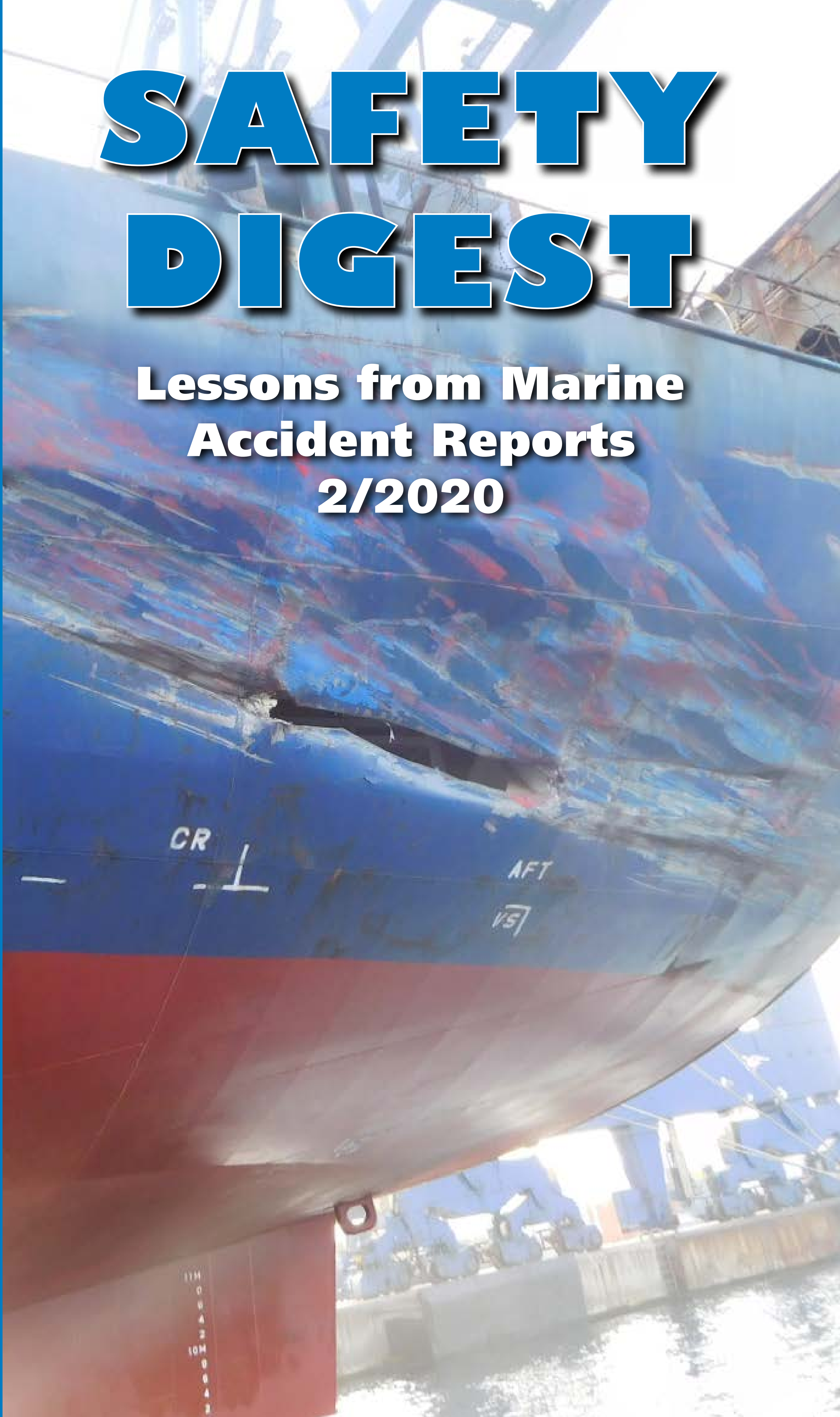
MARINE ACCIDENT
INVESTIGATION BRANCH

MAIB

SAFETY DIGEST

Lessons from Marine Accident Reports 2/2020



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No 2/2020

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October 2020

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 functionally, independent branch within the Department for Transport (DfT). The head of the MAIB, the Chief Inspector of Marine Accidents, reports directly to the Secretary of State for Transport.

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

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

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

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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 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
AIS	-	Automatic Information System
ARPA	-	Automatic Radar Plotting Aid
BNWAS	-	Bridge Navigational Watch Alarm System
C	-	Celsius
CO	-	Chief Officer
ECDIS	-	Electronic Chart Display and Information System
EPIRB	-	Emergency Position Indicating Radio Beacon
HFO	-	Heavy Fuel Oil
kg	-	kilogram
kts	-	knots
m	-	metre
"Mayday"	-	The international distress signal (spoken)
MCA	-	Maritime and Coastguard Agency
MGO	-	Marine Gas Oil
OOW	-	Officer of the Watch
PEC	-	Personal Exemption Certificate
PLB	-	Personal Locator Beacon
PPE	-	Personal Protective Equipment
RIB	-	Rigid Inflatable Boat
Ro-Ro	-	Roll on, Roll off
VHF	-	Very High Frequency
VTS	-	Vessel Traffic Service

Introduction

Welcome to the MAIB's second Safety Digest of 2020. This has been a challenging year for us all, and some sectors of the marine industry have been very hard hit by the fallout from the COVID-19 pandemic. It therefore pains me to say that overall this year there seems to be very little change in the overall rate at which accidents and incidents are occurring. The need to improve safety is therefore very much with us, and I hope the articles in this digest provide you with the inspiration to review at least some aspects of your operation to see how safety can be improved. We can all learn from others' misfortunes.

I would like to thank Mike Drake (Director Marine Operations, P&O Cruises, Australia) and Sean Friday (Inspector, MAIB) for the introductions they have written to the merchant vessel and fishing vessel sections of this edition. Their contributions speak for themselves, and I encourage you to read them. In preparing to write my introduction I was struck by Mike's comment that we need to understand the mind-set of the people doing the job before we improve their performance, and Sean's frustration that investigators so often see similar issues repeated time and time again in tragic accidents. Some years ago I was discussing a conflict with an army intelligence officer, who said to me, "they are losing, but they are not yet ready to stop fighting". His words made me think about people's resistance to or, conversely, willingness to change their approach. After a serious accident has occurred we often find that organisations can be conflicted about what to do next. On the one hand, they do not want a re-occurrence; on the other hand, they worry that change could be seen as an admission of guilt or liability. To this I would suggest two approaches. The first, is to learn from others' misfortunes before you have an accident yourself (see above). The other, is to consider that what went before was not necessarily 'wrong', but it could be 'more right'. Seeing change in this light can help make it a positive activity.

This edition's Recreational Craft section does not have its own introduction as, unfortunately, the contributor had to back out at the last minute. It therefore falls to me to make some observations in lieu of a dedicated section introduction.

The articles for the Recreational Craft section were chosen some weeks ago, and it is a coincidence that in this issue they are all about high-speed craft accidents. Unfortunately, it is likely that the spring 2021 Safety Digest will be similar, due to the high incidence of fatal and serious injury accidents involving RIBs, personal water craft (jetskis) and other high speed craft that have occurred this summer. It would not be right to read too much into this spike. Marine accidents are like buses: you can wait a long time for one and then a number arrive together. However, it could also be that the COVID-19 lockdown earlier this year prevented many leisure boaters from starting the season slowly, cautiously going afloat in late spring to refresh old skills before the good weather arrives. Whatever the reason, I would encourage all leisure boaters to take advantage of the winter months to refresh their knowledge, carry out the inevitable maintenance tasks, and to plan how best to start next year's boating seasons. To misquote Louis Pasteur, "Fortune favours the prepared mind".

Keep safe

Andrew Moll
Chief Inspector of Marine Accidents

October 2020

Part 1 - Merchant Vessels

The Maritime Industry is one of a number of safety critical sectors along with others such as aviation, chemical, nuclear and rail etc. Operating ships is a complex and safety critical process. Accidents within safety critical sectors and the science connected with underlying contributions has evolved dramatically over the last 30 years. The whole idea of an "accident" is relatively modern; the most common viewpoint in recent times is that of a failure of risk management.

There has been a rapid growth in our knowledge of human behaviour. An appreciation and understanding of human factors is now a primary tool; an effective understanding of human behaviour in normal and safety critical contexts is a key component of improving safety at sea. The underlying drivers of human behaviour have evolved over millions of years, will not disappear and should be utilised as a tool to minimise future accidents. Humans are the source of system safety as opposed to weak links or sources of failure – but to assist with this we must move away from "cause and effect" towards "drivers and improvers" of performance and safety. Instead of a root cause we need to discover how all aspects of the system and its dynamic parts combined to produce a negative outcome, noting that the same system had managed to avoid this previously.

We now understand much better how humans perceive and make sense of the World; how we make decisions; what really motivates us at work; how we are affected by technological, environmental and organisational factors; how we communicate and work co-operatively with each other.

One of the curious aspects of accident analysis is that it is often not obvious how the human behaviour at the centre of accidents is any different from that on days when no accident occurs. This means we must look more at what influences people to do the things they do at the time they do.

Improving/enhancing human performance in everyday operations requires a greater understanding of the mind sets of people doing their jobs & creating the right support structure around them. Mind set analysis is a systematic process for drawing out and understanding the decisions taken at the time of an incident, what alternatives were available and the learning implications for an organisation. Simply adding more rules and procedures is often of limited value; cause and effect chain of events evoke interest but are not very useful in a complex system. We need a different approach.

Concluding that staff are complacent is a poor explanation for accidents and does not lead to any useful way forward. Split second operational decisions evaluated, dissected and analysed retrospectively for long periods can sometimes result in conclusions and recommendations that contribute little to preventing a reoccurrence of a similar incident in future.

A new approach to understanding how and why complex systems go wrong is "resilience engineering". Resilience is the key to safe operational performance at all levels- from front line operators to board level directors. Humans are crucial to safe performance in complex systems. Our strengths are vulnerable and our weaknesses need to be supported. A great source of information on organisational resilience is provided in the book "Being Human in safety critical organisations". Witten specifically with the maritime industry in mind I commend this publication to everyone with any operational connection or influence in the maritime domain. Areas covered within the publication include how to practically deal with fatigue, stress, motivation, social capital and boredom – all in the context of preventing incidents.

Progressive shipping companies, organisations & on-board management that reward those who report problems and seek to implement fair minded accountability, and are clear about the distinction between accountability and blame, will be better placed to avoid major incidents. In establishing an effective safety culture, it is small, steady changes that will end up creating a huge difference. Experience shows that there is a cumulative effect; a good idea from the crew, if acted upon, encourages others to offer up their own. Seniors and crew should bounce ideas off each other. Leadership, both ship and ashore is most important to drive improvements and reduce crew injuries, and major accidents. This is an important part of resilience engineering which requires feedback and true attention.

In reading some of the cases a couple of questions spring to mind, which are:

Case 1 – why did it make sense to use AIS rather than ARPA? What was the captain and officer of the watch's frame of mind? To what extent did they believe they had the knowledge and skills to solve the traffic problems? What was their understanding of the situation and their intended goal?

Case 5 – why did many of the bridge practices (ECDIS planning & alarm, BNWAS switched off , AB leaving the bridge etc.) make sense at the time to the officer of the watch?

Answering this question and then identifying what to change next time will go a long way to preventing re-occurrence. However, those necessary changes may extend beyond that particular ship itself.

A Shipping Company & the on-board teams answering these and similar questions will be able to determine ***why a course of action made sense to those on-board at the time*** – and what influencing factors might be changed to help minimise the chance of reoccurrence in future. Training, fatigue, rosters, procedures, equipment and/or ergonomics, manning levels, ship schedules, how large is the gap between "work as imagined" and "work as done" and what can be done to narrow the gap.

MIKE DRAKE, DIRECTOR MARINE OPERATIONS & DESIGNATED PERSON ASHORE P&O CRUISES, AUSTRALIA

Mike is Head of Marine Operations & Designated Person Ashore (DPA) for P&O Cruises, Australia (part of Carnival Corporation & PLC) based in Sydney. He is a Master Mariner with 35 years' experience and a fellow of the Nautical Institute.

As Director Marine Operations he is responsible for providing leadership, strategic planning and direction in the field of Marine Operations & acting as the Company "Designated Person Ashore" as per the International Safety Management Code ; the person based ashore whose influence and responsibilities should significantly affect the development and implementation of a safety culture within the company. The role requires strong engagement with all regulatory bodies concerned with safety; AMSA, UK Marine & Coastguard Agency (Flag State) , Hydrographic Services, ATSB, MAIB, Great Barrier Reef Marine Park Authority and various state regulators , Port Authorities, Harbour Masters and Pilots etc.

In addition to developments within Carnival Corporation Mike has been very involved in navigational developments within the Oceania Region; in particular the challenges of navigational infrastructure in SW Pacific & SE Asia.

P&O Cruises, Australia have a commitment to continuous improvement in the maritime domain. In addition to using the World Class Carnival Corporation training centre, C Smart, recent company initiatives include a Safety Culture project, Port Pilotage Navigational project, "Near miss" programme, & formal navigation and engine room assessment programmes.

Foggy Manoeuvres

Narrative

Due to severely restricted visibility in thick fog and darkness, berthing and unberthing of vessels had been suspended at a large commercial port that was located near a busy traffic separation scheme.

An inbound container vessel had been instructed by the port authority to wait outside the port until conditions improved (Figure 1). At the same time, a gas carrier was proceeding at about 13kts towards a boat transfer rendezvous position near the port's entrance. In the same vicinity, there were eight other vessels heading west towards the traffic separation scheme (Figure 1).

On the bridge of the gas carrier, the master was conning and was aware of the container vessel ahead from radar and AIS data. As the range reduced, the master made an alteration of course to starboard to avoid the container vessel. Realising that this alteration of course had not delivered the anticipated separation, the gas carrier's master applied full starboard rudder; however, this was insufficient to avoid collision. Figure 2 shows the damage to the container vessel's port quarter.

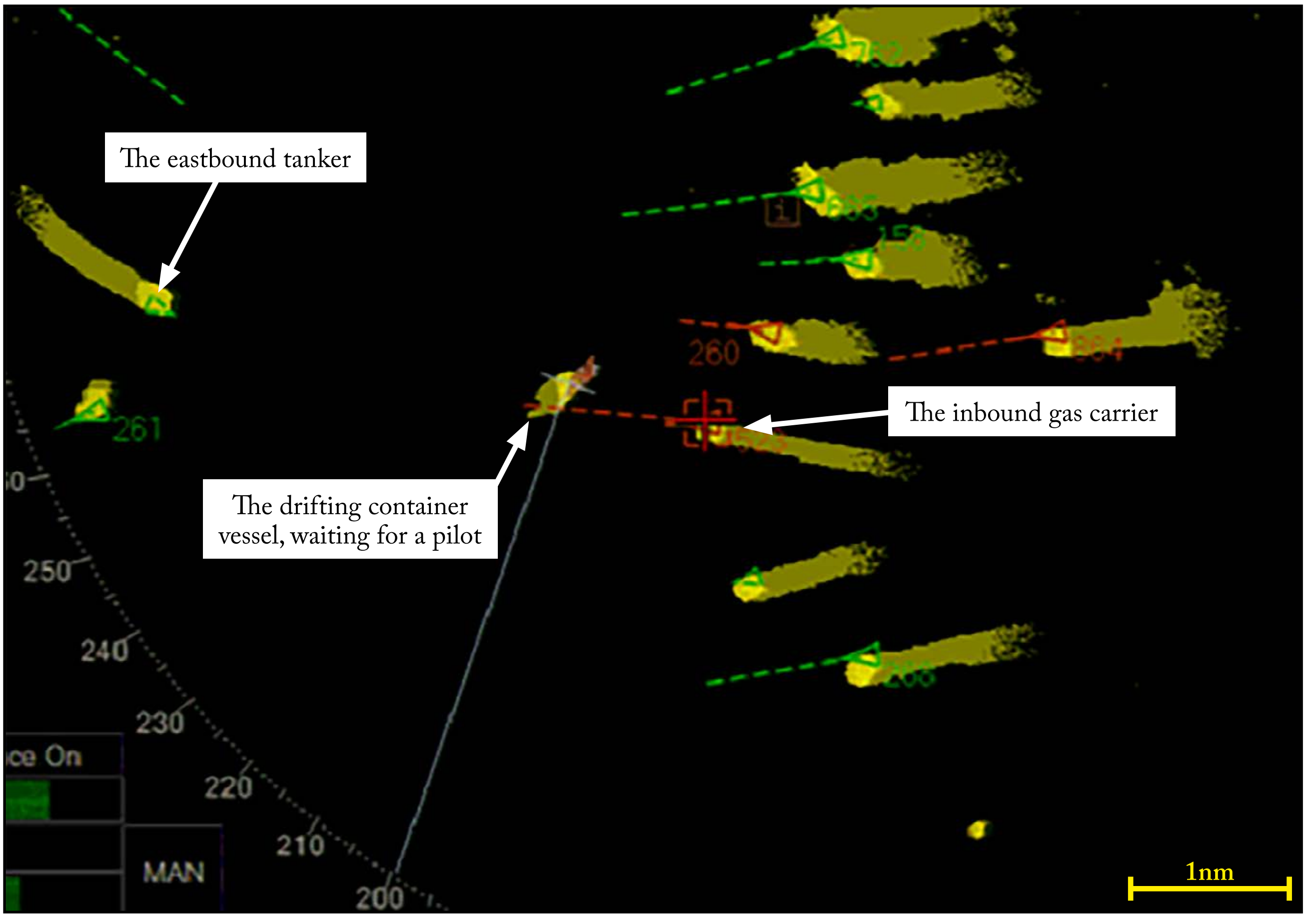

Figure 1: Extract of the container vessel's radar picture 4 minutes prior to collision

Figure 2: Detail of damage to the container vessel's port quarter

The Lessons

1. Collision avoidance decisions must be made using the most accurate information available. The gas carrier's master's understanding of the situation was primarily based on the container vessel's AIS data, which suggested that it was 'underway using engine' and heading south-west. This perception resulted in the gas carrier's master's decision to alter course to starboard to avoid the container vessel by passing its stern, even though it was not visible. However, the AIS data was misleading as the container vessel was actually stopped in the water with its engine off. When a close-quarters situation develops like this, the information from ARPAs will provide accurate data to inform critical decisions, based on the exact relative movement of other vessels.

2. In any condition of visibility, the Collision Regulations require that actions taken to avoid collision are made in ample time, are readily apparent to other vessels and should result in passing at a safe distance. Despite good radar pictures on both bridges, this collision was a result of neither vessel's bridge team following these Regulations. When the shipping situation starts to deteriorate and risk of collision exists, bridge watchkeepers must take all necessary measures to ensure safe passing.

3. Reducing speed is a very effective method of allowing more time to assess a situation, especially in restricted visibility. In this case, the gas carrier was pressing ahead towards its rendezvous position at its normal passage speed of 13kts; reducing speed would have given more time to assess the situation and avoid collision, even if this meant being late for the transfer.

4. In the build-up to this collision, the gas carrier's OOW was responding to persistent radio calls from other vessels and shore stations, including a call from an eastbound tanker (Figure 1) wanting to discuss the passing distance. All of these radio calls distracted the gas carrier's OOW from his primary responsibility of assisting the master with collision avoidance advice.

CASE 2

No Space to Play

Narrative

On a cold, dark January evening fertilizer pellets were being loaded on board a small bulk carrier at one of its regular northern European ports of call. The quayside was very narrow, slippery with cargo and poorly lit. Access to the quayside was via the ship's gangway (see figure).

During cargo operations the chief officer (CO) went ashore to check the vessel's forward draught. As he stood at the edge of the quay looking at the draught marks, he slipped and fell 3 metres into the cold water, injuring his shoulder on the way down.

Once in the water the CO shouted for help. A shore worker nearby heard the CO's calls, threw him a lifebuoy and shouted to the ship's master, who was on the bridge. The master immediately called the crew to assist.

The crew rushed to the scene and rigged a pilot ladder down the side of the quay wall; two crew members climbed down the ladder and grasped hold of the CO. They found it difficult to lift him out of the water, but with the help of other crew members he was eventually rescued and brought onto the quayside.

As no ambulance was immediately available the master arranged for a taxi to take the CO to the local hospital, where he was treated for the effects of cold-water shock and a dislocated right shoulder.

Figure: Ship's gangway on the narrow quayside

The Lessons

1. **The CO went ashore to check the draught marks without telling anyone and without wearing a lifejacket. When he fell into the water it was fortunate that a shore worker heard him and raised the alarm. In different circumstances there might have been no-one around and the CO would have had to try to climb out of the water on his own. If lone working on a vessel, ensure that a responsible person is informed of your location, work intentions and timescale for completion. At the end of the work, report back that it has been completed.**

2. **Immersion in cold water quickly reduces the ability to swim, and therefore remaining afloat without the aid of a lifejacket can be difficult.**

3. **Every vessel's safety management system should include the requirement to undertake a risk assessment for working near quay edges. The risk assessment should take into account the local environment at the time of undertaking the work, and appropriate risk reduction measures should be implemented.**

Another Weighted Heaving Line

Narrative

A chemical/products tanker was entering harbour with a pilot embarked on a breezy, rainy night. A tug was standing by and was ordered by the pilot to secure its tow line. The tug master manoeuvred close to the port bow, ready to receive a heaving line from the ship.

The deckhand stood to one side of the tug's aft deck and indicated to the ship's mooring party that he was ready for them to throw the heaving line. The line was thrown, and the end landed on the tug's deck with a loud bang. Attached to the end of the line was a heavy 0.5kg steel shackle (Figure 1).

The deckhand removed the shackle from the heaving line and continued to pass the tow. The berthing continued without further incident. The tug master informed the pilot of the incident, and the tug provided two bean bags to the ship as alternative, safe weighting for heaving lines (Figure 2).

Figure 1: Steel shackle used as heaving line weight

Figure 2: Bean bag supplied by tug company as a safe alternative heaving line weight

The Lessons

1. **Fortunately, the deckhand was standing to one side of the deck and the shackle landed away from him. He was wearing a hard hat, but a shackle dropped or thrown from height might well have caused serious injury despite this, and would certainly have caused an injury if it had struck any unprotected part of his body. Under no circumstances is a line to be weighted by items such as shackles, bolts, nuts or twist locks. The only safe options are rope-only 'monkey's fists' or a 'bean bag', provided the weight is no more than 0.5kg.**

2. **This tug company has a no-tolerance policy to dangerously weighted heaving lines, removing weights and reporting incidents. It backs this up by keeping supplies of bean bags on its tugs, and crews supply safe alternatives to any ship using dangerously weighted lines. This approach is to be commended.**

Knock-On Effect

Narrative

A lorry driver was waiting in his cab to disembark from a ro-ro ferry. Unaware of a car parked directly in front, the lorry driver started to move his vehicle forward before being instructed to do so by the ferry's crew. The lorry then struck the parked car, shunting it into the back of another car in the lane to the right (Figures 1a and 1b). The driver of the car in the lane to the right was returning to the vehicle at the time and her legs were trapped between the two cars (Figure 2).

Two crew arrived on scene and began to coordinate a response. The lorry driver was instructed to reverse to allow the two cars to be separated. There was no-one in the car that had been shunted by the lorry, so the ferry's crew attempted to push it to free the trapped car driver; however, the handbrake was still on and the car could not be moved. A group of crew and passengers then lifted the car away and freed the trapped driver. She had sustained minor injuries and was taken to hospital as a precaution.

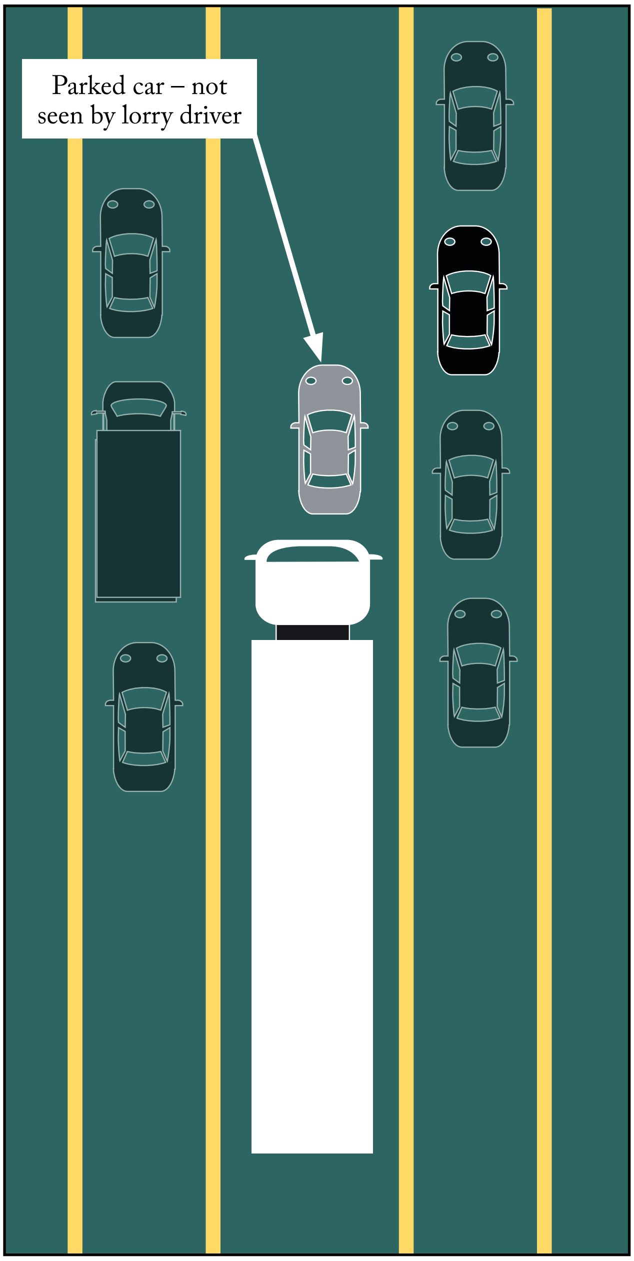

Figure 1a: Location of vehicles on the car deck

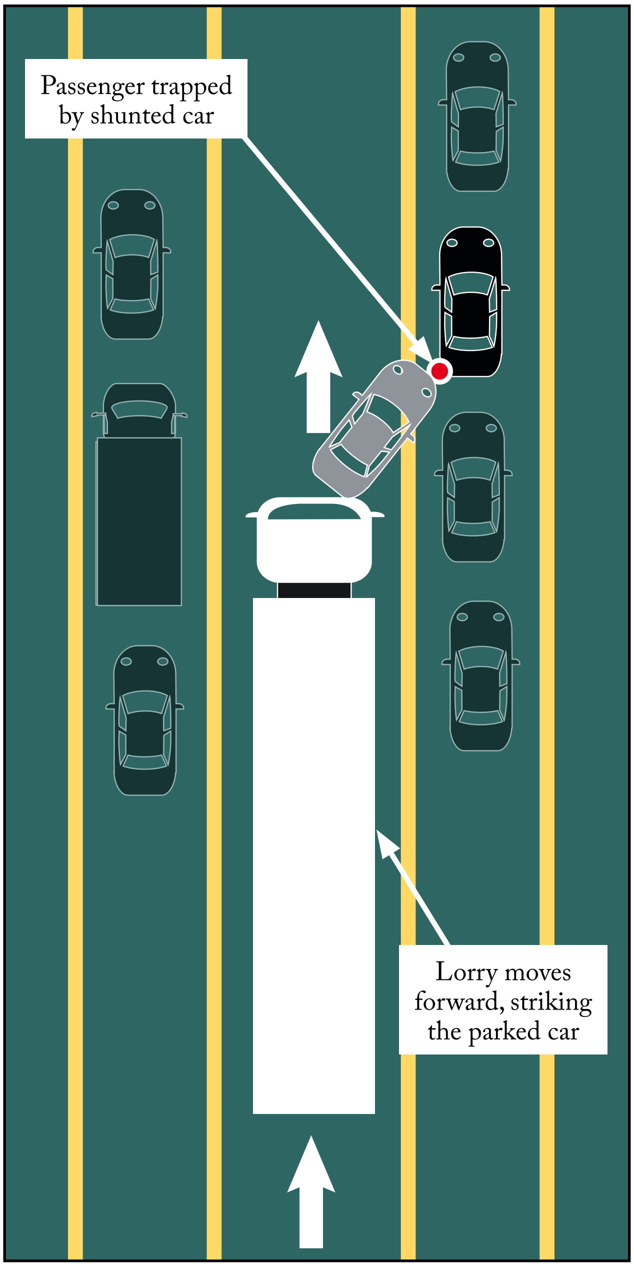

Figure 1b: Position of vehicles after shunt

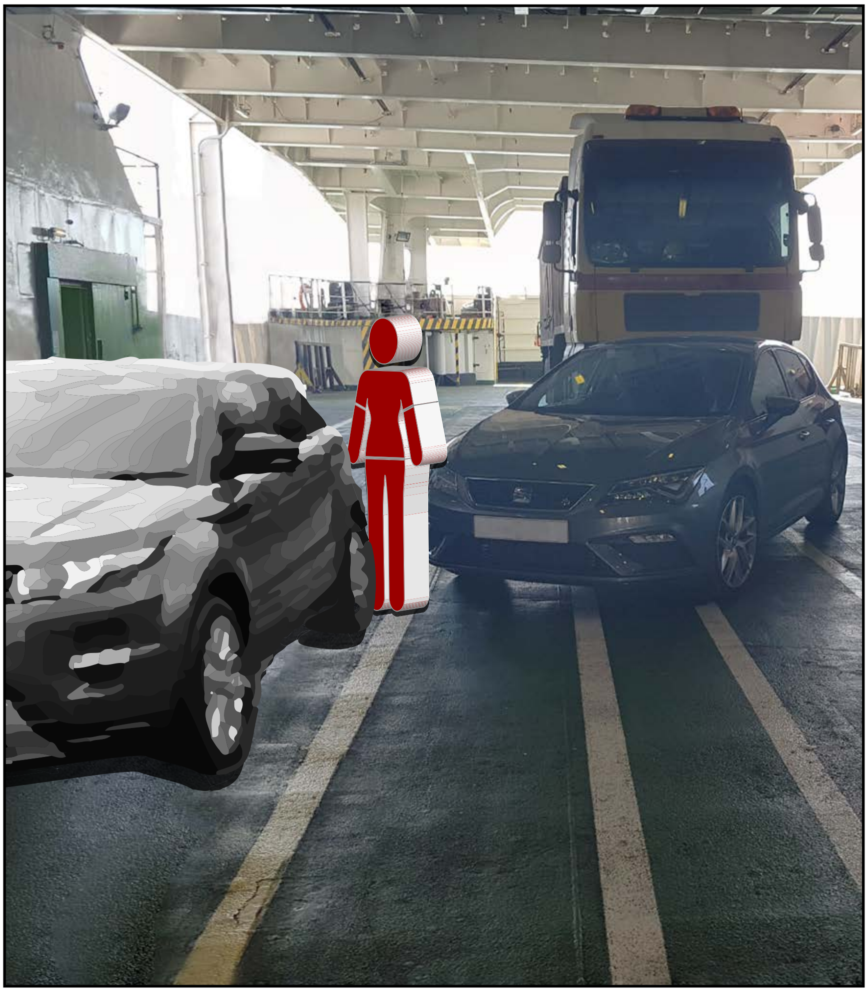

Figure 2: View of vehicle deck showing how car driver was trapped

The Lessons

1. It is vital that drivers on ferry car decks move only when directed to do so by crew. In this case the lorry driver did not wait for a signal from the crew, but moved under his own initiative. With a mixture of vehicles and pedestrians in a restricted space, the car deck of a ro-ro ferry can be a very hazardous environment and crew direction is critically important for the safety of drivers and their vehicles.

2. It is equally important to ensure that there are no obstructions before moving a vehicle on a ferry's car deck. The lorry driver moved his vehicle forward believing that there was no obstruction in his path. However, although the rest of the lane was clear, he had not seen the car parked directly in front as the height of the car and its close proximity meant it was within his forward blind spot. Any vehicle driver must check that there are no cars or passengers in front of them before moving off.

3. The decision to lift the car manually to free the trapped driver might have seemed the quickest way to resolve the situation, but it could easily have resulted in more injuries through the unplanned manual handling of a heavy object. Although the car driver was trapped between the two cars and understandably distressed, she was not in any immediate danger. It might have been more appropriate to wait until the driver of the shunted car returned and could move the vehicle to free the trapped driver, or for a crew member to move the trapped driver's car.

ECDIS is not an Alarm Clock

Narrative

It was a fine summer night and a live fish carrier was on passage; the bridge was manned by the OOW and an AB lookout. It was still dark at 0430 when the AB left the bridge to prepare painting materials for the next watch. Thereafter, the OOW was alone and sitting in the bridge chair. The OOW did not feel tired but must have drifted off to sleep as he was suddenly woken by the ECDIS safety depth alarm indicating that the water depth was less than 10m. The OOW applied astern power and turned to port in an attempt to avoid shallow water. But it was too late, and the vessel was still underway at 4kts when it grounded (see figure).

The master was called to the bridge, and an initial assessment found no internal damage. The crew refloated the vessel using its own power around 30 minutes after the grounding and headed for harbour. Once the vessel was within mobile phone range, the coastguard was informed. An inspection by divers found some minor damage and the vessel proceeded to dry dock for repairs.

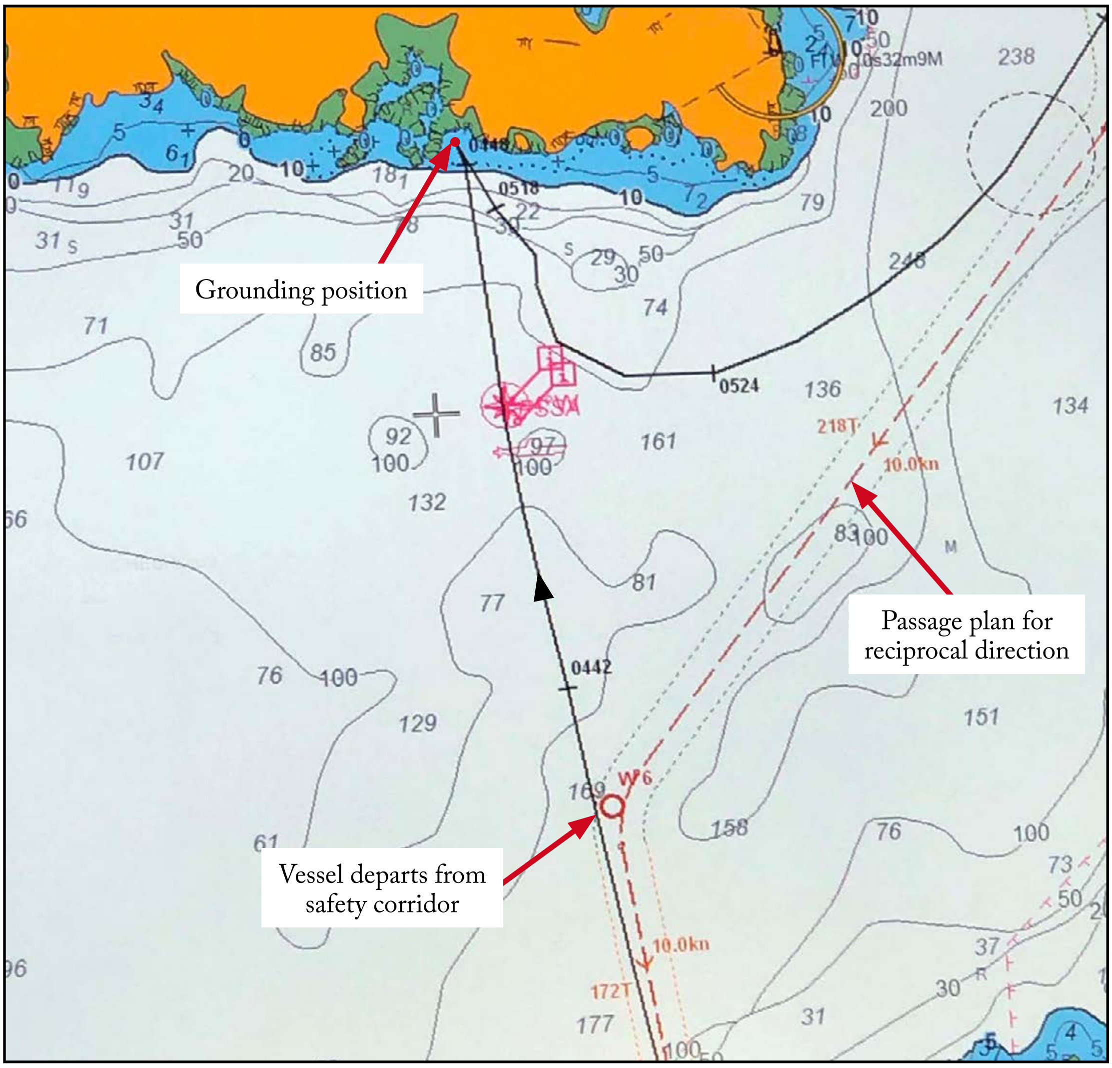

Figure: Planned ECDIS track and actual track showing position of grounding

The Lessons

1. An alarm is only of value if it provides sufficient warning for the OOW to make sense of what is wrong and take action accordingly. In this case the depth alarm came too late to be effective as the seabed shelved steeply around the island and the water depth decreased rapidly. Neither the ECDIS off-track alarm, which would have alerted the OOW to the missed course alteration, nor the BNWAS, which would have alerted the crew to the inactivity on the bridge, had been set. Had either alarm sounded there might have been sufficient time to avoid the grounding.

2. There have been many incidents caused by lone watchkeepers falling asleep on the bridge. After a previous grounding incident under similar circumstances, the company involved in this case had required that a lookout be posted in the hours of darkness. When the lookout left the bridge to perform other duties while it was still dark the OOW was left alone and vulnerable to falling asleep.

3. Fatigue can creep up on you. Even if you do not feel tired it is important to recognise that falling asleep is a real risk when working at night, particularly in the pre-dawn hours where circadian rhythms mean the body is most primed for sleep.

4. Alerting the coastguard should be one of the first actions after an incident – not the last. Although the vessel was refloated without assistance, an early call to the coastguard would have been invaluable had the situation escalated. The ship was within VHF coverage and could easily have communicated with the coastguard without delay.

Fender or Offender?

Narrative

A large research vessel was approaching a harbour and preparing to embark a pilot. The wind was over 30kts from a southerly direction and, after several days of southerly winds, there was an appreciable swell from the same direction.

From the pilot boat, the pilot requested that the research vessel maintain a westerly heading, putting the wind on its port beam and creating a lee to starboard for the transfer.

As the pilot boat approached the boarding point, the research vessel rolled to port, causing the smaller vessel to be pulled in towards the larger vessel.

When the research vessel then rolled back to starboard, its diagonal side fendering struck and punctured the deck edge of the pilot boat (Figure 1). Further contact damaged the research vessel's fendering (Figure 2) and the pilot boat's wheelhouse.

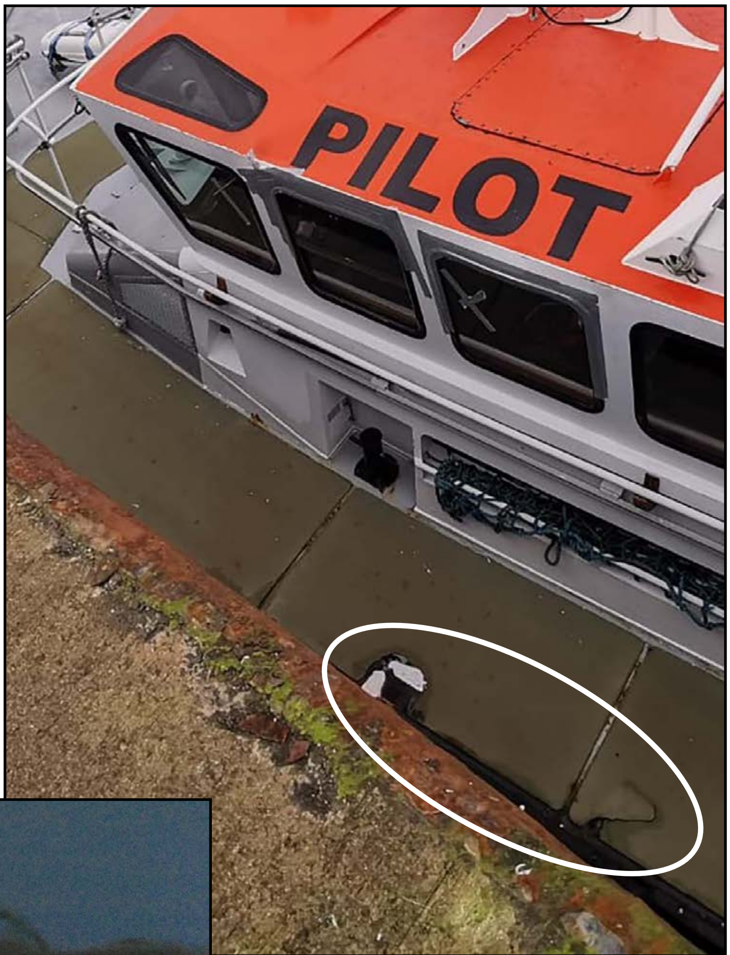

Figure 1: Puncture damage to the pilot boat's deck

Figure 2: Damage to the research vessel's fendering and the unprotected fender ends

Figure 3: Modifications to fender ends after the accident

The Lessons

1. Achieving the optimum conditions for a pilot transfer is a balancing act between wind, swell, sea room and the limitations of the vessels involved. In this case, the pilot's aim was to achieve shelter from the strong southerly wind for the transfer; the westerly heading was also commonly used at this port given the sea room available. However, this heading had the consequence of inducing a significant roll due to the swell, resulting in the situation of unsafe interaction between the two vessels.

2. The fendering on the survey vessel was of a diagonal type, which terminated just below the waterline, so when the vessel rolled, the ends emerged from the water. The fender ends were not protected or faired into the hull, leading to sharp protruding corners (Figure 2), which penetrated the deck of the pilot boat. Following the accident, the fender ends were modified to eliminate the abrupt termination (Figure 3) in order to reduce the risk of recurrence.

3. When the contact happened, the pilot was in an exposed position on the deck, ready to board the research vessel. It was extremely fortunate that he was not knocked overboard or injured when the pilot boat was pinned to the research vessel's side. This highlights the risk inherent in pilot transfer operations and the need for careful judgment about when to move outside the safety zone.

A Splash of Danger

Narrative

The crew of a cargo vessel were preparing for departure from their regular port, and a tug was connected at the bow and waiting to assist. All the mooring lines were still fast and the bosun was preparing to single up the forward lines, which would have included releasing the mooring winch brakes.

However, instead of releasing the mooring winch brakes, the bosun released the port anchor windlass brake, inadvertently freeing the port anchor, which dropped into the water extremely close to the tug (Figure 1). There was no damage to either vessel, and the departure proceeded without further incident after the port anchor had been retrieved.

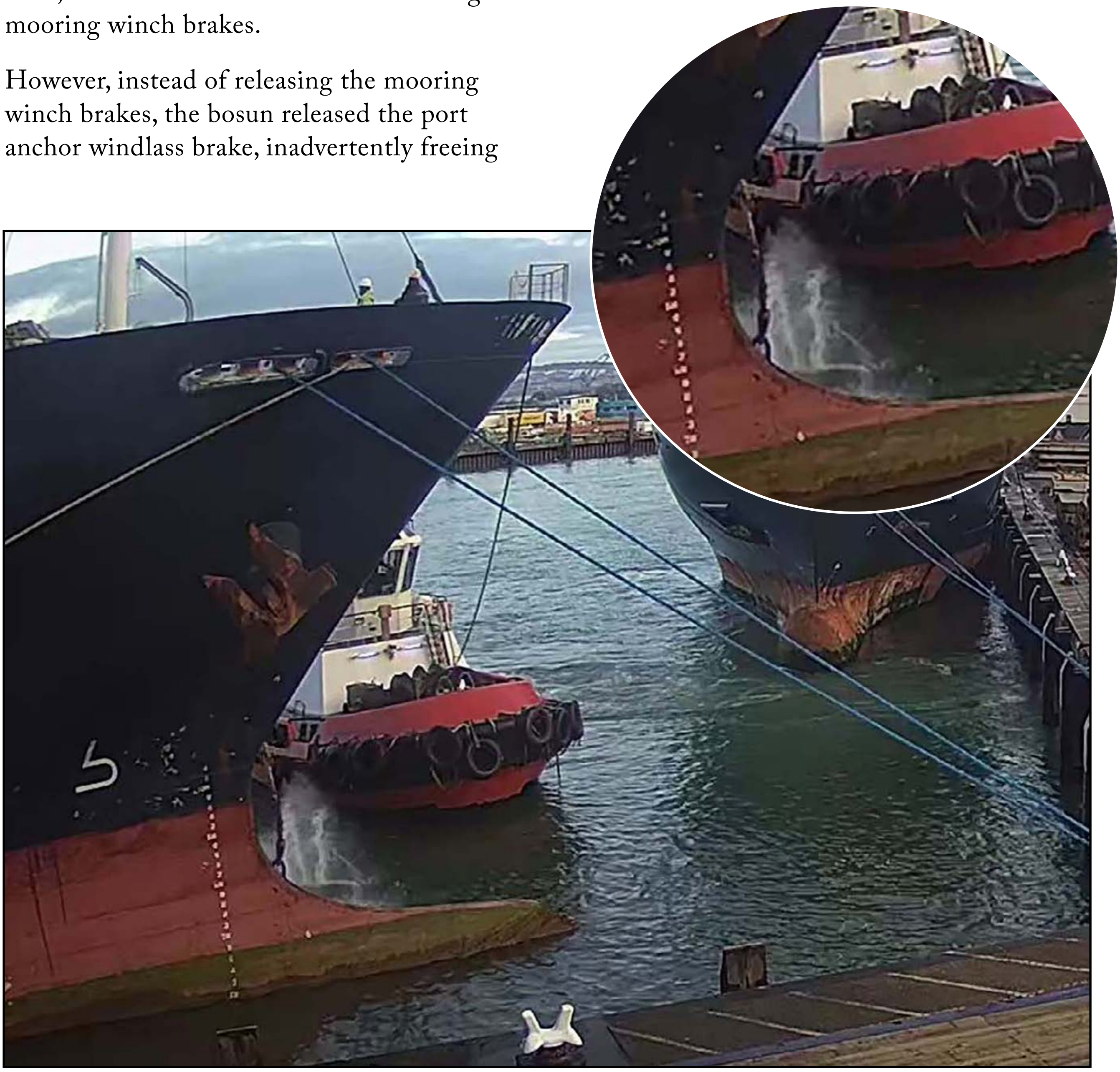

Figure 1: CCTV still image of the moment the anchor splashed into the water

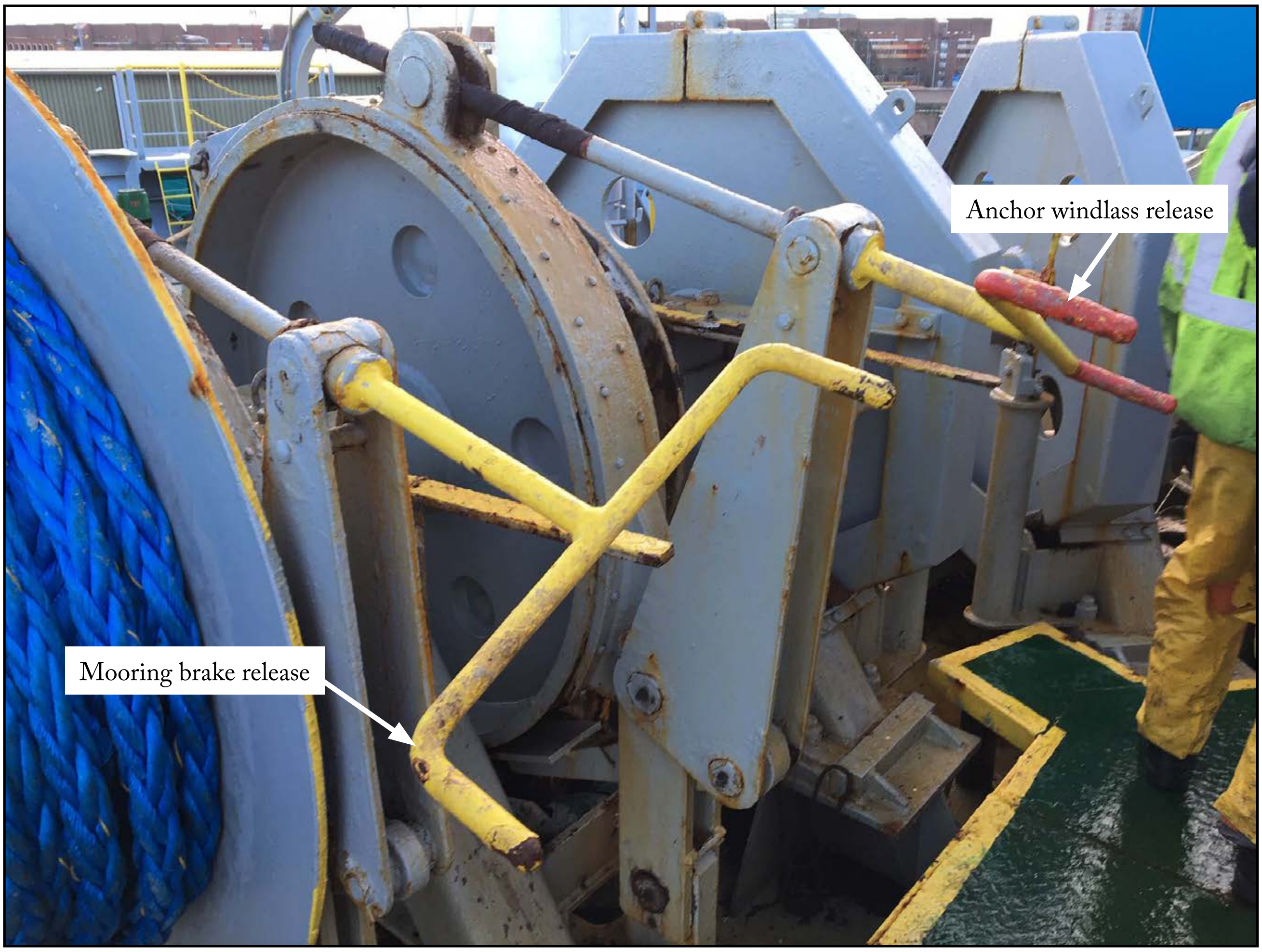

Figure 2: Adjacent mooring winch and anchor windlass brake handles

The Lessons

1. The brake release handles for the mooring winch and anchor windlass were next to each other (Figure 2). This arrangement is not unusual but does introduce the risk of inadvertent release of the wrong handle. On this vessel, the crew had painted the anchor release red to assist with distinguishing between the handles. Nevertheless, when preparing to depart from harbour the bosun operated the wrong handle, resulting in the accidental release of the anchor. This occurred because in all other respects the anchor was ready for letting go, removing any safety barrier to prevent inadvertent release.

2. The bosun was experienced and familiar with the mooring and anchor arrangements; it was daylight, good weather conditions and the crew were rested, so fatigue was not a factor. Therefore, there were no clearly identified causal factors for the bosun's erroneous action. Events like this can happen, and it highlights the need for carefully following procedures, teamwork and maintaining high levels of supervision when working on deck.

3. The anchor fell extremely close to the waiting tug. Had the tug been directly underneath the anchor with crew on deck, this accident could have had severe consequences. This serves as an excellent reminder of the hazards that exist for tugs, workboats or line handling boats when operating in close proximity to larger vessels.

An Arctic Chill

Narrative

After delivering a high-latitude cruise experience for its 670 passengers, a cruise ship was heading south again. When navigating in Arctic waters, the cruise ship had been running on heated low sulphur fuel.

Once close to home, the fuel supply to the main engines and electrical generators was changed over to marine gas oil (MGO), in preparation for entering harbour. Soon after the fuel supply changeover, a total electrical failure was experienced. All power and propulsion was lost, but the emergency generator started automatically to maintain essential services. The cruise ship was then drifting and not under command.

Realising there had been an issue with the fuel, the ship's engineering team restored power and propulsion by changing over to an alternative heavy fuel oil (HFO) supply. Generator power was restored within 5 minutes and, about 10 minutes later, propulsion was available again and the cruise ship entered harbour without further incident.

Figure 1: One of the cruise ship's fuel filters after the incident, clogged with the waxy fuel

The Lessons

1. Post-incident analysis established that, immediately after the changeover to MGO, the fuel filters were blocked due to the presence of waxy crystals in the fuel (Figure 1). MGO reacts to temperature changes, with a key effect being the formation of crystalline wax particles as the temperature falls. The formation of the wax particles has three key stages:

    - The first is the fuel's cloud-point, which is the temperature when the formation of the wax particles becomes visible to the naked eye, giving the effect of cloudiness to the fuel. For MGO the cloud-point is typically 19°C.

    - The second point is the temperature at which the wax crystals are large enough to become trapped by a 45-micron filter. This is called the cold-filter plug-point, typically 12°C for MGO.

    - The third point is the temperature at which the formation of wax crystals affects the fuel's ability to flow through pipework; this is the pour-point, typically about minus 10°C for MGO (Figure 2).

    In this case, the ship had been operating in Arctic waters where the air temperature had dropped to minus 14°C and the sea temperature was between 3°C and 5°C. In these conditions, the ship's engine room ventilation system allowed the ambient temperature to drop to very low levels, resulting in significant cooling of the MGO pipework. This created the environment for the crystals to form in the MGO fuel lying dormant in the supply pipework, which blocked the filters soon after the MGO fuel supply was selected. A number of actions could have been in place to minimise this risk, specifically: pipework insulation, pipework heating, circulation of the fuel back to the service tanks or the use of a fuel additive.

2. The ship's engineering team reacted effectively to the situation, identifying the problem and restoring the fuel supply. Their system knowledge and practised procedures for changing fuel supplies allowed the situation to be recovered rapidly with power and propulsion restored in a timely manner.

Figure 2: An example of waxy deposits formed in a fuel line (library image, not from this incident)

CASE 9

An Unwanted Hot Shower

Narrative

The third engineer of a chemical tanker had been tasked with cleaning the auxiliary condenser; a familiar task. The chief engineer had carried out a toolbox talk with the third engineer and a motorman beforehand. The third engineer set up the cleaning equipment: a drum of hot water, a circulating pump and hoses to supply and return the hot water through the condenser (see figure). The return hose ran from the top of the condenser back to the drum and was secured at the upper end of a nearby ladder.

The third engineer started the pump and stood near the drum while he prepared the cleaning chemicals. The water was discharging from the return hose in fits and starts, and the free end was moving around in the drum. Suddenly the end of the return hose flipped out of the drum and sprayed scalding hot water over the third engineer.

The motorman stopped the pump and raised the alarm. The injured third engineer was given first-aid on board before he was evacuated and transported to hospital. He had suffered severe scalding burns to his upper body and was off work for more than a month.

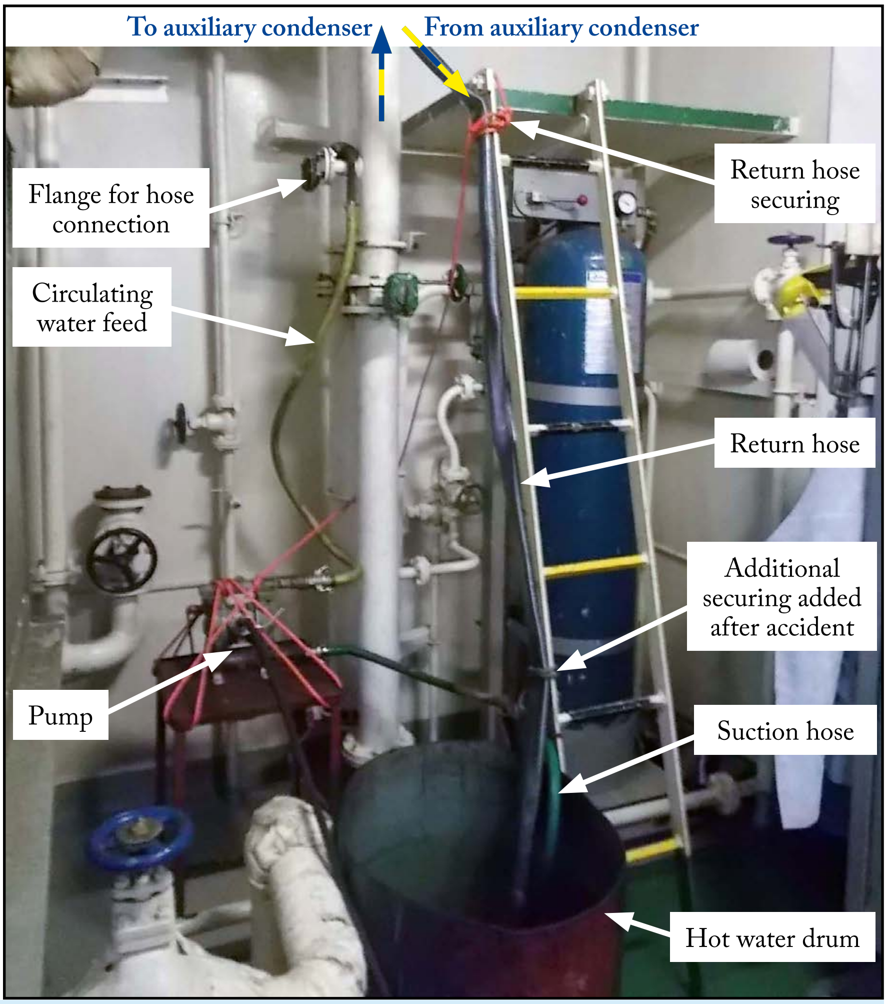

Figure: Auxiliary condenser cleaning arrangement in the post-accident condition

The Lessons

1. **Consider securing arrangements carefully when rigging equipment for cleaning or other maintenance tasks. In this case the return hose flipped out of the drum because the securing arrangement at the top of the ladder caused a bottle neck effect and there was no securing at the lower end to prevent the moving hose escaping the drum.**

2. **Never underestimate the danger of hot water and the risk of scalding. If possible, check circulating arrangements with water of a lower temperature before introducing water hot enough to cause injury. In this case covering the drum might have been another way to reduce risk by placing a physical barrier between the hazard of the hot water and the crew.**

Hot News – TV on Fire

Narrative

A small fire broke out behind a passenger information display screen on board a ferry. An off-duty crew member saw the fire, raised the alarm and extinguished it immediately using a portable fire extinguisher. The onboard investigation concluded that the cause of the fire was an overheated electrical power surge protection unit that had been fitted by the ferry owners to help prevent screen failures (Figure 1). It also established that some components in the passenger information system electrical circuits had been installed to a poor standard and that a 100 volt transformer for an external speaker amplifier was coated with a thick layer of dust and grime (Figure 2) and had also overheated.

The ferry owner's investigation identified that the surge protection units were unnecessary as the vessel's electrical systems were already protected with circuit breakers and the information screens had individual protection fuses. As a precaution, the owners removed the surge protection units and replaced the 100 volt transformers on all their ferries.

Figure 1: Surge protection system

Figure 2: Overheated 100 volt speaker transformer

The Lessons

1. **Always ensure that any additional electrical equipment you intend to fit to an existing circuit is required, compatible, installed to a high standard, and in such a way as to facilitate regular inspection and maintenance.**

2. **Regular inspection and cleaning of transformers should be built into the ship's planned maintenance schedule. Dust accumulation can prevent air circulation and eventually result in the breakdown of insulation. This is exacerbated by any moisture present and can lead to overheating and fire.**

Wet, But Safe

Narrative

With the wind light but some swell present, the opportunity came for a support vessel to carry out some crew training with its daughter craft. The training went well and the time came for the coxswain to approach the falls so the boat could be lifted back on to the support vessel. As the bowman went forward he shouted for more slack in the painter line as he believed the line was too short. However, as he grabbed the painter line the support vessel and the daughter craft rolled away from each other as the daughter craft fell into a wave trough. At that point the bowman, still holding the painter line, was lifted from the bow, and on landing back onto the deck he lost his balance and fell over the port side.

The bowman was wearing a safety tether, which prevented him from being separated from the daughter craft. The coxswain could see what had happened and immediately manoeuvred the daughter craft away from the support vessel to eliminate the risk of crushing the bowman.

The third crew member, who had been in the wheelhouse, went on deck and recovered the bowman shortly afterwards, and the daughter craft was then successfully recovered on the falls and secured. The bowman was immediately assessed by the onboard first-aider. He had suffered only minor injuries as a result of the incident.

Figure 1: The bowman moves forward as the daughter craft approaches the falls

Figure 2: The daughter craft manoeuvres away from the mother ship as the bowman, secured by his lifeline, holds onto the grabline

The Lessons

1. Although the bowman kept hold of the painter line as the vessels moved apart, he was wearing the correct PPE for the operation and the potential for more serious consequences was minimised. The insulated boat suit he was wearing contained an auto-inflation lifejacket, but as he was held sufficiently clear of the water by his safety tether it did not activate.

2. Good management of the incident stemmed from a thorough risk assessment, with mitigating measures in place that were understood by the crew. As a result, what could have been a serious accident resulted in only minor injuries.

3. The coxswain of the daughter craft maintained appropriate oversight of the operation, which allowed him the presence of mind to move away from the support vessel in good time, protecting the overboard crew member. Operating in swell in a small craft can be unpredictable, and requires caution and full attention from everyone.

CASE 12

A Shocking Tale

Narrative

A traditional wooden sail training vessel was preparing to enter a small and unfamiliar harbour to berth overnight. The skipper had studied the electronic charts and was concerned about the depth of water and sea room available at the berth. To be certain that sufficient under keel clearance would be achieved, the skipper sent two crew members in a small tender into the harbour to check the berth's suitability. After a report back from the two crew in the harbour, the skipper was satisfied that all was well, so proceeded to take his vessel in to the harbour under power.

Figure: View of the harbour entrance showing the overhead power cable hazard

As the vessel passed through the narrow harbour entrance a loud cracking noise was heard from aloft. Looking up, the skipper observed that the top of the mast had passed very close underneath power cables that were suspended above the harbour entrance (see figure). Once the vessel was alongside, the skipper discovered that all of the electronic systems that were connected through the mast had ceased to function.

The Lessons

1. **Although the mast had not touched the power cables, it had passed close enough for voltage to jump the gap and earth through the electrical cables, damaging the electronics. The overhead power cables were carrying 22,000 volts (22kV) which is high-voltage and highly dangerous. Advice on safe distances from high-voltage cables is available from the system providers and suggests that, for a 22kV power cable, the minimum clearance should have been 2.7m.**

2. **Although the skipper had demonstrated due diligence in ensuring that the harbour was suitable for the safe navigation of his vessel in terms of depth of water, the air draught had not been considered. It is very understandable that the skipper focused on the under keel clearance, but this also served as a distraction from identifying all potential hazards to safe navigation. In this case, the height of the overhead cables was marked on the chart. When planning to enter an unfamiliar harbour, every potential source of navigational advice such as the chart and pilot books should be checked for advice on safe navigation.**

3. **This incident also serves as an important reminder for vessels with wooden masts to provide an air termination rod, earthing conductor and surge protection to minimise damage in the event of a lightning strike.**

Don't be Backwards About Going Forwards

Narrative

A ro-ro ferry was preparing to depart from its regular harbour. In moderate or light wind conditions the harbour authority permitted the master, who held a pilotage exemption certificate (PEC), to depart past the breakwater going astern. Above 25kts of wind, the master would have been required to turn the vessel at rest adjacent to the berth, before passing the breakwater going ahead.

Observing that the wind was 22kts, the master's plan was to exit the harbour directly by going astern. Having unberthed the ferry, the wind started to increase, and the master struggled to maintain control. However, he pressed ahead with the plan. When approaching the breakwater, the wind was in excess of 30kts and control of the ferry was lost when both bow thrusters failed. The ferry then made heavy contact with a quay wall, resulting in damage to its starboard quarter (figure); there was also damage to the quayside.

Figure: Damage to the ferry's starboard quarter

The Lessons

1. PEC holders need to consistently demonstrate competence in harbours where pilotage exception is permitted. This can be achieved by 'check rides' from local pilots, or a minimum number of entry and exits to retain currency. Although the wind was within the agreed harbour limits for a stern first departure when the ferry unberthed, the situation soon deteriorated, and a safer course of action would have been to turn the ferry around inside the harbour.

2. Post-accident analysis showed that this master very rarely turned the vessel at rest, having done so only twice in the 10 months prior to the accident. Records also showed that a different master of the same ferry had turned at rest 24 times before departing in the same period. This illustrates an inconsistency of approach, which is particularly relevant when passing the breakwater going astern, was only safe in light or moderate wind conditions.

3. Passage plans should include a 'Plan B'. In the circumstances of this accident, it would have been safer for the master to change the plan and turn the ferry off the berth before passing the breakwater. Good bridge teamwork would also have resulted in a prompt from another team member that the wind was increasing, and a pre-planned 'tripwire' had been crossed that necessitated a change of plan.

4. The bow thrusters had tripped due to over-heating after a period of constant heavy use as the master struggled to control the ferry. It is not unusual for heavy electrical equipment that is not designed for continuous operation to have a time limitation when being used at high power outputs. This resulted in an unfortunate situation because, when the master needed the bow thrusters most to avoid the heavy contact, they had tripped.

Too Close for Comfort

Narrative

On a breezy autumn morning, a ferry had departed harbour and was following a buoyed channel to the open sea. At the same time, a small cargo vessel inbound towards the channel was preparing to embark a pilot via a ladder on its port side, as had been directed by the VTS (Figure 1).

In order to obtain suitable sea conditions for the transfer, the coxswain of the pilot boat asked the cargo vessel's master, by VHF radio, to alter course to port, which he agreed to do. The pilot boat's coxswain then informed the ferry's master of the plan. The ferry's master responded by stating his intention to leave the channel passing south of buoys 1 and 2, and that he hoped the cargo vessel would not proceed too far in his direction. As the cargo vessel started its turn to port, the vessels were just over a mile apart (Figure 2).

As soon as the pilot arrived on the cargo vessel's bridge after the transfer, it was immediately apparent that urgent action was required to avoid collision. The pilot informed the ferry's master that he was altering course hard to starboard and, at the same time, the ferry's master had applied astern power to stop the vessel (Figure 3). Both these actions prevented collision and, after passing, the vessels continued their passages without further incident.

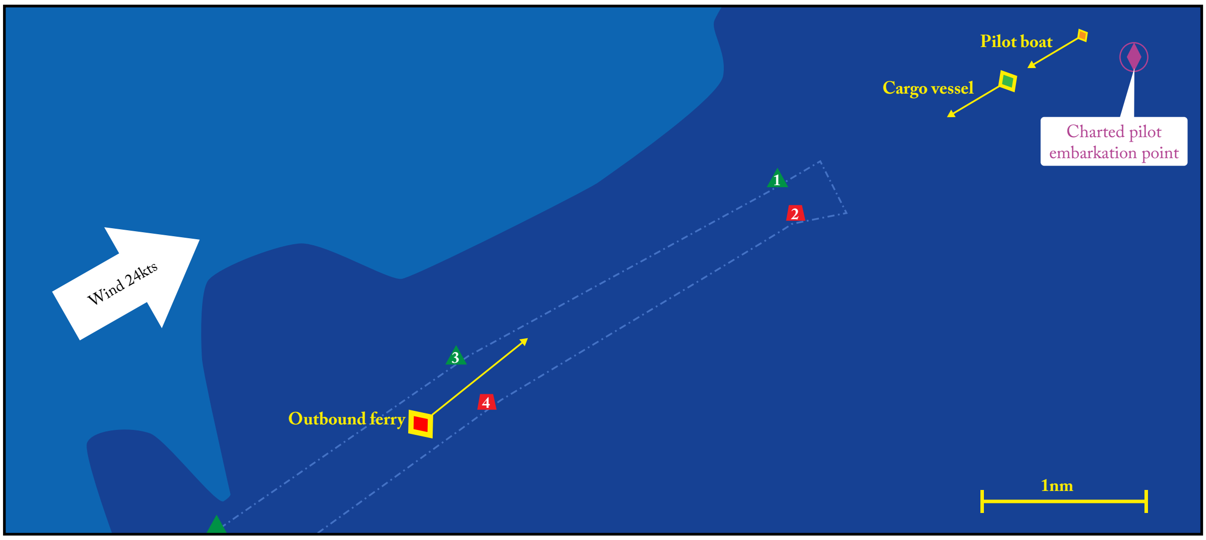

Figure 1: The outbound ferry and the inbound cargo vessel prior to the pilot transfer

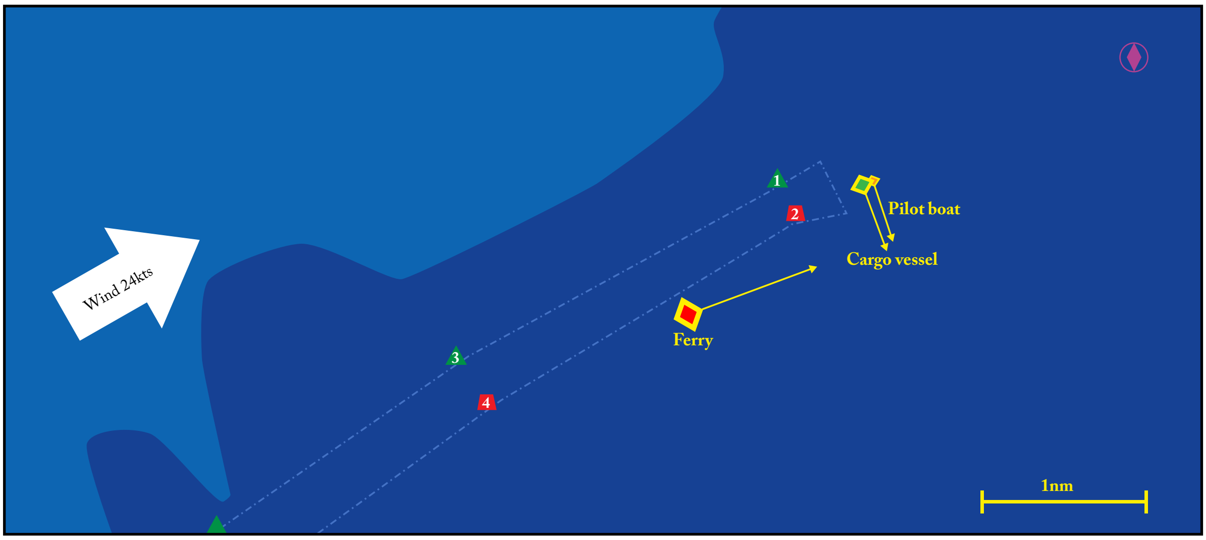

Figure 2: The situation during the pilot transfer

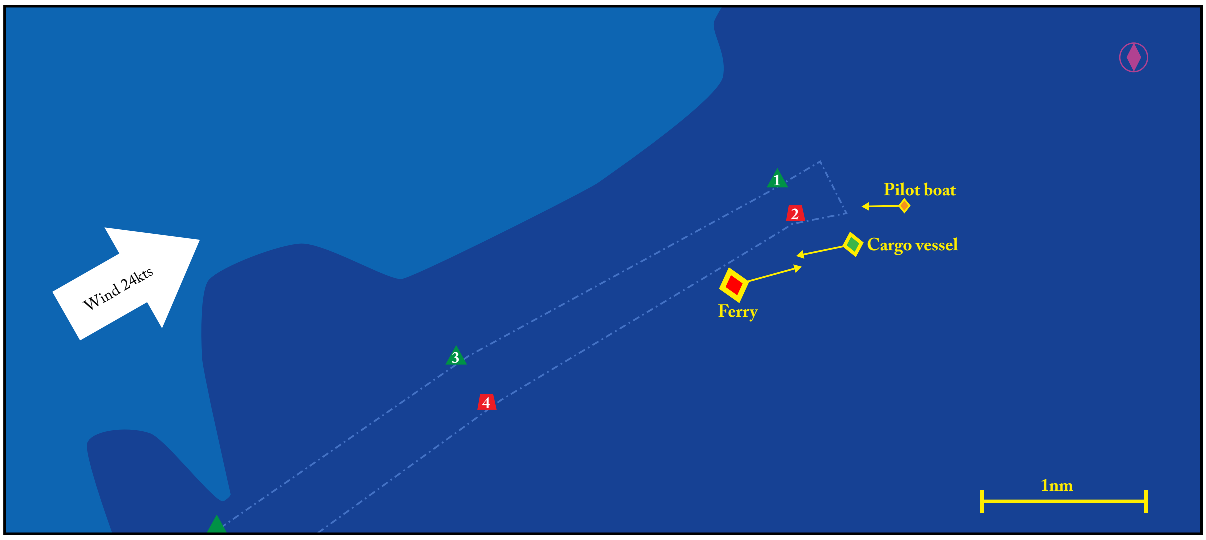

Figure 3: The close pass after the cargo vessel had been altered back to starboard

The Lessons

1. The VTS team has a vital role to play in assisting with collision avoidance. The risk of collision between inbound and outbound vessels in this channel was well documented within the port's safety management system. To mitigate this risk the pilot embarkation point (Figure 1) was deliberately positioned east of the channel entrance. Moreover, the harbourmaster's guidance to VTS operators was that inbound vessels should not pass the charted embarkation point until the pilot was safely on board. Had the VTS operator followed the harbourmaster's guidance on this occasion and advised the vessels accordingly, the risk of collision could have been reduced.

2. The direction by VTS to the cargo vessel to rig the pilot ladder on the port side, also contributed to this incident. With the wind blowing almost directly down the channel from the west, and safe water available to port and starboard, the cargo vessel's pilot ladder could have been rigged on either side. However, by directing the cargo vessel to rig the ladder to port, the VTS operator unintentionally committed the vessel to turn into the path of outbound traffic.

3. A 'shared mental model' of a situation can significantly aid time-critical decision making. In a VTS area, the ideal outcome is for all vessels and the VTS operator to have a common understanding of a situation, including each vessel's intentions. Despite the VHF radio conversations in this case, there was the possibility of misunderstandings between the vessels and the VTS operator. This can be mitigated by unambiguous statements of intent and consistent application of local guidance.

4. Ultimately, the responsibility for avoiding collision rested with the masters of both vessels; in this case the action taken to stop the ferry when an uncertain situation developed was effective in avoiding collision. Equally, the master of the cargo ship could have challenged the request from the pilot boat's coxswain in order to develop and agree a safer plan.

A Bumpy Turn

Narrative

On a blustery evening, a small, laden coaster with a pilot embarked unberthed and turned at rest before proceeding downriver towards the open sea. The departure had been timed to coincide with the last of the flood tide and the passage plan allowed for a minimum under keel clearance of 1m.

Having completed the turn, the vessel started to make way along the channel. When approaching the first bend in the river, the pilot applied starboard wheel, but the vessel did not respond. More wheel was soon applied and the vessel started to turn slowly to starboard. However, by this time, the vessel was on the port side of the channel and its stern struck a small, moored leisure vessel during the turn. There were three people on board the leisure vessel at the time of the collision; thankfully, none were injured.

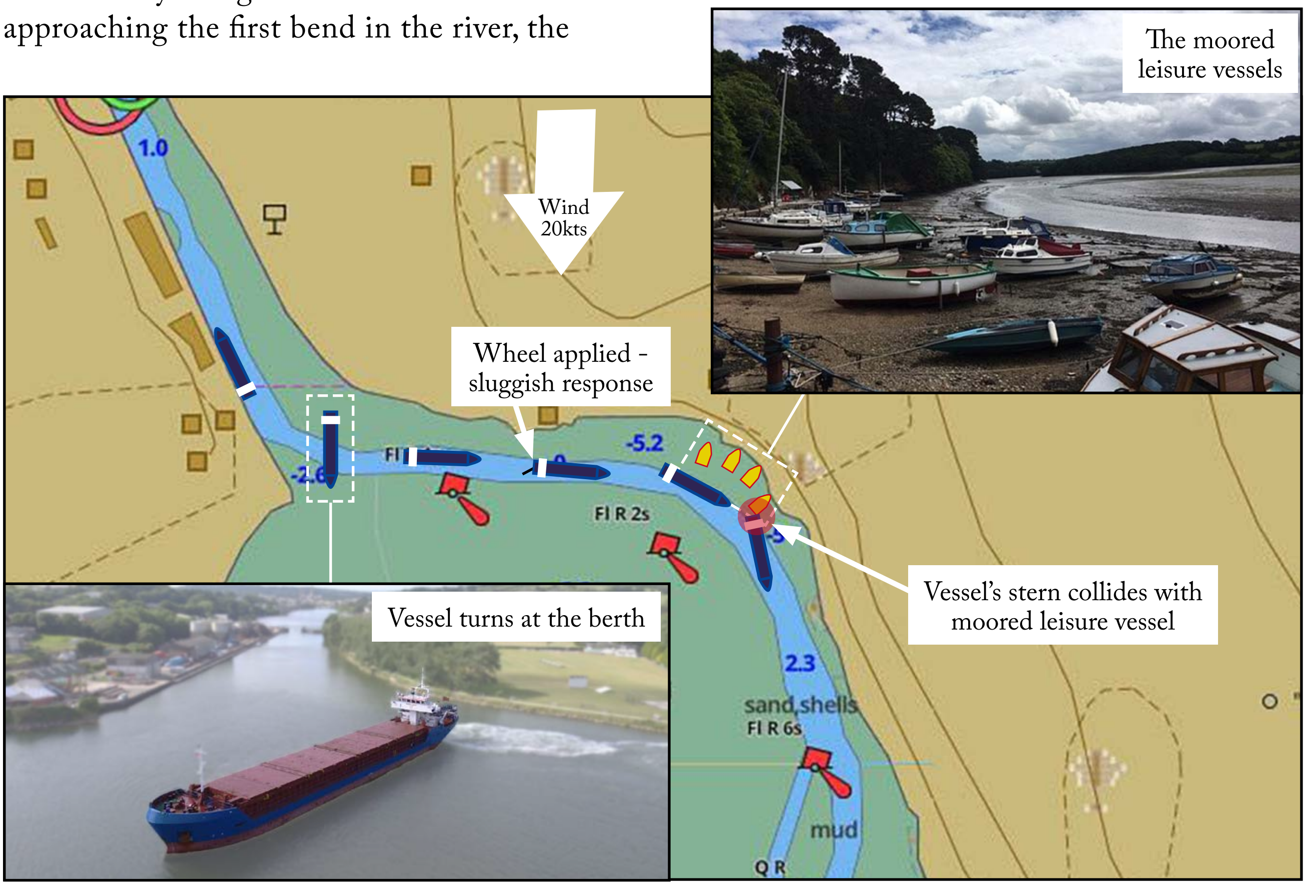

Figure: Overview of accident

The Lessons

1. Hydrodynamic effects can make vessels difficult to turn when the depth and width of a channel are restricted, and these influences should always be taken into account when passage planning. In this case, once the vessel was off the centerline of the channel, it was likely to have been subject to a squatting effect, which can make steering sluggish. It is also likely that a 'bank effect' was experienced, creating a suction zone around the stern, causing it to swing to port towards the moored leisure vessels (see figure).

2. Methods to reduce the effects of operating in shallow and narrow channels include reducing speed, increasing wheel, planning to apply rudder early, and maximising under keel clearance in the passage plan. After this incident, the channel was surveyed to make sure that the best possible local information was available for planning.

3. This accident also illustrates the inherent risk to leisure craft moored close to navigational channels used by commercial vessels. In this case the harbourmaster had sensibly placed a condition on leisure berth holders, prohibiting overnight stays on board. In addition, after the collision, arrangements were put in place for the port's workboat to escort commercial vessels and warn leisure users on the river of the approaching vessel.

A Cracking Building Site

Narrative

In a harbour that was still largely under construction, a berth had been opened to shipping and the contractor had surveyed the area and provided a locally produced chart for approaching vessels. A temporary buoyed channel had also been marked and tugs and pilotage were available.

In calm conditions, daylight and good visibility, a laden, self-discharging bulk carrier entered the channel to approach the berth; this was the third time the vessel had visited the new harbour. The master and pilot had planned for an under-keel clearance of 1.5m, and two tugs were attached to assist. During the final approach to the berth, the master observed that the water level in one of the ballast tanks had begun to rise and that a starboard list was developing. A diver inspection after berthing identified shell plating damage (see figure).

After the accident, the harbourmaster conducted an investigation, including an independent survey. The investigation revealed that, in several areas of the harbour, the actual depth of water was significantly less than shown on the contractor's locally produced chart, confirming that the vessel had grounded during its approach to the berth.

Figure: Detail of the hull damage to the bulk carrier's shell plating

The Lessons

1. **Navigation in port areas where construction work is taking place needs to be undertaken with extreme caution. There will always be additional risk and uncertainty in such an environment.**

2. **In this case, it was established that the contractor's locally produced chart had been compiled using average rather than minimum depths. Charts showing average depth data are primarily for assessing the amount of spoil a dredging contractor has removed, and should not be used for navigation. If a locally produced chart is on offer, it is vital to check that minimum depth data is shown before even considering whether to take it into account for passage planning.**

3. **Masters and pilots should not hesitate to increase the under-keel clearance value to keep safe. The 1.5m under-keel clearance agreed between the master and the pilot here aligned with industry guidance of being in the order of 10% of the vessel's draught. However, given the additional risks of operating in a harbour that was still under construction, it would have been sensible to plan for an increased under-keel clearance.**

Part 2 - Fishing Vessels

Investigating accidents involving fishing vessels and fishermen continues to account for a third of the MAIB's case load each year and this issue of the Safety Digest includes a broad range of accident types and safety lessons. Although some areas, such as the management of risk, seem to be improving, it is still frustrating that our inspectors are deployed to investigate and report on similar issues leading to tragic accidents.

The majority of the fatal man overboard accidents investigated by the MAIB over the last 5 years have been to fishermen operating potters, often working alone. Despite the advances in working practices in this method of fishing, including stern doors and self-shooting, the accidents invariably involve a crewman becoming caught in gear while shooting and being quickly dragged overboard. Without a lifejacket and anyone to assist, the fisherman's chances of survival are limited as the debilitating effects of cold-water shock set in.

The obvious barrier against this eventuality is to take measures to prevent a man overboard, which should now be part of a documented risk assessment. The next step is to ensure that you have the best chance of survival should you end up in the water. You can do this by wearing a lifejacket in areas on board where there is a possibility of falling overboard.

With ILO Working in Fishing Convention (ILO188) now in force, there are additional health and safety responsibilities on all commercial fishing vessel owners and skippers for themselves and their crew, including taking measures to prevent a man overboard as far as possible. The recently launched Home and Dry campaign created by the Fishing Industry Safety Group (FISG) aims to connect and engage with fishermen to help them find safety information and guidance to improve safety and compliance with ILO188. The website can be accessed at: www.homeanddry.uk.

The introduction of ILO188 and the planned revision of the Maritime and Coastguard Agency's suite of fishing vessel Codes of Practice are ushering in a new era of safety and welfare for the UK fishing industry. It is hoped that this new legislation, which is more suited to the modern fishing industry, along with the hard work of fishermen, will result in a reduction in accidents, and the days of MAIB inspectors investigating repeat accidents can become a distant memory.

#HOMEANDD

SEAN FRIDAY
MAIB INSPECTOR OF MARINE ACCIDENTS

Although I had always wanted to go to sea, on my father's insistence my career began with an engineering apprenticeship as a civilian in the British Army. With this providing a good grounding I went to sea as a deckhand in the fishing industry and progressed to the role of skipper of one the UK's largest fishing vessels.

In 2006, I left the sea for a full-time role with the Royal National Lifeboat Institution (RNLI), delivering safety advice and safety interventions to commercial fishermen.

In 2012, I joined the MAIB as a nautical Inspector and commercial fishing lead. I have investigated many accidents, not just to fishing vessels but also accidents involving merchant and leisure craft.

CASE 17

When Working Alone, Keep an Eye on Yourself

Narrative

It was a warm spring day with calm seas when the skipper of a single-handed creel boat noticed another small creel boat going around in circles. He was puzzled as he had spoken to the other boat's skipper about 15 minutes beforehand and knew that he had been dealing with his final string of creels for the day. On approaching the boat, he still could not see the fisherman, so alerted the local harbourmaster before ramming and then boarding the circling boat.

The skipper confirmed that there was no-one on board. The throttle was in the ahead position and there was no fishing gear stowed on deck. Knowing that the boat had been manned earlier in the day, he stopped the engine and anchored it before returning to his own boat. The skipper then began to lift the missing fisherman's creels as he concluded he must have somehow become entangled in the gear and been dragged overboard. This was confirmed when he discovered one of the missing fisherman's boots entangled in a string of creels along with a partial cut in the back rope (Figure 1).

On receiving the news from the skipper, the harbourmaster had called the coastguard, and the local lifeboat was quickly on scene to commence a search. Shortly afterwards a rescue helicopter joined the search, and its crew spotted the missing skipper just below the water's surface. The lifeboat crew quickly recovered the fisherman and he was airlifted to hospital, but he did not regain consciousness and was declared deceased on arrival.

The postmortem report stated that the skipper had drowned.

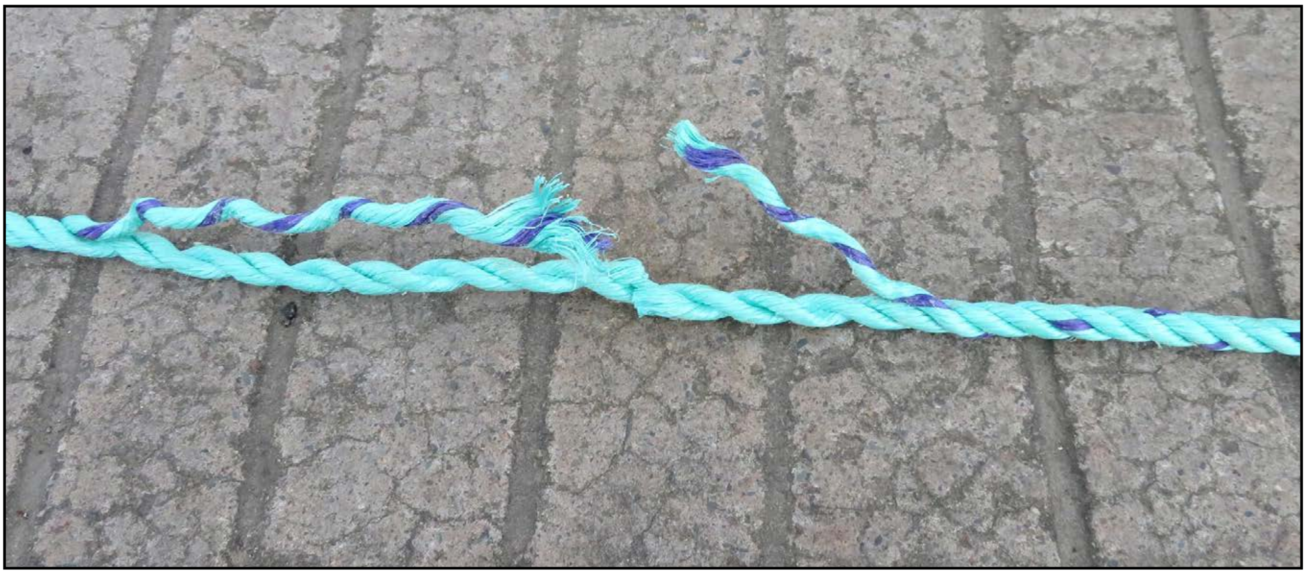

Figure 1: The partial cut in the back rope

The Lessons

1. The missing skipper had been seen earlier in the day wearing an auto-inflate lifejacket. However, when he was recovered from the water he was not wearing it, and it was later found hanging up in the boat's wheelhouse (Figure 2).

Figure 2: The skipper's lifejacket as found

   A lifejacket is useless unless worn. In this case the missing skipper was known to habitually wear his lifejacket, and it is extremely unfortunate that he had apparently taken it off before he needed it. Lifejackets not only keep the wearer's mouth clear of the surface, but they will also substantially reduce the amount of effort needed to reach the surface and remain there, increasing the chances of survival considerably.

2. The boot entangled in the string of creels confirmed that the missing skipper had become caught up in the running gear and was dragged over the side. There was no physical barrier to separate crew from the running lines, and the missing skipper usually retreated to the wheelhouse while shooting the gear. When everything was running smoothly this was not a problem. However, if the running gear snagged for any reason it placed the skipper in a very hazardous position when he returned to the working deck to free the snag.

   There is a great deal of useful guidance on safe single-handed operations in the MCA's *Fishermen's Safety Guide* and their leaflet *Single Handed Fishing*, which is available online. Entanglements can occur very quickly and with little warning; the best way to avoid them is to keep your distance. If you do need to return to the gear, consider your own welfare first. Equipment can be replaced, people cannot.

3. The accident was not witnessed, but the partial cut in the back rope showed that the missing skipper had a knife to hand and had nearly managed to free himself. In many other situations, the availability of a knife could have made all the difference. Unfortunately, that was not the case in this instance.

CASE 18

Wrong Spares, Expensive Breakdown

Narrative

A fishing trawler was out at sea with four persons on board when the engineer noticed smoke coming from the gearbox between the main propulsion engine and the propeller shaft. The gearbox was hot to the touch, so the engineer promptly stopped the engine. Fortunately, the sea was calm and the vessel was in deep waters well away from the coast and other vessels. It drifted without propulsion for approximately an hour until the gearbox cooled down.

A gearbox inspection revealed that all 12 of the coupling pads had disintegrated to varying degrees (see figure). As the vessel carried no spare coupling pads, the vessel's engineer was unable to restart propulsion. The skipper called the coastguard for assistance. An hour and a half later a lifeboat was on scene to tow them to the nearest harbour.

The coupling pads were subsequently examined by the gearbox manufacturer and it was established that they were of the wrong type. They were not designed for varying torque applications such as a propulsion shaft gearbox

Figure 1: Damaged coupling pads (inset: new coupling and pads)

The Lessons

1. **Depending on the application, apparently identical gearbox drives can be used for a variety of purposes. Coupling pads are designed with specific properties compatible with the specific application.**

2. **It is extremely important to order the right spare part by stating the make, model and serial number of the equipment for which the part is being ordered.**

3. **It was fortunate that the sea was calm at the time the vessel lost its propulsion. The consequences of losing propulsion during rough weather can be severe.**

4. **The manufacturer of the gearbox has confirmed that the coupling can be used for a brief period without the pads. However, the risk of damaging the engine and/or the gearbox is very high and operating without coupling pads should be resorted to only in an extreme emergency when no other help is available.**

Pulled Overboard

Narrative

It was mid-morning and a potter's two crew were out at sea lifting pots, removing the catch, rebaiting the pots and then shooting the string of pots back onto the seabed. The conditions on the day were good, the sea being very calm. During shooting, the skipper steered and controlled the boat's speed from the wheelhouse while the crewman handled the pots.

Prior to the accident a string of pots had been recovered, the catch emptied, the pots rebaited and then stacked on the port side ready for shooting. The vessel's usual practice was for the crewman to stand facing aft between the wheelhouse and the engine hatch. To avoid becoming entangled in the back rope and pot tail ropes, the crewman had to keep his feet still on deck while he moved the pots one at a time to line up with the stern ramp on the boat's starboard side (Figure 1). The pots were then pulled along the ramp as the boat moved forward at half-throttle.

As the string of pots was being shot, one of the ropes from the string of pots rolled back off the ramp. The crewman instinctively went to kick it back into place, slipping and losing balance as he did so. The crewman fell on to the ramp, with his foot trapped in the back rope. He was pulled down the ramp and through the stern door, but realising that the back rope above him was slack he wrapped it around his forearm two or three times as he entered the water. The weight of the pots on the rope attached to his leg pulled him under the water.

The skipper quickly stopped the boat and put the back rope from the string of pots on to the hauler (Figure 2). He was able to successfully lift the crewman to the surface. The crewman's lifejacket (Figure 3) had automatically inflated and this assisted in bringing him to the surface. The skipper tied off the rope and was able to swing the crewman back on board. The skipper then headed into port, where the crewman was taken to hospital. On examination it was found that the crewman had broken his forearm where he had wrapped the rope around his arm, and he was suffering from mild hypothermia.

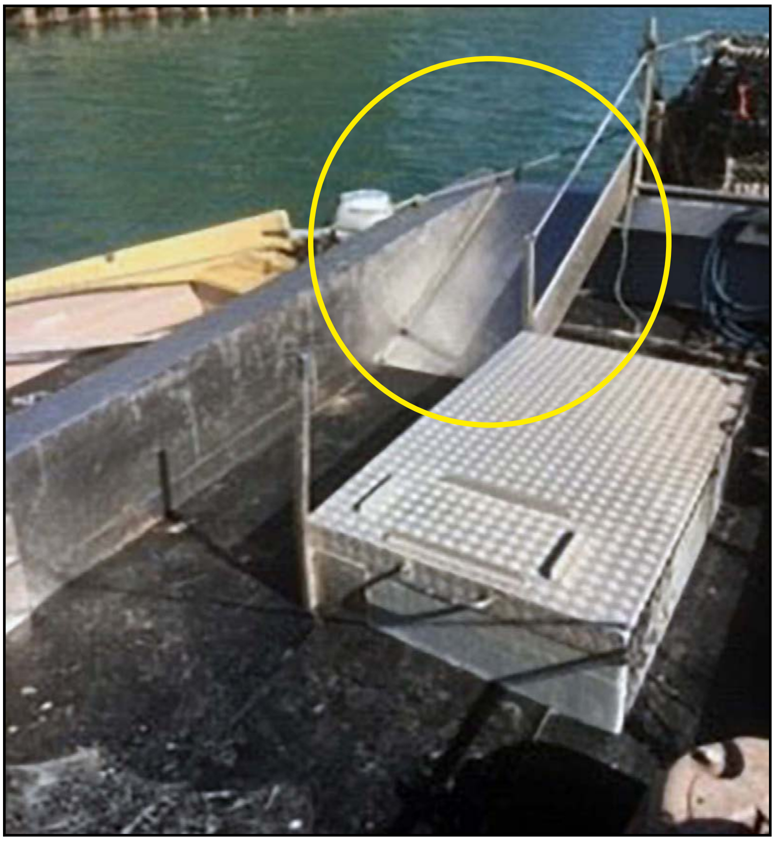

Figure 1: Stern ramp on starboard side

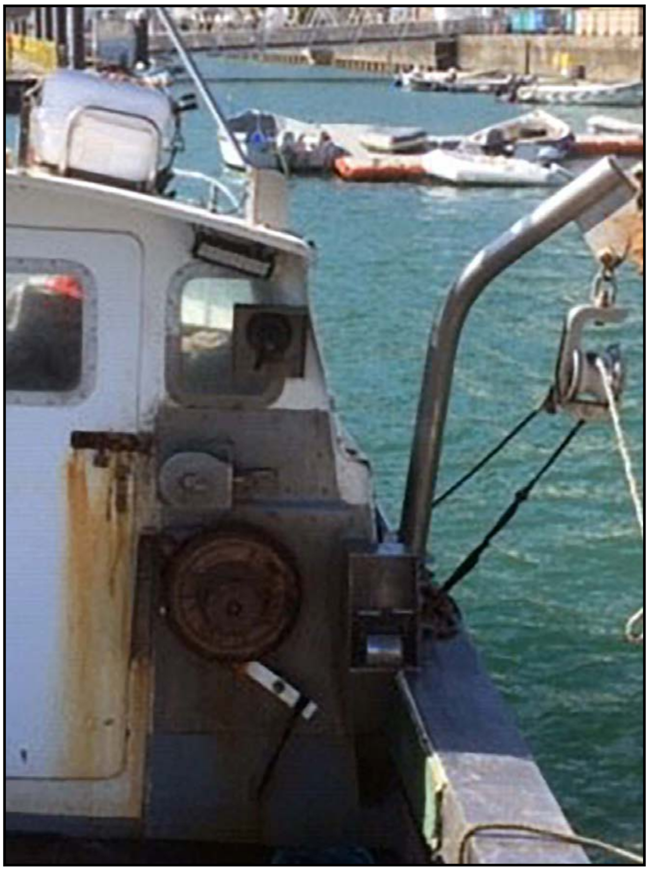

Figure 2: The hauler

Figure 3: The crewman's lifejacket

The Lessons

1. Although difficult on a small boat, it is vitally important to ensure there is minimal risk of entanglement in the pots' ropes. Ideally this should be through the segregation of crew from the pot ropes by means of a physical barrier; even with a barrier, crew must not attempt to untangle or clear jams while the boat is moving ahead.

2. It is important to have a quick and effective method of retrieving people from the water. During this accident, the skipper acted swiftly, the hauler was in good repair and the sea conditions were calm enough to allow him to bring the casualty on board; a difficult task when conducted single-handed. While quick thinking led to the crewman wrapping the back rope around his arm, having a knife readily available on his person to cut an entangled rope would also have been a sensible precaution. Potters' crews must be well prepared for such emergencies to reduce the risk of drowning, cold water shock and other injuries.

3. It is essential and now mandatory to wear a lifejacket while on the working deck of a fishing vessel to maximize your chances of survival in the event of entering the water. In the circumstances of this accident the lifejacket was instrumental in helping the skipper's rescue effort. Furthermore, had the crewman become separated from the back rope, it would have enabled him to float on the sea surface with his head above water until rescued.

Stability, Stability, Stability…

Narrative

The new owner/skipper of a small fishing vessel was keen to get to work and start repaying some of the investment he had made after buying the boat. The day after completing the purchase, the skipper and his crewman prepared the boat for creel fishing; they baited and loaded 90 creels on the main deck and 60 creels on the shelter deck. It was a bright afternoon with good weather and the sea state was slight. Soon after getting underway, the skipper was concerned that a starboard list had developed, so he reduced speed and the crewman moved one fleet of 30 creels from on top of the shelter deck down to the main deck to reduce top weight.

Nevertheless, the starboard list continued to increase, and the situation deteriorated rapidly with seawater being observed coming over the deck on the starboard quarter, and then the vessel capsized. Both crewmen managed to escape and scramble onto the upturned hull. The crewman raised the alarm by calling 999 using his mobile phone that was still working after immersion. A few minutes later the fishing boat sank leaving the two men in the water; neither was wearing a lifejacket. They both then used buoys, which had floated free from the sinking vessel, to aid staying afloat. About 45 minutes later they were rescued by a lifeboat, then flown to hospital in a coastguard rescue helicopter, where they both recovered from the effects of hypothermia.

The Lessons

1. Capsizing is the result of insufficient stability. Understanding your vessel's stability is key to safe operations. The MCA's *Fishermen's Safety Guide* provides the following advice for potting vessel operations:

    - *Consider the stability of your vessel especially when taking pots to and from a new area when it is very tempting to carry as many pots as possible*

    - *Stacking pots high and carrying a significant weight of rope on the deck will have a serious effect on the vessel's stability and freeboard*

    - *A heavily loaded vessel may appear to be safe in calm conditions, but conditions can rapidly change; the vessel ships a little water or the gear shifts resulting in capsize.*

    This fishing vessel had been extensively modified from its original design. Modifications made prior to the change of ownership included: the addition of a shelter deck, which extended almost the full length of the vessel; a hydraulic hauler, which weighed 400kg and was fitted 2 metres above the deck; and a vivier tank for storing live catch. Figures 1 and 2 show the vessel before and after the modifications. No checks on the vessel's stability had been made by the previous owner and the new owner assumed that it was safe. When heading to sea on the day of the accident, the boat was heavily loaded with strings of creels ready to lay for the first time. The combined effects of the modifications and the excessive loading high up created the unstable situation, resulting in capsize and placing the lives of the crew in immediate danger.


Figure 1: The vessel prior to modification

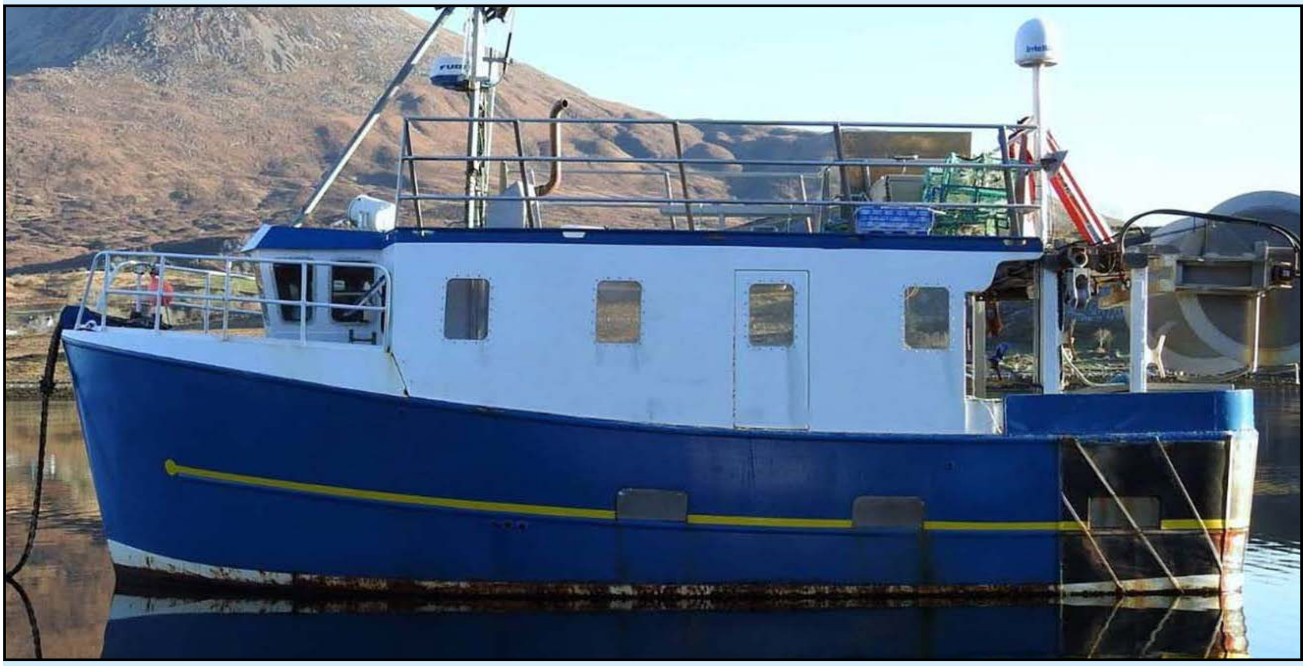
Figure 2: The vessel post-modification and prior to the accident

2. Sudden immersion in cold water has immediate and profound effects on the human body. In this case, both crewmen survived the terrible ordeal of their vessel capsizing, and both were showing signs of hypothermia when they arrived at hospital. The capsize was so rapid that the skipper did not have time to transmit a "Mayday", and the crew survived because they were able to raise the alarm by mobile phone. Had this not worked, their situation could have been much worse. Carrying a PLB and fitting an EPIRB provide highly reliable methods of raising the alarm in an emergency. Additionally, neither crewman was wearing a lifejacket, which is a vital safety precaution when there is a risk of entering the water.

Get the Anchor Ready

Narrative

A fishing vessel departed from its home port after a short maintenance and re-supply stop. The exit from harbour went well, but in the port's approach channel the skipper noticed the engine revolutions had dropped. He alerted the engineer, who quickly diagnosed a broken governor linkage on the main engine and asked the skipper to take the engine out of gear so he could try to fix the problem. As soon as the skipper did this the engine revolutions increased alarmingly. The engineer immediately operated the fuel shutoff valve, but with fuel still in the system the engine continued to overspeed and the turbo charger overheated and failed, leaving the vessel disabled in the middle of the approach channel.

The skipper informed the harbour authority on VHF radio, and was advised to consider anchoring. The skipper stated that it would take him 10 to 15 minutes to anchor, but he took no action to get the anchor ready. With no vessels nearby able to give help, the harbour authority sent a tug and a pilot boat to assist and the coastguard requested that lifeboats attend. The skipper was not keen to anchor in the main channel. However, with a drift rate of around 2kts caused by the combined effects of tidal stream and a moderate to fresh breeze, the vessel was quickly set out of the channel towards a charted submerged concrete barrier.

The tug and pilot boat arrived in around 20 minutes, but by that time the fishing vessel had drifted into shallow water, and on the falling tide the tug was unable to assist. The harbour authority again advised anchoring, but the skipper did not believe there was now enough time to prepare and deploy the anchor. The pilot boat's crew attempted to pass a line, but were unable to do so before the fishing vessel grounded on the submerged barrier. An all-weather lifeboat also tried to assist, but the vessel was too heavy for the lifeboat to tow. The fishing vessel's hull was damaged and started taking on water, but the vessel's pumps were able to cope.

Later, as the tide rose, the fishing vessel drifted over the submerged barrier and was anchored by the crew. After divers had assessed the hull damage, and temporary repairs were made, the vessel was towed to port for permanent repairs.

The Lessons

1. The skipper was familiar with the main channel itself, but was not aware of the navigational hazards close to the channel and did not appreciate how fast the vessel was drifting. If your vessel becomes disabled, it is important to assess navigational safety immediately. Are you safe, how fast are you drifting and how long before you drift into danger? Is help going to arrive in time and, if not, what other options are there? A quick check of set and drift (by observing movement relative to buoys or looking at a chart plotter) could have revealed the danger and prompted more urgent action, perhaps in preparing the anchor.

2. The fishing vessel's anchoring arrangement involved connecting a chain and rope to a kedge-type anchor (see figure) that was then deployed over the stern using a small crane. The anchor was routinely stored disconnected from the chain and rope and was not ready for quick use. Anchors are essential safety equipment and must be quickly deployable in an emergency. This is especially important when operating close to land, such as when entering or leaving harbour. If your engine is disabled and help is not close by, then anchoring before you drift into danger will often be the best option. At the very least, it gives more time for help to arrive and gains time to assess the problems and possibly make repairs.

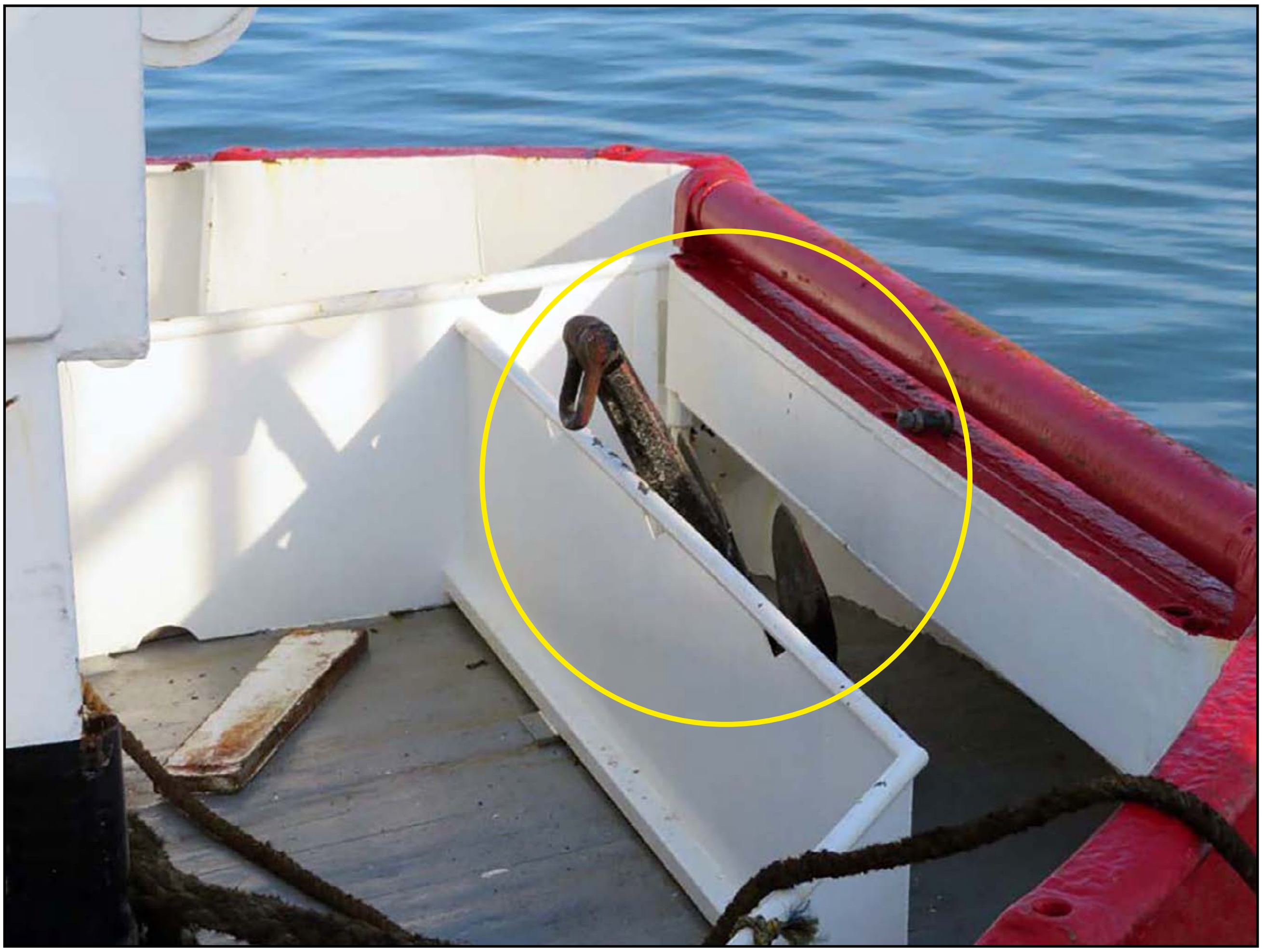

Figure: Anchor stowed at stern, not connected to chain/rope

Know Your Systems

Narrative

A small fishing vessel, built in 1986, was alongside a berth in its home port to carry out maintenance and preparations for going to sea. The skipper and engineer had worked together in the small space aft of the main engine to solve a leak on the coolant system. There had been very little space for them both, but with the engineer balancing on the gearbox they were able to reach the leak and solve the problem.

Two days later, the skipper had been replaced during a scheduled crew change. Later that day the replacement skipper, who had previously sailed on the vessel, was asked to shift berth to make way for a fishing vessel to land its catch. The skipper agreed and briefed the four other crew, including the engineer, who he instructed to prepare and start the main engine. As the engineer made his way to the engine room, the deckhands began to reduce the mooring lines to a single spring line fore and aft in accordance with the skipper's instructions.

Meanwhile, the engineer started the main engine in local control before checking the system to ensure all was well. On hearing the engine start up and with the deckhands standing by to release the final lines, the skipper switched engine control from the engine room to the wheelhouse. He then engaged the clutch. Immediately, the fishing vessel started to move ahead, parting both mooring lines and quickly gathering speed.

Alarmed, the skipper attempted to select astern gear, first at the port and then the starboard control positions, increasing the engine revolutions to achieve the maximum effect. However, the fishing vessel continued ahead, colliding with a fishing vessel and two recreational craft before increasing in speed towards a moored group of large yachts.

The skipper shouted to the engineer, who had just emerged from the engine room, to stop the engine as he steered the fishing vessel to starboard, away from the moored vessels. Having collided with another two small boats and a section of pontoon, the fishing vessel eventually came to a stop with its bow on the quayside (Figure 1).

The subsequent investigation identified that during the repair to the coolant system, either the skipper or engineer had inadvertently moved the position of the gearbox override lever located on top of the gearbox. The lever was not labelled and none of the crew were aware of its purpose or that it was in local control, which would render the wheelhouse control system useless (Figure 2). The investigation also identified that the emergency engine-stop on the wheelhouse had been disconnected, rendering the skipper unable to stop the engine from the wheelhouse.

Figure 1: Fishing vessel coming to rest after damaging other vessels

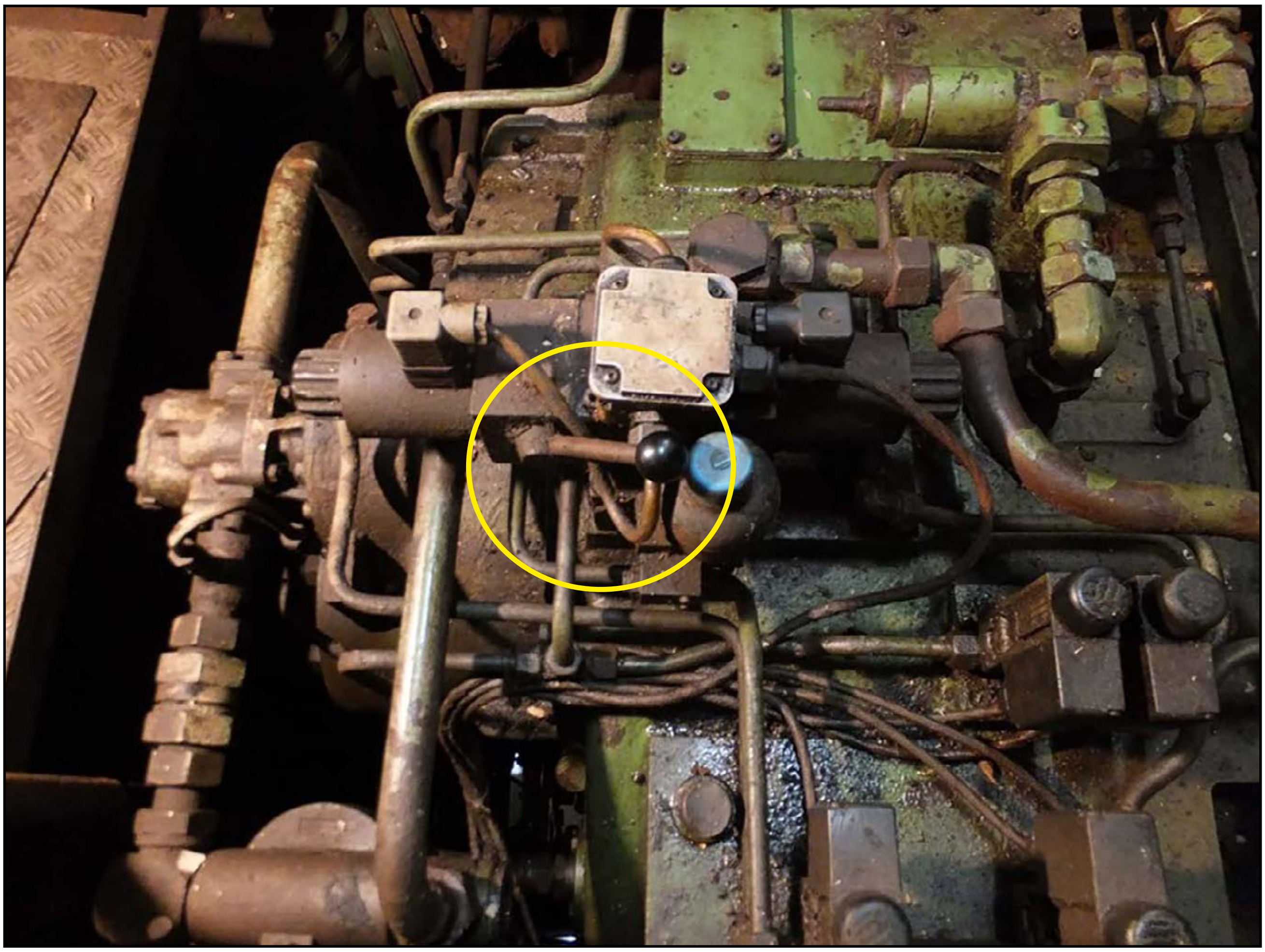

Figure 2: Gearbox override lever in the ahead position

The Lessons

1. The fishing vessel was over 30 years old, and it is clear from this accident that as the vessel changed hands, and vessel information was handed down to subsequent crews, system details were lost. There were system plans and handbooks available on board, but thorough system knowledge had not been reinforced through drills. In many cases, working knowledge of a system is enough for normal operations, but when unplanned events happen the limited time available can mean extensive knowledge is needed to take effective action.

2. No one noticed that the override lever's position had changed as before and after maintenance checks were not usually completed. The importance of these checks is often overlooked because it is easy to become complacent over time. However, as this accident shows, it is important to test critical systems after completing any maintenance on or near them.

3. The skipper was unable to stop the engine from the wheelhouse because the emergency stop had previously been disconnected. The reason why this had been done is not known, but the consequences of doing so speak for themselves. At least two of the craft damaged in this accident were total losses, with substantial damage being caused to the others. All emergency stops must be tested regularly. The worst time to discover that they do not work is at the time you need them.

Part 3 - Recreational Craft

Mind the Gear Lever

Narrative

An outboard engine-powered inflatable boat was being used to transfer crew to a larger moored vessel. Four crew members were on board; two crew were due to embark the larger boat before the inflatable returned to shore to collect the three remaining crew members. It was an overcast winter's day, with a moderate breeze, but the sea was calm in the sheltered waters. All were wearing heavy duty waterproof clothing and lifejackets.

The helmsman stopped the inflatable boat with its port side alongside the starboard side of the moored boat using astern power. He then put the outboard engine gear selector in neutral, leaving the engine running. The crew member on the forward port side of the inflatable stood and took hold of a stanchion on the moored vessel to hold the boat alongside. The second and third crew members then stood up, ready for the short climb on board.

The helmsman moved his left hand forward towards the tiller arm of the outboard to centre the engine. In doing so his left jacket cuff became caught on the gear selector, putting the engine into ahead gear. The boat started moving forward, surprising all on board. It unbalanced the crew member holding on to the moored boat, who bumped into the - also unbalanced - second crew member preparing to board, who then bumped into the third crew member. Both the second and third crew members fell over the port side of the inflatable boat and into the water, where their lifejackets automatically inflated. Reacting quickly, the helmsman pulled his arm away from the engine while stopping it by disconnecting the kill cord.

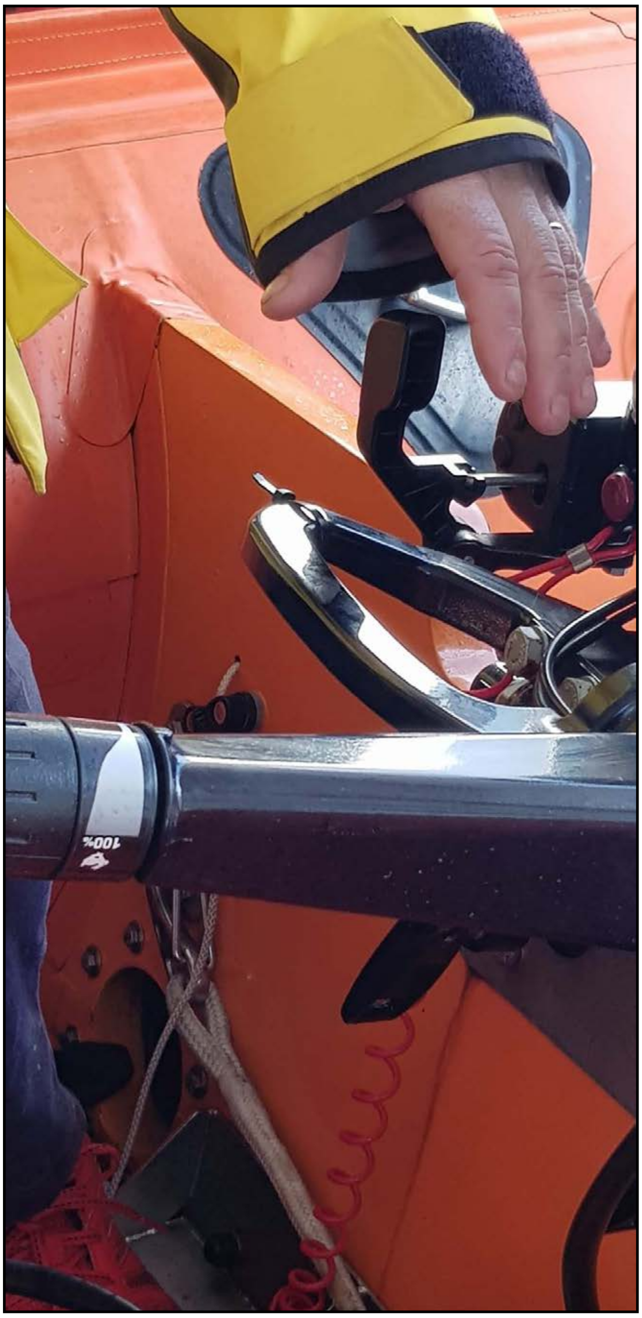

Figure: Loose cuffs can catch controls!

The remaining crew member and the helmsman recovered the two crew members from the water. They were confirmed to be uninjured and returned ashore to get dry and warm up.

The Lessons

1. Boarding a moored or anchored vessel from another vessel can be hazardous. It is important that the method of access is as safe as possible, and any risks should be assessed. In this case, it had become normal practice for the transfer to take place with the boat being steadied by people holding on while the engine remained running. Ensuring that vessels cannot move apart is vital; if possible, secure them together with ropes and stop the engine before allowing crew or passengers to stand up and commence boarding.

2. This accident was caused by the helmsman's very brief inattention, resulting in two people going overboard. In small boats, controls can often be easily knocked, so care is particularly important, especially when people are moving around. Are the controls in your boat exposed, and how can you reduce the risk or impact of them being knocked?

3. The crew were appropriately dressed for the conditions. The two crew members who fell overboard had a cold swim, but were otherwise unharmed. Always wear a lifejacket and PPE appropriate to the conditions.

4. The quick recovery of the people in the water reduced the danger of them experiencing cold-water shock. Make sure that you and your crew are practised at recovering people from the water.

Back to Basics

Narrative

On a calm, clear and sunny winter day a group of passengers prepared for a wildlife sightseeing trip in a powerful RIB (see figure). Before boarding, the passengers were given a safety briefing by the skipper, including what to do in an emergency, donning lifejackets and embarking safely. During the safety briefing, the skipper also suggested that passengers could brace by pushing themselves into the backs of their seats. Once everyone was on board, the skipper started the engine and the RIB headed off for the trip. Soon after departure, the skipper warned the passengers that he would demonstrate the boat's capability, then undertook a series of high-speed figure-of-eight turns.

Soon after these turns, the skipper became aware of a passing merchant vessel that was creating a significant wake, so he reduced speed and altered course to approach the wake at an angle. After crossing the wake, the RIB slammed back down on to the water, and a female passenger, who was sitting in the seat closest to the bow on the port side, indicated that she was in pain. The RIB was returned to the pier and the casualty was assisted ashore by her partner (who was also on board) and the skipper before being taken to hospital by ambulance.

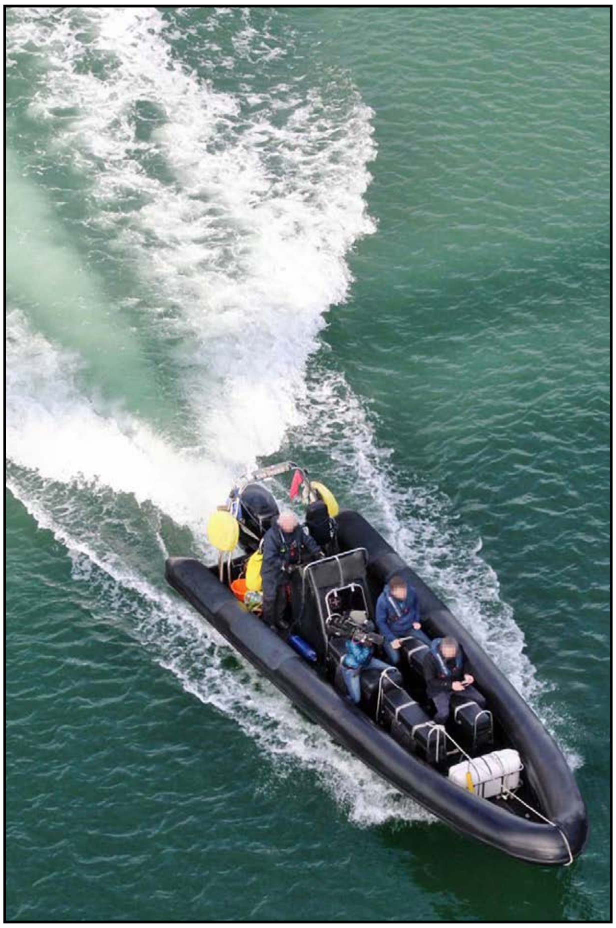

Figure: The powerful RIB (not at the time of the accident)

The injured female passenger had suffered a vertebrae compression fracture in her back, which required a brace to be worn for several months.

The Lessons

1. This accident was one of five similar events in a 12-month period reported to the MAIB, where potentially life-changing injuries had been suffered by passengers during rides in commercially operated high-speed craft. RIB skippers must be aware of the very significant risks associated with the acceleration forces and shock loads that are present when RIBs slam in rough water or over the wakes of larger vessels.

2. Actions that RIB skippers can take to reduce the risk of passenger injury include:

   - Reducing speed to minimise slamming. This is particularly important where the skipper's helming position is at the stern and is, therefore, exposed to significantly less violent motion than passengers at the bow. In this case, the casualty was sitting in the port side seat closest to the bow and thus probably exposed to the greatest risk.

   - Ensuring that all passengers are seated comfortably, ideally with backrests and handholds for everyone.

   - Demonstrating to passengers how to adopt the correct posture to mitigate the risk of back injury by maintaining a straight spine, using handholds and absorbing some of the shock through slightly bent knees. The skipper's advice in this case, to brace by pushing back, was not possible because not all the seats on this particular RIB were fitted with backrests.

   - Trying to identify if any of the passengers could be particularly at risk, perhaps if they have an existing medical condition or are infirm. In this case, the trip had been marketed for wildlife sightseeing and the injured passenger had no expectation that there would be a 'thrill-ride' element.

Ring the Helicopter

Narrative

Tragedy struck when a family had been enjoying an outing at a local lake using their small RIB (Figure 1) to pull a one-person towable inflatable ring (Figure 1 inset). The passenger seated on the inflatable ring hit a jetty on the side of the lake during a turn (Figure 2), and suffered serious leg and back injuries. The injured passenger survived the accident but had to be air-lifted to a local hospital for emergency treatment, and spent a long time in rehabilitation.

The lake was privately owned and had been rented out to private individuals regularly for over 40 years. The lake's owner had developed procedures for the safe use of the lake, including limiting the number of boats using it at the same time, and stipulating the minimum insurance required. There was no requirement and no recommendations for boat operating qualifications within their literature.

The RIB's owner had purchased the boat about 3 months earlier and, although familiar with kayaks and canoes, this was the first powered craft he had owned; he had not undertaken any formal training in its operation.

After launching the boat, the owner took it out onto the lake and then a short while later came back to the jetty and attached the towable inflatable ring. An adult family member climbed aboard the ring, sat feet forwards and held an action camera to record the fun. At first, difficulty was experienced in getting the boat to go fast enough to get it to 'plane'. However, after a few engine 'tweaks' this problem was resolved.

A few circuits were made of different sections of the lake (Figure 2), but when the boat's helmsman decided to make a few tight left-hand turns the resulting pendulum effect forced the ring and its adult occupant to accelerate outward towards the side of the lake. After a couple of turns, the boat became too close to the side of the lake in front of the rest of the family, and resulted in the ring and its occupant hitting the jetty, which jutted into the lake, at a speed of about 20mph.

Figure 1: The towing boat (inset: the towable ring)

Figure 2: The action cam track from around the lake (inset: the moment of impact, captured on action cam)

The Lessons

1. Driving boats is an exhilarating, fun and often fast activity. However, in the hands of inexperienced or untrained operators driving a boat can also be hazardous. Within the UK private individuals are not required to hold formal qualifications to operate a pleasure craft. However, many training centres offer recognised courses in boat operation and handling. These courses are not expensive and all boaters are encouraged to undertake such training.

2. Towing an inflatable ring, 'banana boat', or other inflatable presents its own additional hazards, and the person being towed often has little or no control over their direction and speed of travel. The driving skills required for towing inflatables and other towables are distinctly different from those required for other boat driving activities. Boat drivers are therefore responsible for the safety of the towed riders and should ensure that they are fully aware of their surroundings, other water users, any hazards in the locality, and should keep a close watch on the direction of travel of their tow. British Water Ski and Wakeboard produced a comprehensive '*Code of Practice for the use of Towed Inflatable Equipment*', which can be found on its website. It is a very useful source of guidance.

APPENDIX A

INVESTIGATIONS STARTED IN THE PERIOD 01/03/2020 TO 31/08/2020

Date of Occurrence	Name of Vessel (PLN/IMO number)	Type of Vessel	Flag	Size	Type of Occurrence
23/03/20	*Kaami* (9063885)	General cargo vessel	Bahamas	2715 gt	Grounding
28/03/20	*Key Bora* (9316024)	Chemical/products tanker	Gibraltar	2627 gt	Grounding | flooding
09/04/20	*Shearwater* (6822216) *Agem One*	Dredger Barge	UK[1] UK	342 gt 21.00 m	Loss of propulsion | Flooding
25/05/20	*Norma G*	Cabin cruiser	n/a	5.40 m	Capsize (1 fatality)
31/05/20	*Globetrotter*	Leisure fishing vessel	n/a	12.00 m	Foundering (1 fatality)
25/06/20	*Arrow* (9119414)	Ro-ro freight vessel	Isle of Man	7606 gt	Grounding
15/07/20	*Cimbris* (9281786)	General cargo vessel	Gibraltar	3173 gt	Accident to person (1 fatality)[2]
04/8/20	*Moritz Schulte* (9220794)	LPG tanker	Isle of Man	8234 gt	Fire (1 fatality)[3]
08/08/20	Unnamed *Rib Tickler*	Jet ski RIB	n/a n/a	2.00 m 5.00 m	Collision (1 fatality)
16/08/20	*Diamond D* (SN100)	Fishing vessel	UK	48 gt	Capsize | Foundering
19/08/20	*Diamond Emblem*	Broads cruiser	n/a	12.80 m	Accident to person (1 fatality)
22/08/20	*Seadogz*	RIB	n/a	9.50 m	Collision (1 fatality)

[1] Has since changed flag to St Kitts & Nevis

[2] Investigation on behalf of the Maritime Authority of the Gibraltar

[3] Investigation on behalf of the Isle of Man Ship Registry

Reports issued in 2020

Artemis
Fall on board a fishing vessel in Kilkeel, Northern Ireland on 29 April 2019, with the loss of 1 life.
Report 1/2020 Published 9 January

CMA CGM G. Washington
Loss of cargo containers overboard from a container ship in the North Pacific Ocean on 20 January 2018.
Report 2/2020 Published 16 January

European Causeway
Cargo shift and damage to vehicles on a ro-ro passenger ferry in the North Channel between Scotland and Northern Ireland on 18 December 2018.
Report 3/2020 Published 17 January

Seatruck Performance
Grounding of a ro-ro freight vessel in Carlingford Lough, Northern Ireland on 8 May 2019.
Report 4/2020 Published 6 February

Gülnak/Cape Mathilde
Collision between a bulk carrier and a moored bulk carrier at Teesport, River Tees, England on 18 April 2019.
Report 5/2020 Published 13 February

Red Falcon/Greylag
Collision between a ro-ro passenger ferry and moored yacht at Cowes Harbour, Isle of Wight, England on 21 October 2018.
Report 6/2020 Published 20 February

ANL Wyong/King Arthur
Collision between a container vessel and a gas carrier in the approaches to Algeciras, Spain on 4 August 2018.
Report 7/2020 Published 19 March

Coelleira
Grounding and loss of a fishing vessel off the Shetland Islands, Scotland on 4 August 2019.
Report 8/2020 Published 20 March

Cherry Sand
Man overboard from a dredger with loss of 1 life at Port Babcock Rosyth, Scotland on 28 February 2019.
Report 9/2020 Published 21 May

Seatruck Progress
Accident on the stern ramp of a ro-ro freight ferry with loss of 1 life in Brocklebank Dock, Liverpool, England on 15 May 2019.
Report 10/2020 Published 11 June

ZEA Servant
Fall of a suspended load on a general cargo vessel injuring 2 crew in Campbeltown, Scotland on 2 March 2019.
Report 11/2020 Published 24 June

Anna-Marie II
Capsize of a fishing vessel with the loss of 1 life off Brora, Scotland on 23 September 2019.
Report 12/2020 Published 8 July

Stena Superfast VII/Royal Navy submarine
Near miss between a ro-ro ferry and a submerged submarine in the North Channel, crossing from Belfast, Northern Ireland to Cairnryan, Scotland on 6 November 2018.
Report 13/2020 Published 16 July

Ever Smart
Loss of cargo containers overboard from a container ship while 700 miles east of Japan in the North Pacific Ocean on 30 October 2017.
Report 14/2020 Published 22 July

Thea II/Svitzer Josephine
Grounding and recovery of a container feeder vessel and a tug in the approaches to the Humber Estuary on 15 December 2018.
Report 15/2020 Published 13 August

Appendix B corrrect up to 31 August 2020, go to www.gov.uk/maib for the very latest MAIB news

Safety Bulletins issued during the period 01/03/2020 to 31/08/2020

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY BULLETIN

SB1/2020

MARCH 2020

Extracts from The United Kingdom Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 Regulation 5:
"The sole objective of a safety investigation into an accident under these Regulations shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

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

Press Enquiries:
01932 440015

Out of hours:
020 7944 4292

Public Enquiries:
0300 330 3000

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

All bulletins can be found on our website:
https://www.gov.uk/maib

For all enquiries:
Email: maib@dft.gov.uk
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Fax: 023 8023 2459

Inadvertent discharge of a FirePro condensed aerosol fire extinguishing system during its installation on board the fishing vessel *Resurgam* (PZ 1001) on 15 November 2019 resulting in one fatality

Image courtesy of www.marinetraffic.com

Resurgam

MAIB SAFETY BULLETIN 1/2020

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 provides for the Chief Inspector of Marine Accidents to make recommendations or to issue safety lessons 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 fatality of a shore-based engineering apprentice who was working in the engine room of the fishing vessel *Resurgam* in Newlyn on 15 November 2019.

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

Andrew Moll
Chief Inspector of Marine Accidents

NOTE

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

This bulletin is also available on our website: www.gov.uk/maib
Press Enquiries: 01932 440015 Out of hours: 020 7944 4292
Public Enquiries: 0300 330 3000

BACKGROUND

On 15 November 2019, the UK registered fishing vessel *Resurgam* was in Newlyn, England undergoing maintenance. An engineer and an apprentice from the owner's shore-based support team were working on the main engine in the engine room. Also working in the engine room were two contractors installing a new FirePro condensed aerosol fire extinguishing system.

During the installation and without warning, the fire extinguishing system partially and inadvertently discharged, filling the engine room with a dense cloud of aerosol fire suppressing particles **(Figure 1)**. Both installation contractors and the company's engineer managed to evacuate, but the apprentice collapsed in the engine room. He was later recovered by the local fire and rescue service but was found not breathing and could not be resuscitated.

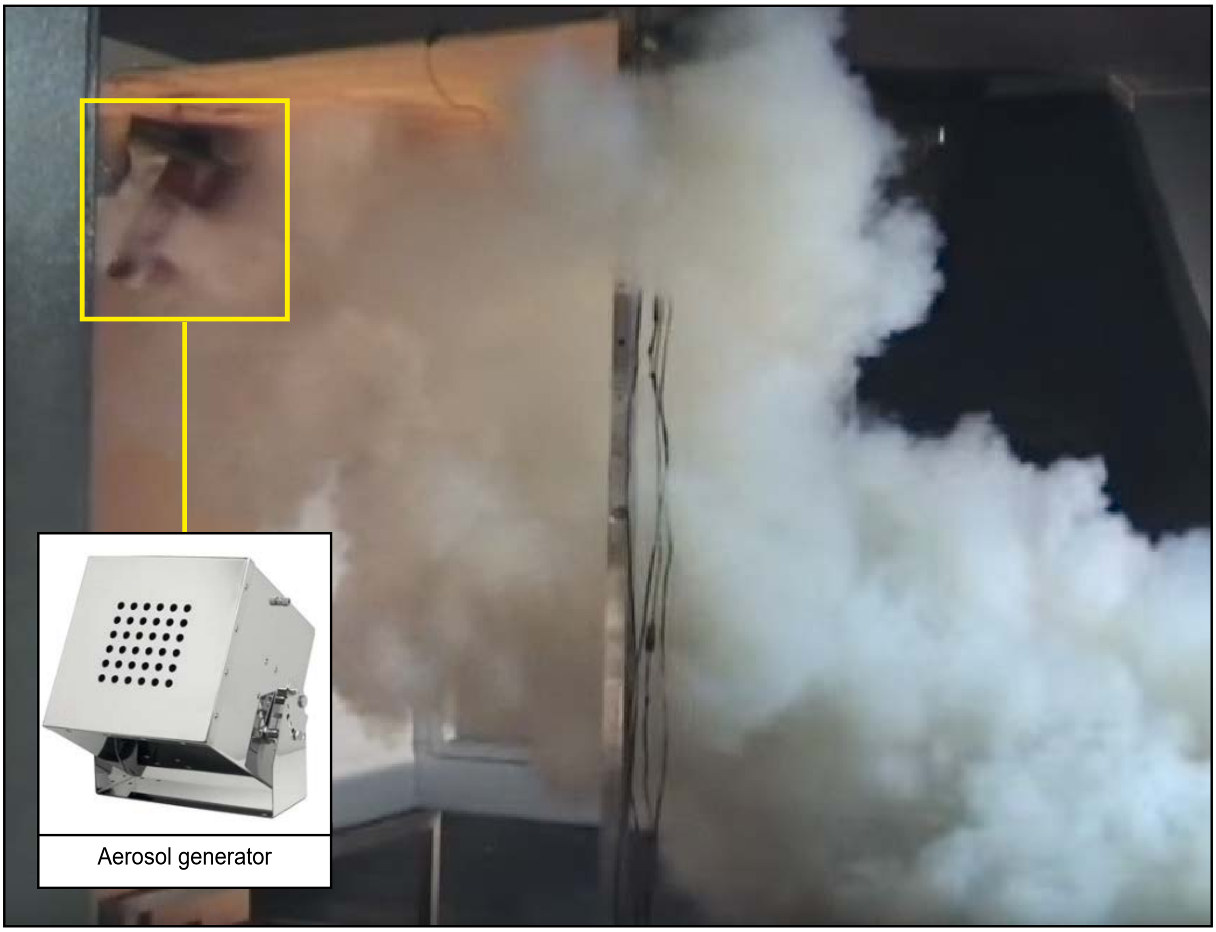

Figure 1: Typical discharge of a condensed aerosol fire suppressant (not at time of accident)

INITIAL FINDING

The exact causes and circumstances of this accident are still being investigated and the findings will be published by the MAIB in a full investigation report. However, during the inadvertent discharge, it is evident that the apprentice inhaled a high concentration of the suppressant particles and this significantly contributed to the fatality.

FirePro's Installation and User Manual and its product's material safety data sheets had recognised the inadvertent discharge of the system, particularly during installation and maintenance, as a hazard. However, the loss of life was not identified as a potential outcome; therefore, the risk associated with inhaling or ingesting a large volume of the suppressant particles was not fully appreciated or protected against.

SAFETY LESSONS

Vessel owners, operators and those contracted to install FirePro and other similar condensed aerosol fire extinguishing systems should be fully aware of the potential risk to life from exposure to the aerosol particles.

Safety precautions should be put in place to ensure that personnel are not exposed to this hazard:

- Prior to intentional discharge of a condensed aerosol system, there should be visible and audible alarms to alert personnel. Checks should also be made to ensure the protected compartment has been evacuated before the system is activated.
- When condensed aerosol fire extinguishing systems are being installed or maintained the system should be fully isolated to guard against inadvertent activation, non-essential personnel should be clear of the area and an enclosed space rescue plan should be in place.

RECOMMENDATION

FirePro is recommended to:

S2020/114 Issue a safety alert to the owner/operators of vessels fitted with its systems and its network of marine installation/maintenance engineers highlighting the circumstances of this accident and advising them of appropriate measures to take to reduce the risk of exposure to fire suppressant particles.

Safety recommendations shall in no case create a presumption of blame or liability