Transport Accident Investigation Commission

Final Report

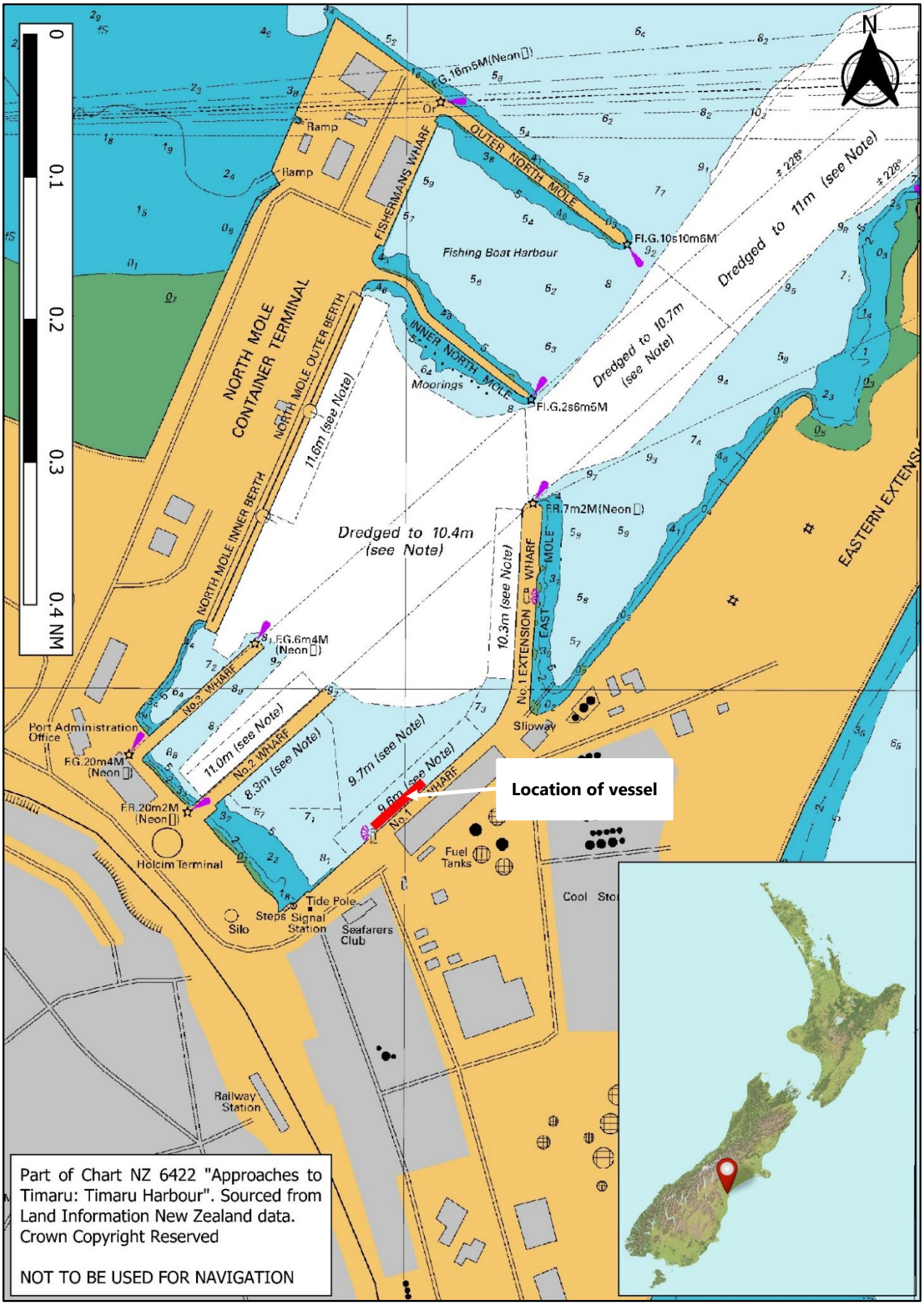
Marine Inquiry MO-2018-202
Accommodation fire on board
Fishing trawler Dong Won 701
Timaru
9 April 2018

December 2019

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas.

The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person. It is not the Commission's purpose to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. However, Commission will not refrain from fully reporting on the circumstances and factors contributing to an accident because fault or liability may be inferred from the findings.



Location of accident

The *Dong Won 701*

Photo courtesy of balticshipping.com

Contents

Figures

1. Executive summary

1.1. On 9 April 2018, the New Zealand-registered fishing trawler *Dong Won 701* was discharging its catch of fish in the port of Timaru when fire broke out in the accommodation space. Initial attempts by crew to extinguish the fire were unsuccessful, and by the time Fire and Emergency New Zealand attended the vessel, the fire had engulfed much of the accommodation.

1.2. The firefighting response continued for some eight days until the fire was fully extinguished. The vessel was later declared a total constructive loss. Three crew members and one Fire and Emergency New Zealand firefighter had to be treated at hospital for smoke inhalation.

1.3. The Transport Accident Investigation Commission (Commission) **found** that the fire started in a cabin on the officers' deck, but due to its intensity and duration and the consequent damage to the accommodation structure, it has not been possible to establish how it started.

1.4. The Commission **found** that delays in sounding the alarm, the inefficient mustering of available crew and a failure to follow good industry practice for fighting the fire allowed it to spread rapidly through the accommodation.

1.5. The Commission also **found** that although the *Dong Won 701* complied with the relevant Maritime Rules, the vessel's structural fire integrity did not meet contemporary standards, and this was a factor in the speed and intensity with which the fire spread.

1.6. **Safety issues** identified included that inconsistencies in the application of Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships may have resulted in up to 12 fishing vessels operating under the New Zealand Flag not complying fully with the relevant safety standards. A further 50 fishing vessels have been afforded grandparent rights that will allow them to operate indefinitely without meeting contemporary safety standards under the current Maritime Rules.

1.7. The Commission has made **one recommendation** to the operator, DW New Zealand Limited, and **two recommendations** to the Director of Maritime New Zealand.

1.8. **Key lessons** arising from this inquiry included:

- safety-critical systems such as fire-detection and alarm systems must be routinely tested to ensure they remain functional at all times in order to give early warning of a fire
- on discovering a fire it is important for the safety of all on board that the ship's general alarm is used to alert crew to the danger as soon as possible
- it is important to slow or prevent a fire spreading by, as soon as possible, closing all openings that can allow air to feed or be drawn into the location of the fire.

2. Factual summary

Background

2.1. The *Dong Won 701* was a New Zealand-registered, 82-metre-long fishing trawler.[1] The vessel was owned and operated by Dong Won New Zealand Limited, a subsidiary of the Dong Won Fisheries Company, based in South Korea.

Narrative

2.2. The *Dong Won 701* sailed from Dunedin on 7 March 2018 and spent 33 days at sea before returning to Timaru at about 0640 on 9 April 2018 to discharge the catch.

2.3. Cargo discharge continued until about 1700 that day. That evening 35 crew members went ashore, leaving the master and eight crew members on board.

2.4. One of the crew members who had gone ashore at 1945 was the first engineer. The first engineer's cabin was located on the port[2] side of the officers' deck (see Figures 1 and 2).

2.5. At about 2045 an engine room rating[3] in an adjacent cabin noticed smoke entering the cabin through the ventilation duct. The engine room rating decided to investigate and noticed smoke coming from the first engineer's cabin.

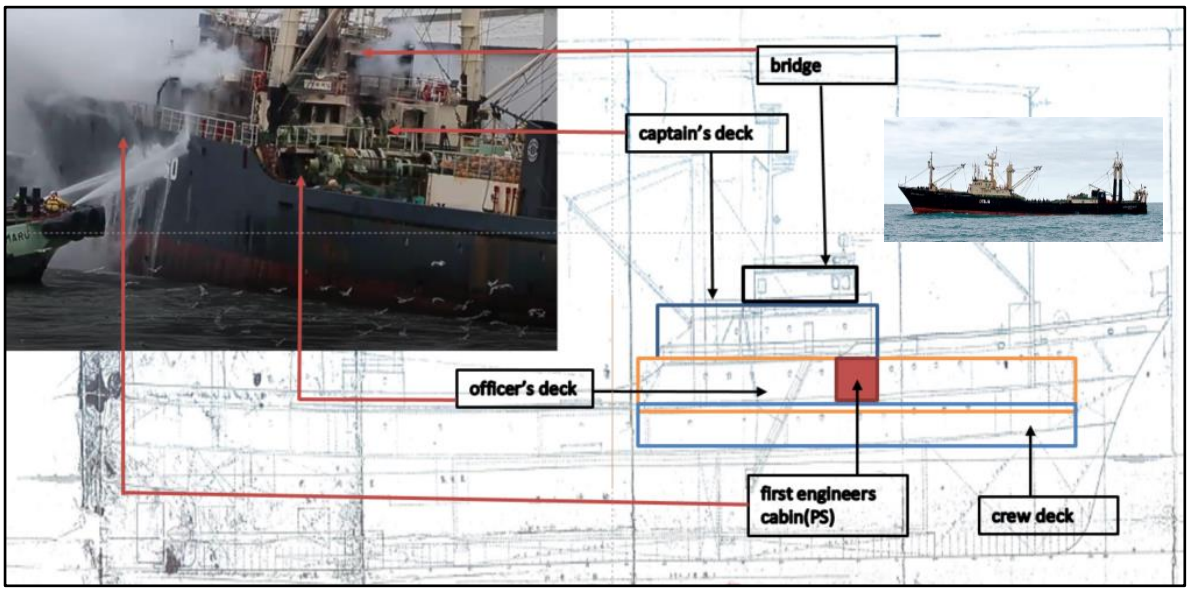


Figure 1: Profile showing location of the first engineer's cabin

[1] A fishing vessel used for trawling.
[2] The left-hand side of the ship when facing forward.
[3] A seaman specialising in engine-room work.

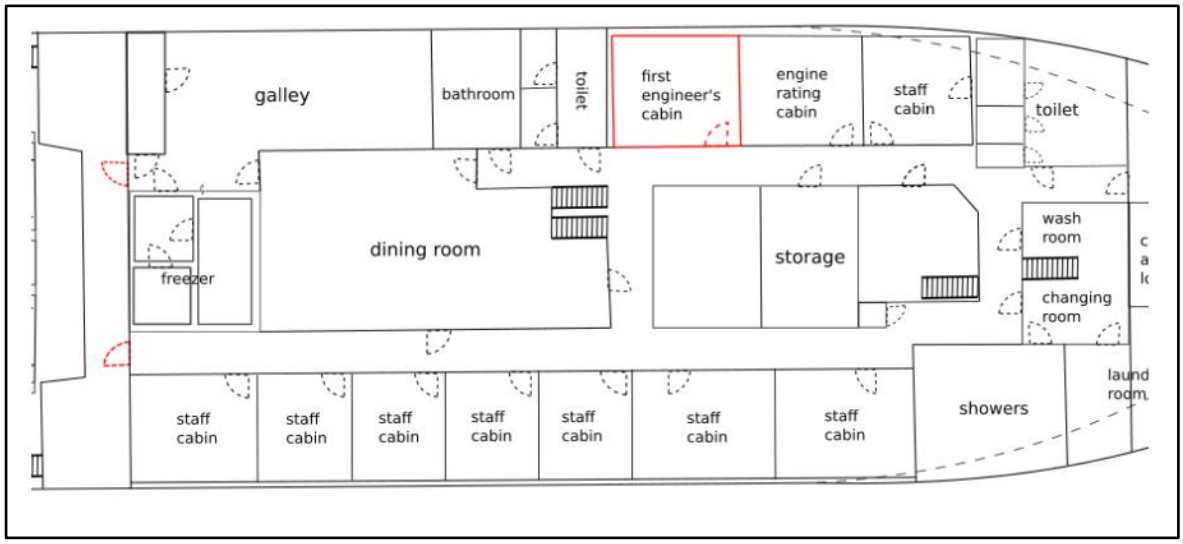


Figure 2: Plan showing first engineer's cabin

2.6. The engine room rating opened the first engineer's cabin door and was overwhelmed by thick black smoke, so closed the door again. The engine room rating then began knocking on other cabin doors shouting "Fire!" to alert the rest of the crew.

2.7. The ship had an automatic fire-detection and alarm system on board but it had not activated.

2.8. A deck officer who was coming down the stairs at the time took a portable fire extinguisher to the first engineer's cabin and together with the engine room rating attempted to fight the fire. However, hampered by smoke they retreated down the passageway through an exit door to an open deck at the back of the accommodation space. They left both the first engineer's cabin door and the exit door to the outside deck open. They thought this would help clear smoke from the cabin and passageway.

Figure 3: The *Dong Won 701* on fire

2.9. Another crew member on the crew deck below the officers' deck heard the engine room rating shouting "Fire!". That crew member also began shouting "Fire!" and knocking on cabin doors to alert any crew members on that deck.

2.10. The master, who was asleep in his cabin at the time, was informed of the fire by a phone call from the bridge. The master went to the bridge to organise a firefighting response.

2.11. The crew attempted to rig a ship's fire hose to fight the fire, but could not pressurise the fire hose because they were unable to get the emergency fire pump to deliver water.

2.12. At about 2130 a number of the crew members ashore learned of the fire and returned to the vessel. At about that time the vessel's generators shut down, causing a blackout.[4]

2.13. The chief engineer and first engineer entered the engine room to restart the generators. Their intention was to restore power to run the refrigeration compressors and collect the ammonia refrigerant flowing through the freezer compartments located under the accommodation space that was on fire. The engineers succeeded in restoring power long enough to divert the ammonia into a secure tank away from the fire.

2.14. At about 2125 a member of the public notified FENZ of the fire. FENZ arrived on the scene at about 2132. By this time the fire was well established and the vessel's accommodation superstructure was engulfed in flames.

Figure 4: FENZ firefighters on the scene at 2132

2.15. FENZ firefighters took control of the scene and evacuated the master and all crew from the vessel.

2.16. FENZ used multiple low-pressure fire hoses and an aerial monitor positioned on the wharf to boundary cool[5] the side of the vessel.

2.17. The operations manager for PrimePort Timaru arrived on the scene at about 2215 and instructed the port tug, *Te Maru*, to assist with the firefighting effort. The tug positioned on the starboard[6] side of the vessel at about 2230 and started boundary cooling.

[4] A failure of power supply on board a ship.
[5] A firefighting method where the areas surrounding a burning compartment are cooled with water to remove heat and slow the spread of fire.
[6] The right-hand side of the ship when facing forward.

Figure 5: Tug *Te Maru* boundary cooling on the port side of the *Dong Won 701*

2.18. PrimePort Timaru engaged an independent maritime expert with specialist knowledge in maritime firefighting to assist FENZ with the technical aspects of fighting a fire on board a ship. The maritime expert was on the scene at about midnight the same evening the fire started.

2.19. The firefighting effort continued for two days, focused on boundary cooling and limiting the amount of water entering the ship.[7]

2.20. On 12 April, with the fire still not extinguished, FENZ decided to inject high-expansion foam[8] into the vessel. The FENZ team cut holes on the upper forecastle deck and injected foam into the lower decks. They also sealed off the accommodation portholes[9] to reduce the supply of oxygen to the fire.

2.21. It took several days to seal the portholes and inject the high-expansion foam into the vessel.

2.22. On 17 April 2018 the fire was fully extinguished.

2.23. Three crew members and one FENZ firefighter had to be treated at hospital for smoke inhalation as a result of the fire or the firefighting effort.

2.24. Although the fire was fully extinguished, the ship was later declared a total constructive loss.

[7] Uncontained water in a ship can adversely affect the ship's stability, and in the worst case can cause it to capsize.

[8] A type of foam used for fire suppression.

[9] Small windows on the outside of the ship.

Scene examination

2.25. The following is an overview of the damage caused by the fire. A FENZ fire investigation report in Appendix 1 provides a more detailed description of the damage. The vessel suffered fire and heat damage to areas forward of the main winches on the upper deck, as shown in Figure 6.

Figure 6: Area affected by fire marked in red

2.26. The accommodation superstructure and area forward of the superstructure suffered severe heat damage and buckled in several areas. The rear of the superstructure was less affected: the protective paint was still relatively intact and there was no buckling of the upper deck.

2.27. A ventilation damper[10] located above the bridge was found in the open position.

[10] A valve that stops or regulates the supply of air to the ventilation fan.

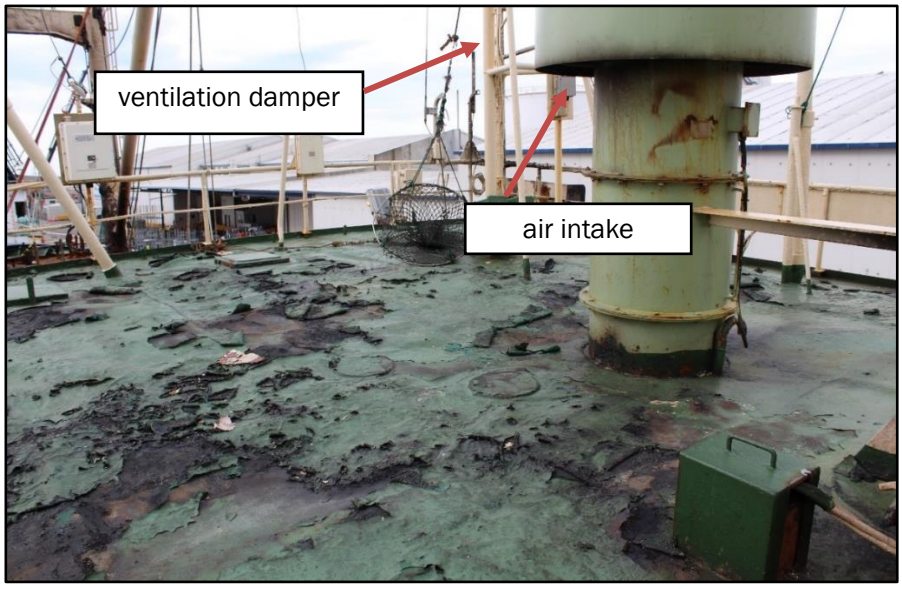


Figure 7: Ventilation damper on top of the bridge

2.28. All cabins located on the port and starboard sides of the officers' deck were destroyed by the fire (see Figure 8 and Figure 9). The first engineer's cabin suffered the most fire damage. The severity of the damage reduced with the distance away from the first engineer's cabin.

Figure 8: Fire damage to cabins on the officers' deck

Figure 9: Fire damage to the officers' deck, port side

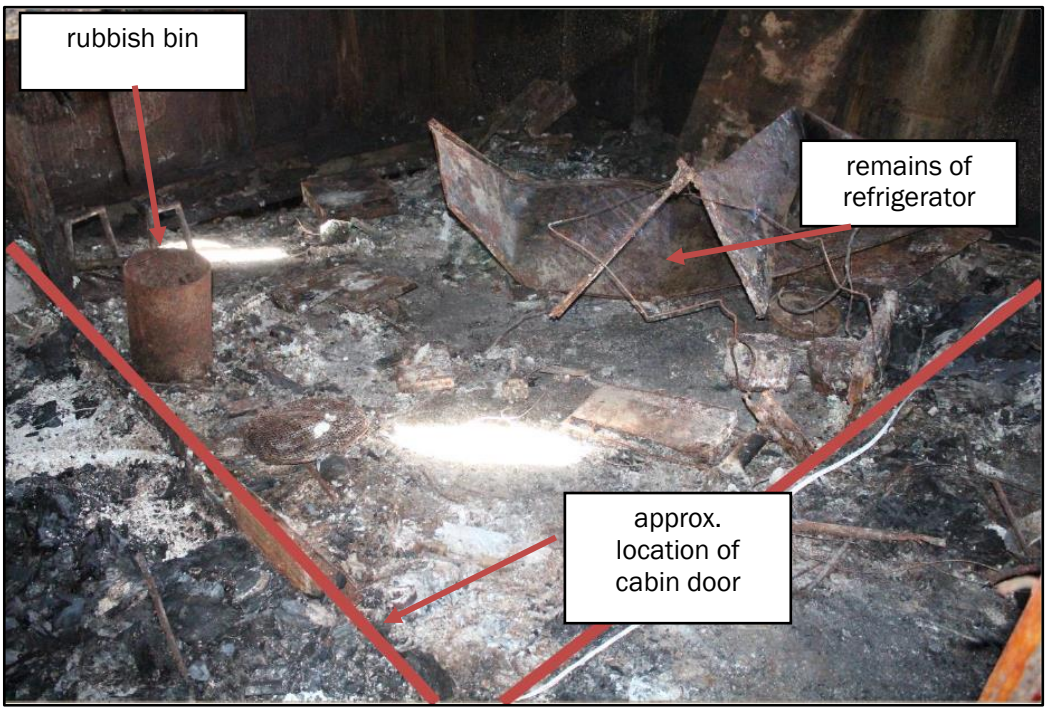


Figure 10: Fire damage to first engineer's cabin

3. Analysis

Introduction

3.1. Fire on board any ship is a serious event. Ships are necessarily designed with a number of high-fire-hazard machinery and electrical installations in close proximity to accommodation and cargo spaces, each with its own fire risk. These fire risks are managed through:

- fire-resistant design and construction
- fire-detection and warning systems
- firefighting appliances and systems
- firefighting procedures.

3.2. In this case the fire occurred while the ship was in port, where shore-based firefighting resources were available[11]. However, because ships spend the majority of their time at sea, remote from shore assistance, ship firefighting systems are designed around self-sufficiency when it comes to managing the risks and consequences of fire.

3.3. The following analysis considers each of these aspects in relation to the fire on board the *Dong Won 701,* and discusses two safety issues:

- some aspects of the crew response to the fire did not meet industry good practice
- safety issues identified included that inconsistencies in the application of Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships may have resulted in up to 12 fishing vessels operating under the New Zealand Flag not complying fully with the relevant safety standards. A further 50 fishing vessels have been afforded grandparent rights12 that will allow them to operate indefinitely without meeting contemporary safety standards under the current Maritime Rules.

Cause of the fire

3.4. Due to the intensity and duration of the fire and the consequent damage to the accommodation structure, it was not possible to determine conclusively the cause of the fire.

3.5. Based on the observed burn patterns and the nature of the damage that occurred, the area of origin was determined to be the first engineer's cabin on the officers' deck. This hypothesis is supported by witness accounts, particularly those of the engine room rating who first discovered the fire, and the crew member on the deck below, who was able to confirm that initially there was no fire in the cabin directly below the first engineer's cabin, or anywhere else on that deck.

3.6. Figure 11 shows a plan of the first engineer's cabin, reconstructed from the ship's plans and according to interviews with crew. It shows multiple potential sources of ignition, mainly electrical sources.

[11] Refer Transport Accident Investigation Commission Report MO-2017-205.

[12] A provision in which an old rule continues to apply to an existing vessel while a new rule applies to all future vessels. Those exempt from the new rule are said to have grandparent rights.

3.7. The point of origin was considered to be at or just above the floor level beside the rubbish bin, next to the first officer's desk. The burn patterns on the ceiling and the warping of the steel plate where the cabin bulkheads[13] were fastened supported this conclusion, as did the accounts of those who entered the cabin during the initial firefighting effort.

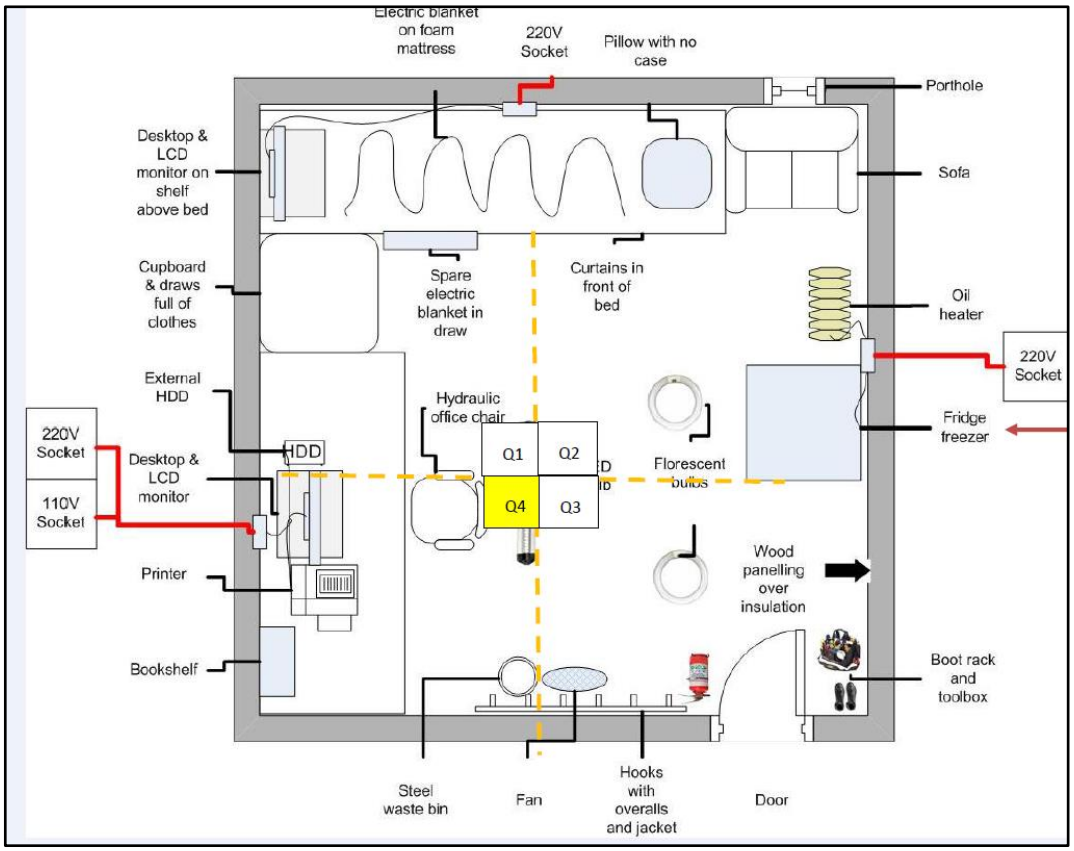


Figure 11: Plan layout drawing of first engineer's cabin

Fire detection and alarm

3.8. The *Dong Won* 701 was fitted with an automatic fire-alarm and fire-detection system for the accommodation spaces. The system had been installed on board between 2015 and 2016.

3.9. Each cabin was fitted with a photoelectric-type smoke detector connected to a fire alarm panel installed on the bridge. The smoke detector sent a signal to the fire alarm panel when smoke was detected. The fire alarm panel displayed the location of the fire and automatically triggered a general alarm throughout the ship.

3.10. Smoke detectors of the type installed in the cabins could detect smoke at an early stage, even before it became obviously visible.

3.11. The early detection of fire is critical to the safety of ship and crew. Early detection allows crew to respond immediately and extinguish the fire by direct attack before it escalates beyond control.

[13] Vertical partitions in a vessel that divide the interior into compartments.

3.12. During this fire the fire-detection system did not detect the fire or sound the general alarm. Due to the damage caused by the severity and duration of the fire, it was not possible to determine why it did not function automatically.

3.13. Fire-detection and alarm systems are critical systems that would normally be routinely tested in accordance with manufacturers' instructions. As the on-board maintenance records were destroyed in the fire, it was not possible to check these for compliance with such instructions.

3.14. The crew responsible for testing the fire alarm system explained that the fire alarms were "tested", but they were unable to describe anything that resembled a routine regime for checking that all components of the fire alarm system were functional.

3.15. Possible reasons for the system not activating include:

- a fault with the smoke detector in the cabin
- an interruption in power supply to the system
- the system being left in manual mode.

3.16. An interruption in power supply was unlikely, as the system had a dual power supply to it and there had been no reported power supply issues prior to the fire. A fault with a single detector was also unlikely, as other detectors should have activated the alarm as the smoke spread to other areas; this did not happen.

3.17. The system having been left in manual test mode could not be ruled out as the crew regularly left the alarm system in manual mode to avoid nuisance alarms triggered by exhaust fumes, hot work etc. The manual mode is not designed to be used as the primary operation mode. In manual mode the audible fire alarm could only be heard on the bridge and required the officer on watch to investigate and raise a general alarm if necessary.

3.18. Regardless of why the system did not activate automatically, there were manual push-button alarms located on every deck that would have bypassed the automation and activated the fire alarm throughout the ship. Pushing one of these buttons would have been the best method of raising the alarm for everyone on board. None of the crew pushed a manual button.

Firefighting procedures and equipment

Safety issue: Some aspects of the crew response to the fire did not follow industry good practice.

3.19. Containing and extinguishing a fire quickly and effectively is critical for preserving life and property. Once the initial individual direct attacks on the fire prove unsuccessful, the response would normally focus on containing the fire and using all available resources to extinguish it.

3.20. The crew of the *Dong Won 701* had all received approved shore-based firefighting training. They were all required to be current with the vessel's firefighting procedures. This would normally have been achieved during the crew induction on board and fire and emergency drills, which according to the operator's (DW New Zealand Limited's) maritime transport operator plan[14] were scheduled to happen four times each year.

[14] A maritime operator's written description of their safety system; this is a requirement under Maritime Rules.

3.21. DWNZ had different checklists for responding to a fire when out at sea and when alongside. When out at sea, the *Dong Won 701*'s Emergency Checklist for Fire/Explosion required the crew to take a number of actions on discovering a fire. The checklist was broadly compliant with industry good practice. However, there was no mention of holding a crew muster to account for everyone on board. DWNZ's Vessel Emergency Alongside checklist required the crew to evacuate the vessel and muster at an unspecified muster station. However, the crew did not evacuate the vessel until ordered to do so by FENZ, and the master was unable to confirm that all his crew were safely off the vessel. Emergencies that occur in port are problematic in that regard, because not all crew will necessarily be on board. In this case only nine of the 44 crew members were on board to initially contain and fight the fire. Several important procedures were not followed, of which some were likely attributable to so few crew being available to respond.

3.22. An important aspect of containing a fire is to deprive it of oxygen. The standard procedure for achieving this is to close all doors and openings to the space where the fire is located. After the retreat from the initial attempts to make a direct attack on the fire, the cabin door was left open – so too was the door leading from the passageway to the open deck. Also, the ventilation flaps supplying fresh air to the accommodation were left open.

3.23. With a free flow of oxygen to the fire, it quickly spread from the first engineer's cabin to engulf the accommodation spaces within a matter of minutes.

3.24. The master's designated position in an emergency was on the bridge. However, by the time he was alerted to the fire the bridge was rapidly becoming engulfed in fire. Consequently the master was unable to use the communication equipment to summon help.

3.25. The master went to the open deck aft[15] of the bridge, where a number of crew had mustered and attempted to organise a full muster and form teams to fight the fire. However, several crew members took their own courses of action, with some proceeding to the engine room to manage the ammonia risk and others re-entering the accommodation space to continue attacking the fire on an individual basis.

3.26. This uncoordinated response to the fire continued until FENZ arrived and took command of the scene, having been called by a member of the public.

3.27. Some crew members attempted to initiate firefighting by preparing fire hoses on the port and starboard sides of the upper deck. However, they were unable to work the portable emergency fire pump to pressurise the fire hoses.

3.28. In summary, the delay in all crew being alerted to the fire was a missed opportunity to extinguish it using portable firefighting equipment before it escalated out of control. Then, because the immediate and surrounding areas were not shut down, the fire was able to spread rapidly throughout the accommodation space before an effective firefighting effort could be mustered.

Fire-resistant design and construction

Safety issue: Inconsistencies in the application of Rule 40D may have resulted in up to 12 fishing vessels operating under the New Zealand Flag not complying fully with the relevant safety

[15] At, near or towards the stern of a ship.

standards. A further 50 fishing vessels have been afforded grandparent rights that will allow them to operate indefinitely without meeting contemporary safety standards under the current Maritime Rules.

3.29. Fishing ships entered into the Fishing Vessel Register under the Fisheries Act 1996 (the Fisheries Act) are required to meet applicable design, construction and equipment rules in Rule 40D. Rule 40D prescribes the minimum requirements for the design, construction and equipment of New Zealand fishing ships, which include standards for structural fire protection. Rule 40D came into force in 2000.

3.30. The application of some parts of Rule 40D depends on the date when a ship was constructed or 'converted to' a fishing ship. Rule 40D states that fishing ships constructed before 27 May 2004 (pre-2004 ships) are not required to meet some standards of design, construction and equipment contained in Rule 40D. Fishing ships constructed after 27 May 2004 (post-2004 ships) are required to meet all of Rule 40D.

3.31. Under the Fisheries Act, either a New Zealand-registered fishing ship or a foreign-registered fishing ship issued with an exemption under section 103A(1) of the Fisheries Act can apply to be registered in the Fishing Vessel Register. In around 2016 changes to the Fisheries Act meant that all foreign-registered fishing ships had to be registered as New Zealand fishing ships to remain on the Fishing Vessel Register.

3.32. Around that period the owners of many foreign-registered fishing ships began registering them as New Zealand fishing ships. For each ship this meant determining whether it was a pre-2004 ship or a post-2004 ship for the purposes of Rule 40D, and there was some inconsistency among surveyors in how this was done.

3.33. In 2017 Maritime New Zealand discussed its interpretation of pre- and post-2004 vessels with surveyors. Maritime New Zealand's view was that vessels constructed outside New Zealand that had been first entered into the Fishing Vessel Register in New Zealand after 27 May 2004 were considered post-2004 vessels, and therefore were required to meet all the applicable standards of Rule 40D.

3.34. The *Dong Won 701* had been constructed in Japan in 1971 and registered in South Korea.[16] In 2000 the *Dong Wong 701* had been entered into the Fishing Vessel Register as an exempt ship, and entered into the New Zealand safe ship management system. As it had been both constructed and entered in the New Zealand system prior to 2004, it was considered to be a pre-2004 ship, and as such was 'grandparented' and deemed compliant with Rule 40D.

3.35. 'Grandparent rights' is a common regulatory tool used internationally in recognition of the difficulty in applying modern shipbuilding safety standards to old shipbuilding techniques, where often the cost of meeting new standards outweighs the benefits.

3.36. An adverse effect of applying grandparent rights to older standards is that the crews are not afforded the same level of safety as, and therefore are more at risk than those on newer vessels constructed to newer standards.

3.37. For example, the corridor bulkheads in the accommodation spaces of a new ship must be constructed of non-combustible material. The standard stairwells on newer ships are

[16] In 2016 the *Dong Won 701* changed its registry to New Zealand.

required to have B-class[17] self-closing doors at one end to slow the spread of fire between decks.

3.38. The internal corridor bulkheads and cabin doors on the *Dong Won 701* were of hardboard or similar wood-product construction and suffered complete combustion in the fire. The stairwells on the *Don won 701* had no doors fitted between decks. Consequently the fire spread rapidly to the decks above.

3.39. It is highly likely that a similar fire on board the *Dong Won 701* while at sea, with more crew and no ability to step ashore, would have had more severe consequences. This made it all the more important that fire-detection systems were working and that the fire response was fast and effective with all firefighting equipment working properly.

3.40. Given the health and safety implications for crew working on older grandparented fishing vessels, the Commission sought information from Maritime New Zealand about the status of the New Zealand fleet. This revealed potential inconsistencies in the application of Rule 40D. This was because it was not clear from the rule that ships entering the system after 2004 should have been made to comply fully with Rule 40D, until Maritime New Zealand issued its guidance to surveyors in 2017. Consequently, prior to 2017, operators and surveyors were applying Rule 40D inconsistently.

3.41. As of June 2018 there were 63 active commercial fishing vessels, over 24 metres in length, registered in New Zealand. Of the 63 fishing vessels, 60 had been constructed or registered outside New Zealand.

3.42. Of these, 50 had been first entered into the Fishing Ship Register prior to 27 May 2004 and were therefore surveyed as pre-2004 ships, in accordance with Rule 40D.

3.43. The remaining 13 commercial fishing vessels had been entered into the Fishing Ship Register after 27 May 2004. Twelve of these vessels had been constructed at various dates before 2004 and as such, according to the Maritime New Zealand guidance issued in 2017, should have been surveyed as post-2004 vessels and fully complied with the standards in Rule 40D.

3.44. Maritime New Zealand was unable to establish from records whether these remaining 12 fishing vessels were correctly surveyed as post-2004 vessels.

3.45. It is likely that some of these fishing vessels are not fully meeting the applicable design, construction and equipment standards prescribed in Rule 40D, depending on their year of construction and the applicable foreign rules according to which they were built. In some respects they are no different from the other 50 vessels that were afforded grandparent rights prior to 2004. As with the 12 post-2004 fishing vessels, the safety standards will vary depending on their year of construction and the applicable foreign rules according to which they were built.

3.46. All grandparented fishing vessels can remain in the system indefinitely, because there was no time limit placed on the grandparent rights.

3.47. A useful variation to the grandparent rights in future would be to put a cap on the year of construction applicable to the rule to prevent very old vessels entering the system and/or limit the number of years a vessel is allowed to operate before it is either upgraded to meet modern standards or withdrawn from the system. Otherwise, there is a risk that over time the average age of fishing vessels in the New Zealand Fishing Vessel

[17] Bulkheads so constructed as to be capable of preventing the passage of flame to the end of the first one half-hour of the standard fire test.

Register will increase and, potentially, safety standards will fall further behind contemporary standards.

3.48. The Commission has made recommendations to the director of Maritime New Zealand to address this issue.

4. Findings

4.1. The fire started in a cabin on the officers' deck, but due to its intensity and duration and the consequent damage to the accommodation structure, it has not been possible to establish how it started.

4.2. The fire-detection and alarm system did not for some undetermined reason automatically sound the general alarm as it should have, and the crew did not activate the alarm manually on detecting the fire. Both delayed the firefighting response.

4.3. The crew's response to the fire did not comply fully with company procedures and good industry practice.

4.4. The structural fire integrity of the *Dong Won 701*, although complying with the relevant Maritime Rule, did not meet contemporary standards, and this was a factor in the speed and intensity with which the fire spread.

4.5. Due to the inconsistency of how Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships was applied to ships entered into the New Zealand Fishing Ship Register after 2004, there are up to 12 ships that likely do not meet the standards required of the rule.

4.6. The provisions of the current Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships potentially allow older fishing vessels that do not have to comply with contemporary safety standards to remain in the system indefinitely.

5. Safety issues and remedial action

General

5.1. Safety Issues are an output from the Commission's analysis of factors that have contributed to the occurrence. They typically describe a system problem that has the potential to adversely affect future operations on a wide scale.

5.2. Safety Issues may be addressed by safety actions taken by a participant, otherwise the Commission may issue a recommendation to address the issue

5.3. Recommendations are made to persons or organisations that are considered the most appropriate to address the identified safety issues.

5.4. In the interests of transport safety, it is important that safety actions are taken, or any recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Safety issues

5.5. Some aspects of the crew response to the fire did not meet industry good practice.

5.6. Inconsistencies in the application of Rule 40D may have resulted in up to 12 fishing vessels operating under the New Zealand Flag not complying fully with the relevant safety standards. A further 50 fishing vessels have been afforded grandparent rights that will allow them to operate indefinitely without meeting contemporary safety standards under the current Maritime Rules.

Safety actions

General

5.7. The Commission classifies safety actions by two types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Safety actions addressing safety issues identified during an inquiry

5.8. Since the accident DWNZ (the owner) has taken the following safety actions:

> All crew of the Dong Won 701 involved in the incident were debriefed and offered counselling. This was followed by a general safety meeting with crew and one on one meetings with senior officers.
>
> For the remaining two vessels in the Dong Won fleet:
>
> (a) DWNZ held safety meetings to discuss the immediate lessons of the incident. Drills were also held on both vessels with fire in port as the exercise scenario (photos of the drills, and records attached).

(b) Fire detection system and maintenance were verified in asset management systems.

(c) All fixed fire-fighting CO2 flooding systems checked and verified for operation, similarly all fire dampers checked.

(d) All cabin electrical fittings inspected by ship's engineers (photos attached). Portable appliance testing (PAT) tags verified (photos attached).

Steps implemented in the medium term

DWNZ has implemented the following medium term steps:

DWNZ senior management directed a complete review of corporate safety management and the MNZ [Maritime New Zealand] approved Maritime Operator Safety System. The system has been completely rewritten and reissued together with a new Maritime Operator Transport Plan. The reissue has included new corporate HSE [health, safety and environment] and "Stop Work" policies and procedures for contingencies.

Senior Management, Ships officers Guard Safety and crew held general safety meetings on board accompanied by Guard Safety staff to explain policies and commitment to safe operations. Drills conducted on board, witnessed and debriefed (debriefing document attached).

Both remaining vessels subject to formal safety assessment and internal audit, recommendations made in regard of personnel training, procedure implementation and vessel asset improvements.

Further advanced training by local fire and safety training contractor to crew (supporting information attached). Heaters in cabins fitted with securing / protection guards (photos attached).

Housekeeping and escape routes subject to increased inspection and scrutiny by vessel management. Both remaining vessels were due to conduct refits, this included some interior structural work. As part of the safety assessment, all newly installed/replaced structure (deckheads bulkheads) was specified to be of suitable fire-resistant materials to current standards. Galley ventilation systems overhauled.

All crew and contractor vessel familiarisation inductions were reviewed, revised and recorded. Permit to Work systems aligned to best practice, on board permit officers trained.

Steps implemented in the longer term

DWNZ has implemented the following longer term steps:

New safety management system rolled out for trial on one vessel, this included procedures to enhance contingency response including development of the crew training matrix.

Prior to docking, both remaining vessels were attended by Guard Safety and a general safety meeting held with a translator on hand. Permit to Work system fully implemented with vessel staff controlling all contractor activity. Contractor inductions given to all non DWNZ staff attending on board.

With the co-operation of the Lyttleton dry dock management, a fire drill was conducted, and a general evacuation of the dry dock took place. This exercise was debriefed followed by a general safety meeting for all crew and vessel management.

Ongoing safety training for all crew including refresher firefighting training. Safety specialists staying on board to observe fishing operations and safety drills.

5.9. Since the accident Maritime New Zealand has taken the following safety actions

The issues around whether a vessel is a pre or post 2004 vessel is being actively considered by Maritime NZ as part of a wide ranging reform project of Maritime Rules Part 40 series. This reform project began in 2018 and has involved regular engagement with recognised surveyors to identify how matters involving challenging rules and or confusion about the application of rules can be improved pending the regulatory changes that will necessarily result from the reform of domestic commercial vessel standards. The draft guidance on pre-post 2004 vessels is an example of work Maritime NZ initiated with surveyors for that purpose. General exemptions were also issued for classes of vessels affected by outdated rules. These are published on our website www.maritimenz.govt.nz/rules

Maritime NZ continue to work closely with the sector and surveyors to support better compliance and clarify rules under the existing law pending the outcome of the 40 Series reform project. This includes holding regular surveyor seminars and, over that last two years, issuing nine position statements and nine interim technical notes that provide supporting information on technical issues or areas related to the maritime rules. This has included guidance on how to ensure commercial vessels imported into New Zealand from Australia comply with Maritime Rule Part 40A, 40C and/or 40D; and guidance to support commercial ships owners to better understand when a modification or repair to their ship may be major and how this applies to pre and post 2004 vessels. The guidance also outlines operator duties to obtain design approval for an in-construction survey of a major modification or repair.

Safety actions addressing other safety issues

5.10. None identified.

Recommendations

General

5.11. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, recommendations have been issued to the owner of the vessel Dong Won New Zealand Limited, and the Director of Maritime New Zealand.

5.12. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

To the owner of Dong Won New Zealand Limited

5.13. The *Dong Won 701* did not have the same level of structural fire protection as new fishing vessels and relied on other fire-protection strategies such as enhanced fire-alarm systems and robust crew training to ensure that the overall fire safety of the vessel was on a par with that of new ships.

The delay in all crew being alerted to the fire was a missed opportunity to extinguish it using portable firefighting equipment and before it escalated out of control. Then, because the immediate and surrounding areas were not shut down, the fire was able to spread rapidly throughout the accommodation space before an effective firefighting effort could be mustered.

On 26 September 2019 the Commission recommended to the owner of the *Dong Won 701* that they assess the overall fire safety of each vessel in their fleet and ensure that the risks and consequences of fire are reduced to as low as possible, including ensuring that crews are appropriately trained and practised in responding to fires. (007/19)

5.14. On 11 October 2019 Dong Won New Zealand replied:

> DWNZ does not consider that the first two paragraphs of the above form part of TAIC's recommendation. Rather, they are factual determinations made by TAIC, elements of which DWNZ does not agree with.
>
> ***The construction of Dong Won 701***
>
> DWNZ is not alone in operating vessels built to previous construction standards. We understand that essentially very few deep sea vessels in New Zealand are new vessels.
>
> Construction rules are in a state of constant change due to new materials, construction methods and design. Owners of vessels are not required or expected to meet the new standards every time a rule changes. Rather they are encouraged to take a performance based approach and take what practicable and reasonable steps they can to meet the intent of the new rule. Rules allow for this internationally right across shipping.
>
> ***Response to the fire***
>
> DWNZ does not agree that there is a proper factual basis for saying that the crew were delayed in being alerted to the fire or that an opportunity was missed. The fire occurred in port. DWNZ procedure, as per common industry practice, is for the crew to attempt a first response and raise the alarm with FENZ. If the first response fails, the crew then evacuate the vessel and await FENZ. Unlike most, if not all, other New Zealand deep sea commercial fishing operators, DWNZ trained all of their crew members to some degree in fire-fighting. This is well in excess of any regulatory compliance requirement. Other operators generally only train those in a designated response team, which would mean a minority of the crew. The fact the crew staged an unsuccessful first response and, despite that, then assembled a fire team to try to contain the fire is to their credit. The action of the first responders in leaving the burning cabin door open may not have been a conscious decision and they may not, in any event, have been able to shut it.

Accordingly, DWNZ does not agree that the first two paragraphs of 007/19 should be published, given they are not part of TAIC's recommendation.

DWNZ recognised some of the challenges of fire safety on board their vessels and prior to the incident had installed improved detection systems on all their vessels. Immediately following the incident, DWNZ management took significant steps in directing a third party review of their entire vessel safety management systems. Many of the action points arising from the review align with the TAIC recommendation. In the intervening period, many action points have been completed and there is a process of ongoing continuous improvement to address safety issues across a range of issues on board including asset management, training and procedural development.

Accordingly, we are instructed that DWNZ will implement what it understands to be TAIC's recommendation (paragraph 3 of 007/19), but, as explained above, DWNZ has already implemented measures which align with that recommendation. We explain this below in more detail.

Actions taken by DWNZ after the incident

Paragraphs 32 – 34 of our letter dated 2 September 2019 set out the steps DWNZ took after the incident. We provide further detail below.

Safety management system

Immediately after the incident, the CEO and senior management of DWNZ conducted an internal investigation of the circumstances surrounding the incident, what lessons could be learned and what improvements could be made.

Management directed a complete review of the corporate HSE management system and its implementation. DWNZ considered that the existing regulatory mandated and audited Marine Operator Safety System (MOSS) was not effective in managing the hazards present. DWNZ engaged a third-party organisation specialising in commercial fishing vessels to conduct the review, develop a better MOSS safety management system and follow up with an implementation and training programme.

The new system was trialled on the DWNZ vessel Dong Won 519 starting in January 2019. Following a second review, the system was issued to the Dong Won 530 in September 2019. The system included new corporate policies, procedures, standard operating instructions and training / competence processes.

Vessel inspections and crew competence assessments

In parallel with the development of their safety management system, DWNZ also

organised independent third-party specialists to carry out a series of inspections and assessments of Dong Won 519 and Dong Won 530. These assessments considered safety issues including: fire prevention, containment and escalation control, watertight integrity and vessel stability, and factory and machinery safety.

The assessment and inspections included:

- at-sea operational assessments, conducted by a specialist with industry experience sailing on board;
- pre–dock inspection: an inspection of the vessel with a safety system focus in order to identify an assessment of the condition of the vessel and improvements to be made;
- attendance on board during dry dock and maintenance periods: identifying further possible improvements, conducting crew training and verifying corrective actions; and
- conducting in-port emergency drills.

Each vessel's hazard register was developed with the results risk assessed for controls. Inspections and assessments included contingency drills conducted on board followed up by a debrief, assessment and corrective action follow up. Recommendations from these assessments and inspections were considered for risk level and prioritised accordingly for action. Recommendations include actions in regard of the vessel, procedures and personnel training /competence.

Specific actions to date

We have **attached**, as **Appendix 1 [see Appendix 4 of report]**, a comprehensive list of the actions taken by DWNZ following the incident. Most of these have been implemented and there is a process in place for ongoing improvement, hazard identification, corrective action and verification of controls.

To the Director of Maritime New Zealand

5.15. A review of records revealed inconsistencies between surveyors when applying Rule 40D. Some were not aware that ships entering the New Zealand Fishing Vessel Register post-2004 were required to comply fully with all of Rule 40D in accordance with the Maritime New Zealand advisory to surveyors issued in 2017.

Potentially there are 12 fishing vessels not complying fully with Rule 40D to varying degrees, depending on their year of construction and the applicable foreign rules according to which they were built.

On 26 September 2019 the Commission recommended to the Director of Maritime New Zealand that they take any measures available to them to make post-2004 fishing vessels comply with as many of the design, construction and equipment standards prescribed in the current Rule 40D as are reasonable and practicable. (008/19)

5.16. On 10 October 2019 Maritime New Zealand replied:

> We agree with this recommendation. Maritime New Zealand is undertaking a review of Maritime Rules Part 40 Series, which is intended to address this issue definitely. Maritime New Zealand will, in the meantime, continue to work with vessel owners, operators and surveyors to adopt an approach to the pre-post 2004 concept in a way that seeks to achieve safe standards.
>
> The 40 Series Reform is a long-term, collaborative project that intends to ensure that the rules for design, construction and equipment for domestic (non-SOLAS) ships are fit for purpose. Maritime NZ is working actively with

> the sector to ensure that survey and oversight of vessels continues under the existing law pending the outcome of the reform project.
>
> Because of the scale of the reform being undertaken in this project, Maritime NZ believes the new rules, if accepted by the Minister, would likely come into effect in 2023.
>
> As maritime rule amendments take some time Maritime NZ is proposing to undertake work within the next 12 months to provide further interim guidance to industry on this issue.

5.17. There are 50 fishing vessels on the New Zealand Fishing Vessel Register that have been afforded grandparent rights under Rule 40D and consequently have not been required to comply with the more modern safety standards captured by Rule 40D. The safety standards on these vessels will vary depending on their year of construction and the applicable foreign rules according to which they were built.

There is a risk that over time the average age of fishing vessels on the New Zealand Fishing Vessel Register will increase and, potentially, safety standards will fall further behind contemporary standards.

On 26 September 2019 the Commission recommended to the Director of Maritime New Zealand that they work with the Ministry of Transport to amend Rule 40D to put appropriate measures in place to ensure that aging fishing vessels are not permitted to remain in the system indefinitely without being required to meet contemporary safety standards. (009/19)

5.18. On 10 October 2019 Maritime New Zealand replied:

> We understand the intent of this recommendation is aimed at ensuring that safety standards do not fall behind and place people at risk. To that end, Maritime NZ is progressing work on comprehensive reform of the Maritime Rules Part 40 series.
>
> Maritime NZ will advise the Minister of Transport, through the Ministry of Transport, of any proposed changes to maritime rules when the work is completed. If the Minister accepts the proposals Maritime NZ makes at the conclusion of its work, it is estimated that the earliest that such new rules could come into effect would be 2023.

6. Key lessons

6.1. Safety-critical systems such as fire-detection and alarm systems must be routinely tested to ensure they remain functional at all times in order to give early warning of a fire.

6.2. On discovering a fire it is important for the safety of all on board that the ship's general alarm is used to alert crew to the danger as soon as possible.

6.3. It is important to slow or prevent a fire spreading by, as soon as possible, closing all openings that can allow air to feed or be drawn into the location of the fire.

7. Data summary

Vehicle particulars

Name:	*Dong Won 701*
Type:	fishing vessel
Class:	trawler
Limits:	unlimited
Length:	82 metres
Breadth:	12.4 metres
Gross tonnage:	1,900
Built:	Japan, 1971
Propulsion:	Akasaka 6DH51SS
Service speed:	13.5 knots
Owner/operator:	DW New Zealand Limited
Port of registry:	Timaru
Minimum crew:	10

Date and time	9 April 2018 9:00 PM
Location	Timaru
Persons involved	44
Injuries	four
Damage	significant fire damage to the accommodation superstructure and areas forward of the accommodation space. Vessel declared a total constructive loss

8. Conduct of the Inquiry

8.1. On 10 April 2018 Maritime New Zealand reported a fire on board the fishing trawler *Dong Won 701*, which had started the previous night while the vessel was berthed at the Port of Timaru.

8.2. The Transport Accident Investigation Commission (Commission) opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge.

8.3. On 10 April 2018 three investigators from the Commission travelled to Timaru to conduct interviews and gather evidence. The Commission engaged professional interpreters to provide Korean and Indonesian translation services.

8.4. The investigators were unable to board the vessel on 10 April 2018 as the vessel was still on fire.

8.5. The Commission obtained as evidence closed-circuit television (CCTV) footage from the port security cameras.

8.6. On 18 April 2018 two investigators boarded the vessel to conduct a scene examination and gather evidence for the inquiry. Two fire investigators from Fire and Emergency New Zealand (FENZ) accompanied the Commission's investigators for the purposes of establishing the cause of the fire.

8.7. FENZ produced a fire investigation report. The Commission received a copy of that report as evidence.

8.8. On 20 April 2018 a protection order was put in place to preserve the evidence.

8.9. On 18 May 2018 the protection order was revoked

8.10. On 22 November 2018 new information was presented to the Commission, so another protection order was put in place to preserve the evidence while the Commission conducted further enquiries.

8.11. On 13 December 2018 the second protection order was revoked.

8.12. On 26 November 2018 two investigators returned to Timaru to conduct interviews with an independent maritime expert who had assisted with the firefighting effort on the *Dong Won 701*, and the engineering superintendent of the *Dong Won 701*.

8.13. On 26 June 2019 the Commission approved the draft report to be circulated to six interested persons for comment.

9. Report information

Abbreviations

FENZ	Fire and Emergency New Zealand
Fisheries Act	Fisheries Act 1996
post-2004 ship	fishing ship constructed after 27 May 2004
pre-2004 ship	fishing ship constructed before 27 May 2004
Rule 40D	Maritime Rules Part 40D: Design, Construction and Equipment – Fishing Ships

Glossary

boundary cooling	a firefighting method where the areas surrounding a burning compartment are cooled with water to remove heat and slow the spread of fire
bulkhead	a vertical partition in a vessel that divides the interior into compartments
engine room rating	a seafarer specialising in engine-room work
grandparent rights	a provision in which an old rule continues to apply to an existing vessel while a new rule applies to all future vessels. Those exempt from the new rule are said to have grandparent rights
high-expansion foam	a type of foam used for fire suppression
port	the left-hand side of a ship when facing forward
porthole	a small window on the outside of a ship
starboard	the right-hand side of a ship when facing forward
trawler	a fishing vessel used for trawling

10. Notes about Commission reports

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant
Commissioner	Paula Rose, QSO

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Aaron Holman
Investigator in Charge	Naveen Mathew Kozhuppakalam
General Counsel	Cathryn Bridge

Citations and referencing

This draft report does not cite information derived from interviews during the Commission's inquiry into the occurrence. Documents normally accessible to industry participants only and not discoverable under the Official Information Act 1982 are referenced as footnotes only. Publicly available documents referred to during the Commission's inquiry are cited.

Photographs, diagrams, pictures

The Commission has provided, and owns, the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

This report uses standard terminology to describe the degree of probability (or likelihood) that an event happened, or a condition existed in support of a hypothesis. The expressions are defined in the table below.

Terminology*	Likelihood	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

*Adopted from the Intergovernmental Panel on Climate Change

Appendix 1: Fire investigation report in part

FIRE EMERGENCY NEW ZEALAND

WHAKAARATONGA IWI

FIRE INVESTIGATION REPORT

Port Loop Road, Timaru Port, Timaru District

Incident Information:

F2519565

High Value Loss

9:25 p.m. 9 April 2018

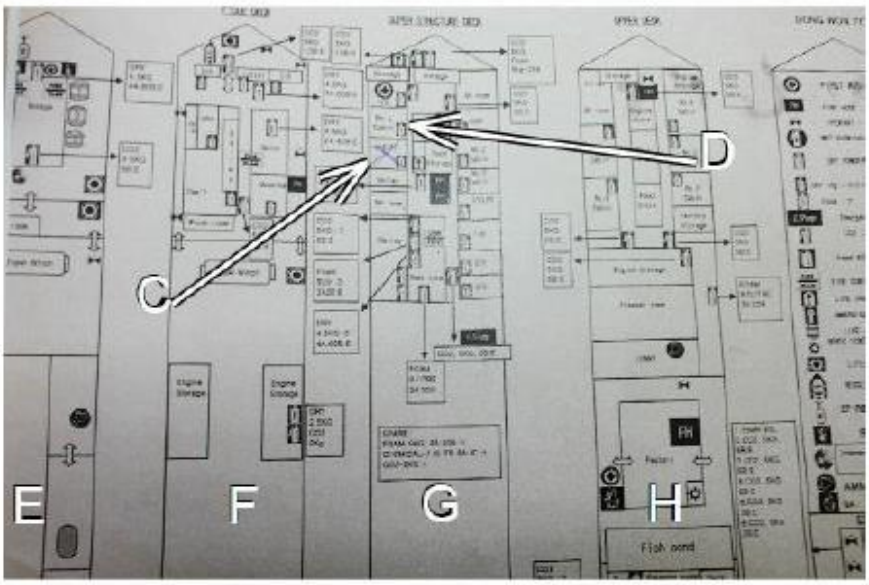


Photo 3: 'C' shows the location of the First Engineer's cabin and 'D' shows the cabin forward where a crewman was on the phone and noticed some smoke. 'E' is the Bridge level. 'F' is the Captain's Living Quarters. 'G' is the Officers' Living Quarters.' H' is the Seamen's Living Quarters.

Scene Examination

External Examination

An external examination of the vessel was carried out which revealed obvious signs of fire and heat damage to almost the entire front half. Oxidization of the steel hull on both port and starboard sides was proof of this. (Refer to photo 4).

The Superstructure and the deck area in front of it showed extreme effects of heat. The buckling and oxidization of the steel on both were evidence of this. There was also extensive warping to the gunnel in front of the bridge windows. (Refer to photo 5 and 6). The rear of the Superstructure was less effected as identified by the remaining paint and no warping of the deck or gunnel.

The only windows remaining intact in the superstructure were the port hole windows at the rear on the port and starboard sides of the Captain's Living Quarters. I noticed numerous vents on the deck alongside the superstructure had been effected by radiant heat and also had smoke staining underneath the vent cap.

Internal Examination

The Bridge-

There was extreme damage to this area. All wall and ceiling linings were gone leaving only the exposed steel structure. The main electrical wiring looms and ventilation ducting were still in place. I noticed the

burning and oxidization of the steel around the windows at the front of the area to have less fire debris left on the port side compared with the starboard side. This aligned to the warping of the gunnel in front of the bridge. There was a large rectangle hole in the floor that had obviously been engineered into the floor. It was more to the port side of the area and was the ladder that provided access between levels. I did not identify anything in the debris that could have been a door or hatch to shut the ladder off from the lower level. (Refer photo 7). The rear starboard corner of the Bridge was less damaged than the rest of the area. I noticed parts of the wooden flooring were still in place along with timber framing that lined the steel structure and polystyrene that was used as cladding between the hardboard walls and the steel structure. (Refer to photo 8).

I was able to determine from the placement of steel droppers that were mounted to the floor and ceiling where the internal walls would have been. By doing this I was then able to identify fire travel. From the indicators identified I determined the fire travelled from the level below up the ladder and produced the most heat for the longest time on the front port side of the area until the internal structure failed.

Captain's Living Quarters-

This area was consistent with the Bridge areas level of destruction. Like the Bridge there were areas of less damage due to being protected longer by internals walls and there being an easy route of travel for the fire along passageways and up the ladders between levels.

As with the Bridge area I was able to identify where the internal walls were and confirmed there was a clear pathway between the ladder that went below and the ladder that went above. The main steel structural beam that ran from port to starboard adjacent to the hole in the ceiling where the ladder to go above was, had warped extensively. This indicated there was an immense amount of heat at that point which was probably due to fire travel and ventilation effects.

The front and both rear corners were less damaged than the centre area indicating the fire took longer to reach those parts due to having an avenue along the passageways from level to level. Intact port holes, flooring and internal wall cladding all being indications of this. As with the bridge I did not identify anything in the debris that could have been a door or hatch to shut the ladder off from the lower level.

Officers' Living Quarters-

I entered this area through the galley door at the rear on the port side. I noticed a chair in the galley that was only partially burnt. Galley appliances such as a wok and deep fryer were also only partially damaged. I noticed the ceiling lining was hanging from the roof at the rear of the galley. I then inspected the dining area and found all wall, floor and ceiling linings were gone. The dining tables were steel frames. I could clearly make out the passageway due to the lack of debris and identified the steel plate that protruded vertically from the floor where the internal wall was fastened too. (Refer to photo 9).

I inspected the two cabins on the port side as I moved toward the front of the ship. Both had similar damage with the exception of the forward-facing steel wall in the second cabin. This wall had been subjected to intense heat. This was indicated by the oxidization of a section of wall. The rest of the room still had the remains of wall linings attached to the walls. There was a cover hanging from the port hole that had moved toward the forward-facing wall due to this being the hottest area. (Refer to photo 10).

On the floor of the passageway I noticed round cylinders. Some were cylinders similar to those used on a self-contained breathing apparatus or scuba diving set. The others were dry powder fire extinguishers. I could tell they were a dry powder type due to the outlet fitting they had on them.

To the left of the cylinders (port side) there was an open space that was obviously living quarters. I knew this due to the debris that remained. I was able to identify the remains of fridges, oil column heaters and electrical equipment. By examining the ventilation ducting and aligning that with the steel droppers that were part of the structure that the hardboard walls would have been fixed to, I was able to determine where each cabin was. After referring to the vessel's map that was supplied to me by Maritime NZ, I was then able to confirm the area to the port side of the cylinders that lay in the passageway was the cabin of the first engineer. (Refer to photo 3).

I continued to examine the remaining area on the Officers' Living Quarters in a clockwise direction. All cabins on both port and starboard sides of this area had been totally destroyed. I noticed less damage as I went further away from the First Engineer's cabin. Like on other levels, there was timber framing and internal wall insulation remaining in others parts of this area. I entered the rooms forward of the accommodation area and identified all these cabins had not been as affected by fire, as the accommodation area. I could tell this by the amount of paint residue and cladding that remained on walls and ceilings etc.

I returned to the First Engineer's cabin and examined the area. I found the remains of a fridge that had collapsed toward the starboard side of the room. Underneath this was an oil column heater. The fridge would have been positioned against the wall between the first engineer's cabin and cabin 1. (Refer photo 11). Working my way to the rear of the cabin from this point I identified a rubbish bin on the starboard side and the metal cover from an electric blower fan beside it. I noticed the steel plate that protruded vertically from the floor where the hardboard wall had warped extensively due to heat at this point. (Refer to photo 12).

I moved to the rear of the cabin and found the remains of a computer, printer and monitor on the floor against the rear wall. I noticed a hole in the floor where it had separated from the wall. It was approximately two metres long and 150 mm wide at its widest point. (Refer photo 13). The bottom section of the wall and the floor that joined it were extremely rusted and corroded. I noticed there was polystyrene insulation along the port side wall and the burn patterns on the steel were not as pronounced as those on the rear wall and the roof.

The burn patterns that showed the area that sustained the most intense heat were those on the ceiling. (Refer to photo 14). They were more intense in a strip across the cabin (port to starboard) in a line between the port hole and rubbish bin. I identified a number of green glass bottles on the floor against the port side wall. The tops of the bottles had distorted and were pointing toward the direction of the most heat. They were indicating across the cabin toward where the rubbish bin was positioned.

I then delayered the debris around the rubbish bin. This revealed little apart from the electric motor that ran the electric blower fan found beside the rubbish bin. I did notice the debris was a lot finer in this area than the rest of the room indicating there it had been subjected to heat for a longer period of time. I moved to the rear wall of the cabin and delayered along it. All the electrical devices that the First Engineer identified to me and that we drew on the plan of his cabin, were found in the expected positions. I was able to identify two electrical multi-boards that appeared to be connected together in series.

I then went down a level to examine the Seamen's living Quarters.

Seaman's Living Quarters

While the walls, floors and ceiling linings of the cabins in this area were destroyed there was clearly less fire intensity. Indicators that identified this were even burn patterns with no obvious fire travel indicators as found on other levels and a considerable amount of cladding and paint remaining on the walls. (Refer to photo 15).

I examined the area below the First Engineer's cabin. While the ceiling below this cabin showed more indication it had sustained heating for longer than the rest of the area it was not to the degree of the patterns on the ceiling in the First Engineer's cabin. I then examined the separation in the ceiling. As above, in the First Engineer's cabin I observed excessive rust and corrosion. I did not consider this to show any indication of fire travel between levels. (Refer to photo 16).

Photo 4: Shows the oxidisation on the superstructure and hull that is a result of excessive heat.

Photo 5: Photo taken looking toward the front of the vessel while standing beside the bridge port entrance. 'I' indicates the bridge.

Photo 6: The circle indicates the warping of the gunnel in front of the bridge windows. Note: this is all on the port side of the bridge.

Photo 7: Looking across the bridge from the port side entrance the circle identifies where the ladder was that gave access to lower levels. 'J' shows the rear entrance on the starboard side.

Photo 8: The circle shows the wall cladding and remaining floor at the rear entrance on the starboard side of the bridge.

Photo 9: 'K' shows the steel frames that were the dining tables.

Photo 10: The circle identifies the cover over the port hole and the arrow shows the gravitation towards the heat.

Photo 11: Shows the first engineer's cabin looking to the rear of it. 'M' identifies the fridge. Note the way it has collapsed. 'L' identifies the oil column heater. 'N' identifies the rubbish bin.

Photo 12: The circle shows the warped steel plate.

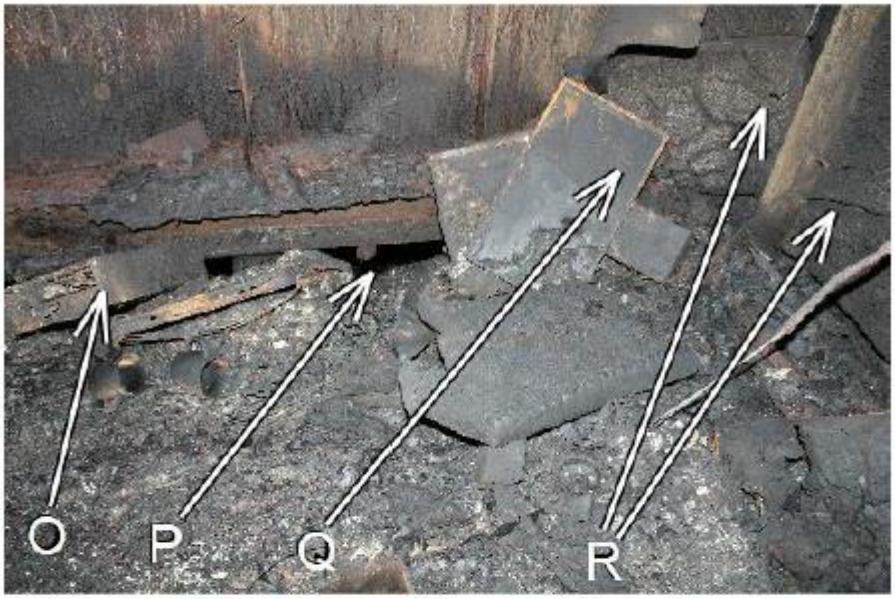


Photo 13: 'O' identifies the computer. 'P' identifies the hole at the bottom of the rear wall. 'Q' identifies the computer monitor and 'R' shows the remaining cladding on the port side wall.

Photo 14: Shows the burn pattern on the ceiling in a line between the porthole and the rubbish bin.

Photo 15: Shows the remaining paint on the walls of the Seamen's Living Quarters.

Photo 16: Shows the corrosion around the separation between the wall and ceiling in the Seamen's Living Quarters.

Area and point of origin

The area of origin was considered to be the First Engineer's cabin on the Officers' Living Quarters level. The extent of heat / fire damage and witness statements showed this to be the area of greatest fire intensity and burn patterns left by the fire confirmed this.

Point of Origin

The point of origin was considered to be at or just above floor level beside the rubbish bin. Indications of this were the burn patterns on the ceiling, the position of the of the fridge, the warping of the steel plate that had the cabin wall fastened to it and the witness statement that identified fire in the wall just above floor level.

Conclusions

Based on the evidence available at the time of this investigation, the classification of this incident has been recorded as undetermined.

Based on the evidence available at the time of this investigation, the classification of this incident is being recorded as undetermined due to the unavailability of sufficient evidence. It is considered possible the cause was due to an electrical fault from equipment or cabling in this area.

Elimination of Other Possible Causes

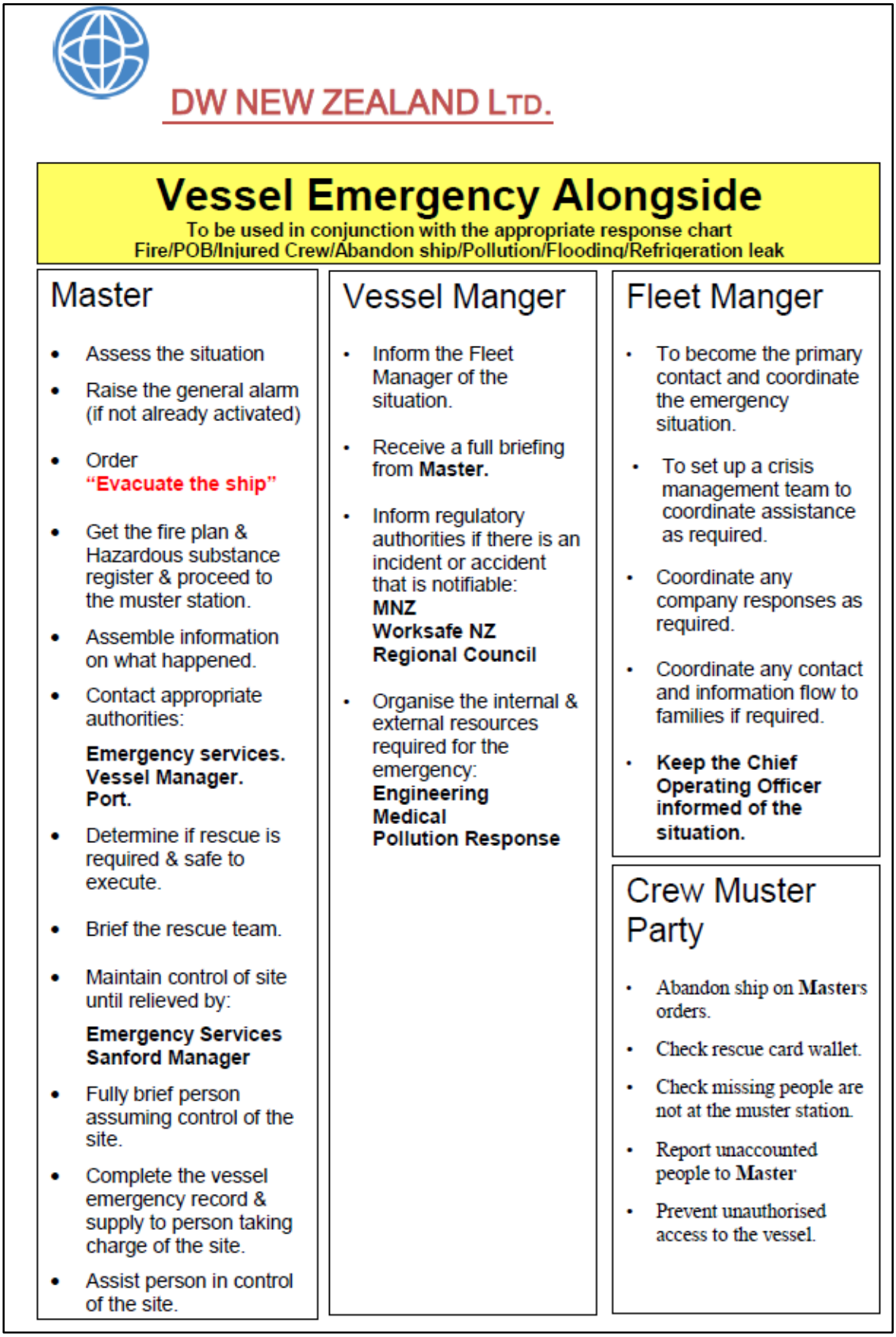
Due to the lack of evidence I was unable to eliminate any potential causes.

Appendix 2: The Dong Won 701's Emergency Checklist for Fire/Explosion

- 'The person who noticed a fire should shout "Fire !", and contact the bridge
- Sound the fire alarm, and arrange the emergency fire-fighting station
- The Master must take position on the bridge
- check the place where fire occurred
- Manoeuvre the ship to an area where the wind is weak to prevent expansion of the fire during the navigation If above is not possible, block and seal the area
- Check for dead or wounded crew and most of all take actions to save lives
- Light the related light and post the related shapes
- Stop cargo handling or bunkering[18] if there is a fire
- Block ventilation and the automatic fire door
- Stop the electric power
- When necessary, stop the engine
- Remove any sources of fire and cool the place near the fire
- Master considered in E/R fire, being using fixed fire-fighting equipment.
- (In this case, escape in E/R is the first priority)
- When the ship is in or near a port, report to the port authority, shore fire station agents about the size and strength of the fire
- Prepare for the International Shore Connection'
- Listen to VHF Ch. 16
- If the ship is sailing when a fire occurred, check the ship's position
- Turn on the deck illumination at night
- If the ship is sailing, turn on light not under command/raise up shapes
- Inform the Radio Operator of the ship's position. When necessary, send the distress signal (SOS call) and VHF (Mayday Repeat)
- When necessary, prepare for rescue, tug, or abandon ship
- Check for causes of the fire
- Check the extent of damage to the ship
- Check the extent of damage to cargo
- Check the extent of damage to shore facilities
- Report to the Designated Person and When necessary, ask for assistance from the shore-based management

[18] Filling the fuel tanks of a ship

Appendix 3: The Dong Won 701's Vessel Emergency Alongside procedure



DW NEW ZEALAND LTD.

Vessel Emergency Alongside

To be used in conjunction with the appropriate response chart
Fire/POB/Injured Crew/Abandon ship/Pollution/Flooding/Refrigeration leak

Master

- Assess the situation
- Raise the general alarm (if not already activated)
- Order **"Evacuate the ship"**
- Get the fire plan & Hazardous substance register & proceed to the muster station.
- Assemble information on what happened.
- Contact appropriate authorities:

  Emergency services.
  Vessel Manager.
  Port.
- Determine if rescue is required & safe to execute.
- Brief the rescue team.
- Maintain control of site until relieved by:

  Emergency Services
  Sanford Manager
- Fully brief person assuming control of the site.
- Complete the vessel emergency record & supply to person taking charge of the site.
- Assist person in control of the site.

Vessel Manger

- Inform the Fleet Manager of the situation.
- Receive a full briefing from **Master.**
- Inform regulatory authorities if there is an incident or accident that is notifiable:
  MNZ
  Worksafe NZ
  Regional Council
- Organise the internal & external resources required for the emergency:
  Engineering
  Medical
  Pollution Response

Fleet Manger

- To become the primary contact and coordinate the emergency situation.
- To set up a crisis management team to coordinate assistance as required.
- Coordinate any company responses as required.
- Coordinate any contact and information flow to families if required.
- **Keep the Chief Operating Officer informed of the situation.**

Crew Muster Party

- Abandon ship on **Masters** orders.
- Check rescue card wallet.
- Check missing people are not at the muster station.
- Report unaccounted people to **Master**
- Prevent unauthorised access to the vessel.

Appendix 4: List of actions taken by DWNZ

SCHEDULE 1: ACTIVITY TIMETABLE

Specific Activity	Date	Activity
1.1.1 Vessel		
New Hazard registers	01/10/2018	Subject to annual review
Removal and replacement of equipment less prone to fire i.e. Mattresses.	01/11/2018	Ongoing. Items identified are being replaced during last quarter 2019 maintenance period. Additionally items that can be readily replaced are changed when identified.
Portable electrical appliance testing.	11/11/2018	Ongoing – Regular scheduled "PAT" testing as part of planned maintenance system regime
Assessment of escape routes, further lighting, marking and ease of escape.	11/11/2018	Routes have been assessed and modifications / improvements will take place during last quarter 2019 maintenance period
Fire resistant materials for all new and replacement works	11/11/2018	Ongoing. Materials replaced during maintenance period and / or as identified
Regular external inspection of vessel safety equipment and contingency management equipment.	06/09/2019	On going – procedures have been developed in the revised safety system to include regular scheduled inspection regimes by crew, verification by management and third party auditors / inspectors.
Removal of redundant electrical installations.	01/10/2019	Currently in progress during last quarter 2019 maintenance period
Protection of domestic circuitry against overload	01/10/2019	Currently in progress during last quarter 2019 maintenance period
Assessment of a vessel by a fire professional	01/11/2019	Inspection made and recommendations included in worklists for last quarter 2019 maintenance period and procedure reviews.
Design and installation of new fire doors,	Scheduled for last quarter maintenance 2019 period	
1.1.2 Procedures		
Changes to contingency management	03/09/2018	Part of MOSS system review, rolled out once approved

Specific Activity	Date	Activity
procedures including musters, ventilation marking and individual responsibilities.		
New Maritime Operator Safety System (approved by Maritime New Zealand).	01/01/2019	
Changes / development of on-board inspection routines to ensure equipment maintenance and reliability.	01/01/2019	Inspection routines checked / verified by third parties and on-board routines reviewed. DWNZ conducted a third party internal audit of the new MOSS system after 6 months in operation on the 519 to verify system effective at the operational level.
Verification of third-party safety equipment maintenance.		This will take place during the last quarter 2019 maintenance periods of both vessels once third-party services are complete.
Corrective action tracking.	Ongoing	Corrective action tracking is now part of the new MOSS system, once crew on both vessels have operated the system for a period this will be audited and physically checked as part of the internal verification process.
1.1.3 Training		
Training of ships officers in operating the system.	03/09/2018	Ongoing. The system has been selectively rolled out over a period of time
Practical, pragmatic crew fire and safety training.	03/09/2018	Ongoing, training matter specific to crew function is being selectively introduced. Further development of training is in hand.
Increased drills and contingency management exercises together with debrief and corrective actions.	03/09/2018	Ongoing, with some drills witnessed by third parties at sea and on shore. All drills debriefed and improvements identified.
At sea and in port training by third parties	11/11/2018	Ongoing, there has been an increase in frequency of drills and exercises including one in conjunction with PCBUs in dry dock environment. External emergency management and fire training to be conducted

Specific Activity	Date	Activity
		by third parties following identification of targeted role-based training.
Crew briefings attended by senior shore management	11/11/2018	Ongoing, as a minimum, a general safety meeting including vessel crew and shore management is held at start of maintenance period and prior to operational departure
Training of staff in permit to work processes, and physical verification of controls.	11/11/2018	Ongoing, new MOSS system has been rolled out on 530 after a 6 month trial on 519 and both vessels will have a full-time safety advisor on board during the maintenance lay up to help manage the permit system, perform worksite inspections and verify controls from risk assessments. Crew are in the process of being trained to take charge of the system.
Promotion of the "Stop work" policy across the vessel crew.	11/11/2018	Ongoing, this is re-iterated at safety meetings and part of the contractor and PCBU inductions.
A training matrix for all crew	01/01/2019	
Job / Rank specific training records for each crew member.	01/01/2019	
Training in hazard identification	11/11/2019	Ongoing

Transport Accident Investigation Commission

Recent Marine Occurrence Reports published by the Transport Accident Investigation Commission

MO-2018-203	Grounding of container ship *Leda Maersk*, Otago Lower Harbour, 10 June 2018
MO-2018-204	*Dolphin Seeker*, grounding, 27 October 2018
MO-2017-204	Passenger vessel *Seabourn Encore*, breakaway from wharf and collision with bulk cement carrier at Timaru, 12 February 2017
MO-2017-203	Burst nitrogen cylinder causing fatality, passenger cruise ship *Emerald Princess*, 9 February 2017
MO-2017-205	Multipurpose container vessel *Kokopo Chief*, cargo hold fire, 23 September 2017
MO-2017-202	Passenger vessel *L'Austral*, grounding, Milford Sound, Fiordland, 9 February 2017
MO-2016-206	Capsize and foundering of the charter fishing vessel *Francie*, with the loss of eight lives, Kaipara Harbour bar, 26 November 2016
MO-2016-202	Passenger ship, *Azamara Quest*, contact with Wheki Rock, Tory Channel, 27 January 2016
MO-2017-201	Passenger vessel *L'Austral* contact with rock Snares Islands, 9 January 2017
MO-2016-201	Restricted-limits passenger vessel the *PeeJay* V, Fire and sinking , 18 January 2016
MO-2016-204	Bulk carrier, *Molly Manx*, grounding, Otago Harbour, 19 August 2016
MO-2016-205	Fatal fall from height on bulk carrier, *New Legend Pearl*, 3 November 2016
MO-2015-201	Passenger ferry *Kea*, collision with Victoria Wharf, Devonport, 17 February 2015
Interim Report MO-2017-203	Burst nitrogen cylinder causing fatality on board the passenger cruise ship *Emerald Princess*, 9 February 2017
MO-2012-203	Fire on board *Amaltal Columbia*, 12 September 2012
MO-2016-203	Bulk log carrier *Mount Hikurangi*, Crew fatality, during cargo securing operation, 27 February 2016

TAIC Kōwhaiwhai - Māori scroll designs

TAIC commissioned its kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngati Raukawa, Tuwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to prevent them. A 'waka whai mārama (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe or risk free'.

Corporate: Te Ara Haumaru - The safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represent the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for aviation.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Marine: ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Marine'.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai.

Price $18.00

ISSN 1173-5597 (Print)
ISSN 1179-9072 (Online)