

The main engine and the auxiliary engines took their combustion air from within the engine room. Therefore, by leaving these engines running there was a significant risk of evacuating the $CO_2$ through the engines and reducing the fixed fire extinguishing system's effectiveness. A secondary concern is that the concentration of $CO_2$ entering the engine intakes could have interfered with the combustion process and, consequently, negated the aim of maintaining propulsion.

## The Lessons

1. Senior officers in decision-making positions must be fully aware of emergency systems and how to use them effectively. Inappropriate use reduces their effectiveness and can endanger both the ship and its crew.

2. The safety management system should provide decision-support processes to assist during an emergency situation. The International Chamber of Shipping (ICS) Bridge Procedures Guide 5th edition gives examples of considerations in the event of an engine room fire (Annex 3 section C7) and main engine failure (C1).

3. Other crew members (in this case the chief engineer in particular) should feel empowered to challenge inappropriate decisions. The ICS Bridge Procedures Guide highlights 'challenge and response' as being an effective leadership approach. This concept should be expanded beyond the bridge team to encompass all members of the vessel's management team.

4. Comprehensive monitoring of the compartment boundaries is essential to ensure that re-entry is not made until the fire has been extinguished. An entry made with residual heat can result in re-ignition and, in extreme cases, a backdraught.

# Now You See Me…

## Narrative

Early on a spring morning a small general cargo vessel was approaching its destination in autopilot. The chief officer was the OOW and a rating was acting as lookout.

The chief officer had previously spoken to the pilot station and was expecting the pilot boat in 30 minutes' time. He completed the pre-arrival checklists and then directed the rating to prepare the boarding point for the pilot. The rating left the bridge, leaving the chief officer alone. The chief officer then notified the master and crew, informing them of the time for the pilot's boarding and the intended standby time.

However, 15 minutes after calling the crew, the chief officer noticed that the pilot boat was approaching the general cargo vessel's side. Although he could see that the boarding point on the ship was ready, the chief officer was not expecting the pilot boat for another 15 minutes, and neither the master nor the rest of the crew were ready. The chief officer saw there was no other traffic in the area and, taking into consideration the short distance between the bridge and deck he decided to nip down to meet the pilot himself.

Accordingly, when the pilot stepped across from the pilot boat to the general cargo vessel's main deck he was greeted aboard by the chief officer. As soon as the pilot was safely on the deck the chief officer ran back to the bridge, leaving the pilot to trail after him.

When the pilot eventually reached the bridge he saw an officer who looked very much like the officer who had met him on deck; a feeling that was amplified when the chief officer greeted him a second time. Feeling sure that the officer on the bridge was the same as the one who had greeted him on the deck, the pilot asked the chief officer a few questions and the chief officer was forced to confirm that he had left the bridge unattended in order to meet the pilot.

## The Lesson

**The requirement to maintain a safe lookout is clear and should need no further emphasis. However, if a watchkeeper needs to leave the bridge for any reason, a competent person must be present on the bridge before the designated OOW leaves it. No matter how genuine the reason or how short an absence, situations can and do change rapidly as the MAIB reports on *Coastal Isle* (No 9/2013) and *Orakai/Margriet* (No 16/2015) demonstrate.**

# Oooops

## Narrative

A ro-ro ferry carrying 52 passengers blacked out and lost propulsion when on passage. A crewman had been using an air hose during deck maintenance work. Although several compressed air hose connection points were distributed throughout the ship, the crewman opted to use a connection point (Figure 1) in the $CO_2$ room housing the $CO_2$ cylinders for the fixed extinguishing system. The door to the $CO_2$ room was secured by a combination padlock set to the ferry's common access code.

After the crewman finished his work on deck, he returned to the $CO_2$ room to disconnect the air hose. However, having knelt to disconnect the hose, he inadvertently knocked the main $CO_2$ distribution valve as he stood up. The valve was moved only slightly, but this was sufficient to momentarily activate the CO alarm and to trigger shutting down the engine room fuel supplies and booster pumps. As a result, the ferry's main engines shut down and the shaft generator stopped. Fortunately, the ferry was in open water and traffic was light. No $CO_2$ was discharged into the engine room.

As power was lost, the emergency generator started and the crew were swift to implement the ferry's post-blackout checklist. Power was quickly automatically restored via the power management system and the main engines were brought back online. The timely identification and rectification of the problem enabled the ferry to continue on its voyage with minimal fuss. Many passengers were not even aware of the disruption to the power supplies.

Figure 1: Compressed air hose connection

Following the incident, security of the access to the $CO_2$ space (Figure 2) was improved. The compressed air hose connection inside the space was also blanked off to control its use.


Figure 2: Access to $CO_2$ space

## The Lessons

1. Spaces on board ships with restricted access, such as $CO_2$ rooms, are kept locked and are marked with appropriate and applicable warnings posted on the doors to protect both individuals and the ships. However, signs and warnings can be ignored. Only good security can prevent unauthorized entry, even if well-intentioned.

2. Air hose connections inside $CO_2$ rooms are fitted to enable the $CO_2$ system to be 'blown through' periodically during maintenance. They might be near and convenient but they are not intended for general use.

3. When working adjacent to any form of control, such as a valve, lever or button, the danger of moving that control is always a possibility. Remain vigilant, and where critical, hazardous or safety related equipment is concerned, always follow onboard procedures with regard to permits to work etc. but also consider the use of additional precautions such as physical barriers and isolations.

# Heavy Weight + Shortcut = Fatal Fall

## Narrative

A deck officer on board a 1700 TEU container vessel died after he fell from a container bay hold hatch cover to the quayside during cargo operations. The deck officer had been working a six-on six-off watch pattern and was in charge of the vessel's cargo watch when the accident happened.

At 0200, one of the vessel's deck crew informed the cargo watch officer that the containers from one of the cargo bays had all been discharged and its hatch cover had been refitted. The officer then went out on to the deck to close the cargo bay vent covers.

Figure 1: Cargo bay ventilation cover

The cargo bay vents were located on the sides of the hatch cover, 2.5m above the main deck (Figure 1). To close them, the officer climbed onto the hatch cover. He then went to the edge of the hatch, bent down and released the ventilation cover. As he did so, he lost his balance and almost fell off the side of the hatch cover. A stevedore, who witnessed the event, asked the officer if he was okay. In reply, the officer gave the stevedore a 'thumbs up' signal.

The cargo watch officer then went to the second vent and attempted to close it in the same manner. As he did so, he fell off the hatch cover, hit the main deck handrails, flipped overboard and landed on the concrete wharf below.

The alarm was raised immediately, and an ambulance arrived on the scene shortly afterwards. However, the officer succumbed to his injuries and died.

Although the vessel's recorded hours of rest for the cargo watch officer indicated that fatigue was unlikely, the investigation into the circumstances of the accident identified that tiredness could have been a factor.

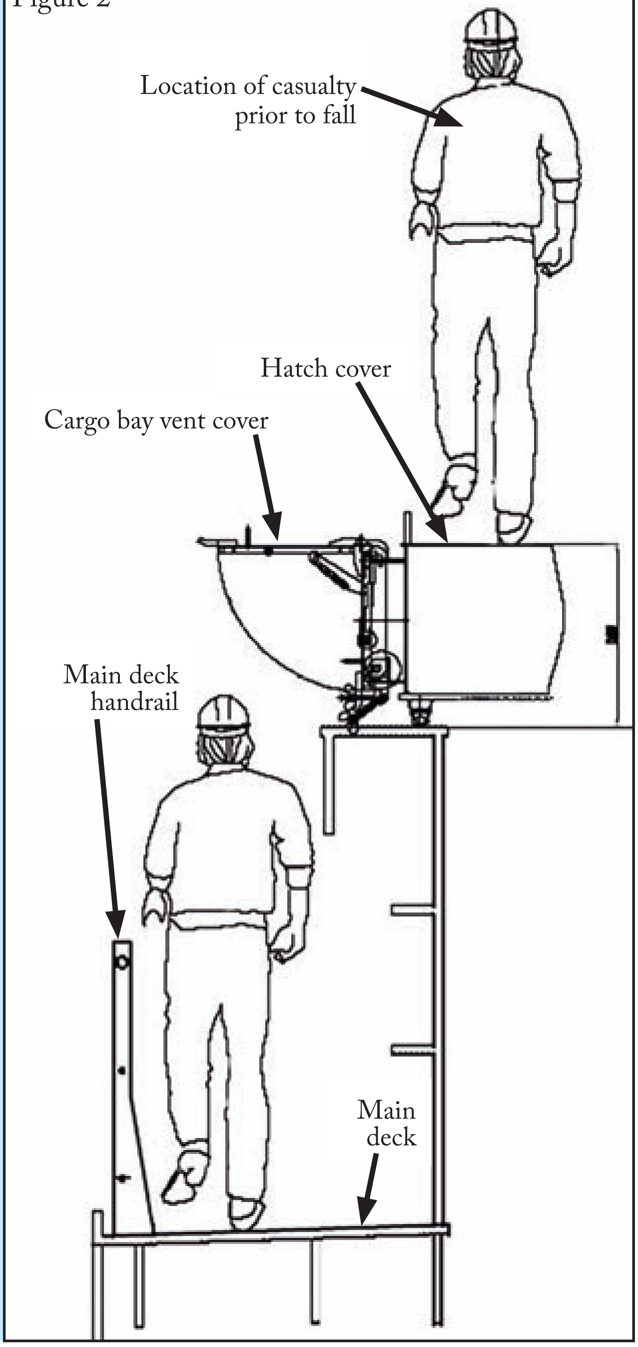
## The Lessons

1. Working close to the unprotected edges of the vessel's hatch covers presented a clear risk of falling to the main deck below. It was also apparent that such a fall would likely result in serious injury or worse. In accordance with the guidance set out in CoSWP 2015, the task the cargo watch officer attempted to carry out should have been subject to work at height safety precautions. If a task requires a person to work at the edge of a hatch cover then temporary safety rails should be rigged or personal fall restraint equipment used (Figure 2).

2. In this case, the task could have been carried out from the main deck below the vents; the vessel carried step ladders specifically for the task. It is always better to avoid hazards rather than trying to control them, and working close to the edges of unprotected hatch covers should be avoided whenever possible.

3. It is possible that fatigue or tiredness adversely affected the officer's decision-making immediately prior to his fall and/or his loss of balance. Fatigue is a killer, therefore it is essential to ensure that you and the people you are responsible for are sufficiently rested. In order to monitor the risk of fatigue it is important to accurately log hours of rest.

Figure 2



# A Close Shave

## Narrative

A laden chemical tanker was proceeding at slow speed in a designated 'pilot boarding area' waiting to embark a pilot in preparation for arrival into port. It was a calm, clear day and there were numerous small recreational fishing vessels anchored in the same vicinity, which was popular for sea-angling (see figure). The tanker's master was aware of the anchored fishing vessels ahead but did not want to alter course until the pilot boat transfer was complete.

In the meantime, the two occupants on board one of the anchored fishing vessels had been concentrating on fishing and were unaware of the tanker approaching until it was extremely close. When the fishermen saw the tanker's bow, they immediately realised that there was a risk of collision. The fishermen considered cutting their anchor line but did not want to leave the boat's cockpit to do so, and they did not have time to lower the outboard engine down into the sea.

When the pilot arrived on the tanker's bridge, he realised that the fishing boat was only about 20m ahead, so he ordered full starboard rudder in an attempt to swing away from the anchored boat; however, the tanker and the fishing boat briefly came into contact. The fishing boat's anchor line broke after snagging on the tanker and the fishermen fended off by hand until the tanker had passed.

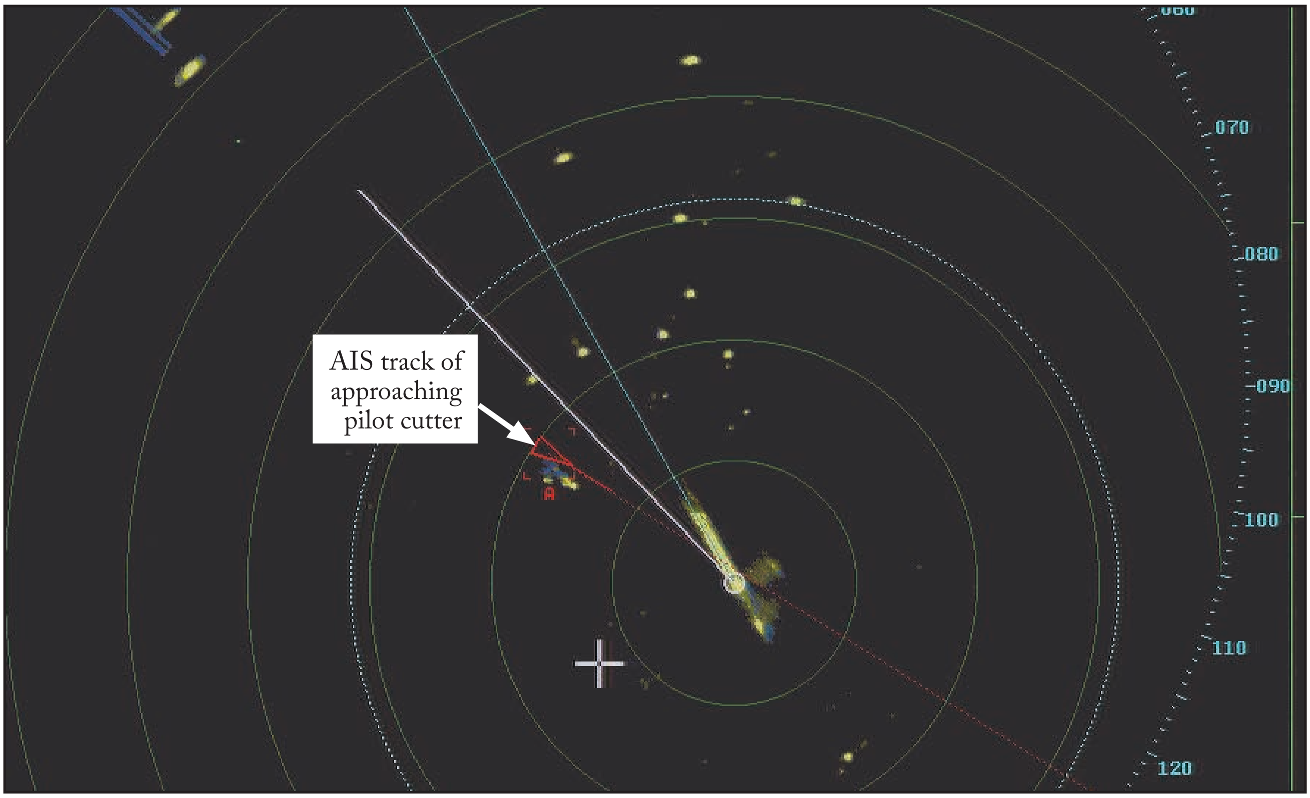



Figure: Extract of the tanker's radar picture 6 minutes prior to the collision, showing the pilot cutter approaching and the fishing vessels ahead

## The Lessons

1. All vessels at all times have a responsibility to take action to avoid collision. There was plenty of sea room either side of the anchored fishing vessels, so the tanker's master could have taken early avoiding action. Even if this resulted in a short delay to the pilot transfer, it would have been a safer option than continuing to head slowly towards the fishing boats.

2. Although it is the general practice of good seamanship that a vessel underway will keep clear of an anchored vessel, the crew of the fishing boat should have acted earlier to avoid the collision. They were very familiar with the area and knew they were anchored in a pilot boarding area. Despite this local knowledge, the fishermen were not keeping a lookout and did not see the tanker appproaching until it was too late. Had they spotted the tanker earlier, there would have been plenty of time to lift the anchor, start the engine and get out of the way.

3. Sound signals should be used when the actions of another vessel are uncertain. It was good, daylight conditions and neither vessel thought to use sound signals to warn the other.

4. VHF radio can provide important additional information to improve awareness, especially for vessels operating in the approaches to a commercial harbour. The fishing boat was equipped with a hand-held VHF radio; however, this was switched off.

# Training Saves the Day

## Narrative

A roll-on roll-off passenger ferry was on passage during the early evening when the ship's fire alarm system sounded, indicating a fire in a crew member's cabin. The crew initially investigated the fire alarm following the procedure practised during their training, and discovered smoke in the cabin. Ventilation was shut off to the affected area, and the cabin and surrounding deck spaces were electrically isolated.

In accordance with company procedures, one senior crew member entered the cabin with a portable fire extinguisher. He immediately felt the heat of the fire and saw isolated flames and lots of black smoke. Aiming at the flames he discharged his extinguisher and then retreated out of the cabin, shutting the door behind him.

A short time later, a designated fire team wearing fire approach suits and breathing apparatus arrived on scene. Following instructions, they entered the cabin carrying another fire extinguisher, performed a sweep of the area to check for casualties, and then extinguished the fire.

The fire team reported that no casualties had been found and that the fire was out. They then re-entered the cabin, unplugged and removed all portable electrical equipment, and doused the area with fresh water to cool the remaining smouldering hot spots. The decks above and below the cabin, and the adjacent compartments, were checked to verify that there were no other hot spots or signs of fire travel, and a fire watch was posted.

Once the area was declared safe, the ship's fire investigation discovered that the seat of the fire was located where a mini fridge (Figure 1) had been placed. The carpet, cabin furniture and surrounding bulkheads were damaged, with smoke deposits and scorch marks clearly indicating that the fridge was the source of the fire. The fridge's plastic casing had melted and its power cable had suffered severe damage (Figure 2). The metal centre core of the fridge and the cans of juice inside were almost undamaged.

The fridge had been in the cabin for about 4 years, and always located in the same position - on top of the carpet, against the wardrobe. The investigation concluded that, due to its location, the fridge didn't have proper ventilation around it, and therefore this could have caused it to overheat. The investigation further found that the cabin inspection routine had neither identified this hazard nor picked up that personal electrical equipment was not being inspected.

Figure 1: Similar travel fridge to the one in the cabin

Figure 2: Remains of the fridge after the fire

## The Lessons

1. It is hoped that seafarers will never have to put into place the emergency training that they have undertaken and practised on board ship during drills. However, sometimes the unexpected happens, and if ready for it this will help towards a successful resolution to the problem. In this case, the well trained crew used the F.I.R.E. principle of <u>F</u>inding the fire, <u>I</u>nforming others about what was found, <u>R</u>estricting the fire, and then <u>E</u>xtinguishing it. In the end, their actions prevented this fire from becoming a major incident that could have threatened the lives of the crew and passengers on board. Regular drills helped ensure the first responder and the fire team did the right things instinctively.

2. Permanent electrical equipment, such as fridges, must be installed, used and maintained according to manufacturer's instructions. Sufficient room should always be arranged to allow air flow around the unit. However, in this case this did not happen.

3. Crew routinely bring personal portable electrical equipment on board ships. Although portable appliance testing is not a requirement, ensuring that items are fit for task and inspected before and during use, is. Most companies have good routines for examining portable work equipment, but often omit to include personal items. Periodic inspections should include, but not be limited to, items such as music equipment, coffee makers, mobile phone chargers, hairdryers, televisions, fridges, heaters and coolers.

# Faulty Cigarette Bin Sees Sparks Fly

## Narrative

A 3000 tonne ro-ro passenger ferry was on passage when the helmsman noticed flames through the bridge wing window. The alarm was swiftly raised, and while crew fought the fire the passengers were mustered and coastguard informed.

The crew attacked the fire with a combination of portable extinguishers and fire hoses, boundary cooling adjacent compartments as required. Approximately 30 minutes later, the fire was extinguished and, on arrival at the ferry's destination, the local fire brigade inspected the scene of the fire and declared it safe.

The damage caused by the fire was significant and included shattered bridge windows, scorched paintwork, and damaged wiring and equipment (Figure 1). Thankfully, due to the crew's prompt action the fire was quickly contained and the ferry was out of service for only a few days while repairs were carried out.

The investigation discovered that the fire had started when a cigarette bin caught fire. Further investigation found that the bin caught fire because its metal liner was missing, which caused the plastic exterior to melt. This melting plastic then fell into an open container of highly flammable paint thinners that had been left underneath the bin, causing the

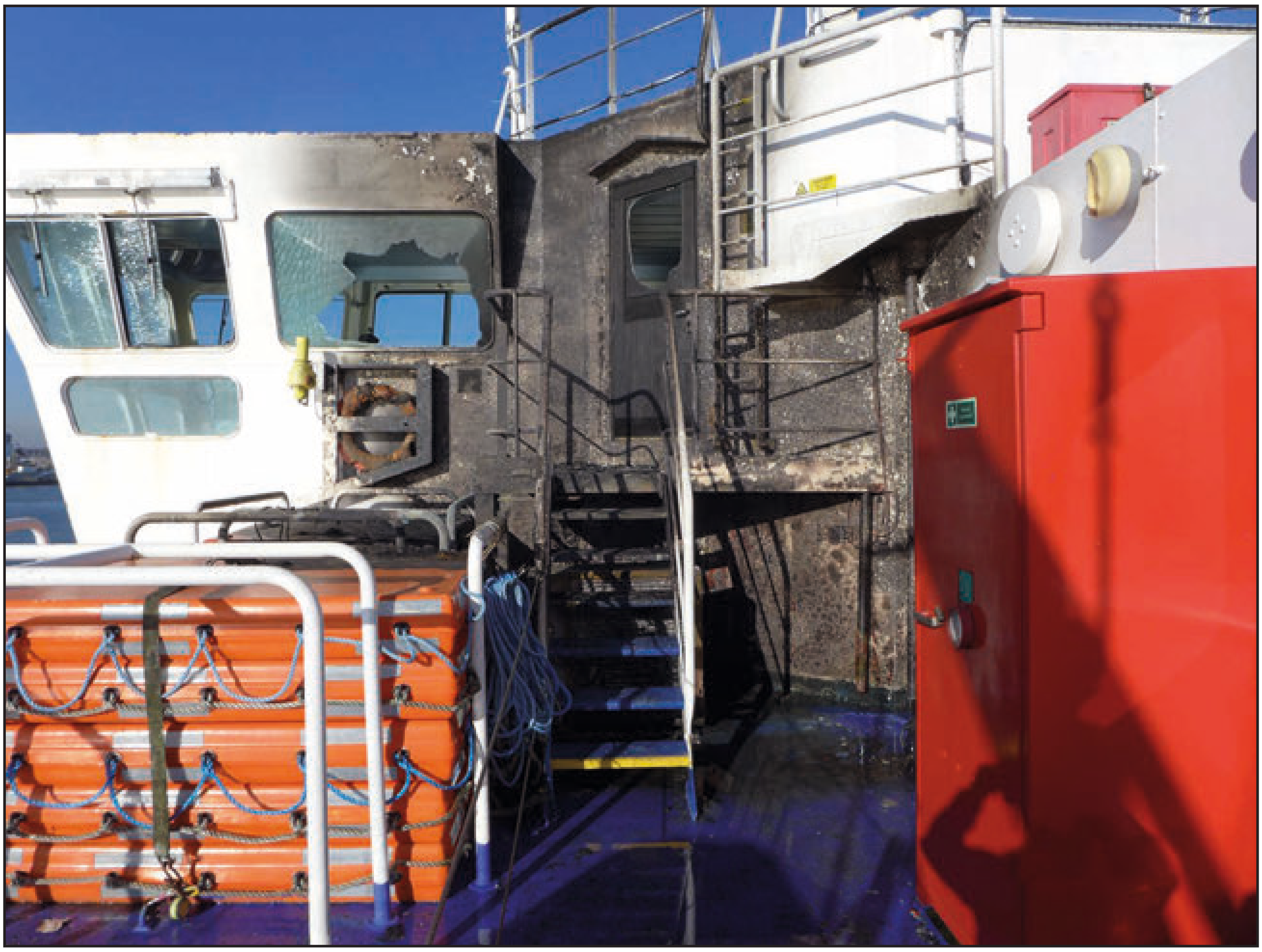


Figure 1: Damage caused by the fire

fire to really take hold (Figure 2). After the incident the ship operator introduced a more frequent routine to empty and inspect these bins, discovering in the process that other bins were missing metal liners.

Discussions with the crew also revealed there had been a number of unreported cigarette bin fires.

Figure 2: Cigarette bin and open bin with liner, which was missing from the bin that caught fire

## The Lessons

1. Cigarette bins require regular housekeeping to prevent them becoming a fire hazard. Owners and operators should require that regular safety rounds of smoking areas are conducted, and that cigarette bins are emptied and inspected. They must also encourage a culture where all incidents are reported so that action can be taken to prevent more serious accidents from taking place.

2. Moreover, there is little doubt that in this case the presence of the flammable paint thinners significantly increased the ferocity of the fire. Ships' teams must ensure that hazardous chemicals - such as paint thinners - are correctly controlled. On this occasion, the open container of paint thinners left below the faulty cigarette bin led to an intense fire and significant damage to the ferry.

3. Finally, the crew's swift and decisive action prevented the fire from becoming more serious and demonstrates the practical benefits of regular, realistic training.

# Beware of Slack Ropes and No Shared Awareness…

## Narrative

A member of the aft mooring team on board a 144m combination oil and chemical tanker lost the lower half of his left leg when it became entangled in a tug line messenger rope during a routine berthing operation. The aft mooring team was led by the tanker's second mate and comprised two ABs and a messman (see figure). The mooring party ABs (AB1 and AB2) were experienced deckhands, but the messman had no formal training in mooring operations.

The tanker had completed its discharge operations and was required to move to a layby berth for cargo tank cleaning. In preparation for the shift, the master instructed his forward and aft mooring teams to prepare the mooring ropes for a 'starboard side to' berthing. The vessel had a pilot on board and was assisted by a tug at the stern, which was made fast using the tug's line. The eye of the 80mm diameter tug line was heaved on board through a panama fairlead using a 20mm diameter messenger line, and placed over a deck bollard.

Once the vessel was secure alongside the layby berth, the pilot instructed the master to let go the tug. The master then relayed the pilot's instruction to the second mate. The second mate, observing that the tug line was slack, instructed his team to let go.

AB1 grabbed the messenger line and placed several turns around the mooring winch drum. The second mate at the winch controls took the weight off the eye of the tug line by heaving in on the messenger. The messman removed the eye from the deck bollard and the tug line was lowered until its eye reached the panama fairlead.

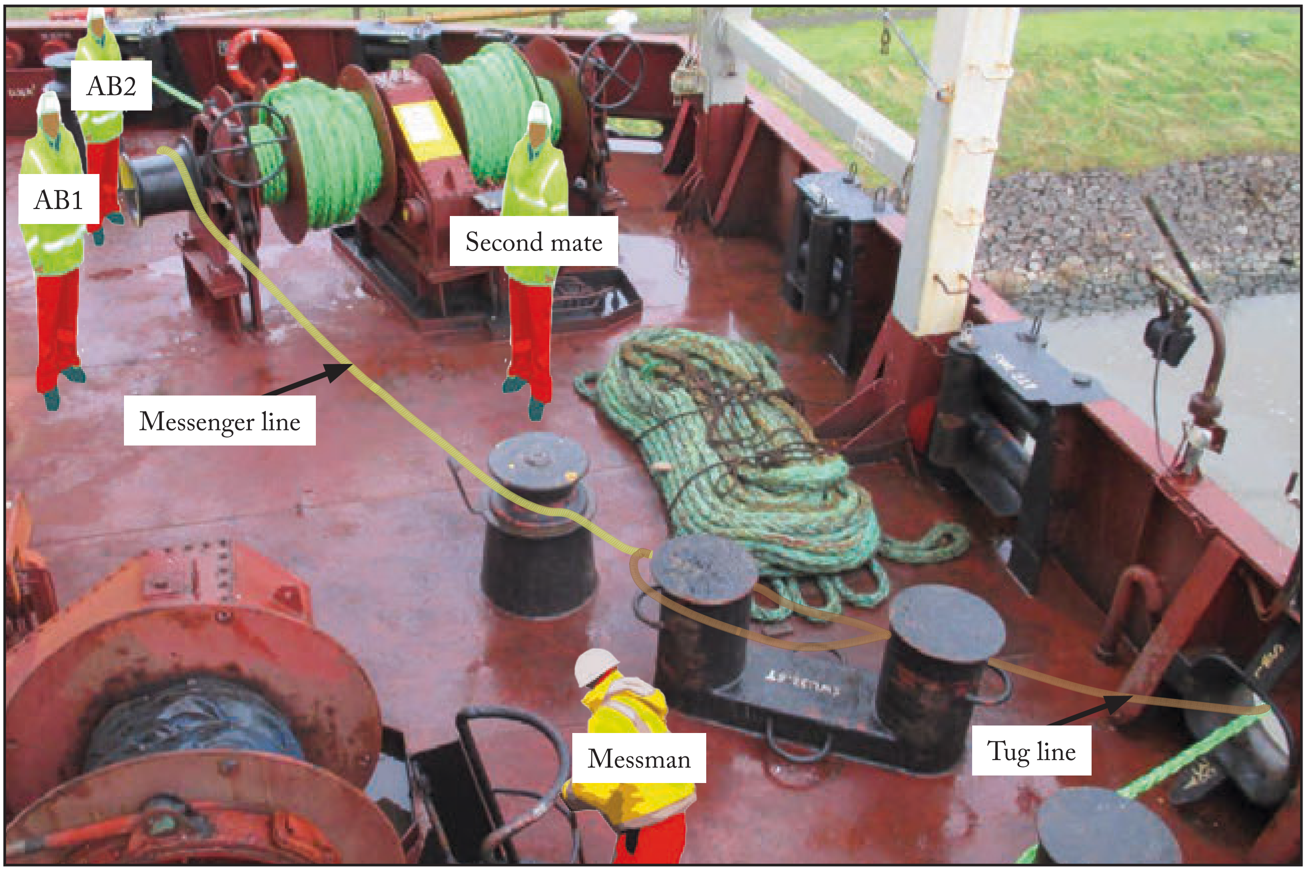



Figure: Locations of the aft mooring team

As the messenger line became slack, the second mate instructed AB1 to remove it from the winch drum and take a turn around the deck bollard to lower the tug line to the tug. As instructed, AB1 removed the turns from the winch drum and began to walk towards the bollard. Almost immediately, and without warning, tension came onto the tug line and the messenger rope snapped tight. As it did so, AB1's left foot became entangled in the coils of the messenger line that were lying on the deck. The AB was dragged along the deck on to a deck roller fairlead, where his left leg became trapped between the roller and its guide. As the weight on the line increased, his foot was severed. Despite the master's quick response in seeking medical assistance, and the rapid response of the shoreside paramedics, the AB's leg could not be saved.

The subsequent safety investigation identified that the tug line had not been stoppered off before the eye was taken off the bollard. Moreover, when the messenger line was taken off the drum the tug continued to heave in the line.

## The Lessons

1. Mooring decks are extremely hazardous places, and seafarers are all too often injured or killed during mooring and towing operations. The highest number of deaths and injuries occur when crew become caught in the bight of a slackened rope or when they are struck by a parted rope. Be aware of your surroundings; never stand on or in the bight of a slackened rope, and avoid snap back zones.

2. A tug's line should be cast off in a controlled manner; in this instance well established seamanship best practice was not followed. In this case a stopper should have been used to take the weight of the tug's line when transferring the messenger rope from the winch drum to the bollard. Had this been done, the tug would not have been able to heave in its line until the tanker crew were ready.

3. The tanker's bridge team and aft mooring party did not communicate its intentions to the tug's crew before attempting to let go its line. Good communications between vessels are imperative when operations such as towing are conducted. They enable a shared situational awareness to develop and errors to be quickly identified and mitigated. In this case clear communication would have prevented the tug crew from heaving in on its line before the mooring team were ready to release it.

4. The second mate did not utilise his team resources effectively. AB2 arrived late at the mooring station, but once there he was not used. Instead, the second mate operated the winch and tasked the messman to assist AB1.

5. During tug operations, the person in charge on the mooring deck should have a full overview of the operation, not only on board his vessel but on the tug as well. This will enable monitoring of the tow line and provide early warning when the operation does not go according to plan. By taking charge of the winch operation the second mate denied himself and the mooring team the necessary oversight, both because of his direct involvement in the operation and also because he was not in a position to monitor the tug.

6. The messman had little experience of working on deck and was not properly qualified to be a member of the tanker's mooring team. Experience underpins the ability to recognise risk and is vital when undertaking potentially high risk tasks such as mooring and towing operations. Experienced hands are far more likely to quickly recognise when accepted mooring practices are not being followed and, through anticipation, take appropriate action to ensure the safety of the mooring team.

# Grounding – What Grounding?

## Narrative

On a drizzly winter's morning, a harbour pilot boarded a small general cargo vessel to take the vessel to its berth. The intended route through the harbour tracked south before turning to the west around a breakwater's end. It was the master's first visit to the port and, although a passage plan had been input to the vessel's ECDIS, the pilot's instructions were followed without question. The pilot was very experienced and navigated confidently by eye, passing conning orders to the chief officer on the helm.

As the vessel approached the breakwater's end, the pilot ordered '*starboard 20*' to turn toward the inner harbour. The resulting swing was much faster than the pilot had anticipated so he ordered '*hard-to-port*'. In response, the chief officer applied port helm, but the rudder angle indicator did not move. The master and the chief officer quickly noticed that the steering had failed, but neither of them informed the pilot.

The vessel was now swinging towards the breakwater's end and the pilot again ordered '*hard-to-port*'. The master then informed the pilot that the rudder was not responding. The pilot ordered the engines to '*full astern*' and an anchor to be let go. He also notified port control of the situation and requested tug assistance.

Meanwhile, the master put the engines astern and ordered the forward mooring party to let go the port anchor. But these actions did not prevent the vessel from grounding on the breakwater footings. The vessel soon refloated and initial soundings indicated that the vessel's ballast tanks had not been penetrated. However, when the vessel was alongside and cargo operations had commenced, water was found in the pipe tunnel. The master initially attributed the water ingress to a previous heavy contact a few days earlier, but when the source of the water ingress was investigated significant damage was found (Figures 1 and 2). It was only then that the master informed the ship's manager of the grounding.

## The Lessons

1. The reporting of accidents or near misses is not usually a comfortable experience. Nevertheless, it is a very important aspect of an established safety culture, and one that warrants encouragement at all levels. Failure to do so could result in valuable lessons being missed and further similar accidents following unnecessarily. It is unfortunate that the 'open reporting' of accidents and near misses is occasionally hindered by a fear of punishment.

2. Critical equipment can fail at any time. When it fails close to dangers, immediate and intuitive action is required if an accident is to be avoided. This is unlikely to be achieved without good system knowledge and regular drills.

3. Reliance on pilots is usually necessary to some degree. They are typically experienced ship-handlers and have local knowledge of the area. However, no matter how experienced and competent a pilot might be, they are not infallible. Monitoring and challenging pilots' actions is not an insult to their competency; it's a sign of effective teamwork and resource management.

Figures 1 and 2

# Nuts About Bolts

## Narrative

The skipper of a workboat was killed when a remotely operated deck crane collapsed while it was being used to slew a 2.2 tonnes load ashore (Figure 1). The load was within the crane's theoretical safe working capacity.

The crane was being remotely operated by the workboat's skipper and crewman when a loud bang was heard and the crane toppled towards the two men. The skipper and the crewman tried to run clear, but the crane landed on top of the skipper, causing fatal injuries.

The crane, which had been fitted on board 6 weeks earlier, had been delivered to the installer complete with its mounting fixtures. The tie bolts, nuts and washers were M24, a size commonly used for the crane type fitted. The installer inspected the crane and its components and fitted the crane to the workboat. The tie bolts were tightened to a torque based on their size and grade of steel. Following installation, the crane was examined and tested. No material defects were identified and a "*Report of Thorough Examination of Loader Crane*" was issued.

The crane collapsed because the threaded section of the nuts on the tie bolts failed under load (Figures 2 and 3). Several factors contributed to the failure:

- No installation guidance was provided with the crane.
- The crane was installed with smaller and fewer tie bolts than intended by its manufacturer.
- The lock nuts were of a lower grade material strength than indicated by their markings.
- The statutory thorough examination and test of the crane following its installation did not identify the inadequacy of the mounting arrangement.

Figure 1: Collapsed crane

Figures 2 and 3: Failed nut and tie bolt

## The Lessons

1. When installing equipment - particularly lifting or load-bearing equipment - always follow the manufacturer's guidance. If there isn't any, request it from the supplier or, if necessary, get it directly from the manufacturer. Also, don't just rely on the bits in the box - check that what has been supplied is correct. If it doesn't look right, it probably isn't right.

2. Fasteners must be fit for purpose, with the material specification of the nut being the same or higher than the stud or bolt. Simply put, if there is going to be a failure during assembly caused by over tightening, then it is preferable for the bolts to snap rather than a thread to strip. The theory is that a bolt in two pieces will be obvious, whilst a stripped thread could go unnoticed. The strength of bolts and studs is indicated by numbers stamped on them. There are ten grades used, the most common are 8.8, 9.8, 10.9 and 12.9. The strength marking on nuts is not so easy to see; it is indicated by a single number (8, 9, 10 or 12) or by a series of "clock face" marks (Figures 4, 5 and 6).

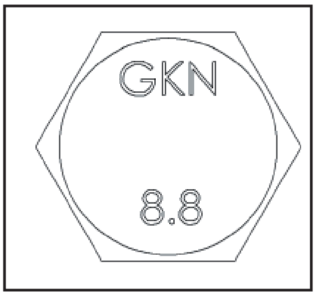


Figure 4: Typical bolt marking

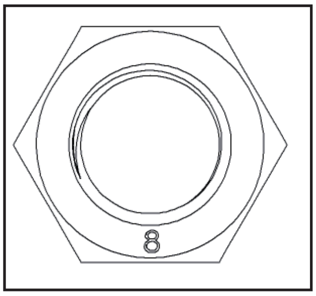


Figure 5: Number stamp on nut

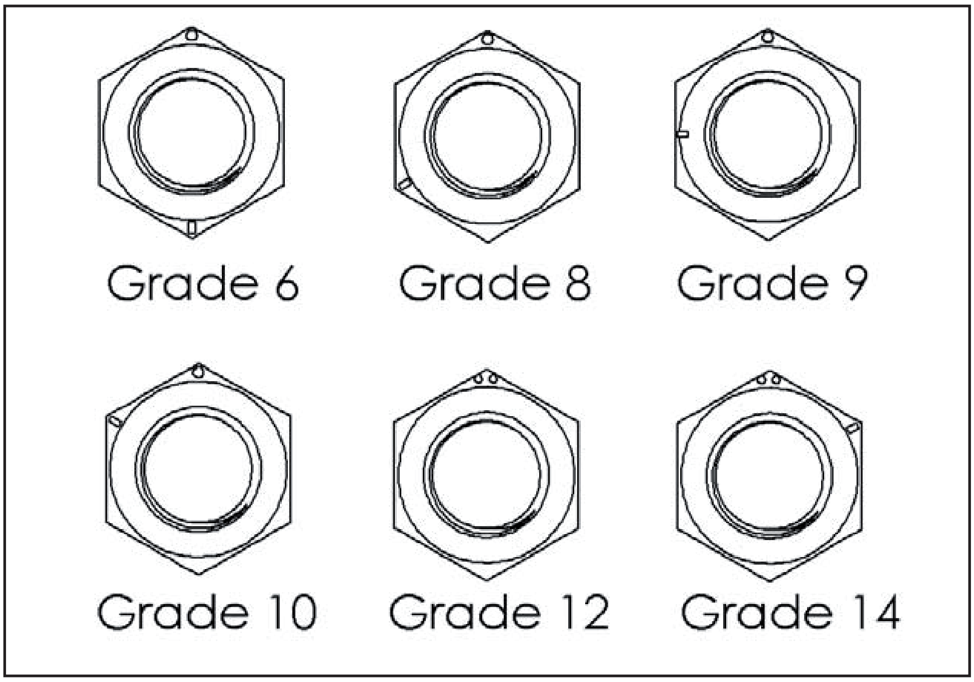


Figure 6: Clock face marking on nuts

3. To be fully effective, testing procedures and visual inspections during thorough examinations must be followed to the letter. Short-cuts and work arounds can easily lead to deficiencies not being identified, and the absence of installation guidance makes it impossible to tell whether a crane has been fitted in accordance with the manufacturer's design intent.

# Part 2 – Fishing Vessels

Throughout my career in the fishing industry, safety has been a constant cause for concern between the industry and the regulators, and I have seen many initiatives and changes to the legal framework, and yet we are still seeing many avoidable accidents plaguing our great industry. With Brexit on our horizon and with optimism high, it is more important than ever to make a real difference to safety and welfare on our vessels.

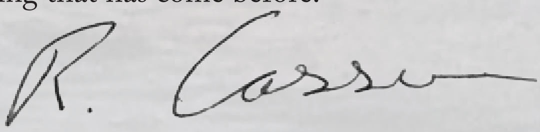
The Marine Accident Investigation Branch is an organisation that in my opinion works on behalf of the owners and crew of fishing vessels, by helping to keep them safe. It is necessary to review when things go wrong and to share that information with others, and publications like this Safety Digest, the full investigations, or the newer summary flyers can all be an intrinsic part of preventing the next accident.

To organisations like the NFFO, where I am the Chairman of their Training Trust, the MAIB occasionally makes recommendations. These can help to keep focus and direction, often driving innovation. An example of this innovation was the recommendation following the loss of a man on the Beryl in 2015. The MAIB recommended the Federations made available to all the boats in the UK a man overboard "dummy". The NFFO worked with a company called Fibrelight to produce a new type of mannequin that uses water to create the weight, and retails at less than £100.00. Without the recommendation and the NFFO addressing the challenge of getting every vessel able to access a mannequin, it likely would not have happened.

Through the years, the relationship between regulation and safety have had a cause and effect relationship, we have seen the introduction of length limits in quota give rise to rule beating vessels and days at sea restrictions putting pressure on vessels to ignore the weather and instead focus on the calendar. Whilst there is no excuse for not being safe, I hope that the future of fisheries legislation, especially as it may all be in our hands soon, shall consider the impact on safety when introducing new laws.

We are heading into a new era of safety and welfare, key legislation that will lead to the biggest reforms on these areas yet. The ILO C188 Work in Fishing Convention will no doubt reshape the landscape of fishing regulations, and hopefully for the better. My colleagues in the NFFO along with the other Federations have, since 2014, been working with the Maritime and Coastguard Agency to ensure that as ILO C188 is introduced it is done in a way that will be practical to implement, and have a greater chance of reducing accidents. In 2018 this Convention will come into force for the UK, and the NFFO along with the Fishing Industry Safety Group have started a project to make a fully auditable Safety Management System available to help all fishing vessels structure their compliance with the new legislation. The NFFO is working with Industry to give every UK vessel a chance to become fully compliant before the laws are implemented, and to do this through the free SafetyFolder.co.uk website.

Reading through this issue's stories I get a sense of déjà vu, the potter caught in a bight, or the skipper/watchkeeper grounding happen far too often. We very much have to focus on prevention at the root cause, rather than reacting after the effect to have any real chance of improvement, and for that reason, the requirements of the ILO C188 to have a system of safety management, to reduce fatigue and to be medically fit for the job may stand a greater chance to make a difference than anything that has come before.



**ROBERT CASSON**

Robert's fishing career began in 1963 when he worked out of North Shields on board trawlers working in Icelandic waters. Between 1967 and 1971 he worked out of North Shields on North Sea grounds and he obtained his skipper's ticket in 1968. He became skipper/owner of an inshore fishing vessel in 1971 and between 1976 and 2003 was skipper/owner of MFV Nimrod, a 60ft North Sea trawler.

He has been Chairman of the North Shields Fishermen's Association, Director of the Anglo Scottish Fish Producers Organisation, Chairman of the National Federation of Fishermen's Organisation, President of the NFFO and Deputy Launch Authoriser for Cullercoats Lifeboat. He is now the Chairman of the NFFO trust fund.

# A Bump in the Night…

## Narrative

On a midsummer's evening, the 5-man crew of a 17m scalloper landed their catch, readied the vessel for departure and visited a public house for a meal and a few beers before going back on board and resting. Early the following morning, the vessel departed port bound for fishing grounds. It was a fine day, and soon after sailing the skipper handed the wheelhouse watch over to a deckhand who had been on the vessel for a few years and held an under 16.5m skippers' ticket. Before turning in, the skipper instructed the watchkeeper to follow a route on the electronic plotter, which would take the vessel through the centre of a narrow sound.

The watchkeeper settled into the comfortable wheelhouse chair and occasionally monitored the vessel's progress on the plotter. A couple of hours later, the scalloper was to the starboard of the route on the plotter. As the vessel approached the entrance to the sound at 9 knots, it suddenly veered off course and grounded on a small island. Although the scalloper did not appear to be taking water, the tide was falling and it soon took on a starboard list. Attempts to refloat it were unsuccessful, so with the list worsening the crew abandoned into a liferaft (Figure 1). They were soon picked up by a lifeboat.

A short time later, the scalloper began to flood and it eventually settled on its starboard side in shallow water (Figure 2). The vessel was later salvaged, but the cost of repair meant that it did not return to service. The cause of the scalloper's sudden deviation from the planned heading is not known.

Figure 1: Crew abandoning vessel into a liferaft

Figure 2: The partially submerged vessel

## The Lessons

1. Electronic and mechanical failures will always happen. The trick is to be prepared for them. To quickly identify, diagnose and react effectively, wheelhouse watchkeepers must have knowledge and experience of the equipment to make best use of the little time that may be available to take the appropriate actions when an emergency occurs.

2. Navigating with electronic plotters is a common practice. Although convenient, such equipment does not reduce the need to keep a proper lookout and to make best use of lights and buoys whenever possible. Over-reliance on plotters, particularly when close to hazards, is potentially dangerous and, as in this case, expensive!

3. Completing the under 16.5m skippers' ticket or attending bridge watchkeeping courses are ways to demonstrate knowledge and competency. However, experience, skill and having the right attitudes and behaviours cannot be underestimated.

4. Fishermen are used to working long hours and having little sleep. But it's obvious that little sleep and a few beers is not a good idea for watchkeepers. The combination of fatigue, alcohol and a warm wheelhouse all add up to a low level of arousal. Even if you are 'awake' your response time to an emergency or a navigational problem will be slower.

# Stability Matters

## Narrative

It was a fine summer's day and the skipper and deckhand on board a small scallop dredger were hoping for some good fishing. However, during the morning's tows several miles offshore the catch had been disappointing. To add to the skipper's problems, one of the winches used to secure the scallop gear when hauling, had broken.

During the afternoon, contact with the vessel was lost and the vessel did not return back alongside as expected. An EPIRB was carried inside the wheelhouse, but it was not float-free.

A search and rescue operation was started and the body of the deckhand was found floating on the fishing grounds the following morning. He was not wearing a lifejacket. The wreck of the vessel was also located on the seabed.

From the evidence gained from underwater surveys (Figure 1) along with the vessel's salvage (Figure 2) and subsequent stability assessment, it was apparent that it had capsized quickly while the two crew were in the process of emptying the starboard scallop dredges with the port dredges suspended from a gantry block. The scallop dredger's poor initial stability had been worsened by a low fuel level, the suspension of weights from a high point, storing catch on deck and uneven loading initiated by the earlier winch failure.

The vessel had been built as a stern trawler but had been modified for scallop dredging. A high gantry had been fitted to lift the scallop dredges, but no calculations had been required or carried out to assess the use of the gantry on the vessel's stability.

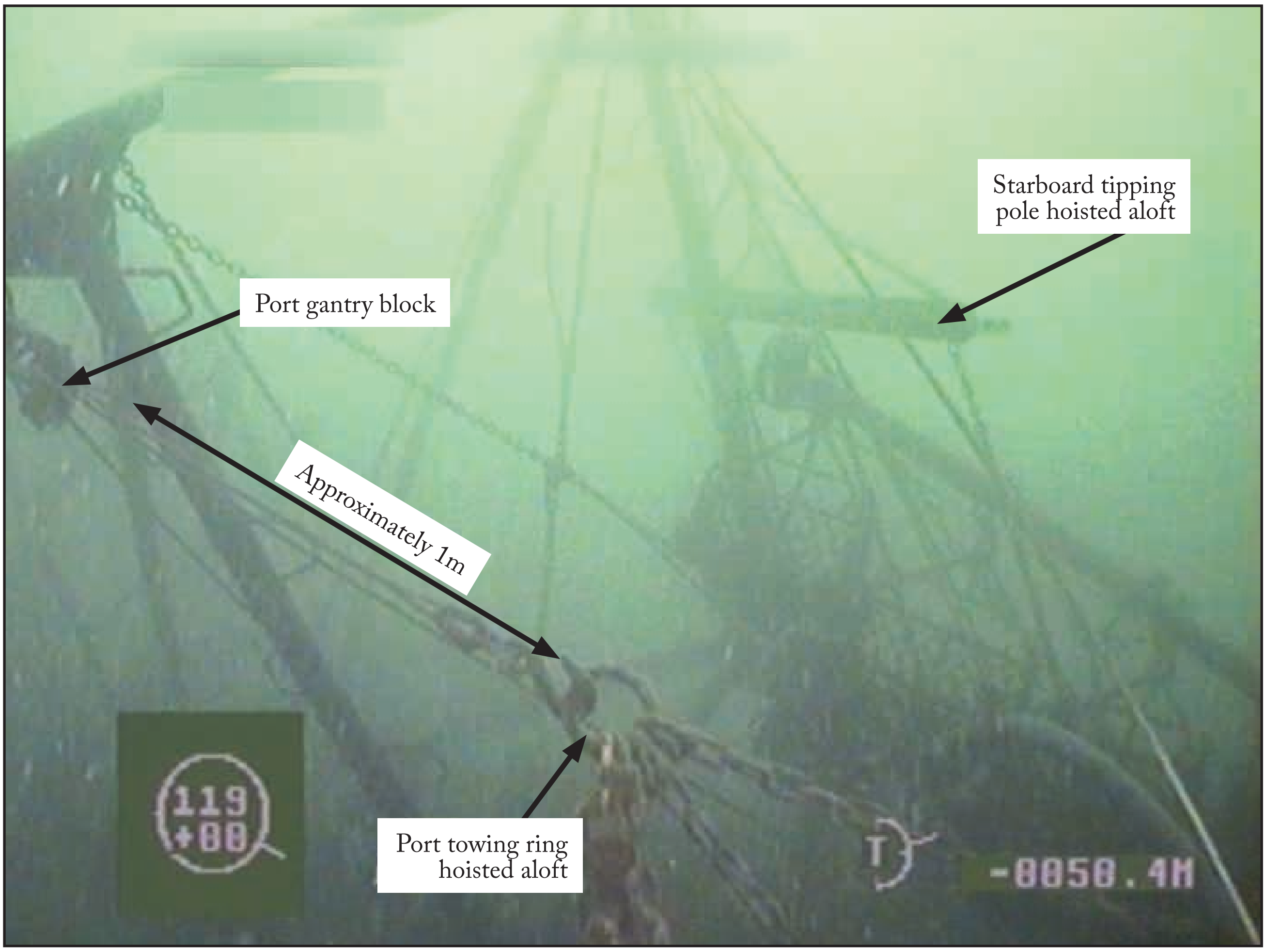



Figure 1: Underwater image of port and starboard scallop gear



Figure 2: The vessel's salvage

## The Lessons

1. Financial pressures and fishing patterns often necessitate a change of fishing method, but substantial alterations can make a vessel unsafe. Changing the height of lifting points and the addition or removal of machinery, equipment and ballast all impact on a vessel's centre of gravity and freeboard, and must be properly considered.

2. Small fishing vessels are not required to meet a stability standard and therefore they must be operated with caution. Lifting heavy weights from high points, fuel and water levels, and catch stowage are among the factors to take into account. The fitting of a Wolfsen Mark will not make a vessel more stable but it will provide owners and skippers with a useful indication of its operating limits.

3. PFDs provide buoyancy, a means of attracting attention and a small amount of thermal protection – but only if worn. When working on deck don't wait for an emergency to put one on - it takes only seconds for a vessel to capsize or for someone to fall overboard. By then, it's too late.

4. If no one knows that you are in trouble, then it's unlikely that you will be rescued. The fitting of a float-free EPIRB alerts shore authorities immediately should a vessel suddenly capsize or sink. The shorter the time in the water, the greater the likelihood of survival.

# Another Tragic Reminder of the Hazards of Potting

## Narrative

Early one morning, a father and son left harbour on their 11.6m potter (Figure 1) to fish for lobster and crab. This routine was followed most days, when the weather permitted. The weather was forecast to deteriorate later in the day so they set off early with the intention of returning before the weather worsened.

The boat was designed to allow self-shooting, with a large opening in the transom through which the baited pots were deployed. Each string worked by the boat contained between 50 and 60 pots. As each string was hauled the catch was removed, the pots re-baited and then stacked three pots high on the port side of the main deck, ready to shoot. Despite the vessel being designed for self-shooting, the normal practice on board required a certain amount of manual intervention by the crewman on deck.

Figure 1: Opening in transom

Once in position, with the boat moving slowly ahead, the end weight was deployed through the transom opening. As the pots were shot away, the third tier of pots was manually lifted down onto the deck by the crewman to prevent the boat's deck becoming damaged as the pots were shot.

Local fishermen saw the vessel working at its usual fishing grounds throughout the morning. However, early in the afternoon the boat was seen grounding on rocks, several miles away, and then foundering. No crew were seen on board or in the vicinity, and a large-scale search and rescue operation was initiated. The father's body was later recovered from the water by a coastguard helicopter 3 miles from where the fishing boat had foundered. He was wearing neither a lifejacket nor other buoyancy aid. The son remains missing.

It is probable that the accident occurred while shooting a fleet of pots earlier in the day. It is also likely that whatever happened, caused the two men to go overboard in quick succession as the boat's engine remained in gear and no alarm was raised.

A likely scenario is that one of the men working on deck became entangled in the back rope as a fleet was being shot. The other then went to his assistance, resulting in both men going overboard.

The boat's pots were hauled by other local fishing boats in the days after the accident. One string of pots recovered from the fishing grounds indicated that an attempt might have been made to cut the back rope on one of the strings of pots (Figure 2).

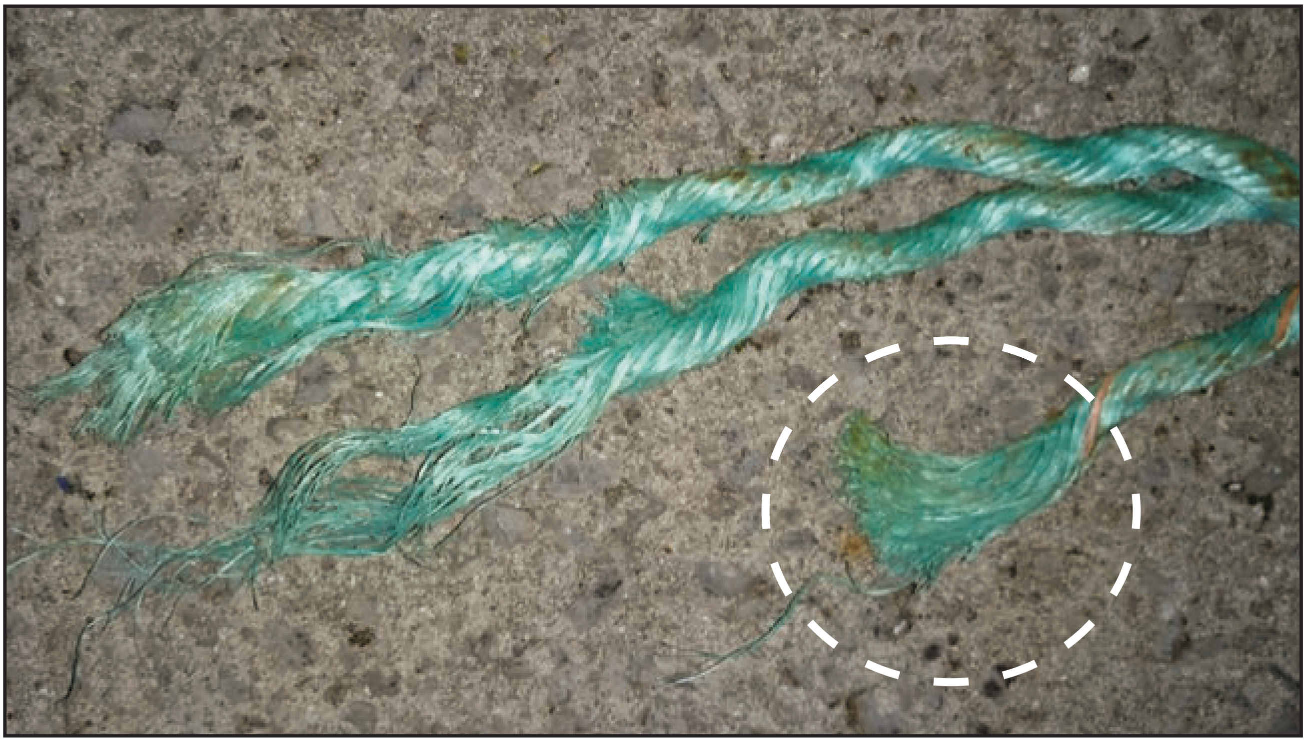


Figure 2: Broken back rope, indication that at least one strand had been cut

## The Lessons

1. The assumed system of work for shooting pots on this boat did not sufficiently separate the crew from the running gear to prevent the accident. Seafish has published a Potting Safety Assessment, which suggests three methods to reduce or eliminate the danger of becoming entangled in the running gear:

    - Rope pounds or divisions to physically separate the crew member from the back rope.

    - Detachable pots using a loop and toggle system, allowing the crew to work the gear in a controlled fashion while still being separated by a barrier from the gear.

    - Self-shooting systems, which do not require manual intervention.

    Whatever system of shooting is employed, crew should ensure that they have a sharp knife to hand and that they are standing in a safe area during shooting operations.

2. Neither crew member wore a PFD, significantly lowering their chances of survival. A PFD keeps a man overboard casualty afloat and can prevent the inhalation of water both during the initial gasp reflex on entering the water, and subsequently. Furthermore, a PFD allows the casualty to remain still, conserving energy and significantly reducing cardiac workload.

3. A personal locator beacon is a very useful additional means of raising the alarm, particularly, as in this case, if no one is left on board and the only other means of raising the alarm remains on the boat.

# A Fatal Bight

## Narrative

Having loaded their small potter with two strings of 30 pots, a skipper and his crewman headed out to sea; conditions were fine and it was only a short transit to the fishing grounds. The pots were newly made up and being shot for the first time. There were also two passengers on board: an adult and a child who had come along to do some recreational fishing after the pots had been shot.

During the operation to shoot the second string of pots, the crewman's leg became entangled in the gear and he was pulled overboard. The skipper realised what had happened, stopped the boat and pulled the crewman back up to the surface using the hauler. The skipper then cut the back rope in an attempt to free the crewman. However, this was unsuccessful and the crewman was dragged back under water by the weight of the pots still in the sea.

Having alerted the coastguard by calling on the VHF radio, the skipper motored the boat back at full speed to pick up the surface marker buoy at the end of the string and started hauling the pots back on board as fast as possible. The last pot emerged from the sea with the crewman still entangled in the gear. The crewman had been under water for about 20 minutes and, despite the efforts of the skipper and the emergency services, could not be revived.

Figure 1: Reconstruction of the deck at the time of the accident showing the hazard associated with loose ropes

## The Lessons

1. Figure 1 is a reconstruction of the boat's deck at the time of the accident and shows the hazard associated with loose ropes on the deck. Every year a number of fishermen are injured or killed as a result of their feet or legs becoming trapped in bights of rope. Most of these accidents could be prevented by safer working practices; in the case of potters, this means finding ways to separate the crew from the ropes.

2. On small potting vessels, space can be very limited on the deck; it is important to think about the loading and management of the strings. In this case and given that the fishing grounds were only a short distance from the harbour, it would have been easy to load and then shoot a single string at a time rather than having to manage the additional risks of having two strings on board at the same time.

3. It is important to keep a sharp knife handy at all times. The crewman was not carrying a knife and there was not one readily available on deck. Had a knife been available, there would probably have been an opportunity for the crewman to be cut free before going overboard.

4. Always wear a PFD when working on an exposed deck. The crewman was not wearing a PFD while shooting the pots. Had he been wearing one, it could have improved his chances of survival; equally, had he been able to cut himself free from the gear, the PFD would have kept him at the surface until rescued.

5. Although not significant in this case, there were some delays in the coastguard identifying the vessel's position. Alerting the coastguard by the fastest means possible will ensure the best help is available in a distress situation. Had the boat's DSC distress button been pressed - an action that takes about 5 seconds - the coastguard would have been alerted immediately to the incident, including the location.

6. It is not appropriate to take passengers to sea during commercial fishing operations. The hazards for visitors, especially children, are significant and potentially difficult to manage.

# Are You Aware of the Risk of Carbon Monoxide?

## Narrative

A scallop dredger had recently been bought by a new owner who was conducting some maintenance at sea. The skipper was using welding gear on deck to repair the scallop gear. The portable generator that was being used to supply power was stowed in the hold with the hatch open.

After he had finished welding, the skipper went into the hold and switched the generator off before heading to the accommodation to have a cup of tea. Once there, he asked the deckhand if he could tidy up in the hold and put everything away.

The deckhand went down into the hold and started to sort out the welding gear. A short time later he felt hot and removed his smock-top. He started to feel dizzy and then passed out in the hold.

The skipper went looking for the deckhand within 15-20 minutes of speaking to him and found him unconscious in the hold. He called the other crewman, and the skipper went into the space and tied a rope around the deckhand. The deckhand was then hauled out of the compartment and onto the deck.

The skipper called for an ambulance and proceeded to a nearby dock to meet it. By the time the fishing boat and ambulance crew met, the deckhand was conscious and was able to walk himself to the ambulance. He made a full recovery.

## The Lessons

1. Petrol engines, even if well maintained, will emit high levels of carbon monoxide in their exhaust. Gas cookers, solid fuel stoves and diesel engines will also all generate carbon monoxide. It has roughly the same density as air and is undetectable by smell. The gas is readily absorbed into your bloodstream instead of oxygen, and will eventually lead to death if action is not taken. If you see someone unconscious for no obvious reason, think, could it be carbon monoxide poisoning?

2. Ventilation is the key to preventing the build-up of carbon monoxide. Running a petrol generator inside a confined space will lead to a build-up of carbon monoxide, even if, as in this case, a hatch is open. By all means store a petrol generator in the hold, but only use it on deck in a well-ventilated area.

3. Fitting carbon monoxide detectors will alert you to the presence of the deadly gas. The monitors will alarm at a level low enough to enable an individual to escape. Once in a position of safety in fresh air, steps can be taken to stop the emission of the gas and clear it. Never enter a space where you suspect carbon monoxide is present until you have thoroughly considered the risks and taken adequate precautions.

# Safety First

## Narrative

On a calm moonlit night, a crewman on board a 24m stern trawler was catapulted overboard by a steel wire trawl warp. Although he kept himself afloat in the water for several minutes, his crewmates were unable to recover him before he succumbed and sank out of sight. The crewman's body was never recovered.

Shortly after landing his catch, the trawler's skipper manoeuvred the vessel off the berth and headed for his fishing grounds with his five-man crew on board. The skipper, unhappy with the previous day's catch, wanted to re-mark his steel wire trawl warps so that he could adjust the way the net sat on the seabed. He wanted the job done as quickly as possible so that the crew could go to their bunks and grab a couple of hours' sleep before they started fishing at daybreak.

Once the boat was clear of the harbour entrance and making way towards the fishing grounds, the crew streamed about 220m of the port warp over the vessel's stern into the water. With about 180m of the wire on the seabed, the crew used a length of synthetic rope to create a stopper (Figure 1) and take the strain of the trailing warp. One of the crewmen then released the winch brake and slackened off the trawl warp, while the other crewmen pulled the inboard section of wire onto the deck.

To mark the warps, the crew intended to open up the warp's steel wire strands with a marlin spike and insert short strips of synthetic fibre rope yarns. To give themselves enough room to work, one crew member kneeled inside the bight of the slackened warp while another kneeled opposite him and held the warp down (Figure 2).

Moments later, the rope stopper failed and the trawl warp snapped tight. The warp struck the crew member across his chest and violently hurled him backwards over the side of the boat and into the sea. Although probably injured by the force of the impact, the crewman was alive and treading water astern of the vessel.

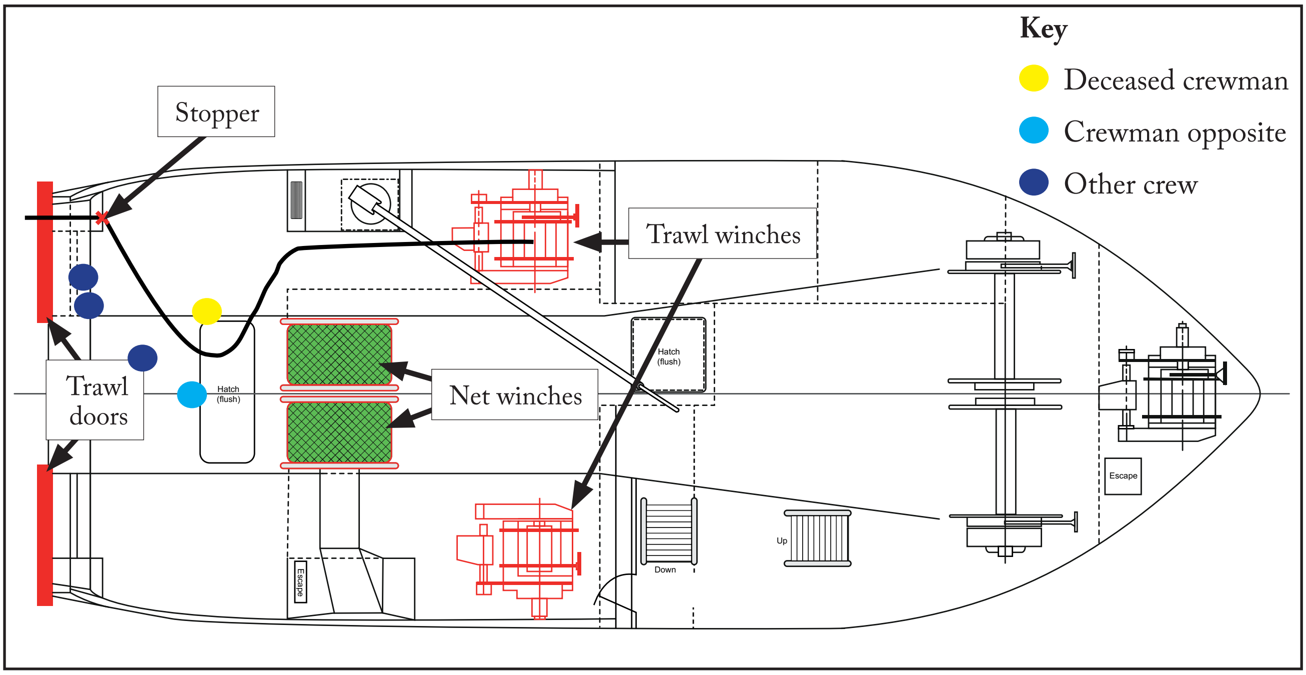



Figure 1: Positions of the deck crew when the stopper failed

The other crewmen alerted the skipper, who immediately stopped and then reversed the boat. The crew monitored the casualty's position in the water and threw two of the vessel's three lifebuoys towards him. After several minutes, the casualty, who was not wearing a PFD, sank out of sight below the surface. The skipper then alerted the coastguard, who initiated a search and rescue operation.

The crew were not practised in manoverboard recovery and the vessel did not carry a dedicated manoverboard recovery device. In addition, none of the crew were wearing PFDs while attempting to mark the trawl warps.

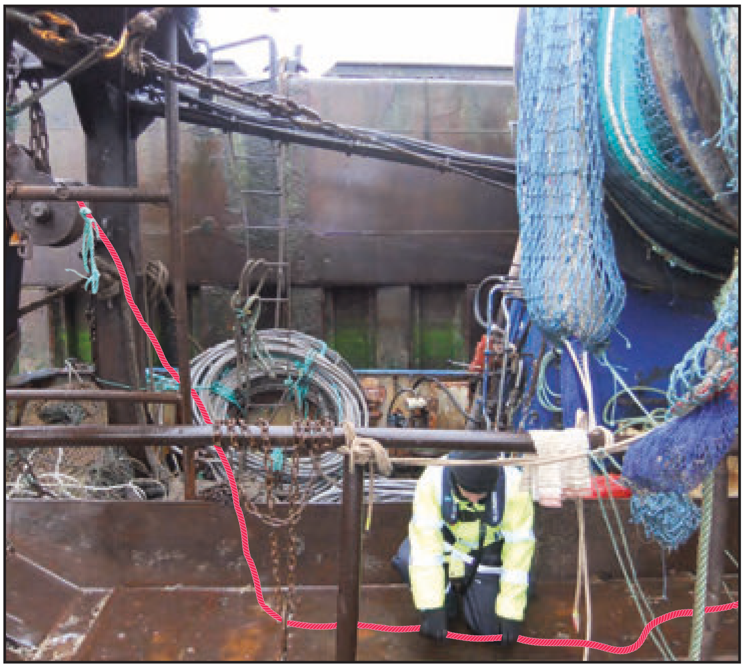


Figure 2: Reconstruction of marking the warp

## The Lessons

1. The importance of wearing a PFD when working on an open deck cannot be overstated. In this case, the weather was good and, had the casualty been wearing a PFD there is every likelihood that he would have been recovered from the water.

2. In accordance with basic seamanship good practice, you should never position yourself in the bight of a rope. Furthermore, you should not use a synthetic rope to stopper a steel wire; instead, a dedicated stoppering device or chain should be used.

3. Practice makes perfect. Emergency preparedness is crucial so that everyone is ready and trained for when things go wrong. Drilling the crew regularly will dramatically improve the chances of a successful outcome if someone goes overboard.

4. The method used to mark the trawl warps was unnecessarily hazardous and could have been achieved in a much safer manner while the vessel was in port.

5. The hazards associated with this particular task had not been thought through before it was started. There was no documented assessment of risks for the task attempted, even though it had been performed on board several times previously. A well-considered risk assessment should have identified the hazards of kneeling in the bight of the slackened rope (stand in the safe area), the failure of the stopper (in this case, use a chain and not rope) and falling overboard (wear a lifejacket). Risk assessments need not be complicated, nor difficult to perform. Simply by discussion among the crew, hazards in a task can be identified, highlighted in the consciousness of staff, and then guarded against while working.

# Don't Lose a Hand Through Inexperience

## Narrative

An 18 year old deckhand on a scallop dredger went to assist the skipper, who had been tipping the vessel's starboard dredges single handed. They had been fishing all day and had been forced to recover the dredges early due to the combination of worsening weather and the dredges snagging on the seabed. The young deckhand had completed tipping the port side dredges with another crew member and could see that the skipper, who was on his first trip aboard the vessel, was struggling.

The dredges were tipped using the whipping drums on the trawl winch. The crew would wind 1.5 to 2 turns of the tipping rope around the whipping drums (see figure) and control the tension from their position at the dredges. Unknown to the new skipper, the young deckhand had not been trained in the use of the whipping drums, having merely observed others working them from a distance.

The young deckhand applied another full turn onto the whipping drum, making a total of around 3.3 turns, and the rope immediately began to lift the dredge without him applying any tension. In an attempt to stop the dredge from being lifted too high, the young deckhand placed his gloved hand against the rope on the drum, pushing against the direction of rotation. His glove and hand became trapped between the rope and the drum, causing them to be drawn in and around the drum.

The skipper had his back to the winch, but saw the dredge bar being lifted towards the derrick head, and looked around. At the same time, the other crew member heard a shout and ran to the winch to stop it. Unfortunately, the injuries sustained by the young deckhand led to him losing his hand.

Starboard whipping drum with 1.5 turns of rope

## The Lessons

1. Following the accident, the whipping drums on this boat were modified to be used as captive drums, removing the dangers associated with whipping drums. Have you considered safer options on your boat?

2. This boat was not required to be fitted with emergency stops for its winches. Why wait until you are required to fit stops? Be proactive and fit them now, before you or one of your crew loses a hand.

3. The skipper was new to the boat and did not know the limitations in the young deckhand's knowledge. Know the capabilities of your crew and, if in doubt, ask!

# Part 3 – Recreational Craft

Whenever reading the cases published in the MAIB Safety Digest Recreational Craft section I am always left with a feeling of 'there but for the grace of God go I'. Many incidents are caused by minor errors that could have been made by any of us. Others feature a compounding cascade of coincidences or bad luck; it is rare that a single overwhelming mistake is the cause of a disaster.

Of the cases presented in this issue, the unfortunate collision with a ro-ro ferry in fog is a classic example of a series of occurrences that coalesce into a predicament. I know many sailors who navigate by apps on a tablet; I have used such apps as an extra source of reassurance but do not trust them as a sole source of positioning. The non-functioning of a navigation light is a maintenance issue, but the failure to sound a fog horn or use radar was human error. These four factors combine to cause increased risk; in most instances, there would not be a ro-ro ferry passing at the critical time. Unfortunately, on this occasion there was.

I suspect few regular recreational boaters bother to give a safety briefing before each trip. I certainly do not when aboard our own yacht with my wife; we assume we know it all already, though Carol would probably contradict me. Our sailing club is consistent at briefing crew well at the start of a charter – although the departure might be slightly delayed as a result, the benefit of a proper briefing commanding full attention is in no doubt. Whether the crew then take note of and follow the advice given is up to them. Unsympathetic advocates of the process of 'Natural Selection' and 'The Darwin Awards' might shrug their shoulders at the inevitability of some members of humanity's stupidity, but on a boat the skipper is responsible for the actions of his crew and should strive to ensure that safety procedures are followed. The tragic death of the 32-year old swimmer who ignored safety advice and got into trouble is a typical example. The skipper did the right thing and called for help, though the swimmer's decisions had exposed himself to danger that proved fatal despite extensive involvement of the emergency services.

Risk assessment and disaster planning are items low on many sailors' priorities, though we all perform these processes regularly without necessarily naming them as such. The skipper of a yacht proceeding along a lee shore should consider their actions in case of engine or rig failure. Thoughts of the location of the nearest safe shelter, assessment of anchoring depths and the physical readiness of the anchor all should swim around in our subconscious 'what if' layer of mental process. We don't recognise them as actual risk assessment in the same formal way that the master of the holed superyacht had done, but the consideration of preparations to be made is much the same. The master's instructions and preparedness undoubtedly saved the yacht. The crew knew what the risks were, where the damage control equipment was, and how to use it.

Some might read the MAIB Safety Digest as a disaster log and become fearful ever to put to sea, but as recreational boaters we have to make sure that we get the correct balance between safety and enjoyment. One hundred years ago few of the safety systems we have today existed. Inflatable lifejackets had not been invented – cork was the common flotation device. Whilst lighthouses guarded our shores, many of the navigational buoys we enjoy today were absent. GPS was a twinkle in its inventor's eye, and even radio was in its infancy. We could say that sailing was a much more dangerous activity then, but its enthusiasts still relished going to sea and obviously accepted the risks. We should never make danger a reason not to push or enjoy ourselves, though we should act responsibly and ensure that we have taken every reasonable step to minimise the potential for mishaps. Most of our greatest achievements throughout history have involved considerable hazards – climbing Everest, the first flight, landing on the moon – but without the positive attitudes of those adventurers who achieved their objectives they might never have happened. So enjoy yourself, push yourself, and meet danger on its own terms by examining it closely, recognising it, and take steps to minimise it. Don't let these cases deter you from your sport, but take note of them and analyse their lessons and relevance to you.

Many professions and institutions use Significant Event Analysis to review issues that arise from their spheres of work. The lessons learnt in my own medical practice can be used to uncover loopholes in procedures and to prevent similar issues affecting other patients. The MAIB reports act as the Marine Industry's Significant Event presentations. It is vital that we should all read them, learn from them, and take any relevant actions or improvements that can be unveiled from the information presented.

Jonty Pearce

**JONTY PEARCE**

As a 59-year old newly retired GP who lives nearly as far as possible from the sea, I am looking forwards to spending more time aboard my own Pembrokeshire based yacht. In addition to being a boat owner, I am ex-commodore of The Penguin Cruising Club, and have dabbled in yachting journalism (largely to escape the strains of the NHS) as a contributor to Yachting Monthly for the last five years. I have written Yachting Monthly's website blog for the last 2 years, and my wife Carol and I contributed to the Cruising Association's MOB seminar following our practical 'Expert on Board' YM article 'How an 8st woman recovers a 20st man'. We have given several lectures to sailing clubs on the subject as a result. My main sailing interest is safe coastal cruising aboard our own as well as chartered yachts.

# Are You Sitting Safely?

## Narrative

Two passenger carrying RIBs were proceeding in parallel on a commercial trip to an offshore island. The skippers of both RIBs then increased speed and commenced a power turn away from each other with the intention of passing each other in the course of completing a round turn.

However, as the RIBs turned towards each other, it became apparent that they were in danger of colliding. Although both skippers acted quickly to reduce the speed of their respective vessels and so lessen the impact, they were unable to prevent a collision.

A passenger who was sitting on an inflatable tube of one of the RIBs was crushed between the helm console of the RIB she was sitting on and the bow of the colliding RIB. She sustained serious resulting injuries.

One of the skippers immediately informed the coastguard of the accident by VHF radio, advised that the RIBs would be returning to harbour, and requested the coastguard to arrange for an ambulance. A coastguard team met the vessels on arrival and, following initial treatment by attending paramedics, the injured passenger was transported to hospital.

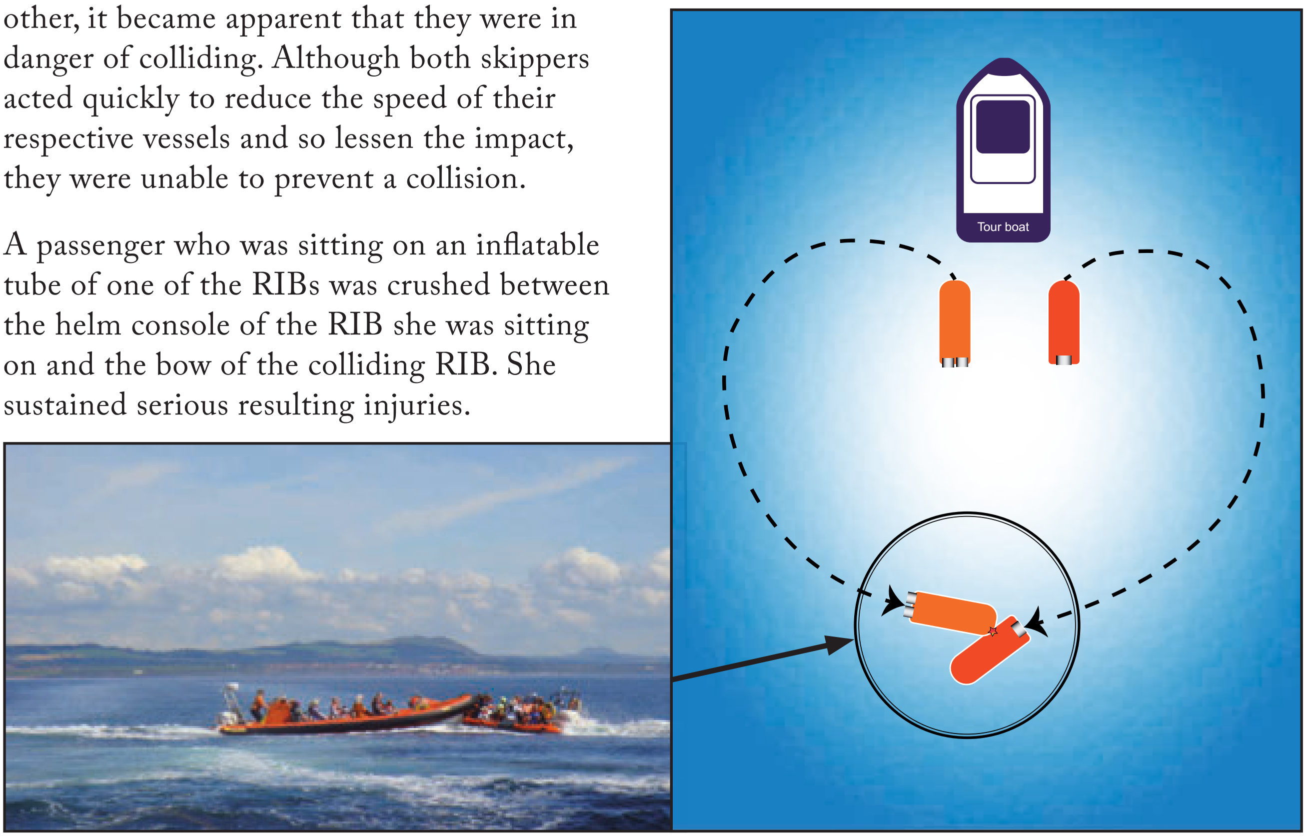



Figure 1: Power turn manoeuvre and collision


Figure 2: RIB's sitting arrangement showing location of injured passenger

## The Lessons

1. As the RIBs exited their respective turns at close range, the skippers had insufficient time in which to react and prevent a collision (Figure 1).

   The skippers had decided to incorporate a level of excitement into the trips when the two RIBs were operating together. The power turn manoeuvre had been carried out successfully on several previous occasions, but it had not been formally risk assessed and no thought had been given as to what to do if a potential collision situation developed.

   Interaction with other vessels brings additional risks that need to be proactively assessed and, where necessary, addressed to ensure that an adequate level of safety is maintained. Without conducting a formal risk assessment, the additional risks associated with the power turn manoeuvre had not been recognised.

2. While her injuries would no doubt have been less severe had she been sitting elsewhere on the RIB's inflatable tubes, the injured passenger could have suffered even more severe injuries had the colliding RIB's speed not been substantially reduced before impact (Figure 2).

3. Passengers sitting on the inflatable tubes of a RIB and not on suitable inboard seating have an increased risk of falling overboard, are at significant risk of musculoskeletal injuries as a result of inappropriate posture and vessel motion, and are more exposed to serious injury in the event of a collision.

   Is the seating provided on your RIB fit for purpose? Are passengers forced to sit on the inflatable tubes?

4. Recognising that the passenger was probably seriously injured, the skippers decided that the quickest means to get her to hospital was to return to harbour. They made no request to the coastguard for external help at the scene. A lifeboat and rescue helicopter were available and could have been tasked by the coastguard to provide assistance if required.

   In this case, the skippers' decision to transport the injured passenger to shore by RIB proved to be the most expedient option. However, the outcome might have been different had the RIBs been delayed in returning to harbour as a result of unforeseen circumstances.

   Both skippers were first-aid trained. However, internal injuries are hard to diagnose without specialist medical expertise. Unless the extent of an injury is clear and can be competently addressed by those present, appropriate medical assistance should be sought immediately.

5. Although it in no way contributed to the accident, one of the RIB skippers did not have his engine kill cord attached when the RIB departed harbour on the day of the accident.

   The use of a kill cord is fundamental to the safe operation of small planing craft. It is imperative that skippers of passenger carrying RIBs wear a kill cord at all times.

# Listen to Safety Instructions

## Narrative

During a hot summer day, a family of three on holiday in the UK rented a small self-drive motor boat (Figure 1) for a trip on an inland lake. The family, consisting of mother, father and 32-year old son were shown to their boat and given a safety briefing, a safety card and buoyancy aids.

The boat was approximately 3 months old, fully serviceable and fitted with the required safety equipment for its area of operation. Safety placards instructing customers to stay on board, and warning them not to swim, were permanently fitted to the boat's structure and were in full view (Figure 2).

At approximately 1345 the boat left the pier and, a short time later the son decided, against his parents' advice, to go for a swim. He removed his buoyancy aid, stripped off to his underwear and jumped from the boat into the lake. After a short swim he returned to the boat and attempted to climb back on board. The distance between the waterline and the top of the boat's hull was 58cms, which was too high to enable the swimmer to climb back on board, and he soon tired.

At about 1400, the father called the boat hire company's duty manager and told him that his son was in difficulty in the water and could not get back on to the boat. The duty manager alerted the company's safety boat crew, who proceeded immediately to the scene, and relayed the alert to other boat users in the area.

In the meantime, the son decided to swim for the shore and, although he made it, he collapsed as he attempted to climb out of the water. He was given immediate first-aid by lake wardens, and the emergency services were called to attend. The casualty was subsequently evacuated by helicopter to hospital, but never recovered.


Figure 1: Small self-drive motor boats


Figure 2: Safety placard

## The Lessons

The dangers of entering the water from leisure craft should never be underestimated no matter how benign and inviting the conditions might seem.

1. In this case, the safety instructions were clear but were ignored. Safety instructions and safety equipment are provided for good reason and are based on the hazards associated with an activity. Follow the rules and you should enjoy a safe and rewarding experience on the water; ignore them and you will expose yourself and others to dangers that you might not fully appreciate.

2. Buoyancy aids and lifejackets are designed to help save lives, and should always be worn if there is a chance of falling in water. In this case, to deliberately remove it against all advice, in order to go for a swim, was very foolish.

3. It is important to appreciate the risks associated with entering and swimming in cold water. Sudden immersion in cold water can induce shock and cause breathing and pulmonary problems. Once in the water, cold temperatures can very quickly impair muscle operation and strength, and therefore reduce a person's ability to keep their head above water. The lake temperature at the time of the accident was 16°C, which is cold enough to induce shock and impair muscle function.

4. The distance from the waterline to the top of the boat's hull proved too high for the 32-year old swimmer to negotiate, even with the assistance of his parents. One should never underestimate how difficult climbing from the water into boats can be without the aid of a specially designed swimming ladder.

5. Having failed to climb back into the hire boat, the son decided to swim ashore. He must have thought that this was well within his capabilities because he did not take the opportunity to ask for his buoyancy aid before setting off. Distances in open waters can be difficult to estimate visually from boats or while swimming, and the effects of local currents should never be underestimated.

# Bunged Up

## Narrative

The crew of a large luxury yacht were completing maintenance of the hull following a 20-year special survey in preparation for the forthcoming season. The work involved cleaning and de-scaling the engine room bilges before applying anti-corrosion treatment. As the work was being conducted below the yacht's waterline, the master had instructed the crew to have damage control equipment (Figure 1) ready in case the worst should happen.

The last area of the hull that required maintenance was an area of the hull plating between the main engines (Figure 2). This part of the hull was not accessible when the yacht was operational and was prone to corrosion as it was generally damp. Working from within the bilges, the crew set about descaling the area with a needle gun.

The descaling was going well until the needle gun suddenly punched straight through the hull plating. As the hole was below the waterline, water started flooding quickly into the engine room bilge. The crew immediately used a bung from the damage control equipment to plug the hole, and secured it in place with resin (Figure 3). This initial fix was later replaced by a tapered bung applied by a diver from outside the hole. The tapered plug was secured in place by resin on both sides of the hull plating.

The motor yacht was later lifted out of the water for permanent repair.

Figure 1: Damage control equipment

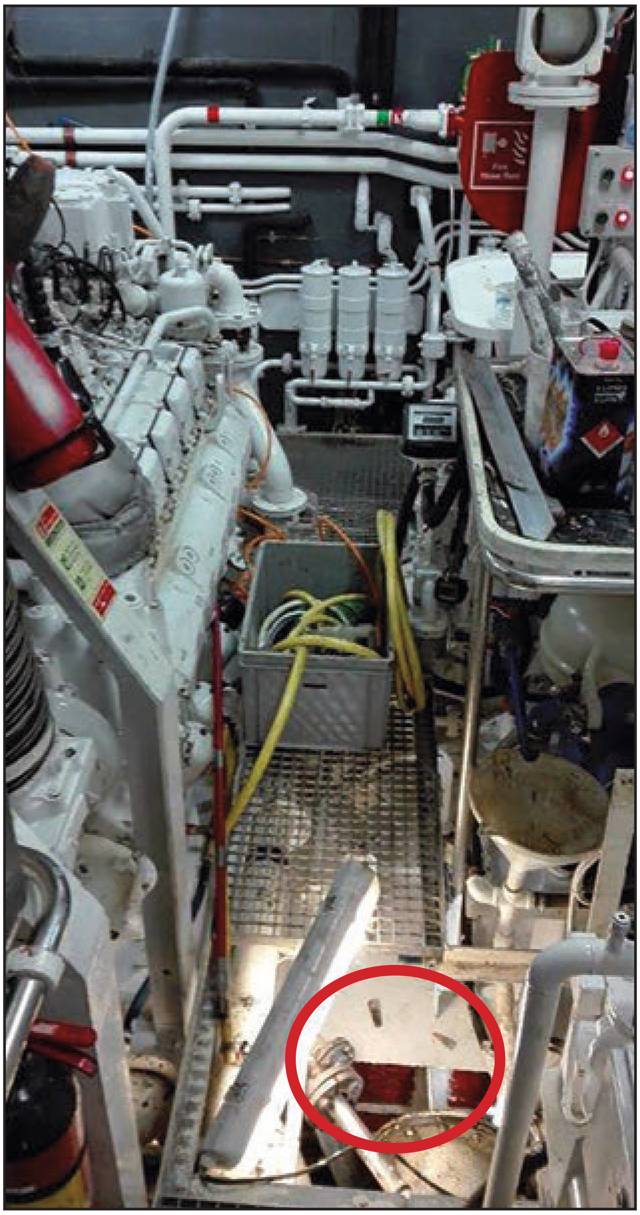


Figure 2: Location of works

Figure 3: Bung in place

## The Lessons

1. The master's risk assessment of the task had identified the potential for flooding and he had mitigated this through the readying of damage control equipment. Without this preparation, the crew would not have been able to take such effective prompt action and the yacht might have been lost. Careful planning clearly brings its rewards.

2. The hull of any vessel may be a point of failure if not adequately maintained. Difficult to reach locations are sometimes neglected due to their inaccessibility and are prone to corrosion if not properly maintained. Don't rely solely on surveys to tell you about the condition of your hull; you will know best where the likely weak points are.

3. The crew's training and understanding of what needed to be done, and the way to achieve it, are clear from the successful outcome in this case. Training can be seen as an unnecessary burden, but this case demonstrates the value of thorough and realistic training experience when facing an actual situation.

# Ships? I See No Ships

## Narrative

Fog. It's a challenging situation for any mariner, but is especially dangerous if one underestimates its effect.

Just after sunrise on a summer's day, a privately-owned motor launch departed its berth for a trip upriver. On board were the skipper, who was also the owner of the launch, and one crewman. Both were wearing PFDs. There was dense fog in the area and visibility was reduced on the river to as low as 100m in places. However, the skipper worked on the river and was confident in his ability to navigate in the fog. He also expected the fog to lift as the sun rose.

The launch was equipped with a storable mast which, when stowed, allowed the launch to pass under low bridges. For this trip the mast remained stowed, which meant that the radar could not be used as the scanner was on the mast. The launch's starboard sidelight was illuminated but the port sidelight was not working. The skipper had opened the sliding coach roof and was steering the launch with his head through the coach roof. Despite the fog, no sound signal was being made.

The two men had intended to navigate using an app on a tablet, but the app stopped working when the launch passed out of the Wi-Fi coverage. The skipper was confident that once they located a buoy he would be able to safely navigate to their destination. The launch continued to head through the fog and, unbeknown to the men, into the main shipping channel.

In the main shipping channel, there was a ro-ro ferry proceeding at a speed of about 14 knots. On its bridge were the master, chief officer and a lookout, all unaware that the motor launch was in the main channel. The ferry's master thought he could see a small intermittent target forward of his vessel's starboard beam. Following a discussion with the chief officer, who did not observe the target, the master adjusted the ferry's course 5° to port and sounded the fog horn twice in short succession. Thinking that the target might have been a false echo, the master returned the ferry to its original course.

Seconds later, the launch's skipper saw the ferry's bow looming above him. He attempted to manoeuvre away, but saw that a collision was inevitable, and shouted a warning to the crewman. The ferry's port bow struck the launch, seriously damaging the structure and hull. The bridge team were unaware of the collision and the ferry continued its voyage.

The skipper saw that the launch was badly damaged and foundering bow-first. He called a "Mayday" on his VHF radio and then he and the crewman set about getting the liferaft ready. As the launch continued to sink, a local pilot vessel rescued the skipper and crewman. The launch sank about 30 minutes after the collision.

## The Lessons

1. Changes to the environment cannot be controlled but should prompt a review of the voyage plan to ensure that it is still fit for purpose. If it is not, then it must be altered so that the challenges presented can be dealt with safely. If this is not possible then the voyage must be delayed.

2. Navigation in fog must be done in accordance with the COLREGS. The skipper's decision to proceed without using his radar and with no means of navigation was based on his extensive local knowledge. However, it was the wrong decision and it is fortunate that it was only the launch that was lost in the subsequent accident.

3. Your primary means of being detected at sea is by displaying the correct lights and making the required sound signals. These cannot be considered optional, especially in restricted visibility.

4. The ferry's master was sufficiently concerned to make a minor alteration of course. Had he made a significant alteration, which would have been apparent to other vessels, the accident might have been avoided.

# APPENDIX A

| INVESTIGATIONS STARTED IN THE PERIOD 1/03/17 TO 31/08/17 | | | | | |
|---|---|---|---|---|---|
| **Date of Occurrence** | **Name of Vessel** | **Type of Vessel** | **Flag** | **Size** | **Type of Occurrence** |
| 03/03/2017 | *Ocean Way* (LK207) | Fishing vessel \| Stern trawler | UK | 268 gt | Flooding \| Foundering |
| 04/05/2017 | *CMA CGM Centaurus* | Cargo ship \| Solid cargo \| Container ship | UK | 13,1332 gt | Contact |
| 10/06/2017 | *Ocean Prefect* | Cargo ship \| Solid cargo \| Bulk carrier | UK | 29323 gt | Grounding |
| 01/07/2017 | *Huayang Endeavour/*<br>*Seafrontier* | Cargo ship \| Solid cargo \| Bulk carrier<br>Cargo ship \| liquid cargo \| Oil tanker | China<br>China | 30241 gt<br>41605 gt | Collision |
| 17/07/2017<br>08/06/2016 | *Red Eagle*[1]<br>*Eddystone* | Passenger ship \| Passenger and ro-ro cargo<br>Cargo ship \| Solid cargo \| Ro-ro cargo | UK<br>UK | 4075 gt<br>23235 gt | Loss of control \| loss of containment |
| 02/07/2017 | F4 Powerboat<br>F4 Powerboat | Recreational craft \| Other craft<br>Recreational craft \| Other craft | -<br>- | 0.35 gt<br>0.35 gt | Collision |
| 06/08/2017 | *James II/*<br>*Vertrouwen* (DS11) | Recreational craft \| Motorboat<br>Fishing vessel \| Trawler \| Beam trawler | UK<br>UK | 0.56 gt<br>144.50 gt | Collision<br>(3 fatalities) |

[1] 2 separate incidents being investigated concurrently by a single investigation team.

# Reports issued in 2017

***Johanna C***
Fatal accident during cargo operations on board a UK registered cargo vessel at Songkhla, Thailand on 11 May 2016
Report 1/2017 Published 12 January

***Toby Wallace***
Fatal man overboard from an ocean rowing boat in the North Atlantic Ocean on 14 February 2016
Report 2/2017 Published 1 February

***City of Rotterdam/Primula Seaways***
Collision between the pure car carrier *City of Rotterdam* and the ro-ro freight ferry *Primula Seaways* on the River Humber on 3 December 2015
Report 3/2017 Published 8 February

***Petunia Seaways/Peggotty***
Collision between the ro-ro freight ferry *Petunia Seaways* and historic motor launch *Peggotty* on the River Humber on 19 May 2016
Report 4/2017 Published 8 February

***King Challenger***
Fatal man overboard from a scallop dredger off Scalloway, Shetland Islands on 23 June 2016
Report 5/2017 Published 2 March

***Uriah Heep***
Passenger ferry made contact with Hythe Pier, near Southampton, England on 13 May 2016
Report 6/2017 Published 6 April

***CV21***
Two fatal accidents on board a UK registered yacht 122nm west of Porto, Portugal on 4 September 2015 and mid-Pacific Ocean on 1 April 2016
Report 7/2017 Published 12 April

***Pauline Mary***
Fatal man overboard from a fishing vessel, east of Hartlepool on 2 September 2016
Report 8/2017 Published 4 May

***Love for Lydia***
Carbon monoxide poisoning on board a motor cruiser on Wroxham Broad, United Kingdom between 7 and 9 June 2016, resulting in two fatalities
Report 9/2017 Published 11 May

***Osprey/Osprey II***
Collision between RIBs resulting in serious injuries to one passenger, Firth of Forth, Scotland on 19 July 2016
Report 10/2017 Published 18 May

***Royal Iris of the Mersey***
Grounding of a passenger ferry on the Mersey River, UK on 10 July 2016
Report 11/2017 Published 25 May

***Ardent II***
Fire on board a fishing vessel while alongside in Port Henry Basin, Peterhead on 16 August 2017
Report 12/2017 Published 14 June

***Zarga***
Failure of a mooring line on board an LNG carrier while alongside the South Hook Liquefied Natural Gas terminal, Milford Haven, resulting in serious injury to an officer on 2 March 2015
Report 13/2017 Published 15 June

***Surprise***
Grounding and evacuation of a domestic passenger vessel at Western Rocks, Isles of Scilly on 15 May 2016
Report 14/2017 Published 29 June

***Sea Harvester***
Serious injury to a deckhand on a fishing vessel while in Firth of Clyde, Scotland on 3 August 2016
Report 15/2017 Published 6 July

***Domingue* and *CMA CGM Simba***
Capsize of the tug *Domingue* while assisting the container ship *CMA CGM Simba*, resulting in two fatalities in Tulear, Madagascar on 20 September 2016
Report 16/2017 Published 20 September

***Louisa***
Foundering of a fishing vessel while at anchor off the Isle of Mingulay in the Outer Hebrides on 9 April 2016, resulting in three fatalities
Report 17/2017 Published 27 July

***Vasquez***
Fatal CO poisoning on board a motor cruiser while moored at Cardiff Yacht Club on 12 November 2016
Report 18/2017 Published 10 August

# Safety Bulletins issued during the period 01/03/17 to 31/08/17

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

## SAFETY BULLETIN

SB1/2017

June 2017

**Extracts from**
**The United Kingdom**
**Merchant Shipping**
**(Accident Reporting and Investigation) Regulations 2012**

**Regulation 5:**
"The sole objective of a safety investigation into an accident under these Regulations shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

**Regulation 16(1):**
"The Chief Inspector may at any time make recommendations as to how future accidents may be prevented."

**Press Enquiries:**
**01932 440015**

**Out of hours:**
**020 7944 4292**

**Public Enquiries:**
**0300 330 3000**

**NOTE**

This bulletin is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.



All bulletins can be found on our website:
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**Auxiliary boiler explosion**

**on board the container ship**

***Manhattan Bridge***

**at Felixstowe container terminal, England**

**resulting in one fatality and one serious injury**

**on 19 January 2017**

Image courtesy of Ron van de Velde

**Figure 1:** *Manhattan Bridge*

## MAIB SAFETY BULLETIN 1/2017

This document, containing safety lessons, has been produced for marine safety purposes only, on the basis of information available to date.

*The Merchant Shipping (Accident Reporting and Investigation) Regulations 2012* provide for the Chief Inspector of Marine Accidents to make recommendations at any time during the course of an investigation if, in his opinion, it is necessary or desirable to do so.

The Marine Accident Investigation Branch is assisting the Japan Transport Safety Board (JTSB) in carrying out an investigation into the auxiliary boiler explosion on board *Manhattan Bridge*, resulting in one fatality and one serious injury.

The JTSB will publish a full report on completion of the investigation.

**Steve Clinch**
**Chief Inspector of Marine Accidents**

NOTE

This bulletin is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall not be admissible in any judicial proceedings whose purpose, or one of whose purposes, is to apportion liability or blame.

This bulletin is also available on our website: www.gov.uk/maib

Press Enquiries: 01932 440015; Out of hours: 020 7944 4292

Public Enquiries: 0300 330 3000

## BACKGROUND

At about 2304 on 19 January 2017, an auxiliary boiler furnace explosion occurred in the engine room on board the Japan registered container ship *Manhattan Bridge* **(Figure 1)** as it was berthing alongside a container terminal in Felixstowe, England. *Manhattan Bridge*'s second engineer and an engine room oiler were investigating a boiler flame failure alarm at the time and were caught by the blast. The oiler suffered severe injuries and died soon after the explosion. The second engineer suffered burn injuries to his face and right arm, which required a skin graft.

The Japan Transport Safety Board (JTSB) is conducting a full investigation into the causes and circumstances of the accident and, in accordance with the IMO Casualty Investigation Code, will publish its findings in due course. The UK Marine Accident Investigation Branch (MAIB) deployed inspectors to Felixstowe to conduct an initial accident site investigation. Its findings have prompted the MAIB to publish this safety bulletin, which is designed to raise awareness of a safety issue that might be linked to the initial boiler flame failures.

## EVENTS LEADING UP TO THE ACCIDENT

*Manhattan Bridge* had been operating in the North Sea Sulphur Emission Control Area (SECA) for several days prior to the accident. In order to comply with international emissions control standards[1], the auxiliary boiler fuel supply had been switched from heavy fuel oil (HFO) to marine gas oil (MGO). The MGO was loaded at Rotterdam in November 2016 and was declared as meeting the quality standards set out in ISO 8217:2005 – *Petroleum products – Fuels (class F) - Specifications of marine fuels*.

In the hours leading up to the accident, the auxiliary boiler had cut out several times due to flame or ignition failures, and on each occasion, the fault was investigated and the boiler reset by the second engineer.

The boiler explosion occurred while the second engineer and the oiler were trying to restart the boiler burner unit following a flame failure cut-out. The force of the explosion blew open the boiler burner unit door **(Figure 2)** and propelled the burner's air diffuser into the engine room **(Figure 3)**. The oiler was standing directly in front of the burner unit and the second engineer was close by.

## INITIAL FINDINGS

Following the incident, examination of the boiler fuel system by the burner unit manufacturer identified the build-up of waxy deposits in the supply filter, sufficient to restrict the fuel flow **(Figure 4)**. Samples of the MGO being burnt at the time of the accident were taken by the MAIB and sent to a laboratory for analysis. The samples were tested in accordance with specifications set out in the latest ISO 8217:2017 standard, which included Cloud Point (CP), Cold Filter Plugging Point (CFPP) and Pour Point (PP) tests.

The tests found that the fuel had a CFPP of 14°C and a PP of less than -9°C, requiring a minimum fuel operating temperature of 15°C. The ambient air temperature at Felixstowe on 19 January 2017 was about 4°C, low enough for wax formation. The CP of the fuel could not be obtained because the test samples had a dark appearance, which was attributed to the mixing of residual HFO deposits with the MGO in the system pipework.

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[1] On 1 January 2015, the sulphur emissions limits within the designated maritime SECAs were reduced from 1.0% to 0.1% by mass, which has resulted in an increased demand for MGO bunkers across the shipping sector.

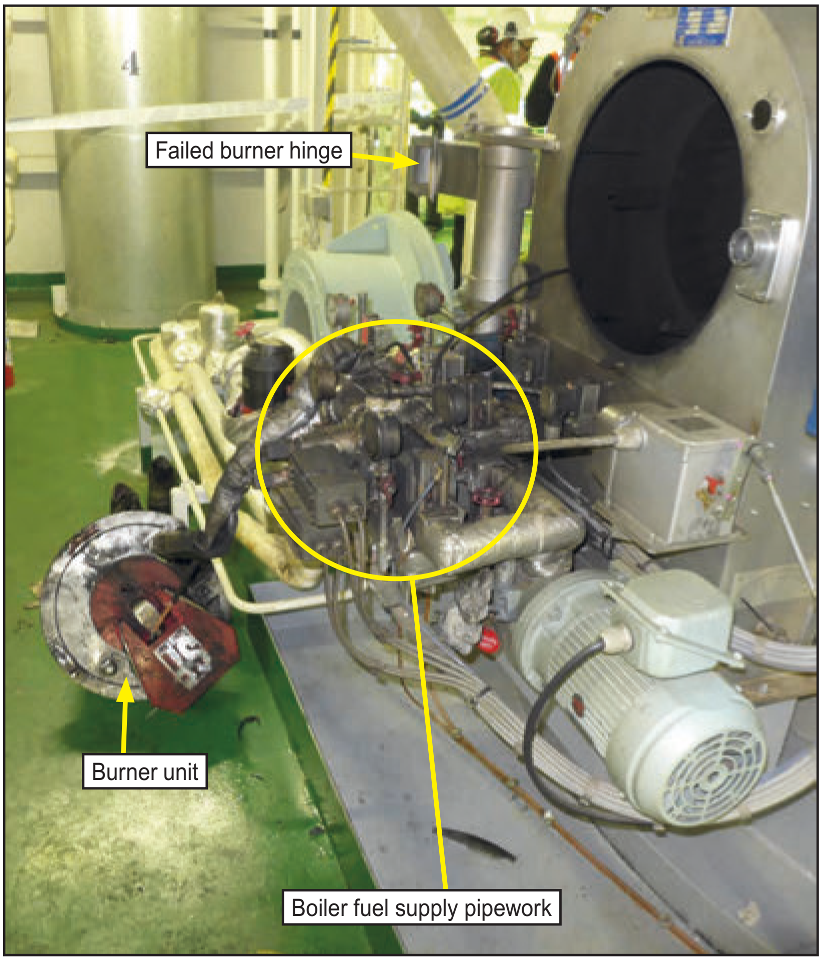
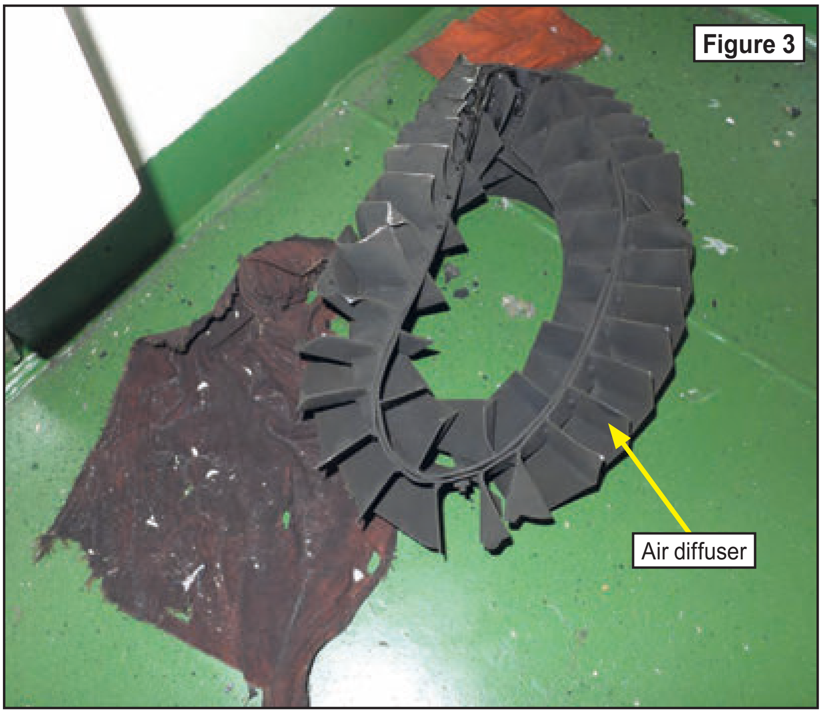
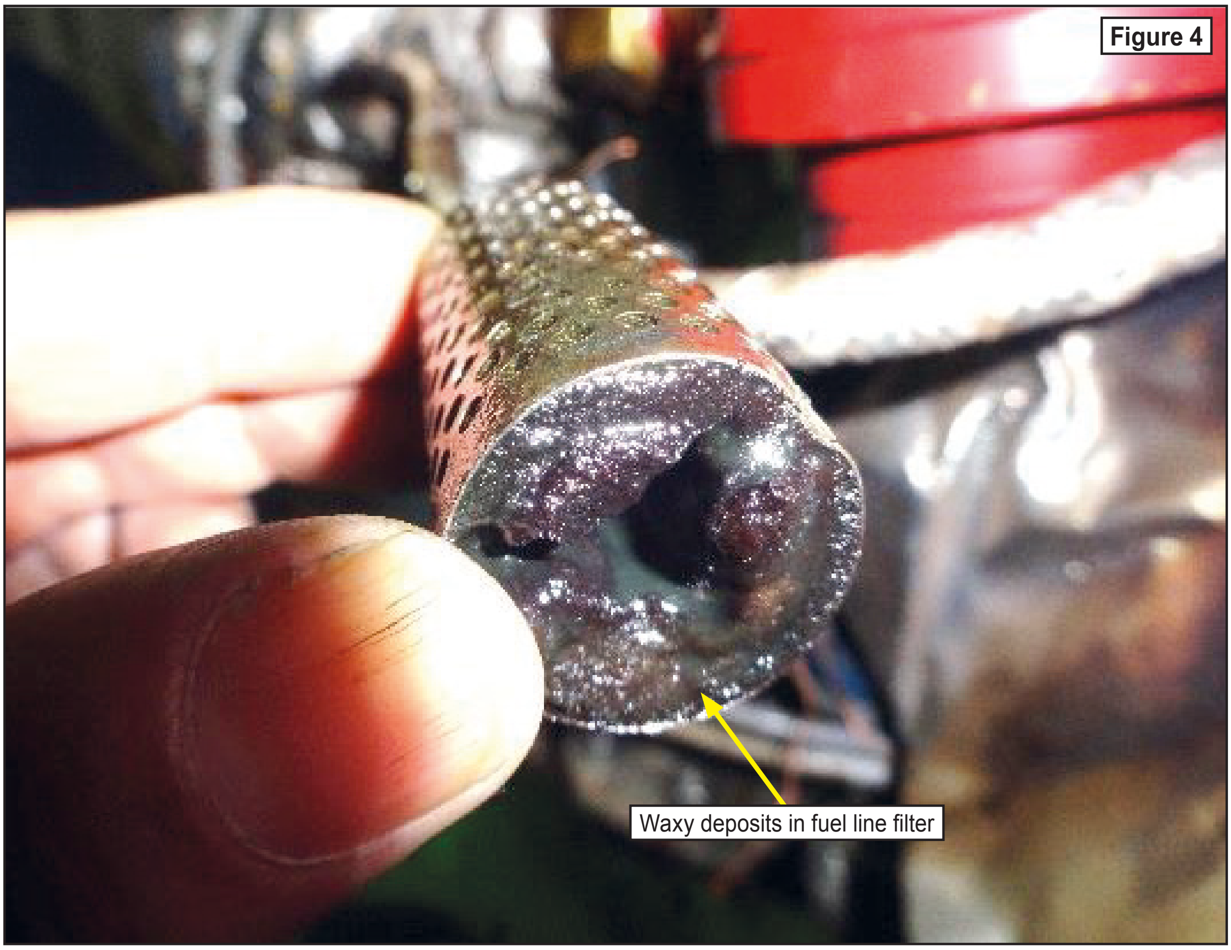



**Figure 2:** Boiler and burner unit






## SAFETY ISSUE

Industry reports indicate an increased incidence of boiler and marine diesel engine performance problems in colder waters following the implementation of the more stringent sulphur emissions limit. This has been attributed to the increased paraffin content found in some low sulphur distillate fuels (MGOs) and the subsequent formation of waxy deposits or crystals as the fuel temperature falls. Restricted fuel flow due to wax deposits in filters and pipework can cause intermittent and incomplete combustion to the point of flame failure.

The paraffin content of MGOs varies globally due to the regional composition of crude oil and variation in refinery processes. There are three measurable stages in the waxing process for distillate fuels; these are CP, CFPP and PP. The first discernible stage, CP, is defined as the temperature at which wax crystals start to visibly form in the fuel and a transparent fuel becomes cloudy or hazy. The CFPP is the lowest temperature where the fuel of a set volume, drawn, by vacuum, through a standardised filter (45 micron) within a specified time (60 sec) still continues to flow. The PP is the lowest temperature at which the fuel will continue to flow when cooled. The PP does not provide any indication of the temperature at which filtration issues may occur.

Prior to March 2017, the ISO 8217 standard, often used by the shipping industry as the baseline specification when ordering and testing fuel oil bunkers, focused on PP and did not include test specifications for CP or CFPP. As a consequence, the MGO loaded on board *Manhattan Bridge* in Rotterdam was not subject to CP or CFPP testing.

## SAFETY LESSONS

It is essential that vessel operators carefully consider anticipated ambient air and sea temperatures that will be experienced during the voyage when purchasing low sulphur MGO bunkers. Such information should be used to identify the required cold flow characteristics of the fuel being supplied using CP and CFPP as key metrics. When this is impractical, it is important to establish the CP and CFPP of the fuels carried on board through sample testing.

When operating in cold climates, the risk of waxy residue developing in the vessel's fuel lines can be controlled by:

- Closely monitoring the visual appearance of low sulphur MGO bunkers for signs of wax precipitation.
- Conducting regular fuel filter inspections and close monitoring of fuel system pressures.
- Maintaining the temperature of the low sulphur MGO in the vessel's tanks and pipework above the CP and CFPP temperatures to avoid the possibility of filter blocking.

The addition of *cold-flow improver* chemicals to the low sulphur MGO in the vessel's storage tanks should only be considered as a last resort under the strict guidance of an additive supplier.

More detailed guidance[2] on the cold flow properties of MGOs can be found on the International Council on Combustion Engines (CIMAC) website: www.cimac.com.

**Issued June 2017**

[2] 01/2015 CIMAC Guideline: *Cold flow properties of marine fuel oils.*
06/2015 CIMAC Position Paper: *New 0.1% sulphur marine (ECA) fuels.*

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