Marine Accident Investigation Branch (MAIB) - Safety Digest 3/2001

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MARINE ACCIDENT INVESTIGATION BRANCH

The Marine Accident Investigation Branch (MAIB) is an independent part of the Department for Transport, Local Government and the Regions, and is completely separate from the Maritime and Coastguard Agency (MCA). The Chief Inspector of Marine Accidents is responsible to the Secretary of State for Transport, Local Government and the Regions. 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. It contains facts that 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.

The Safety Digest is only available from the Department for Transport, Local Government and the Regions, and can be obtained by applying to the MAIB. Other publications are available from The Stationery Office and the DTLR Publications Sale Centre, Unit 21, Goldthorpe Industrial Estate, Goldthorpe, Rotherham, S63 9BL (Tel: 01709 891318)

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023 8023 2527

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Extract from The Merchant Shipping (Accident Reporting and Investigation) Regulations 1999

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

Glossary of Terms and Abbreviations

AB	Able Seaman
ARC	Atlantic Rally for Cruises
ARPA	Automatic Radar Plotting Aid
DGPS	Differential Global Positioning System
EPIRB	Emergency Position Indicating Radio Beacon
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GT	Gross tonnes
HAZ	Heat Affected Zone
HSE	Health and Safety Executive
LPG	Liquefied Petroleum Gas
OOW	Officer of the Watch
RYA	Royal Yachting Association
SAR	Search and Rescue
SCBA	Self-contained Breathing Apparatus
TSS	Traffic Separation Scheme
UMS	Unmanned Machinery Space
VHF	Very High Frequency
VLCC	Very Large Crude Carrier

INTRODUCTION

On October 15, 1913, a poem titled "Our Fathers" by a Captain R A Hopwood, Royal Navy, appeared in *The Naval and Military Record.* It was written during the naval manoeuvres that year and was dedicated to the memory of the nameless killed and wounded at sea. It appeared a few months before World War I broke out.

One verse in the poem stands out, and is as relevant today as it was then.

> *In an age of swift invention it is frequently believed*
> *That the pressure of a button is as good as work achieved:*
> *But the optimist inventor should remember, if he can,*
> *Though the instrument be perfect, there are limits to the man.*

Nothing much has changed.

We live in an age of rapidly advancing technology. It dominates much of our lives and has made a major contribution to economic success, the business of shipping and other forms of seafaring, and safety at sea. It has enabled substantial savings to be made in operating costs. It is now possible to communicate instantly around the world, for much of the drudgery of working at sea to be removed, and for complex calculations to be made in a microsecond.

But for all its undoubted advantages, there are three factors that are as relevant today as they have always been:

The sea is still as unforgiving of mistakes as ever.

- Even the most sophisticated 'machine' (and I include computers) can either malfunction or be incorrectly operated.
- And there are limits to the man.

Man still has to make the decisions. Man still has the pair of eyes to actually see what is happening, rather than having implicit faith in what the computer tells him. Man still has the ears and sense of smell to alert him to something that isn't right. Man still has the extraordinary ability to make mistakes, and to prevent them.

The good seafarer possesses an instinctive feel for what is going to happen next, and will constantly be making what modern terminology describes as risk assessments. But if the man is badly treated, ignored, taken for granted, overworked, or is made to live in fear of his job, he cannot possibly give of his best. Man is the single greatest asset the shipowner has. He is worth looking after, and money spent training him will pay handsome dividends.

For the man at sea, however, learning about how people react in certain situations, understanding how the mind functions and realising just how important adequate rest is, will make the vessel you are serving in a more effective and, ultimately, a happier place to both live and work if the right kind of leadership is provided.

This edition of the *Safety Digest* contains a number of references to the human factor, and readers are invited to focus their attention on these to see what can be learned. A deep understanding of this issue is one of the last great challenges of the sea. And it faces us all.

Bon Voyage.

J. S. Lang
Chief Inspector of Marine Accidents

PART 1 - MERCHANT VESSELS

A feature of life at sea today is modern technology such as electronic charts, unmanned machinery spaces and satellite communications. Whether we like it or not the oil lamp, topgallants, oilskins, morning stars, Morse code, and the steam reciprocating engine are distant memories to most of us.

The ancient mariner might find certain features of today's equipment a little perplexing but, with his grasp of basic skills, he will usually be in a position to cope with the challenges presented by the sea. On the other hand the younger seafarer may well have a better understanding of the technology involved and might be something of a prodigy on the keyboard, but could be floored if the system fails.

The reality is that all of us at sea, both young and old, on deck or in the engine room, hotel staff or franchise holder, have to live with technology. It features in every shape and form from computer-controlled equipment to navigation aids, from alarm monitoring to system diagnostics, and from cargo handling to the exchange of data.

It goes without saying that the value of such systems is degraded if we, the operators, do not know how to use them properly.

There are three issues to consider: an ability to operate the system or equipment correctly, an understanding of any limitations, and an awareness of the 'distraction' factor.

Knowing how to use technology is a basic requirement, but many of us are not as good as we should be. Analysis of accident investigations frequently reveals, for instance, shortcomings with the human/technology interface.

Most of us know the basics but are thrown if we push the wrong button, or the system defaults in some way. We sometimes come across seafarers who are provided with perfectly reliable equipment but are not using it correctly because they don't know how to, and are too embarrassed to say so. Training is the key to overcoming such shortcomings, but it must embrace both normal and abnormal situations. One example of operator error we see over and over again is the failure to change from auto steering to hand, or vice versa, and especially when tension on the bridge is high. Practice makes perfect.

Some systems give a sense of security that isn't always justified. Navigation aids fall into this category, and there are numerous examples of watchkeepers who assume GPS is infallible and don't bother to cross-check the ship's position by independent means. Going aground is not popular.

Or there is the person who worships at the shrine of the ARPA and fails to look out of the window. Over reliance on automation is often found to be a crucial factor in accident causes.

Looking at limitations from a different direction, we must not forget the poor operator who sometimes has to absorb an excessive amount of information. Anyone working alone soon becomes swamped, and there is an expectation that people will react correctly and instantly to an alarm in a crisis situation. This rarely happens. Research shows it usually takes at least 30 seconds for an operator to react correctly.

Finally the 'distraction' factor. Some people become so absorbed by the system that they forget to get on with the job in hand. It is a curious characteristic of the human that when the telephone rings, he or she feels compelled to answer it. GMDSS can be a major distraction. If you feel tempted to respond to them at precisely the same moment you find yourself on a collision course

with another vessel, there should be no prizes for guessing which requirement takes priority. Too many watchkeepers think it's the telephone!

CASE 1
Bad Dream Becomes a Reality - Middle Watch Grounding

Narrative

While on passage from the Turkish port of Izmir, to Goia Tauro in Italy, the 7,720gt Cayman Islands-registered container ship *Captain Spyros* became stranded on Psara Island in the Aegean Sea in the early hours of 1 October 2000.

Built in 1977, all her certificates were in date, she had three qualified deck officers in addition to the master, and was equipped with a full range of navigational equipment, including two radars and a GPS. She was employed on a weekly round voyage between Izmir, Goia Tauro and Piraeus.

She had sailed from Izmir at 2145 on 30 September on what was a routine and familiar passage. Visibility was good and it was a clear dark night. The second officer relieved the third officer at midnight and the ship's position, derived from the GPS, was being plotted on the chart from time to time. The charts in use had the courses to steer marked in black ink and could not be erased. An AB shared the bridge watch.

Course was altered at 0025, and again at 0047, with the ship's position being plotted on the chart each time she settled on to a new course. At 0243 she altered course again, to 237° and, once again, the position was plotted.

About 45 minutes later there was a violent shuddering motion as *Captain Spyros* grounded at full speed on the steep, rocky east coast of Psara Island. The entire ship's company was woken. The time was 0325.

The vessel was eventually refloated with the assistance of tugs, and was towed to Piraeus.

The Lessons

1. Even a well-equipped vessel with fully qualified officers who are familiar with a particular passage, can run aground on a well charted island. In this instance there were no problems in establishing the ship's position, and it was a clear night with good visibility. Why then did it happen?

2. This ship was on a regular route, and the courses had been indelibly marked on the chart. So, too, had the courses to steer. The numerals 237 were clearly evident, as was the reciprocal 157 for the return voyage. After the grounding it was found that the automatic steering had been set to 257°. Although the investigators could not prove the point beyond doubt, there was at least the possibility that the officer of the watch had inadvertently set the wrong course, having mixed up 237 with 157 in his mind, and arrived at 257°. It could explain the discrepancy.

3. Much more to the point is why, if as seems likely, this happened and why did nobody notice?

4. The most common mistakes at sea are made by people who are tired, when they carry out very repetitive tasks, and are working between the hours of 0100 and 0600. The ingredients for error on 1 October were all in place.

5. Because of the schedule being kept, with a constant round of relatively short passages, periods at anchor, berthing and cargo work, deck officers and ratings onboard *Captain Spyros* were working very long hours and getting little sleep. In the day immediately preceding the grounding both the second officer, and the AB sharing his watch, had worked in excess of 15 hours. There is no record of how much sleep they had managed to achieve, but both had been up for much of the previous night. Their time off duty before coming on watch at midnight had been less than an hour.

6. Very, very few mariners will ever confess to being tired; it is part of the culture. Expressions such as fatigue or sleep deprivation don't feature in the daily vocabulary. Unfortunately the human body, and more particularly the brain, doesn't pay attention to what the mariner thinks; it needs sleep and adequate rest. Unless it gets them, individual alertness deteriorates, and mistakes will be made. Once this is recognised, however, and measures are put in place to offset the risk of error, the chances of something going badly wrong are much reduced.

7. The conscientious navigator makes two basic checks when the time comes to alter course. He checks that the course drawn on the chart actually matches the numerals written alongside it, and double-checks to see it is safe by looking along the bearing of the new course to be steered.

8. A fix, from whatever the source, merely tells you where you were at a particular moment. To verify its accuracy, use some other means to confirm it. Fixes using visual means are still among the best means of all. GPS is extraordinarily accurate, but students of marine casualties will have noted the number of times a misplotted or misread position has led to a grounding. Never rely on a GPS position alone. You may get away with it 999 times out of a 1000, but the 1000th time will catch you out, probably in the middle watch. No doubt you will have assumed that the neat position drawn on the chart was correct. If an error creeps in, no matter how derived, and you don't notice it, the consequences could be very expensive indeed and lead to your becoming acquainted with all sorts of people you never knew existed.

9. Once a position has been plotted, the projected track and dead reckoning must be calculated. Any unexplained variation from the anticipated track will be the trigger to establish the reasons.

10. Plot fixes at regular intervals: the closer to land or other hazards, the more frequent they should be. All will be important, but none more so than those following a course alteration. If the wrong course has been set, it will start to show up when the plotted positions start to diverge from the planned track.

11. The oft-repeated phrase "keeping a good lookout" is not confined to the avoidance of collision. It also means you are responsible for preventing your vessel from hitting charted hazards. If navigating in the vicinity of islands, it pays to be particularly vigilant when looking ahead. A good pair of eyes, and frequent looks at the radar, will ensure you are not running into danger.

Footnote

This article has been prepared from a report produced by the Cayman Islands Shipping Registry, whose assistance and co-operation is gratefully acknowledged.

CASE 2
Rudder Fatigue

Narrative

Arco Avon, a 3,474gt dredger, completed dredging for sand at 0100 on 20 November 2000 and started her passage to Flushing for discharge. The sea was slight with a gentle south-west breeze.

At 0300, following a course alteration to avoid a fishing vessel, the dredger failed to respond to the helm and she continued to turn to starboard. The navigating officer, realising that he had lost steering control, called the master, who immediately reduced the propeller pitch to zero and succeeded in checking the swing. The chief engineer was called and, with the vessel stationary, the steering system was tested. This found the steering system itself to be operating correctly, and that fault lay outboard. Either the rudder was damaged or it had been lost. The vessel anchored clear of shipping.

The company was advised of the situation, and arrangements were made for a tow to Hull for a full investigation and repairs. A tug arrived at 2005 and preparations were made for the tow. The weather had deteriorated and was recorded as south-west force 6 to 7 with rough seas.

By 0725 the following morning the tow got underway, and at 0352 on 23 November the dredger arrived alongside to discharge. By 0800, with the sand partially discharged, and the rudder palm clear of the water line, it became evident that the rudder blade itself was missing. Once the discharge was complete the vessel moved to a repair berth, where work started on removing the palm bolts and remains of the rudder blade, and the withdrawal of the rudderstock. Examination found that the weld metal securing the rudder blade to the blade palm was intact, but the parent blade metal had failed. All six 110mm fitted palm bolts showed signs of stretching, with the securing nuts missing from the starboard forward and the port aft bolts. Further inspection showed that the parent metal had fractured in the heat affected zone (HAZ) adjacent to the welding.

The rudder is a semi-balanced spade type with a high angle of turn capability for slow speed manoeuvring. The vessel generally turns hard to starboard at the end of each run while dredging with a maximum rudder angle of 35° as per company policy. The closing plate of the rudder is on the starboard side.

With metal fatigue identified as the cause of the rudder loss, the company, after consulting with Bureau Veritas, made a number of design modifications to both the rudder palm and the rudder. This included providing extra internal stiffening in the rudder, thicker rudder shell plates to allow double-sided welding, and changing the rudder blade palm shape so that the rudder leading edge could be welded directly on to the palm. These modifications will also be carried out on the company's other vessels.

Following successful testing of all welds, and a test assembly of the modified rudder and stock in the workshop, the parts were separated and transported to the dry-dock for fitting back into the vessel.

The Lessons

This incident illustrates the importance of good shipboard management team training. As soon as the watchkeeping officer became aware of the loss of steering, he called the master. Emergency procedures were followed, engine speed was reduced and the vessel's position was

established in relation to the traffic zone. Only then was the company informed and the vessel anchored.

Steering failures of this nature are fortunately very rare, but as this incident demonstrates, it could happen. Imagine the situation if this had occurred in a river, a narrow channel, restricted waterway or just as you were about to pass another vessel at close range. What would YOU do? Stop the main engine, put it full astern, try the emergency steering, hoist the NUC shapes or lights or just shout for help?

There is no textbook answer; so much depends on the circumstances. But what is clear is that the action must be prompt. And prompt actions that are correct are entirely dependent on having thought through in advance how you might react.

CASE 3
Inadequately Secured Deck Cargo

Narrative

On 4 February 2001, the 2,997gt general cargo vessel *Sardinia,* was on passage from Belfast to Grangemouth on the Firth of Forth, with a cargo of 119 empty, non-standard 10.5m containers. Stowed on deck were 63 containers. The remainder were in the single hold.

Weather conditions for the first part of the passage were fair, with wind force 3 to 5 from the north-west. After passing through the Pentland Firth and turning south, the vessel encountered force 8 to 9 winds from the south-east, causing a short steep swell, which made her pitch and roll heavily. The master reduced speed and altered course into the sea to reduce the movement. However, the wind increased to force 10 and the vessel started to ship heavy seas over the deck, causing some containers to move.

When 5 miles south-east of Peterhead Harbour, some lashings failed, and a number of containers were washed over the side, tearing away sections of railing.

The vessel usually carried only bulk cargoes, and was only equipped with wire lashings to carry timber deck cargoes. Slides for stacking devices to rest 7m and 14m containers were fitted on the hatch covers, including pillars at the extreme breadth of the ship, allowing carriage of 4 across if required. However, the hatch covers were not fitted with lugs for attaching lashing bars, and bottle screws to secure containers.

The vessel was equipped with an approved cargo-securing manual, which provided information on securing 7m (20ft) and 14m (40ft) containers, but not for the non-standard 10.5m (30ft) containers on board.

These containers were secured 3 across by mounting the corners of one end of the lower stack of containers in stacking devices, and the other end was mounted on timber, which was not secured against sliding. Tiers 2 and 3 were then placed on twist locks fitted to the corners of each container. Each stack (consisting of 9 boxes in tiers of 3), was then lashed with a single steel cable at each end from lashing points on the port and starboard hatch coamings, across the top of the stack. There were 7 such stacks of nine containers stowed on deck.

The Lessons

1. It must be recognised that securing a deck cargo of containers against heavy seas is difficult, especially on a relatively small non-container vessel. However, every effort should be made to secure containers and their supports such that they can withstand such impacts.

The securing devices should be arranged in a way to tolerate transverse and longitudinal forces which may result in sliding or tipping.

2. Containers should be secured using 1 of the 3 methods recommended in Figure 1, Annex 1 of the '*Code of Safe Practice for Cargo Stowage and Securing*' published by the International Maritime Organisation*. Such an arrangement requires the vessel to be fitted with the necessary securing devices to allow deck cargoes of containers to be carried with maximum security.

3. If a vessel is expected to carry a deck cargo of containers, the ship's cargo-securing equipment should be:

- **Available in sufficient quantity;**
- **Suitable for its intended purpose, taking into account the recommendations of the 'Cargo Securing Manual';**
- **Of adequate strength; and**
- **Well-maintained.**

4. The ship owner, operator and shore agent should use relevant expertise when considering the shipment of containers with non-standard characteristics. The containers may require special attention to their stowage and securing, and the weather conditions which may be expected during the intended voyage.

*'Code of Safe Practice for Cargo Stowage', ISBN 92-801-1290-2, IMO sales number: IMO -292E. International Maritime Organisation, 4 Albert Embankment, London, SE1 7SR

CASE 4
Confined Space - Life or Death ?

Narrative

Baltiyskiy-107 was on passage from Riga, Latvia, to the UK port of Poole with a cargo of sawn timber and bundles of pallet timber. At 1230 on Sunday 11 September 2000, when about 70 miles north-north-west of the Hook of Holland, a seaman working in the forecastle, went aft.

When he failed to return, the bosun went to find him and, while making his way aft past No 2 hold, he noticed the cargo cover lashings were undone. He looked more closely and found the hatch cover to the access shaft wedged open. He then saw the seaman's body at the bottom of the shaft. He called for assistance, and with other crew members, went to the man's aid, wearing self-contained breathing apparatus (SCBA).

Despite resuscitation attempts, the seaman could not be revived. Both the Russian and UK authorities were informed, and *Baltiyskiy-107* continued to Poole where the police met her. Before unloading, the atmosphere in the access shaft to No 2 hold was tested and showed very low levels of oxygen.

It is not known why the seaman chose to enter the shaft alone, without authority and without following standard procedures. For whatever reason, he did so and, tragically died as a result.

The Lessons

The main lesson to emerge from this tragedy is that nobody should EVER enter a confined space without first making sure the procedures for ensuring safe entry have been complied with.

The *Code of Safe Working Practices for Merchant Seamen* has a special section, Chapter 17, which deals exclusively with the dangers of enclosed spaces and what precautions should be taken. You should also be aware that *confined spaces* could mean any space on a ship which, by virtue of its structure and lack of ventilation, becomes a confined space. This could be somewhere relatively innocent like a storeroom, unused cabin, or areas such as boiler furnaces, steam drums, ductwork etc.

In this accident:

1. The man entered the space alone and unauthorised - he did not ask permission, nor did he tell anyone where he was going or what he was doing.

2. He did not check the atmosphere before entering, or attempt to ventilate the space.

3. Access was limited, and prevented entry wearing the SCBA (the SCBA set was passed to the rescuer once he had entered the shaft).

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in May 2001.
It can be obtained free of charge by writing to the MAIB.

CASE 5
Near miss in Dover Straits

Narrative

A 106m tanker was transiting the Dover Strait at about 13.5 knots in the south-west bound lane of the traffic separation scheme (TSS) and was overtaking a small vessel on her starboard side. Her officer of the watch (OOW) observed a small general cargo vessel crossing from port to starboard making about 8 knots. Before crossing the traffic lane, the cargo vessel informed Dover Coastguard of her intentions.

When the distance between the two had closed to 4 miles, the tanker's OOW assessed that a risk of collision existed. The crossing vessel took no action. At a range of about 2 miles, the tanker tried calling on VHF and flashed his Aldis light. There was no response. The range closed further.

As the tanker (the stand-on vessel) was unable to alter her course to starboard because of the close proximity of the vessel being overtaken, she reduced speed and came hard-to-port.

The tanker passed astern of the crossing vessel at a distance of about 0.8 miles. The crossing vessel took no action throughout the incident.

The Lessons

1. Every bridge watchkeeper will be familiar with this type of incident, and similar experiences will have added to the grey hairs of many mariners. We do not know what was going through the mind of the person on watch in the small cargo vessel, but the Dover Strait is one of the busiest waterways in the world, and transiting it requires concentration, anticipation and a high degree of "situational awareness." It demands a full understanding of the Rules and the confidence to implement them correctly without embarrassing the 'other' vessel.

2. It is possible the 'give-way' vessel thought he could safely cross in front of the vessel transiting the south-west bound lane of the TSS. It might have seemed straightforward to the OOW in the small cargo ship, but it clearly agitated his opposite number in the tanker. Think carefully about how the other man will interpret your actions. Alteration of course to starboard, and/or slowing down by the give-way vessel, is preferable to crossing a vessel ahead (Rule 15 COLREGS) even if the alteration required is in excess of 60 degrees.

3. An alteration to port by the stand-on vessel should, where possible, be avoided (Rule 17 COLREGS).

4. If possible, it is always better to overtake a vessel on your port side to leave the starboard side clear for alterations.

5. The fact that the coastguard has been informed of intended action does not relieve a vessel of her obligations under the *International Regulations for Preventing Collisions at Sea.*

Footnote

This incident was reported as a hazardous incident. To encourage further such reports, the identities of the two vessels concerned are not revealed.

CASE 6
Cold Comfort

Narrative

Sun Sophia, a 4,482gt refrigerated reefer vessel was berthed alongside at Albert Quay, Peterhead, to load frozen fish. A local stevedoring company was engaged to load and stow it using pallets in the centre tweendecks of holds Nos 1 and 3. Both tweendecks had been cooled to a temperature of approximately 20° C before loading. Once on board, the pallets were moved by LPG-powered fork-lift trucks to where a team of stevedores manually stacked them around the tweendeck.

As loading progressed, a number of the stevedores complained of headaches and nausea. The situation gradually deteriorated until all loading was stopped. Because shore workers were involved, the Health and Safety Executive was contacted. It was initially thought the source of the problem could be attributed to the ship's refrigeration system, but further investigation showed it to be a build-up of noxious fumes within the tweendecks.

The use of an LPG-powered fork-lift truck in a 20° C environment is thought to have reduced the effectiveness of combustion within the engine. This in turn led to increased quantities of noxious fumes e.g. carbon monoxide, nitrogen monoxide, butane etc, being produced in the exhaust. With the fork-lift truck operating mainly within an enclosed and still air environment, these various gases slowly built up until the stevedores became affected. The resultant assimilation of carbon monoxide into the blood, via the lungs, led to increasing levels of headaches, nausea and general weakness.

Subsequent discussion with the manufacturers of the fork-lift truck confirmed that the recommended vehicle for tweendeck operation was the electrically-powered version.

The Lessons

1. DO NOT use vehicles powered by internal combustion engines within an enclosed or restricted space. If it cannot be avoided, ensure that mechanical ventilation is available and that the space is well ventilated.

2. DO NOT leave the engine running when the fork-lift truck is not being used.

These two lessons are identified in Chapter 21, paragraph 21.8.4 of the *Code of Safe Working Practices for Merchant Seamen.*

During the HSE investigation of this incident, an inspector of the Health and Safety (Occupational Health) section was asked to provide details of the likely effects of carbon monoxide on the human body. Part of their response is reproduced below:

Carbon Monoxide

Carbon monoxide is a colourless, odourless, non-irritating gas, which is slightly soluble in water and burns in air with a bright blue flame. It is a widely encountered toxic gas and is a product of the incomplete combustion of carbon-containing fuels such as gas, domestic or bottled, coal, oil or wood. It is also produced by natural processes within the human body. With external exposure to additional carbon monoxide, subtle adverse health effects begin to occur. Exposure to higher levels can result eventually in death. These adverse health effects are largely the result of the formation of carboxyhaemoglobin, which impairs the oxygen-carrying capacity of the blood.

An occupational exposure standard has been set for carbon monoxide of 3Oppm long-term exposure limit (8-hour TWA reference period) or, 200ppm short-term exposure limit (15 minutes reference period). The aim of an Occupational Exposure Standard is to protect workers from the harmful effects of exposure to carbon monoxide. EH 40[1] (EH4O/2000 Occupational Exposure Limits 2000 HSE Books) states that extended periods of exposure around the STEL, particularly without interruption, causes adverse health effects, and should be avoided.

When we breathe in air, the oxygen content is transferred from the lungs to the oxygen-deficient circulating venous blood. This oxygenated blood then returns to the heart to be pumped around the body.

The blood contains a red pigment called haemoglobin in the red blood cells. Haemoglobin has a very strong affinity for oxygen, and when they come into contact the oxygen is absorbed, forming oxy-haemoglobin. This oxy-haemoglobin will readily release the oxygen from the haemoglobin into the tissues.

Carbon monoxide is a chemical asphyxiant because haemoglobin has a greater affinity (over 200 times more) for carbon monoxide than it does for oxygen. Haemoglobin and carbon monoxide combine to form carboxyhaemoglobin. Carbon monoxide will also impede the release of oxygen into the tissues. Carboxyhaemoglobin is a stable compound with a half-life of 4 to 5 hours (the half-life of substance is the time taken for its concentration to fall to half its original value on cessation of exposure and uptake).

Carboxyhaemoglobin is found in everyone's blood. This is produced naturally by normal metabolism, usually between 0.3% and 0.7%. There is no detriment to health at this level.

Environmental factors and lifestyle habits will raise carboxyhaemoglobin levels. For example, tobacco smoke contains carbon monoxide and is the commonest cause of elevated carboxyhaemoglobin. Urban non-smokers may have a level of between 1% to 2% haemoglobin converted into carboxyhaemoglobin. Cigarette smokers have on average, carboxyhaemoglobins of between 5% and 6%. Heavy smokers can have levels in excess of 10%. There is some variation in individual susceptibility to the poisoning effects of carbon monoxide. However, a level greater than 5% in a non smoker, and greater than 10% in a smoker, would suggest an additional source of carbon monoxide in inhaled air[2].

In general, once more than 10% of haemoglobin has been converted into carboxyhaemoglobin, serious impairment of oxygen transportation begins. The sufferer may begin to notice tightness across the forehead, with headache and mild breathlessness on exertion. As the amount of carboxyhaemoglobin increases, these symptoms become more severe and others develop.

When 20 to 30% of haemoglobin has been converted into carboxyhaemoglobin, the headache becomes severe.

At levels of 30 to 40% there is weakness, dizziness, nausea and vomiting.

Between 40 and 50%, the affected person can collapse and the heart and breathing rate will increase, which results in the uptake of more carbon monoxide.

At levels of 50 to 60% carboxyhaemoglobin, the individual will lose consciousness. Death becomes increasingly likely at levels greater than 60%.

CASE 7
The Explosive Force of High Speed Rotation!

Narrative

Aurora, a 76,152gt passenger vessel was cruising in the Mediterranean, on passage between Rhodes and Kusadasi. On the evening of 22 November, during the 8 to 12 watch, one of the watchkeeping engineers was assembling a lub oil purifier that had been stripped for maintenance by the earlier watch. Most of the work had been done, and only the top locking ring needed to be secured, and the clearances checked. On completion, the bowl hood was closed and the remaining connections refitted.

The purifier was then started and run up to the operating speed of 7500rpm. No unusual noises or vibration occurred. A number of water seal and ejection cycles were then successfully carried out to secure the correct location of the polyamide gaskets. The lub oil inlet valve was then opened, and a start made on adjusting the discharge backpressure.

At that moment, there was a major failure of the bowl assembly. The bowl hood became detached and a section broke free, which struck the watchkeeper a glancing blow. Other debris also started to fly around. The watchkeeper operated the emergency stop and vacated the area.

An inspection of the purifier found the bowl hood fractured and damaged internally, the separator spindle was bent, the upper parts of the bowl assembly were extensively damaged and the drive motor flange fractured. The upper locking ring, securing the bowl assembly, was found to be unmarked.

The absence of damage to the locking ring suggests the sequence of events was brought about by either a failure to fit the ring in the first place, or a failure to lock it securely after it had been assembled.

During the initial run-up to full speed, the lack of any upward pressure in the rotating bowl assembly would mean that nothing untoward would emerge until the lub oil inlet valve is opened. As soon as oil enters the bowl, the rotating elements are forced apart. Without the locking ring to impose restraint, the rotating elements would be forced upwards until they make contact with the stationary bowl hood. With the element assembly rotating at 7,500rpm, the stress levels on both the spindle drive assembly, and the underside of the bowl hood, eventually caused the bowl hood to fracture and fail at the top end. At the bottom end meanwhile, the flange to which the drive motor was attached also fractured.

The Lessons

This incident vividly illustrates the need for engineering staff to be continually aware of the potential dangers when undertaking maintenance. This is particularly important when dealing with high speed rotating machinery. Flying debris can kill.

1. Always CHECK, and DOUBLE-CHECK, the assembly of any rotating machinery before giving it a test run - if in doubt ASK. Better to be safe than DEAD.

2. If you are handing over an incomplete maintenance job, make sure that your relief KNOWS exactly where you stopped and what remains to be done.

3. If possible, always ensure that when you hand over, every part you have been dealing with is properly in place and secure - never assume that your relief will see it and carry out the correct procedure. Plan your work to ensure that you reach that point before you hand over.

CASE 8
Collision Between a Cargo Ship and Moored Yacht

Narrative

After departing Newport, Isle of Wight, the 1967-built small domestic cargo ship *Wightstone*, was proceeding on passage down the River Medina to the Solent and towards Southampton without a cargo. While passing the Folly Inn the master noticed his speed was greater than the local speed limit of 6 knots and he was creating a wash.

He reduced speed by pulling back on the fuel control, only to find that as he did so the engine stopped. At the same time the powered steering failed and the vessel began veering to port and towards some pontoons on the edge of the channel. It became obvious to the master that his vessel was going to collide with what appeared to be an unoccupied yacht moored alongside one of them. The ship's whistle was blown to alert anybody on board to the approaching danger.

Wightstone struck the yacht's port bow. It heeled on impact, and then floated free with her mooring ropes trailing. At exactly the same moment, and about 30 seconds after the engine had stopped, the engineer restarted it. With power restored the master went astern and backed off into the channel. He informed Cowes' harbourmaster of the incident and asked that assistance be provided for the yacht.

The Lessons

1. It is all too easy to exceed the maximum speed in harbours and rivers, particularly if you make the passage regularly and nobody has ever objected. Observe the speed limits; they have been imposed for a reason. Had the master not found it necessary to reduce speed on this occasion this accident is unlikely to have happened.

2. There are times, however, when it is necessary to reduce speed. You might be passing a dredger, or moored vessels or you think the wash is causing excessive damage to the environment. Few masters would give it a second thought other than observe good seamanship. Engine or steering failure (let alone both at once) are probably furthest from their minds but, as this instance has shown, it can happen. Having a ready prepared contingency plan will do much to minimise, or even prevent, the consequences.

3. In this incident, the failure of the main engine affected the steering. The channel was narrow, the speed relatively slow and there were pontoons and small craft adjacent to the main channel. The confined space and shortage of time did not permit a change to manual steering. To be effective, a contingency plan must take account of such constraints.

4. Contingency plans should look at everything, from making sure the anchors can be let go at short notice (if appropriate), to having an independent power drive to the steering gear.

5. This incident occurred in November and it is fortunate that the yacht involved was unoccupied. At another time of the year, such as in summer, the consequences could have been more serious had people been on board. Injuring people (or even worse), is likely to lead to some very difficult questions being asked. Prevention is always better than sorting out the mess afterwards.

6. The reason for the main engine stopping could have been the failure to allow time for it to achieve the correct operating temperature. The keel-cooled fresh water cooling system was

not fitted with a temperature controlled bypass which would have allowed the engine to reach normal operating temperature quickly.

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in June 2001. It can be obtained free of charge by writing to the MAIB.

CASE 9
Complacent Navigation Causes Ferry to Ground

Narrative

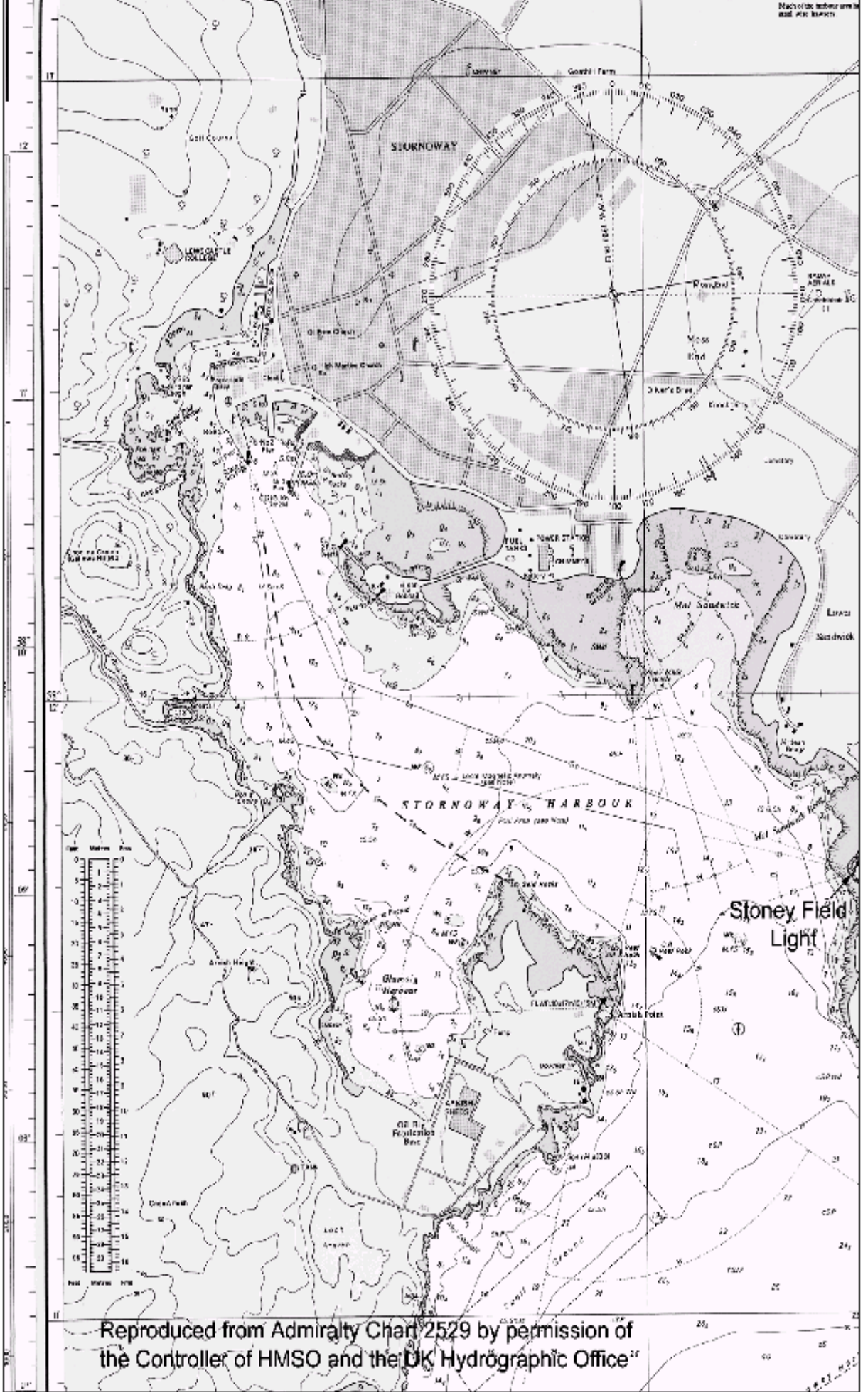
The 101m passenger ro-ro ferry *Clansman* briefly touched bottom on departure Stornoway at 0623 on 18 November 2000. It was still dark, there was a strong west-north-westerly wind, and the visibility was clear. The master, chief officer, second officer and a quartermaster manned the bridge. They were all very familiar with the requirements for navigation in the area.

The vessel let go and moved astern off the ro-ro berth at about 0615. The master was conning the vessel by eye from the starboard bridge wing. When the vessel was clear of the berth she was swung to starboard, and an initial course of 160° was set **(**see chart extract**).** A number of fishing vessels were seen leaving the harbour ahead of her and, because of this, the quartermaster took the helm and speed was reduced. As the white sector of Stoney Field light became visible, the master gave the order "port easy." The helmsman applied 5° of helm.

The chief officer monitored the vessel's progress using radar and the electronic chart system. There had been no communication between the master and chief officer about the intentions for the passage out of harbour and, because of the fishing vessels, he thought the master intended to steady up when the Reef Rock buoy became fine on the starboard bow. The chief officer noticed the vessel was swinging too slowly, and moving south of the safe track. He warned the master on the enclosed bridge wing, who immediately instructed the helmsman to apply more port helm. The order was too late; *Clansman* was felt to touch bottom. She had grounded on Seid Rocks, close to an unlit beacon.

She was immediately manoeuvred into safe water and out of the harbour area, while checks were made to see if they were taking water. It was not easy. Vehicles on the car deck obstructed access to the sounding pipes of some of the void spaces. Denied this means of determining whether water had entered the hull because of damage, the only means available for making such a check was to rely on the high-level bilge alarms. The damage checks did not reveal any serious hull damage, and at about 0632 the vessel continued on her passage to Ullapool.

Divers carried out a hull survey the following day, which revealed scrape marks and indentations on the starboard side.



Reproduced from Admiralty Chart 2529 by permission of the Controller of HMSO and the UK Hydrographic Office[27]

The Lessons

1. A feature of any ferry operation is the repetitive nature of the work. It demands great skill and concentration, and most masters pride themselves on being excellent navigators and competent ship handlers. It is one of the great attractions of the job. The danger is that it can sometimes lead to complacency: everyone knows exactly what to do and there is no need for anyone to communicate. It is in such circumstances that things can, and do, go wrong.

2. On this occasion the vessel was being navigated and conned by the master by eye from the starboard enclosed bridge wing. Departure Stornoway demands precise navigation, and the vessel was fitted with modern navigational aids. The chief officer, who had sight of the navigational instruments, was monitoring events. The one thing lacking was that he did not know what was in the master's mind when a number of fishing vessels were seen ahead. A deviation, albeit small, from the usual departure plan was made, but the chief officer could not monitor the master's intentions because he had not been told what they were.

3. The person with the conn may well have cause to change his plan but, to ensure it is safe, he must communicate his intentions. Even the best navigator will value input if the deviation is taking the ship into unsafe water. But in this day and age the need for good communications on the bridge should not be reserved for when things go wrong; master and his bridge team should be working as a team - all the time every time.

4. When it became necessary to check the void spaces for damage, vehicles on the car deck prevented the crew from gaining access to many of the sounding pipes. This was a design fault, and is not uncommon. The fall-back position, using the high level alarms, was the selected alternative, but they were only tested annually. If any of the alarms had been inoperative and the vessel had been holed, the crew's ability to recognise and cope with the damage would have been severely reduced. The essential need for quick access to sounding pipes after an accident should be borne in mind by ship designers and builders.

CASE 10
Main Engine Turbo Charger Air Filter Fire

Narrative

Main engines on the motor tug *Dunter* were shut down at 0930 after berthing a tanker at the Sullom Voe oil terminal in Shetland. The fire alarm in the engine room was activated soon afterwards. The chief engineer made an initial investigation and saw smoke coming from the forward end of the port engine.

A fire team consisting of the chief engineer, second engineer and general-purpose rating entered the engine room wearing breathing apparatus sets. A small fire was found in the turbo charger suction filter, and was quickly extinguished using a CO_2 extinguisher and water spray.

As a precaution, the Sullom Voe terminal fire department, assisted by the local fire brigade, was alerted. However, the tug crew extinguished the fire before they arrived.

The fire was caused by a plug in the exhaust flange immediately above the turbo blower loosening and blowing out, allowing hot gases to ignite the blower's suction filter paper elements. Paper elements were a standard engine part supplied by the engine manufacturer.

The Lessons

1. The plug in question was designed to fit an exhaust gas temperature probe pocket not used for that purpose. Because insulating lagging covered the plug, the engine room staff were unaware of it coming loose.

2. The plug in the exhaust gas casing probably worked loose under the lagging throughout the five-year life of the tug. Such fittings should be wired or locked in some other way to prevent loosening.

3. The ship's three-strong staff fire team quickly and efficiently dealt with the fire. This highlights the importance of having at least two people: one to fight the fire, the other to provide safety back-up in the event of difficulties.

4. Although the Sullom Voe Terminal fire department was correctly alerted as a precaution, and they were assisted by the local fire brigade, they were not required. Don't assume they are not required. If things get out of hand, the shore-based fire-fighting capability will be essential. Never assume you can do without them. Duty watchkeepers in port should, as a matter of routine, make themselves familiar with the procedures for calling the emergency services - every time.

CASE 11
Poor Operational Design Contributes to Gas Carrier Grounding

Narrative

Happy Lady, a 6,107gt LPG carrier with 4,200 tonnes of butane on board, arrived at the Thames Estuary on the evening of 20 January, after an uneventful 22 hour passage from Grangemouth. She had been due to berth at Coryton on arrival, but because the terminal was enveloped in thick fog she was instructed to anchor at Z4 anchorage off Shoebury Ness **(**see chart extract**).** She dropped her starboard anchor in clear visibility in position 51° 29.7N 000° 50.1E, just south of the centre of the designated anchorage. She was brought up with four shackles of cable on deck in a charted depth of about 14m.

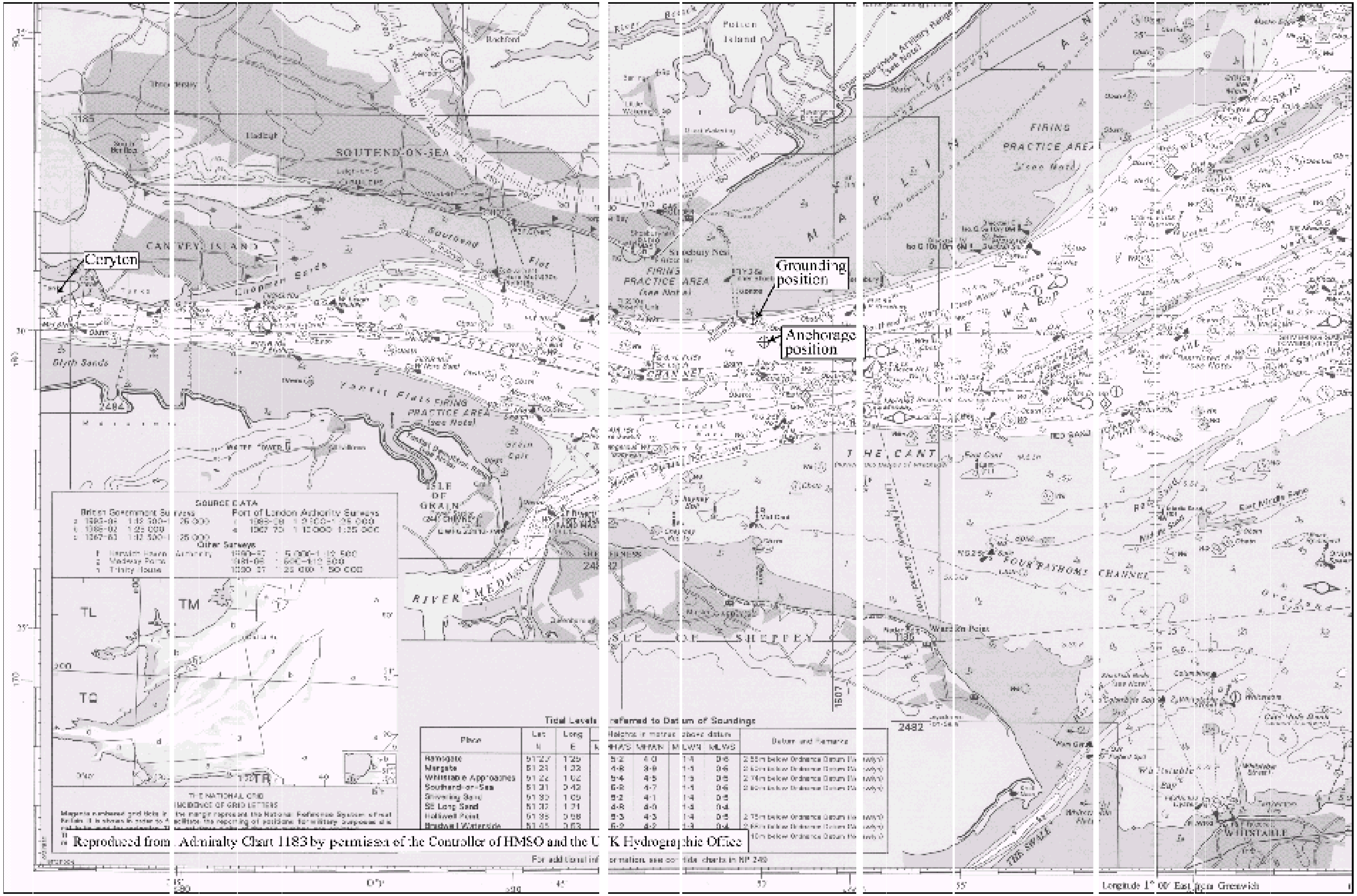
The pilot boarded the vessel at 0950 the following morning, to take her to Coryton. Master/pilot information was exchanged, and it was agreed that the former should manoeuvre the vessel while the anchor was being lifted. The Filipino senior AB (the vessel did not carry a bosun), and a deck boy were stationed on the forecastle, equipped with a hand-held VHF radio for communication with the Russian master. The vessel was heading into the wind, which was from the east-south-east, force 7 to 8. The tide had begun to ebb at a rate of about 1 knot.

The senior AB reported that the cable was leading on the port bow (10 o'clock) with moderate weight on it. The master instructed him to begin heaving. The engines were running with the controllable pitch propeller set on zero pitch. The cable was successfully heaved in a little way with the weight gradually increasing, and its lead growing further to port. At 1005 the senior AB reported that the cable was leading around the bow and astern, and that the windlass was having trouble heaving. The master used propulsion, rudder and bow thrust to try and turn the vessel to port. However, although the vessel gradually turned from east-south-east through north, the anchor cable continued to lead to port and astern, and frequently became lodged in the acute angle between the rake of the stem and the bulbous bow.

The chief officer was instructed to go forward at about 1020. The third officer, meanwhile, who was manning the bridge with the master and a helmsman, plotted the ship's position on the chart and reported that she was moving to the north towards the drying bank off Shoebury Ness about half a mile away. The master continued to try to swing the vessel to port and, whenever possible, the chief officer ordered the cable to be heaved, but it was slow progress hampered by the strong wind. The master was unable to manoeuvre the ship to improve the lead, and the cable jammed frequently.

The third officer continued to plot the vessel's position, and reported that she was steadily moving towards the bank. At 1036, after the vessel's head had reached about 275 degrees, the chief officer reported that the anchor was visible near the surface but jammed on the port side of the bulbous bow. The master knew that the vessel was very close to the bank and he tried to manoeuvre astern into deeper water. Despite his endeavours, the vessel did not move and, by 1041 he realised she was aground. The tide was falling.

The vessel refloated, with the assistance of two tugs, at the next high water at about 2130. She proceeded under her own power to Z4 anchorage, where checks revealed that she had apparently sustained no damage.



Reproduced from Admiralty Chart 1183 by permission of the Controller of HMSO and the UK Hydrographic Office

The Lessons

1. Prudent navigators will note the precise position in which the anchor is dropped. The relative position of the anchor to the vessel's current position when beginning to heave the anchor cable, will invariably give a good indication of how the ship is lying. It will also provide sufficient information to enable the master to manoeuvre his vessel to ensure the least strain on the cable and the best lead.

2. Vessels with very prominent bulbous bows should, so far as possible, manoeuvre to ensure the cable is leading on the correct side of the bulb before starting to heave. A cable that crosses the stem is likely to be hard to heave and will have a tendency to jam.

3. Once an anchor has started to drag, momentum tends to build up rapidly. Never trust to luck. In this case, the master hoped that he could get the anchor clear, and still have time to manoeuvre into safe water. He was wrong. The second anchor should have been let go in time to prevent the grounding.

4. It is often too late to send an officer to the forecastle after an incident occurs. The near gale force winds, and the proximity to the shore, should have prompted the master to ensure that the chief officer, who spoke the same language as him, was in charge on the forecastle.

5. The possibility of an anchor cable becoming trapped in the angle between the raked stem and the bulbous bow should be considered during the design and building of vessels such as *Happy Lady.*

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in May 2001. It can be obtained free of charge by writing to the MAIB.

CASE 12
Care and Attention

Narrative 1

The ro-ro passenger vessel *P&OSL Kent*, was in Dover and beginning to load for her next passage to Calais. While in harbour there had been a crew change, and the new crew had just taken over. Loading on the lower car deck had just started when two seamen suddenly smelt burning and saw smoke. Loading was stopped while an investigation was carried out. A quick examination found the source of the smoke and the burning to be a refrigerated container socket. The fire was immediately put out using a dry powder extinguisher, while the socket's electrical supply was isolated.

The subsequent investigation found that the insulation on the 380 volt supply cables, which entered the plastic socket box, had melted and set fire to it. Water was also found inside the socket box.

The fire was thought to have started because water from car deck washing had managed to penetrate the socket box through a defective gland seal, and had caused a short circuit.

Narrative 2

Norsea, a ro-ro passenger vessel, was alongside in Hull for maintenance and repairs. The scope of work originally discussed between the chief officer and the welding contractor, only concerned welding to handrails and lifeboat cradles above deck level. For this reason, it was agreed that it was not necessary to post a fire watch in the cabin below. However, the workmen, having completed this work, went on to close a deck penetration without further authorisation from the chief officer.

Soon afterwards the fire-alarm sounded on the bridge, which was manned at the time. The zone was identified immediately. A fire team was quickly assembled and ran to the indicated accommodation area, where it found a small carpet fire in one of the cabins on the port side of deck 6. The fire was quickly put out using a dry powder extinguisher.

The subsequent investigation found that this cabin was directly beneath the welding work being carried out on deck 7. The heat generated by the welding ignited a rubber ring which formed part of the sealing arrangement for the deckhead light. It had caught fire, melted and dropped on to the carpet beneath. The carpet started to burn and the smoke from this small fire activated the cabin fire detector.

The Lessons

In both these cases the failure of an individual or individuals to exercise a duty of care under the *Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997, Part V*, provided the opportunity for fires to occur. In the first example, and notwithstanding the poor sealing arrangements on the electrical socket, water had been allowed to splash over electrical equipment while washing down. In the second case, having extended the scope of the original work, neither the welder, nor the fire watcher, had checked the underside of the deck before undertaking hot work.

It needs to be remembered that it is not only the e*mployer* that is required to have a duty of care, YOU, as an e*mployee* are also required to have a duty of care to your fellow crewmen or workers.

1. When washing or hosing down decks or bulkheads, NEVER EVER spray electrical equipment or fittings. Apart from the fact that the entry of water into an electrical equipment or fitting is likely to cause internal damage and subsequent failure, you should bear in mind that a jet of water is a very efficient electrical conductor. If an electrical fault is present at the time, there is a strong possibility that the person holding the hose could have a shocking experience. Put another way he could be electrocuted.

2. Inspect all sockets and fittings in public and crew areas regularly. Particular attention should be paid to items of equipment which are required to be watertight. Cable and equipment water-sealing arrangements should be checked and renewed if there is any doubt about their effectiveness. Make sure that the equipment or fitting is installed in the correct position and the right way up!

3. Before undertaking any hot work ensure that an effective "permit to work" system is in place, which fully covers the scope of work to be undertaken. Always check there are no combustible materials close to the point where hot work is to be carried out, including the area below. Suitable fire extinguishers should be on hand, and a fire watch established to cover areas not readily visible to the welder. Fire checks should continue for at least two hours after the work has been completed to ensure that any residual heat or sparks have not started a fire.

CASE 13
An Extra Pair of Hands

Narrative

At 0108 on 28 August 2000, the UK-registered Class 1 passenger ship, *RMS St Helena*, left Cardiff for Tenerife on the first leg of a voyage to the South Atlantic.

At about 1325 that afternoon, as the vessel was clearing the Scilly Isles, the watchkeeping engineer lifted a rocker box cover on the starboard main engine in an effort to locate a coolant leak. As he did so, oil from a leaking pipe in the rocker box sprayed from beneath the cover and impinged on the cladding of the engine's exhaust. There it ignited.

The engineer closed the cover, then raised the alarm and stopped the engine from the machinery control room. Meanwhile, engine room ratings extinguished the fire using a portable extinguisher. There was no significant damage or injuries.

The Lessons

This incident demonstrates the value of having at least a second person nearby when opening any system containing flammable liquid, gas or vapour. Without the crewmen being available to tackle the fire immediately, it would have been free to burn while the engineer stopped the engine and raised the alarm. This might have allowed the fire to spread.

Whenever covers of running machinery are opened, expect the unexpected.

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in May 2001. It can be obtained free of charge by writing to the MAIB.

PART 2 - FISHING VESSELS

During the year 2000, one fishing vessel sank, on average, every two weeks. This bald statement conceals individual tragedies, loss of earnings, a mass of unwelcome paperwork, and sometimes, and most awful of all, the deaths of those onboard.

The reason why fishing vessels sink is self-evident: they fill with water. It can enter through a defect in the hull, a collision, grounding, from an internal leak, or because the vessel capsizes through excess topweight. So much is obvious but, of equal concern is the seeming inability to stop the water coming in or at least slow down the rate of ingress.

If flooding does take place, the aim should be to either stop it altogether by identifying the source and isolating it, or contain the inflow by pumping. If the worst does come to the worst and sinking becomes inevitable, it should be delayed as long as possible to enable everyone on board to abandon ship. Survival is a better option than being trapped below decks in a rapidly sinking vessel.

Previous *Safety Digests* have repeatedly stressed the importance of having bilge alarms that function reliably. Early warning of flooding buys you time to take appropriate action or to alert all the crew.

There are two other factors that demand the attention of owners, skippers and crews: the onboard pumping arrangements, and the inherent watertight integrity of the vessel.

In any flooding incident, the first call is for your own pumps; not those provided by others such as those put on board by helicopters or RNLI lifeboats. They must be guaranteed to work efficiently and reliably, and capable of dealing with the majority of flooding incidents. You should know the rate of ingress that would follow a failure of the main seawater cooling system. It is a function of the size of the pipework and the depth below the waterline of the inlet and outlet. If you find yourself in a vessel with flooding taking place, you should have an instinctive feel for the pumping rate capacities. If the pumps cannot cope with the ingress that can be expected from a pipework failure, then you have a problem. Doing the sums in harbour with expert advice today, and doing something about it could save your boat, your livelihood and even your life.

Any fishing vessel that capsizes tends to invert rapidly if uncontrolled downflooding takes place. The chances of getting out alive are not good unless you can slow the process down. It has been found over and over again and all around the world, that the most common factor in all capsizing incidents, and many founderings is the tendency for doors and hatches to be left open at sea, so reducing the watertight integrity. When a fishing vessel wreck is examined on the seabed, investigators frequently find doors, hatches or ice scuttles open when they should have been shut. And not only are they found open, there is often evidence to show they could not have been closed in the first place. They are either lashed open or they lack any means of being secured.

There is a great temptation to leave hatches and doors open at sea when they are not in use. But an open door is often the cause of uncontrolled flooding. And loss of life.

CASE 14
Another Lone Fisherman Tragically Lost Overboard

Narrative

One day in November 2000 the 6.24m St Abbs potting boat, *Girl Alice,* set out for a normal day's work. The only person on board was her skipper. When she failed to return to harbour the alarm was raised and a search initiated. She was found by another fishing boat and the Eyemouth lifeboat 1.5 miles south-east of Burnmouth. There was nobody on board.

There was a slight sea and swell at the time, and the wind was 10 knots from the west with good visibility. The boat was found with the engine engaged, 17 pots outboard and 3 inboard, one of which was jammed in the gunwale. Only a small catch of crabs was found, which indicates that whatever happened, occurred early in the day. All the indications suggested that the sole occupant had somehow gone over the side. The emergency services carried out a detailed search using four lifeboats, a coastguard helicopter and 15 local fishing boats, but no trace of the victim was ever found.

The fisherman had over 17 years experience, and is not thought to have been wearing any form of lifejacket or buoyancy aid.

The Lessons

This tragic accident again highlights the dangers involved in single-handed fishing vessels.

One can only imagine what the victim's thoughts were as he went over the side. He was on his own and, if he was following his usual custom, was not wearing a lifejacket. He would have had little means of keeping his head above water. Fishing is, at the best of times, a risky venture but the risks multiply if you fish alone; there is nobody on hand to assist or raise the alarm should anything go wrong.

If you do put to sea single-handed always wear a lifejacket or buoyancy aid, and consider carrying mini flares and a personal locator beacon. At least it gives you a chance of being rescued should you go over the side. If you die, you leave behind people who will be devastated by your death, and wanting to know why you considered it so wrong to take the basic precautions that an increasing number of fishermen are now finding acceptable.

Always let someone know your movements. Keep in regular contact with other fishing vessels while at sea. This way the alarm can be raised if your expected movements or call are overdue.

Consider installing engine and steering controls local to the working position, i.e. near the hauling winch. In the event of a leg being caught in a bight of rope it gives you the chance to stop the boat before you are pulled over the side.

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in May 2001. It can be obtained free of charge by writing to the MAIB.

CASE 15
Grounding in Restricted Visibility

Narrative

The Spanish owned, but British registered fishing vessel *Horizonte Claro,* sailed from Lochinver on the west coast of Scotland at about midnight on 20 October 2000, to return to the fishing grounds. The Spanish skipper was in the wheelhouse accompanied by two lookouts. He adjusted the autopilot to follow the departure track shown on a video plotter which was designed for fishing purposes and could only display a latitude and longitude grid, not electronic charts. Positional information was fed to the video plotter from DGPS and GPS receivers and was verified by the skipper using visual and radar references. An appropriate chart of the area was available but not used.

About 10 minutes after sailing, the vessel entered an intense squall with the wind gusting up to 35 knots in heavy rain. Visibility dropped and the radar picture became degraded. The skipper tried to improve the picture quality on his radar displays but was unable to do so and, in the absence of either visual or radar references, continued to follow the track displayed on the video plotter. At 0019 the skipper told the two lookouts to leave the wheelhouse and keep a lookout from the open deck. One went forward to the bow and saw land close by and directly ahead. He shouted to the skipper to go astern, but it was too late. The vessel grounded to the east of Soyea Island at 0020.

Unable to speak English, the skipper had to inform the coastguard through someone who could. He contacted the vessel's Spanish-speaking agent in Lochinver by VHF radio, who called the coastguard. The skipper then checked the vessel to ensure her watertight integrity had not been breached.

The check was made, but several scuttles were left open, none of the crew donned lifejackets and the liferafts, which were lashed down on the wheelhouse roof, were not made ready.

The Lochinver lifeboat arrived on the scene at 0048 with a Spanish-speaking representative of the vessel's agent embarked. The fishing vessel's crew were recovered into the lifeboat and taken back to Lochinver where several required assistance to disembark. There are conflicting reports as to whether or not some of the crew were under the influence of alcohol. *Horizonte Claro* was later refloated by the coastguard tug *Anglian Prince* and towed to Stornoway for survey and repair.

The Lessons

Each year the MAIB receives a number of reports of fishing vessels that ground soon after they sail at about midnight, having landed their catch. This is one such instance. The lessons are by no means new, but warrant careful study so they can be relearned. The opportunity is taken to extend the lessons beyond those that might have applied in this particular incident.

1. Video plotters are convenient and easy to use. In many people's eyes they are the answer to the watchkeeper's problem by relieving him of the need to draw a track on charts, to plot fixes, or to transfer GPS positions. All you have to do is sit back and drive down the track by adjusting the autopilot. Unfortunately it isn't quite so straightforward, and reliance on video plotters frequently ends in disaster. When used in isolation, they are rarely sufficiently accurate for safe navigation in very confined water. By all means use them, but only trust them when their accuracy can be checked by comparison with other navigation aids such as radar, charts, GPS receivers, echo sounders and the mark one eyeball. Even in reduced

visibility with no radar, their accuracy can be checked periodically by plotting GPS positions on to an appropriate chart.

2. On sailing, two crewmen kept a lookout from the shelter of the enclosed wheelhouse. There is nothing wrong with this in fine weather or the open sea, but lookouts should be maintained from where they can be of greatest use. Had they moved outside the wheelhouse as soon as the heavy rain reduced the visibility, and degraded the radar picture, it is possible Soyea Island might have been sighted sooner, and allowed effective avoiding action to be taken. Depending on the nature of the restricted visibility and the proximity of navigational dangers and shipping, more can frequently be seen from an open deck. Although few crew enjoy this task, it is better than being rescued and having to look for work elsewhere.

3. A liferaft lashed down is as useful as a getaway car with a wheel-clamp. After grounding on rocks, a vessel is totally at the mercy of the elements and fortunes can turn very quickly, especially on a small fishing vessel. In such circumstances it is essential the crew are prepared to abandon the vessel at short notice. It may be too late to start looking for lifejackets and be preparing liferafts once the vessel begins to list heavily. Survival equipment is there to be used, and liferafts should be made ready for deployment, regardless of whether or not help is on its way.

4. Drinking alcohol before sailing or when at sea is fraught with dangers. It might seem a good idea at the time, but when you are tired and facing the prospect of sailing at midnight, a quick drink, or even a couple of 'very small ones' can have unwelcome repercussions.

5. Alcohol makes you even sleepier, it slows down the thinking process and performing simple tasks can be very difficult. And if you have an accident and someone is injured or even killed, you could be answering a few very difficult questions afterwards. There are ways of sobering up fast; this is not one to be recommended.

6. There are times to enjoy a drink, but just before sailing at midnight is not one of them. You may think the 'no drinking' advice doesn't apply to you, as there was no question of you doing anything other than turn-in once on board. But emergencies can happen at any time. Groundings, collisions, floods, and fires can occur when least expected. Few of us are saints, but the effects of alcohol are unpredictable, and can render people incapable of performing the most basic tasks, let alone fighting fires, launching liferafts or giving first-aid. They not only jeopardise their own lives, but also the lives of all on board. And those of the rescue services.

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in May 2001. It can be obtained free of charge by writing to the MAIB.

CASE 16
Vessel Sinks After Hitting Wreckage

Narrative

Audentia, a 17.44m long wooden vessel, was fishing to the west of the Isle of Man one night in February. While trawling, she collided with some wreckage and was holed. The wind was force 3 to 4 from the south-west, and the sea was slight to moderate.

The bilge alarms indicated that there was flooding, and this was confirmed by visual inspection. The bilge pumps were started, but the level of the floodwater continued to rise. Although the bulkheads both delayed the flooding, and gave the crew more time, three compartments were filling. The fishing gear was hauled so as not to impede the rescue services, and the decision was taken to make towards Peel. It was thought that beaching was the best option available.

A "Mayday" was broadcast and was acknowledged. The Peel and Donaghadee lifeboats were dispatched but, before they could reach the casualty, another fishing vessel, *Bain Loyal,* which had also responded to the distress call had arrived on scene and had taken off the crew. When the Peel lifeboat arrived the vessel was listing to port, leading to the conclusion that the main part of the damage was underwater on this side. Inspection of the other side revealed that the vessel was holed above the waterline on the starboard bow.

Audentia sank about two hours after being holed. The lifeboats recovered the EPIRB and the liferaft. Following the accident, the coastguard received reports of floating wreckage in the area.

The Lessons

1. Wreckage, either flotsam or jetsam, is one of the hazards which users of relatively small boats (and fishing vessels are included in this category) have to contend with. Wreckage shows no lights, doesn't keep a lookout, and pays no attention whatsoever to the Rule of the Road. And it is singularly uncooperative when it comes to assisting accident investigators. Wreckage is not the only thing floating around the oceans of the world these days. The semi-submerged container is a popular candidate for blame, as are tree trunks, whales, dunnage, oil drums and the very occasional hulk. Some have the potential to inflict significant damage. The MAIB has no magic formula for avoiding them, but the best defence against hitting any of them is to maintain a very good lookout. They are very unlikely to show up on radar, except in very calm conditions.

2. If wreckage, a container, or other floating objects likely to be a hazard to safe navigation are ever sighted, tell the coastguard so that others can be alerted to their presence. And if you are carrying containers and lose some of them overboard, inform the appropriate authorities without delay.

3. There are additional lessons for the victims of such encounters. Always keep your bilge alarms in good working order, and regularly check they work. In this case they provided early warning of flooding, and gave the crew time to deal with the emergency.

4. If your vessel is fitted with watertight bulkheads, make sure they are just that. Holes, gaps, unplugged glands, and open doors make a mockery of the expression 'watertight.' Your life, and the safe return of your livelihood, could well depend on the watertight bulkhead being watertight.

5. Check that your bilge pumping arrangements are adequate. The further below the waterline the source of the damage, or the hole through which water is coming, the faster the rate of flooding. The greater the pumping capacity, the greater the chances of survival. If you don't know the capacity of your present system, this is a good moment to check. Now work out the rate of flooding that could occur, and see if it is greater than the pumping rate. If it is more, then you have a problem that needs to be addressed.

CASE 17
Man Overboard During Hauling Operation

Narrative

The 58m fishing vessel *Pathway* had hauled her gear and, using her fish pump, had just taken the catch aboard from the net.

On recovering the fish pump pipes, which were suspended from a crane, the vessel rolled and the crane knocked one of the crewmen against the rails and then dragged him overboard. He was wearing oilskins and an inflatable lifejacket.

The weather conditions were not good. There was a force 6 to 7 wind, with a moderate to rough swell, and it wasn't long before he drifted out of range for a lifebuoy to be thrown to him. Fortunately he managed to grab hold of a rope which was trailing from the vessel, and this enabled his colleagues to drag him closer to the vessel's side.

Several unsuccessful attempts were made to recover him on board, but hypothermia was beginning to set in and he lapsed into unconsciousness. He began drifting away again. Realising what was happening, the second engineer, who was wearing a survival suit, dived into the water and managed to get him back alongside. The crewman was eventually lifted back on board. He had been in the water for approximately 15 minutes.

Once on board he was treated for hypothermia and was in a stable condition within 30 minutes.

The Lessons

1. The first, and obvious lesson is to make sure that everything possible is done to prevent people going overboard in the first place. There is a great temptation to accept everyday practices just because 'it is always done that way'. Anything that swings freely is a potential danger. When added to a constantly moving deck, any equipment or machinery left free to move only has to hit someone to create the sort of situation seen here. Take the necessary precautions before it is too late.

2. A key feature in this incident was that the victim was wearing a lifejacket. Had he not been doing so he might well have lost his life; it kept him afloat when he lost consciousness. Lifejackets save lives. Join the steadily growing number of fishermen who routinely wear them nowadays.

3. Recovering someone who has fallen overboard is extremely difficult because of the weight of waterlogged clothing and the casualty's inability to help himself. Body temperature falls fast, and even the fittest person becomes exhausted within minutes if not seconds. Speed of recovery is essential, as is keeping an eye on the person in the water.

4. Practice recovering someone from the sea. ('Someone' in this context should be a heavy weight of the approximate shape and size of a man!) Every skipper should work out his own system in his own boat, but it is essential he can answer two questions: how is he going to secure the man, and how is he going to lift him inboard? Manoverboard drills should be carried out on a regular basis.

5. The action of the crewman who went into the water to aid the casualty, was commendable. However, always remember not to aggravate any rescue situation by going into the water

yourself unless it is absolutely essential to do so, and then only with the aid of a safety line and a survival suit. The last thing you want is two casualties.

Footnote

Advice on working type lifejackets for fishermen can be found in *Marine Guidance Note MGN 155(F)* entitled *Buoyancy Equipment for Fishermen at Work,* available from the MCA.

CASE 18
How to Handle a Flooding Incident

Narrative

Past *Safety Digests* have often reported flooding incidents where mistakes were made while trying to save the vessel and her crew. This is a case where all the right actions were taken once the flooding had been discovered, and the crew can take credit for how things were handled.

Aranatha, an 8.63m long GRP vessel, was trawling to the south of Milford Haven on a January evening with two crew on board. The wind was from the north-west force 3 to 4, and the sea was slight. The skipper was alerted to flooding in the engine room when the bilge alarm activated and the main engine started to misfire. The skipper switched the bilge pump on immediately, and called the coastguard to advise them of the situation. While the skipper was talking to the coastguard, the crewman located the source of the flooding; a pipe that had come off the water pump to the engine. It was refitted and temporarily secured.

The main engine kept running, and with the Angle lifeboat in company they were able to return to Milford Haven docks safely.

The bulkheads each side of the engine room were watertight, and limited the flooding. The valves on the sea inlets were used to stop the flow of floodwater until the pipe was refitted to the water pump. All pipe connections have since been refitted with heavy-duty clamps.

The Lessons

1. This is one of the few occasions when the bilge alarm gave the crew ample warning of flooding. The MAIB is frequently informed of cases where the bilge alarms do not work because of poor maintenance, they are switched off, or they have been landed for repair. Bilge alarms should be in good condition, and should be checked regularly to ensure that they are working.

2. The crew contacted the coastguard at an early stage. By doing so, they alerted them in good time to provide assistance, or rescue them had it become necessary. Always call the coastguard if flooding is suspected; they would rather be informed at an early stage, than later when the incident could have become much more serious. By calling the coastguard you are not automatically summoning a helicopter or lifeboat, merely giving them time to think and take whatever steps they judge appropriate.

They can be relied upon to take the appropriate action, while you do your best to resolve the problem at sea.

3. The bulkheads were watertight, the stopcocks were accessible and could be operated, and the bilge pump worked and was very effective in clearing the floodwater. All these factors helped to save the situation.

CASE 19
Fishing Vessel Grounds While Leaving Harbour

Narrative

The 24.36m fishing vessel *Keila* docked at Aberdeen in the early hours and landed her catch for that morning's market.

During the day, the crew worked on board in preparation for sailing that evening. The engineer had been busy working on the main engine and, while doing so, had disconnected the auto-start for its cooling pump.

Keila sailed from Aberdeen that evening as planned. The skipper was in the wheelhouse, two crewmen were on deck tending the ropes and the other two crewmen, one of whom was the engineer, were asleep below.

As she left harbour the alarm for the main engine cooling water temperature sounded. The skipper put the wheel amidships and nipped below to the engine room to find out what was wrong. He discovered the main engine cooling pump was not functioning and switched it on; the engineer had forgotten to reconnect the auto start. The skipper was just returning to the wheelhouse when he heard a loud rumbling noise. *Keila* had grounded on a rocky ledge outside the channel.

He stopped the main engine, called the crew and reported the incident to Aberdeen harbour control.

Keila was hard aground on her starboard side, and as the tide ebbed she fell over on her starboard bilge keel. Fortunately there was little damage sustained and she was refloated on the following tide.

The Lessons

1. No matter how great the temptation, never leave the wheelhouse unattended in confined waters. Even the 'nippiest' visit to the engine room has a habit of taking longer than expected. In this case the skipper could have instructed one of the deckhands to call the engineer who could have rectified the problem. There was no need for the skipper to leave the wheelhouse.

2. Whenever entering or leaving port, there is much to be said for having two people in the wheelhouse. Had an additional person been present, the grounding could have been prevented.

3. Ensure there is an adequate management system in place when maintaining and testing the main engine and ancillary equipment. The phrase 'management system' might appear to be a pretty good example of gobbledegook, but in plain seafaring language it means having a system in place to ensure that things are properly connected up after maintenance or repairs. Had someone checked, and discovered the pump auto-start had not been reconnected before sailing, this accident (and the embarrassment) would not have occurred.

CASE 20
Use the Correct Caulking Compound

Narrative

Fin-Ar-Bed, a 13.98m long wooden vessel, was fishing to the north of Cromer in East Anglia early one September morning. A crew of five and a dog were on board. The wind was from the north-west at 15 to 20 knots, and the sea was moderate with a swell from the north-west. The vessel had been punching its way through the swell to reach the fishing grounds.

The skipper was alerted to flooding in the engine room by the bilge alarm sounding. The main engine stopped. The skipper called the coastguard, and used the bilge pumps to try to contain the floodwater. A rescue helicopter put another pump on board, and later an inshore lifeboat put a crewman on board to assist. When the Cromer lifeboat arrived, a further pump was put on board, and *Fin-Ar-Bed* was taken in tow. The two vessels later arrived safely at Lowestoft.

The cause of the flooding was not initially apparent, but when the vessel was slipped, some of the caulking was found to be in a very poor state. This was surprising as these seams had been sealed with synthetic sealant only about three months previously. The vessel was of carvel construction, using oak planks. The defective seams have since been recaulked, and extra bilge pumps have been fitted.

The Lessons

1. Underwater seams of wooden vessels are best sealed with caulking cotton or oakum. The main advantage of these two methods is that they can be compressed into the gap between the planks. A sealant, such as synthetic rubber, can be applied to finish the seam, as this will provide a smooth surface and help to protect the caulking cotton/oakum. Pitch can also be used to finish seams. For seams facing up the pitch can be poured, for seams facing down the pitch should be brushed on.

2. Some sealant manufacturers claim that you can use their products without caulking cotton or oakum. It may be possible to achieve good results this way provided the manufacturer's instructions are followed for the use of primers etc. You can't get compression in the seam by just using a synthetic sealant. Silicone sealants react with seawater, and are not suitable for caulking seams on sea boats.

3. Oak planking is unusual. It has the advantage that it is strong and resistant to rot, but it expands and contracts more than usual, so particular attention is necessary for the seams. Oak contains tannic acid, which may react with some sealants.

PART 3 - LEISURE CRAFT

One evening towards the end of the summer, a well-equipped yacht was returning to its home marina on the south coast of England after an extended and very successful cruise around Brittany and the Channel Islands. Her crew consisted of two married couples who got on well and had accumulated extensive experience over many years. The skipper was careful, safety conscious and knew his boat well.

The final day crossing the channel had gone well. The weather was good, the breeze adequate and visibility near perfect. The passage to the marina was trouble free.

The only concern was the state of the tide for berthing. It was springs, and the skipper had worked out the time of slack water. To avoid having to berth downtide on his finger pontoon he knew he had to delay his arrival time until the ebb had ceased. That time had been predicted accurately, and he realised he would have to wait for about 40 minutes unless he slowed down. The crew was briefed accordingly and told that someone had tried to berth too early a year or two before in similar circumstances; with expensive results.

But as so often occurs in the business of sailing, a chain of events, very human ones, started to influence the skipper. Despite slowing down, the crew found themselves approaching the marina ahead of schedule. What now? Everyone on board had a legitimate reason for wanting to get in a bit early. The men were returning to work the next day and wanted time to prepare, while their wives had other priorities.

It was a glorious evening. It was warm, peaceful, quiet and everything looked so easy. As the yacht approached the marina the skipper decided to have a look at the tide. It was clearly ebbing strongly in mid-stream, but looked virtually slack in the vicinity of the pontoons. The siren voices called "have a go."

There were still 30 minutes to go before slack water, but the temptation was there, and the skipper decided he would try. The approach involved turning across tide for a few metres and then making a sharp turn to port. The skipper had done it many, many times before, but halfway through the manoeuvre he knew he wasn't going to make it. The approach was too fast and the turn was insufficiently tight. Despite the application of stern power, and a rapid redeployment of fenders, the yacht's CQR anchor managed to puncture the hull of the craft in the adjacent berth.

It was a relatively minor accident and the damage wasn't that great, but the skipper was mortified. It also spoilt what had been a very successful cruise. And as many people have found after such an incident, sorting out the consequences becomes time consuming and very embarrassing.

So why did it happen?

Many of the lessons will be obvious, not least of which is the old adage that the passage isn't over until you have finally secured alongside. Mistakes so often seem to happen when in sight of your destination. And yes, there were pressures to get in early. And yes, it looked all right to 'have a go' despite knowing it should have been delayed by 30 minutes.

But the crucial factor in the entire incident was that the skipper chose to ignore the lessons of the past. As he admitted afterwards, he knew he was pushing his luck and that something could go wrong. So why did he do it? It was a curious feature of human nature. Although he knew somebody else had got it badly wrong a year or so earlier, the time lapse induced a sense of complacency. Had

the previous accident occurred a week or so earlier and been fresh in his mind, there is very little doubt he would have backed his earlier judgment and held off.

The key human factor element to be learned from this incident is that lessons or experiences of the past become diluted with time. We are all guilty of making the same misjudgment. Take driving a car. People will meticulously observe the speed limit for a while after seeing the double flash of a speed camera in their rear window, but within a week or two they will probably be back to normal and pushing their luck.

We learn from our own mistakes, but it is much more agreeable to learn from someone else's, no matter how long ago they occurred. Misfortunes must not be diluted by time. The *Safety Digest* and its back numbers provide a readily available means of reminding people what can go wrong at sea.

CASE 21
School Trip Tragedy

Narrative

As part of an organised term-time activity, an independent school decided to give nine of its pupils practical experience afloat using a 4.27m dory-type open boat, in the sheltered waters of Portsmouth Harbour. There was only one teacher on board, in charge of the nine pupils.

Because the conditions had been judged unsuitable for sailing, the decision was taken to use the dory for some very basic manoeuvring in a relatively sheltered area where the wind strength was force 2 to 3.

Shortly after leaving the pontoon, the outboard motor stalled, but was successfully restarted. Various events followed, all of which generated a sense of excitement among the children:

- a large plastic sheet found floating in the harbour, was pulled on board;
- a jellyfish fell out of a bailer and stung one of the pupils;
- a boy fell into the water but was recovered safely; and
- while making way at 3 to 4 knots, spray came in over the bow.

Throughout this time water and spray began to accumulate in the boat.

The outboard engine then stalled a second time but could not be restarted. The teacher told four of the pupils to start paddling but, when only 75m from the pontoon, the boat capsized and inverted. All 10 occupants were pitched into the water.

Buoyed by their lifejackets, some children managed to climb on to the upturned boat while others, including the teacher, clung to the hull. The crew of a local boat saw what had happened and gave immediate assistance. They recovered all the pupils they could see and the teacher, but when the rescue was complete, one of the children was found to be missing. The crew lifted the upturned boat and found a young girl underneath. She was pulled from the water and given first-aid, but died later in hospital.

Following the accident, the boat was examined to reveal a substantial amount of water trapped in the void between the inner and outer hulls under the floor. The investigation revealed that uncontrolled movement of seawater in both the boat, and the void beneath the floor, combined to make it so unstable that she would eventually capsize. It was found that seawater had entered the void through two small holes in the bows where a towing bolt had been fastened, but had at some stage become detached.

The Lessons

1. Sailing or boating activities are a wonderful way of introducing children to a sense of adventure, respect for the elements, individual responsibility, realistic discipline and, in controlled conditions, an element of risk. It is also great fun and supremely rewarding. But it needs to be carefully planned, sensibly supervised and sufficiently well thought through to ensure that risks have been identified, and measures to ameliorate them are in place.

2. Those approving and authorising such activities must have access to the best advice and guidelines available. Such advice has been drawn up as a result of others' experience, sometimes tragic.

3. Everyone involved in youth projects afloat should heed the advice available on the level of supervision, replacement of outboard motors, fitting of kill switch cords, fuel tank securing, and many other safety considerations.

4. Any person placed in charge of activities afloat, should be trained to the standard recommended by the Adventure Activity Licensing Authority.

5. Any youth organisation (including schools) buying a second-hand craft, should ensure it is professionally surveyed before it is purchased, and any deficiencies revealed should be made good before use.

6. Any craft likely to be used afloat must be properly maintained, regularly checked and inspected carefully before it is used. By noticing something important that a bolt is missing to leave two small holes just above the waterline, could be the difference between a few minutes delay rectifying it, and a very tragic accident.

7. Many young children in today's safety conscious and risk aversion world may be totally unaware of potential dangers, and have little feel for certain kinds of hazard. This puts an added weight of responsibility on those supervising them. It also requires a degree of firmness in taking charge of excitable and impressionable youngsters. Having responsibility for nine children is making unrealistic demands on a single adult. Four, possibly five, is a general working maximum when afloat.

8. Lifejackets are essential. But remember what might happen if the boat completely inverts; someone could be trapped underneath it. Anyone caught in such a predicament could find the inflated lifejacket actually inhibits an escape. Once survivors find themselves in the water and in the open, it becomes essential to carry out an immediate check to make sure everyone is accounted for.

9. If someone is missing, the chances are that he or she is either inside, or beneath the inverted craft. There are no hard and fast rules about what should be done because there is a real prospect the missing person is alive and well. The important thing is to get help as soon as possible.

10. Always have some means of alerting people to an emergency. A VHF radio, suitably contained in some form of a waterproof material, mini flares, whistles or even a mobile telephone, might suffice. Offshore, a personal locator beacon could pay handsome dividends.

The dory in this accident was fitted with lifelines. They greatly helped those in the water by providing them with something to hang on to. The rigging of such equipment is strongly recommended.

Footnote

This incident was the subject of a full MAIB investigation. A comprehensive report, giving details of the causes, an analysis, and recommendations was published in March 2001. It can be obtained free of charge by writing to the MAIB.

CASE 22
Two Drown in Speedboat Sinking

Narrative

Four men left a Scottish harbour in June in a 5m Sabre-plane speedboat fitted with an 85 horsepower outboard. The boat had been purchased the week before, and this was the first time its new owner had used it. He had been on the water once before, in another speedboat the week before.

The owner was wearing a lifejacket and a wet suit; the others were dressed in normal clothes. The wind was south-westerly force 5.

The speedboat had not been properly prepared for sea, and neither battery nor fuel tank was secured at the after end. No sooner had the craft cleared the harbour entrance when the fuel line came away from the engine; the clip securing it was inadequate. The boat stopped in the confused sea state as attempts were made to resecure the fuel line.

Meanwhile she started to ship water. The engine was restarted, but died almost immediately, most probably because of water contamination of the fuel. More water was shipped, and the boat sank, throwing all four men into the water. Two were able to swim to shore, one of which was the owner and the only one wearing a lifejacket. The bodies of the other two were recovered later.

The Lessons

Buying and going to sea in a powerboat is, to some people, a very straightforward business. All that needs to be done is:

- **complete the purchase**
- **board the boat**
- **start the engine**
- **let go the mooring lines**
- **open the throttle, and**
- **steer it like a car.**

This very simplistic approach is fraught with danger and can have, as this accident demonstrated, very tragic consequences.

1. If you are thinking of buying a powerboat, seek advice about the craft most suitable for your requirements. Resist the temptation, for instance, to buy something that may well be overpowered for your needs.

2. Before going out in it for the first time, get someone with the appropriate knowledge and experience to advise you on how the craft should be prepared and equipped.

3. Taking a boat to sea for the first time is not as straightforward as it might seem. If you have no, or very limited experience, you are very strongly recommended to seek appropriate training. Ideally this should be a Practical Motor Cruising Course run by the Royal Yachting Association, and newcomers are strongly advised to contact one of the RYA-recognised motor

cruising schools for advice. The alternative is to go to sea with someone responsible who can show you how to do things correctly and sensibly.

4. Care must be taken to ensure vital equipment crucial to the boats operation, such as fuel tanks and batteries, are secured in place, and that fuel lines are properly secured.

5. It is always advisable to carry a means of communication with the shore, such as a hand-held VHF radio. A skipper should also know the range of signals available to him to alert others to an emergency.

6. Reference should be made to the guidelines contained in *Safety Afloat*, a voluntary code of best and safe practice for leisure craft users.

7. If going afloat, wear the appropriate clothing. Anyone doing so for the first time in British waters may be unaware how cold it can get, or how quickly insulation breaks down if clothing becomes wet.

8. The one essential item that must always, always be carried in any craft is a lifejacket for everyone embarked. If a non-swimmer, or the conditions are a bit on the rough side, or you are unsure about whether or not to wear one, put it on before going to sea. They must be on board and easily accessible for all others. The decision to wear them is left to the discretion of individuals, or the requirement of the skipper. But everyone should (a) know where they are (b) how to put them on and (c) put them on so they know how to, and to ensure they fit properly. To ignore this advice could cost you your life.

Footnote

The Royal Yachting Association can be contacted at RYA House, Romsey Road, Eastleigh, Hants, SO50 9YA.
Telephone: 023 8062 7400

A Pause for Thought

Accident investigation reports routinely refer to the human factor having a direct or indirect bearing on an incident. The rather meaningless statement that 80% of all accidents are caused by human error is so frequently made that it has long since lost its impact, and there are many people only too ready to attribute blame for an accident on someone making a mistake. The traditional penalty for such 'mistakes' is the sack. And everyone, or nearly everyone, goes home happy.

The question the professional marine accident investigator repeatedly finds himself asking is why, with so much talk about the human factor, does the mariner understand so little about it, and why do people at sea - often well trained - make mistakes?

The aviation industry has invested much in understanding human factors to reduce accidents. Aircrews are not only examined on the subject, but many airlines actively promote joint training of flight deck and cabin crews, together with senior management, technicians and air traffic controllers, in an effort to create a safe operating environment. The day of the macho pilot refusing to accept that others could help him do his job better, is probably long gone.

The marine world has, by contrast, a long way to go. Some companies try. Some individuals, against the odds, endeavour to provide effective leadership and one of the driving forces behind the ISM code was the need to involve management in sharing responsibility for what goes on afloat. The Code, which on 1 July 2002 embraces all cargo ships of 500gt and above, plays an important part in trying to address the human factor, but there is a suspicion that much of the effort is being directed at getting the paperwork right. The poor man is, once again, being ignored in too many instances.

Very little has ever been written on the subject for the man or woman at sea. There is an abundance of academic literature which quickly lapses into language that leaves the average seafarer totally bewildered, and few will have the foggiest idea what is meant by 'visual/tactile dissimilarity', 'cognitive aspects of safety', 'rule-based behaviour', 'latent conditions and pathogens' or 'non-optimised performance-shaping factors.' What the seafarer needs is a simple explanation about what is meant by human factors so he or she can better understand why it matters, and what needs to be done to improve safety and conditions of service.

This *Safety Digest* article tries, in a few words, to introduce the human factor to the average mariner.

Consider the following unrelated, fictional, situations.

You are the master of a bulk carrier attempting to do a good job. You know your business and have had an unblemished record. You have worked for a number of companies and your present managers are no better or worse than many others. You think you are undervalued and you are heartily sick of all the paperwork that constantly piles up on your desk. Your ship is in date for all its surveys, but you know that as soon as you arrive at your destination you will be swamped by battalions of surveyors and other officials who will be inspecting/vetting/surveying various aspects of your command. You have just received a satellite phone call saying your mother is dangerously ill. And the chief is on his way up to tell you that the air conditioning in the ratings' accommodation has broken down again. Six months ago you submitted a list of defects and safety concerns to your superintendent but, with a couple of exceptions, you are acutely aware that absolutely nothing has been done about them. And you have just looked out of your cabin window to see you are on the port bow of a ship some 4 points to starboard and about 2 miles away. You have an uncomfortable

feeling your officer of the watch is not doing anything about it. You start thinking about coming ashore.

You are a junior engineer officer on a ro-ro ferry and have been with the ship for about 6 months. You like the work, and have ambitions to rise to the top of your profession. But you don't like the chief engineer. You are not sure if the dislike is mutual but, from the moment you first joined, he has done nothing but find fault with everything you do. He has his likes and dislikes about how things should be done, and woe betide you if you fail to pay particular attention to one of his hobbyhorses. He doesn't approve of anyone gossiping in the machinery control room, and you have noticed that whenever he is around, your colleagues tend to stop talking and pretend they are busy. And you have also begun to realise you aren't sleeping very well and are taking something your local chemist at home has recommended. You have just read an article on stress in the Reader's Digest and are horrified to realise you have all the symptoms.

You are the mate on a very well equipped feeder container vessel and keep watch on a 6 hours on, 6 hours off basis with the master. You are one of a very small, mixed nationality crew and morale on board is good. But you have been working a punishing schedule for several weeks. The cycle of watchkeeping, stations, cargo work, and supervising the crew has left you tired, very tired. You know there is no point in making a fuss, nobody pays the slightest attention to you, and the fact that you worked over 90 hours last week is of no interest to anyone. What is particularly worrying is that last night while on watch going down channel, you suddenly found yourself being woken up by the bridge watch alarm sounding. You hadn't meant to fall asleep when you sat down briefly in that comfortable chair, but there is no disputing you did. The most disturbing factor is that having reset the alarm, you went straight back to sleep.

You were a cabin steward and had just joined your second cruise ship. You liked the first one, where training was taken seriously and you had a sympathetic leading hand who showed you exactly what to do. After a while you felt on top of the job and part of a team. In your new ship the atmosphere is very different. Training, while still carried out, was not as well supervised, and people did not appear to have as much time to show the newcomers around. You were expected to know. One day soon after you joined, a fire was detected in part of the passenger accommodation. It was quickly extinguished, and the damage was slight. The onboard investigation traced the source of the fire to a water heater which had been left to boil dry. To your horror, you realised the boiler was in the cabin section you were responsible for. You owned up and, after a while, were informed you were to be dismissed. The rest of the crew was told that the person responsible for 'starting the fire' had been identified and dealt with. What they didn't know was that in this ship the 'off' switch to the boiler heater was made up exactly opposite to that in your first ship. You left the sea to work in a hotel chain and were talking to a former colleague recently. The switches, it appears, are still set differently in the two ships of the same company.

Four very different scenarios and based on fictitious characters and circumstances, but many people will recognise some of the ingredients. In the space of four paragraphs about 30 different human factors have been identified, any one of which could be the crucial factor in a chain of circumstances that might lead to an accident. If any one of the factors identified had been different, an accident might have been avoided.

People respond to encouragement, good humour, co-operation and fairness. They will work better if they are well fed, well rested and get adequate exercise. They will be more effective if they feel people are interested in them and listen to them when things are not right. The shore manager who ignores pleas from sea is almost certainly contributing to things going wrong. The plea might be unreasonable but, by listening carefully and talking the matter through, the pent up resentment that

might arise can be resolved. The senior officer who makes himself unapproachable, or who has particular fads, is just as much a contributory factor to an accident as the lazy junior who tries to cut corners. Seafaring is all about teamwork, the ability to get on with colleagues, to socialise with them as well as having mutual respect for their competencies. And it means drawing safety deficiencies to the attention of higher authority without any fear whatsoever of retribution.

People make mistakes because of a number of reasons, and these have been well catalogued in psychological studies. Expressions such as latent error, violations, spatial disorientation, slips and knowledge-based mistakes, feature in the marine accident investigator's lexicon, and it falls to him to identify what these are as he goes about his business. His task, ultimately, is to highlight the reasons for the mistakes and to propose solutions to prevent them happening again. Or he can identify the lessons to be learned and bring them to people's attention.

Ultimately, however, we are all in the business of creating a safer environment. Each one of us, be it the senior master of a large cruise ship, the third engineer in a ULCC, the mate of a pelagic trawler or the most newly joined deckhand in a small inter-island ferry, can do much to achieve this aim. Seafarers, unlike many shore-based job holders, have the distinction that by and large they work and live together in the same small 'box'. We all depend on each other. The crew that pulls together, has common aims, and is happy in its work will have every chance of being in a vessel that is least likely to have an accident.

It largely depends on understanding the human factor.

MAIB NOTICEBOARD

The United Kingdom is not alone in recording tragic fishing vessel accidents. In April 2001, the fishing vessel *Arctic Rose* sank with the loss of 15 lives in the Bering Sea. The event led to the following editorial appearing in the American newspaper the Seattle Times. Although the observations are directed at a USA readership, the comments will provide food for thought to fishermen throughout the world.

SEATTLE TIMES ... EDITORIAL -
29 August 2001

Make safety the legacy of the Arctic Rose.

As the U.S Coast Guard looks for details that explain why the Arctic Rose sank in the Bering Sea and killed 15 men, the basic story line is all too familiar.

Over and over, lives are lost because of poor vessel or equipment conditions, inadequate preparation for emergencies and vessel stability problems that are unknown or ignored.

That is the certain knowledge and experience the Coast Guard applies to examining murky videos from the sea bottom where the Arctic Rose rests and parsing through hours of conflicting, emotional testimony.

The U.S fishing industry is famously and effectively resistant to safety improvements. A dozen years ago, when Congress responded to another tragedy at sea, the industry mantra was unchanged: safety cannot be legislated.

That is wrong. Enactment of a law requiring survival suits, life rafts and

emergency beacons resulted in a dramatic decrease in deaths.

Of course, the Coast Guard understood the improvements dealt narrowly with surviving a sinking ship, not making vessels more seaworthy.

Keeping a fishing boat afloat in an unpredictable environment requires a combination of knowledge and skills matched to the characteristics of the vessel. Improper loading or suspect vessel modifications can create dangerous conditions.

The Coast Guard is trying to determine what event or chain of events sank the Arctic Rose early on April 2 in reportedly calm seas. Presumably, the crew was asleep, but testimony also suggests a large 20,000-pound catch of sole might have had everyone working through the night. A remotely operated video camera revealed a door that appeared to be open. Operating rules called for the door to be closed to create a watertight seal between a processing room and the vessel's deck.

Any extra water on board would undermine the stability of a boat former crew members testified could be skittish to handle. Yesterday, however, expert testimony said the vessel's technical specifications all looked right. This is where the Coast Guard is the important arbiter.

Any recommendations for safety improvements always face a challenge from a politically potent industry. Fishing is a dangerous occupation. Just acknowledging that fact encourages the fatalistic notion that nothing can be done. The Coast Guard argues otherwise in report after report that loss of lives and vessels at sea is preventable.

The grim paradox, according to the Coast Guard, is the same fishermen who ask the Legislature to pay for a suitable memorial to lost fishermen one session, are back the next session opposing requirements for basic survival and emergency communications gear.

The Arctic Rose is the greatest loss of life in the fishing industry in half a century. This episode must not end with the names on the memorial at Fishermen's Terminal.

Footnote

This article has been reproduced by kind permission of the Seattle Times, whose co-operation is gratefully acknowledged.

APPENDIX A
Investigations started in the period 01/07/2001 - 31/10/2001

Date of Accident	Name of Vessel	Type of Vessel	Flag	Size	Type of Accident
19/07/01	*Vertrauen*	Fishing vessel	UK	211gt	Foundering/flooding
24/07/01	*Our Nicholas*	Fishing vessel	UK	20.33	Grounding
30/07/01	*Sand Heron*	Dredger	UK	3,751	Collision/contact
30/07/01	*Celtit*	Fishing vessel	France		Collision/contact
04/08/01	*Royal Princess*	Cruise	UK	44,588	Accidents to personnel
09/08/01	*Choice*	Passenger	UK	50.23	Grounding
12/08/01	*Aurelia*	Fishing vessel	UK	337	Foundering/flooding
24/08/01	*Grand Turk*	Non-commercial sailing vessel	UK	314	Accidents to personnel
10/09/01	*Sundance*	Fishing vessel	UK	3.21	Capsize
20/09/01	*HSS Stena Explorer*	ro-ro passenger	UK	19,638	Fires/explosions
09/10/01	*Ash*	General cargo	SVG	1009	Collision
	Dutch Aquamarine	Chemical tanker	Holland	4,671	
17/10/01	*Gulsar Ana*	Bulk carrier	Turkey	23,602	Machinery
23/10/01	*Gemma Fidelis*	Fishing vessel	UK	62	Accidents to personnel

APPENDIX B
Report issued in 2000 (Priced)

MAIB Annual Report 1999
Published July 2000
ISBN 1 85112 186 2
£16

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The Stationery Office bookshops or alternatively:

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A list of Stationery Office stockists and distributors outside the UK appears at Appendix D.

APPENDIX C
Reports issued in 2001 (Unpriced)

Alfa Britannia - parting of a mooring line while Bahamian-registered tanker was berthing at Tranmere oil terminal near Birkenhead on 18 November 1999, resulting in injuries to crew members on board a gig-boat.
Published 31 January 2001

Alma C - death of a fisherman about 55 miles west-by-south of Thyboron in Denmark on 25 January 2001.
Published 31 August 2001

Angela - capsize and foundering of fishing vessel in the North Sea on 6 February 2000.
Published 26 April 2001

Annandale - flooding and foundering of fishing vessel 16 miles NNE of the Shetland Islands on 23 March 2000.
Published 7 March 2001

Atlantic Eagle - capsize of vessel off St Justinians, Ramsey Sound, 28 September 2000.
Published 25 May 2001

Atlantic Princess - man overboard incident from vessel in the English Channel on 23 November 2000.
Published 31 August 2001

Baltiyskiy - accident on the general cargo vessel, resulting in the death of a seaman on 10 September 2000 while on passage from Riga, Latvia to Poole, UK
Published 11 May 2001

Brucestone/Loverval - collision between vessels, River Thames, Purfleet Deepwater Berth, 21 December 2000.
Published 23 August 2001

Celtic King/De Bounty - collision between UK-registered feeder container ship *Celtic King* and Belgian-registered fishing vessel *De Bounty,* to the south of The Smalls traffic separation scheme off the south-west coast of Wales on 19 March 2000.
Published 2 February 2001

Coastal Bay - grounding of vessel in Church Bay, Anglesey on 21 July 2000.
Published 9 March 2001

Diamond Bulker - incident on bulk carrier with the loss of two lives, when at anchor in Lough Foyle, Londonderry, Northern Ireland on 5 April 2000.
Published 3 April 2001

Eastfern/Kinsale - collision between Irish-registered cargo ship *Eastfern* and Cyprus-registered bulk carrier *Kinsale* 10.6 miles SW of Dover on 25 September 2000.
Published 3 May 2001

European Pioneer - grounding off Fleetwood 1 December 2000.
Published 27 April 2001

***European Tideway* and *Vrouw Grietje* -** collision between vessels in North Sea on 16 October 2000.
Published 25 May 2001

***Evangelos CH* -** fatal accident to a crew member on board the bulk carrier at the Zulu Anchorage, River Thames Estuary on 20 November 2000.
Published 10 August 2001

***Fivla* -** death of an engineer on board vessel in the Bluemull Sound, Shetland on 16 July 2000.
Published 17 April 2001

***Fleur de Lys* -** explosion on board vessel, which then foundered 18 miles south-east of Portland Bill on 16 April 2000.
Published 12 October 2001

***Girl Alice* -** loss of skipper from vessel 1.5 miles south-east of Burnmouth on 19 November 2000.
Published 2 May 2001

***Happy Lady* -** grounding of vessel off Shoebury Ness, Thames Estuary, 21 January 2001.
Published 11 May 2001

***Highland Pioneer* -** collision between the offshore supply vessel and the DA jack-up rig of the Douglas offshore installation in Liverpool Bay 27 January 2000.
Published 27 April 2001

***Horizonte Claro* -** grounding of fishing vessel on Soyea Island, Loch Inver, 21 October 2000.
Published 18 May 2001

***Inga* -** death of a crewmember on motor tanker after falling down a pumproom hatch at Pembroke on 7 July 2000.
Published 10 April 2001

Lifeboat Safety Study 1/2001 - Review of Lifeboat and Launching Systems' accidents.
Published 22 February 2001

***Mariama K* -** carbon monoxide poisoning on vessel in Douarnenez, France 10 June 2000 - one fatality.
Published 20 April 2001

***P&OSL Aquitaine* -** impact with quay by passenger ro-ro ferry at Calais on 27 April 2000.
Published 19 July 2001

***P&OSL Calais* -** failure of No 5 lifeboat winch on 25 June 1999, and related investigation into self-lifting sprag clutch behaviour.
Published 20 April 2001

***Philomena* -** fatal accident on board vessel in the Moray Firth on 6 March 2001.
Published 31 August 2001

***Portsmouth Dory* -** capsize of school boat on Fountain Lake, Portsmouth with the loss of one life on 16 September 1999.
Published 20 March 2001

***Pride of Bilbao* -** rescue boat falling from *Pride of Bilbao* into Cherbourg Harbour injuring two people on 1 July 2000.
Published 16 February 2001

***Ross Alcedo* -** fire on board vessel while underway about 32 miles north-west of the Isles of Scilly on 16 January 2000.
Published 15 February 2001

***Solstice II* -** investigation of a fatal accident to a crew member, 25 miles south-west of Rockall 13 May 2000.
Published 18 May 2001

***Southampton Boatshow RIB* -** three persons falling overboard from RIB in River Test on 22 September 2000, resulting in one fatality.
Published 3 August 2001

***St Helena* -** engine room fire on 25 August 2000.
Published 4 May 2001

***Van Dijck* -** loss overboard of a fisherman from fishing vessel while fishing 30 miles south-west of Guernsey on 16 April 2001.
Published 5 October 2001

***Wightstone/Rose Ryal* -** collision between *Wightstone* and the moored yacht *Rose Ryal* in River Medina, Isle of Wight on 9 November 2000.
Published 8 June 2001

***Wintertide/MSC Sabrina* -** collision between vessels off Texel Traffic Separation Scheme on 13 June 2000.
Published 15 March 2001

***Xuchanghai/Aberdeen* -** collision between vessels at Immingham oil terminal on 12 December 2000.
Published 22 August 2001

MAIB Annual Report for the year 2000

***Safety Digest 1/2001*: Published April 2001**
***Safety Digest 2/2001* : Published August 2001**

SAFETY DIGEST
Copies of the *Safety Digest* publication can be obtained, free of charge, on application to the Marine Accident Investigation Branch
(Mrs J Blackbourn (023 8039 5509)).

APPENDIX D
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