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“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

NOTE

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

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Fire on board the fishing vessel **ONWARD**

**60nm off the north coast of Scotland
resulting in the loss of the vessel
11 April 2012**

SUMMARY

Shortly after 1300 (UTC+1) on 11 April 2012, a fire was discovered on board the UK registered stern trawler *Onward*, 60nm off the north coast of Scotland. The vessel's crew did not attempt to fight the fire and eventually abandoned the vessel and boarded a liferaft. They were rescued by a coastguard helicopter and there were no injuries. *Onward* subsequently disappeared and is presumed to have foundered. No pollution has been reported.

The MAIB investigation established that:

- The fire probably started in the engine room and that the spread of smoke inside the ship was assisted by several doors and hatches being left open.
- The fire detection system had not been tested for a considerable time and did not operate. Consequently,

the fire was already well established by the time the crew were alerted.

- Safety of the vessel was given insufficient priority by the crew. Their response to the fire reflected the absence of emergency drills on board and poor knowledge of the vessel's systems and equipment.

The accident occurred only 11 months after the loss of *Beryl*, which flooded and foundered north of the Shetland Islands. *Beryl* and *Onward* frequently trawled as a pair and had common ownership interests. In view of the similarities between some of the contributing factors in the accidents on board *Beryl* and *Onward*, a recommendation has been made to Mithcovie Fishing Company Limited aimed at improving the safety of any vessels it may own in the future.



Photograph courtesy of Ally

Onward

FACTUAL INFORMATION

Narrative

At about 0300 on 11 April 2012, the 21.3m stern trawler *Onward* completed fishing approximately 45nm north-west of the Butt of Lewis and headed towards fishing grounds closer to the Orkney Islands (**Figure 1**). The vessel was on an easterly heading, in autopilot, and was making good a speed of between 7kts and 8kts in rough seas. *Onward* was scheduled to arrive in MacDuff, Aberdeenshire the following evening in order to complete a periodic survey.

The vessel's skipper, mate, engineer and two deckhands were on board. Between 0300 and 0900, the wheelhouse watches were shared between the skipper (0300-0500), the engineer (0500-0700) and one of the deckhands (0700-0900). The engineer visited the engine room during his watch and found that the main engine and the auxiliary machinery systems were operating normally. When not on watch, the crew slept in separate cabins in the accommodation area aft (**Figure 2**).

At 0900, the skipper took over the watch from the deckhand in the wheelhouse, and between 0951 and 1203 he made a number of telephone calls via the internet to his home, MacDuff Shipyard Ltd and MacDuff harbour regarding the vessel's return and the planned survey. On completion, the skipper left the wheelhouse and went to the galley (**Figure 2**) to make himself some toast and tea. The galley door was open but the adjacent engine room and shelter doors were closed. About 5 minutes later, the skipper returned to the wheelhouse and made another telephone call at 1217. He then looked at the chart plotter and contemplated where next to fish while seated on the port side of the wheelhouse. There were no other vessels in the immediate vicinity.

Just after 1300, the skipper smelt smoke and burning coming through the wheelhouse hatch from the deck below. He got down on his hands and knees and looked down the near vertical steps and saw smoke in the main alleyway below. The skipper shouted to the crew to get out of bed. He then reduced the vessel's speed. The skipper was concerned that the crew had not heard his instructions and repeated them over the vessel's intercom system. He then left the wheelhouse via

the aft door which led on to the main weather deck. He was extremely worried that the crew would not be able to escape.

However, the crew had heard the skipper shouting through the intercom. The two deckhands routinely slept in their clothes and they were the first to leave the accommodation via a vertical ladder which led to the main internal alleyway. The first of the deckhands was not fully awake and he thought the crew had been woken because the vessel was still fishing and that the gear had become snagged on the seabed. He did not notice any smoke as he went forward via the main alleyway, passing the crew's lifejackets that were hanging there on hooks, and climbed the ladder to the wheelhouse. He then exited on to the weather deck. The remaining crew, some of whom had smelled burning as soon as they were awake, also climbed the vertical ladder from the cabins but encountered black smoke in the alleyway and heard crackling noises from the vicinity of the engine room door. They immediately opened the aft watertight door that led to the trawl deck (**Figure 2**), and from there climbed the vertical ladder to the main weather deck aft of the wheelhouse, where they met the skipper and the other deckhand.

By the time the crew had gathered, dark smoke was billowing up into the wheelhouse, from the engine room and galley vents on the main deck, and from the open hatch on the port side of the foredeck. As a consequence, the crew were unable to re-enter the wheelhouse or enter the forward shelter in order to activate the fixed carbon dioxide (CO₂) fire extinguishing system for the engine room. The skipper and his crew closed some of the vents on the main deck but they did not secure the vent flaps with dog clips.

The skipper soon assessed that the fire was out of control and ordered the crew to abandon ship. As the crew prepared to launch one of the two 8-man liferafts sited on the foredeck, the skipper climbed on to the wheelhouse roof, unclipped the Emergency Position Indicating Radio Beacon (EPIRB) from its mounting and switched it on.

The first of two liferafts carried on board was thrown overboard and it inflated correctly. However, the vessel was still moving through the water at a speed of about 3kts and the liferaft was towed through the water by its painter, which soon parted. To stop the vessel before launching the remaining liferaft, the skipper and the crew tried to foul the

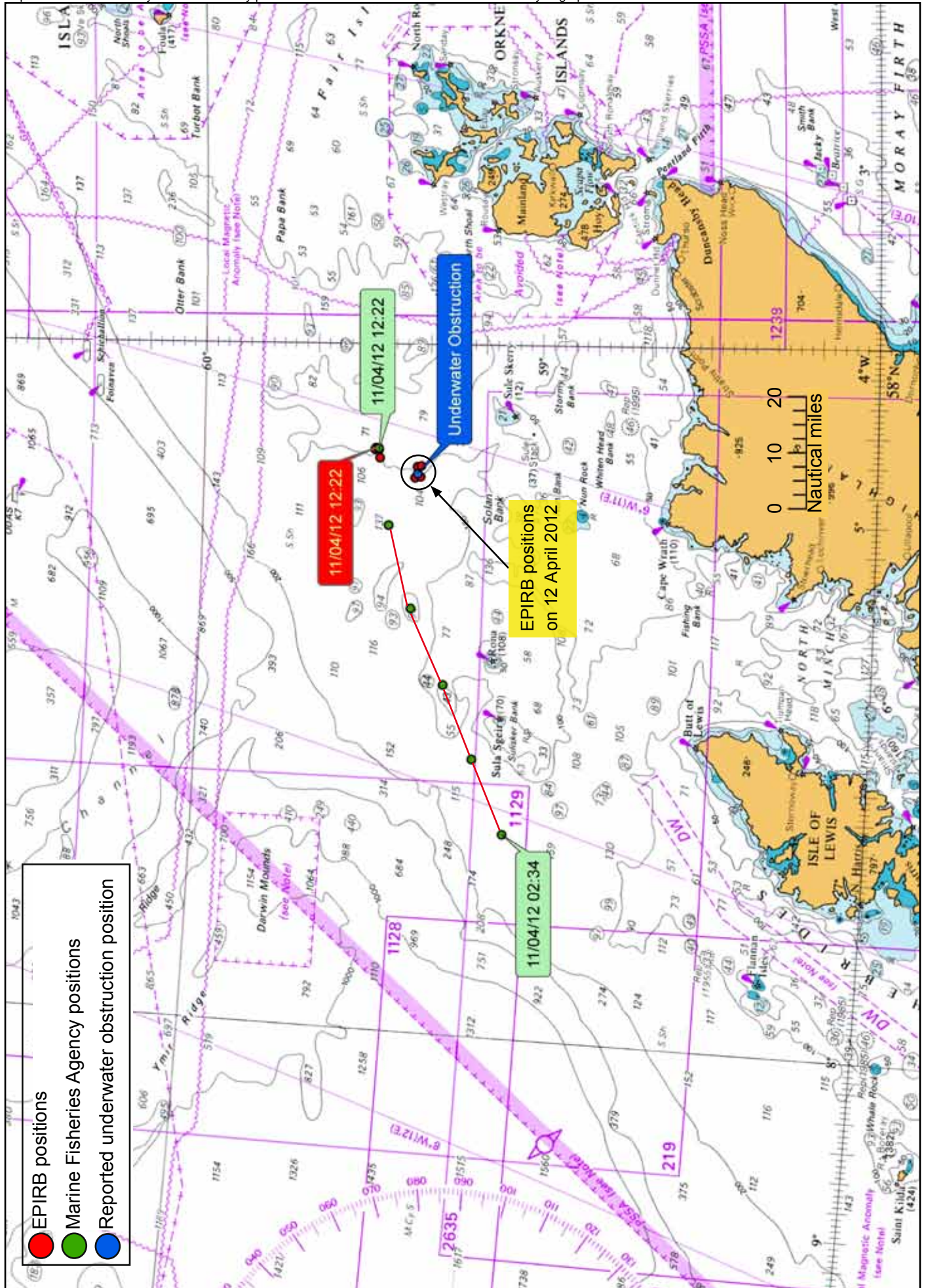


Figure 1: Vessel and EPIRB positions (times on this chart are UTC)

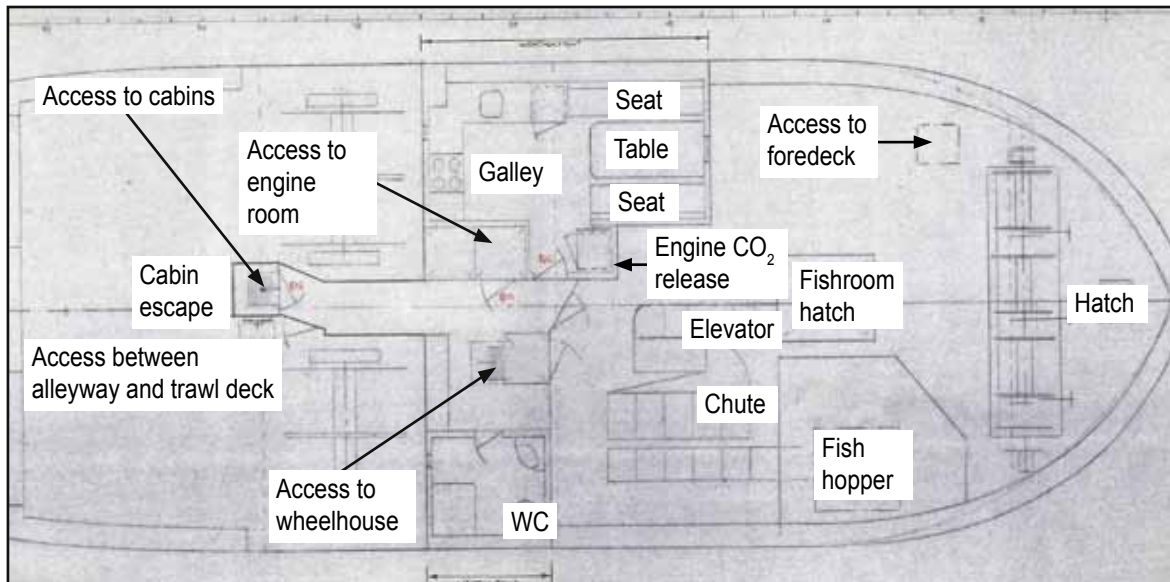


Figure 2: General arrangement (Accommodation deck)

vessel's propeller using a mooring rope. This was unsuccessful, so the skipper broke a window at the aft end of the wheelhouse with a sledge hammer in order to reach the engine controls. Once the window was broken, a rush of hot black smoke was emitted through the opening. With great difficulty, the skipper reached the engine controls with the hammer but inadvertently increased, rather than decreased, the engine speed.

Almost immediately, the fire in the wheelhouse increased in intensity so the skipper and the crew reassembled on the foredeck, taking life rings with them. They were all wearing light clothing and

were beginning to feel the cold induced by the wind and the sea spray. None of the men were wearing lifejackets.

As the men waited, the wheelhouse and surrounding deck became engulfed in flames and the vessel was no longer keeping a straight course. The main deck was noticeably warm and the crew heard numerous alarms sounding inside the vessel. Suddenly, the main engine stopped and the vessel's speed quickly reduced.

When *Onward* was almost stopped in the water, the crew launched the second liferaft, which inflated upside down. The skipper climbed down



Figure 3: *Onward* on fire

a boarding ladder, righted the liferaft and got inside. He was soon joined by the crew. The liferaft was then cast off from the burning vessel just as the aluminium mast on top of the wheelhouse collapsed.

A transmission from *Onward's* EPIRB was first detected and relayed to Falmouth Coastguard at 1322. The coastguard attempted to contact the vessel, but without success, so a surveillance aircraft operating in the area of the EPIRB's position was diverted to investigate. At 1423, the surveillance aircraft located *Onward* (**Figure 3**), and the fishing vessel's crew were winched on board a rescue helicopter from the liferaft about 50 minutes later. Although the men were hypothermic to varying degrees, none were seriously injured.

The Emergency Towing Vessel (ETV) *Anglian Sovereign* arrived on scene later the same night but, although one of the two liferafts was recovered, neither *Onward* nor the EPIRB were found. In June 2012, a fishing vessel reported snagging her nets on a previously unknown underwater obstruction in position 59°22N 004° 45W (**Figure 1**).

Crew

The skipper, mate and engineer normally worked an approximate 2 weeks on, 2 weeks off cycle, and they had all rejoined the vessel on 28 March 2012 in Lerwick, Shetland Islands. The two deckhands were both Filipinos who had periodically lived and worked on board *Onward* for about 2 years.

The skipper had been a fisherman since 1997 and held a deck officer (Fishing Vessel) Class 2 Certificate of Competency. He had completed the Seafish Industries (Seafish) basic safety training courses in fire-fighting sea survival, first-aid and health and safety, and had also attended an advanced fire-fighting course.

The mate and the engineer had also completed the Seafish basic

safety training courses. The two deckhands held equivalent STCW (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended in 1995 and 1997) 95 basic training qualifications but had yet to complete the Seafish safety awareness course. The engineer was also the vessel's cook.

Vessel construction

Onward was built in 2000 by MacDuff Shipyard Ltd. The vessel was of wooden construction with an aluminium wheelhouse and shelter deck. The decks were mainly wooden, but the decks above the engine room and the aft part of the main deck were made of steel. **Figures 4, 5 and 6** are photographs taken on board a sister vessel, *Ocean Challenge*.

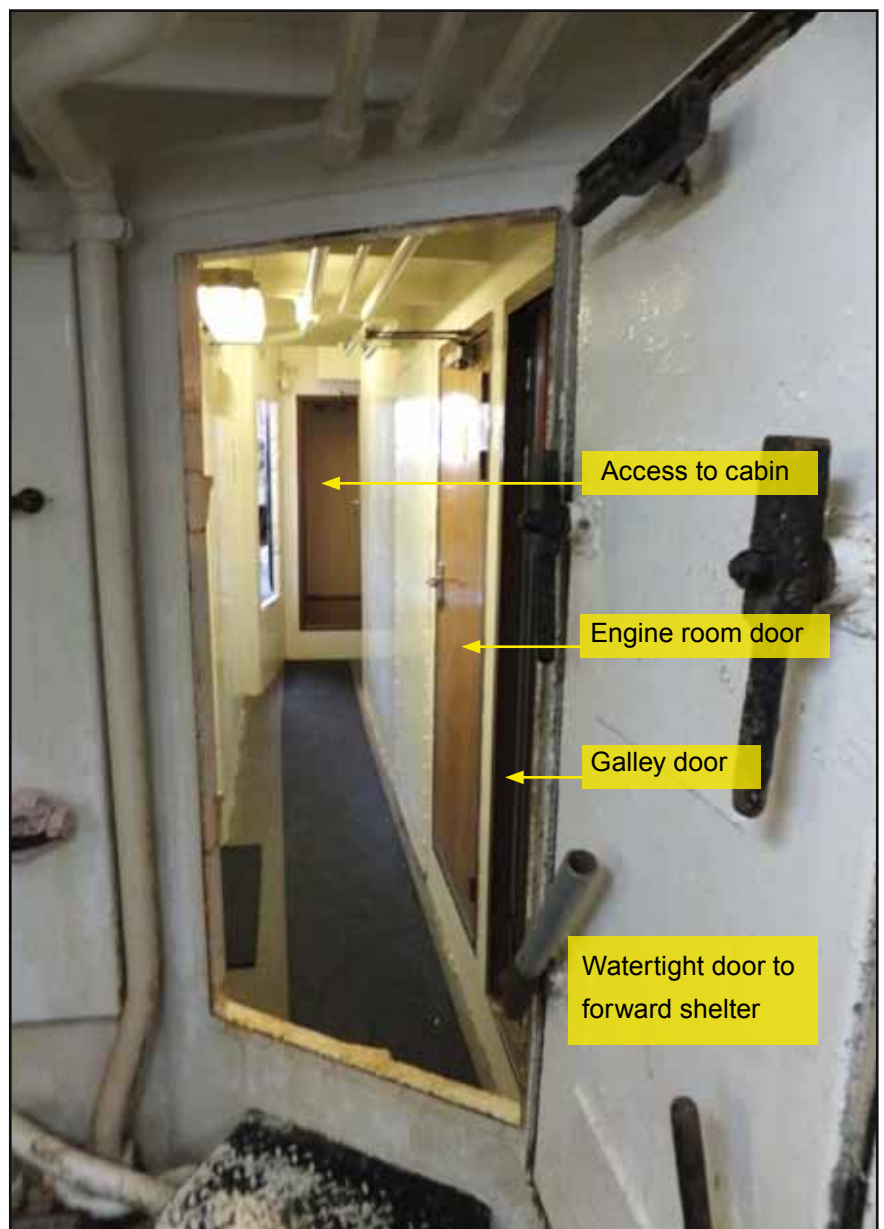


Figure 4: Access to the engine room via a door sited on the port side of the main alleyway (*Ocean Challenge*)

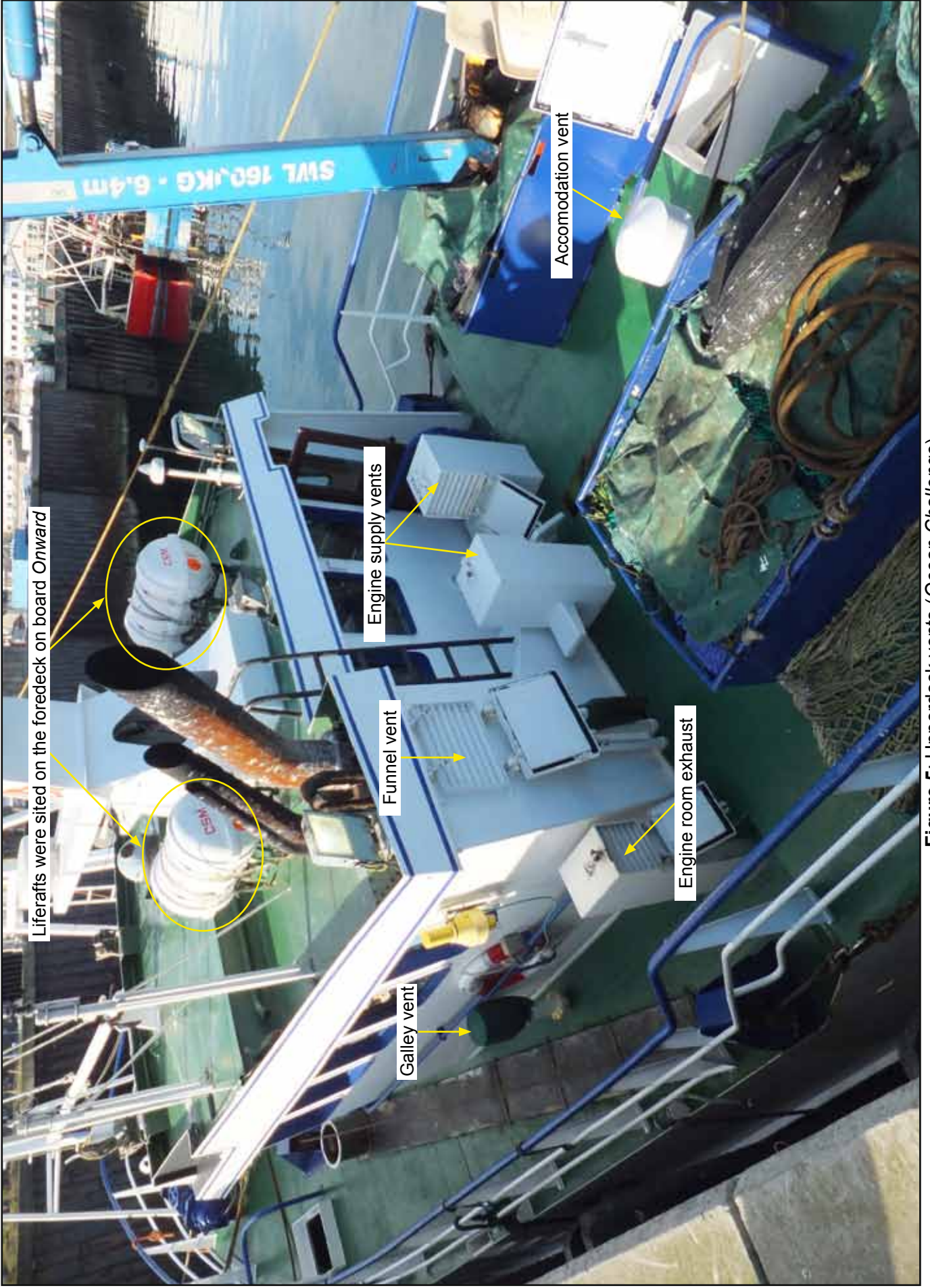


Figure 5: Upperdeck vents (Ocean Challenge)

Engine room

Access to the engine room was via a door sited next to the galley door on the port side of the main alleyway (Figures 2 and 4). The compartment's bulkheads, deckhead and access door had a fire insulation rating of B15¹. The engine room access door was kept closed when the vessel was at sea, but it did not provide a tight seal. The engine room had a single exhaust fan leading to a vent to port of the wheelhouse (Figure 5). A closed circuit television (CCTV) system enabled the engine room and trawl deck to be monitored from the wheelhouse.

The vessel's main engine was a twelve-cylinder 411kW diesel engine manufactured by Mitsubishi, which drove a fixed pitch propeller via a reduction gearbox. The engine had been overhauled in 2010. A series of pulley wheels and belt drives on a Power Take Off (PTO) shaft at the forward end of the engine was used to drive auxiliary equipment, including a bilge pump, a fridge compressor, 110V direct current (dc) and 24V dc alternators, and a small hydraulic pump. The engine-driven belt drives required regular attention to prevent slippage. On a previous voyage, the slippage of one of the engine-driven belts had led to the belt overheating. An emergency stop for the main engine was sited in the wheelhouse.

A six-cylinder, 180kW auxiliary diesel engine drove two hydraulic pumps supplying deck machinery. Belt drives at the free-end of the engine drove a bilge pump, and 110V dc and 24V dc alternators. The engine was only operated while the vessel was fishing and was not running at the time of the fire.

Onward's two fuel tanks were sited one on each side of the engine room. The tanks had plastic sight-glasses and self-closing push-button type tank level indicators. All four tank outlet valves were normally left open, and two short braided



Figure 6: Fire detection system control panel (*Ocean Challenge*)

steel flexible hoses fed fuel to the engine-driven fuel pumps. The vessel was carrying approximately 7000 litres of diesel oil.

The remote switches for closing off the fuel supply from the tanks to the main engine were located in the main alleyway at the bottom of the ladder leading to the wheelhouse. Other tanks within the engine room included a hydraulic oil service tank and a lubricating oil storage tank.

¹ B15 fire protection insulation requires that the average temperature at the unexposed-face is not more than 140°C, and spot temperatures on the unexposed face should not rise more than 225°C, within 15 minutes.

The engine room also contained, inter alia:

- 110V dc and 24V dc switchboards, with a 230V alternating current (ac) transformer/rectifier.
- A single-cylinder hand-start diesel engine and battery charger.
- Four, 6V heavy duty batteries used to start the main engine and two 12V heavy duty batteries used to start the auxiliary engine.
- A electro-hydraulic power-pack for the steering gear.

Galley

The combined galley and crew mess was sited on the vessel's port side, immediately aft of the forward shelter deck (**Figures 2 and 4**). To insulate against the spread of fire, the compartment bulkheads and deckhead were rated to A30² and the door was rated to the B15 standard. The furniture inside the galley was mainly wooden.

The galley was fitted with two portholes: one in the forward bulkhead, which provided an emergency escape route into the forward shelter; the second porthole was smaller and was sited in the aft bulkhead above the hob. At the time of the fire, the forward porthole was open. The aft porthole was normally kept shut when the hob or oven was not in use.

The galley was equipped with an electric hob fitted with four heat rings which could be isolated by a circuit breaker in the wheelhouse. Due to a faulty control switch, one of the heat rings, which drew 4 amps of electrical current, had been temporarily re-wired by a qualified electrician in January 2012 so that it remained permanently 'on' at a medium heat. The hob control was due to be repaired when the vessel returned to port.

The galley and mess was also equipped with a 110V dc oven, a hot water calorifier, two freezers, an extraction fan above the oven, a rice cooker, a microwave oven, a toaster, a television and a video player. The electrical equipment in the galley was protected by circuit breakers in the wheelhouse.

The galley door was usually secured in its open position on a hook and eye. It was reported that the galley was clean and tidy, and no items had been left on top of the hob.

Fire protection and fire-fighting

The vessel's structural fire protection met the Fishing Vessel (Safety Provisions) Rules 1975 for wooden vessels and she was fitted with a multi-zone fire detection system, approved by Lloyd's Register (LR). Smoke and heat detectors were fitted in the engine room, galley, alleyway and cabins. The system's control panel (**Figure 6**) was located on the port side of the wheelhouse. In addition to providing alarm indication for the locations of the detector heads, the control panel provided a visual warning of internal faults and included a test function. The fire alarm was designed and installed to be audible in the wheelhouse and accommodation areas. The fire detection system was not routinely tested but the crew were not aware of any problems or faults. It was not prone to false alarms. The system's main power supply was provided from 24V dc batteries sited in the engine room. A back up power supply was provided from emergency batteries located close by the wheelhouse.

The fire-fighting equipment carried on board *Onward* included a fixed CO₂ fire extinguishing system for the engine room, which was manually operated by a valve sited in a locker on the aft bulkhead inside the forward shelter. The vessel also carried water, foam and CO₂ portable fire extinguishers in various locations. The vessel's crew did not conduct fire-fighting drills.

Maintenance

On 28 March 2012, the engineer carried out a number of basic maintenance tasks which included changing the main engine oil, replacing the fuel filters, replacing the refrigeration system PTO belts, checking the other engine PTO belts, and general greasing.

In preparation for the vessel's forthcoming survey, the engineer had also checked the vessel's lifesaving equipment and had identified that the batteries in the EPIRB should have been replaced by January 2012.

² A30 fire protection insulation requires that the average temperature on the unexposed-face is not more than 140°C, and spot temperatures on the unexposed face should not rise more than 180°C, within 30 minutes.

Previous accident

On 22 May 2011, the 20.8m twin-rig trawler *Beryl*, which frequently trawled with *Onward* and shared ownership interests, foundered north of the Shetland Islands. The crew had been alerted to a problem in the engine room by the sounding of a cooling water temperature alarm. On investigation, the engine room was found to have flooded to a depth of about 1.5m. The four crewmen abandoned the vessel approximately 1 hour and 40 minutes after the flood was discovered, and were rescued from a liferaft by *Onward*. *Beryl* sank 20 minutes later.

ANALYSIS

Fire source and smoke spread

The source of the fire is unknown. However, in view of the speed at which the fire and its associated smoke spread, it is almost certain that the fire was already well established with a good supply of fuel when the alarm was raised. There was no evidence of a fire when the skipper visited the galley between 1203 and 1217, but when the skipper smelled smoke in the wheelhouse just after 1300 it only took about 20 minutes for the smoke to become so dense and extensive to prevent re-entry and to necessitate the vessel's abandonment.

The onset of thick black smoke indicates that the fire was predominantly oil-based. Although the galley contained many potential heat sources, including the temporarily re-wired heat ring, there was no cooking taking place and the potential fire load in the galley was largely carbonaceous. Therefore, given that smoke was being emitted from the engine room vents when the crew arrived on the deck, it is most probable that the fire started in the engine room, possibly as a result of leaking fuel coming into contact with one of the several potential heat sources available. The almost simultaneous increase in the fire's intensity when the engine speed was inadvertently adjusted might have been coincidental, but might also indicate that there was a fuel leak on the main engine.

Once an oil-based fire was established in the engine room, large quantities of black smoke would have escaped into the alleyway through the gaps between the engine room door and its frame. It is highly likely that the rapid development and spread

of the smoke was assisted by the air flow through the vessel resulting from the foredeck hatch, the galley porthole and door, and the wheelhouse hatch all being left open. As soon as the engine room door burned through, the fire would have instantly intensified and thick black smoke would have quickly spread throughout the vessel.

In view of the intensity of the fire (**Figure 3**) and the vessel's wooden construction, *Onward* would have continued to burn until foundering. The proximity of the underwater obstruction discovered in June 2012 to the vessel's last known position, and the positions of the EPIRB on 12 April 2012 (**Figure 1**), suggests that the obstruction could be the wreck of *Onward*.

Fire detection

The first indication that a fire had broken out was when the skipper smelled smoke in the wheelhouse that had come up from the deck below. Given that both smoke and heat sensors were fitted in the engine room, galley, alleyway and the cabins, and that no alarms were heard by the skipper in the wheelhouse or by the rest of the crew when they were in their cabins, it can be concluded that the fire detection system was either unserviceable or was not switched on.

Although the fire detection system fitted on board *Onward* met the design and performance standards required by LR, it was not tested regularly. Indeed, it is possible that the system had not been thoroughly tested since the vessel's last survey in 2009. In such circumstances, the probability of some of the system's sensors not functioning as intended, particularly those in high-risk spaces such as engine rooms, which were continuously exposed to high levels of heat, dirt and vibration, was increased considerably. It is possible that system faults were indicated on the control panel in the wheelhouse, but they had either not been noticed or their significance had not been recognised by any of the crew.

The malfunctioning of the fire detection system allowed the fire to develop unnoticed and denied the crew the opportunity to fight the fire in its early stages. As a consequence, the fire spread far more rapidly than might otherwise have been the case. Ultimately, this led to the almost immediate evacuation of the vessel's interior, which contained the vessel's control and communication equipment as well as the crew's clothes and lifejackets. The

rapid spread of the smoke and fire also reduced the time available to take key actions such as operating the fuel supply trips and operating the fixed CO₂ fire extinguishing system in the engine room.

Crew response

Notwithstanding the fire-fighting training completed by the skipper and the crew, *Onward* did not carry sufficient fire-fighting equipment for her crew to tackle a large fire. Therefore, the skipper's decision to activate the EPIRB and to abandon the vessel as soon as the vessel's interior was no longer accessible was prudent and justified. Nonetheless, several factors reduced the overall effectiveness of the crew's actions in this perilous situation. In particular:

- The skipper's rousing of the crew was ambiguous and caused a degree of confusion. Although the skipper managed to wake the crew, none were immediately aware of the nature of the emergency. The words "fire, fire, fire" stated over the vessel's tannoy system would have been clear and simple.
- No attempt was made to immediately try and identify the seat of the fire by operating the CCTV system cameras in the engine room and trawl deck.
- Not activating the fuel supply cut-off switches at the bottom of the wheelhouse hatch or pressing the main engine emergency stop control allowed pressurised fuel to continue to be supplied to the main engine.
- Although the skipper might have intended to return to the wheelhouse, leaving it unattended with the main engine running ahead resulted in an inability to stop the vessel that jeopardised the crew's ability to successfully launch a liferaft.
- Digital Selective Calling (DSC) was not used to alert both the coastguard and other ships in the area with accurate positional data.
- Not prioritising the activation of the CO₂ fire extinguishing system in the engine room meant that the fire went unchecked and the opportunity to use the CO₂ system was eventually lost.
- The closing of the vents on the upper deck was uncoordinated and incomplete.

Given the condensed timescale of the fire's spread, the skipper and his crew were undoubtedly panicked to some extent. However, the failure to respond effectively in this difficult situation

reflects not only their performance in very stressful circumstances, but also their lack of understanding of the importance of key equipment and systems fitted on board.

Safety culture

The circumstances of the loss of *Onward* strongly indicate that the manner in which the vessel was being operated gave insufficient emphasis to safety. This was shown, among other things, by:

- The absence of any testing or maintenance on the fire detection system, or the recognition or understanding of any faults that were probably displayed visually on its control panel.
- The lack of any emergency drills.
- Leaving doors, hatches and portholes open when at sea. The galley door was a fire door and therefore should have been closed when not in use, particularly when all the crew except the skipper were in their beds.
- The lack of knowledge regarding the uses of the various vents on the upper deck and the key vents to be closed in the event of a fire in the engine room.
- The re-wiring of the galley hob in order to leave a heat ring permanently on.
- Leaving the wheelhouse unattended when on passage.

Equipment such as fire detection systems and bilge alarms are the first lines of a vessel's defence and are critical to their safety. They are essential and not just a requirement of regulation. Consequently, such equipment must be given appropriate levels of attention to ensure they are properly maintained and tested, and that crew have a good understanding of their operation. Had the fire detection system and the bilge alarms worked correctly on board *Onward* and *Beryl* respectively, the vessels' crews would have been able to tackle the fire and flood in their infancy, and the abandonment and loss of the vessels might have been avoided.

Crews must also be trained to deal with emergency situations. Basic training courses in fire-fighting, sea survival and first-aid are important in this respect. However, crews must also have a good knowledge of their vessel's emergency procedures, equipment and layout, which can only be gained through emergency drills. All UK registered fishing vessels over 15m length overall are required to conduct drills monthly and when

a new crew member joins the vessel. The drills are also required to be recorded into a vessel's logbook (Merchant Shipping Notice 1770(F)). In this case, no drills had been conducted and the crew's response demonstrates that they were not prepared to cope with the situation they faced.

Although the skipper's timely activation of the EPIRB and his personal endeavours to right the second liferaft helped to ensure the crew's survival, given that the replacement of the EPIRB batteries was 3 months overdue, it was extremely fortunate that the EPIRB worked on this occasion. Had it not, the outcome for the crew might have been much more severe.

CONCLUSIONS

- The source of the fire is unknown, but it probably started in the engine room.
- The fire detection system did not operate.
- The fire was already well established by the time the crew were alerted, leaving them very little time in which to take emergency response actions, such as activation of the fixed CO₂ system in the engine room.
- Smoke spread rapidly inside the ship because several doors and hatches had been left open.
- A number of actions which could have improved the crew's chances of extinguishing the fire and their survival were not taken.
- Vessel safety was given a low priority. The fire detection system had not been tested for a considerable time and the crew were ill-prepared to deal with the emergency.

RECOMMENDATIONS

Mithcowie Fishing Company Limited is recommended to:

- 2012/150
- Ensure that the crews on board any vessels it may own in the future are fully prepared to effectively deal with emergency situations, taking into account, inter alia:
- The requirement to conduct periodic emergency drills and the importance of emergency drills to a vessel's safety.
 - The need for all early warning devices such as fire detection systems and bilge alarms to be properly maintained and tested, and that crews fully understand their operation.
 - The need for crews to have a good knowledge of all onboard safety-related systems and equipment, and that routine safety precautions such as the closing of fire doors are taken at all times.

SHIP PARTICULARS

Vessel's name	<i>Onward</i>
Flag	UK
Classification society	Not applicable
Fishing numbers	BF 440
Type	Fishing vessel, stern trawler
Registered owner	Mithcowie Fishing Company Ltd
Manager(s)	Mithcowie Fishing Company Ltd
Construction	Wood
Length overall	21.3m
Registered length	20.2m
Gross tonnage	202
Minimum safe manning	Not applicable
Authorised cargo	Fish

VOYAGE PARTICULARS

Port of departure	Scrabster
Port of arrival	MacDuff (intended)
Type of voyage	Coastal
Manning	5

MARINE CASUALTY INFORMATION

Date and time	11 April 2012 at about 1300
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	59°30N 004°37W
Place on board	Not applicable
Injuries/fatalities	None
Damage/environmental impact	Loss of vessel
Ship operation	On passage
Voyage segment	Mid-water
External & internal environment	Wind: north-easterly beaufort force 5 -7 Sea state: rough Visibility: good
Persons on board	5