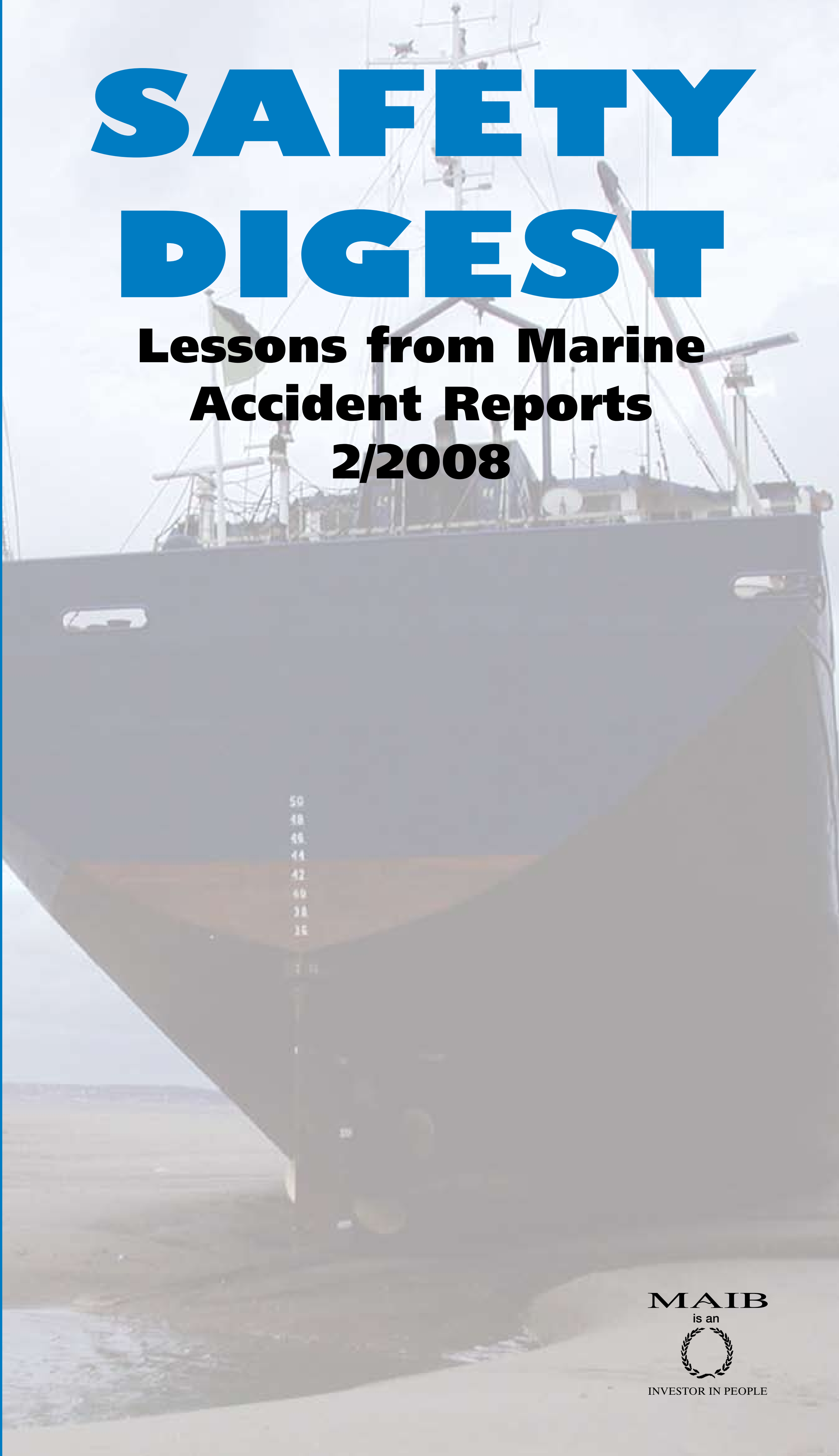
SAFETY DIGEST

Lessons from Marine Accident Reports 2/2008

MARINE ACCIDENT INVESTIGATION BRANCH

MAIB



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No 2/2008

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MARINE ACCIDENT
INVESTIGATION BRANCH

The Marine Accident Investigation Branch (MAIB) is an independent part of the Department for Transport, the Chief Inspector of Marine Accidents being responsible directly to the Secretary of State for Transport. The offices of the Branch are located at Carlton House, Carlton Place, Southampton, SO15 2DZ.

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 facts which have 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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Summaries (pre 1997), and Safety Digests are available on the Internet: www.maib.gov.uk

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

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

Extract from
The Merchant Shipping
(Accident Reporting and Investigation)
Regulations 2005 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2005 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of 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

2/O	–	Second Officer
AB	–	Able seaman
ARH	–	Automatic Release Hook
ARPA	–	Automatic Radar Plotting Aid
C	–	Celsius
Cable	–	0.1 nautical mile
CPR	–	Cardio Pulmonary Resuscitation
CSM	–	Cargo Securing Manual
DPA	–	Designated Person Ashore
DSC	–	Digital Selective Calling
ESD	–	Emergency Shut Down
FRC	–	Fast Rescue Craft
GPS	–	Global Positioning System
GT	–	Gross tonnes
HGV	–	Heavy goods vehicle
HP	–	Horsepower
HRU	–	Hydrostatic Release Unit
ISM	–	International Safety Management Code
kg	–	kilogram
kW	–	kilowatt
LNG	–	Liquefied Natural Gas
m	–	metre
“Mayday”	–	The international distress signal (spoken)
MBL	–	Minimum Breaking Load
MOB	–	Man Overboard
MSN	–	Merchant Shipping Notice
OOW	–	Officer of the Watch
“Pan Pan”	–	The International Urgency Signal (spoken)
pH	–	Symbol representing potential for hydrogen. The measure of the acidity/alkalinity of a solution
QM	–	Quartermaster
RIB	–	Rigid Inflatable Boat
RNLI	–	Royal National Lifeboat Institution
Ro-Ro	–	Roll on, Roll off
SMS	–	Safety Management System
SOLAS	–	International Convention for Safety of Life at Sea
SWL	–	Safe Working Load
VHF	–	Very High Frequency
VTS	–	Vessel Traffic Service

Introduction

Hindsight is a wonderful thing!

Every week in the MAIB, we are briefed on the latest accidents and incidents that our teams are investigating. In virtually every case, as the incident unfolds in front of us, we can see what is going to happen. You can feel an air of disbelief in the room that the players in the accident can't see it coming and don't step in to stop it.

The prime purpose of the Safety Digest is to use the hindsight provided by other incidents to arm you with the foresight to avoid accidents yourself. All of us who go to sea – for work or for pleasure – believe accidents happen to other people, never to us. Thankfully accidents are relatively infrequent, so few of us have first-hand experience to warn of the hazards lurking. Regular readers of the Safety Digest tell me that it provides them with an invaluable reminder every 4 months of the dangers of seafaring.

Complacency is one of the greatest threats to the mariner. Much of what we do – planning, navigation, watchkeeping, maintenance, shooting and recovering fishing nets, cargo handling – is repetitive. When these tasks become routine, they become dangerous. Please take time to read the cases in this edition of the Safety Digest. Remind yourselves of the hazards that are lurking. Are you being as safety conscious as you could be? Do you have things in place to ensure that none of these accidents could happen to you? As I say, hindsight is a wonderful thing – let's use it with these cases to stop accidents in the future.

MULTIPLE DEATHS

Just as I finished drafting this introduction (11 June) news came in to the MAIB of two seamen unconscious in a ballast tank on board *Saga Rose* in Southampton. Tragically one of the two died.

We are also currently investigating the deaths of three seamen on board *Viking Islay* on 23 September 2007 and two seamen on board *Sava Lake* on 18 January 2008; all died after entering enclosed spaces. A similar upsurge of enclosed space fatalities is being reported around the world.

Please, please, please ensure that procedures for entry into enclosed spaces are absolutely rigorously applied in your ship.

Stephen Meyer
Chief Inspector of Marine Accidents
August 2008

Part 1 – Merchant Vessels

I am very pleased to have been asked to write this introduction as I hope that my small contribution will encourage people to read the accident summaries that follow and learn the lessons that inevitably come from them. The purpose of this publication and the more detailed MAIB investigation reports is not to identify who is to blame but, more importantly, why accidents have happened and how they could have been prevented. Whilst we all benefit from our own experiences I suggest that there is great merit in benefiting from the experiences of others, and there are some salutary lessons detailed within this particular Digest.

An accident may be defined as something which happens unexpectedly and unintentionally and which often damages something or injures someone. Therein lies a key lesson that I believe is often missed and which the MAIB publications serve to highlight. By way of explanation I offer the following.

As the Harbour Master of Southampton I am proud to be associated with the past and present glories of this magnificent Port, a Port where there has always been and where there continues to be a focus upon providing safe and efficient marine operations. The efforts of the professionals who make up the marine team at Southampton go largely unnoticed by the general public and therefore I shall take this opportunity to publicly praise them. Unfortunately, what people do tend to remember when thinking about the Port of Southampton is the link to one of the most tragic maritime accidents in history, namely the loss of the RMS Titanic.

Ninety-six years ago the Titanic sank with the loss of over 1500 men, women and children. This accident led to a real focus being placed upon maritime safety and the result was a number of significant improvements, both in overall awareness and in technological developments. Yet I wonder whether the real lessons have ever been learnt, I venture to suggest that the sinking of the Titanic does not really fit comfortably within the definition mentioned earlier. Clearly the sinking of the Titanic was unintentional, but, could it really be that proceeding in an area where an encounter with ice was probable, at a speed of 22 knots, a resulting accident could be considered unexpected?

Fast forward to the present; is it really unexpected when people suffer death or serious injury from entering enclosed spaces without following the correct procedures? There are two such examples within this Digest. Would you really be surprised if communication techniques and equipment did not perform as planned when they have not been fully tested in the work environment? There is an example within this Digest. We all know the importance of the pilot/master exchange and the clear need for passage planning to include berth to berth transit, again there is an accident report linked to this within the Digest.

There are further summaries within this Digest associated with fatigue, bridge team management, acting in haste and repenting at leisure, failures in maintenance and communications; the list is all too familiar.

So we come full-circle. If the modern day list of accidents and their causes is familiar and recognisable can it really be that future accidents are unexpected? Once again I suggest that it is time to start learning from the experiences of others, it is time to start putting in place measures that minimise the potential for incidents and it is time to learn that we must expect the unexpected. Reading and remembering the contents of this Digest might be considered a good place to start.

Captain Philip Holliday

Captain Philip Holliday, 40, commenced his seagoing career as a 16 year old cadet when he joined Ropner Shipping Services. After a five year period he moved to Souter Shipping, where he served for a similar amount of time before gaining his Class 1 (FGN) Masters certificate. A spell at University saw him gain a 1st class BSc (Hons) degree in Business Information Studies and then came a move into port operations when he joined Associated British Ports (ABP) in 1998.

Having undertaken a number of roles within ABP, including that of Marine Manager for the ABP South Wales Ports, he currently works as both the Harbour Master for the ABP Port of Southampton and the ABP Marine Advisor, fulfilling the functions of the Designated Person for ABP's twenty one UK ports.

Philip has taken the lead role representing ABP in areas such as developing industry guidelines for Port Marine Safety, regulating the standards associated with Vessel Traffic Services and ensuring ABP remains compliant with the requirements of the Port Marine Safety Code.

Philip is married with two young children.

Crew Response Prevents Major Fire

Narrative

A ro-ro ferry was on passage without cargo or passengers when a fire alarm was activated in the engine room. Moments later, the main engine stopped, electrical supplies were lost and the vessel blacked out.

The crew mustered on the bridge and the chief engineer went to the engine control room to investigate. Dense black smoke escaped as he opened the control room door, so he shut it quickly, realising that the fire was serious. Despite struggling in the thick smoke emitting from the engine room ventilation ducts on the upper deck, the crew managed to shut the fire flaps and seal off the air supply to the fire below.

The master transferred command to the mate and prepared to lead one fire-fighting team, while the chief engineer took charge of the other. Wearing breathing apparatus, one team entered the engine room via a pipe tunnel from forward and the other through the control room. Both teams were able to locate the source of the fire at the main engine and it was soon put out using portable dry powder extinguishers. The engine room fixed fire-fighting system was available, but was not used.

The fire had caused serious damage to the main engine, so the vessel was towed to a repair port. The Designated Person Ashore (DPA) was informed and began an investigation immediately. The investigation determined that the fire was caused by a fracture in a low pressure pipe that supplied fuel to the main engine. Although it was made of steel and supported by clamps at regular intervals, a section of fuel pipe approximately

Figure 1 – Burst fuel pipe

Figure 2 – One metre from the start of the fire

Figure 3 – Port side of main engine under deck

100mm long had become detached. Pre-heated fuel oil had then spilt between the two banks of the V configured main engine and, despite splash guards being in place, ignited.

The fire caused severe damage in an area of 6m radius around the fractured pipe. Engine controls, the governor, cables, a turbocharger and numerous fittings on the deck head were destroyed.

The investigation by the company rightly praised the prompt and determined response of the crew, whose efforts certainly prevented a serious fire from escalating dangerously.

The Lessons

1. **In this case, the master courageously decided to lead the attack on the fire himself. It is up to the master on a case-by-case basis to decide whether personally to lead a team that is responding to such a danger, or whether his experience is better utilised in overseeing and co-ordinating the whole operation.**

2. **Fuel and lubrication pipework should be inspected regularly and replaced if there are signs of any leakage or wear.**

3. **While it is always good practice to clamp pipework securely, clamps must fit correctly so that they do not introduce more stresses into the pipework.**

4. **Fire flaps can be awkward to close, particularly when dense black smoke is pouring out of them. Managers and crew should satisfy themselves that flaps can still be operated safely, even with smoke coming out of ventilation openings.**

5. **The team re-entered the engine room without protection from fire hoses or water mist. This left firefighters and the rest of the ship more vulnerable to the effects of heat, and increased the risk of the fire flashing over as entrances to the compartment were opened and fresh air was introduced.**

Too Fast a Swing

Narrative

After boarding a 2000gt dry cargo ship, a harbour pilot discussed with the vessel's master his plan for the vessel's first entry to the port, which was accessed from the open sea via a 30m wide river. During the discussion, the pilot was not made aware of the type and performance of the vessel's rudder, nor was he shown the vessel's pilot card or wheelhouse poster which were displayed on the bridge.

The approach to the entrance of the river was made on a course of 355° at a speed of 10 knots, aiming to leave a beacon marking the western entrance of the river to port at a distance of about 10m. As the ship approached the beacon, speed was reduced, and the pilot advised that the vessel should commence a turn to port to bring the ship from open water into the mouth of the river. The pilot recommended 20° of port helm be used to turn the ship onto a course of 329°, the axis of the river, but the master, who was on the helm, either misheard or misunderstood the pilot and applied 50° of helm.

The ship started to turn quickly to port and the pilot was not aware of the amount of helm the master had applied. As the ship approached the intended heading, the pilot recommended 20° of starboard helm to steady the vessel, but this had no immediate effect. Maximum starboard helm was then recommended and applied and, although the rate of turn reduced, it was evident that the ship was leaving the navigable channel. The engine was put to full astern and the bow thruster to maximum thrust to starboard, but this did not prevent the vessel simultaneously making contact with a breakwater and grounding on a submerged training wall.

Fortunately, a pilot launch was able to pass a line to the vessel, which was re-floated within 5 minutes of grounding. The vessel was holed below the waterline in her forepeak and two double bottom tanks (see figures).

Damage below the waterline

Damage below the waterline

The Lessons

1. Nearly 80% of all merchant vessel collisions, contacts and groundings in UK waters occur in port areas or river approaches. In a very large percentage of these, good Bridge Team Management would have prevented the accident.

2. First and foremost, a good pilot/master exchange is essential. Both are experts: the master has an in depth knowledge of the characteristics and organisation of his vessel, and the pilot a detailed knowledge of the local environment. Although there are sometimes a number of factors such as cultural differences, language and personalities, which occasionally impede the sharing of this knowledge, key information contained in the pilot's written passage plan, and the ship's pilot card and wheelhouse poster, should always be available. If these documents are not presented, it is up to the master or the pilot to request them, and then to discuss and confirm their contents. Sufficient time must be allowed for a thorough exchange; a perfunctory exchange is a recipe for disaster.

3. The master has a key role to play in monitoring/supporting the pilot and overseeing the bridge. If the master takes the helm himself, a key safety barrier has been removed. Ships must produce a competent helmsman for pilotage areas, so that the master and pilot are both free to exercise their proper roles. If the ship cannot provide a competent helmsman, pilotage should not be undertaken.

4. When approaching, or on passage through, restricted waters the margin for error is frequently very small. Therefore it is paramount that bridge teams, including pilots when embarked, work together to ensure mistakes or misunderstandings are quickly spotted and rectified. This is only possible by verifying that each helm order has been understood and correctly applied, regardless of the helmsman's experience. The quickest and most effective method of achieving this is to monitor the rudder angle indicator following each helm order. It only takes a glance and allows immediate corrective action to be taken if necessary. By the time the ship's head is swinging, it is often too late.

5. A large turn into a narrow channel or other restricted waterway requires judgment and accuracy. Therefore, where conditions allow, it is often good seamanship to reduce course alterations in these waterways to as small an angle as possible. This not only allows an assessment of the effect of the wind and tidal stream on the vessel to be made and allowed for in open water, but it also reduces the likelihood of getting the turn wrong.

CASE 3

Hot Spots and Oil Sprays: a Lethal Cocktail

Narrative

As a dive support vessel was entering harbour a fire broke out in her aft engine room. Through a CCTV camera the engineers in the engine control room saw a wall of fire between two engines. All three engines in the compartment were shut down, and fuel and ventilation were shut off.

The vessel diverted to the nearest available berth, where the local fire service boarded shortly afterwards. The fire was extinguished in less than 20 minutes using only water spray, although foam was also at hand. An extractor fan was turned on to disperse the dense black smoke, but within 5 minutes the fire re-ignited, possibly due to sparking in the lighting circuits. The ship's staff quickly isolated the electrical circuits and the fire was re-extinguished using portable CO_2 extinguishers and water spray.

During the fire-fighting operation, hand-held UHF radios did not work in the compartment used to control and monitor the situation, and a fixed telephone line had to be used to communicate with the bridge. The fire damage to the aft engine room was extensive, and the vessel was out of service for more than a month. The cost of repairs and loss of earnings was about £4 million.

The cause of the fire was a ruptured low pressure fuel hose spraying marine gas oil on to exposed sections of the engine exhaust pipe. Laboratory tests carried out on the flexible pipe revealed a small area of damage to one end where it was crimped to a metal collar forming part of its end fixture. The inner layer had opened up slightly, causing gas oil to enter the space between the inner and outer layers (Figure 1). This resulted in the outer layer degrading gradually and

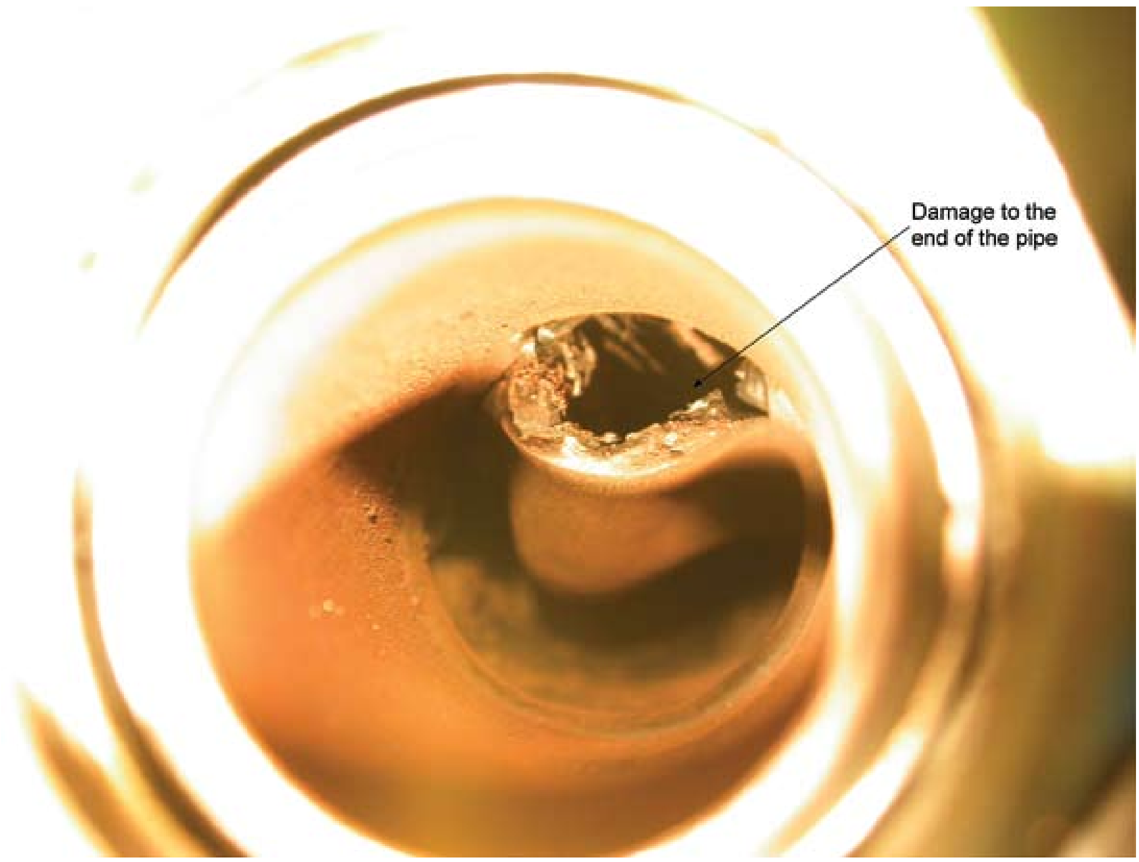


Figure 1

Figure 2

tearing. There were no shields fitted above the pipe to deflect any accidental release of fuel into the bilges. When the pipe ruptured, marine gas oil at 6 bars pressure sprayed on to the exposed sections of the engine exhaust pipe. A similar exposed section of exhaust pipe on another of the ship's engines is shown at Figure 2. The fuel spray ignited, and spread to the bilges, where a substantial amount of fuel had accumulated. The fire continued to be fed by more fuel from the leaking hose.

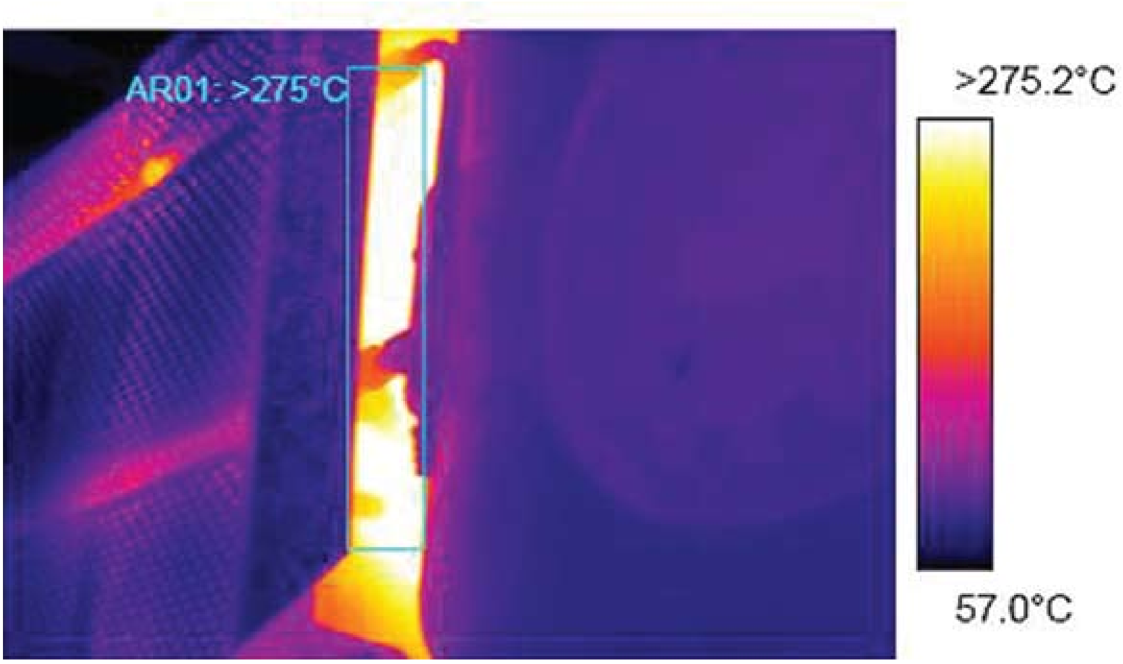


Figure 3 (Source: SeaTec U.K. Limited)

The Lessons

1. Fires can be very costly. Prevention is generally far less expensive.

2. Although SOLAS requires all surfaces which are above 220°C to be insulated, it is common to find such insulation to be incomplete on awkward areas such as indicator valves, pyrometers and other sensor attachments, lifting lugs and inspection manhole covers. While a good visual examination can spot many of these deficiencies, regular infrared thermal imaging surveys greatly increase the probability of identifying all the exposed surfaces (Figure 3).

3. SOLAS also requires all fuel pipes and associated equipment in the vicinity of the engine to be shielded to prevent oil sprays resulting from damaged pipes, filter covers, etc. While high pressure systems are usually well protected, low pressure systems, which may contain fuel up to 6 bars pressure, are frequently overlooked. This is unfortunate because it is not difficult to fabricate a sheet metal cover to fit over the pipes in such a way that any oil leak would be directed to the bilges.

4. Rubber hoses do not last forever; even if the manufacturer's instructions do not specify the shelf life, it is a good idea to discuss this issue with them and to implement a flexible hose replacement programme.

5. Good communications are essential when fighting a fire; it is therefore important that portable UHF radios are tested to establish that they work in all locations. Where 'black-spots' exist, the fitting of repeaters at strategic locations will undoubtedly pay dividends.

6. While a fine spray of water may be effective in fighting an oil fire, the occurrence of a 'flash pan' effect is always a potential hazard, and could result in the fire spreading out of control. Foam is usually the better option when it is available.

Faulty Interlocks and Structural Corrosion

Narrative

A conscientious chief officer always ensured that his rescue boat was test launched every month. After all, it was good practice to ensure that the equipment was readily available and the crew were familiar with the operation of the system.

Instructions for launching and recovery of the boat, and an associated risk assessment were posted near the davit operating position. The instructions emphasised that none of the safety systems (interlocks) were to be overridden and that the system should be:

"… checked for irregularities/malfunctions. Test procedures shall be carried out before launching the boat".

The launching team assembled and lowered the boat into the water. Significantly, they did not check the functionality of the limit switch or manual handle interlock controls, as inferred by the instructions.

After a successful launch, the rescue boat was brought up to the stowed position, but when the operator tried to stop the winch it continued to heave in. As this system was not fitted with an emergency stop to isolate the electrical supply between the contactor and the motor, the operator had no option but to wait for the limit switch to operate and stop the winch motor.

As the cable continued to heave in, the bob weight operated the limit switch (Figure 1), but once again the motor failed to stop and the cable continued to be heaved in. With the hook now hard up against the davit head, the heaving load was transferred to the structure. The winch bedplate gave way, and it fell into the water together with the rescue boat.

Luckily there were no injuries.

Figure 1

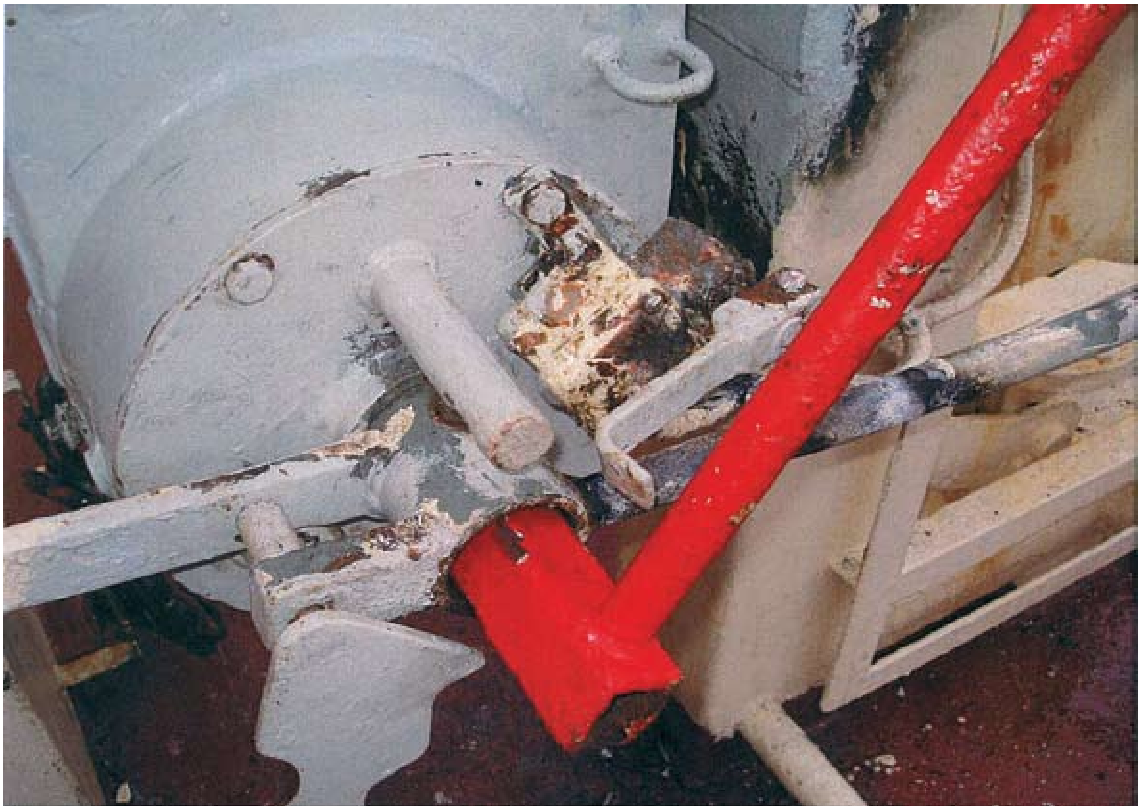


Figure 2 – Safety interlock handle

Investigations found that two out of three winch motor starter contacts had welded together. This prevented the manual stop and limit switch from isolating the electrical power. The contacts were static welded together due to excess current being drawn across them. This happened because they had, at some time prior to the accident, been changed from the original specification to a much lower maximum rating than that drawn by the winch motor.

The davit arm limit switch was found to be working correctly. However, the manual operation handle interlock was incorrectly adjusted (Figure 2), and would not have operated when the handle was inserted into the drive boss. This dangerous situation would have left electrical power connected while in manual operation mode.

To complete this sorry tale, the winch bedplate was found to be badly corroded, which caused it to become detached from the winch (Figure 3). Access to the plate was difficult, so little attention had been paid to its preservation.

Figure 3 – Old bracket

The Lessons

The chief officer quite correctly adhered strictly to the monthly test launches of the rescue boat. However, the same attention was not applied to the electrical standards or structural maintenance of this essential piece of equipment.

The following lessons can be drawn from the accident:

1. Ensure that instructions are clear and unambiguous – if not, there will inevitably be confusion, and important checks are likely to be missed. While in this case there were operating instructions, they were generic in nature. The instructions stated that functionality checks were to be made, but they did not specify to which parts of the system they applied, so the electrical interlocks were not checked.

2. When replacing items in electrical starters, or in any electrical components, make sure the alternative to the manufacturer's item(s) is suitable. In particular, ensure that contactors have the appropriate current carrying capacity. If an overload condition occurs with inadequate current rating contactors, then there is the risk of an electrical fire, or inability to control equipment.

3. Electrical interlocks are fitted to ensure safe operation of equipment, either as part of normal operation sequencing, or to safeguard the system in the event of a fault. Interlock functional testing should be a periodic maintenance item – do not get caught out: check interlocks regularly and attend to defects without delay.

4. Consideration should be given to fitting an emergency stop button to equipment where a risk assessment identifies that it is justified.

5. Dealing with structural corrosion is part and parcel of everyday life at sea. Access difficulties all too often mean areas of corrosion are neglected. Note the signs, because these areas will warrant extra attention – as this accident clearly illustrates.

Down the Hatch – Make Sure You Come Out Again

Narrative

A small dredger was undertaking dredging operations at a tidal river berth when the crew observed water entering the below deck accommodation space.

The crew promptly started the bilge pump for this space and prepared a portable petrol-driven pump for use as a contingency. After a short time, they realised that the rate of water ingress was such that the portable pump would be needed to stem the flow of water. Initially the pump was sited on deck, above the accommodation space, but as it would not operate efficiently from there, the crew moved it into the space to obtain suction.

The skipper positioned the vessel so that her bow was safely aground, and made arrangements for another company worker to bring additional pumps to the vessel. Once the additional pumps were on board, the skipper decided that it was safe to move the vessel to the middle of the berth such that she was afloat. Then, with the situation reasonably under control, he would go ashore to purchase ready-mix cement in anticipation of making a temporary repair to the hole in the hull. He then departed, leaving two crew members on board to continue pumping out the vessel.

Shortly after the skipper left, the vessel took the bottom and trimmed by the head as the tide ebbed. The pumps lost suction as the water flowed forward from the accommodation space into an adjacent compartment.

The two remaining crew members decided that they should relocate the pumps to the adjacent compartment, immediately forward of the accommodation space, which had no fixed bilge suction, in order to continue pumping

out the water. Again they attempted to operate the petrol-driven pump from the deck, but this was unsuccessful, so to obtain suction they lowered the pump into the compartment. This compartment was effectively a confined space, with access gained through a small hatchway; also there was minimal airflow into the space via two small vents in the deckhead.

With the pump in the compartment, suction was obtained and both crew climbed out. However, a short time later, the pump was heard to cavitate as it lost suction, and one of the crew saw that the suction hose had lifted clear of the water. He entered the space to place the hose back in the water. The other crewman returned to the area and saw that his colleague was in the space, moving the suction hose, so he entered the space to assist him.

The first crewman to enter the space complained that he was feeling dizzy, so his colleague said they should get out as quickly as possible. As they reached the bottom of the ladder, the first crewman lost consciousness and collapsed across the pump. His colleague managed to pull him clear of the pump, which he stopped. He then climbed out of the space to fetch a rope, re-entered the space, tied the rope around his colleague and climbed from the space again.

By that time, the second crewman was also feeling dizzy. However, fortunately, the skipper returned to the vessel, lifted the unconscious crewman from the space, administered first-aid and summoned an ambulance.

Both crewmen were taken to hospital, where they were detained and treated for carbon monoxide poisoning. The levels of poisoning indicated that they had suffered medium to high exposure levels. Both eventually recovered and returned to work.

The skipper has since scrapped the portable petrol-driven pump and replaced it with a diesel pump with a much improved suction capability. This pump can operate effectively from the deck.

The Lessons

1. **If you carry a portable pump – think about where it should be positioned to operate effectively during an emergency. Then assess whether it can be operated safely in those areas, without adding to your problems.**

2. **Think about the confined spaces on your vessel – if you had to enter them during an emergency would it be safe to do so? Can you improve the ventilation of the space without compromising watertight integrity?**

3. **Be prepared! In this case, the vessel was on a tidal berth with a good mud bottom, and the skipper was able to control the situation by placing the vessel safely aground. This gave him time to go to the local builders' merchant to purchase supplies to effect temporary repairs to the hull. You may not have a shop just around the corner when you encounter a problem.**

4. **Risk assessment need not be a great bureaucratic exercise, but it should allow you to identify potential dangers and take appropriate corrective action. Operational guidance is contained in the Code of Safe Working Practices for Merchant Seamen, a copy of which should be available on board all UK vessels.**

CASE 6

'Shock' Horror!

Narrative

A container feeder vessel was lying to her starboard anchor, preparing to get underway to embark a pilot. The chief mate was the officer of the watch and was responsible for manoeuvring the vessel towards the pilot station. The master was in his cabin preparing to meet the pilot.

The chief mate called the duty seaman and ordered him to proceed forward to heave-in the starboard anchor and, once that was complete, to rig the pilot boarding ladder. Alone on the forecastle, with a hand-held VHF radio for communication, the seaman commenced heaving-in at slow speed. Although the weather conditions were good, there was a lot of weight on the cable, and after about 3-4 minutes heaving-in, the electric windlass was unable to cope with the weight.

Checking overboard, the seaman was unable to see the cable or the anchor. He returned to the windlass and tried a further four times to heave-in, but without success. Deciding that the anchor must be home, he reported to the bridge that the anchor was secure, applied the brake and took the windlass out of gear. As the chief mate started manoeuvring the vessel towards the pilot station, the seaman made his way to the port side and started rigging the pilot ladder. When the pilot boarded, he was met by the seaman and escorted to the bridge before returning to the main deck to help unlash the cargo.

With the pilot on the bridge, the chief mate increased speed to 11 knots making ground towards the port. About 5 minutes later, the chief engineer rang the bridge and asked for a reduction in speed due to high loading on the engine. Simultaneously the seaman, now

Vessel's anchor, fouled with a power cable working on deck, heard a slow but loud banging noise from forward. Accompanied by another seaman, he went forward to investigate the noise and discovered that about 2 shackles of cable were outboard and banging against the hull. The windlass brake had not failed.

The chief officer quickly stopped the ship, and the decision was taken to weigh anchor again. The pilot, aware of a number of charted cables and pipelines in the area, informed the local VTS of the problem and awaited confirmation from the forecastle that the anchor was all clear.

Once the anchor was clear of the water, the seaman reported that it was home but fouled with some lashing wire. The master, who by that time was on the bridge, was content that it was safe to manoeuvre. However, as soon as the vessel started to turn it became apparent that what had appeared to be lashing wire was actually a 132,000 volt power cable which, prior to this incident had been supplying power to a nearby island and an oil refinery.

The Lessons

1. **Insufficient and inexperienced manpower had been allocated to the task of weighing anchor. It was unsafe for one seaman to operate the windlass, communicate with the bridge and observe the anchor cable. As a result, when the seaman looked overboard for the first time he assumed that the cable was fully home. In fact, it was probably leading under the bow and not visible because of the sheer.**

2. **The situation was made worse because the seaman, who was also the lookout, was also tasked to rig the pilot ladder alone. Specifically:**

   - **This was an unsafe practice which, had he fallen overboard, could have cost him his life.**

   - **The pilot ladder, and its associated equipment, was not checked by a responsible officer prior to the pilot boarding.**

   - **The approaching pilot vessel encouraged the seaman to rush so that he could rig the pilot ladder in sufficient time; this pressure might have influenced his report to the bridge that the anchor was secure.**

3. **Good seamanship dictates that the anchor cable should be clearly marked by paint and by turns of seizing wire secured around the relevant link adjacent to the joining shackle. Had this cable been more appropriately marked, anyone working it would have had a better chance of recognising that the anchor and cable could not be fully home. Furthermore, had the section of cable that passed over the windlass when the anchor was secure, been painted, the OOW might also have recognised that the anchor could not be home.**

CASE 7

Main Boiler Chemical Clean Ends in Fatal Explosion

Narrative

An LNG tanker was berthed alongside a shipyard, undertaking repairs to her port and starboard main boilers. The work included extensive re-tubing and air casing repairs, and was carried out by a well established boiler repair contractor who was familiar with the vessel. The ship managers' technical superintendent and the repair contractor's technical superintendent were both on site.

As the repairs neared completion, the repairer sub-contracted a UK chemical cleaning expert, who was well known to them, to carry out the post-repair chemical clean of the internal surfaces of the boilers. Inhibited sulphamic acid was selected as the cleaning agent. The inhibitor component protected the boiler steel from acid attack, a by-product of which is hydrogen gas. The inhibited cleaner also contained a colouring agent to indicate the acid strength.

After completing shipyard-sponsored safety training, which included Permit to Work and entry into confined space routines, the cleaning expert set up his equipment. The final cleaning configuration is shown in the schematic at Figure 1.

The expert did not have a method statement or any risk assessments to support his work, and neither the prime contractor nor the managers' technical superintendent asked for them. There was a blind acceptance that he was the expert, and those on site, including the ship's engineers, had virtually no interaction with him.

Following a successful pressure test, the starboard boiler was cleaned of oils and greases using a proprietary alkaline cleaner. This went without incident and was completed the following day. Meanwhile, the ship managers arranged for a Danish chemical cleaning expert to oversee the clean on their behalf. Although it was not unusual in the case of high value contracts, neither the prime repair contractor, nor the UK chemical cleaning expert was aware of his impending arrival.

At 0800 on the day of the chemical clean, the water was heated up and circulated around the boiler. By 1300 the water was at 57°C, the overseer, worried that the continued heating would be detrimental to the effectiveness of the inhibitor, recommended that the heating steam be turned off. By mid afternoon 800kg of sulphamic acid had been added to the water/acid mixing tank. At 1700 tests were carried out which confirmed that the inhibitors were still active, and the water/acid colour and pH readings confirmed that the acid strength was still satisfactory. Although checks were made to ensure there were no leaks, there was no indication that any checks had been made on the ventilation system, if indeed it had been fitted.

By 2100 things had rapidly changed. Tests indicated that the boiler steel was being attacked by the sulphamic acid. The UK expert was rather sceptical about the interpretation of the test results because he had expected to circulate the water/acid mixture for a few more hours. However, he agreed to stop circulating the water/acid mixture and reconfigured the system to pump the mixture into a shore-side bowser. In the meantime, he asked the repair contractor to arrange for the after door of the starboard boiler steam drum to be opened (Figure 2) so that the internal surfaces of the boiler could be inspected.

At about 2145 the steam drum door was opened, and as the contractors pushed the door into the drum there was a noticeable suction as the seal was broken. The workers also moved a non-intrinsically safe halogen lamp to a handrail near to the steam drum.

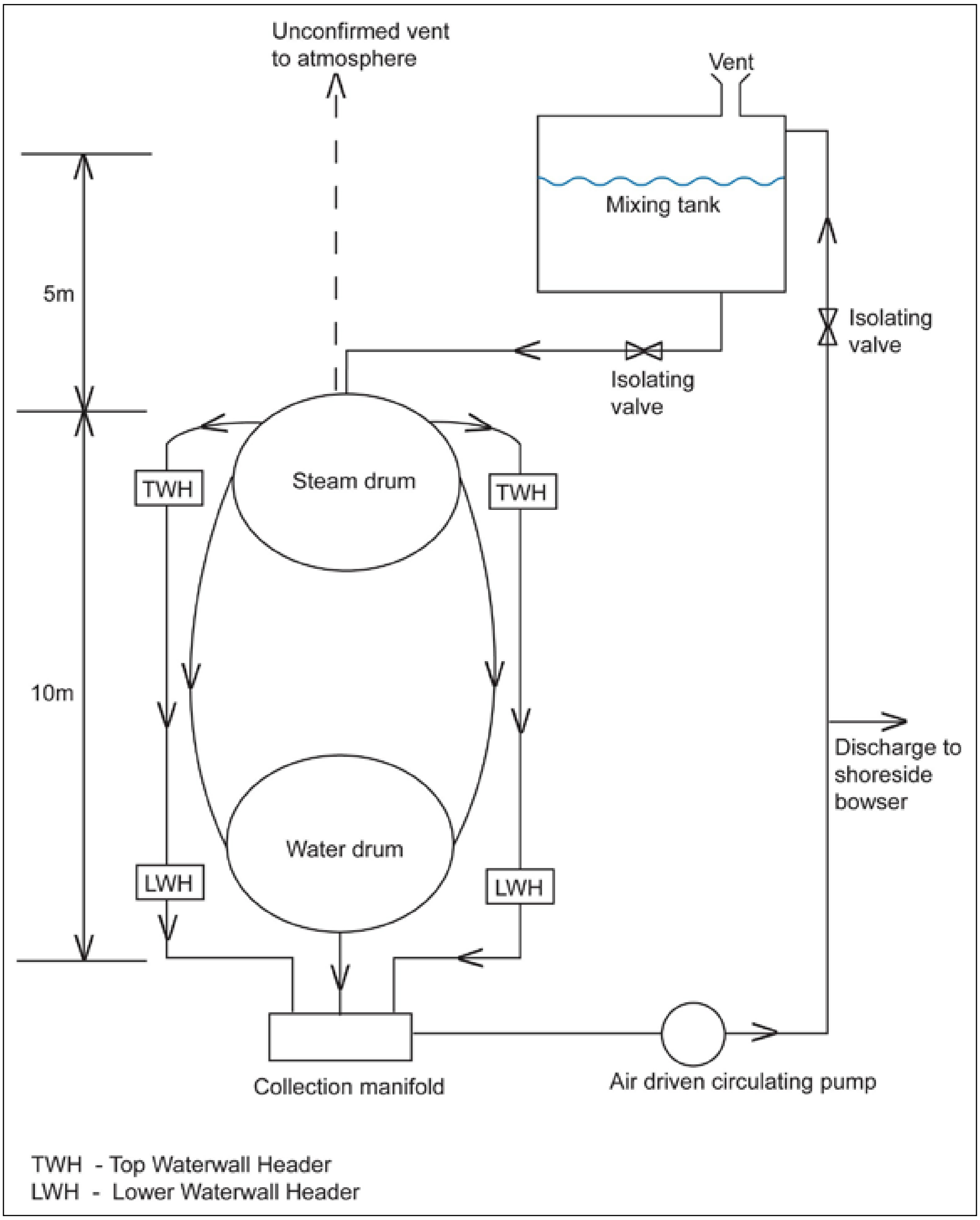


Figure 1

At 2200 both of the cleaning experts approached the steam drum door (Figure 3). No tests were conducted to check the steam drum atmosphere for either toxic or flammable gases. The UK expert picked up the halogen lamp (Figure 4) and placed it just inside the steam drum. The Danish expert saw a small flame or spark, and an explosion immediately followed.

The UK expert was thrown backwards about 4.5 metres; he was found to be unconscious and had suffered a number of fractures and severe burns. Sadly he failed to recover from his injuries and died 9 days later. The Danish expert was also burnt, but less severely. There was no fire or severe damage to either paintwork or structure.

Figure 2

Figure 3

Figure 4

The Lessons

All the evidence points to an accumulation of hydrogen gas in the steam drum, which evolved during the cleaning procedure. As the steam drum door was opened, the air combined with the hydrogen to create a mixture that was within the hydrogen's wide explosive limits. As the UK expert introduced the halogen lamp, either the hot lens or bulb, or an electrical spark from the lamp ignited the mixture, causing the explosion.

It is unclear what arrangements were made to ventilate the boiler and so release the evolved gases to atmosphere. Had the boiler been properly ventilated, the hydrogen build up would not have occurred. The introduction of the hot halogen lamp into the untested, confined space of the steam drum, which was known to have possibly contained flammable gases, was a serious error of judgment.

The following lessons can be drawn from this accident:

1. Do not take short cuts when entering confined spaces. Ventilate properly, and ensure that the atmosphere is correctly tested for both toxic and flammable gases, and that the atmosphere is certified as being safe.

2. Check that the ISM documentation details the crew's responsibilities relating to contractors. Be involved and interested; you may have the opportunity to avert a disaster. If you spot something wrong or if you are unsure, report it – do not ignore it; your life may depend on it!

3. Do check the Product and Material Safety Data sheets of materials to identify if there are dangers associated with its use. If so, ensure that control measures are in place to mitigate the risks.

4. Be aware that sulphamic acid will liberate hydrogen gas as it attacks scale and steel – if this risk exists, test for the presence of hydrogen whenever possible.

5. Use only intrinsically safe lighting systems in confined spaces.

Less Distraction – More Reaction

Narrative

This incident involved a close quarters situation between a ro-ro ferry crossing a traffic lane, and two vessels – a container ship and a tanker – that were transiting the lane.

The ferry had recently cleared the harbour. With the master using the starboard ARPA and the OOW using the port ARPA, they had identified a suitable gap between two groups of vessels using the west-going traffic lane prior to the master leaving the bridge. As the ferry began its crossing at 21 knots, visibility was 4-5nm and a quartermaster (QM) was on the bridge. Although the QM was nominated as the dedicated lookout, he had been allowed to continue cleaning the bridge, a task he had started while the ferry was alongside.

Ten minutes later, a SAT C alarm sounded at the rear of the bridge. The OOW investigated and, believing that the commercial message was important, telephoned the master to brief him of its content. He sat on the footrest of the port bridge chair to make the call, during which his view through the wheelhouse window was considerably restricted. He finished talking to the master 5 minutes later, and then proceeded to fix the vessel's position before making a routine VHF radio call.

As the OOW completed his transmission, he received a call from a deep sea pilot on board a nearby tanker, warning him of a developing close-quarters situation. At that point, there had been no proper lookout maintained on the ferry's bridge for nearly 9 minutes as it entered the east-going lane. As the OOW looked out, he saw the tanker was 40° on the ferry's starboard bow at 1.9nm, and the situation was exacerbated by the presence of a third vessel, a containership, which was overtaking the tanker on her port side.

The OOW initially made a succession of small alterations of course to starboard using the automatic pilot, passing ahead of the container vessel at 5 cables. He then manoeuvred between the two vessels. The ferry eventually passed 1 cable astern of the tanker.

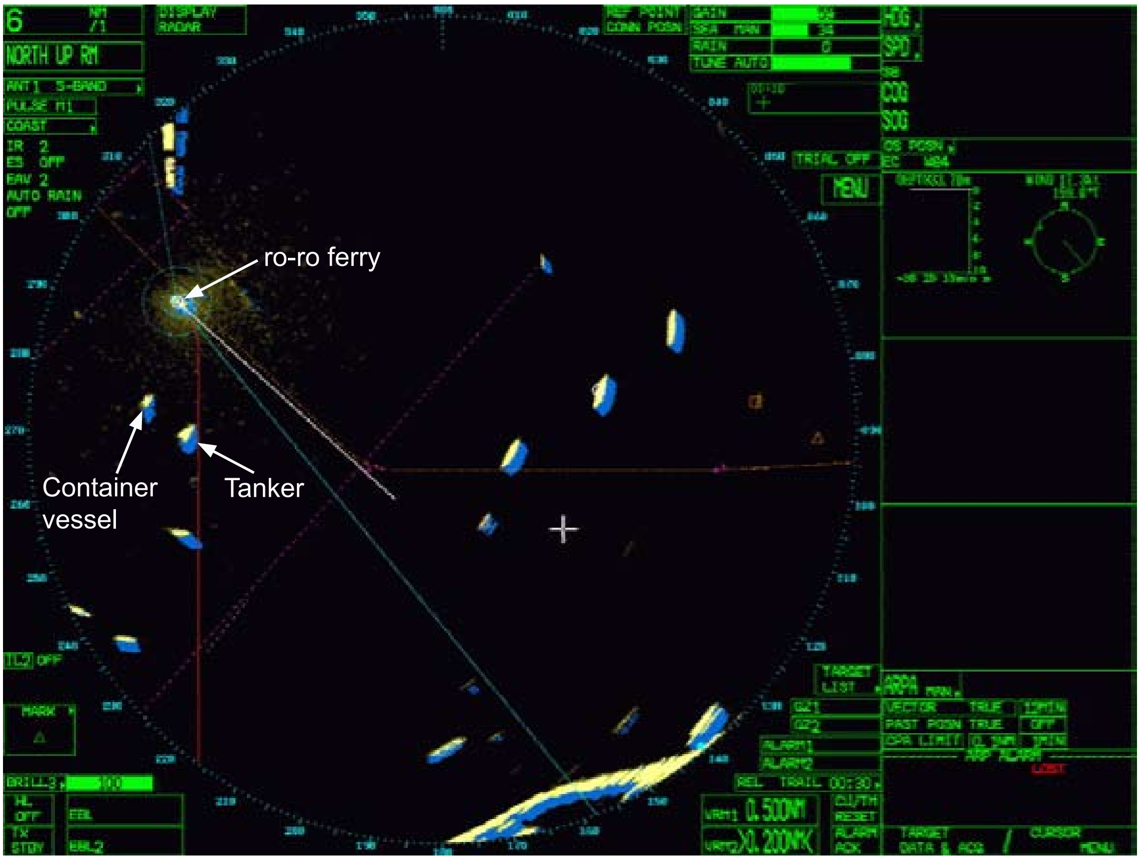
The Lessons

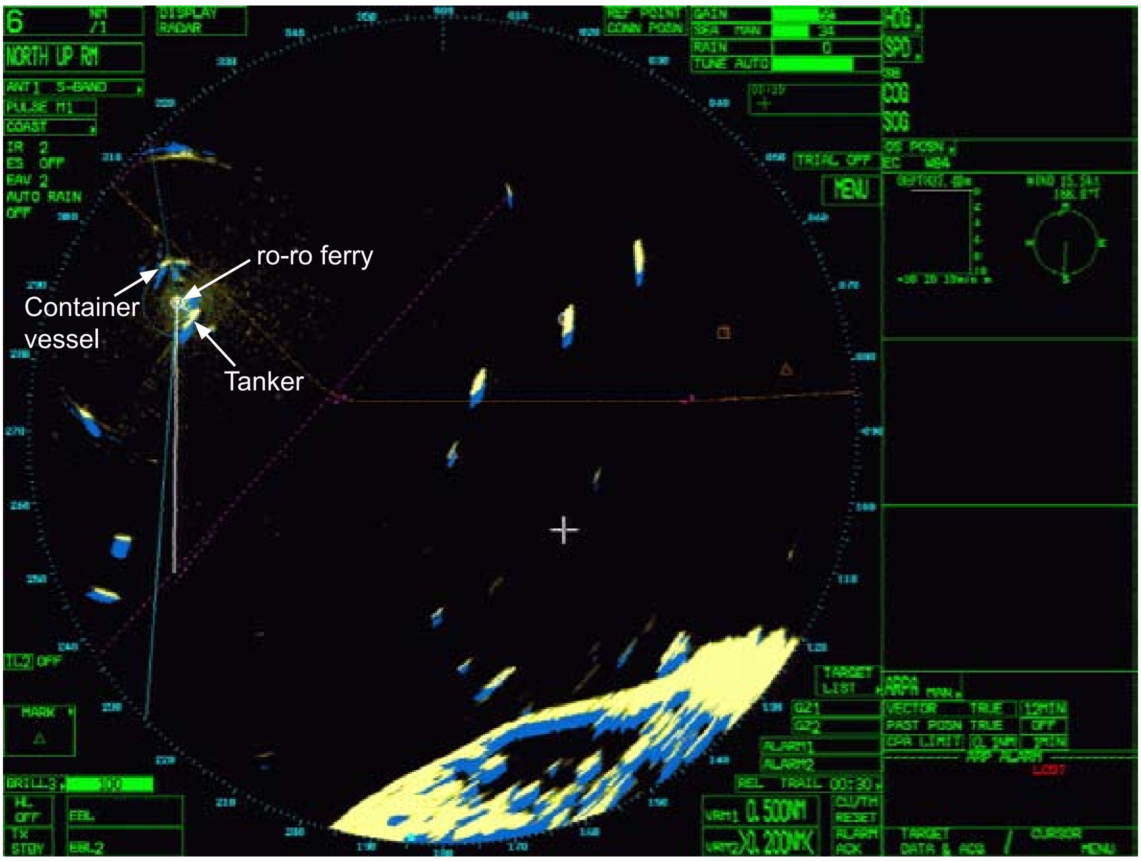
1. **Standard practice was for the master to hand over the watch to the OOW before the vessel altered course to cross the traffic separation scheme; he would then leave the bridge. Handing over at this position gave the OOW little time to become fully acquainted with the traffic and navigational situation. Had the master remained on the bridge for longer, he could have provided support and advice to the OOW, and would have been better placed to monitor his performance.**

2. **Although there was a QM on the bridge available for lookout duties, poor bridge management had allowed him to become involved in other, inappropriate tasks. The situation was exacerbated when the OOW became unnecessarily distracted by the SAT C message and the conversation that followed with the master.**

3. **When the OOW sat on the footrest of the bridge chair, there was no-one keeping either a radar or a visual lookout on the bridge, while the ferry crossed one of the busiest traffic separation schemes in the world.**

4. **The close-quarters situation developed quickly because all the vessels involved were making in excess of 20 knots, leaving little time for avoiding action. The OOW's ability to detect, evaluate, and then take effective action was seriously compromised by his lack of attention to, and distractions from, his watchkeeping duties. OOWs must recognise that modern closing speeds do not leave much time for action.**


ro-ro ferry
Container vessel
Tanker
NORTH UP RM
MENU


ro-ro ferry
Container vessel
Tanker
NORTH UP RM
MENU

Beware of Hydraulics

Telescopic folding jib

Narrative

While a tug was alongside in port, her engineer and the engineering supervisor were maintaining the telescopic folding jib crane mounted on the aft deck in preparation for the crane's annual scheduled service and periodic load testing the following day. The crane's hydraulic power was drawn from the tug's port main engine, which had to be running for the crane to operate.

When the work was finished, the tug's engineer stood at the crane controls and operated the levers to stow the crane. As the jib's crutch was difficult to see from the operator's position, the engineering supervisor helped him line the jib up with its stowage. Once the jib was stowed, the engineering supervisor turned away and started to collect their tools together.

The tug's engineer stepped down from the port side of the crane's control position, on his way to the wheelhouse to disengage the hydraulic power take-off. As he stepped down, the telescopic section of the crane jib extended while in its stowed position. This caught and crushed his lower left leg, causing him to shout out.

The engineering supervisor heard the shout and rushed to operate the controls to retract the telescopic section. He then freed the injured engineer and laid him on the deck. Meanwhile, the crew from another tug, moored alongside, jumped on board to assist. The alarm was raised immediately, and port paramedics were quickly on scene. The injured engineer was stabilised before he was flown to hospital. Sadly, although attempts were made to save his lower leg, it had to be amputated below the knee.

A subsequent inspection was unable to identify any significant fault with the crane or its controls. It is believed the injured engineer might have inadvertently moved the jib controls as he climbed down from the operator's position.

The Lessons

1. Treat hydraulically powered equipment with care and respect. It is extremely powerful and can inflict terrible injuries, as demonstrated by this accident.

2. Since 24 November 2006, equipment such as the crane in this accident must comply with the Merchant Shipping PUWER[1] and LOLER[2] regulations. As an employer, ensure you are aware of these requirements for work equipment and lifting equipment.

   In summary, PUWER requires equipment to be:

   - Safe and fit for purpose
   - Properly maintained and any maintenance log kept up to date
   - Used by operators who have been adequately trained in its use
   - Fitted with readily accessible emergency and normal stop controls.

   In addition, LOLER requires:

   - A periodic thorough examination and inspection by a competent person
   - Load testing at necessary intervals
   - The resulting certification of testing and examination to be kept on board.

   MCA surveyors or other appointed inspectors may board and inspect a vessel to ensure compliance with these regulations.

3. In this case, while the control levels for the crane appeared to operate satisfactorily, they were not fitted with a protective cover to prevent inadvertent operation. Further, the power take-off switch was mounted in the wheelhouse and there was no local stop control as required by PUWER regulations.

1 The Merchant Shipping and Fishing Vessels (Provision and Use of Work Equipment) Regulations 2006, MGN 331 (M+F) refers

2 The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006, MGN 332 (M+F) refers

Doing it all Yourself

Narrative

A well boat was engaged in transporting live fish to and from fish farms on the west coast of Scotland. Occasionally this would include a canal transit of 9 hours each way. The master insisted on being on the bridge for the canal transit, and for berthing and un-berthing. He also took charge of loading and discharging the fish cargo. The mate was therefore on watch only for the less onerous sea transits, when he and the master reverted to a 6-on, 6-off watch routine, with the master on watch from 2000 until 0200.

The ship's Safe Manning Certificate stated that the minimum manning requirement was four, consisting of master, chief officer, AB/cook and AB/engineer.

The vessel had made the canal transit, and was on passage to a fish farm. The mate took the watch until 2000, when the master took over for his routine 2000 to 0200 watch. Arriving at the fish farm at 0130, the master anchored the vessel before handing over to the mate. He left instructions that he was to be woken at 0700 for berthing at the fish farm. The master had been on duty for 19 of the previous 24 hours.

The following morning, the weather was too bad for the vessel to make an approach to the fish farm, so she remained at anchor. By about 1500 the weather had eased enough for an approach to be made. The master, who had remained on watch since the morning, manoeuvred the vessel alongside the fish farm and then took charge of the cargo discharge. Once this was complete, one of the crew left the vessel, leaving three people on board.

The master was still on watch when the vessel departed. The mate offered to take over, but the master declined this because he wanted to return to the normal 6-on, 6-off watch pattern. The plan was therefore for the master to

Operating panel at master's seat, looking to port remain on watch until 0200. The mate returned to the bridge a number of times, offering to bring the master food and drink, or to take over the watch. All offers of assistance were refused.

The passage plan initially took the vessel through open waters, where her motion was quite lively. However, once the vessel entered more sheltered waters, this motion eased. The master was alone on the bridge and sitting in a chair to the starboard side of the bridge. At some point after altering course to pass between two islands, he fell asleep. He awoke when the vessel grounded, at full speed, 40 metres from a lighthouse.

The Lessons

1. **A main contributing factor to the grounding was the master's fatigue. For a number of days he had received less than the statutory minimum hours of rest permitted, mainly owing to his insistence on doing everything himself. His failure to delegate tasks to the mate greatly increased his working hours, reducing his opportunity for rest, and building up a sleep deficit.**

2. **The vessel had sailed short-handed, and this meant that it was not practicable to post a lookout. An additional person on the bridge could have alerted the fatigued master to the approaching danger of grounding.**

3. **The vessel was fitted with a watch alarm, but this had been switched off. A switched off alarm will <u>never</u> perform the function for which it is designed.**

Tell Me About It

Narrative

A high speed ferry was proceeding in the river approach to a UK port. It was foggy and visibility was about 50 metres. In addition to the usual master and mate bridge team, a trainee master was preparing to undergo the berthing element of his type rating assessment as master. The trainee master had the con and had reduced the ferry's speed, posted an extra lookout, and started to sound the fog signal. The radar in use was in a sea stabilised true trails mode, which, due to the strength of the tidal flow meant that all fixed radar targets created trails on the radar screen, making the picture difficult to interpret.

A bulk carrier, with tugs attached, was in the vicinity of the ferry's intended berth, waiting to enter a lock. The pilot was unhappy about making his approach in the low visibility and had positioned the vessel off the lock, stemming the last of the flood tide and waiting for the visibility to improve such that he could make the approach safely.

As the tide reached high water, the stream next to the bank started to ebb. Position keeping in the river became more difficult because the vessel was situated between the ebb and flood flows. This occurred regularly in the port, and in good visibility the pilot would have available to him a number of local transits to assist in monitoring his position. However, when fog was present he had to rely on the radar alone, delaying his ability to take effective corrective action to maintain position in the river. Realising that, even if the fog lifted there was now insufficient time to enter the lock before high water, the pilot began to make preparations to let go the tugs and proceed to the designated anchorage. The bridge team was not briefed on the approaching ferry, nor involved in supporting the pilot.

The VTS Information Service gave regular traffic broadcasts on the port operations VHF radio channel. However, no reference to the bulk carrier was passed specifically to the ferry.

As the ferry approached the bulk carrier, the latter was moving towards the riverbank, causing her radar return to merge with those of the riverbank and neighbouring jetties and the trails they created. She then moved back into the river and towards the approaching ferry.

A number of things then happened at the same time:

- The bulk carrier's forward tug saw the ferry right ahead at a range of 50 metres, and altered course rapidly to port.
- The bulk carrier's pilot called the ferry, stating that his vessel was about to proceed downriver.
- The lookout on the bow of the ferry saw the tug, and reported this to the bridge.

The trainee master ordered "hard-a-port". The bulk carrier's bow then appeared out of the fog, and the master ordered "hard-a-starboard" and increased speed in an unsuccessful attempt to swing the ferry's stern clear.

The vessels collided, ripping a large hole in the ferry's engine room. This caused rapid flooding of the space, stopping the starboard engines and generators. The electrical load was transferred to the port generator, which overloaded and tripped out, leaving the vessel temporarily on emergency power only. The emergency alarm was sounded and passengers were instructed to put on their lifejackets. The two vessels then collided again, the ferry's starboard bridge wing contacting the bulk carrier's accommodation ladder, which was stowed outboard of her side rails.

Damage to the bulk carrier was minimal; the situation on the ferry was more critical. She was now listing to starboard and trimmed by the stern, with only the port engines available. Fortunately, tugs were immediately available to offer assistance and they towed the ferry alongside, where the passengers, some of whom had minor injuries, were able to disembark.

The Lessons

1. **During the period leading to the collision, the ferry's master was engaged with the trainee master in discussions on the "blind" approach for berthing. In diverting his attention to the forthcoming berthing manoeuvre, the trainee master's role of collision avoidance in reduced visibility was compromised, resulting in the presence of the bulk carrier in the immediate vicinity of the ferry being missed.**

2. **Operating the radar in a sea stabilised mode means that the true course of a target given by an ARPA, and also indicated by its true trail, will normally represent the heading of the target, and this stabilisation mode is therefore normally used for collision avoidance. However, in a confined area, where a strong tidal flow can be expected, true trails will clutter the picture and make its interpretation difficult. On the other hand, a ground stabilised mode will produce a clearer picture since no trails are generated by land returns. This will enable the observer to detect more easily the trails of moving targets, thus enhancing the observer's situation awareness.**

3. **The bulk carrier's pilot was carrying out a number of tasks in the period leading to the collision. It is essential that a pilot is proactive in requiring support from the vessel's bridge team, and that the bridge team is proactive in giving that support so as to avoid any unnecessary increase in the pilot's workload.**

   Additionally, had the pilot decided to wait until the ferry had passed before releasing the tugs, he would have been more able to monitor the approach of the ferry, and to give early warning of the impending collision in time for the ferry to take effective action.

Maintain Your Automatic Release Hook

Figure 1 – FRC davit

Narrative

The port Fast Rescue Craft (FRC) on board a specialist ro-ro vessel was deployed during a training exercise at sea; the wind was westerly force 5 with a moderate swell. The master and OOW were on the bridge, the chief officer was on deck and the boatswain, in charge of the controls, was being assisted by two men handling the bowsing lines.

The drills had started earlier that morning with the more frequently exercised starboard boat crew. The starboard FRC exercise went according to the plan, with the two-man team reversing the roles of coxswain and bowman when the starboard FRC was launched for a second time.

Both port FRC crewmen had recently joined the vessel and, although they had received previous training on this specific type of craft, this was the first time they had launched from this type of vessel. During onboard emergencies, the port FRC team were assigned to fire-fighting duties and were not frequently launched in the FRC. The two crewmen were wearing lifejackets, immersion suits and helmets during the exercise, as required.

The two crewmen decided who would be coxswain and who would be bowman, aware that their roles would be reversed after the first run. Having watched the previous exercise on the starboard side, when the boat was launched and a full turn made before returning to the ship's side, the two crewmen understood that the same was required of them.

The FRC was lowered from the stowed position and stopped 2m above the water. The bowman released the preventer chain and pulled the Automatic Release Hook (ARH) wire, checking as he did so that the hook indicator had changed from the “safe” to the “cocked” position. In the “cocked” position the offload hook would automatically release when the weight was removed from the hook. The distinctive noise of cocking the hook was heard by the personnel on deck and by the boat crew. Following confirmation between the FRC crew, boat deck personnel and the bridge that all was ready, the FRC was lowered into the water and the weight came off the fall wire.

The coxswain understood that once the ARH had released, the engine power should be increased ahead to avoid the bow line taking the full weight of the boat. Then, and once the bow line was free, he should increase speed again to clear the ship’s side. However, the ARH did not release. As the coxswain increased engine power the bowman released the bow line without visually checking that the ARH hook had released.

Figure 2 – Quick release hook

Figure 3 – FRC winch controller

Still restrained by the fall wire, the FRC turned to port, away from the ship, and listed heavily to starboard. The crew jumped clear of the boat as it was pulled on its side through the water.

The ship's manoverboard (MOB) procedure was promptly activated and the starboard FRC was launched to rescue the men in the water. Both men were successfully recovered and were taken to the ship's hospital within 10 minutes of jumping into the sea. They were cold but uninjured.

When the port FRC was recovered, still attached to the ARH, the hook would not release from the FRC lifting cradle D ring. The ARH was forcibly removed and subsequently landed ashore for testing, where it was found that a build up of salt contamination, both internally and externally, combined with insufficient lubrication, had caused the hook not to release. Once the ARH was cleaned and lubricated, it operated correctly.

The Lessons

Maintenance:

1. In the secured position, the FRC was supported by the fall wire, making routine maintenance extremely difficult. However, this shortcoming had not been raised with management ashore.

2. The planned maintenance instruction for the ARH was not on board, so had not been followed, despite clear maintenance instructions being printed on the side of the ARH.

Maintenance of safety critical items is not optional.

Training:

3. This type of FRC was known to be directionally unstable at slow speeds and this, combined with a perceived need to avoid the FRC placing too much load on the bow line had resulted in a routine requiring the coxswain to apply power quickly. This crew, however, had not practised launching from this size of vessel, or at this speed before, and in their haste to get away from the ship they did not check that the ARH had released.

4. It is necessary to ensure that training is conducted at an appropriate level, proceeding to advanced drills in steps. In particular, all involved should speak up if the training is too challenging for the crew.

What Goes Up, Mustn't Go Down…

Narrative

A large ro-ro passenger ferry was conducting a lifeboat familiarisation drill alongside to demonstrate the operation of the lifeboats to a number of catering staff who had recently joined the vessel. Conditions were good, and both starboard 150-man gravity-lowered lifeboats were simultaneously lowered to just above the water, each with a couple of crew embarked.

The electric motor-driven winch on each davit was then being used to recover the lifeboats, when the forward winch motor suddenly stopped without warning, leaving the lifeboat suspended about 2.4m below the davit heads. Inspection by one of the ship's electricians soon identified that the motor had burnt out, and with no means of effecting a quick repair, a team of crew members began to take turns to manually raise the boat using the crank handle.

After about an hour, they had only managed to raise the boat to the davit heads, at which point the two crew members on board the lifeboat climbed out using a lashed deck ladder. They then continued to manually luff the boat and davits inboard, but this proved to be an even slower process, with only a few inches of movement achieved after a further 40 minutes of cranking.

With time running out before the vessel's scheduled departure, a plan was devised to swap over the operational motor from the aft lifeboat to complete the recovery. Several of the crew began to disconnect the damaged motor but, as they removed it from the davit housing, the geared pinion shaft also withdrew and the lifeboat released unexpectedly. One of the crew ran round to the other side of the davit and swung off the hand brake to try to stop the lifeboat descending. But this had no effect; the boat continued to lower at a controlled speed. No damage was sustained when the boat hit the water, although it did begin to fill with water because the drain plug had been left out. The operational motor was then successfully transferred and used to recover the boat, without further incident.

The Lessons

1. **The design of this davit system had the roller ratchet freewheel assembly, which held the load, on the other side of the geared pinion shaft from the wire/pulley. The removal of the geared pinion shaft, along with the motor, therefore disconnected the gearing and the boat was free to lower on the davit's integral centrifugal brake.**

2. **The crew were unaware of this aspect of the design, which was also not made clear in the lifeboat winch manual. However, prior to commencing the rectification work, the manual wasn't consulted anyway, nor was shore-based technical guidance sought, despite the crew having little technical knowledge of the system. Fortunately on this occasion the crew's new found understanding of the system was gained without damage or injuries – make sure you fully understand the consequences of planned or unplanned work on your lifeboat system, before you get caught out and aren't quite so lucky.**

3. **The most fundamental lesson from this incident is the need to ensure that there is no load on the system prior to conducting any maintenance work. Even if, like the crew here, you believe that the work you are conducting will have no effect, always play safe and make sure that the load is off the system, either by securing the boat using pendants or by some other means, or by lowering the boat to the water.**

ESD Valves – Are Your Tests Effective?

Narrative

A fully pressurised gas carrier had just completed loading liquefied propane at an oil refinery. A freeze test had been carried out 2 hours before the tanks were full, and the same cargo surveyor returned to the ship at the end of loading to collect his cargo samples and tank volumes.

The cargo surveyor connected his sampling device to the ship's sampling connection on the No. 1 tank, and the chief officer then circulated the cargo, using the tank's deep well pump, to ensure a good representative sample was obtained. Having taken four samples, the cargo surveyor moved aft to the sampling point of tank No. 2 while the chief officer secured tank No. 1. Operating alone, the cargo surveyor started to fit his equipment to the sampling point of tank No. 2. As he turned the sampling connection towards himself, the sampling valve assembly came off in his hand.

The chief officer saw and heard a gas leak, and immediately activated the emergency shut down (ESD) valves. Attempts were then made to refit the sampling valve, but the 11 bar pressure of the cargo and the formation of ice on the connection made it impossible. It soon became apparent that the ESD valve between the tank and the sampling connection was not holding.

The emergency services were alerted soon after the accident and the ship was doused in water sprays to disperse the gas cloud. After several options had been considered, it was decided to hot tap the cargo pipework and inject a sealing compound to stop the leak of gas. Using this method, the leak was sealed 29 hours after it had started. Once a temporary repair of the sampling point was complete, the

Burr on gas valve

Sampling point and ESD valve

Scoring damage on valve disc body

tanker sailed to her discharge port to unload, before proceeding to a scheduled dry docking period.

The original arrangement for cargo sampling had been via slip tubes, but this had become unacceptable practice and a drain point on the cargo pipework system was used to draw samples instead. Inspection of the ESD valve, which had failed to close and contain the leak of liquefied propane, revealed that it had been jammed open by a small burr. How long the ESD valve had been in this condition could not be determined.

The Lessons

1. **Although the ESD valves were tested regularly to ensure their closure rates were acceptable, the indicator, a sleeve on the valve spindle, was not attached to the valve disc. Therefore, although the valves appeared to have shut, the indicators did not provide a positive check that they were. Make sure you are familiar with the design of your ship's critical valves and the limitations of any testing regimes.**

2. **Most of the ESD valves on board could be checked by a simple pressure test of the cargo lines. However, the sampling point was situated on the discharge line, which had a non-return valve in the line preventing the same simple test from being applied. Ensure you have a system for regularly testing all your safety critical valves while in service. They are your last line of defence against a major leak.**

3. **It is also important that ESD valves are regularly examined at dry docking periods to ascertain that they are functioning correctly. In this accident, the burr on the valve could have existed since the ship was built 10 years previously! There might not be a requirement to test and inspect your ship's ESD valves at class surveys, but it would be prudent to do so anyway, as these valves form a vital part of the cargo safety system.**

4. **The revised sampling point was inadequate for the intended task. Remember, you are opening the contents of your cargo tank, potentially, to atmosphere when sampling, so make sure your sampling arrangement is safe and meets industry guidelines[3].**

5. **Care must always be taken when non-crew conduct operations involving a ship's equipment. In this case, the cargo surveyor incorrectly believed he had two valve separation between the sampling point and the pressurised cargo tank. Ships must have procedures in place to ensure the actions of cargo surveyors do not endanger themselves, ships' crews or shore staff.**

3 Report of a working group on liquefied gas sampling procedures, published by SIGTTO in 1989

Box Clever – Know the Limits

Narrative

An 868 teu container vessel engaged on an intensive north-west European schedule was on passage in the Baltic Sea when a stack of 30 foot containers collapsed in a hold. The wind had been fresh to strong, and she had been rolling and pitching heavily at times during the night before the collapse was discovered.

The collapsed stack consisted of seven containers: the lower four containers held bulk cargo which was damaged and crushed, with a loss of cargo; the upper three were tank containers filled with Butylene gas. Fortunately, although the frames of the tank containers suffered damage, it was later found that no gas had escaped from them.

On discovering the collapsed stack, the master contacted the ship managers and charterers to inform them. The ship managers later contacted the coastal state authority for the vessel's port of destination, which then implemented an emergency plan requiring the vessel to be diverted to a port capable of isolating the vessel during the removal of the damaged containers.

The damaged containers were eventually removed and the vessel was able to resume her schedule after a delay of 1 week.

The investigation revealed that the collapse occurred as a result of downward compression and racking forces acting on the lower containers of the stack, which were not strong enough to support the weight of the stack. The maximum allowable stack weight for the hold had been exceeded, and no lashing bars had been applied, contrary to the requirements of the cargo securing manual (CSM).

The lowest containers, which should have been lashed, had an allowable stack weight of 100 tonnes, and the total weight of the stack was 225 tonnes; the CSM stated that the maximum allowable stack weight in the hold was 150 tonnes.

The chief officer, who had recently been promoted and had no previous experience of loading 30 foot containers, used the vessel's load computer when checking the load plan. However, the computer had not been correctly programmed, and it did not recognise the stowage of 30 foot containers in the hold and provided no alarm when this stack was loaded.

The shore-based cargo planners also used a load computer and this, too, was not correctly programmed and did not recognise that the weight of the stack exceeded the vessel's parameters.

The Lessons

1. **Load computers are placed on vessels to assist officers in cargo operations. Ship managers should ensure they are fit for purpose in respect of all the cargoes carried by the vessel.**

2. **Officers should gain a thorough knowledge of their vessel's cargo securing manual to ensure stack weights are not exceeded and securing requirements are complied with at all times.**

3. **Shore-based cargo planners should have a good understanding of the effects that their load plan will have on the vessel.**

4. **Effective communications between the planners and the vessel should be maintained at all times.**

5. **Ship managers should ensure that when officers are appointed to senior ranks, they are given time to become fully familiar with the vessel and her cargo securing manual prior to assuming the role.**

6. **Masters should ensure that the nearest coastal state is informed of the circumstances of any accident on board a vessel as soon as is reasonably practicable.**

CASE 16

A Knotty Problem

Narrative

Work had been successfully carried out to replace the sheave diverters on a shipboard crane. A post-maintenance load test, using a conventional water-bag test weight arrangement, was planned while the vessel was alongside. There were "light airs" at the time, and the vessel was well secured to the berth.

A comprehensive risk assessment and method statement had been produced by the testing contractor, which had been agreed by the ship's staff. Those involved in the test were well briefed and it was agreed to use a high quality synthetic rope with a tensile strength in excess of the test load requirements to suspend the water-bag. The contractor and an experienced member of the ship's staff

Figure 1 – View of set-up for test process

Figure 2 – View showing knot attachment to shackle

inspected the rope from the storage drum to the hanging point of the water-bag; no defects were found.

A “hard eye” was spliced at the end of the rope, but it was found that the water-bag load cell shackle pin would not pass through the eye. After some discussion, it was agreed between the ship’s staff and the contractor to remove the “hard eye” and connect the rope to the load cell shackle using a bowline knot (Figure 1).

The water-bag was lifted from the jetty and partially filled with fresh water. At a load of about 10 tonnes (Figure 2) the sheaves were inspected for any structural change – none was found. More water was added to the water-bag but, soon afterwards, the rope failed and the water-bag fell onto the edge of the quay. Fortunately no-one was injured and there was no damage to the vessel or equipment.

On inspection, it was found that the rope had parted at the “crane side” of the bowline knot.

The Lessons

1. All too often, little thought is given to the importance of assessing a rope's safety factor in relation to its Safe Working Load (SWL) – (also known as Maximum Working Load). Ropes are classified with a Minimum Breaking Load (MBL) – (also known as Minimum Tensile Strength) based on "break tests" data. The SWL is normally determined by dividing the MBL by the safety factor. The safety factor itself is determined by the condition of the rope, its history, its properties and intended use. Safety factors typically range from 3:1 for static type use where the risk to personnel is low, to 20:1 where severe conditions exist and where rope failure will cause severe risk to personnel or equipment. Do keep the safety factors under review; they will change dependent upon use, and this will affect the Safe Working Load of a rope.

2. When considering rope usage, bear in mind that knots in ropes can cause up to 60% loss of tensile strength. Where knots are used, an adjustment to the safety factor should be made to ensure that the rope is fit for its intended purpose.

- Crucially, in this accident, a revised risk assessment was not undertaken when the bowline knot was used instead of the "hard eye", so no consideration was given to the implications of introducing the knot into the otherwise certified load test equipment.

- Wherever possible, it is preferable to use a splice rather than a knot. Some rope manufacturers, as in this case, provide instructional video films on splicing techniques. Make sure you know the splicing procedures for your ropes. They do vary.

- Finally, where there is doubt over a rope's intended use or suitability of splices/knots, those responsible should not hesitate to contact the rope manufacturer for professional advice.

Part 2 – Fishing Vessels

Although I have practiced as a Solicitor in Hull for over 33 years I am not totally without seagoing experience. I joined my firm of Andrew Jackson at a time when there was still a large fishing industry in Hull and Grimsby. With special dispensation from the Law Society I spent part of my articles as a "deckie learner" fishing in the White Sea. I sailed out on the "Lord Nelson", the oldest stern trawler in the fleet and came back on the "Dane" one of the newest vessels. "One week out and one week back" actually ended up in a 6 week trip.

This singular experience has lived with me ever since. I came to realise that the trawler men, who I had envisaged as a bunch of hard drinking labourers were in fact serious professionals. They took a pride in their work, which they carried out carefully and cheerfully, in the most unbelievably bad weather and sea conditions. The dangers of the job were all so obvious, but these were well trained experienced men who worked together as a team, based on mutual trust, to minimise the risks. Cadets were supervised and trained whilst a "snacker" like myself was kept well away from the moving gear.

I was left with a profound respect for fishermen and an appreciation of exactly what gale force conditions in the middle of nowhere mean. In those days I also dealt with factory accidents and I remember a claim by someone who had put his hand through the only gap in an elaborate guard completely encircling a piece of machinery. At the same time, I was dealing with accidents on Grimsby anchor seiners with open revolving rope drums and whipping drums, and being told how much safer these boats were than when the job was done with "coilers".

In some respects there has not been any great improvement in safety on board fishing vessels in the intervening 30 years or so. Some things are better, others I believe worse.

The industry has become over regulated. As a lawyer I know how many Acts of Parliament, Statutory Instruments, rules, regulations, marine guidance notes etc etc apply to the safe operation of fishing vessels. Yet I struggle to identify and analyse them all. Worse still, it seems to me that the powers that be do little to gently encourage compliance with or to police our rules. If there is an accident then someone may well get prosecuted. Who is encouraging awareness and compliance with rules to try and prevent the accident from happening in the first place? If the access to a vessel is unsafe why isn't anyone going around pointing out the problem, rather than quoting the requirements after somebody has fallen in?

To my mind the most important regulations to have emerged within the last 30 years were undoubtedly the Merchant Shipping & Fishing Vessels (Health and Safety at Work) Regulations 1997. These impose, amongst other things, the requirement for risk assessment, which was something totally new to the fishing industry, although accepted procedure on merchant vessels.

Risk assessment, properly undertaken on a common sense and collective basis, can, in my opinion, make a large contribution to on board safety. I was excited to work with Alan Dean of Seafish in a project which led to the production of the Fishing Vessel Safety folder of risk assessment documents (available free from Seafish, or downloadable from their website). We worked with several skipper/owners to trial our documents and satisfy ourselves of their value.

However, despite the encouragement of organisations such as Seafish (and the MAIB) I believe there are still many boats not using the system properly. Many owners had a risk assessment drawn up (often by outside consultants who had never even seen the boat in question) so as to "comply". Few engaged their crew in the assessment exercise and fewer still have maintained an ongoing review of the assessments, as is necessary to comply with the regulations and to give any purpose to the exercise. I am not, however, aware of any prosecution for failure to have a risk assessment (over a decade since the requirement arose) or, worse still, any sensible effort to check risk assessments and encourage those not complying to do something about it.

There is a lack of knowledge within fishing about stability. Anyone such as myself, who deals with fishing vessel losses, or even a casual reader of MAIB reports or Safety Digests, will appreciate that many vessels founder, often with loss of life, due to a problem of stability. This might be attributable to a deficiency in the vessel herself or because an onboard practice has developed which impacts upon stability. Achieving a knowledge of stability is not easy, I was once told to read "A Shipmaster's Guide to Stability" and had to give up before the end of the first chapter!

The second MAIB fishing vessel report published was in 1991 in respect of the loss of "MAJESTIC" and her crew of five men. The complexity of stability book information was identified and the then Marine Directorate, Department of Transport was recommended to produce "simplified, clear and basic stability information….for the advice of the Skipper and all crew". Similar recommendations have been made in a number of reports since, for example "Sapphire" in 1999. The MAIB has also repeatedly recommended that stability guidance be given in respect of under 12 metre vessels.

Almost 20 years after the loss of "MAJESTIC" it must be a frustration to the MAIB that nothing has really changed. Marine Information Note 287 (F) published last year by the MCA indicates that progress on these issues is now at last taking place.

A final problem area I would mention is that of training. This is an area where I think the industry has gone backwards. When I did my trip to the White Sea there were many trawler men in Hull. Although casual share fishermen, they operated within a system of rank and promotion by experience, and learning how to do the job safely was part of the process. Apart from anything else, accidents caused disruption and lost money.

A huge problem today is getting and keeping regular crews, let alone experienced and safety conscious ones. Every opportunity must be taken to train crews about safety issues wherever possible. Carefully explaining the vessel's risk assessment documentation as previously mentioned is a good start.

A further good move would be to carefully consider, and circulate, MAIB Reports and Safety Digests, to include the case studies that follow. To talk about the problems of rules and regulations, stability and training is all very well, but the most straightforward way to avoid accidents is to learn the lessons from those that have impacted on others. That of course brings us back to the purpose of the MAIB. Accidents like those that follow are real, human, tragedies. Five cases – three fatalities. I am always taken by how quickly things can go wrong and tragedy can strike. So let us learn the lessons of others' misfortune and set about creating a real safety culture in the fishing industry.

Silas W Taylor.

Silas Taylor

Silas Taylor has spent his entire career at the Hull law firm Andrew Jackson. He was brought up in Bedford but went to Hull University and has remained in the City ever since.

He has overseen the development of the Shipping and Transport law department at Andrew Jackson from small beginnings to an International practice with some 15 specialist lawyers, the largest outside of London.

Silas works as a casualty lawyer and has always had a close involvement with the fishing industry.

Much of his time is now spent acting as a mediator of major International shipping disputes.

CASE 17

Small Hole – Costs a Life

Narrative

The skipper of a 9 metre steel hulled fishing vessel lost his life when his vessel sank while trawling off the east coast of Scotland.

While in port after the previous trip the skipper, who fished single-handed, had told some other fishermen that a significant amount of water had entered the vessel's under deck area, and that he had experienced some problems with a bilge pump.

The vessel had a single undivided space under deck from the wheelhouse to the transom, and had a low freeboard, resulting in water coming onto deck through the freeing ports when the vessel was underway.

The skipper had also previously reported having problems with his engine exhaust. The exhaust system was a dry exhaust, which vented to atmosphere via an outlet at the top of the stern gallows. The exhaust gases flowed through the steel box section of the gallows, with no internal flue liner fitted.

One of the major components of engine exhaust gas is sulphur oxide which, when in contact with water, combines to produce sulphuric acid. In this case, the location of the exhaust trunking created ideal conditions for corrosion to take place, which would have led to water entering the below deck space.

Analysis of previous accidents to similar vessels shows that water can flow through relatively small holes at a surprisingly high rate, and that a relatively small amount of water entering the hull area can adversely affect the stability to such an extent that very rapid downflooding can occur. For example: 0.5 tonne of water per hour will flow through a hole of just 18mm in diameter assuming a constant head of 25mm.

The Lessons

1. This tragic case illustrates the vital importance of having – and maintaining – an adequate freeboard and keeping your vessel watertight.

2. While there are no statutory requirements for fishing vessels of less than 15 metres in length to undertake stability tests, it is prudent for all skippers to be aware of the stability condition of their vessel at all times.

3. Never underestimate how much water can flow though relatively small holes, and make sure you have an operational bilge alarm and bilge pump system.

CASE 18

Complacency Kills

Vessel after recovery

Narrative

A small fishing vessel and her skipper had been chartered for the day to catch small fish for display purposes. To achieve this, the boat had a fine mesh trawl net, a small rectangular tank for sorting the catch and two circular tanks for storing the fish. On board were the skipper, the charterer's representative and a passenger who was along for the ride.

Shortly after clearing the harbour entrance, the net was shot over the stern and the skipper set an easterly course for a tow across the bay. The two circular tanks were positioned just aft of the engine casing on deck, and once the nets were shot these tanks were filled with water using two electric 'bilge' pumps immersed in the sea at the stern. Each pump had a discharge hose passing through the port side freeing port leading to one of the tanks. The pumps discharged continuously into these tanks, which then overflowed through holes about 60cm from the bottom of them into buckets and then onto the deck.

The first tow lasted 45 minutes, after which about 40 minutes were spent sorting the catch into the tanks before the net was shot again. The second tow was uneventful, until several centimetres of standing water were noticed on the starboard side of the deck, with water coming on deck through the starboard freeing port in the stern. The skipper's attention was drawn to this water, but he gave no sign of being concerned and told the others not to worry. The tow continued as intended until the skipper began to haul in the gear.

Hauling continued for about 5 minutes until the trawl doors were hanging from their chains on the stern gantry. By this time, the amount of water on deck had become substantial and the skipper released the clutches on the winch, allowing the fishing gear to return to the seabed.

The skipper checked below deck and found water in the aft void and the engine space. He then took one of the electric pumps being used to top up the tanks, and used it as a bilge pump. However, the depth of water on deck was increasing, so while the passengers started bailing, the skipper went to the wheelhouse to call for help. Using VHF Channel 16, he called the coastguard, stating his vessel was taking in water and requesting a lifeboat. He gave a local position, but did not include a latitude and longitude. The coastguard responded by broadcasting a "Pan Pan" message and alerting air and surface search and rescue units.

Bailing appeared to be achieving little, and the level of water had reached the top of the bulwark at the stern. One person went to the wheelhouse to join the skipper who, having raised the alarm, was collecting lifejackets from the cabin. One lifejacket was passed out on deck, by which time the stern was completely submerged.

Before any more lifejackets could be gathered, the vessel rolled to starboard and her stern completely submerged, leaving only the bows above the surface. The skipper appeared to be still in the wheelhouse or cabin, but the other two managed to swim clear. The vessel sank shortly afterwards. The skipper was not seen again.

The two people in the water held onto the single lifejacket for about 45 minutes before being rescued, as the search for them had commenced in the wrong position. Fortunately, they were found as the search area expanded, were winched from the sea and transferred to hospital, where they were treated for mild hypothermia. Divers later recovered the skipper's body from the vessel.

The vessel was raised so that the cause of sinking could be established. It was found that her starboard quarter was damaged such that water could enter the hull under conditions of limited freeboard or poor weather. At the time of her loss, she had additional weight on deck in the form of water tanks which held live catch. This weight reduced the freeboard sufficiently to allow flooding through the damaged area of the hull. To complicate matters further, the skipper had removed the electrical bilge pump to use it to provide a flow of sea water to the holding tanks, and there was no bilge alarm.

It is not certain when the hull damage occurred. Because protective rubber matting largely covered the area of damage, it was obscured to the casual observer and might have been present for some time, becoming critical only when the freeboard was reduced by extra weight.

The Lessons

1. **The skipper was unaware that the hull of his vessel was breached above the waterline and would let in water in a moderate sea or when heavily loaded. Check your hull regularly, especially the areas that are not easy to see, such as under matting or fenders.**

2. **During this trip, the vessel was unsafe. Although the skipper was unaware of the hull damage, he further compromised the safety of his vessel by heavily loading the deck with tanks, removing the only working bilge pump to fill those tanks, and not having a working bilge alarm. Individually, these deficiencies could have been coped with; put together they proved fatal. Sometimes compromises are necessary, but always keep an eye on their cumulative effect: complacency kills.**

3. **The two survivors were lucky, they had only one lifejacket between them, and the position given to the rescuers was inaccurate. Think through what you would do in an emergency: how you would pass a "Mayday" message; where your lifejackets are stowed; whether your flares are accessible, and so on; and talk the drill through with your crew.**

CASE 19

Even a Short Time in the Sea Can be Fatal

Narrative

A crewman died after being dragged overboard by a trawl net during routine hauling operations.

The crewman had assumed that the cod ends were ready to be lifted on board, and had lain across the net while clearing the dog rope (which had become twisted around the bag). The net drum operator was usually informed when it became necessary to clear twists from the dog rope; unfortunately, on this occasion he was not. The net drum operator's view was restricted by the physical size of the net drum, and he was unaware that the crewman was working with the dog rope when he veered the net back into the sea to enable fish in the bag to drop into the cod end. As the net was veered, it also carried the casualty overboard.

The alarm was raised immediately. However, because the stern trawler was being hampered by her nets, it was impossible for the skipper to come astern to the casualty without fouling the propeller, which would have disabled the vessel and prevented further endeavours at rescue.

After several attempts, a life ring was thrown, and was grabbed by the crewman, allowing the other crew to haul him alongside a ladder. The crewman was rapidly losing consciousness, so two of his colleagues went down the ladder, into the sea, to assist and support his head out of the water. A crane was then used to lift him from the sea onto the deck, where cardio pulmonary resuscitation (CPR) was attempted. He could not be revived.

The crewman regularly wore a flotation jacket on deck, but unfortunately he was not wearing one on this occasion. It was estimated that he was back alongside the boat within 10 minutes of going overboard, and was immersed in the 14° C sea water for probably fewer than 15 minutes in total before being recovered to the deck.

Operator's view towards net drums

Position of the casualty before going overboard

The Lessons

1. Ideally, deck machinery controls should be placed where the operator has an unrestricted view of the surrounding area. However, if the view is restricted, communication between parties is essential before controls are operated. Communication is a two way thing: it should be given, and should then be acknowledged by the recipient to prevent any misunderstanding.

2. Beware the dangers of routine. It can foster complacency due to the repetitive nature of the work, and will sometimes cause lapses in vigilance.

3. Always assess the possible dangers involved in any tasks, no matter how routine, and ask yourself, "is this really safe, or is there a safer way to do it?"

4. Carrying out tasks on board a fishing vessel will sometimes necessitate leaning overboard. The simple precaution of wearing some sort of flotation aid will help mitigate the obvious risks and will increase your chances of survival if you fall overboard. The casualty involved in this case had been a fit and healthy man, yet after just a few minutes of being immersed in the cold water, the debilitating effect of cold shock rendered him unconscious.

5. In this case, it was possible to lift the casualty from the sea using a deck crane. In the process, crewmates were required to go into the sea to assist. Not every vessel has the benefit of a convenient crane; serious thought should be given by all seamen on how a man can be recovered from the sea on their particular boat. Bear in mind, the medically safest way to recover someone from the water is to keep their body horizontal rather than attempting to lift it vertically.

6. If it is absolutely necessary to send anyone into the water to assist during a recovery, ensure they are properly dressed in thermal clothing and wearing a flotation device.

7. Life rings are cumbersome to throw at any great distance, but they do give a swimmer support. There are various line throwing devices available (not necessarily mechanical) which could be used to good effect in recovery situations.

Mystery Fire Sinks Potter

Figure 1

Narrative

During the early morning, a skipper and his single crewman took out their Cygnus 26 potter to recover and shoot their lobster and langoustine pots. As the weather deteriorated, they decided to return to their mooring which was about 40 metres from the shore.

The skipper was acutely aware of the risks of fire and flood, so he shut the gas supply valve from the gas bottle to the stove, and isolated the electrical supplies at the main battery isolating switches just before leaving the boat at about 1300. As usual, the bilge pump control was switched to the “auto” position to cope with any unexpected water ingress sensed by the high bilge level float switch. The power for the pump and float switch was derived from the battery side of the battery isolating switch.

At about 1730, the skipper saw the boat riding easily at its mooring, with no signs of the impending disaster.

Just after midnight, a friend of the skipper was walking along a road high above the small harbour when he noticed that the boat was fiercely ablaze, but still at its mooring. He immediately roused the skipper, who lived nearby. They both went to the foreshore to see the boat drifting away towards a headland as the fire burnt through the mooring lines. The skipper notified the coastguard, and the local inshore RIB lifeboat arrived a short time later. Unfortunately, they were unable to get close to the boat because of the ferocity of the fire. It was then decided to allow the boat to drift, and a couple of hours later it was headed towards rocks in an isolated inlet, still burning.

In the morning, the skipper and his crew tried to locate the boat, but were unable to do so. They believed that it was probably dragged out to sea by the tides and had sunk. However, they continued to search the inlets and eventually found it at low tide resting on rocks. The wheelhouse, deck and most of the hull had been consumed by the fire.

Figure 2

The Lessons

Discussions with the local authorities confirmed that the boat was well maintained, and that the skipper took good care of it and of his fishing gear. There was no suggestion of arson or foul play. All the indications suggest that the fire was probably caused by an electrical fault on the bilge pump or high bilge level float switch circuit which were the only circuits that were live while the boat was at the mooring.

It is not possible to identify specific lessons associated with this case because the exact cause can only be a matter of speculation. Although they would not have helped this safety-conscious skipper, it is timely to highlight the following areas of good electrical practice:

1. Make sure that electrical circuits are maintained in good condition, that connections are tight and corrosion free, and that insulation is in good order.

2. Attend to electrical defects promptly. The constantly flickering light or intermittent power supplies are sure indications of potential problems.

3. Do not install additional electrical equipment until you are certain that the cable carrying capacity and fuse ratings are adequate.

4. Isolate as many electrical circuits as you can before you leave your boat.

5. Always properly isolate and use correct terminations for redundant circuits.

6. Makeshift plugs, sockets and fuses should not be used.

7. When in doubt, seek professional advice/assistance from a qualified electrician.

General advice on electrical safety can be found in MCA's Code of Safe Working Practices for Merchant Seamen, which is available on the MCA's website at www.mcga.gov.uk.

Insecure Fiddle Leaves Crewman in Hot Water

Cooker with old fiddle and kettle

Narrative

A small fishing boat was rolling easily while trawling in a moderate beam sea. The skipper and crewman were in the wheelhouse together and decided to have a hot drink.

A kettle of water was placed in the fiddle on the stove which was located in the wheelhouse. The crewman sat down beside the stove, waiting for the water to boil, while the skipper remained at the wheel.

As the water began to boil the boat took a heavy roll. The kettle came free of the fiddle and fell from the stove, tipping hot water onto the crewman and scalding him. The skipper reacted quickly by drenching his colleague with cold sea water from the deck wash hose before calling the coastguard to ask for assistance.

The crewman was transferred by lifeboat to a local hospital where he was treated for his injuries. Fortunately, thanks to the prompt action taken by the skipper, his injuries were not too severe and he was able to leave hospital after a short stay.

The skipper later inspected the fiddle to establish why the kettle had been able to fall from the stove. He found that the fiddle had not been properly adjusted to suit the kettle which had been recently supplied to replace an older and different sized model.

The skipper ensured that the fiddle was properly adjusted to fit the kettle before the stove was used again.

Ensure the fiddle is properly positioned when placing pans on a stove

The Lessons

1. The supply of hot drinks is one of the key requirements on any vessel. However, as with any other items of equipment, it is essential that the kettle can be used safely in all weather conditions.

2. Fishing boats can be expected to roll, especially when trawling in a beam sea. The skipper had taken the precaution of securing various items of working gear but had not foreseen the hazard caused by a defective fiddle.

3. Galley equipment should not be overlooked when securing for adverse weather, especially on a small boat.

Part 3 – Leisure Craft

Life is full of risks, both at home and at work. Those of us working in the marine environment will face our fair share, but they will be different to those encountered by our land-based counterparts.

Risks are an integral part of everyday life, and to some extent they make life exciting and challenging. Some can be mitigated by making an assessment in advance, but very often we are faced with completely unexpected risks or ones which we have never encountered before. These are the ones that creep up unexpectedly and trigger a chain of events which take us completely by surprise. So often at sea, a minor problem can escalate very quickly into a catastrophe.

Many of us have made errors of judgment at sea. We might have embarked on a rough passage which, in hindsight, should have been delayed to the following day until the weather conditions improved, or perhaps we have not worn the appropriate safety gear for the task in hand. You look at the risk, make the assessment and nearly always hope for the best. Lone sailors may find this type of approach satisfactory. But if you are in charge of a crew, whose safety is of primary concern, you must be more cautious.

Today the internet provides us with vast amounts of information about numerous incidents which have taken place, and the lessons learned by the investigating authorities. Never before have we had such instant access to a huge library of such information. Somebody somewhere has possibly faced the same situation and the same risks as you; by reading about what went wrong, you can learn very quickly the correct procedures.

The reports which appear in this publication are produced on a regular basis by the MAIB, and are one of the greatest tools available to us as marine surveyors and naval architects. Any seagoing person – whether in a pleasure or professional capacity – is urged to read as many of these reports as possible to increase their own working knowledge of their hobby, their work or their life's experiences. They contain good factual reporting and do not attribute blame; instead they present the facts about what went wrong and explain how the situation could have been avoided.

In life, we all learn from our mistakes. However, the Safety Digest provides us with a unique opportunity to learn from other people's mistakes. I still find it interesting to read other people's opinions, and often from publications such as this one I pick up a real gem of information, which I can store away and hopefully use in the future. I urge you to do the same.

James W F McIlraith

Jim McIlraith is principal surveyor of Survey One Limited, which specializes primarily in small craft under 24 metres for survey and design work. Jim has a lifetime's experience in small vessels, and is an active member of many of the associations. His work was recently recognized by RINA and IESIS, by being awarded fellowships. He is also one of a rare breed of professionals who enjoy the water for pleasure purposes, being a keen sailor, too. Jim is an honours graduate in naval architecture from Strathclyde University, Glasgow, where he still lectures occasionally.

CASE 22

Keel Failure Leads to Loss of Life

Narrative

Following a very successful 2006 racing season, the owner of a 10 metre yacht put the boat into a boatyard for repairs and maintenance. The boat looked in great shape as the 5-man delivery crew arrived to take it back to its home port. The boat was checked over, the two new crew members were briefed on the safety gear, and the mainsail and genoa were rigged as the boat sailed at 2335. There was an 8 -10 knot north-easterly wind, and the boat was on a port tack and heeling about 15° to starboard when the first reef was put in the mainsail just before midnight.

Everything was normal, the boat felt businesslike – this promised to be an exhilarating trip and the chance for the new crew to gain experience. Unfortunately this expectation was soon to change.

By 0045 the owner, one of the watch leaders, and crew were in the cabin, having put the second reef in the mainsail. By 0245 the wind had increased to 25 knots, gusting 35 knots, and the boat was heeling 25° to starboard. At 0300 the relief crew arrived on deck, and at 0315 the heel increased to 30° and preparations were made to put the third reef in the mainsail, the genoa having already been ⅔ furled.

Before the mainsail could be reefed, the heel rapidly increased, and at about 0320 the boat very quickly inverted, trapping the skipper inside the cabin. Once in the water, three of the crew made their way to the transom and immediately noticed that the keel was missing.

One of the crew was not wearing a lifejacket and found it difficult to keep himself afloat; despite this he set about cutting the liferaft lashings at the transom. One of the others was wearing an auto-inflation lifejacket, which had operated, and the other crew member was wearing a manual inflation lifejacket, which he did not inflate. Despite this rapid change in circumstances, the skipper kept calm in the upturned yacht. He managed to locate and push the flare box and grab bag out of the cabin. These floated to the surface and the flares were set off. At the third attempt the skipper escaped from the cabin, but there was no sign of the fifth crew member.

The skipper, who was not wearing a lifejacket, was slipping in and out of consciousness, and was suffering the effects of hypothermia. Fortunately the crewman wearing the auto-inflated lifejacket was able to support him.

The crew managed to cut the liferaft free and set off the flares held in the liferaft. They were rescued at 0430 by a nearby ship. The body of the missing crew member was recovered by a lifeboat at 0655.

Investigations found that the fabricated steel keel had failed just below the fillet weld connecting the fin to the taper box (see Figure 1). Laboratory metallurgical analysis confirmed that the keel had suffered fatigue failure due to reverse bending stresses. Defects were also found in the keel taper box welds, and two of the three keel bolts had also failed.

It was further discovered that the boat builder had sub-contracted the hollow keel construction to a steel fabricator who had no marine experience. The fabricator changed the original design, and incorporated a fillet weld in a critical area. He did so to ease manufacture and reduce costs, but without the supporting calculations to assess the stresses to which the keel would be subjected. He did not consult with the designer on the changes. In 2005, 160kg of lead was added to the keel bulb for racing optimisation reasons. Once again there were no supporting calculations, nor were there detailed checks made against the "original" or "as built" designs to ensure that the modification was safe.

It was found that none of the designs achieved the required Safety Factor of 2. The addition of

Figure 1

Figure 2

the extra bulb weight exacerbated the problem and the keel was unable to withstand the "in service" bending stresses, and this led to the conditions of failure.

When the boat was taken out of the water at the end of the 2006 racing season, considerable detachment of the keel's epoxy filler and anti-fouling was found (see Figure 2). There was also evidence of the likelihood of fine cracking in the steel adjacent to the fillet weld, but this went undetected by the repairer, so the last chance to prevent the accident was missed.

The Lessons

1. **Yacht designers should ensure component designs satisfy the appropriate standard safety factor requirements. In this case, the keel steel's full ultimate tensile strength was used in the calculations instead of yield strength, and thus an artificially high safety factor was achieved.**

2. **Changes to critical parts such as hollow, highly stressed keels, should be properly worked through and supported with calculations to ensure their suitability. Owners should seek expert professional advice, and wherever possible, reference should be made to design drawings, and the designer/builder consulted to check construction details and suitability of the modification.**

3. **Do not dismiss the importance of keel coating detachment, or evidence of cracking of the coatings at the keel to hull interface; this may indicate more deep seated keel structural problems. Seek expert advice – you may need to use non-destructive procedures to check that the keel structure is sound. Also, regularly check the tightness of keel bolts and thoroughly investigate the cause of any failures. *Remember*, action at this stage could save your life.**

4. **The RNLI recommends that liferafts are secured on deck and that nothing is stowed on top of them. Hydrostatic Release Units (HRU) can be fitted to automatically release liferafts in a sinking or capsize situation. Where it is not practicable to fit an HRU, skippers and owners should consider securing liferafts with quick release knots to expedite release.**

5. **It is always good practice to wear your lifejacket while on deck. It significantly improves the chances of survival, and in cold waters, in the middle of the night, it will prove to be your very best friend. Look after it, know how to use it and maintain it correctly.**

Wayfarer Sailors Have Narrow Escape

Narrative

Two Wayfarer class sailing dinghies were crossing the Solent, close-hauled in a fresh breeze and good visibility. The boats were sailing abeam of each other about 150m apart on a parallel course.

The crew of the windward Wayfarer saw a powerboat cross close in front of their leeward companion before continuing towards them and hitting them amidships with great force. The dinghy was almost cut in two and dismasted. The helmsman sustained head injuries from the impact and was thrown into the water. The crew, who was sitting further forward, passed underneath the powerboat and fortunately was missed by the propellers. He then had to disentangle himself from rigging and wreckage to reach the surface, from where he and his helmsman were recovered by the powerboat.

The semi-submerged dinghy was taken in tow by the powerboat and they started to make slow progress towards a harbour. However, the dinghy helmsman began to go into shock, and medical assistance was sought. He was transferred to an ambulance via a RIB, and was taken to hospital where he received treatment for concussion and shock.

Photograph courtesy of Steve O'Toole

Vessel being recovered

The Lessons

1. In the busy waters of the Solent, close-quarters situations between small craft are not uncommon, but catastrophic collisions are thankfully rare. The importance of keeping a proper lookout is obvious, but particularly so when navigating a large powerboat at high speed.

2. The powerboat was being operated single-handedly and was being steered from the interior steering position. The boat was of a semi-displacement design which tends to be fairly 'bow-up' when travelling at speed. Forward visibility can therefore be restricted by the boat's attitude. Such an accident is inevitable if no-one can see clearly ahead.

3. Although not the give-way vessel, had the crew of the Wayfarer been aware of the approaching powerboat, they could have made an emergency alteration to avoid/minimize the collision. The fact that the powerboat might have been obscured by the other Wayfarer, meant that the dinghy that was hit had very little time to take avoiding action. Additionally, vision to leeward would inevitably have been restricted by the sails, so the importance of frequently glancing under the boom is clear.

Great Fun Until it all Goes Wrong

Narrative

A new model of a 7m long, stepped deep V hull powerboat had been acquired by a leisure craft sales office. The outboard engine had a maximum power rating of 225kW (300hp), and had been supplied with a mid-range 21.5" pitch propeller. Meanwhile, the manufacturer of the powerboat had decided that an 18.5" propeller would give better performance, so had dispatched one to the sales office.

On receiving the replacement propeller, the manager tasked his contractor, an experienced powerboat driver, to fit the new propeller and to take the powerboat for a sea trial and find out how it performed at maximum speed. After fitting the new propeller, the contractor cast off and, while leaving the marina, pumped the bilges using the electric pump. The contractor took along with him a friend, as a passenger, having been granted the manager's permission to do so. There were two lifejackets in the forward cabin, but the contractor and his friend did not put them on, and they did not carry a VHF radio.

The contractor, who had the engine kill cord attached to him, made several straight runs at high speed with the engine trimmed out. At the end of the runs, he made wide turns at reduced speed and with the engine trimmed in. Before heading back to the marina, on the approach to the last turn, the contractor reduced speed by 25% and trimmed the engine in. He then made an "aggressive" turn to starboard, but the powerboat unexpectedly rolled to port and capsized.

The contractor and his friend were unhurt and managed to cling onto the upturned hull and wave to attract attention. Onlookers ashore saw them, and called the RNLI lifeboat service and the coastguard. Two passing jet skiers recovered the two men from the water and they were taken back to the marina. The upturned hull was returned to the beach, where it was recovered.

The Lessons

1. **The contractor was an experienced powerboat driver and had made "aggressive" turns before, although not with the same hull and propulsion unit configuration. Stepped hull powerboats have different handling characteristics to those associated with straightforward deep V hulls. The contractor was caught out by the configuration on this occasion; make sure you are not! If the boat configuration is new to you, seek professional advice before taking the boat through its paces.**

2. **Companies engaged in the sale of powerboats have a duty of care to their employees, contractors and customers. They should carry out risk assessments and implement appropriate and robust safety control measures. Particular attention should be paid to recognised driver training, the carriage of a VHF radio and the wearing of lifejackets.**

3. **The manufacturer's *Owner's Manual* gave advice that owners should receive appropriate training and that they should slow down when going into turns. This manual should also provide clear and specific safe handling advice for the particular class of powerboat, highlighting the real danger of capsize if such advice is not followed.**

CASE 25

Safety Briefing Saves the Day

Narrative

A 5-day motor cruiser hire on a calm inland waterway was a real treat for a couple and their 2 boys, especially so as one of the boys was disabled. It was going to be a great break, a chance to do a little fishing and, well, just to take it easy. However, a very unpleasant surprise was just around the corner.

The father was very safety conscious and made sure that the group paid attention to the safety briefing given by the hire company. They also paid close attention to the accompanying video, which provided advice on conning the vessel, its safety features and emergency actions. Not content with this introduction, the father insisted on being shown each of the cruiser's safety features.

Now fully prepared, the group left the berth to start their holiday. All went well for the first 2 days, and the experience certainly met the group's expectations. On the third day, the cruiser was brought alongside so that the group could buy provisions. A couple of hours later, at about 1815, the cruiser once again left the berth and headed out to the open water at about 5 knots.

A short time later, the disabled boy went to the bathroom which was located off the lounge, on the main deck, where the engine access hatch was also positioned. The other three members of the group were on the flying bridge. It was at this time that the father heard an extinguisher discharging. He looked through the glass access from the bridge to the lounge and saw the lounge rapidly filling with thick black smoke which was emanating from the engine compartment hatch. He tried to stop the engine from the bridge, but was unsuccessful.

The father, conscious that the disabled boy was in the bathroom, immediately went down into the lounge and found the engine emergency stop. He knew where it was located because he had been shown it during the safety briefing. He pulled it and stopped the engine because he wanted to prevent the chance of diesel fuel supplying the fire, which was clearly in the engine compartment.

The father then managed to take the disabled boy to the bridge so that he could be in fresh air. He instructed the family to go to the stern, to put them as far from the fire as possible. The father then went back to the lounge, where the smoke levels had reduced slightly.

He gathered a foam extinguisher, carefully lifted the engine hatch and discharged the extinguisher into the compartment. Having done as much as he could to fight the fire, the father alerted the emergency services. He then went to the stern of the cruiser to join the rest of his family, and instructed them to put on as much clothing as possible and to don their lifejackets. He checked that they were fitted correctly and instructed them that the group should stay together if they had to abandon the vessel.

While waiting for the emergency services to arrive, the father heard the lounge deck cracking and assumed that the fire had re-ignited. The engine then restarted, and the cruiser slowly headed towards the bank. After about 5 minutes, the engine stopped, by which time the cruiser was close to the bank. Conscious that it may be necessary to abandon the cruiser, the father decided to jump into the water to test the depth and so enable him to make a decision on the best way to take his family to safety. Fortunately, he found that he was able to walk in the water.

The emergency services arrived and took the group off the cruiser. The vessel was then taken under tow to a nearby jetty, where it was met by the local Fire and Rescue Services, who extinguished the fire.

The Lessons

This case illustrates the importance of thorough safety briefings, and the need to pay careful attention to them. The father of the group was especially safety conscious and had prepared himself well for an emergency situation. All too often, those enjoying boating on benign waters do not consider themselves as susceptible to emergencies as those on open waters.

The father thought his way through the situation, and even if it had become necessary to abandon the cruiser, he had a plan which the entire group understood. This ensured the best chance of survival.

The subsequent investigation found that the most likely cause of the accident was an electrical short as the cable exited a metal conduit. The engine re-started when the insulation burnt through on the start electrics, which connected the start circuits. The engine subsequently stopped as the fuel pipes failed.

The following lessons emerged from this accident:

1. Make sure everyone pays attention to the safety briefing – it could save your life and others.
2. Know where the lifejackets are stowed, and where the emergency stops and fire extinguishers are located.
3. Keep calm – it helps you to think more clearly, and others around you will have confidence in your actions.
4. Take people to a point of safety away from the fire.
5. Don lifejackets and be prepared to abandon the vessel.
6. Be very careful when opening hatches/doors where there has been a fire; the sudden inrush of oxygen can cause re-ignition, with fatal results.
7. Check that electric circuits are in good condition and that fuel pipes are free from chaffing.
8. Attend to fuel leaks promptly.

APPENDIX A

Preliminary examinations started in the period 01/03/08 – 30/06/08

A preliminary examination identifies the causes and circumstances of an accident to see if it meets the criteria required to warrant a full investigation, which will culminate in a publicly available report.

Date of Accident	Name of Vessel	Type of Vessel	Flag	Size	Type of Accident
04/03/08	*Horizon*	Fishing vessel	UK	41.55	Grounding
	Sanlormaho II	Fishing vessel	UK	67	Acc to person (1 fatality)
04/04/08	*Lady of Rudding* *Datchet*	Pleasure craft Tug	UK UK	22 62	Collision
05/05/08	*Courageous III*	Fishing vessel	UK	177	Grounding
09/05/08	*Oceana*	Fishing vessel	UK	14.68	Grounding
14/05/08	*Queen Victoria*	Cruise ship	UK	90049	Contact
22/05/08	*Englishman*	Tug	UK	329	Acc to person (1 fatality)
23/05/08	*Bountiful*	Fishing vessel	UK	93	Grounding
29/05/08	*Girl Patricia*	Fishing vessel	UK	39.22	Foundering
05/06/08	*Mistress Quickly*	Amphibious vessel	UK	8	Machinery failure
	Wind Solution	Ro-ro vehicle passenger ferry	UK	8893	Contact
07/06/08	*Navion Torinita* *Fast Filip*	Tanker General cargo	Bahamas Vanuatu	58911 1740	Collision
08/06/08	*Maike D*	Container	UK	6326	Escape of harmful substance
21/06/08	*Varmland*	Container	UK	6434	Acc to person (1 fatality)
	Overseas Camar	Product Tanker	Marshall Islands	26113	Machinery failure
23/06/08	*Misty Dawn*	Fishing vessel	UK	2.4	Capsize/listing
24/06/08	*Guyona*	Fishing vessel	UK	34.23	Foundering
25/06/08	*Montis*	General Cargo	Germany	1649	Contact
29/06/08	*Antari*	General Cargo	Antigua & Barbuda	2446	Grounding
30/06/08	*Moondance*	Ro-ro vehicle passenger ferry	Bahamas	5881	Grounding

Investigations started in the period 01/03/08 – 30/06/08

Date of Accident	Name of Vessel	Type of Vessel	Flag	Size	Type of Accident
10/03/08	*Astral*	Chemical Tanker	Sweden	7636	Grounding
20/04/08	*Partner 1*	Small commercial RIB	UK	Unknown	Hull failure
12/05/08	*CFL Performer*	General cargo	Netherlands, Antilles & Aruba	4106	Grounding
15/05/08	*Costa Atlantica* *Grand Neptune*	Cruise ship Dry cargo	Italy Panama	85619 59217	Hazardous incident
11/06/08	*Saga Rose*	Cruise ship	Bahamas	24258	Acc to person (1 fatality)

Reports issued in 2008

Audacity/Leonis – collision at the entrance to the River Humber on 14 April 2007
Published 25 January

Dublin Viking – parting of a mooring line alongside at Berth 52 in the Port of Dublin, Ireland, resulting in one fatality on 7 August 2007
Published 31 March

Lady Candida – fire and subsequent sinking off Corsica on 28 July 2007
Published 18 February

Lady Hamilton/Blithe Spirit – collision between fishing vessels in Falmouth Bay, Cornwall on 3 October 2007
Published 15 April

Last Call – foundering of motor cruiser at Whitby on 23 November 2007 with the loss of three lives
Published 30 June

Logos II – two accidents during berthing and unberthing, St Helier, Jersey on 20 and 26 June 2007
Published 22 January

MSC Napoli – structural failure in the English Channel on 18 January 2007
Published 22 April

Pacific Star – heavy weather damage sustained by passenger cruise ship while on passage in the South Pacific Ocean on 10 July 2007
Published 29 February

***Rigid Raider* (Army Cadet Force Rigid Raiding Landing Craft)** – capsize of craft in Loch Carnan, South Uist in the Western Isles of Scotland on 3 August, resulting in one fatality
Published 18 March

Ursine & Pride of Bruges – contact between two vessels, King George Dock, Hull on 13 November 2007
Published 30 May

Young Lady – vessel dragging anchor 5 miles east of Teesport and snagging the CATS pipeline, resulting in material damage to the pipe on 25 June 2007
Published 1 February

Leisure Craft Safety Digest 2nd Edition
Published March

Safety Digest 1/2008 Published 1 April