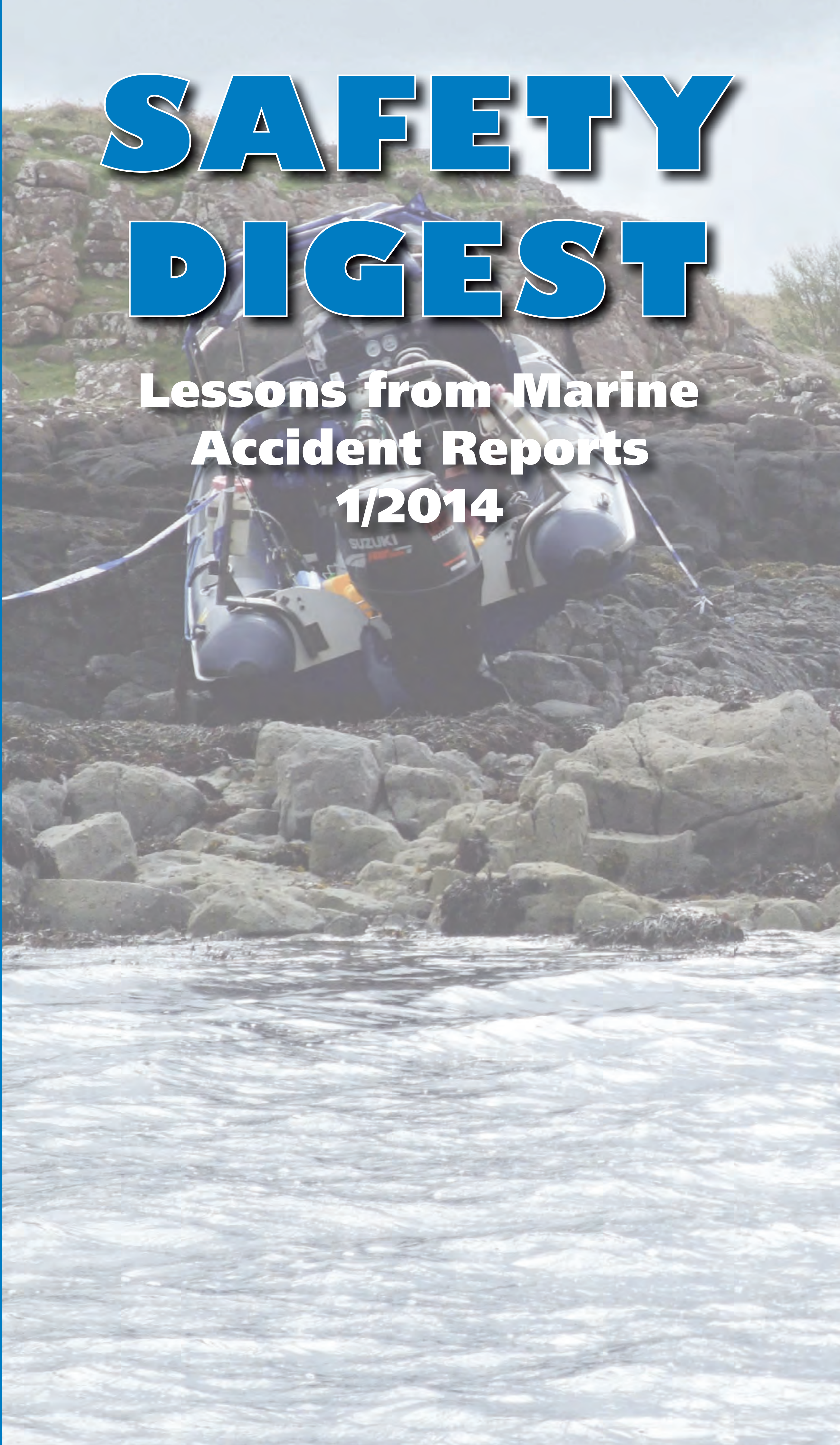
SAFETY DIGEST

Lessons from Marine Accident Reports 1/2014

MARINE ACCIDENT INVESTIGATION BRANCH

MAIB



MAIB

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Lessons from Marine Accidents

No 1/2014

MAIB

is an

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April 2014

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.

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

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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
BA - Breathing Apparatus
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
CPR - Cardio-Pulmonary Resuscitation
DSC - Digital Selective Calling
EPIRB - Emergency Position Indicating Radio Beacon
GRP - Glass Reinforced Plastic
LSA - Life Saving Appliances
m - metre
"Mayday" - The international distress signal (spoken)
MCA - Maritime and Coastguard Agency
MGN - Marine Guidance Note
MRCC - Maritime Rescue Co-ordination Centre
MSN - Merchant Shipping Notice
PLB - Personal Locator Beacon
PTW - Permit to Work
RIB - Rigid Inflatable Boat
RNLI - Royal National Lifeboat Institution
Ropax - Roll on Roll off Passenger Ferry
Ro-Ro - Roll on, Roll off
SAR - Search and Rescue
SMS - Safety Management System
SOLAS - International Convention for the Safety of Life at Sea 1974, as amended
STO - Safety Training Officer
VHF - Very High Frequency
VTS - Vessel Traffic Services

Introduction

As those of us in the UK shelter from the succession of winter storms that has left much of our country under water, we should spare a thought for our colleagues at sea for whom a winter storm is just one of many occupational hazards that have to be dealt with.

Mercifully, the extraordinarily extreme weather systems that have pummelled the UK this winter do not appear to have produced an upturn in related marine accidents. However, Case 9 provides a graphic illustration of the consequences of sending men on deck in heavy weather without a proper plan.

This edition of the Safety Digest also provides many other examples of the risks faced by mariners on a daily basis. Poor communication, failure to adhere to defined procedures, inadequate product knowledge, poor seamanship and cursory maintenance regimes have all been factors in accidents that could have been avoided.

Improved safety on ships is achievable if we not only routinely think about what might go wrong before conducting a voyage, an individual task or period of maintenance, but also take responsibility to check that the appropriate safety barriers and contingencies, designed to prevent the worst from happening, are in place throughout.

Case 15 highlights the importance of drills. Properly trained crew who have been regularly drilled in the responses needed to deal with foreseeable emergencies are far more likely to react instinctively (and correctly) to a developing situation. Too many ships and lives have been lost because the skills taught during basic training have not been applied when a "real" fire, flooding, collision or abandonment occur. The practical difficulties of recovering someone back on board even a small boat can only be appreciated, and mitigated if this scenario is regularly drilled. Imagine how you would feel if your mate were to go over the side and survive, only to lose his life to the effects of cold water because you had never practised how you would recover someone from the sea.

The small craft section of the Safety Digest contains articles, some previously published, that focus on the use of kill cords. This is in support of a campaign being led by the Royal Yachting Association and other industry stakeholders which promotes the use of this important safety tool. With the advent of spring and the prospect of better weather, many leisure boaters will be putting their craft back into the water. I therefore repeat the plea I made in the introduction to my last Safety Digest: if your boat is fitted with a kill cord, please ensure the device is always securely attached to the driver whenever the engine is switched on.

Until next time, keep safe

Steve Clinch
Chief Inspector of Marine Accidents
April 2014

Part 1 - Merchant Vessels

For an organisation whose mission is "to enhance the safety of life, property and the environment", the work of Lloyd's Register (LR) makes it a natural partner to the MAIB.

In the Marine Business we work with regulators in the form of port states, flag states, regional agencies such as EMSA, and other stakeholders, to provide a global framework to provide risk assurance. It is this network of national and international organisations that helps create a safety regime for the global seaborne fleet of merchant cargo, passenger and even naval vessels.

Over the 254 years that the concept of Marine Classification has existed, from Lloyd's Register's roots as an offshoot of Lloyd's of London, the challenges continue to change and increase.

The safeguards in place have not always prevented marine accidents and incidents, but a continuous evolution of technical understanding has allowed lessons to be learnt, and rules amended accordingly. Increasingly the risk has focussed on human rather than technical factors, and many see the advent of further on-board automation as a potential solution, as we have seen in the aviation and automotive fields. With the advent of new connectivity of communication systems, which will dramatically increase the coverage of the oceans, with large bandwidth, the opportunity for remote operation becomes more of a potential reality. Such a change will require its own regulation, and security, to ensure we don't simply replace one set of risks with another.

For LR we have to maintain our knowledge of existing ship design and construction whilst keeping an eye on the future. Any new technology needs to be understood, particularly within a marine context, so that its application can be managed safely. For this reason we are strengthening our technical capability, and investing in resources to understand new technologies, with the opening of our Global Technology Centre on the campus of the University of Southampton this summer. The access to university resource, and the opportunity to collaborate with research and industry partners at the Southampton Marine and Maritime Institute (SMMI), will enhance our ability to meet the challenges that all kinds of stakeholder pressure will continue to place on the marine business.

Over the next few years we can expect new emission regulations, the ballast waste convention, the recycling convention and other new pieces of legislation to add more complexity to industry. LR is doing its utmost to ensure it can be in a position to give objective advice to designers, builders, owners and operators of ships on how to comply safety with this new wave of regulatory change.

We live in interesting times.

Tom Boardley

Tom Boardley is Marine Director of Lloyd's Register, which provides ship classification services to a large global fleet. Founded in the City of London in 1760, Lloyd's Register works closely with shipbuilders, shipowners and insurers to ensure ships are safe to operate throughout their life. It also provides technical advice to the marine industry on environmental and regulatory matters. Tom joined Lloyd's Register in April 2009 and is responsible for worldwide operations as well as strategy and business development.

From July 2012 to July 2013, Tom also took on the Chairmanship of IACS, the International Association of Classification Societies.

Prior to joining Lloyd's Register, Tom had held several senior management positions in the container shipping and ports industry. At the Japanese shipping giant NYK, he had managed the European operations for the container shipping division, including the co-ordination of related activities including inland logistics and supply chain management for major Japanese manufacturers. At P&O Ports, Tom had led business development and acquisitions activity, helping build a global network of container ports that was acquired by Dubai Ports World in 2006. He had also managed the Canadian business post-acquisition, based for a year in Vancouver B.C.

For the first 24 years of Tom's career, he was with the container shipping division of P&O, originally trading as OCL and subsequently as P&O Nedlloyd. He held various management roles in the UK, Taiwan, Korea and Japan before being appointed as Director for Australia and New Zealand, based in Sydney, in 1996.

Tom is an engineering graduate of Oxford University and is also a fellow of the Royal Institute of Naval Architects.

Who's in Control?

Narrative

The crew of a general cargo vessel joined 2 days prior to its scheduled sailing from a discharge port. During the handover, the relieving crew were told that the main engine's automatic bridge control system was unreliable and that it was safer to operate the engine and gearbox manually from inside the engine room, particularly when manoeuvring in confined waters. However, the ship's managers had not been informed about the situation.

In manual control, engine orders were passed from the bridge to the engine room via the engine telegraph. The orders were acknowledged by the ship's electrician using the telegraph repeater in the engine room. He then indicated the intended direction of movement by pointing either forward or aft. The chief engineer operated the gearbox and clutch solenoid controls (Figure 1) and the second engineer adjusted the engine governor (Figure 2) to control the engine's speed. A shaft speed and direction indicator was not fitted in the engine room.

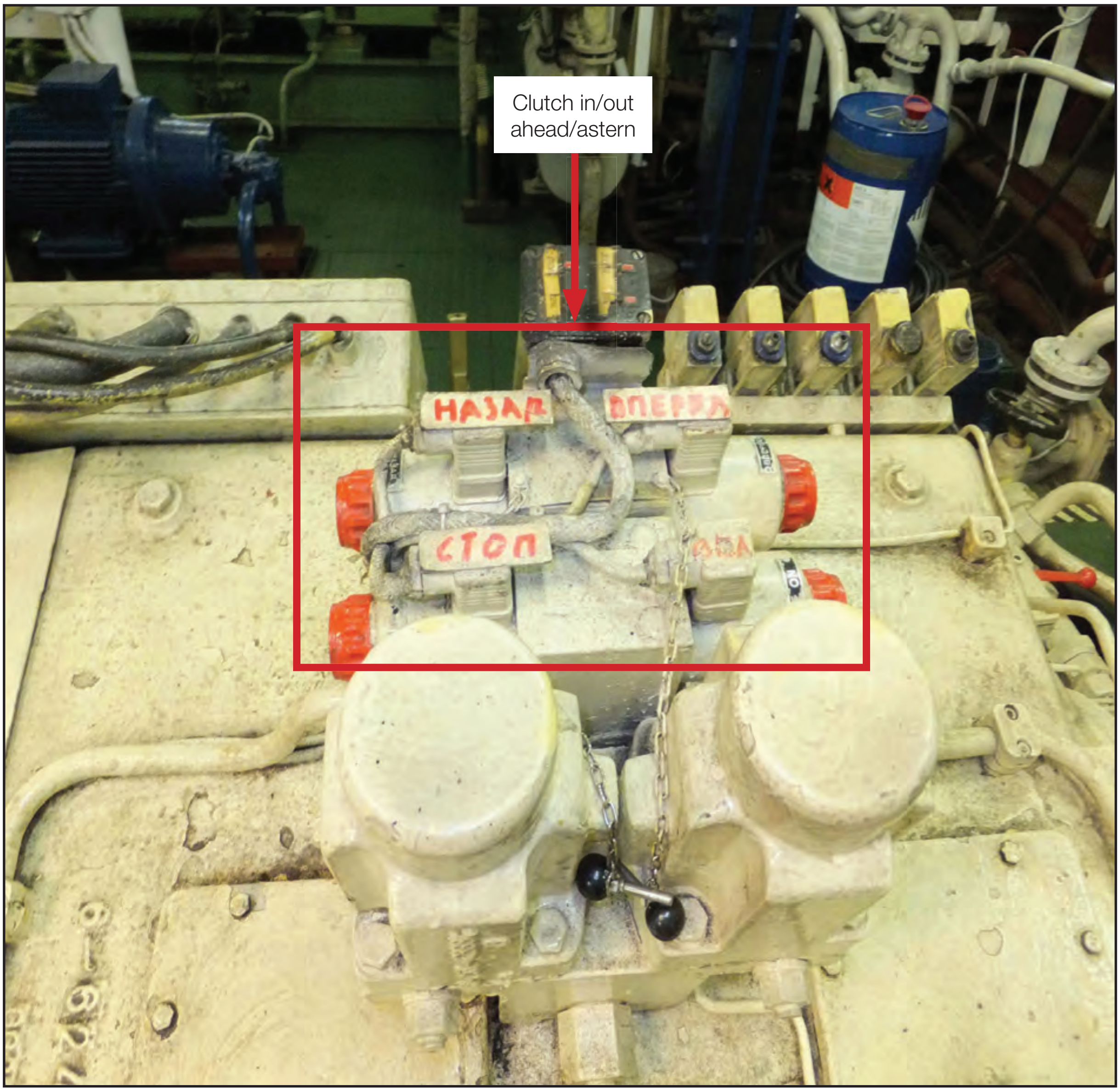


Figure 1: Gearbox solenoid controls

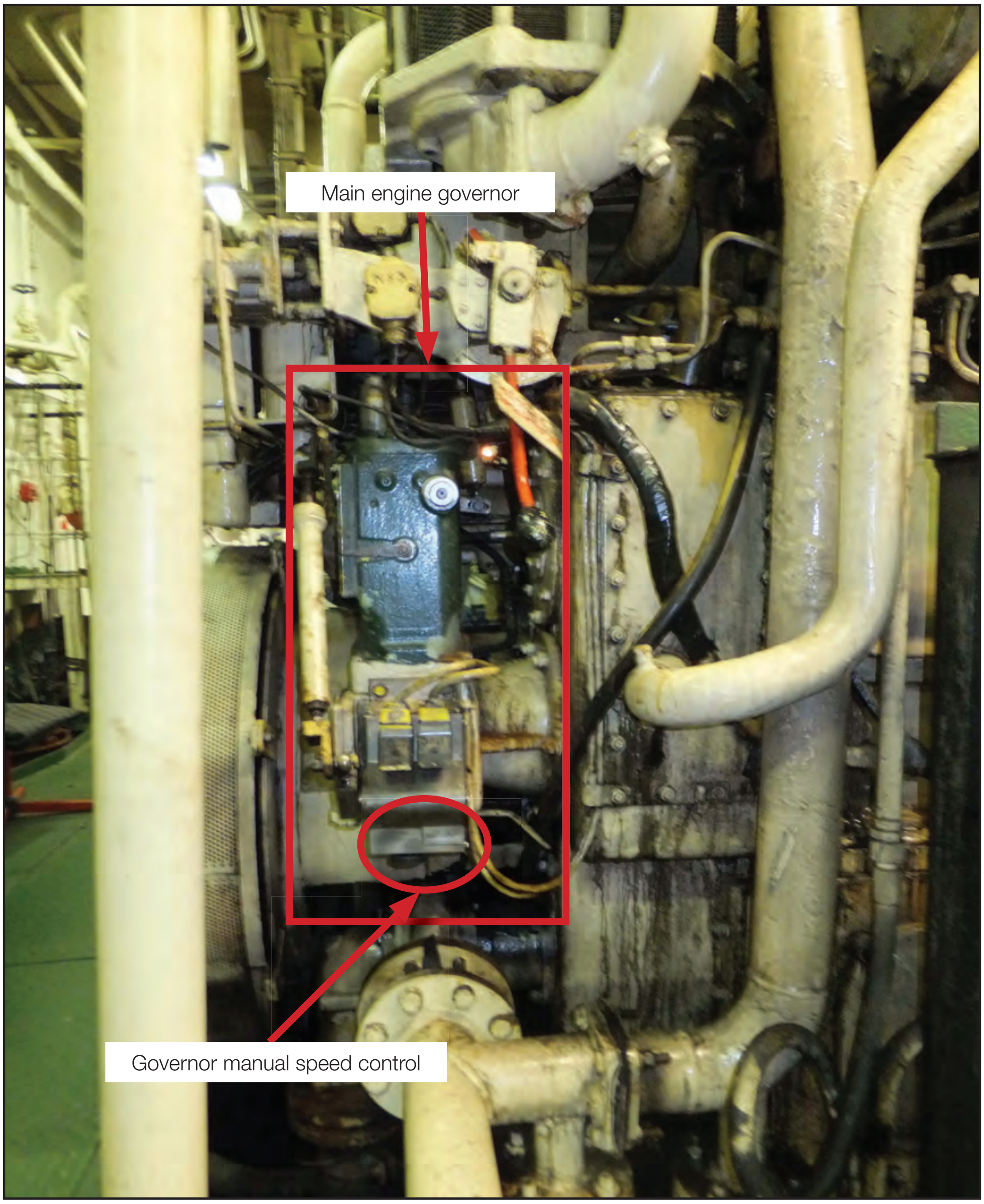


Figure 2: Main engine governor

Prior to sailing, the main engine's operation was tested ahead and astern. The chief officer then met the harbour pilot when he arrived on the bridge. The pilot was informed that the vessel was operating correctly; no defects were reported. When the master arrived on the bridge he advised the pilot that he preferred not to make fast the tug that had been ordered because he wanted to gain an understanding of the vessel's manoeuvring characteristics.

After the mooring ropes were let go, the vessel was gently set off her berth by the light wind. Once sufficiently clear, the master set the bridge telegraph to 'dead slow astern' to manoeuvre the vessel towards the centre of the dock basin. All was going well and, when the vessel approached the intended turning position, the master moved the telegraph lever to 'stop'. However, this did not check the vessel's speed astern.

CASE 1

The cargo ship started to close a dredger that was working on the opposite side of the dock basin, so the pilot told the master to go 'ahead'. Accordingly, the master moved the telegraph lever to 'slow ahead' and, soon after, to 'full ahead', but the vessel continued to move astern. This caused concern to the dredger's master, who called the cargo ship via VHF radio. In reply, the pilot confirmed that the outbound vessel was going 'ahead'.

Less than a minute later, the stern of the general cargo vessel struck the dredger's starboard side and pushed the dredger into the side of another vessel which was discharging her cargo alongside. The cargo vessel's engine continued to operate astern until 'stop' was ordered on the engine telegraph when prompted by the pilot. The vessel was then manoeuvred back alongside. All three vessels involved in the collision were damaged.

The Lessons

1. **Propulsion systems do not have to be controlled automatically from the bridge, but the use of the alternative methods of control must be carefully considered. Factors such as engine room ergonomics, the provision of shaft speed and direction indication, means of communication, crew familiarity and the potential for human error must all be taken into account. Although secondary methods of control should be available, some are suitable for use only in an emergency.**

2. **When manoeuvring, it is important that all orders are acknowledged <u>and</u> are followed. To do this, the ordered action must be closely monitored and its completion must be reported. In this case, scrutiny of the bridge shaft indicator would have quickly shown that the shaft was still rotating astern, even after the order for 'ahead' had been passed and acknowledged. Mistakes happen but, if quickly spotted, accidents can be prevented.**

3. **Reporting defects to ship managers and authorities such as classification societies and ports is critical to vessel safety. If a defect is not reported, it is likely not to get fixed and could easily stand a vessel into danger. In particular, pilots must be made aware of all defects affecting a vessel's safe navigation in order to allow appropriate precautions to be taken.**

4. **An enclosed dock, with limited manoeuvring space and other vessels in close proximity, is not the ideal place to get to grips with a vessel's handling characteristics.**

Post-refit - Falls From a Lifeboat. Have You Spotted the Risks?

Narrative

The completion date for an extended refit of a Class I passenger vessel, which was new to the company, had been frustratingly delayed by industrial action. The ship's senior officers became increasingly involved in the refit project management to limit further delays and minimize disruptions to the first, post-refit cruise. In the meantime, the crew were heavily involved in bringing the ship's public areas up to the required standard, and preparing for the various required inspections and surveys.

In readiness for the ship's operational role, the company employed a Safety Training Officer (STO) to carry out ship-familiarisation and general emergency training based on the duties detailed on the muster list. The STO did a good job in scheduling and delivering numerous training periods, but there was virtually no involvement of, or oversight by, the ship's safety organisation, which had overall responsibility for training. While the STO was content to deliver the general emergency training needs, he was unfamiliar with the specific tenders and lifeboats (Figure 1) and their release gear (Figure 2). He advised the master he was unhappy about conducting the related lifeboat preparation training and, while this was acknowledged, the responsibility was not formally transferred to anyone else.

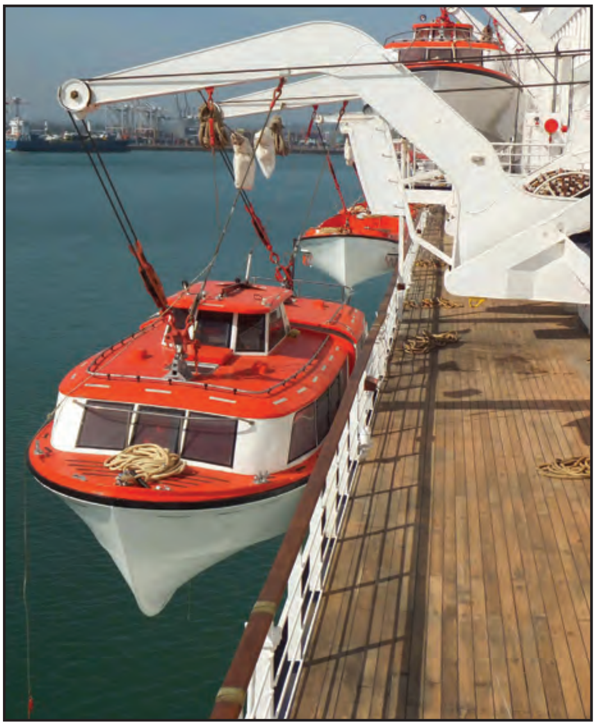


Figure 1: Tenders and open lifeboats

Figure 2: "On-load" release gear

With the happy prospect of finally cutting the refit ties just over the horizon, what was not needed was the delay that occurred in the open lifeboats and tenders being returned on board because of weight growth issues. The consequence of the delay was that only one ad hoc lifeboat preparation training period took place, and this was conducted before the lifeboats were returned. The quality of the training was further hampered by poor attendance, excessive refit noise levels on the deck, and by the officer, who was taking the training period, being called away to another task.

There was a distinct sigh of relief as the vessel finally left her refit port and made her way towards the UK. Although much of the ship's safety documentation was still not in place, including, crucially, the risk assessments, there was now more time available in which to establish the safety organisation. In addition, it was always the master's intention to continue training during the passage. However, both aspirations were hampered by the continued involvement of the crew in preparing the public areas, supporting the numerous contractors who were still on board, and making the ship ready for the imminent expanded Port State Control inspection that was to take place before the vessel entered passenger service.

On the day of the inspection, a drill was initiated. As the fire teams prepared to tackle the fire, the lifeboat preparation teams mustered under the direction of the fourth officer. The teams wore lifejackets, safety helmets and safety shoes, but none of them wore a safety harness and tether. The starboard side open lifeboats and tenders were lowered, under gravity, and were automatically brought alongside the embarkation deck by their tricing pennants. The bowsing tackles were then rigged by crew who were required to stand on the tenders' smooth coach roof, none of which had a non-skid finish applied (Figure 3) to improve traction.

Figure 3: Rigging bowsing tackles

Figure 4: Bowsing rope turned up on the bitts

However, this was the first time the first cook, who was the forward crewman of one of the tenders, had been to sea and, to make matters worse, he had received no specific practical training for his role. Consequently, he was unsure what was expected of him. With advice from the crew on the deck, the first cook tried to tension the bowsing tackle. He had great difficulty doing so because the manila rope was oversize and jammed in the throat of the bowsing tackle block. (The problem had been identified during the refit but the rope had not been changed for one of the correct size.) The first cook persevered and managed to take a turn around the securing bitts attached to the bowsing tackle block (Figure 4). He could not take a further full turn around the bitts because of the oversize diameter of the rope.

The first cook was holding onto the bowsing tail rope as the order was given to release the tricing pennants. He was unable to remove the drop-nosed pin, which secured the tricing pennant hook release lever, because he was unfamiliar with the equipment. Noticing that he was in difficulty, the fourth officer went onto the tender's coach roof to assist him. As the fourth officer removed the pin and operated the tricing pennant release lever, the first cook stepped out of line with the bitts, and the bowsing tackle came free. With neither the bowsing tackle nor tricing pennant connected, the bow of the tender swung violently outboard, as it aligned itself with the now vertical forward falls, and heeled to port. Without the protection of any form of restraint, the fourth officer and first cook grabbed hold of small ropes attached to the lifting plate and tricing pennant release lever. Unfortunately, this did not prevent them from sliding off the coach roof between the tender and the ship's side.

The fourth officer made contact with a cabin balcony rail as he fell 22 metres into the water. He was immediately followed by the first cook. As they both surfaced, the bosun, who was on the davit winch deck, alerted the bridge to the emergency situation. The drill was aborted as the master broadcast *"man overboard"*. Both men were recovered from the water very quickly and passed into the care of the ship's medical team. They were taken to a shore hospital soon afterwards and released later the same day.

Both men were extremely fortunate to have suffered only relatively minor injuries. They both had rope burns to their hands; the fourth officer also had a penetrating wound to his right ankle and two dislocated toes.

The Lessons

Bringing a vessel out of a prolonged refit is arguably one of the most demanding, difficult and vulnerable periods in a ship's schedule. This is especially so when the vessel is new to the company and her crew. Systems which have been overhauled are often unproven, and the crew will not have been worked up as a team to deal with, not only their day-to-day responsibilities but, more importantly, to deal with emergency situations.

To this end, it is essential that sufficient planning and oversight are maintained for the tricky, sometimes hazy, transition from refit project management to operational management.

1. It is all too easy to lose focus on the operational requirements as the ship's senior management becomes involved in refit project management tasks. Commercial pressure will often dictate the need for this involvement to the detriment of effective pre-operational programme preparation.

2. Integration of the training requirements, especially those which are equipment-dependent, into the refit Project Management Plan, will help ensure training is given the right priority and the crew are properly prepared to go to sea.

3. Given the size of a cruise ship's crew, it can be all too easy to lose track of the training needs. This merits close oversight and regular updates to the senior management to assess progress. This accident shows the first cook was in a vulnerable position because he had not received any specific, practical training for his emergency role.

4. The onboard safety management organisation should be adequately established to ensure the vessel is safe to proceed to sea. In this case, the fundamentals of overseeing training, ensuring people were trained in their role, establishing risk assessments and managing personal protective equipment were obvious omissions and compromised the safe operation of the vessel.

5. Encourage the review of standard procedures. An arrangement whereby the lifeboat crew secure the bowsing rope, while concurrently releasing the tricing pennant drop-nosed pin and operating the tricing pennant release lever, can lead to overload. Examine alternative ways of operating the equipment. In this case, the bowsing gear can be reversed to secure it on the ship and so relieve the lifeboat crew of some duties. Do not forget, changes may require Flag and/or Classification Society approval, especially if structural changes or new securing arrangements are needed.

6. If there is a need to access coach roofs or other vulnerable positions to operate lifeboat securing or release equipment, this should be considered as "Work at Height". Safety harnesses and tethers should be used where appropriate.

7. Do review access areas on lifeboats and, where appropriate, apply a non-skid finish to provide added traction. This requirement is laid down in the International Maritime Organization's "Life-Saving Appliances including LSA Code 2010 Edition".

Enclosed Lifeboat = Enclosed Space

Narrative

While undertaking a routine maintenance check of an enclosed lifeboat (Figure 1) an officer detected a strong odour when he opened the boat's access door (Figure 2). The interior of the boat smelled of rotten eggs, and the officer realised that it would be necessary to check the atmosphere in the boat before entry.

A check of the atmosphere inside the boat was undertaken with the vessel's own gas monitoring equipment, which revealed the presence of hydrogen sulphide gas in concentrations exceeding 60 parts per million.

The lifeboat was thoroughly ventilated and, once clear of gas, a permit to enter was issued to allow the crew to investigate the source of the gas. It was subsequently discovered that a faulty battery charger had overcharged the boat's batteries (Figure 3), which produced the hydrogen sulphide gas.

Figure 1: View of lifeboat in housed position

Figure 2: Access door

Figure 3: Battery locker

The Lessons

1. The interior of an enclosed lifeboat is not one that mariners would intuitively class as an enclosed space. However, this incident demonstrates that the potential risks of entering an enclosed lifeboat, without first checking that the atmosphere is safe to breathe, are severe. Exposure to hydrogen sulphide gas at the concentration found in this incident has the potential to cause permanent eye damage.

2. It may not be a sufficient control measure to simply leave the access door open for a period of time prior to entry as hydrogen sulphide is heavier than air. The gas may therefore pool in the wells of the boat, especially on freefall lifeboats. Forced ventilation may be required to make the interior of the boat safe to enter.

3. To avoid the risk that hydrogen sulphide gas is produced, the correct operation of the battery charger should form part of the regular maintenance checks which are conducted on lifeboats.

CASE 4

Bridge Team Management is Not a Spectator Sport

Narrative

Slight to moderate sea conditions, north/north-easterly wind and good visibility greeted a large vehicle carrier on its morning, daylight arrival at a major port. A draught of 9.8m meant that the vessel would be constrained to the narrow, buoyed, approach channel. This would prove to be significant.

The vessel was equipped with updated paper charts as its primary means of navigation and had completed a passage plan for the voyage. Although the route plotted on the chart was berth-to-berth, it lacked the necessary detail. Hazards and 'no go' areas were not highlighted, abort points were not identified and very few parallel indexes, or other position monitoring methods required for her safe navigation had been considered at the planning stage.

The confusion started when the master, who had not taken the con from the third officer on watch, gave orders to the helmsman. The chief officer was also on the bridge. No briefing had been given by the master or defined roles and responsibilities given to the bridge team for the arrival, hence the chief and third officer automatically deferred to the master without question. Adding to the lack of situational awareness was that only one position had been plotted since the pilot's embarkation. This showed the vessel to be about 0.3 mile to port of the planned track.

After embarkation, the pilot had entered the bridge via the port bridge wing door, ordering 'Hard a Port' and 'Half Ahead'. The bridge team executed these instructions without question. A brief exchange then took place between the master and pilot, during which the pilot informed the master that the vehicle carrier would now be entering ahead of the tanker, which was in close proximity, not following the vessel as port control had previously advised.

The vehicle carrier continued her south-easterly approach with the pilot now aiming for a gap between the inbound tanker and an outbound container ship. This forced the container ship to alter course to the north, eventually passing down the vehicle carrier's port side at about 0.14 mile. Now drawing ahead of the tanker, and some distance to the north-east of the track, the pilot ordered 'Full Ahead' and 'Hard a Starboard' across the tanker's bow.

The new course took the vessel almost directly over No.2 buoy. The pilot began a series of course alterations to port as the vessel approached the channel, but remained outside it. He explained that he was keeping to the north of No.4 buoy to allow for the effect of the wind. This was acknowledged by the master, but the bridge team failed to notice the charted wreck and shallow water on the pilot's intended track.

As the vessel passed to the north of No.4 buoy, a loud scraping sound was heard, followed by a sharp reduction in speed and a reported 15-20 degree heel to starboard. The heel quickly corrected itself and, after rejoining the channel, the vessel continued to her berth without further incident.

At her next port, a dive inspection was carried out, where significant underwater damage was found. Although restricted to ballast tanks, the potential for more severe damage was readily apparent. The vessel then discharged all cargo and proceeded to dry dock for repairs.

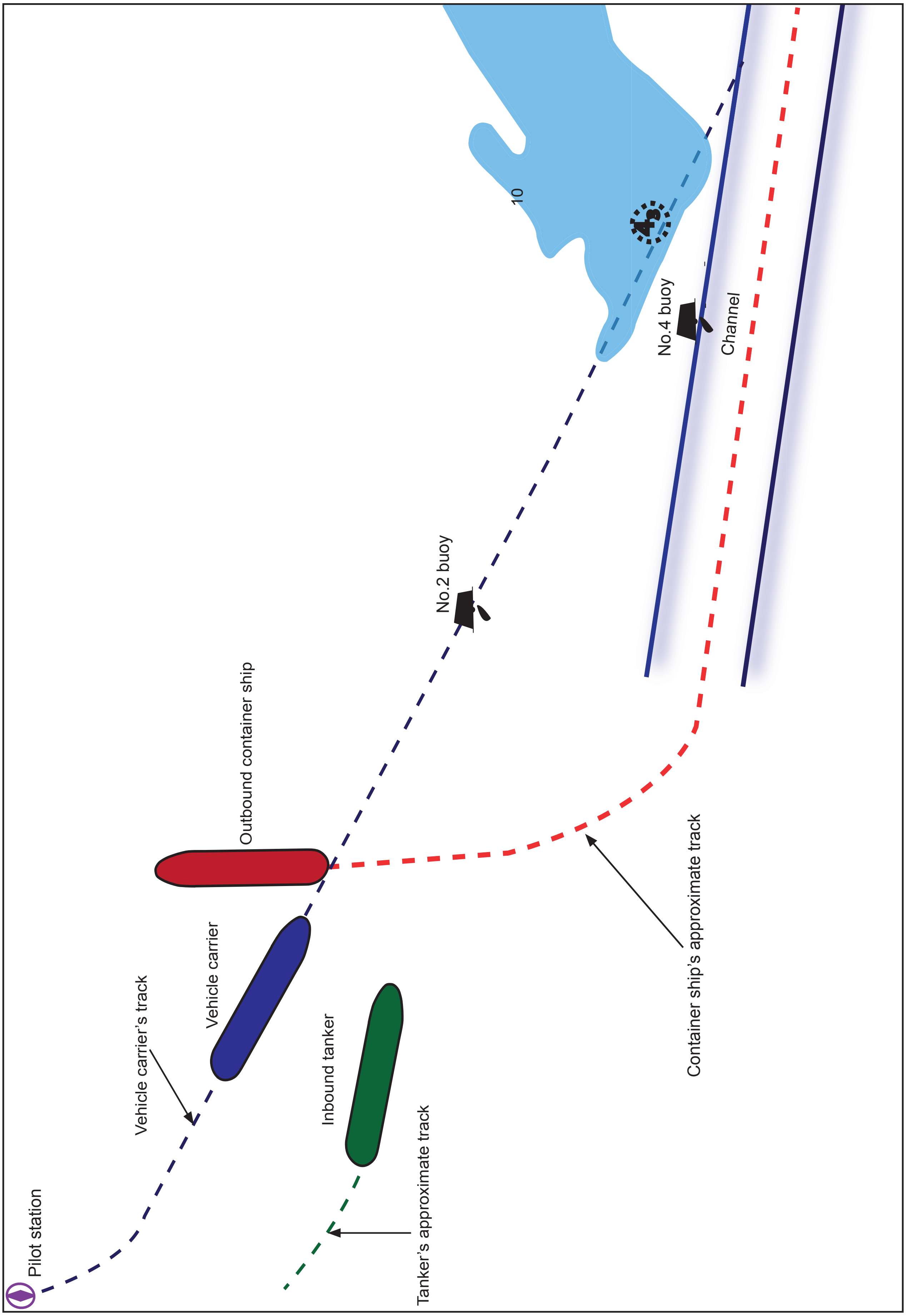


Diagram showing track of vehicle carrier and other vessels

The Lessons

With lack of detail in the passage plan, poor master-pilot exchange, and a passive bridge team, it is not hard to see how the situation rapidly deteriorated. A key factor was that no one fully understood the pilot's intentions and, despite this, no one questioned him. The fundamental principle of monitoring the vessel's position was forgotten and, as the situation developed, the bridge team failed to appreciate the danger of the vessel remaining outside the channel.

1. A berth-to-berth passage plan must be more than courses on the chart! Hazards and 'no go' areas must be highlighted, enabling watchkeepers to quickly identify unsafe areas. Time pressures cannot be allowed to prevent scrutiny of any proposed changes to the planned route and must involve a review of potential dangers. Once an agreed plan is executed, it is important that the vessel's progress is effectively monitored with positions plotted at appropriate intervals. Advice on voyage planning can be found in Annex 24 of the MCA's guidance on implementing Chapter V of SOLAS.

2. Prior to arrival at the pilot station, the master should ensure a pre-arrival briefing takes place with the bridge team. The passage plan should be reviewed and members of the team delegated specific roles and responsibilities. Commit individuals to action, and ensure they are empowered to 'shout out' if something is not going to plan.

3. The master-pilot exchange is an essential stage to integrate the pilot into the bridge team. Aside from sharing important information regarding the vessel itself, it is essential that the bridge team fully understand the pilot's intentions and planned route; any variation from the vessel's own passage plan must be agreed prior to pilotage commencing. Always remember that the presence of a pilot on the bridge does not absolve the bridge team from their respective duties and responsibilities; if something is not as you expect - question it. Further guidance can be found in the International Chamber of Shipping's Bridge Procedures Guide.

4. Where conflicts exist between individual goals, these must be de-conflicted and a common understanding of priorities agreed. In this case, port control and the pilot had different ideas regarding the arrival sequence of vessels. Instead of resolving these differences and confirming an agreed plan, the master was prepared to allow events to take their course. Failure to have a common understanding seriously reduces the team's ability to support each other and to identify when things are going wrong.

5. When a pilot is on board during a port approach, the COLREGS still apply, as does the practice of good seamanship. In this case, allowing the pilot to manoeuvre the vessel in such close proximity to other vessels, in confined waters, and against the instructions of port control, was highly dangerous. The master is at all times responsible for the safety of the vessel and her crew. It is essential that he or she recognises that responsibility and exerts the necessary authority and leadership to ensure a safe outcome.

Mooring Dangers - the Need to Always Keep Alert

Narrative

"That's the first of the fore and aft spring lines ashore pilot".

A routine enough comment made by the master of a chemical tanker during the final stages of berthing. Little did he know that his words were to set in train a rapid series of events that would cause an AB of the aft mooring party to suffer life-changing injuries in very traumatic circumstances.

The fore and aft tugs were connected, and the approach to the jetty was straightforward enough with the light airs and negligible ebb tide from ahead having virtually no effect on berthing. The after tug's 80mm polyester towline passed through the centre Panama fairlead to a set of bitts, which was directly in-line with the fairlead. The eye of the rope was over the forward bitt and an 18mm polypropylene messenger rope, which was attached to the towline's eye, was flaked down between the bitts (Figure 1).

As the spring lines were tensioned, the pilot requested the master to instruct the aft mooring party to let go the tug so that it could move amidships to push the vessel's starboard side onto the berth. The pilot also advised the tug's skipper that the instruction had been passed to the mooring party. The tug's skipper then manoeuvred the tug to a position directly under the vessel's stern to recover its towline and messenger rope. The 2nd mate, who was in charge of the aft mooring party, instructed the towline to be released. He then assisted a fitter and two ABs to take the towline's eye off the forward bitt and place two turns of the messenger rope around the bitt to control lowering of the towline.

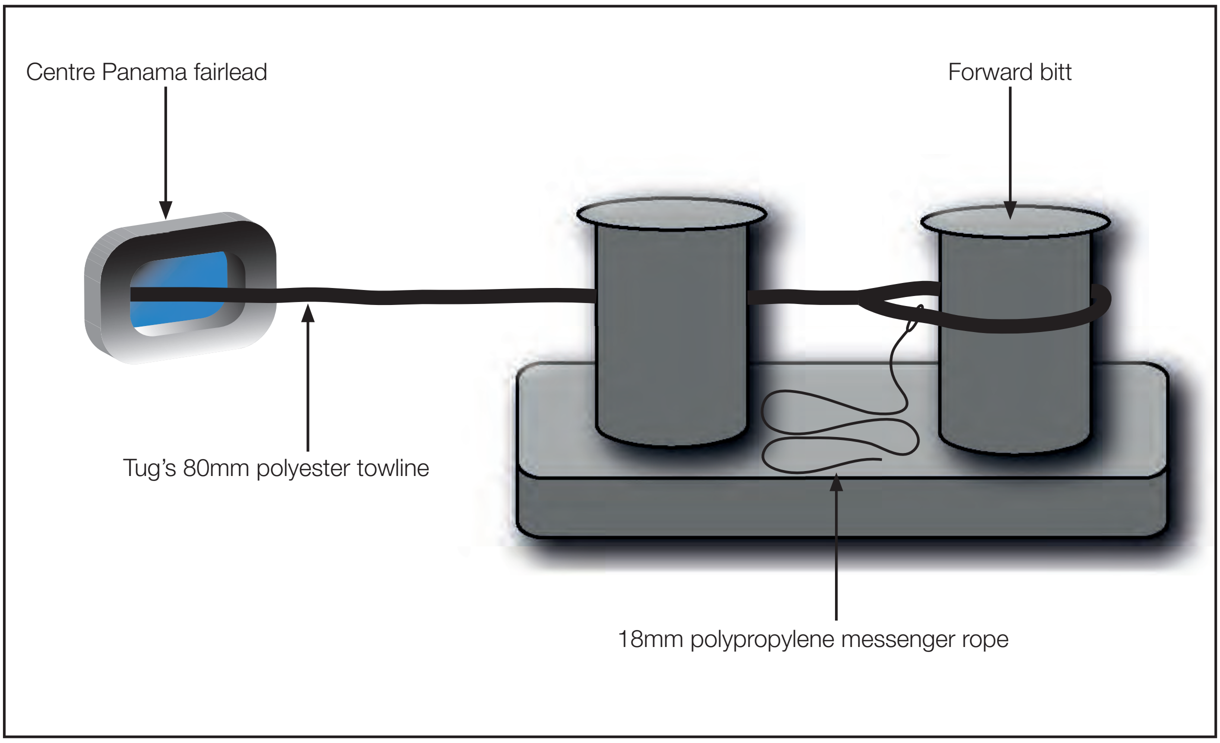


Figure 1: Position of tug's towline and its messenger rope

When the eye of the towline was outboard of the Panama fairlead, one of the ABs was left to slacken the messenger rope as the rest of the mooring party continued to deal with the spring line, to adjust the vessel's position, and to prepare the other stern mooring lines. The position of the bitts prevented the AB from seeing the tug's crew. Likewise, the vessel's freeboard and bulwark height prevented the tug's skipper, and the tug's engineer, who was operating the tug's winch from the wheelhouse control position, from seeing the AB.

As the rest of the mooring party was involved in getting the mooring lines ashore, the 2nd mate's attention was drawn away from the AB slackening the messenger rope. Although there was no established verbal or visual communication between the tug's crew and the aft mooring party, the tug's engineer noted a large bight in the towline, indicating that it was being payed out, and so he started to recover it and the messenger rope using the tug's winch.

The engineer then noticed the messenger rope tighten, and at the same time the 2nd mate heard a frantic shout from the AB controlling it. He saw the AB's left leg become entangled with the messenger rope, him being dragged along the deck, and his left leg being pulled through the Panama fairlead as the tug winch tension continued to be applied (Figure 2). The mooring party shouted to the tug's crew to stop hauling, but the tug's skipper and engineer had already noticed the problem. The engineer had veered the winch, which caused the messenger rope to slacken and fall onto the tug's deck.

The mooring party saw that the AB's leg was very badly damaged and applied a tourniquet as both the pilot and tug's skipper alerted the VTS control room to request an ambulance. The AB, who was by now unconscious, was quickly transferred to hospital, but his left leg was severely damaged, requiring it to be amputated below the knee.

Figure 2: AB's leg pulled through Panama fairlead

The Lessons

The seafarer is routinely confronted with numerous hazards when involved in mooring operations. He/she must always be cautious about becoming complacent with, what is often seen as a day-to-day routine requirement. High-powered tugs, rotating winches, ropes and wires under high loads present recognisable dangers. To mitigate the risk, it is important to ensure that sufficient attention is paid to proper and constant supervision and efficient communications between the bridge, mooring party and the tug. This will ensure that mooring operations are properly controlled to reduce the risk of accidents.

In this case, the evidence suggests that the AB was struck by the flailing messenger rope as it whiplashed around his leg because the rope was being hauled by the tug faster than it was being payed out by the AB.

1. Those involved with supervising mooring operations should position themselves so that they have visibility of the whole operation.

2. Do not be rushed. Careful control is fundamental to a safe operation.

3. It is important that efficient communications are established between the bridge, mooring party and the tug.

4. The vessel's freeboard, design of poop and forecastle decks, especially bulwark heights, can make visual communications between the deck and the tug difficult - think how to overcome this and understand how to tell the tug to stop operations in an emergency or when in doubt.

5. Although the evidence in this case points towards a whiplash accident, there continue to be too many mooring accidents caused by crew standing in the bights of ropes. AVOID BIGHTS AT ALL COSTS.

6. Advice on safe mooring practices can be found at Chapters 12 and 25 of the MCA's publication - Code of Safe Working Practices for Merchant Seamen.

CASE 6

Delivery Voyage Tragedy

Narrative

A 20m steel workboat was bought by its new owner with the intention of certifying it for commercial use. An initial survey took place at its location overseas and the owner and two crew completed the necessary work to enable the vessel to make the passage to the UK, where the plan was for the certification process to be completed.

The boat was fitted with two main engines, each driving its own shaft, as well as an auxiliary engine for electrical power. The compartments aft of the engine room, for which access was gained via the deck, were all sealed shut. The engine room and the steering gear compartment were fitted with bilge alarms. The vessel was fitted with a bilge pumping system, which could be operated from the engine room, and back-up electrical pumps. Three liferafts were carried, but only one was in-service date and had been hired specifically for the voyage. The owner also provided an EPIRB and one of the crew had a personal locator beacon.

With the skipper and two crew on board, the first half of the passage was uneventful. Although one of the main engines developed a problem, they were able to make good progress. The vessel took shelter in port for a period due to adverse weather, but a couple of weeks later, with an encouraging forecast, the voyage recommenced at 7 knots using one engine. Routine checks of the engine room were made every 30 minutes and the three crew stood 2-hour watches during the hours of darkness.

On the anticipated last day of the passage, the weather started to deteriorate with the wind speed increasing to an average of 20 knots, and the sea on the vessel's stern. During the night, the vessel passed through a fleet of fishing vessels. The skipper then noticed the vessel's speed drop by 1.5 knots. Later, the speed dropped further and the stern felt heavy. He checked the engine room, which was dry, but saw through the aft engine room door that the aft deck was under water. The steering then stopped functioning.

The skipper started the bilge pumps and then made a "Mayday" call. The two crew donned extra clothing and lifejackets. The skipper grabbed the EPIRB and went on deck to manually release the liferaft fitted forward of the wheelhouse. As he did so, the vessel started to sink rapidly by the stern. He had not donned his lifejacket.

The skipper and one of the crew managed to get clear, but the third crewman was lost with the vessel. The two survivors climbed into the liferaft that the skipper had released. The EPIRB was activated along with the personal locator beacon. Ships responded to the "Mayday" and stood by the liferaft until a helicopter rescued the two men.

The Lessons

1. The precise cause of the loss of this vessel was never established. However, its stern probably became heavier as a result of the vessel snagging an object, or through undetected flooding, or a combination of the two. By the time the skipper had established that the aft deck was under water, the engine room vent was close to becoming immersed, at which point the vessel was probably beyond saving. Given the sea conditions and the fact that it was dark, it would have been prudent for the skipper to turn the vessel head to sea, wake the crew and investigate the situation when he first detected the reduction in speed. Pressing on is not always the best option.

2. Ensuring a vessel is watertight for any voyage is an essential requirement. However, sealing and bolting down hatches so that a compartment cannot be accessed does mean you can never be certain if that compartment remains dry. Bilge alarms can help, but unless they are regularly tested their reliability cannot be guaranteed, so another means of checking a compartment - such as by manual sounding - is a sensible precaution.

3. Although tragically one man lost his life, this accident does demonstrate the benefit of carrying appropriate safety equipment. The VHF radio enabled the alarm to be raised, both the EPIRB and the personal locator beacon alerted the rescue services and the two survivors managed to board a liferaft. However, it was fortunate that the out-of-date liferaft on the foredeck functioned correctly. The hired raft, which didn't fit the cradle on the foredeck, was lashed to the vessel at the aft end of the superstructure. Don't limit the effectiveness of your liferaft by lashing it down; use an appropriate cradle fitted with a hydrostatic release and secure the liferaft painter with a weak link. The MCA's MGN 353 (M+F) provides further guidance on this.

4. The skipper was fortunate that he was able to board the liferaft quickly as he had not had time to don his lifejacket. In an emergency there will always be many tasks to attend to, but fitting your lifejacket, if it is not already worn, must be a priority.

Kill the Critters, Not the Crew

Narrative

A little knowledge can be a dangerous thing, as the crew of a general cargo vessel discovered during the discharge of a fumigated cargo.

Bulk grain cargoes are often fumigated to prevent or to address insect infestation. In this case, the maize cargo was fumigated by placing bags of aluminium phosphide fumigant on top of the cargo in each of the vessel's four holds (Figure 1). The hatches were then closed and sealed for the 14 day voyage. The fumigation process was estimated to take about 5 days, after which the fumigant was expected to have become inactive.

A consultant surveyor boarded the vessel as she drifted outside the discharge port. He had been hired by the ship's agent to check the atmosphere at the top of the cargo holds. Initially, the level of phosphine gas was too high, but after a short period of natural venting the level had reduced sufficiently to enable the surveyor to confirm that it was safe to discharge the cargo.

The vessel then berthed, the hatches were opened and cargo discharge commenced. The bags of fumigant were still on top of the maize cargo; some were eventually removed and put next to the holds but others were discharged into a shore hopper and store ashore. When the bags were eventually seen in the hopper, a stevedore attempted to remove them. In doing so, at least one of the bags burst open and the fumigant spilled onto the ground (Figure 2).

The area around the spill was cordoned off and the emergency services were alerted. The fumigant bags next to the holds were put into plastic bags on the main deck, but these soon started to smoke. As the smoke increased in density (Figure 3), the crew evacuated from the vessel. Several of the crew and a stevedore were taken to hospital, but fortunately nobody was injured.

The fumigant bags were disposed of by a qualified fumigator, although not all of the bags were accounted for and therefore some might have entered the food chain. The fumigator also confirmed that the level of phosphine gas in the vessel's holds and the store ashore were dangerously high. Even using forced ventilation of the cargo, it took 5 days for the levels of phosphine gas in the cargo holds to reduce to acceptable levels.

Figure 1: Bags of fumigant on top of the maize cargo

Figure 2: Spilled fumigant

Figure 3: Smoke from fumigant

The Lessons

1. Fumigants are dangerous if not handled correctly and appropriate precautions are not taken. A number of factors may cause a fumigant to remain active, regardless of the length of voyage. Therefore, where possible, all fumigant residues should be removed from the cargo holds by a qualified fumigator before cargo discharge commences.

2. When a vessel is carrying fumigated cargo, the safety of its crew is paramount. It's the little critters that need to be eliminated, not the deck crew! To achieve this, masters and crews must follow the instructions provided by the fumigator on loading. In addition, owners and ship managers must also provide comprehensive procedures and guidance on board their vessels to enable the applicable international recommendations and national requirements to be complied with.

3. The frequency of vessels carrying fumigated grain cargoes varies from year to year in line with good or bad grain harvests in different parts of the world. However, given the potential harm to stevedores and other shore-side workers posed by fumigants, any port accepting fumigated grain cargoes, even as a 'one-off', needs to have developed and implemented procedures to make sure the discharges run smoothly. Emergency plans also need to have been developed just in case they don't.

Taking a Turn for the Worse

Narrative

A change of orders was the first in a chain of events that led to a collision between a bulk carrier and an anchored vessel.

The river pilot had disembarked and the master was preparing to carry out a crew change. The ship's agent then contacted the master and instructed him to proceed to anchor so that the ship could also take bunkers. The master quickly worked out a route through the busy shipping area to the anchorage. Once permission had been obtained from the VTS to anchor, the starboard anchor was made ready for letting go. The vessel's port anchor was unusable due to a problem with its windlass.

As the bulk carrier approached the anchorage on a north-westerly heading at a speed of about 5 knots, the master noticed that another vessel was weighing her anchor. The master decided that once the departing vessel had cleared the area, he would drop anchor in its position. The master also saw that there was another vessel anchored and taking on bunkers to the east of his intended anchorage position. A current was running to the north-east at a rate of 1-2 knots.

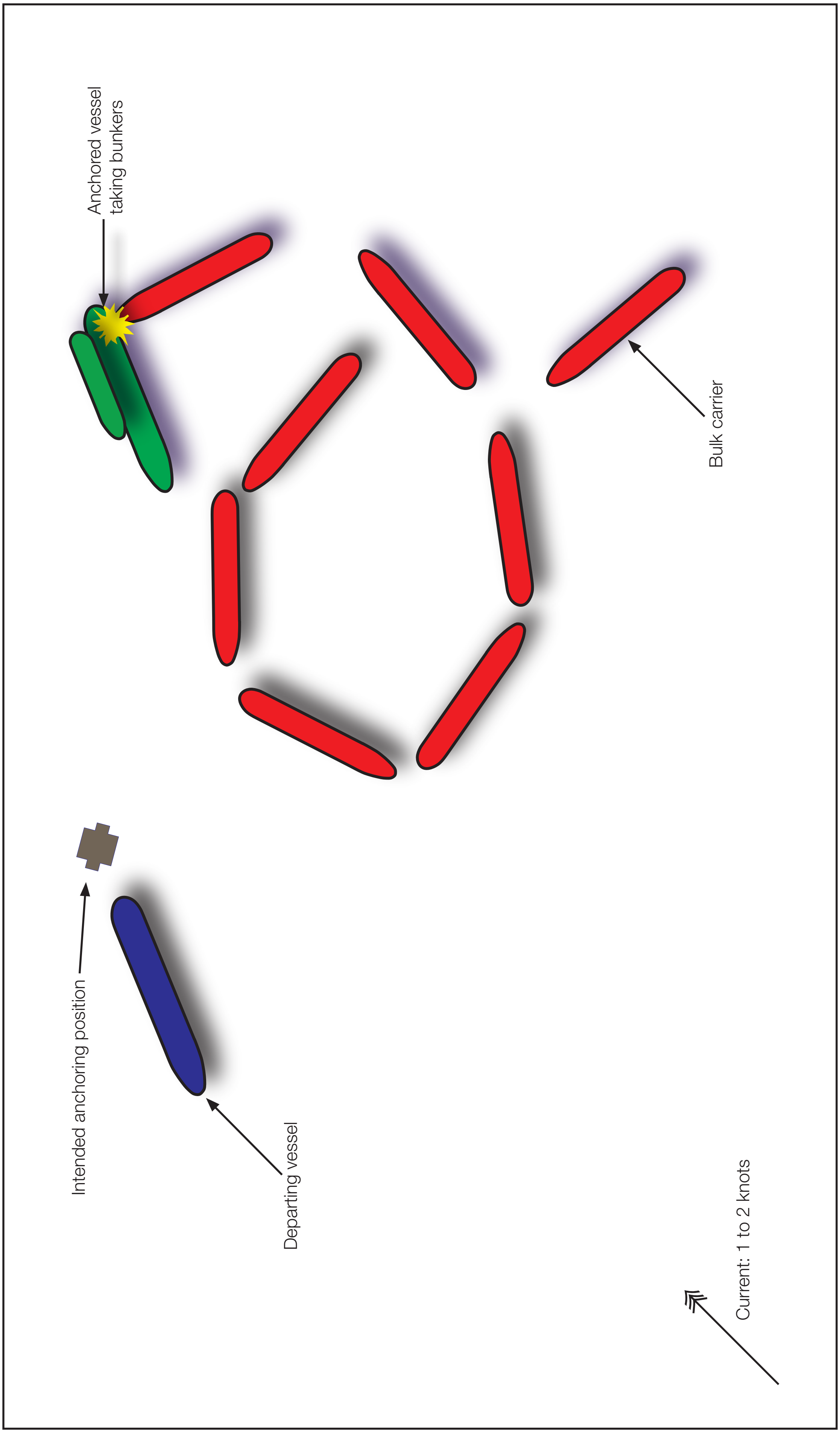
While the master waited for the vessel to weigh anchor, he decided to take a round turn out to port to provide more sea room for the bulk carrier's approach to the anchoring position (see figure). As the bulk carrier was loaded and proceeding at a slow speed, its rate of turn was slower than the master anticipated, so the master increased the engine speed to full ahead.

The master then realised that the distance between his own and the vessel taking bunkers was rapidly decreasing. He ordered the wheel hard to port, but the distance between the two vessels continued to close. Seeing that a collision was inevitable, the master placed the engines full astern, but this did not prevent the bulk carrier's stem from striking the anchored vessel on her port quarter. Both vessels were damaged in the collision.

The Lessons

1. **To be safe, short-notice changes to schedules and passage plans need careful consideration and planning. Whether a vessel is given 10 days or 10 minutes to plan an anchorage, the basic principles are the same. A short-notice change is not an excuse for short-cuts to be taken.**

2. **In areas where precise manoeuvring is required, either due to navigational constraints or the proximity of other vessels, teamwork is an essential factor in following the plan and maintaining situational awareness. Briefing others on the plan, the delegation of tasks such as monitoring distances to other vessels, and using the skills and knowledge of others, are not weaknesses; they are prerequisites of good leadership.**



Vessels' movements in anchorage

On Deck in Heavy Weather - Why and Under What Conditions?

Narrative

A 13,000gt general cargo vessel was on passage with a timber deck cargo. It was daylight with a forecast force 9 headwind and 6m head sea, and the vessel was making good a speed of about 3 knots through the water and 1 knot over the ground.

A nylon mooring rope, which had been secured on a pallet on the aft mooring deck, was loose in its stowage and the master was concerned that if it was washed overboard it would sink and potentially foul the vessel's propeller. He therefore decided that the rope needed to be re-secured.

Two crew members volunteered to go onto the aft mooring deck to secure the rope. The master's plan was for each of them to wear a lifejacket and a safety harness, with one end of a firefighter's lifeline attached to the safety harness and the other secured to a handrail two decks above. Any slack in the lifelines would be manually taken up by crew members tending the secured ends of the lifelines.

With the lifelines secured and tended as planned, the two volunteers proceeded to the aft mooring deck and started to secure the mooring rope. The vessel then shipped a large wave, the force of which washed the two men overboard and caused the tending crew members to release their grip on the lifelines. The lifelines then parted.

The lifejackets of the two men overboard inflated and the vessel's two bridge wing lifebuoys and attached smoke/light units were released. A DSC alert was transmitted on VHF radio and a "Mayday" message was then broadcast on Channel 16. The master considered that it would be too dangerous to turn the vessel around in the prevailing weather conditions. However, on being notified of the accident, the coastguard tasked two lifeboats and two rescue helicopters, and a number of other vessels joined the search and rescue effort to locate and recover the two men.

The body of one of the crew members was later recovered from the sea, but attempts to recover the body of the second crew member were unsuccessful.

Parted end of firefighter's lifeline

The Lessons

1. The nylon mooring rope had been secured on the aft mooring deck in accordance with the vessel's normal routine. Although heavy weather had been forecast, no formal checks were made following the vessel's departure from her last port. No heavy weather checklist was available and none was required to be completed as part of the vessel's safety management system. Furthermore, there was no designated enclosed means for stowing the coiled aft mooring ropes because a need for one had not been recognised. Had the mooring rope been properly stowed away, there would have been no need for anyone to go onto the aft mooring deck during the adverse weather conditions.

2. The mooring rope had come loose because a steel bar, holding the pallet on which the rope was coiled, had broken free from the deck due to weld failure. The structure as manufactured had lacked strength, and its exposed position and lack of maintenance rendered it liable to corrosion from the effects of weather and shipped seawater.

3. The vessel's safety management system did not contain instructions about the precautions to be taken before sending crew on deck in heavy weather. Despite this lack of guidance, the master did not instigate a formal assessment of the risks involved, nor did he consult the Code of Safe Working Practices for Merchant Seamen (COSWP), a copy of which was provided on board. Section 13.9 of COSWP states *"no seafarer should be on deck during heavy weather unless it is absolutely necessary for the safety of the ship or crew"*.

4. COSWP warns of the possibility of encountering *"rogue"* waves and the need to *"plan for, and expect, the unexpected"*. Although the significant wave height was 6m, research indicates that a wave height of nearly 10m could have been expected once in every 100 waves and, in support of this, a maximum wave height of 10.2m was recorded in the vicinity at the time of the accident. It is possible that the master did not spend enough time reviewing the prevailing sea conditions. Had he made a more studied assessment of the actual wave heights being experienced, he might have made a more realistic estimation of the potential wave heights likely to be encountered.

5. The vessel was not equipped with safety lines for use when sending crew on deck in heavy weather. A safety harness and tether conforming to a fall-restraint standard would have been appropriate. A firefighter's lifeline is not designed to be used in a load-bearing application; its function is to aid navigation during the low visibility conditions of a fire. The increased strength of a fall-restraint safety harness and tether compared to that of a firefighter's lifeline might have been sufficient to prevent the crew members from being washed overboard.

Bridge Team Communications - Or Lack Of

Narrative

Arriving in port, a 112m hi-speed ro-pax catamaran was approaching her berth stern foremost when she was set off track by a strong wind and her port hull made contact with a mooring dolphin. This holed the aluminium hull below the waterline, flooding one of her four engine rooms.

It was not until shortly before the impact that the vessel's bridge team "saw" the dolphin on a CCTV monitor. The vessel had no bridge wings, which meant that the sea surface could not be seen from the manoeuvring station within 93 metres of the beam and 184 metres of the stern. Furthermore, when proceeding stern foremost, which was the vessel's normal berthing approach, the master had to turn around to observe key navigational displays, all of which dramatically reduced his situational awareness leading up to the accident.

Senior crew members had been stationed fore and aft at mooring stations, and were occasionally reporting distances from fixed structures to the bridge team. However, the crewmen had not been effectively briefed as to what the bridge team expected them to report, and as a result the vessel's set onto the dolphin was not detected until it was too late to avoid making contact.

Figure 1: Master's view aft, from the manoeuvring station

The accident occurred in strong winds, which on this modern, high-sided vessel had a significant effect on her manoeuvrability. However, no windage information had been provided by the builders on delivery into service.

A windage diagram was obtained after the accident, analysis of which showed the relative direction of the wind at the time of the contact to be at its maximum effect on the vessel's ability to maintain station.

Figure 2: Diver's view of the hole in the aluminium hull, which resulted in a flooded engine room

The Lessons

1. The International Chamber of Shipping's Bridge Procedures Guide states: "A *bridge team which has a plan that is understood and is well briefed, with all members supporting each other, will have good situational awareness. Its members will then be able to anticipate dangerous situations arising and recognise the development of a chain of errors, thus enabling them to take action to break the sequence*".

2. The ergonomics of the vessel's bridge equipment and lack of visibility from the manoeuvring station should have alerted the master to the risk that he might lose situational awareness at a critical time.

   The receipt of good feedback from the fore and aft mooring stations, while the vessel was manoeuvring to the berth, might have prevented this accident. The master lost situational awareness at a vital time, which, with improved planning and communications, could have been prevented.

3. The windage forces information should have been available to the vessel's bridge team from her entry into service. Access to such information is vital on high sided vessels if effective planning and risk assessment of manoeuvres is to be achieved.

Failure to Recognise a Suspended Load Results in Death

Narrative

Modifications were being carried out on the diving bell recovery system of a diving support vessel. The modifications were part of an upgrade to enable the bell to be recovered in the event of a main bell winch system failure. The work involved installing a new winch arrangement for the bell's cursor[1].

The new winch was used to raise the 4 tonne cursor to allow technicians to work on top of the bell. The winch system was designed such that the brake was automatically applied when the winch control was placed in the neutral position or when hydraulic power was removed.

Once the cursor was in position the brake of the new winch was applied to lock it. Several technicians then worked on top of the bell for a period of time.

Part of the modification required removing buoyancy blocks from the top of the diving bell. A technician climbed on top of the bell to do this, but the blocks were very cumbersome and it became apparent that the cursor would have to be raised further to enable the blocks to be removed. Power was applied to the new winch and an operator went to a control position sited above the cursor and diving bell, from where he began to raise the cursor. From his control position, the operator was unable to see the top of the diving bell or the technician on top of it, and was being directed by hand signals from a visible part of the deck below. Once the cursor was at a suitable height, lifting was stopped, power to the winch was switched off, and work on top of the bell set to continue. A few seconds later the winch rendered and the cursor fell, trapping the technician between the diving bell and the cursor.

Despite his colleagues' best efforts and rapid evacuation to hospital, the technician died from his injuries.

The cause of the winch failure was attributed to a faulty pilot valve in the cursor's winch control system, which prevented the winch brakes from applying once hydraulic power was removed.

[1] Cursor. An arrangement in the shape of an inverted bowl, which guides the diving bell into the ship from below, enabling the diving bell to become integral with the ship and its movements

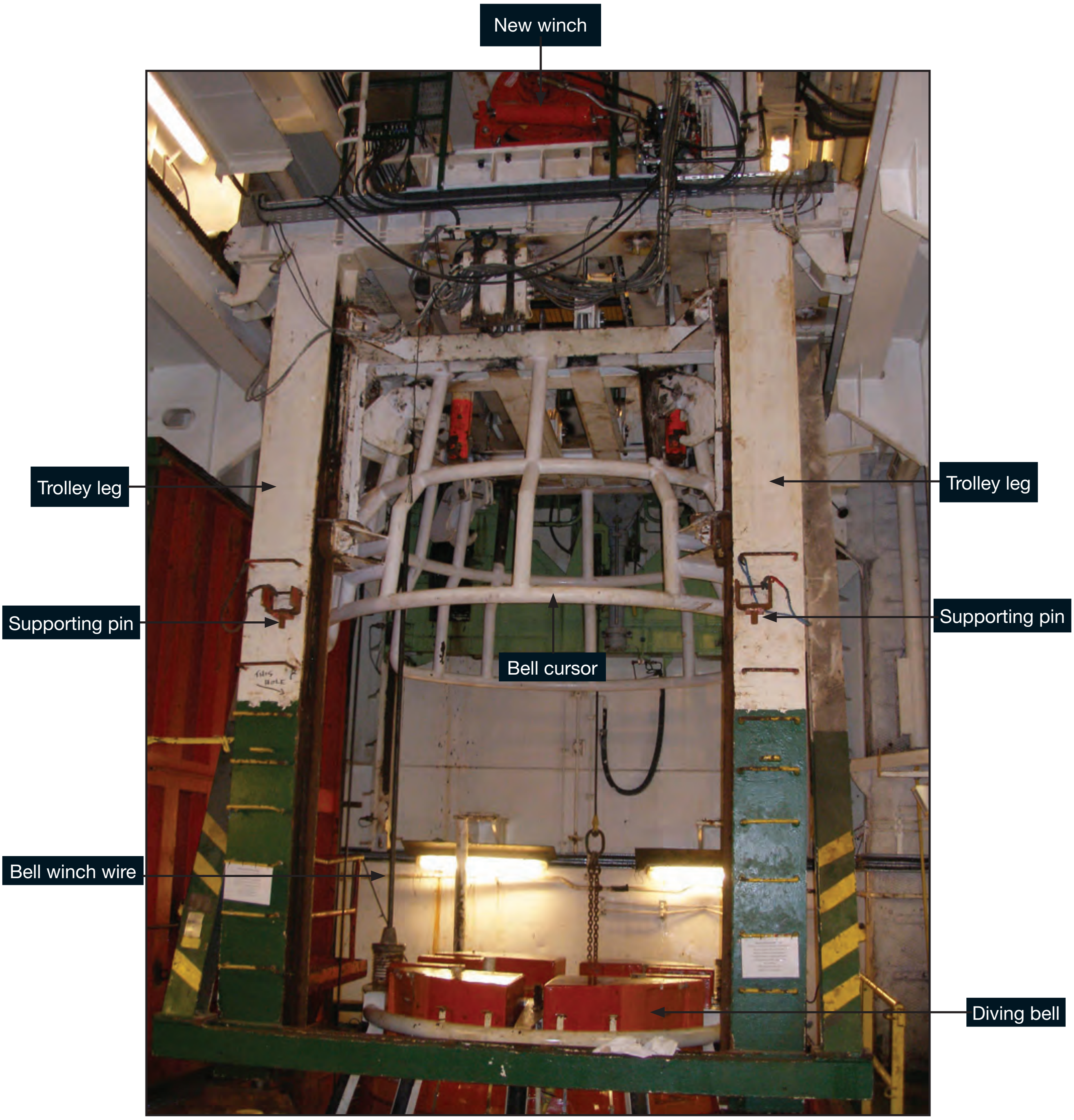


Figure 1: Diving bell trolley and components

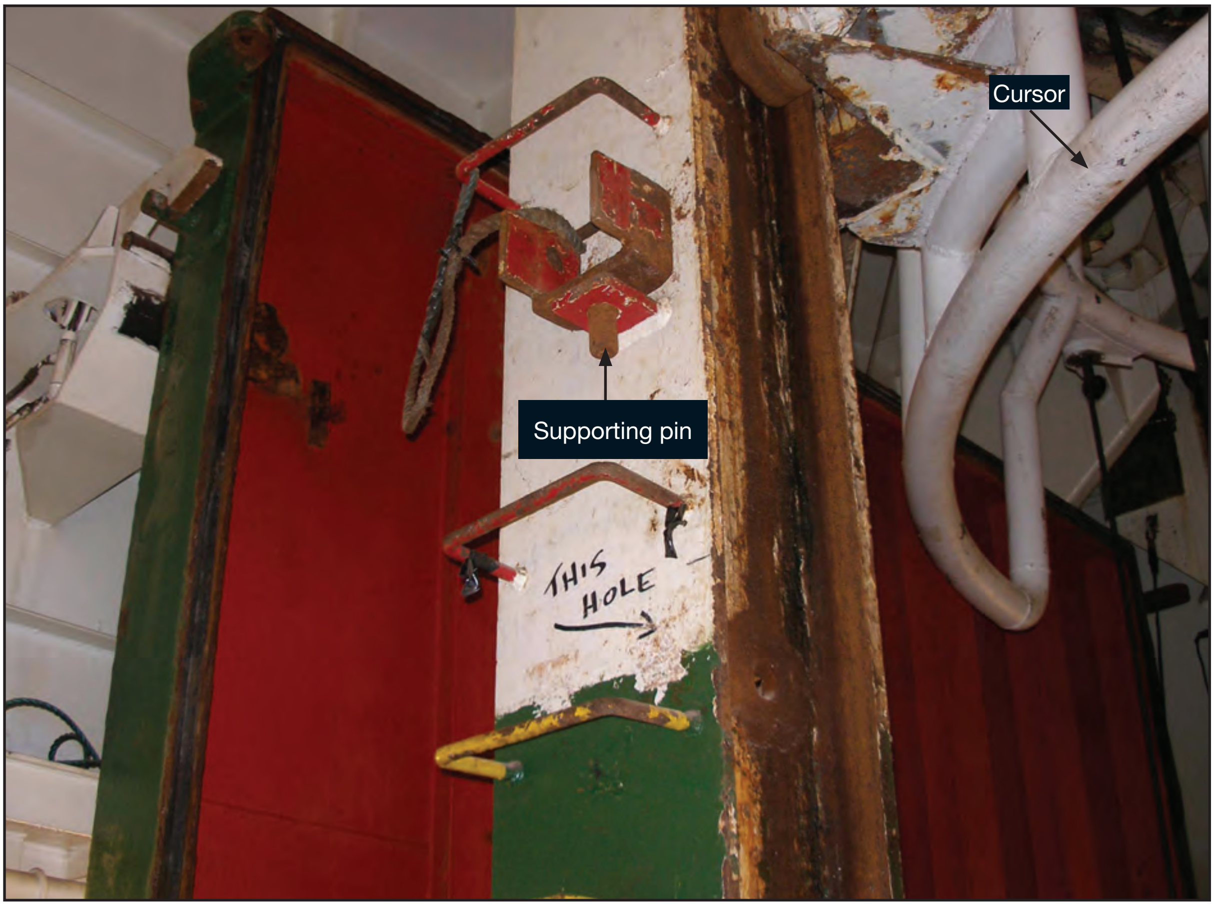


Figure 2: Bell trolley leg and cursor supporting pin (stowed position)

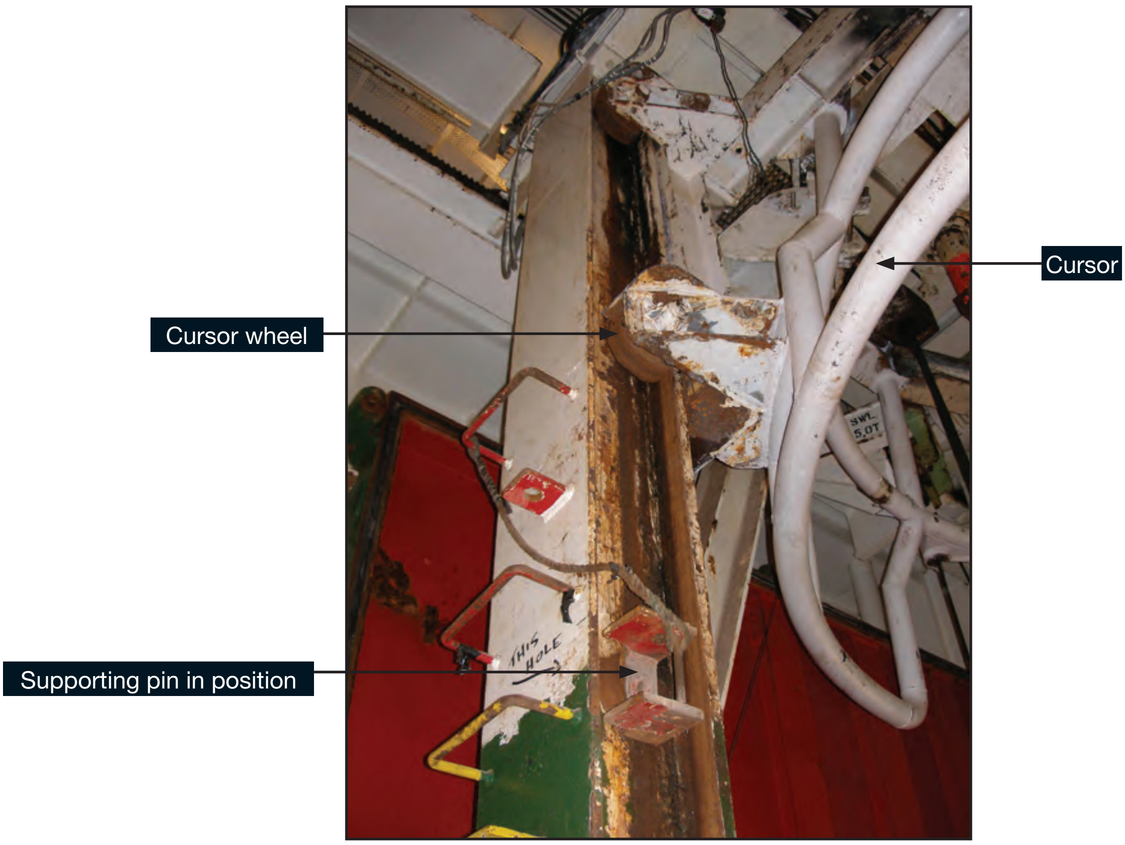


Figure 3: Bell trolley leg and cursor supporting pin in position below cursor wheels

Figure 4: Technicians working below the suspended 4 tonne cursor, supported only by its winch wires

The Lessons

1. Investigation revealed that a pilot valve in the hydraulic system was not seating properly, allowing pressure to bypass and thus prevent the winch brakes from applying properly. Further, the design incorporated a single point of failure: one pilot valve serving two brakes. This had not been approved by the vessel's owners, operators or classification society before the modifications began. Formal approval of systems and their component elements is an essential safety barrier, and should never be circumvented.

   Most importantly, this was a new system that had yet to be commissioned. It is essential not to place any confidence in machinery until it has been fully commissioned and properly tested.

2. The installation team failed to apply the most basic of safety principles while working under the suspended load. Regardless of whether the winch had been commissioned and declared fully functional, the cursor should have been supported by additional means before anyone went underneath it. This team of experienced technicians would never have stood below a similar suspended load swinging from a crane, yet they failed to recognise the similarities because it was not swinging. It was simply not appreciated that the cursor was a suspended load as it sat firm between the trolley legs.

3. The new winch introduced a novel situation: the ability to separate diving bell from cursor without the need for normal fixed supports. A novel situation should always be treated with the utmost respect until proven; even then, the "what if?" should be considered. Additionally, safety devices must always be fitted … just in case.

4. The vessel's operators had numerous management procedures and safety tools in place to ensure safe working. These were either not applied or were applied ineffectively, to the extent that no-one recognised the risk posed by the suspended cursor. Safety management systems and procedures are useless if their purpose is not understood and applied with diligence by all involved.

5. During the modification, lines of responsibility between the vessel and shore-based staff became confused. As a result, overall management of the modification project lacked direction and control. Responsibilities should be clearly defined and understood; it is always better to ask too many questions than to carry on with a potentially hazardous task in the belief that other people are doing what is expected of them.

Cracked Nipple Fire Risk

Narrative

A large cargo vessel was alongside in port when the flame in the auxiliary boiler went out unexpectedly. Crew went to investigate and found fuel oil spraying from the discharge side of the boiler's fuel pump. Fortunately, nearby equipment was well lagged and the fuel oil did not ignite.

The crew investigated and found that a steel hexagonal nipple fitting, which connected the burner pipework to the pump casing, had failed, allowing hot fuel oil to escape. It was thought that exposure to hot, high pressure fuel oil over a long period had caused the fitting to suffer from fatigue or stress corrosion cracking. This in turn had caused the nipple to shear.

The Lessons

1. **There is always a risk of fire associated with fuel oil systems and fittings. These should be checked regularly and, if there is any doubt, fittings should be replaced. Engine room fires are dangerous and expensive; new fittings are far cheaper.**
2. **A fire was avoided in this case because the fuel oil did not come into contact with any hot surfaces. This underlines the importance of making sure all hot surfaces are properly lagged.**

Pilot Ladders … Shouldn't be a 'Leap of Faith'

Narrative

Vessel 1:
Favourable weather conditions were present for a late evening pilot disembarkation from a small outward bound general cargo vessel in ballast. The light sea and wind should have meant an uneventful transfer; however this routine operation nearly turned into disaster for the disembarking pilot.

The ship's crew had rigged the pilot ladder, which was reportedly in 'clean and good condition', on the vessel's starboard side. When the crew confirmed the ladder was ready, the pilot made his way down to the deck in preparation for disembarkation and waited a short time while the vessel turned to make a lee for the transfer.

With the turn completed the pilot launch came alongside and the pilot stepped onto the ladder. At some point shortly after committing his full weight to the ladder, it gave way and the pilot fell approximately 1-1.5 metres onto the waiting pilot boat. Amazingly, the pilot suffered only a sprained ankle and was able to return to work soon after the accident.

The managers of the vessel confirmed that the pilot ladder had been issued with a Certificate of Conformance 4 years prior to the accident, and was therefore valid.

Figure 1: Vessel 1 - Pilot ladder failed at sheer strake

Vessel 2:

With equally favourable conditions present and about 3 hours later, a survey vessel was attempting to embark a pilot. After initially preparing the pilot ladder on the vessel's port side, the crew shifted it over to the starboard side at the request of the port VTS.

Once 'apparently' ready, the pilot launch approached and the pilot stepped onto the ladder, causing the side rope to immediately fail in the area adjacent to the securing point. Fortunately the pilot had not begun to climb the ladder and was therefore able to step back onto the launch, suffering no injury.

The transfer operation was then aborted until a second ladder had been rigged and tested. The pilot was able to board without further incident.

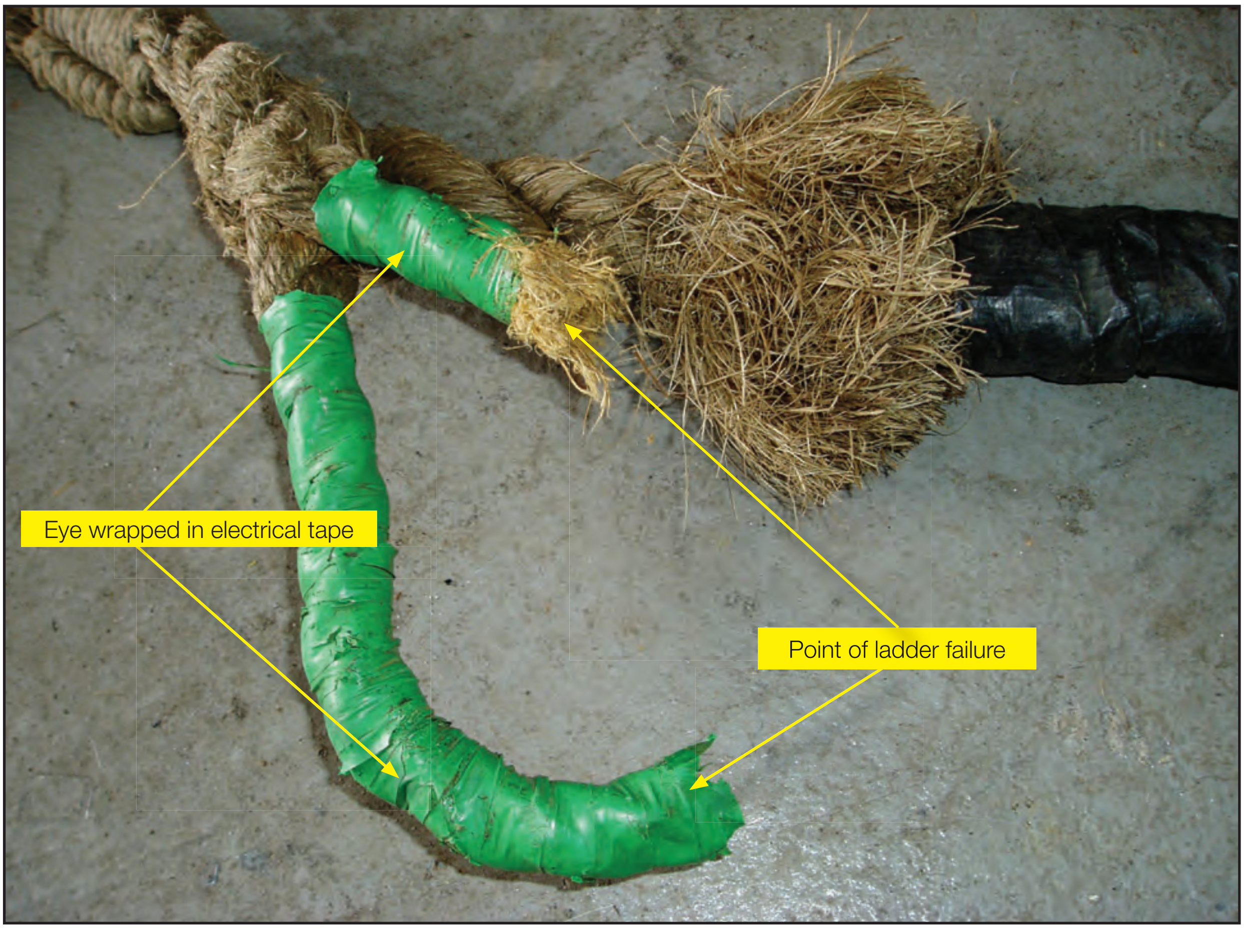


Figure 2: Vessel 2 - Pilot ladder failed at soft eye used to secure ladder

The Lessons

Although both ladders suffered failures in differing sections, the similarities between the two accidents are all too obvious. Both failed due to inadequate pilot ladder maintenance. Failure to properly test them prior to the pilot stepping on, meant that defects with the ladder went unnoticed until it was too late.

1. Having a valid Certificate of Conformity does not deem the ladder as 'fit for purpose'. Such certificates confirm only that the ladder has been manufactured to the appropriate requirements. Pilot ladders must be thoroughly inspected frequently as part of a regular planned maintenance system. These inspections must include special attention to areas which have high potential for wear, for instance the part of the ladder which meets the sheer strake and lashing points.

2. Ladders should not be modified, and mariners are particularly cautioned against using electrical tape, or similar, on them. Although well intentioned, the tape applied to the ladder in the second accident masked the condition of the rope underneath, and hampered proper inspection of its condition. The tape also trapped moisture within the line and prevented it from drying once it became wet, providing ideal conditions for it to rot - unnoticed.

3. After use, ladders should ideally be hung up clear of the deck and stored wherever possible in a clean, dry environment. They must also be protected from oil, chemicals, paint, or any other source of contamination that could affect their strength.

4. Once rigged, the ladder should be tested to confirm its strength. Any such test must be conducted in such a way that does not place the individual carrying out the test in unnecessary danger should the ladder fail, but that does provide confidence in the ladder's strength and suitability for the transfer.

Hot Work - the Need for Effective Controls

Narrative

The crew of a foreign-flagged dredger had made good progress with dumping armour stones to protect electrical export cables from an offshore wind farm until a hydraulic ram operating one of the dumping doors failed. Although progress was interrupted, it would nevertheless be a fairly straightforward job to replace the ram.

The ram's protective steel casing was removed by the crew, and a local company was contracted to cut away the rusted casing framework that was welded to the main deck (Figure 1).

At 0600, the dayshift crew issued a Permit to Work (PTW) for the hot work on the main deck. However, the job was not risk-assessed, a fire sentry was not nominated, there was no toolbox talk to agree the procedure and the PTW was not signed. All of these omissions were contrary to the instructions in the vessel's SMS.

As the contractor set up the oxy-acetylene cutting gear, the chief officer instructed him to go ahead and start cutting off the framework from the main deck. However, neither the chief officer nor the contractor checked to see if a fire sentry was in place or if there were flammable materials in the spaces under the main deck.

At 0935, the chief engineer heard the fire alarm. As he made his way up to the main deck he saw black smoke building up in the alleyway, under the area where the framework was being cut off. Conscious of the need to limit the spread of fire, he closed doors behind him and, as he reached the main deck, he shouted *"fire, fire, fire"*. This was the first the crew knew of a problem because the fire alarm could not be heard on the main deck.

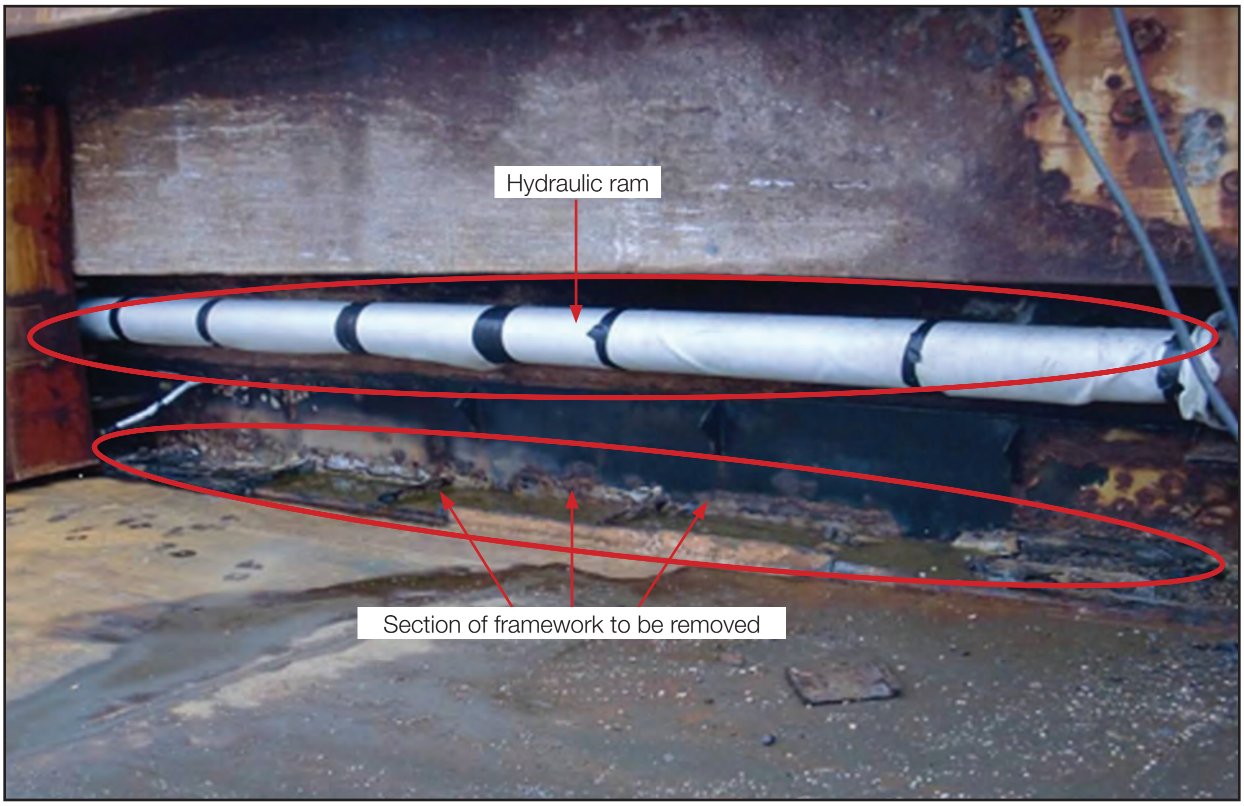


Figure 1: Dumping door hydraulic ram and framework to be removed

The crew were mustered, and boundary cooling was quickly established on the main deck in way of the hot work area. Electrical power was isolated throughout the ship with the exception of the emergency fire pump, which had been started to provide fire-fighting water.

Two of the crew, wearing BA, entered the alleyway and confirmed that black smoke was coming from a dry store, which was directly under the area where the hot work had been taking place. They were also standing in 50mm of water, which came from the boundary cooling, indicating that the 24mm main deck had been holed during the burning operation.

A short time later, the BA team entered the dry store and found that a number of old immersion suits stowed there had partially melted, causing the heavy smoke (Figures 2 and 3). The boundary cooling water, pouring in from above, had cooled the suits and there was no evidence of other fires in the compartment. The local fire and rescue service also attended the vessel and deployed BA teams, who confirmed that there were no fires or areas of excessive heat.

Figure 2: Partially melted immersion suits

Figure 3: Compartment smoke damage

The Lessons

The precautions to be taken in the event of hot work being carried out are well established and known to all but the most inexperienced of seafarers. It is worrying that virtually none of the hot work procedures laid out in the vessel's SMS or those detailed by the contractor were complied with.

In this case, the ambivalent approach to safety could have easily cost lives and resulted in severe damage to the vessel. If it hadn't been for the prompt action of the chief engineer in raising the alarm and closing doors to prevent the spread of fire and smoke, the £180,000 repair costs would have been far greater.

1. When considering approving hot work, do make sure that the safety procedures, including conducting a risk assessment as laid out in the SMS, are fully complied with.

2. Pre-operation "tool box" talks are very useful in ensuring all those involved are fully aware of the precautions to be taken, the alert procedures and the scope of work.

3. Hot work contractors will also have their own company procedures to follow; it would be helpful to cover these during the "tool box" talk.

4. Do search adjacent compartments for flammable materials before the start of hot work. Remove them where there is a risk of ignition.

5. Make sure if you are a fire sentry that you are able to communicate with the person conducting the hot work so you can alert him/her to dangers.

6. Do take time to brief contractors on the action to be taken in an emergency. This should be clearly laid out in the vessel's SMS.

7. The fire alarm and public address system are very quick methods of alerting those on board to dangers or general advice. Their effectiveness depends significantly on coverage throughout the vessel. Do attend to defects and "blank" spots promptly.

Part 2 - Fishing Vessels

I have been asked to write an introduction for the next Safety Digest.

This week my crew have all been issued with the new PFD (Personal *Floatation Device)*. This is a well constructed piece of kit. A lot of thought has gone into the design to enable fishermen to conduct their various tasks on a working deck without hampering their movements.

It's great to see a change in attitude towards the implications of safety equipment regarding fishermen. The PFD units are supplied as an option and are not mandatory. Having said that, I expect more fishermen will opt for the new units.

Accidents at sea may never be prevented - the environment we all have to work in is so unpredictable and circumstances change very quickly. However, good seamanship, safety awareness, crew training and risk assessment can go a long way to help prevent accidents and incidents at sea. Just a few simple changes can make the difference between a crewmember suffering a very serious injury or experiencing just the normal knocks and bumps that go with the job.

Some of the most effective changes take place in people's attitudes, who often have a lot of goodwill and commitment to their work. When everyone understands what causes accidents and works together to prevent them, then everyone feels a shared sense of responsibility.

To all who may read this: be safe, be well and good fishing...

George William Anderson

George was born in 1956 and brought up in the island of Whalsay, in the Shetland Islands, where he still lives.

He has been a fisherman all his life, starting on white fish boats, then moving on to pelagic vessels.

At present, George is the skipper of MV *Adenia* LK 193 and is a director of Adenia Fishing Company Limited. His three sons are also on board this vessel.

Restrictions in fishing from quota regulations mean he is at home more than in the past. However, he is now a grandfather and enjoys spending time with his grandchildren.

Drills - Your Emergency Investment

Narrative

With the gear shot away, the skipper of a twin-rigged, 18.7 metre wooden stern prawn trawler looked through the wheelhouse window and felt things were looking up. The weather had improved, the vessel was handling well and the fishing promised to be good.

However, things were definitely not going to turn out quite as he thought!

At about 1200, the three crew, one of whom was salaried, hauled in the catch, during which it was found that the centre warp had stranded. The skipper felt it was unsafe to continue fishing and set a course for the vessel's home port.

Until 1500 progress had been steady, but at about that time the engine room fire alarm sounded. The skipper had experienced a few previous spurious alarms. But this was different - the alarm would not reset. As the skipper went from the wheelhouse into the galley, to go down the vertical ladder (Figure 1) to the engine room lobby, he was joined by the mate. Once in the engine room, both of them noticed a pool of flames under the auxiliary engine. As it was a relatively small fire, the skipper opted to engage the main engine-driven deck-wash pump so that the crew could fill a bucket with water for him to douse the flames. This was despite a dry powder extinguisher (Figure 2) being immediately available in the engine room and a foam one being accessible in the adjacent accommodation space.

Figure 1: Access to engine room lobby

Figure 2: Auxiliary engine and dry powder extinguisher location

The bucket of water was thrown onto the flames, but this only broke them up into a number of smaller fires which then licked up the turn of bilge, outboard of the auxiliary engine. A second bucket of water was also unsuccessful and the fire intensified as though it was being fed from a liquid fuel source. The smoke density forced the skipper and mate from the engine room. The mate tried to close the engine room wooden door, but it was seized.

The skipper managed to transmit a "Mayday", but because the hatch from the galley to the engine room lobby was left open, smoke rapidly filled the galley and wheelhouse. The skipper did not have time to collect the hand-held VHF radio, close the wheelhouse windows, stop the main engine or operate the remote fuel quick shut-off valves before being driven from the wheelhouse. Luckily, the mate managed to shut the galley external steel door before joining the rest of the crew on the deck, who by that time had donned their lifejackets.

The whole of the after section of the vessel was now heavily smoke-logged, and smoke began to spiral up from the fish hold hatch as the engine room forward bulkhead began to burn through. The situation was becoming desperate. The crew were unaware of the true extent of the fire and were unprepared to deal with it because no drills had ever been carried out.

While the crew were waiting to be rescued, they brought the liferaft down from the wheelhouse roof, while it was still accessible, in case they needed to abandon the vessel. As they were doing so, the skipper managed to put his arm through the open wheelhouse window and disengage the gearbox. Unfortunately, he was unable to reach the main engine stop button to stop the engine and reduce the risk of the engine providing fuel to the fire.

As the smoke thickened under the shelter, the mate managed to speak to the rescue helicopter crew through a link established by the coastguard, and he was advised that the aircraft would soon be on scene. The mate decided it would help the winching operation if the vessel could be turned into the wind.

After soaking his hat with water and placing it over his nose and mouth, he entered the smoke-filled wheelhouse via the galley. He managed to turn the vessel, but had to make a rapid escape from the smoke. In doing so he left the galley external steel door open in his rush to reach the fresh air. The fire now had an uninterrupted oxygen supply.

The rescue helicopter arrived soon afterwards and the crew were recovered, luckily having suffered only minor smoke inhalation.

The vessel was later towed into harbour, still burning and with the main engine running. Having received a briefing from the vessel's owner, a local fire and rescue service breathing apparatus team tripped the fuel quick shut-off valves, closed the doors, hatches, windows and engine room vents and operated the CO_2 system, which quickly extinguished the fire.

The engine room suffered widespread fire damage, particularly at the forward end (Figure 3). Most of the overhead cabling and plastic fittings had been destroyed, as were the switchboards. There was also heavy smoke damage to the accommodation, galley and wheelhouse. The vessel was later surveyed and declared a constructive total loss.

From the description, the fire was liquid fuel-based and was located under the auxiliary engine. It was found that the engine fuel supply pipe was totally unsupported throughout its length and that the braided flexible pipe connected to the engine fuel lift pump had suffered severe chafing and electrical arc damage. The internal polymer pipe was also melted and so the true, pre-fire condition could not be determined. However, all the indications pointed to a failure of the pipe, which allowed fuel to build up in the bilge. From the survey, it was found that a large overhead 110 volt electrical cable had been arcing against the sharp edges of the steel cable carrier, and this was the most likely ignition source.

Figure 3: Engine room - forward bulkhead damage

The Lessons

The efforts taken to fight this fire were disappointing. There was no co-ordination and the basics of dealing with a liquid fire seem to have been forgotten. There was little consideration given to establishing smoke boundaries to provide time, options and access. The need to close down the engine room and use CO_2 was also poorly considered. This was despite blanking systems to close off the vents and the facility to stop the vent fans remotely from the wheelhouse being readily available. The skipper was not aware of the latter arrangement.

No effort was made to set up boundary cooling despite the deckwash hose playing onto a small section of the deck above the accommodation space. The option of using the salvage pump, which was stowed in an enclosure together with a petrol canister, to provide boundary cooling water, was not thought through. Although the pump was later found to be defective, the crew did not know this at the time.

1. Make regular checks of pipework to ensure it is properly supported to prevent chafing, which will eventually lead to fatigue and, in the case of fuel and oil systems, will increase fire risk.

2. The importance of conducting regular drills cannot be over emphasised[2]. They ensure crew are familiar with the equipment location and its use, and instils confidence. Importantly, drills also make reactions instinctive, and success in an emergency more likely.

3. Prompt use of fuel quick shut-off valves is essential to prevent feeding a fire in the engine room. In this case, they were fully functional but were not operated. The consequence in this case was that diesel fuel oil was supplied to the fire as the auxiliary engine's flexible hose melted.

4. The mate's action in re-entering the wheelhouse, with only a water-soaked hat as protection against smoke, was well-intentioned but extremely dangerous. The only real protection in this situation was breathing apparatus. As it was, he was unable to close the galley's external door and so provided an uninterrupted supply of oxygen to the fire.

5. Do take time to regularly run the portable salvage pump. These pumps are prone to seizing through poor maintenance and exposure to the weather, so it is advisable to flush the pump through with fresh water after each use.

6. A spare petrol canister presents its own fire hazard. In this case, it was stowed directly above the fire. When deciding where to stow the canister, think how it can be jettisoned; Section 5.1.8.8.4 of MSN 1770 (F) provides guidance.

7. Because one of the fishermen was salaried, the owner had a responsibility under health and safety legislation[3] to carry out risk assessments, but hadn't done so. If he had, it is possible that the need for drills, and checking of functionality of emergency equipment, would have been identified. The Sea Fish Industry Authority's Fishing Vessel Safety Folder provides guidance and methods of recording and evaluating risks. The folder is available on application.

8. The MCA's Fishermen's Safety Guide provides comprehensive, easy-to-read guidance on the operational and management aspects of fishing vessels and covers many of the issues relating to this case. It is recommended reading and can be downloaded at: http://www.dft.gov.uk/mca/197-370_mca_fisher__8217_s_safety_g.pdf

[2] Section 8.1.2 of MSN 1770(F) - The Code of Safe Working Practice for the Construction and Use of 15 metre Length Overall to Less than 24 metre Registered Length Fishing Vessels requires recorded drills to be carried out monthly.
[3] Statutory Instrument (SI) 1997 No 2962 - Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 as amended.

PLB … Is Yours a Lifesaver?

Narrative

Despite being overcast, a light north-north-easterly breeze and slight seas meant a pleasant start for a day's fishing. After a quick cuppa the skipper let go his lines and set off to move his nets closer to port in preparation for some bad weather which had been forecast for later that week. His 7m boat was used primarily for potting, but when weather conditions prevented this he fished with nets. Accustomed to fishing alone, the skipper had made sure that everything was squared away nicely for a day's work.

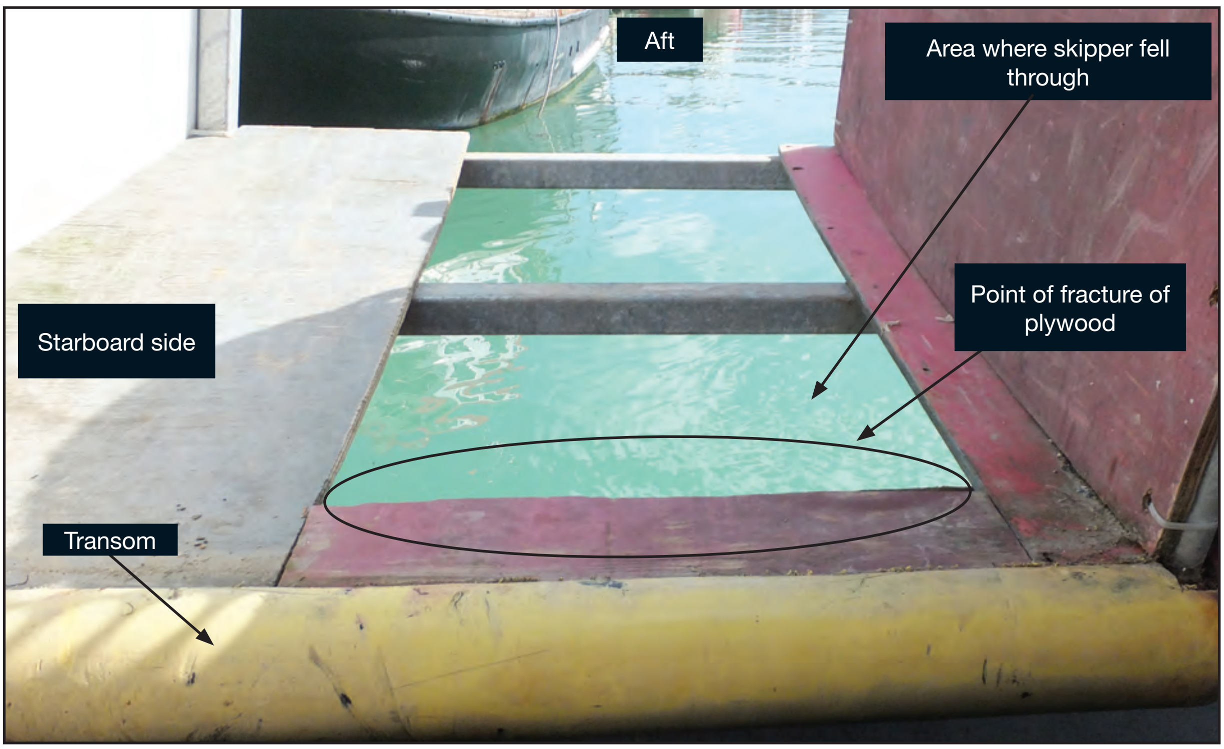
Importantly, and as would prove to be lifesaving, the skipper had opted to wear a two-piece foul weather suit with buoyant sections in the bib. He had also purchased a personal locator beacon (PLB), which he placed in his bib pocket.

After a short trip out to the first of two nets, the skipper set about hauling it using the hauler situated forward on the starboard side. Having retrieved the net, weights and buoys, the net was quickly stowed in a bin situated on deck at the aft end. Having satisfied himself that the net was ready for shooting again, the skipper set off to the position of his second net.

On arrival, the skipper sent a text message to someone ashore and then began hauling the net. Unbeknown to the skipper, the boat had drifted across the lines attached to the net's weight and marker buoy. Glancing towards the stern, he noticed the marker buoy by the transom. Concerned that the lines could foul the boat's rudder or propeller, he quickly climbed onto the plywood-decked cat catcher and pushed the buoy clear and around to the other side of the boat.

Having cleared the danger, he turned around and stepped forward. The plywood suddenly gave way and, just like a trap-door, opened up to the water below. The skipper fell straight through, fortunately managing to seize hold of a line attached to the net he had previously recovered.

The skipper attempted three times to get back into the boat, but was unsuccessful owing to the adverse effect of the cold water (just 8°C) on his physical ability, and the boat's freeboard. Wisely, the skipper wrapped the line he had seized, around his arm, and then used it for purchase as he pushed off the transom with his feet to lift himself up and clear of the water.



Starboard side of 'cat catcher'

Having managed to get into as good a position as possible under the circumstances, it was time to raise the alarm. No other vessels were in the vicinity so nobody observed his fall. It was therefore fortunate that he had brought a PLB; but he was unfortunate to have placed it in his bib pocket. Unable to readily access it, he removed his glove and immersed his hand to reach into the pocket, eventually getting hold of and retrieving the PLB. By that time, the cold water had caused him to lose much of the dexterity in his hand, which made it difficult for him to activate the PLB. He ultimately lost his grip and dropped it into the water. Not designed to float, the PLB sank, and along with it the only chance the skipper had of alerting someone to his peril.

His only hope now was that he would be seen by the crew of a boat passing by. As time went on, he progressively suffered the numbing effects of the cold water, and slipped in and out of consciousness. Fortunately, a small commercial fishing vessel eventually passed by en route to its fishing grounds, and the skipper was quickly rescued after having been in the water for over 1½ hours. He went on to make a full recovery.

The Lessons

The skipper was trying to do everything right. He had risk assessments in place, the boat was well maintained, and he had thought about the dangers of working alone. He had also purchased suitable safety equipment. This clearly paid dividends when he fell into the water; survival for in excess of 1½ hours in water at the temperature experienced is not guaranteed.

This is a good news story, but we can learn from this skipper's experience.

1. **Being conscientious, the skipper had replaced the plywood decking on the cat catcher the previous summer. Because lines had previously become entangled on the rudder post, he opted to modify the deck design to allow a panel to be removed to allow quick access. This meant the original deck was divided in two and not fixed to the steel frame. The plywood, although marine grade, was very flexible under foot, and over time its movement ultimately caused a stress fracture at the transom edge. Not being fixed down meant that the remaining piece, now unsupported, flipped up - acting just like a trap-door. If making structural modifications, it is important to fully consider the implications of doing so. It is rarely a good idea to have an unsecured item on a moving boat.**

2. **Although not an exact science as there are a number of factors which affect cold water survivability, the two-piece suit that the skipper was wearing almost certainly increased his chances of survival. The built-in flotation stitched into his bib assisted him to remain afloat despite reportedly drifting in and out of consciousness in the last moments before his rescue. Time and time again the wearing of lifejackets and flotation aids has saved lives. Make sure your life would be saved - wear your lifejacket!**

3. **As he worked alone, the skipper had wisely bought a PLB so that the alarm could be raised if he was in difficulty. Unfortunately, being placed in his bib pocket meant that it was difficult to reach when he really needed it, ultimately necessitating the removal of his glove, resulting in loss of dexterity and his ability to activate the device. PLBs are provided with various accessories to allow flexibility when they are worn. Make sure yours is worn in such a way that it can be accessed easily when you really need it most. Ensure you are familiar with how your PLB works and always use the flotation pouch where one is provided.**

4. **When overboard, the skipper remembered his sea survival training and did his best to keep himself clear of the water. By doing so, he increased his chances of survival as body heat is lost much more slowly in air than water. The skipper also remembered the importance of remaining awake and alert, spending his time talking to himself and keeping up his morale - he maintained his belief that he would survive the accident. It goes to prove the value of sea survival training. Make sure you have done it - it just might save your life.**

Splashes to Ashes

Narrative

The five-man crew of a cockle dredger abandoned ship by jumping into the sea after a portable petrol-driven salvage pump caught fire on deck.

The pump, which was being used as part of the cockle dredging operation, was being topped up with petrol from a jerry can while it was running. A passing vessel's wake caused the dredger to roll, and petrol accidently splashed onto the hot exhaust manifold. The spilt petrol erupted in flames, engulfing the deck area almost immediately. A quick-thinking crewman pulled the pump's hose from the sea and played it onto the fire, but this had no effect and the crew were left with little option other than to jump into the sea. The skipper, who was trapped in the wheelhouse by flames, escaped through a window. He had just enough time to register that the deck by the liferaft was melting before he, too was driven into the sea. None of the crew had time to collect lifejackets before they abandoned the vessel, and they kept themselves afloat by holding onto fenders that lined the side of the dredger.

Fortunately, the cockle dredger was fishing in proximity of another dredger, whose skipper saw the crew abandon ship and went to their rescue. In their haste to effect a rescue, the dredge hose of the second dredger became fouled in the propeller, leaving the vessel disabled approximately 30 yards from the burning craft. The crew of the disabled dredger attempted to throw lifebuoys and ropes to the crew in the water, but were unable to reach them.

The burning dredger's skipper recognised the rescuing craft's predicament and he swam to it, collected a lifebuoy, and returned to his crew with it. Fortunately, the crew of the disabled craft were able to free the hose from the propeller, enabling them to then rescue the stricken crew from the sea.

All five crewmen were taken to hospital, where they were treated for shock and smoke inhalation.

The vessel burned for several hours, and eventually sank while a harbour fire service vessel played water onto the flames.

Figure 1: Abandoned vessel

Figure 2: Stricken vessel and rescue vessel

Figure 3: Petrol-driven pump similar to that being used

The Lessons

1. While there can be no doubt about the benefits of carrying a portable salvage pump on board, consideration should be given as to whether the pump is petrol or diesel-driven. While petrol-driven pumps are generally lighter and cheaper than their diesel counterparts, these benefits can be outweighed by diesel pumps' greater fuel efficiency and reliability, especially where they are being used for prolonged operations such as cockle dredging. Furthermore, diesel fuel is much less volatile than petrol and, therefore, is fundamentally safer.

2. Although highly advisable, where a pump is in prolonged use it is not always practical to allow the engine to cool down every time it is topped up. However, the dangers of petrol and its volatile vapour cannot be stressed enough, and extreme precautions must be taken when refuelling, taking due account of the following:
   - Always stop the engine before attempting to refill the fuel tank.
   - Use a goose necked funnel to displace the fuel pouring activity away from the engine, and a flexible spout on the fuel container to help reduce splashing and vapour.
   - Do not overfill the tank; avoid the temptation of "just a little bit more."
   - If possible, have another person standing by with an appropriate foam-type fire extinguisher.
   - Secure all lids immediately the filling operation is complete; wipe up spills and dispose of rags promptly to reduce vapours.
   - If using a petrol-driven pump for fishing operations, ensure the petrol tank is full before starting the engine.

   Note, petrol vapour is four times heavier than air, so be alert to the danger of escaped vapour lying in the bilges. Do not store petrol in unventilated spaces. Consider storing it in several small approved containers rather than one large container as this makes the job of transfer much easier, and thus safer.

3. Weather conditions were benign at the time of this accident, and the last thing on anyone's mind that day was ending up in the sea. Life on a fishing boat teaches to 'expect the unexpected'; constant wear inflatable lifejackets specifically assist during such unexpected times. This crew were all saved thanks to the close proximity of the other vessel; had that vessel not been in attendance the chances of surviving in the sea without any flotation device would have been slim. With practice, a fisherman should find it as easy to don an inflatable lifejacket as to put on his oilskin trousers.

4. Lifebuoys provide buoyancy to people in the water, but they are difficult to throw to any distance. There are efficient (unpowered) line throwing items available that can travel much greater distances than a thrown lifebuoy. Thought should be applied to carrying these items on board in addition to the required lifebuoys.

Look After Your Pipework

Narrative

Two crew had to abandon their small creel boat after it started taking on water, and subsequently sank.

The GRP boat, which was fitted with a vivier tank, had sailed that morning to haul and re-bait pots. The weather was good, with a gentle breeze and slight sea. It had been cold, but as the skipper warmed up he removed his jumper and idly threw it onto the console in the wheelhouse. Unfortunately, the jumper covered the controls and indicator lights for the automatic electric bilge pumps.

As the vessel returned home, the skipper and crew noticed that the bow appeared lower in the water than normal. The skipper stopped the boat and lifted the deck hatch for the forward compartment, which contained the pipework and the pump for the vivier tank. The compartment was full of water, to the extent that the sea valves were no longer accessible.

The skipper pressed the Digital Selective Calling (DSC) distress alert button on the VHF radio and the coastguard responded immediately. The crew donned lifejackets, manually deployed the liferaft and secured it alongside. On moving his jumper, the skipper noticed the automatic bilge pump indicator light for the forward compartment was illuminated, but the small pump was clearly unable to stem the flooding. The bilge alarm fitted to the forward compartment had failed to operate.

The floodwater eventually reached the engine room in which two further electric bilge pumps were fitted. The engine room bilge alarm was triggered as the level of flood water rose. This prompted the skipper and crew to board the liferaft, taking the vessel's flare pack with them. A helicopter airlifted the two men ashore, by which time the fishing vessel had sunk.

The exact cause of the flooding is unknown. However, some of the vivier pipework, which had been found to be heavily corroded, had recently been repaired using a GRP bandage.

Vivier pipework prior to temporary repair with GRP bandage

The Lessons

1. Pipework connected to sea inlets and discharges, particularly those connected to vivier tanks, are clearly critical to the watertight integrity of a vessel. They must be inspected regularly - either by removal or by ultrasonic thickness testing. Other than the recent repairs, the owner had not touched the vivier pipework in the 7 years he had owned the vessel.

2. Repairing pipework with GRP bandaging should only be a temporary measure before full replacement of any damaged or heavily corroded pipework takes place. Following such a repair, it is wise to regularly check for leaks.

3. The vessel was fitted with automatic bilge pumps and bilge alarms. The forward bilge alarm did not sound, and the automatic bilge pump indicator lights had been inadvertently covered. Bilge alarms should be fitted low enough in the bilge and tested before each trip to ensure the crew are alerted as early as possible to flooding. A simple test of the alarm takes virtually no time at all and may ultimately save your boat and, more importantly, your life.

4. Once alerted to flooding, the crew need to be able to take effective action to stem the flow of water. This must include the closing of sea valves, which may require extended spindles to make them accessible. MGN 165(F) - Fishing Vessels: The Risk of Flooding provides comprehensive practical advice on how to reduce the risk and what to do in an emergency.

5. The rescue phase of this accident was well carried out. The coastguard were alerted quickly by DSC alert; the liferaft was deployed manually and kept alongside until needed; the crew donned lifejackets; and additional safety gear was taken into the liferaft in case it was needed. The actions of the crew resulted in neither of them getting wet!

Man Overboard Recovery Goes to Pot

Narrative

A beam trawler was returning to port after 5 days of fishing. The sea was very rough with a 5m swell and winds gusting up to storm force 10 on the vessel's port quarter. As five of the crew sorted fish and maintained the trawl gear on the open foredeck (Figure 1), waves broke over the gunwales and ran down the sides of the accommodation block. None of the fishermen were wearing personal flotation devices.

Eventually, the mate went to the wheelhouse and told the skipper that the conditions were too severe for the crew to work safely. In response, the skipper shouted to the crew to shelter in the accommodation. Two of the deckhands stowed their tools and made their way to the starboard side with the intention of climbing the aft stairs to the poop deck. However, as they reached the starboard side of the accommodation block, the vessel rolled heavily to starboard and the starboard side of the deck was swamped with water. One deck-hand managed to grab a hand-hold (Figure 2) as he was lifted off his feet, but the second deckhand was washed overboard.

Figure 1: Foredeck

Figure 2: Starboard side main deck

A life-ring with a smoke float was immediately thrown over the side, and the skipper started to manoeuvre the vessel. Within 5 minutes the trawler was sufficiently close to the man overboard to enable a safety line to be thrown, which he caught and held onto. However, the effort required for him to remain afloat in the cold and rough seas soon began to take its toll; he began to lose consciousness and started to swallow seawater. The man overboard was hauled close alongside the vessel's port quarter, and a pilot ladder was thrown over the poop deck handrail. However, the man overboard was unable to help himself and the crew could not reach him due to the high freeboard and the vessel's movement, despite one of the crew climbing down the ladder.

As the man overboard was pulled further forward, where the freeboard was lower, he let go of the safety line. A crewman who was wearing an immersion suit grabbed a life-ring and jumped into the water. He managed to get hold of the man overboard, who was then pulled on to the deck. Although CPR was quickly given, the man overboard did not recover. Postmortem examination identified that the deckhand had drowned; it also revealed that he had taken recreational drugs shortly before his death.

The Lessons

1. Working on deck in rough seas is not unusual, but it is dangerous and should be avoided if at all possible. There is no point working on deck in rough seas if the jobs can wait until a vessel gets alongside. Where this is not possible, the rigging of safety lines and the wearing of lifejackets when working on deck at sea are simple precautions that are proven life savers.

2. Too many fishermen drown every year because of the time taken to recover them after falling overboard. This is largely due to the lack of crew drills and the lack of suitable means of recovery. Don't wait for an accident to happen to find out if your boat and crew are up to speed in this respect, otherwise you could end up watching someone drown.

3. Alcohol and drugs have no place on board fishing vessels. Their effects can dramatically adversely affect a person's perception and performance, putting everyone's lives at risk.

Part 3 - Small Craft

As the RYA's Chief Instructor for Motor Cruising and Power, I was delighted to be invited to write the introduction for the small craft section of the Safety Digest. I have been powerboating for the past 15 years, teaching powerboating for much of that time. I have been lucky enough to drive and teach on a whole host of different powerboats, ranging from small tiller controlled safety boats on Alpine lakes to large, powerful cruising RIBs.

I am pleased to note that in addition to its report into the recent tragic RIB accident that resulted in the loss of two family members and injuries to several others, the MAIB has taken the decision to re-publish a number of previous Safety Digest articles that hold common themes.

Accidents are rarely a result of just one poor decision, there are usually several contributory factors, of which any one may have reduced the severity of the incident, or perhaps prevented it altogether.

What worries me is the recurrence of the same key safety points being ignored or forgotten.

Preparation

In several of the cases, the boat was being taken out for the first time in the season, and while most were deemed to have been well looked after and many of the owners/drivers featuring in the following pages are described as safety conscious, some crucial areas had deteriorated without the owner's realisation. We must make sure that after a period of inactivity, we make the time to have a good look over our boat before launching - checking the hull fittings such as seating pods/consuls remain in good order, keeping our eyes open for signs of possible problems with the steering system, indicated by drips and leaks or peculiar sensations when steering - for example a lack of responsiveness or juddering. If in doubt, get the boat checked over professionally before you take to the water.

Safety Equipment

Anyone who has a boat will know that its upkeep is not cheap, in many of the cases essential safety equipment was not carried. Equipment such as flares needs to be checked for their general condition, that they are still 'in date' and everyone should know how to deploy the type carried. A hand-held VHF is a vital piece of equipment, which is possibly best attached to the driver, rather than attached to the console. If a driver is parted with the boat's controls they will still be able to use the VHF to radio for help.

Personal Flotation

In some instances, personal flotation was carried but not used; in others, it was worn but not activated; and in 2 cases no personal flotation devices were even on board. When taking your boat out, make sure everyone wears an appropriate personal flotation device - be it a buoyancy aid or life jacket.

Check everyone is wearing it correctly fitted and, if it is an inflatable life jacket, they know how it activates so that it will work as intended, should the need arise. Nowadays, there are comfortable and inexpensive devices on the market, but just like all other safety equipment, you need to keep on top of its upkeep by regularly checking and servicing in line with the manufacturers recommendations. Don't wait for the conditions to change to decide to wear it, it could be too late.

Speed

In several of the cases, the throttle was fully open when the boat moved in an unanticipated and catastrophic way. Driving a high-powered boat requires an amount of understanding and skill. When driven at the top end of its capability, a boat may become unstable and display undesirable handling characteristics. There are many contributing factors to safely driving a high-powered boat at speed, including skilful use of power trim and/or trim tabs, reading the water - being mindful of wake from other vessels. Keeping the boat in contact with the water is a good rule of thumb. Once clear of the water, a boat is essentially out of control and at the mercy of its landing.

Seating And Hand Holds

To reduce the possibility of injury or ejection when travelling at speed, passengers should be in dedicated seating with good hand-holds, rather than sitting on the cushions that are used at low harbour speeds, or while sunbathing at anchor.

Kill Cord

Fundamentally, once the driver is dislodged from the driving position, unless they are wearing a correctly functioning kill cord the consequences can be disastrous. In all but one of these cases, this simple piece of equipment, if worn correctly, would have minimised the damage. The kill cord, when secured around the leg, should not hinder the steering or throttle. It can be easy to get distracted and forget to attach the kill cord, but don't feel embarrassed to remind the driver.

I was heartened to read the case entitled "Well prepared, well equipped, well done", which just goes to underline that good equipment, thorough planning and appropriate training allow powerboaters to make informed judgements.

As the boating community, I would like us to work together to make sure that whenever we set off we remember the following quick and easy tips:

1. Always wear a kill cord.
2. Keep a good look out.
3. Keep passengers and crew seated safely with secure hand-holds.
4. Operate within your and your boat's limits.

The biggest challenge we face is influencing a change in behaviour.

Rachel Andrews

I have been working in the watersports industry as an instructor and a professional skipper for the past 15 years, during which time I have had the pleasure of working both in the UK and abroad on a range of boats from small tiller-steered boats, to larger more powerful boats. I really enjoy introducing people to watersports as well as helping them to develop their skills. I have been working as the RYA's Chief Instructor for Motor Cruising and Power for the past 3 years.

CASE 20

Kill Cords and Lifejackets – Your Tools for Survival

Figure 1: 6m RIB

Narrative

A family and a friend were holidaying on the south coast. The friend, who had 6 years' boat handling experience, had brought his well maintained, 6m RIB with him (Figure 1). The boat was fitted with a 90 hp engine, and there were two 150N lifejackets and a buoyancy aid carried in a kitbag. There were no flares or VHF radio on board and, although there was anecdotal evidence that a kill cord was occasionally used, it was not found.

It was a bright and sunny afternoon on the day of the accident. There was a bit of a chop to the sea, and the wind was force 4 when the boat's owner took the father for a fast, wave jumping ride. It was an exhilarating trip – but unfortunately, tragedy was just around the corner.

At about 1315 the owner took the daughter out for another wave jumping trip. Neither wore a lifejacket despite them being readily available in the boat. Soon after leaving the slipway, the RIB was sighted going past a ship at anchor and a yacht, at high speed, in the following sea. At 1324 a member of the public contacted the coastguard and informed them that a boat had passed by, again at high speed, and had come to an abrupt stop. There were no signs that anyone was on board.

The coastguard immediately activated the inshore and all weather lifeboats, rescue helicopter and coastal rescue teams to search the area for possible survivors. At 1445 the body of the owner was discovered on the foreshore. The postmortem report showed that he had died from drowning. Despite extensive searches it was not until 9 days later that the female's body was found. The RIB, which had snagged on lobster pot lines, was recovered by the local marine police. It was found in the upright position with all its equipment still on board. Subsequent investigations identified that the engine throttle was in the "full fuel throttle" position and the engine start circuits were set to the "run" position. There was no evidence of a kill cord having been fitted. The engine and steering were found to be in good condition, and there were no defects to explain why the two persons on board were thrown into the sea. It was also proven that, had a kill cord been connected to the engine stop toggle switch, and fitted to one of those on board, the engine shutdown circuit would have operated as the person was thrown overboard.

All the indications suggest that this was an accident that occurred when wave jumping in a following sea. It is possible that the RIB stove into a wave, and if not already at full speed, the throttle might have been inadvertently shifted to the "full fuel" position, tipping both those on board into the sea. As the kill cord was not connected, the boat continued at high speed until it was snagged on the lobster pot lines.

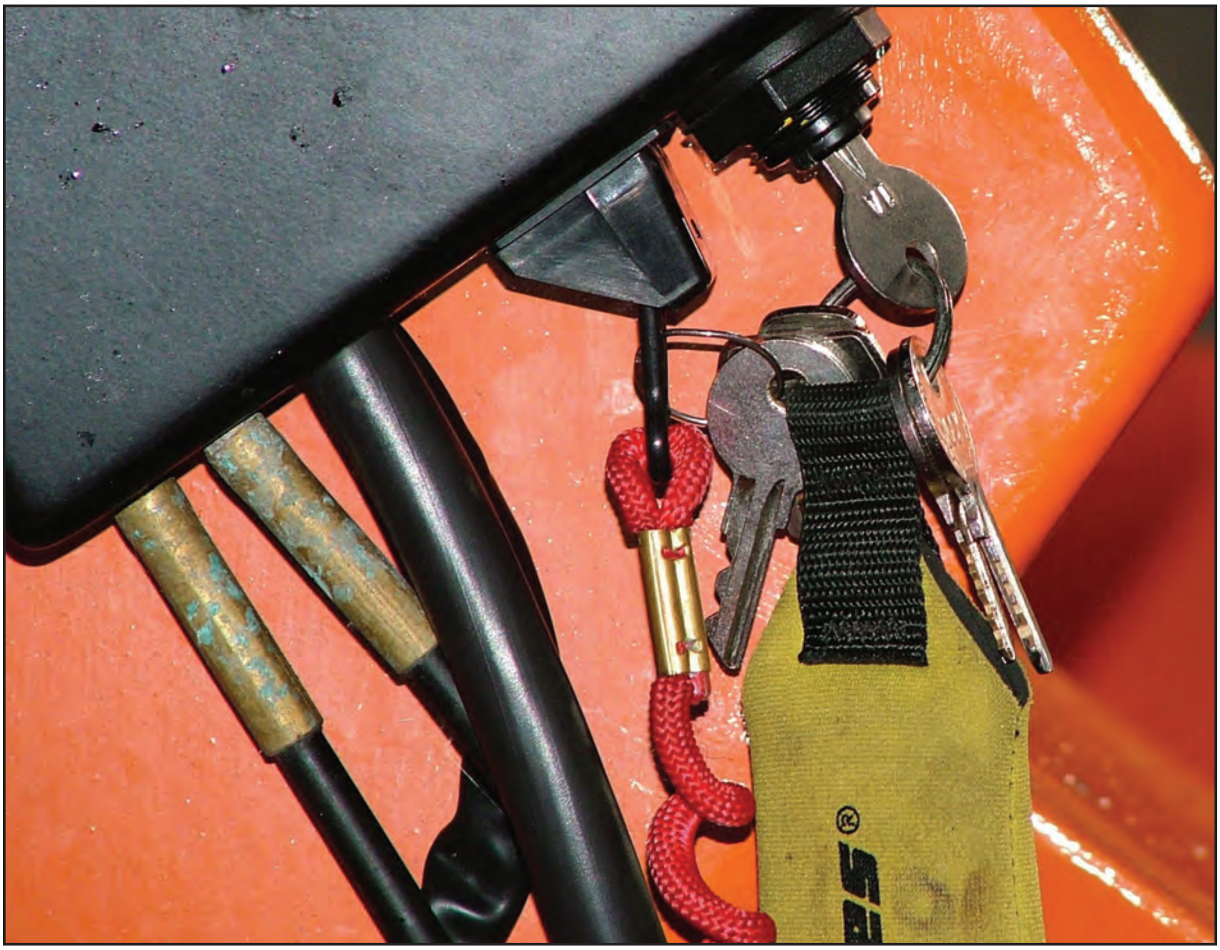


Figure 2: Kill cord toggle-type switch

CASE 20

Figure 3: Example of fitting of the kill cord

The Lessons

There have been numerous accidents, many leading to loss of life, that have been due to people not carrying out the most basic of precautions. Sadly, this case illustrates once more, the importance of connecting kill cords and wearing lifejackets.

The following lessons can be drawn from the accident:

1. Had the kill cord been used, the boat would have remained in the vicinity with its engine stopped, significantly improving the chances of survival. There are many configurations for fitting kill cords. Some operate a toggle type switch (Figure 2) and others hold off a spring-loaded engine circuit isolating switch. Whichever system you have, do check that your kill cord is free from abrasions and that the crimps securing the loops are tight. Always use the kill cord and make sure that it functions and that it is securely fitted to your body or to equipment that you are wearing. An example is at Figure 3.

2. Some engine systems are designed to operate only with the kill cord in place. If you have one of these, it is prudent to carry a spare cord so that the engine can be re-started and you can rescue the person attached to the kill cord if thrown into the water.

3. Always wear your lifejacket – it is your very best friend in this type of situation. Do not be fooled by warm air temperatures. Exposure to cool sea water temperatures can rapidly sap your strength, especially if you have suffered the trauma of being thrown overboard and your boat continues without you.

4. While the lack of a hand-held VHF radio and flares might not have prevented this tragedy, both the RNLI and RYA strongly recommend that they be routinely carried, to raise the alert in the case of an emergency.

Well Prepared, Well Equipped, Well Done

Narrative

A 5m RIB departed a sheltered estuary for a sea crossing bound for Ireland, with only its owner on board. The boat was in good condition and was well equipped for prolonged offshore cruising. The owner/helmsman was wearing an immersion suit, a Gecko marine safety helmet and an automatic lifejacket, which had a portable VHF radio in one pouch and a PLB in another.

When the RIB was about 5 miles offshore, rough seas were encountered, so the helmsman reduced speed from around 24 knots to between 14 and 17 knots. All was well until the RIB landed so violently and with such force after riding over one of the moderate waves that the helmsman's seat was wrenched from the deck. As a result, he was thrown overboard. On entering the water his lifejacket did not automatically inflate, so he had to inflate it manually.

Because the helmsman had attached a kill cord around his leg, the kill cord was pulled from the engine ignition as he was thrown overboard, causing the RIB's engine to stop. Nonetheless, the RIB continued to make way in the water until it stopped about 100m from the helmsman. To make things worse, the VHF radio in the lifejacket pouch had been damaged beyond repair. However, all was not lost because the helmsman's PLB activated as designed.

The PLB alerted the local MRCC, which contacted the wife of the RIB owner, who confirmed that he was at sea in the area of the distress beacon. In a bizarre twist of fate, however, the coastguard then received a report that the RIB had since arrived at its destination. In fact, this was a different boat with the same name. After some delay, the situation was resolved and a full scale SAR operation was initiated. Ferries, fishing vessels and local leisure craft converged on the PLB's position. RNLI lifeboats and a rescue helicopter were also tasked.

A passenger ferry spotted the empty RIB and the helicopter located the helmsman 300m from his boat. After 1 1/2 hours in the water, the RIB owner was winched on board the helicopter. He was uninjured and asked to be lowered back onto his boat. Once back on board the RIB, the owner repositioned the broken seat and with an RNLI vessel in attendance made his way back to the boat's marina.

The 5m RIB

The Lessons

1. Safety equipment saves lives. Good equipment costs money, but a small financial outlay can pay massive dividends. It's better to have paid for safety equipment and not to have needed it, than not to have bought or worn it and to wish that you had. Being thrown into rough seas with no one else around is a frightening experience, but by wearing an immersion suit, a lifejacket and carrying a PLB, your chances of survival will significantly increase.

2. If a person driving a RIB or similar craft doesn't wear a kill cord, incapacitation or falling overboard can leave a boat out of control and extremely dangerous. A correctly attached kill cord will prevent a boat from becoming a runaway bus, thereby protecting not only its helmsman and passengers, but also other water users.

3. Modern PLBs are small, lightweight and unobtrusive, and they are relatively affordable. However, if you do buy one, make sure that all contact details and information provided on the PLB registration forms are kept up to date.

4. Auto-inflate lifejackets are ideal for use in many situations, but for various reasons they don't always work as expected. Therefore, be ready to inflate them manually if required.

5. The MAIB has investigated several accidents in which RIB fixtures and fittings have become detached. A periodic check of the integrity of attached structures will help to prevent unwelcome surprises.

6. Going to sea alone, on any type of boat, presents its own hazards and challenges. In this respect, keeping the coastguard informed of passage plans and intended movements is of great value should an emergency arise.

Almost a 'Deadman's' Handle

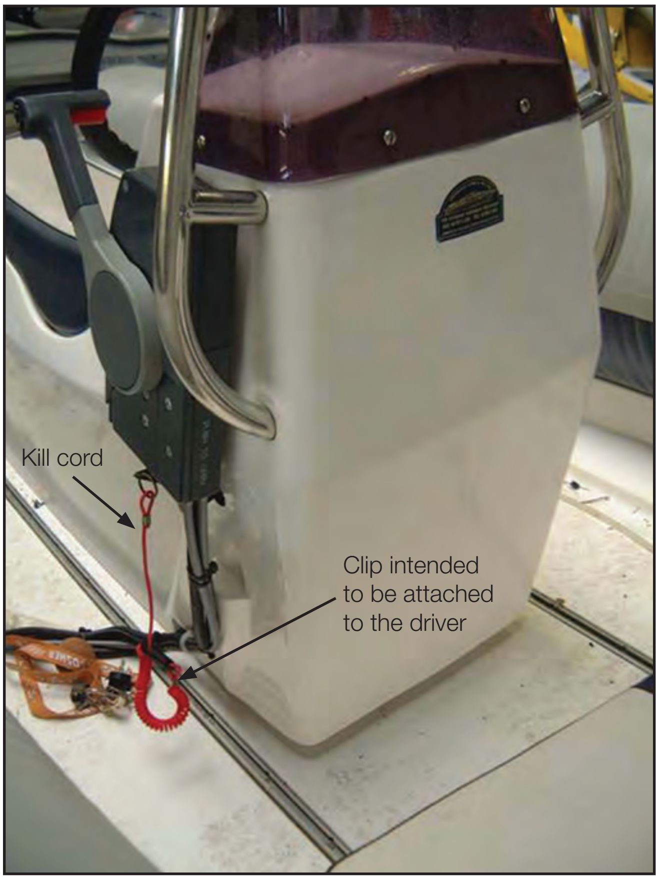


Figure 1: Photograph showing console and kill cord

Narrative

As a 4.5m RIB with three teenage occupants approached the beach to pick up a wakeboard, it passed a line of markers indicating the boat was entering an area in which a 4 knot speed limit applied. The driver reduced speed to about half throttle, and commenced a slow left-hand turn. During the turn, the console on which the driver was sitting, and to which the steering wheel was mounted, detached from the deck (Figure 1). The driver was unable to maintain his balance, and fell over the boat's port side and into the sea.

The RIB immediately turned sharply to starboard, and a passenger who had been sitting on the rubber tube to the driver's left was thrown into the water. He was immediately struck by the RIB's rotating propeller. A few seconds later, the remaining passenger panicked, and jumped out of the boat, leaving the now unmanned RIB to circle in a clockwise direction, at a speed of between 10 knots and 15 knots. While circling, the RIB passed sufficiently close to the driver, who was assisting the injured passenger, for its propeller to rip his fleece top. None of the RIB's occupants were wearing buoyancy aids.

Fortunately, the accident was seen by another powerboat in the vicinity, which managed to pass a line to the people in the water and tow them clear. The injured passenger sustained deep lacerations to his chest and left side (Figures 2 and 3), and was taken to hospital by air ambulance. He remained hospitalised for 3 weeks. The RIB, escorted by a local lifeboat, circled for about 30 minutes until it finally beached in an area which had been cleared of many other, varied activities by local authority officials. The flares carried on board the RIB were found to be out of date.

Figure 2: Injuries to passenger

The Lessons

1. Had the kill cord fitted to the RIB been used, the injuries caused by the propeller would have been avoided. A RIB driver does not expect to be thrown from his or her boat, and therefore it is not difficult to see why some drivers might see the wearing of kill cords as unnecessary, or even as an insult to their ability. However, this accident shows that the unexpected does happen, and that people do get seriously injured as a consequence. It is common sense to use the kill cord; it is foolish not to.

2. Although many boats' fittings and accessories might appear to be secure, this should not be taken for granted. Wear and vibration take their toll over time, and can result in catastrophic failure of some fastenings, particularly on high-speed craft. Periodic inspection of these items takes little time, and increases the probability of the detection of loose items in time to allow remedial action to be taken and potential accidents averted.

3. Speed limits are usually imposed for several reasons including the prevention of wake damage, and the reduction of the risk of collision in busy areas of diverse activities. Disregard for such limits is potentially dangerous, not only for the vessel in question, but also for the other water users in the same area, which includes swimmers, divers, and young children paddling, who are unable to move out of the way quickly should the need arise.

4. A buoyancy aid is of no use whatsoever unless it is worn. On this occasion, it was fortunate that the injured passenger did not lose consciousness. Had he done so, his chances of survival without a buoyancy aid or lifejacket would have been considerably reduced.

5. Thankfully, most boat owners never have to use their emergency flares in danger. However, all flares must be periodically checked and renewed when past their "use-by" date. Otherwise they may fail to work, when needed.

CASE 23

A Tragic End to the First Trip of the Season

Figure 1: 6.4m RIB

Narrative

The owner of a high powered, rigid inflatable boat (RIB) was well known to have been a keen and competent yachtsman. He always made a point of wearing his lifejacket, and ensured that his yacht was properly equipped to cope with emergencies. In sum, he was considered to be very safety conscious.

About 2 years before the accident, he had moved into the faster paced RIB craft arena. He enjoyed the excitement of driving his boat, and decided to replace it with a larger, more powerful, 6.4 metre RIB with a 150 horsepower engine, providing a top speed of about 50 knots (Figure 1). It was very doubtful if the boat was subjected to regular maintenance or a professional survey prior to purchase, but the outward appearance was of a smart, well presented craft.

The owner was pleased with the RIB's performance, but as the weather deteriorated during the latter part of the year, he decided to lay up the boat for the winter. As the weather improved, during the early part of the New Year, he took the opportunity to take the RIB on its first run of the season. As a treat, he also decided to take his two teenage daughters on the trip. Although clear and bright, it was a chilly day, the wind was force 4, the air and water temperatures were at 5°C and 3°C respectively, so the group wore warm clothing.

Once at the slipway, the owner realised that he had left the three lifejackets at home, but not wishing to disappoint the girls he decided to go ahead with the trip. Also contrary to his normal practice, he had no VHF radio or flares on board, with which to raise the alarm if anything untoward happened.

During the early part of the trip, the elder daughter took the wheel. She found steering the RIB rather difficult, and soon after, her father took over. He was sitting on the most forward seat, with his younger daughter on the seat behind and with her sister standing beside her. After a period of weaving the RIB about, the owner steadied on a course and set the throttle at full ahead. The RIB then unexpectedly lurched to port, throwing the father and his younger daughter into the cold water.

Because the engine kill cord had not been connected, the RIB continued at high speed until the elder daughter was able to scramble to the steering console and reduce the engine power. Despite the haphazard steering, she managed to drive the RIB back towards her father and sister. Without a VHF radio or flares, she could not raise the alarm, but on the way, she raised an arm to try to alert a passing cruiser to her predicament. Unfortunately, they mistook this to be a greeting and continued on their way.

Once close to her family, the elder daughter jumped into the water in an attempt to rescue her sister. The cold water was too much to bear and, despite her very brave rescue attempts, she had to climb back into the RIB. Tragically, without the support of lifejackets, her father and sister disappeared from view.

The elder daughter then drove the RIB towards two fishermen in a boat, told them of the situation and they raised the alarm by mobile telephone.

Despite long and rigorous searches, the father and his younger daughter were not seen again.

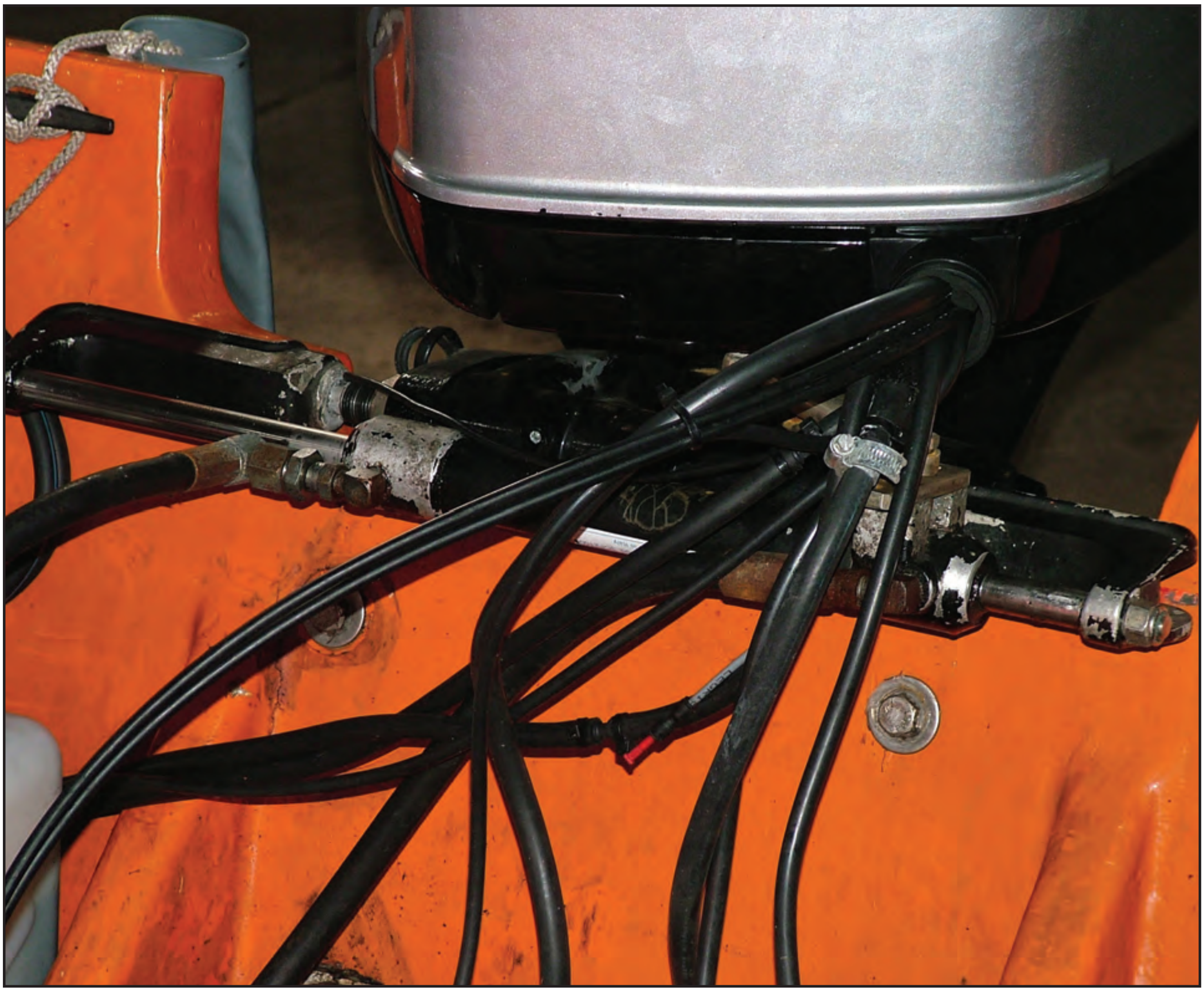


Figure 2: Steering system

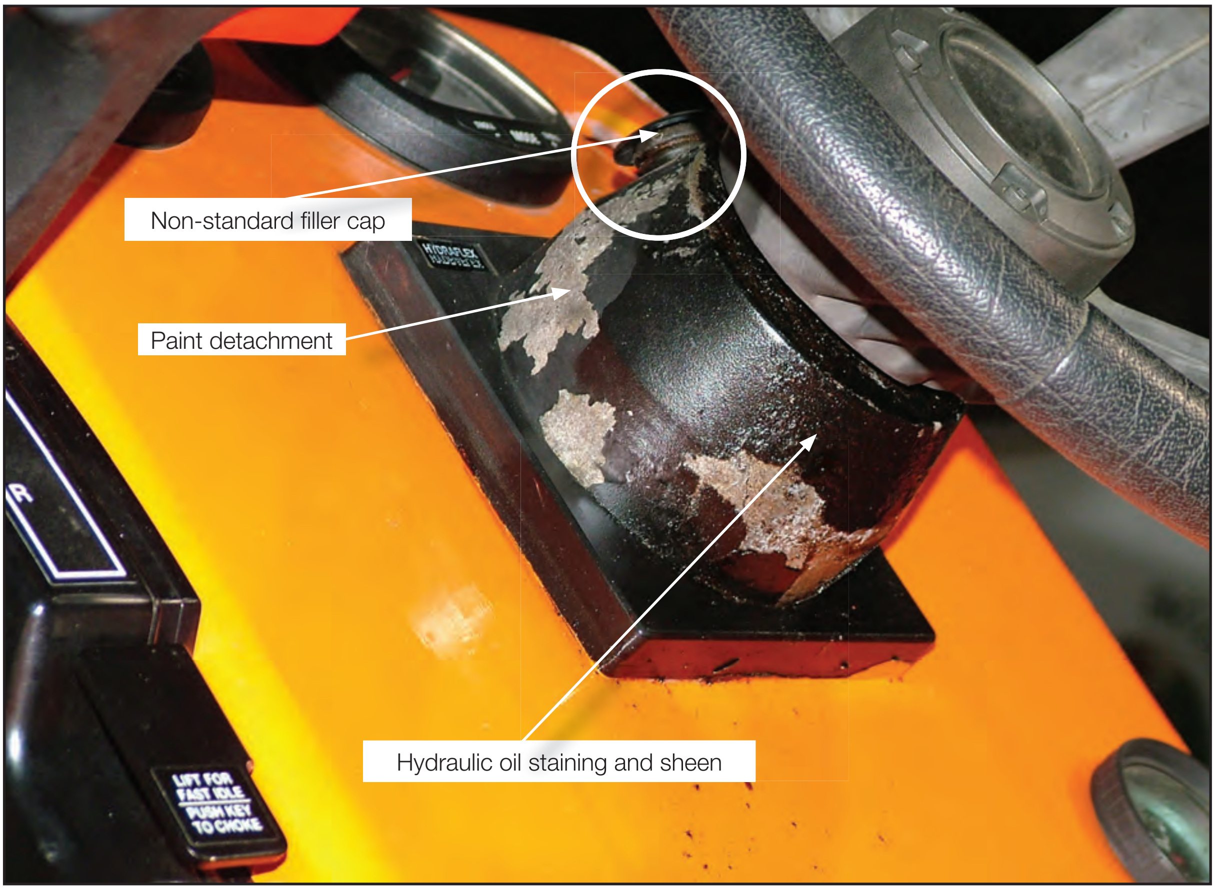


Figure 3: A view looking up from underneath the helm pump boss, showing leakage of hydraulic pump

The Lessons

All the evidence points towards a mechanical failure of the RIB's steering system (Figure 2) causing it to lurch uncontrollably. It was found that the system had non-standard components fitted, and that the hydraulic oil level was low, due to oil leakage from the helm/shaft pump boss (Figure 3). This allowed air and moisture to enter the system, causing intermittent steering control, and water ingress causing corrosion to internal components.

It is tragic that a number of contributory factors to this accident have also been causal in other fatal leisure craft accidents. Most are obvious, and include:

1. Good preparation cannot be over emphasised – the use of lifejackets, carriage of flares and a VHF radio will greatly improve your chances of survival – you owe it to yourself and your passengers to carry them on board.

2. Do take the opportunity to regularly maintain your equipment in accordance with the manufacturer's instructions.

3. Always investigate fluid leaks and do not delay rectification – your life may depend upon it. Pools of fluid are obvious signs of leakage, but also look for staining and paint detachment on components as possible indicators of problems. It is important to do this during, and following, lay up because systems can develop leaks as seals can become dry and brittle through under use.

4. Always connect your engine kill cord – remember your boat may be the only lifeboat available – you do not want to see it disappear from view.

5. Make sure that those on board are aware of the internationally recognised method of signalling distress: raising and lowering of the arms outstretched at each side of the body.

Kill Cords Save Lives, When Used Properly

Narrative

It was a lovely sunny, calm day in spring, just right for taking a boat out for a spin. This boat was a rigid-hulled inflatable boat (RIB) with a 225hp outboard engine. The owner and a friend planned to take it out for an hour or so and then stop off for a meal before returning to a local boatyard where they could leave the RIB for the night.

In the early afternoon, they stopped off at a marina, and after a lengthy meal with wine started the return journey. The boat was well maintained. As they set off, both occupants were wearing flotation devices and the driver had looped the engine kill cord around his wrist. The boat left the harbour and initially steered a straight course, but the RIB unexpectedly swerved to port, throwing the two people into the water.

It is thought likely that the driver had seen an object in the water close in front of the boat, and his instinctive reaction had been to turn to avoid it. This had occurred at high speed and at a time when the passenger had momentarily released his grip on the steadying grab handles to retrieve an object from the floor of the boat. While the boat heeled in the sudden turn, the driver reached across the controls to try to steady his friend. This left neither the driver nor the passenger holding on tightly, and resulted in both men being tipped from the boat. In reaching to steady his friend, the kill cord had become entangled with the throttle controls, and despite the cord being stretched as the driver entered the water, it slipped off his wrist before it acted to stop the engine.

The RIB continued at high speed, constantly turning in a spiral and, fortunately, moving away from the people in the water. It grounded at speed and climbed to eventually come to rest on a footpath on top of a sea wall (see photograph).

Figure 1: RIB photographed after accident

At first, the two friends spoke to each other in the water, but soon, the driver stopped talking and the two drifted apart. The passenger was not a strong swimmer and only had a 50N buoyancy aid on. The driver had been wearing a manually inflatable 150N lifejacket which, for some unknown reason, he did not inflate. After about 30 minutes, they were seen from a passing ferry, which used its rescue boat to pull them from the water. The passenger was unhurt, but suffering from the cold. Unfortunately, it was not possible to revive the driver.

The postmortem report on the driver confirmed that, at the time of the accident, he had been almost twice the legal alcohol limit for driving cars on British roads.

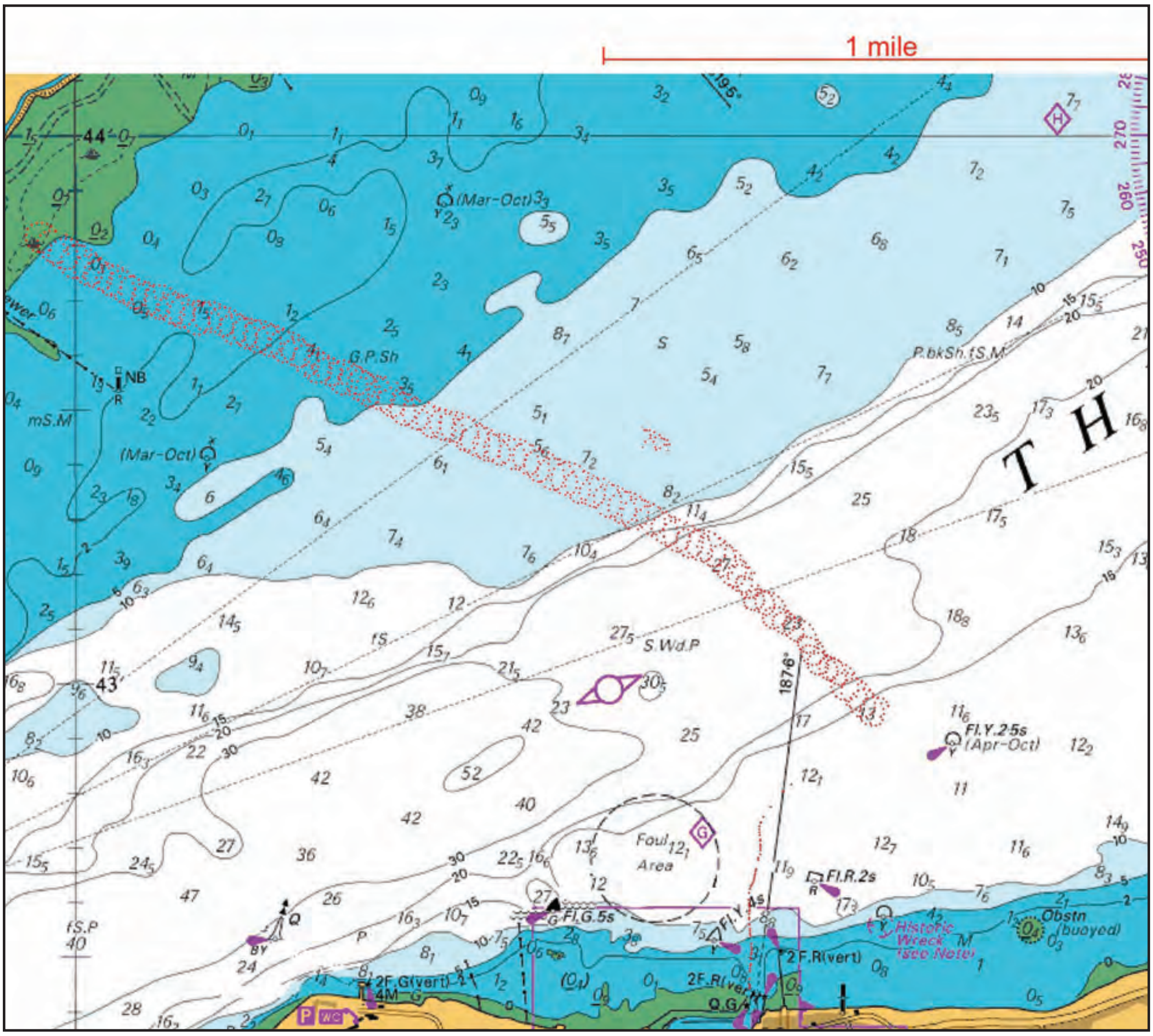
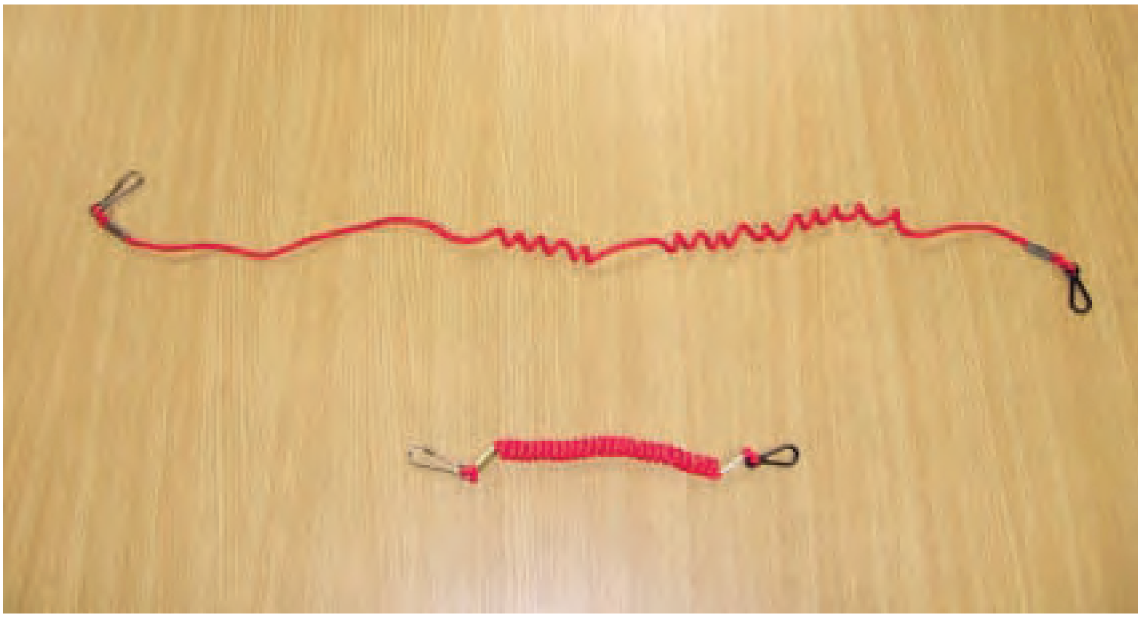


Figure 2: Vessel's actual GPS track after incident

	**Buoyancy aid 50** Standard Application Swimmers only, sheltered waters Help at hand Warning: This is not a lifejacket Relevant European Standard EN393:1993
	**Lifejacket 100** Standard Application Sheltered waters Children under 40kg Relevant European Standard EN395:1993
	**Lifejacket 150** Standard Application Offshore Foul weather clothing Relevant European Standard EN396:1993
	**Lifejacket 275** Standard Application Offshore, extreme conditions Heavy protective clothing Relevant European Standard EN399:1993

Information derived from European Standards for lifejackets and personal buoyancy aids



Stretched kill cord in comparison with new item

The Lessons

A number of factors to this accident have also been contributory in other recent leisure craft accidents. Most are obvious, and they include:

1. Don't drink alcohol and then take a high speed boat onto the water. You never know when you may need quick reactions and all your wits to save your own or someone else's life. Furthermore, if you do end up in the water for any reason, your survival time will be significantly reduced if you have alcohol in your blood stream.

2. The engine kill cord should be connected to the driver's leg or lifejacket harness. Had the kill cord operated correctly in this case, the boat would have remained in the immediate vicinity to provide a possible lifesaving platform. If neither man had been hurt, they might even have been able to reboard the boat and restart the engine. It is also worth noting that the consequences in this case could have been even worse had the boat circled, as a number have done in the past, and then run over the people in the water.

3. A boat should be equipped with safety equipment that is appropriate for the area of intended operation. In this case, the use of buoyancy aids during an offshore passage is not advised; they are only designed for use "by those who can swim and are close to help". When you purchase any flotation device, check it is up to the task you are going to use it for and that it is approved to CE standards. There should always be a picture or written information which identifies its intended use (see figure). If in doubt, discuss what you are going to use it for with the vendor.

4. It is so easy to underestimate the reaction this type of performance vessel will have to a high speed turn. Get to know the limitations and capabilities of your craft, preferably through an approved familiarisation course.

Hold On Tight, If You Can

Narrative

A rigid inflatable boat (RIB) was being employed as a support boat for an event on the water. The 6.3 metre RIB was powered by a 115 hp outboard engine, giving a potential top speed in excess of 30 knots. The RIB was just over a year old but had only been used for a 4-month period prior to being bought by the current owner 2 months previously.

On the day of the accident, the boat was being used to transport event personnel out to barges. At the time of the accident, there were three people on board: the helmsman was positioned at the controls, standing astride the starboard seat pod; a passenger was seated in the port seat; and a second passenger was standing behind the two seats, holding on to the seat backs. There was a settee ahead of the instrument console, but this was unoccupied.

Having dropped off his two passengers at a barge, the RIB loitered nearby. To collect them, the helmsman manoeuvred his vessel across the 3-4 knot ebb tide back alongside. With the throttle set ahead to counter the tidal stream, he removed the kill cord from his left wrist and stepped across to the port side of the RIB to hold on to the barge while his two passengers boarded. He then returned to his seat, replaced the kill cord and manoeuvred clear of the barge. Having asked his two passengers if they were holding on, he commenced a turn to starboard to head down stream. As the RIB turned, there was a loud crack and all three occupants were thrown into the water, along with the two seat pods.

With no one at the helm, the boat careered on out of control because the kill cord had fallen off the helmsman's wrist, and not operated. The RIB then collided with another vessel during which the console top was broken free

Figure 1: Vessel's deck showing outline of consoles - note lack of preparation and adhesive

Figure 2

of its fixings and the throttle hit the deck, pushing it to full ahead. Fortunately, the crew of a nearby support boat brought the runaway RIB under control very quickly, preventing serious injuries to those in the water. The auto-inflating lifejackets worn by the three men operated successfully, and within a few minutes they were rescued by other support craft, having suffered only minor injures.

The seat pods and boat were examined after the accident. The glass reinforced plastic (GRP) seat pods had each been attached using 6 × 25mm stainless steel self-tapping screws with penny washers and a bead of a sealant-like substance. The deck was constructed from 18mm plywood, with a 2-3mm GRP skin which was impregnated with small plastic granules to create a non slip surface. Analysis of the sealant was unable to positively identify it as any particular product, but it was established that it was polyurethane-based. Polyurethane adhesive sealants normally provide good adhesion, but in this case poor surface preparation had resulted in ineffective adhesion to the deck, leaving the self-tapping screws as the only means of securing the seats. Over time, water had seeped into the six screw holes and softened the plywood, resulting in the screws pulling out as the RIB turned to starboard, and the weight of the occupants was forced laterally against the seats.

Figure 3: Vessel's seat
note: wide spacing of securing screws and poor coverage of sealant

The Lessons

1. The RIB's three occupants were very fortunate not to have been more seriously injured during this accident. The potential consequences of RIB seat pods or consoles coming adrift, especially at speed, can be very serious indeed. Owners and operators should regularly check that their RIB seats and consoles remain secure, particularly if adhesive sealant and screws are the method of attachment. Do not take your seat fixings for granted.

2. The kill cord must be attached properly if it is to be effective. Either secure it around your leg, or clip it to a hard point on your lifejacket. As demonstrated in this accident, simply looping it around your wrist can result in it pulling free. It was only the skill of another boat's crew that prevented this runaway boat from causing serious harm.

3. Do not force yourself into unsafe practices by being undermanned and for the sake of expediency. The helmsman was leaving his throttle ahead to counter the tide and then removing the kill cord from his wrist in order to hold on to the barge. A proper assessment of the task would have identified the need, in these conditions, to carry an additional crewman to secure the RIB, leaving the helmsman free to remain at the helm and in control.

4. Where possible, ensure that all passengers on board are seated before increasing speed. Ideally, there should be sufficient seating without employing the RIB side tubes. Having passengers standing up can all too easily lead to injury.

Investigations started in the period 01/09/13 to 28/02/14

Date of Occurrence	Name of Vessel	Type of Vessel	Flag	Size (gt)	Type of Occurrence
17/09/2013	*Sally Jane*	Fishing vessel/ trawler/beam	UK	18	Capsize
18/09/2013	*Ovit*	Cargo ship/liquid cargo/ chemical tanker	Malta	6444	Grounding
29/09/2013	*Cleopatra*	Passenger ship/ only passenger	UK	8	Fire (2 injuries)
14/10/2013	*Snowdrop*	Passenger ship/ only passenger	UK	670	Person overboard
28/10/2013	*Stena Alegra*	Passenger ship/ passenger and ro-ro cargo	UK	22152	Grounding
09/11/2013	*Horizon II*	Fishing vessel	UK	125	Person overboard (1 fatality)
	New Dawn	Fishing vessel	UK	36	As above
19/11/2013	*Wanderer II*	Fishing vessel/ dredger	UK	37	Occupational accident (1 injury)
04/12/2013	*Corona Seaways*	Cargo ship/ solid cargo/ro-ro cargo	UK	25609	Fire on main deck
11/12/2013	*Paula C*	Cargo ship/ solid cargo/general cargo	UK	2990	Collision
	Darya Gayatri	Cargo ship/ solid cargo/bulk carrier	China (Hong Kong S.A.R)	44325	Collision
18/12/2013	*Sea Melody*	Cargo ship/ solid cargo/general cargo	Barbados	2450	Person overboard (1 fatality)
20/12/2013	*Key Bora*	Cargo ship/ liquid cargo/chemical tanker	Gibraltar	2627	Contact
03/01/2014	*Navigator Scorpio*	Cargo ship/liquid cargo/ liquefied gas tanker/LPG	Liberia	18311	Grounding
11/01/2014	*Rickmers Dubai*	Cargo ship/solid cargo/ general cargo	Liberia	15549	Collision
	Kingston	Service ship/ tug (towing/pushing)	UK	113	Collision
	Walcon Wizard	Service ship/ special purpose ship	UK	106	Collision
14/01/2014	*ECC Topaz*	Service ship/ special purpose ship	UK	10	Fire
15/01/2014	*Eshcol*	Fishing vessel	UK	10	Occupational accident (2 fatalities)
22/01/2014	*Karen*	Fishing vessel/ trawler/stern trawler/stern	UK	50	Collision
	Sapphire Stone	Fishing vessel/ trawler/stern	UK	103	Collision

Reports issued in 2013

ACX Hibiscus and Hyundai Discovery - collision of merchant vessels in the approaches to the eastern Singapore Strait TSS on 11 December 2011
Published 19 June

Alexander Tvardovskiy - collision between *Alexander Tvardovskiy* and *UKD Bluefin* and *Wilson Hawk* in Immingham on 1 August 2012
Published 31 May

Amber - contact and grounding of bulk carrier at Gravesend Reach, River Thames on 15 November 2012
Published 24 October

Amy Harris III - engine room fire on board fishing vessel, south of the Isle of Arran on 16 January 2013
Published 23 August

Arklow Meadow - release of phosphine gas during cargo discharge, Warrenpoint, Northern Ireland on 5 December 2012
Published 23 August

Audacious/Chloe T - flooding and foundering of the fishing vessel *Audacious* 45 miles east of Aberdeen on 10 August 2012, and the flooding and foundering of the fishing vessel *Chloe T* 17 miles south-west of Bolt Head, Devon on 1 September 2012
Published 12 December

Beaumont - grounding of merchant vessel on Cabo Negro, Spain on 12 December 2012
Published 14 June

Betty G - capsize of fishing vessel while beam trawling in Lyme Bay on 23 July 2012
Published 7 February

Carrier - grounding at Raynes Jetty in Llanddulas, North Wales on 3 April 2012
Published 22 May

Coastal Isle - grounding of the container vessel on the Island of Bute on 2 July 2012
Published 30 May

Denarius - fire and abandonment of fishing vessel 83 miles north-north-east of Kinnaird Head on 9 July 2012
Published 6 February

E.R.Athina - fatal injury to a crew member on a platform supply ship while at anchor off Aberdeen on 10 June 2012
Published 23 January

Finnarrow - contact with the berth and subsequent flooding of merchant vessel, Holyhead, on 16 February 2013
Published 22 November

Fri Ocean - grounding of merchant vessel, 2.5 miles south of Tobermory on 14 June 2013
Published 6 December

Heather Anne - capsize and foundering of fishing vessel in Gerrans Bay, Cornwall on 20 December 2011, resulting in the loss of one crewman
Published 10 January

Jean Elaine - death of a recreational diver after a fall on board, 15 miles north-west of Cape Wrath, UK on 14 August 2012
Published 5 December

Purbeck Isle - foundering 9 miles south of Portland Bill on 17 May 2012, resulting in the loss of her three crew
Published 2 May

Sarah Jayne - capsize and foundering of the fishing vessel, with the loss of one life 6 miles east of Berrry Head, Brixham on 11 September 2012
Published 13 June

Seagate and Timor Stream - collision between merchant vessels, 24 nautical miles north of the Dominican Republic on 10 March 2012
Published 26 June

St Amant - loss of a crewman from a fishing vessel off the coast of north-west Wales on 13 January 2012
Published 9 January

Swanland - structural failure and foundering of the general cargo ship in the Irish Sea on 27 November 2011 with the loss of six crew
Published 12 June

Timberland - man overboard from merchant vessel, North Sea on 25 November 2012
Published 7 June

Vidar - fatal man overboard from the trawler, off Milford Haven, on 28 January 2013
Published 16 August

Vixen - foundering of the small passenger ferry in Ardlui Marina, Loch Lomond on 19 September 2012
Published 20 June

Wah Shan - fatal injuries to a crewman while securing a tug's tow wire on board, River Humber, on 2 October 2012
Published 17 July

Windcat 9/Island Panther - combined report on the investigations of the contact with a floating target by the wind farm passenger transfer catamaran *Windcat 9*, south-west approaches to the River Humber, on 21 November 2012, and the contact of *Island Panther* with turbine I-6 in Sheringham Shoal wind farm on 21 November 2012
Published 20 November

Zenith - fatal man overboard from a fishing vessel 29 miles south-east of Kilkeel on 29 January 2012
Published 24 January

Safety Digest - published 1 April
Safety Digest - published 1 October

MAIB Annual Report - published 31 July

Reports issued in 2014

Achieve - foundering of the fishing vessel and death of a crew member, north-west of the Island of Taransay, Western Isles on 21 February 2013
Published 10 January

Douwent - grounding of the general cargo vessel on Haisborough Sand on 26 February 2013
Published 29 January

JCK - foundering of fishing vessel, with the loss of her skipper, in Tor Bay on 28 January 2013
Published 9 January

Milly - ejection of family of six from the RIB, Camel Estuary, Cornwall, leading to two fatalities and serious injuries to two people on 5 May 2013
Published 30 January

Prospect - grounding on Skibby Baas and foundering in the north entrance to Lerwick Harbour, Shetlands Islands on 5 August 2013
Published 19 February

Sirena Seaways - heavy contact with the berth at Harwich International Port on 22 June 2013
Published 31 January

Speedwell - foundering of fishing vessel, Firth of Lorn, with the loss of her skipper on 25 April 2013
Published 8 January

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY BULLETIN

SB3/2013

October 2013

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."

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The sinking of the DUKW amphibious vehicle

WACKER QUACKER 1

in Salthouse Dock, Liverpool on 15 June 2013

and

The fire on board the DUKW amphibious vehicle

CLEOPATRA

on the River Thames, London on 29 September 2013

MAIB SAFETY BULLETIN 3/2013

This document, containing safety recommendations, 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 carrying out investigations into the sinking of the DUKW amphibious vehicle *Wacker Quacker 1* on 15 June 2013 and the fire on board the DUKW amphibious vehicle *Cleopatra* on 29 September 2013.

The MAIB will publish a full report on completion of the investigations.

STEVE CLINCH
CHIEF INSPECTOR OF MARINE ACCIDENTS

Background

In 1998, World War 2 DUKW amphibious vehicles, modified to carry passengers on sightseeing tours, were certified by the Maritime and Coastguard Agency (MCA) to operate on the River Thames, England. The vehicles were required to comply with the stability criteria set out in Merchant Shipping Notice (MSN) 1699 (M)[1]. In order to provide 110% buoyancy, the owner inserted buoyancy foam in the void spaces around the hull of each vehicle. In 2000, a similar operation was introduced in Liverpool.

On 30 March 2013, the Yellow Duckmarine Ltd (YDM) DUKW *Wacker Quacker 4* (*WQ4*) sank in Salthouse Dock, Liverpool. After the accident, the MCA discovered that the hulls of all four of YDM's vehicles did not contain the 9.7m^3 of buoyancy foam required to keep them afloat if flooded. The YDM's waterborne operations were suspended for 2 months while the company inserted additional buoyancy foam.

The sinking of *Wacker Quacker 1*

On 15 June 2013, *Wacker Quacker 1* (*WQ1*) sank in Salthouse Dock, Liverpool, resulting in the DUKW's 31 passengers and two crewmen abandoning into the water; fortunately all were recovered without serious injury. After *WQ1* was recovered ashore, it was apparent that the vehicle had flooded because two large holes had been torn in the hull as a result of the forces generated when the vehicle's propeller became fouled by a tyre **(Figure 1)**. As was the case with *WQ4*, *WQ1* sank because the volume of buoyancy foam fitted was insufficient to keep it afloat when flooded.

Following the sinking of *WQ1*, the MCA identified that YDM's other DUKWs in service again had insufficient foam fitted and suspended the company's operations in Liverpool dock. The company has subsequently entered into administration and there are no DUKW vehicles currently operating in Liverpool.

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[1] MSN 1699 (M) – The Merchant shipping (Passenger Ship Construction: Ships of Classes III to VI(A)) Regulations, 1998. MSN 1699 (M) was superseded in April 2010 by MSN 1823 (M) – Safety Code for Passenger Ships Operating Solely in UK Categorised Waters.

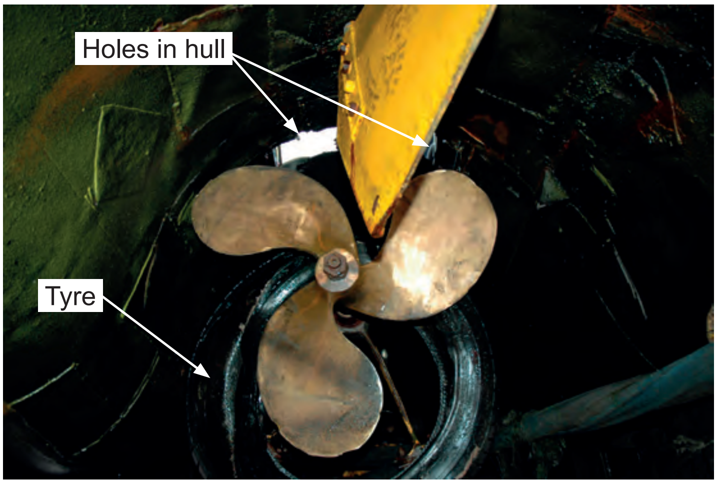

Figure 1: Holes torn into *WQ1*'s hull after the propeller was fouled by a tyre

The MCA then checked the DUKWs operated by London Duck Tours Ltd (LDT) on the River Thames and identified that those vehicles were also deficient in reserve buoyancy. LDT voluntarily suspended its operations while it fitted additional buoyancy foam to its vehicles to achieve the 110% buoyancy required.

Post-accident tests and trials

During 30 and 31 July 2013, the MAIB conducted a series of stability tests and a flooding trial on *WQ1*. In preparation for the tests and trials, MAIB oversaw the foam insertion process. The aim was to:

- Establish if it was physically possible to fit the required volume of buoyancy foam within the vehicle's designated void spaces.
- Identify potential adverse consequences presented by the foam that might affect the safe operation of the vehicle.

The MAIB's contractors were unable to fit sufficient foam into the hull spaces to give 110% buoyancy. In total, they fitted $8m^3$ of foam, and only then by ignoring the need to provide the clearances required for the vehicle's moving and rotating parts. Some of the potential adverse outcomes identified were:

- fouling and overheating of moving parts
- overheating of the engine
- lack of access for routine maintenance
- inability to visually inspect the internal steel hull
- blocking of bilge pumps
- contamination of foam by oils, greases and sea water
- acceleration of hull corrosion.

These observations, made during the foam fitting process prior to the tests and subsequent trials, raised serious questions about whether the operators of DUKWs could fit sufficient foam internally to comply with the current requirement for 110% buoyancy without compromising the safe operation and the practical day to day maintenance of these vehicles.

Therefore, on 5 August 2013 the Chief Inspector of Marine Accidents recommended the Maritime and Coastguard Agency to:

2013/221 Require operators of DUKW passenger vessels in the UK to demonstrate that they are able to provide 110% effective residual intact buoyancy in their vessels, and where buoyancy foam is fitted for this purpose, the quantity installed is measured by volume and the foam does not impede the operation or maintenance of key equipment.

The fire on board *Cleopatra*

On 29 September 2013, a fire broke out inside the hull of the DUKW *Cleopatra*, an amphibious vehicle operated on the River Thames by LDT. The master was able to beach the vehicle prior to ordering the evacuation of his passengers and crewman. There were no serious injuries.

At the time of this accident, LDT had still to demonstrate to the MCA that its DUKWs could be fitted with sufficient buoyancy foam and still be operated safely.

The ongoing MAIB fire investigation has established that the seat of the fire was located under the crew seating platform close to a drive shaft coupling. Foam in the area was found to be heavily contaminated with grease and had fuelled the fire, generating thick black smoke.

A report commissioned by the London Fire Brigade and completed by Bureau Veritas' Fire Science Department concluded that:

> *"There was no obvious ignition source in the vicinity of the buoyancy foam, and therefore the most likely cause of fire was the action of the rotating drive shaft (or other moving parts) on the oil contaminated surfaces of the buoyancy foam blocks."*

Other related accident

On 12 July 2013 LDT's DUKW, *Elizabeth*, was towed from the River Thames following the failure of a drive shaft universal coupling in her engine bay. The company's own investigation identified that the temperatures within the engine bay and surrounding areas were higher following modifications made to accommodate the insertion of the additional foam. This had caused the universal joint to overheat and run dry of lubricant. In an effort to combat this, LDT undertook to use high temperature grade grease to lubricate these joints.

Conclusion

The MAIB identified significant difficulties in fitting a DUKW with the volume of foam required to meet the buoyancy standards set out in MSN 1699 (M). Further, the nature of these old amphibious vessels, specifically their weight in relation to their size and the complexity of their propulsion arrangements, makes it difficult for operators to comply with the standards applicable to more conventional craft by solely using internal foam buoyancy. An alternative standard, ensuring that DUKWs have the necessary level of damage survivability, therefore needs to be established if they are to be operated safely.

Recommendation S2013/233

The **Maritime and Coastguard Agency** is recommended to:

In addressing recommendation 2013/221, ensure that the means used by DUKW operators to achieve the required standard of buoyancy and stability for their vessels does not adversely impact on their safe operation. Furthermore, these vessels should not be permitted to operate until satisfactory levels of safety can be assured under all feasible operating conditions.

4

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY BULLETIN

SB1/2014

February 2014

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

Regulation 5:
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"The Chief Inspector may at any time make recommendations as to how future accidents may be prevented."

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Carbon monoxide poisoning on board the scallop-dredger *ESHCOL* in Whitby, North Yorkshire on 15 January 2014 resulting in two fatalities

MAIB SAFETY BULLETIN 1/2014

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 carrying out an investigation into the deaths of two persons on board the scallop-dredger *Eshcol* on 15 January 2014.

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

Steve Clinch
Chief Inspector of Marine Accidents

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Background

An overnight break from fishing ended tragically when the skipper and a crewman sleeping on board the 9.95m scallop-dredger *Eshcol* died in their bunks. Initial findings indicate the men were poisoned by carbon monoxide.

Initial Findings

Before going to bed, the skipper (aged 26) and the crewman (aged 21) had lit the grill of a butane gas cooker fitted in the wheelhouse **(Figure 1)** in order to warm both the wheelhouse and the adjacent sleeping area. When they were not seen as expected the following morning, crewmen from fishing vessels tied up close by forced open the wheelhouse door. The gas grill was still lit **(Figure 2)** and the wheelhouse was full of fumes; the two men were dead in their bunks.

Eshcol was not fitted with a carbon monoxide alarm.

Figure 1

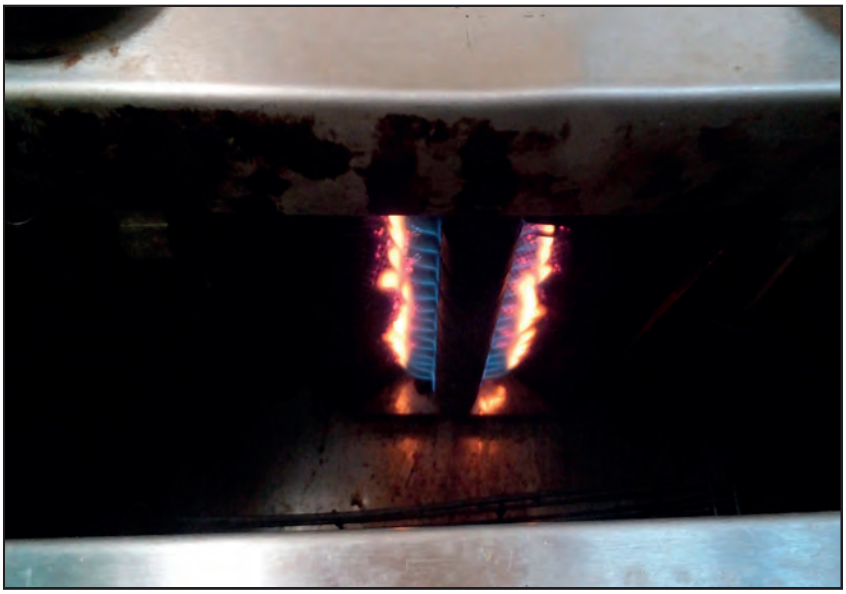

Figure 2

Safety Issues

1. Gas cookers are designed for cooking, not domestic heating. Accommodation areas need to be heated, especially during the winter months and, for this, appropriate, purpose built heaters are required.
2. Fossil fuel burning appliances, such as cookers, need to be checked and maintained to ensure they are in good condition. A yellow flame indicates poor combustion, resulting in an excess of carbon monoxide that, in a poorly ventilated space, can quickly build up to lethal levels.
3. Carbon monoxide is a lethal gas, which has no smell, no taste, is colourless and is extremely difficult for human senses to detect. Crew need to be vigilant and recognise the signs of carbon monoxide poisoning, which can include: headaches, dizziness, nausea, vomiting, tiredness, confusion, stomach pain and shortage of breath.
4. Carbon monoxide alarms are not expensive and should be fitted. When selecting a carbon monoxide alarm, preference should be given to those marked as meeting safety standard EN 50291-2:2010, which are intended for use in a marine environment.

Further guidance for fishermen on the use of liquid petroleum gas (LPG) heaters and cookers can be found in Marine Guidance Notes 312 (F) and 413(F). More detailed advice on how to avoid carbon monoxide poisoning and on carbon monoxide alarms, can be found at:
http://www.boatsafetyscheme.org/stay-safe/carbon-monoxide-(co)

Issued February 2014

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY BULLETIN

SB2/2014

February 2014

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

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Fire and subsequent foundering of workboat

ECC TOPAZ

11nm east of Lowestoft

on 14 January 2014

Figure 1: *ECC Topaz* on fire (**inset:** subsequent foundering)

MAIB SAFETY BULLETIN 2/2014

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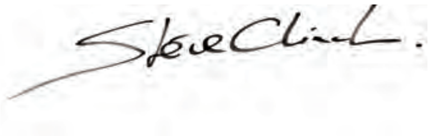
The Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 provide for the Chief Inspector of Marine Accidents to make recommendations at any time during the course of an investigation if, in his opinion, it is necessary or desirable to do so.

The Marine Accident Investigation Branch is carrying out an investigation into the fire and subsequent foundering of a wind farm support vessel. The most likely cause of the fire was an uninsulated air heater exhaust pipe in close proximity of the plywood structure of the vessel.

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



Steve Clinch
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Background

At approximately 1230 (BST) on 14 January 2014, the 14m wind farm support catamaran, *ECC Topaz,* caught fire 11nm east of Lowestoft. The three crew members on the vessel were unable to extinguish the fire, which spread rapidly throughout its GRP structure **(Figure 1)**, forcing them to abandon to a liferaft. There were no passengers on board at the time of the accident.

Once in the liferaft, the skipper transmitted a “Mayday” call using a hand-held VHF radio and then activated a Search and Rescue Transponder (SART). The crew of another vessel in the vicinity alerted the coastguard when they saw thick black smoke on the horizon. The crew of *ECC Topaz* were winched from the liferaft by helicopter and taken to a nearby hospital for treatment. The fire on *ECC Topaz* continued unabated and, at 1422, the burnt out remains of the vessel foundered in 33m of water **(Figure 1: inset)**.

Initial findings

There is compelling evidence to suggest the source of the fire was in way of an uninsulated section of the exhaust pipe from a diesel fired air heater that was situated in a compartment in the starboard hull, directly under the wheelhouse. A few days after the fire, the MAIB received information that crew on similar workboats had observed charring to the underside of main decks, where they were penetrated by the exhaust pipes from air heaters.

Detailed examination of one of these vessels revealed that the heater exhaust had been modified to route through a single walled, inverted U-pipe on the main deck **(Figure 2a)** to prevent sea water ingress from the exhaust overboard. As originally built, the exhaust pipe was insulated by woven glass lagging protected by an aluminium oversleeve **(Figure 3)** to prevent the hot exhaust gases (around 450°C) from heating the surrounding area. However, where the exhaust piping had been broken to route it through the main deck,

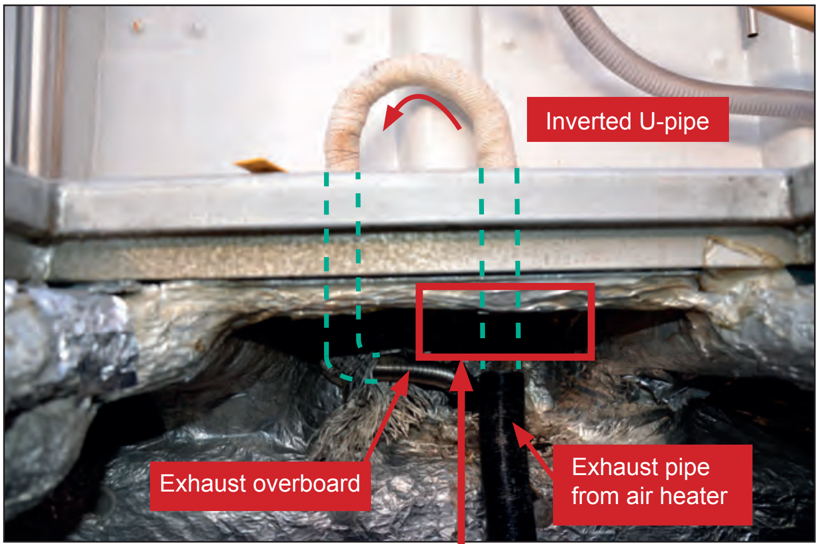


Figure 2a: Air heater exhaust pipe layout on similar vessel

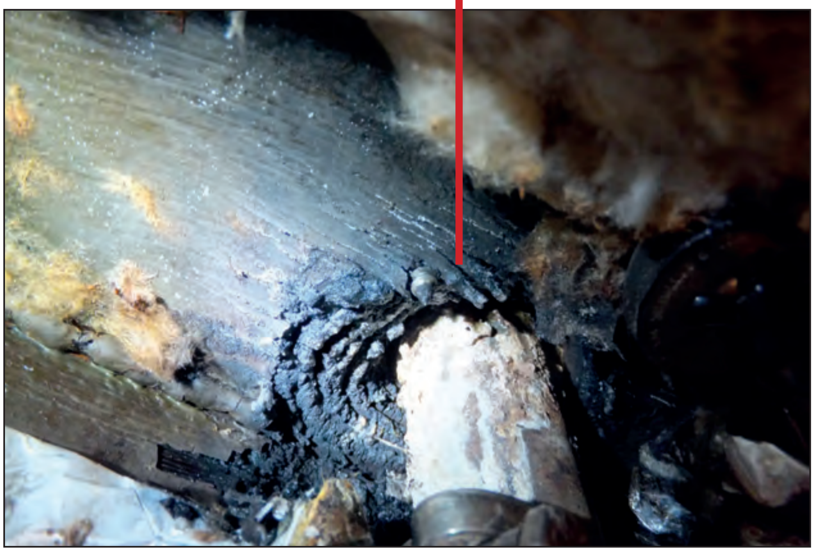


Figure 2b: Scorching under deck on similar vessel

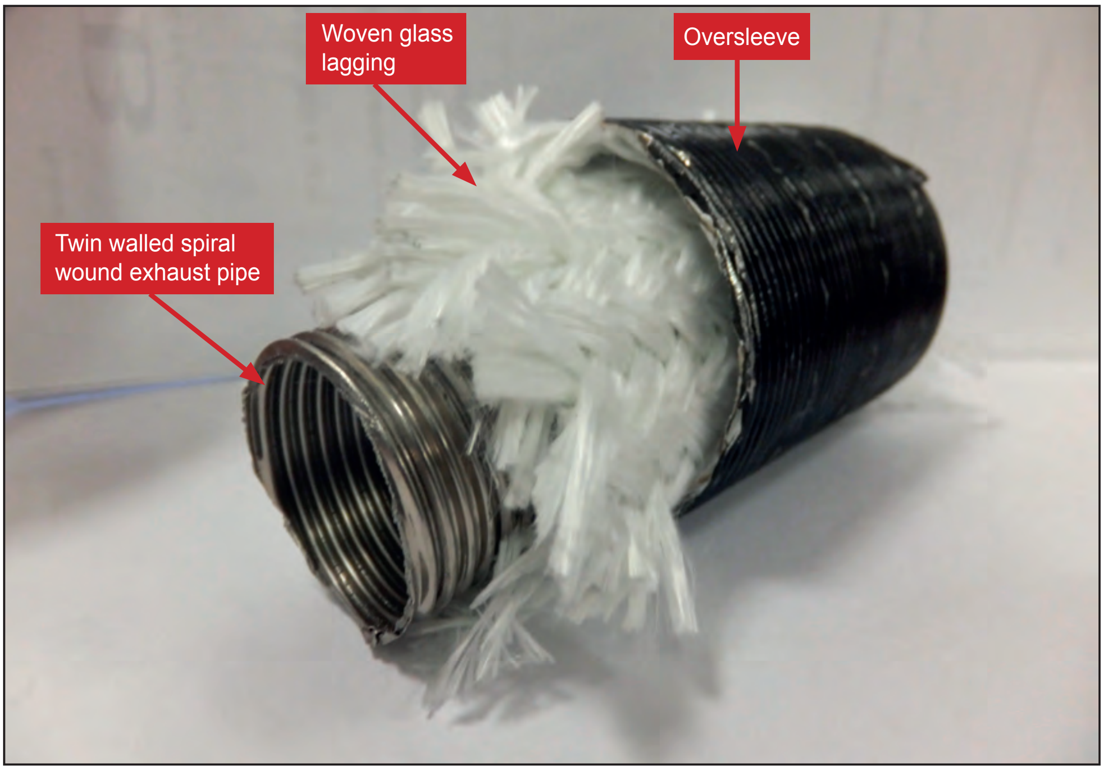


Figure 3: Heater manufacturer's supplied exhaust pipe with insulation

the connection between the heater exhaust pipe and the inverted U-pipe was not insulated. Consequently, the uninsulated section of the hot exhaust pipe in close proximity to the plywood underside of the deck, caused the charring seen in **Figure 2b**.

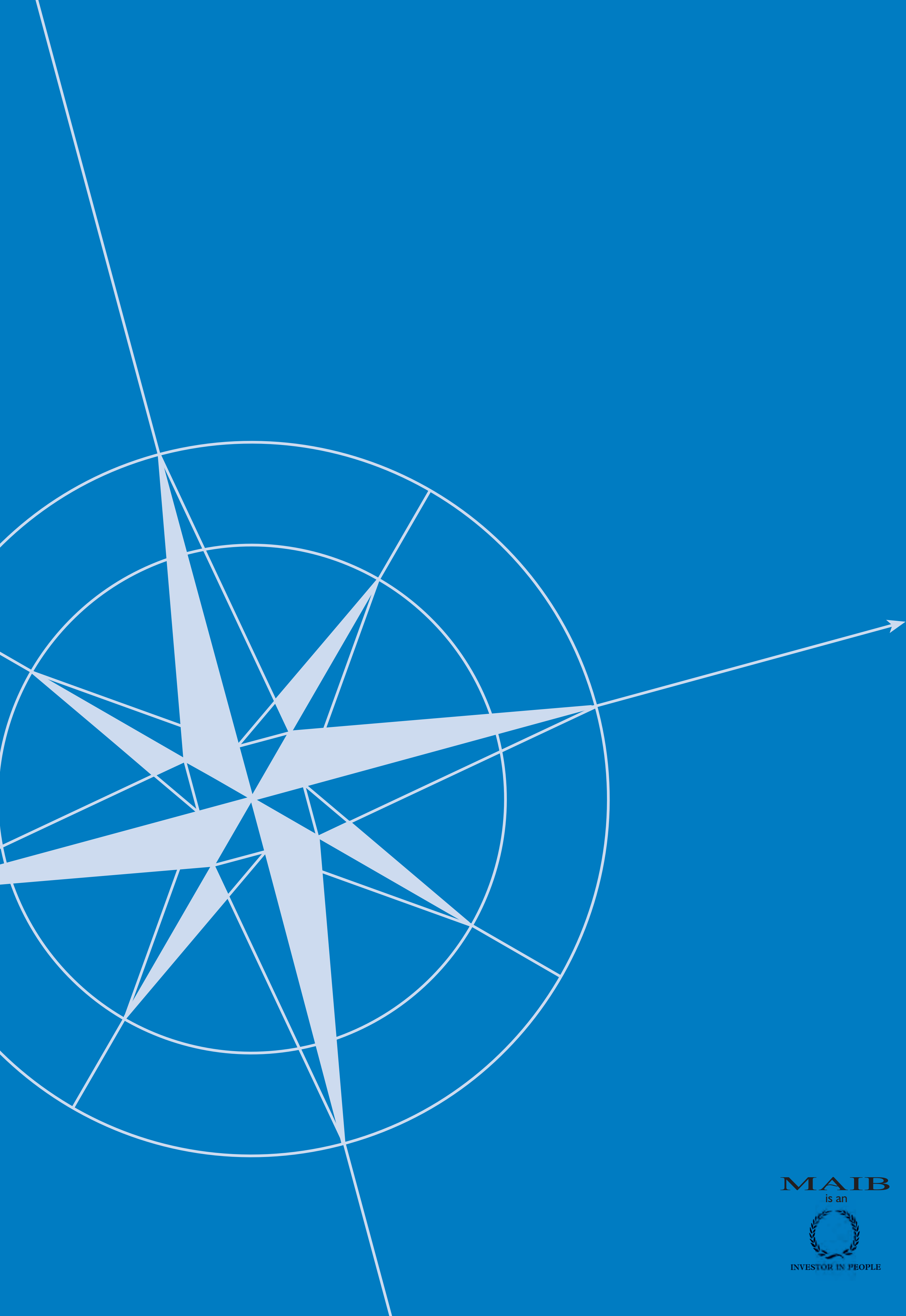
ECC Topaz was fitted with the same model of heater and had the same exhaust configuration. The MAIB has concluded the most likely cause of the fire on board *ECC Topaz* was the poorly insulated hot exhaust pipe igniting the plywood structure of the vessel. The compartment where the heater was situated was not fitted with any fire detection or extinguishing systems, and contained several flammable items including sacks of rags, rolls of paper towels and several small drums of oil that would have provided additional fuel for the fire once it was ignited.

Safety lessons

Uninsulated exhaust pipes will quickly reach the temperature of the exhaust gases and, when in close proximity to wood or other combustible material, the likelihood of a fire is very high. Owners and operators of vessels are strongly advised to:

- Check that all exhaust pipes on their vessels are fully insulated and do not come close to combustible material.
- Fit fire/smoke detectors in enclosed spaces where diesel-fired air heaters are installed.
- Avoid placing flammable material in compartments that contain potential heat sources. A useful reference is MGN 497 (M+F): 'Dangerous Goods – including Chemicals and other Materials – Storage and Use on Board Ships.'

Issued February 2014



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