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Summary

In the early hours of 30 November 1991, while on a positioning voyage from Singapore to Cebu City in the Philippines, the Australian registered fishing vessel Northern L caught fire. The six crew were unable to fight the fire and abandoned the vessel in approximate position latitude 8 degrees 03 minutes North, longitude 118 degrees 34 minutes East, taking with them an emergency radio and the vessel's 406mHz emergency position indicator radio beacon (EPIRB). At about 0500 explosions were heard coming from the vessel, which sank shortly after.

At sunrise the crew took stock of their surroundings and activated the vessel's EPIRB.

At about 0830, the Australian Marine Rescue Coordination Centre received a distress alert from the United States MRCC, Washington that a distress beacon belonging to the Australian registered fishing boat had been detected in position 8 degrees 02 minutes North 118 degrees 33 minutes East.

These details were passed to Westpac MRCC in Japan, and Manila MRCC in the Philippines.

At 1130 (UTC+8) the Liberian registered tanker Nagasaki Spirit, en route from Dulang, Malaysia, to Santan, Indonesia, was requested by Westpac MRCC to proceed to a position 08 degrees 03.3 minutes North and 118 degrees 34.3 minutes East to investigate the EPIRB signal. At 1245 the Nagasaki Spirit sighted an orange canopy and by 1340 the six survivors had been taken on board the tanker.

The master of the Northern L (a Philippine national), the mate (an Indian national) and the two engineers (both Indonesian nationals) were landed in Santan. The two Australian crew remained with the Nagasaki Spirit until the ship arrived off Brisbane on 14 December.

Sources of information

Information was provided by:

The Australian crew members of the Northern L

Karina Fisheries Pty Ltd, Port Lincoln

Lukin International Fisheries Ltd, Singapore

The Australian Maritime Safety Authority

- Maritime Rescue Coordination Centre

- Ship and Personnel Safety Branch

- The Registrar of Ships

Singmarine Dockyard and Engineering Ply Ltd, Singapore

The Master, m t Nagasaki Spirit

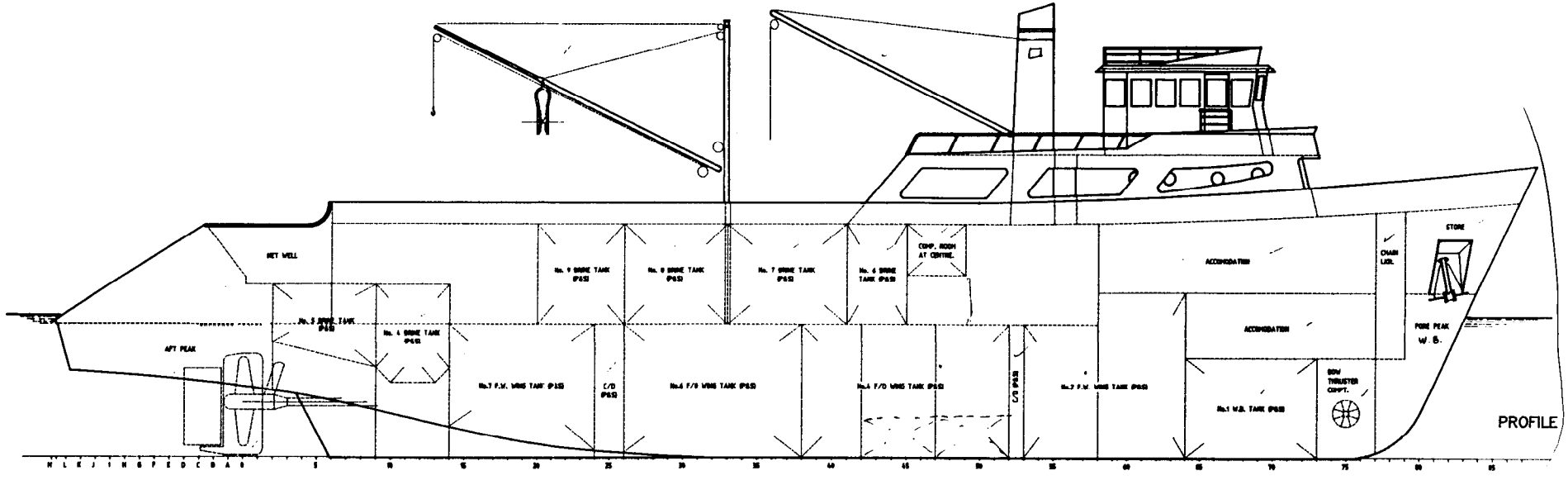
The American Bureau of Shipping

Tidewater Port Jackson Marine Pty Ltd

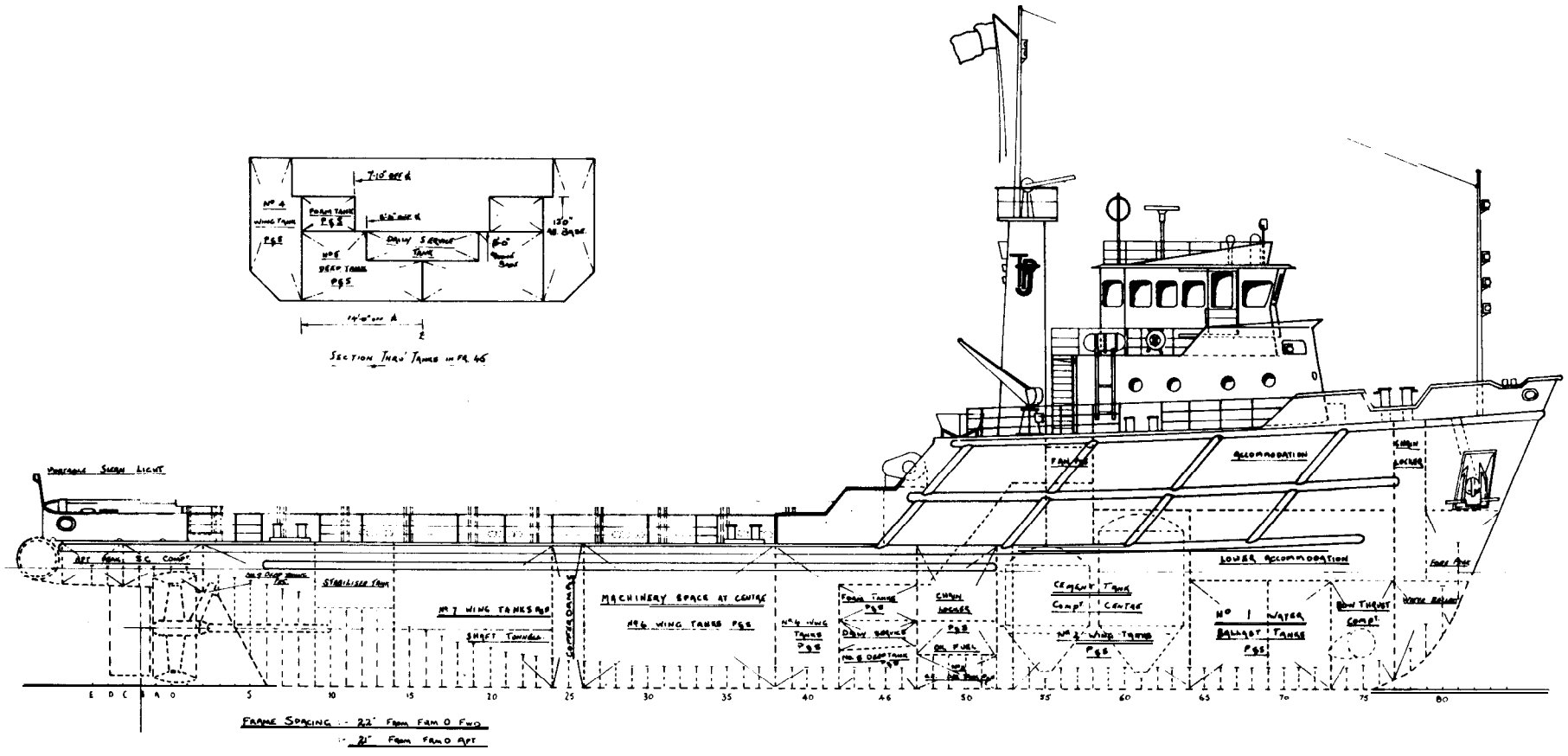
The Master of the Northern L responded to a letter sent by the Inspector, supplying certain detailed information.

The Inspector also gratefully acknowledges the assistance of the Director of Marine, Marine Department, Singapore and the Department of Scientific Services, Singapore.

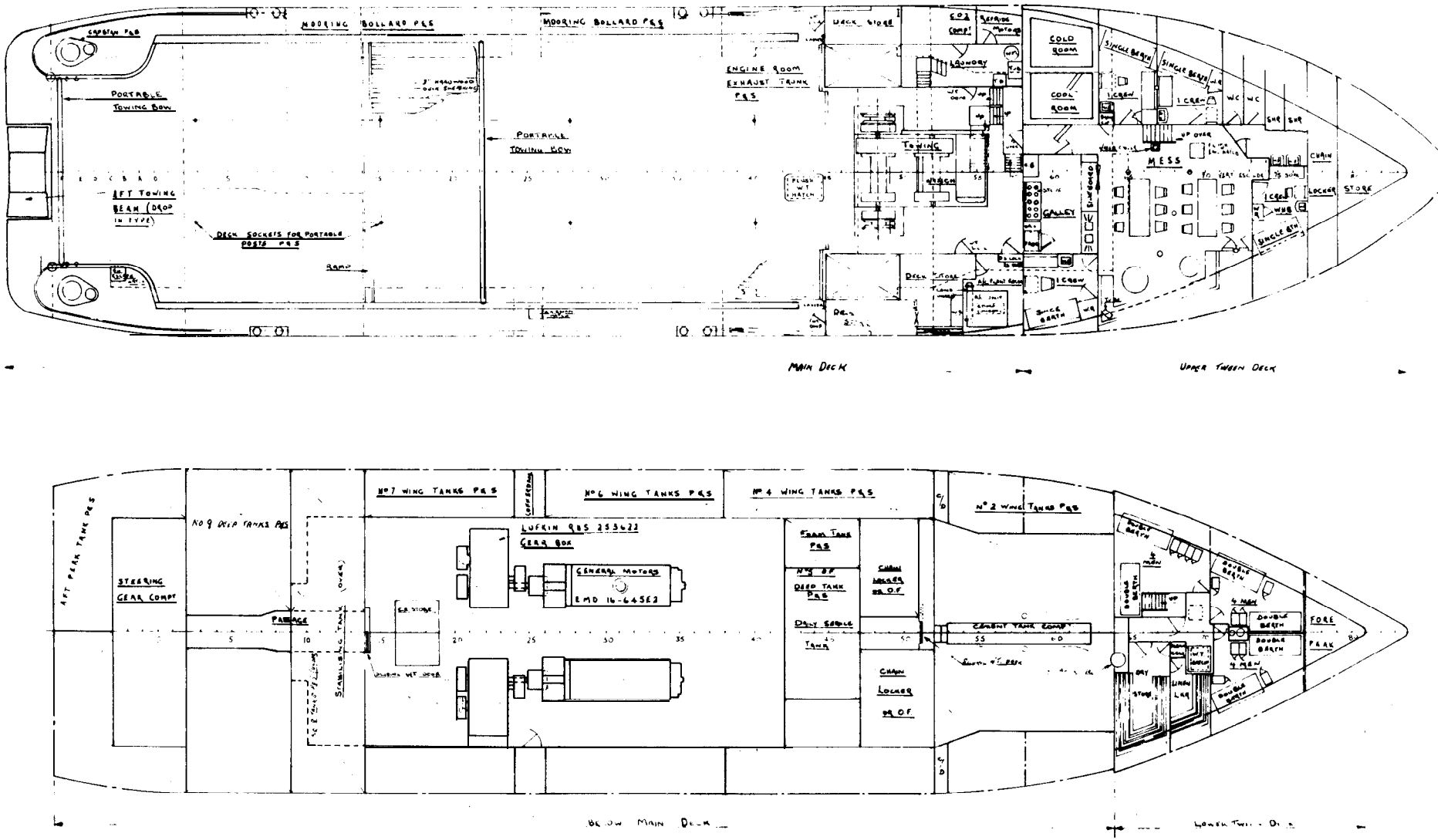
Times:
Unless otherwise indicated all times are given in the ship's time kept on the Northern L.



Outline drawing of the Northern L



*Genera/ arrangement of the vessel as the Northern Tide 19 73-8 7 — **Profile***



General Arrangement of the Vessel as the Northern Tide 1973-87 — Plan

THE VESSEL

The Northern L was an Australian registered fishing vessel owned by Karina Fisheries Pty Ltd, of Port Lincoln. Originally the Northern Tide, it was purchased from Tidewater Port Jackson Marine Pty Ltd, in January 1988 and fitted out for purse-seine fishing. The vessel was registered as having changed name and undergone alterations in February 1989.

The Northern Tide

The vessel was built as the Northern Tide in 1973, in Newcastle, New South Wales, as an off-shore support vessel. It was classed with the American Bureau of Shipping (ABS) with class notations "+A1E", "+AMS" and built to conform with the Corn-monwealth Navigation (Construction) Regulations and the Navigation (Fire Appliances) Regulations.

As the Northern Tide, the vessel was originally 49.6m in length overall, 12.22m maximum breadth, 5.09m moulded depth and had a summer draught of 4.242m. The forecastle deck extended from the stem (frame 84) to frame 58 and carried a deck housing, containing accommodation for the officers, and the wheelhouse. Further crew accommodation was beneath the forecastle deck at main deck level (tween deck) and below the main deck (lower tween deck), forward of frame 58. Access to the accommodation at the main deck level was by a hinged weathertight door located to port of the centre line at frame 58. The main deck between frame 45 and 58 was partially enclosed by stores, the starboard funnel casing and the air conditioning plant on the starboard side, and on the port side, by the port funnel casing, the crew laundry, stores and the CO_2 store for engine-room fire smothering. The towing winch was in the open deck space between these stores. Just aft of the towing winch and slightly to starboard of the centre line between frames 42 and 45, an access hatch (1.52m x lm) flush with the deck, provided access to the engine-room for equipment. Aft of frame 45 the deck was open for 30.175m to the stern, providing an unencumbered working space.

Below the main deck, the vessel was divided into five main watertight compartments by watertight bulk-heads at frames 14,51/52 (stepped bulkhead at forward end of engine-room), 64 and 77 (the collision bulkhead). Access between the engine-room and the spaces immediately forward and aft of it was by way of locally and remotely operated sliding watertight doors at frames 14 and 51, the remote controls for both the sliding doors were above the bulkhead deck, on the main deck at frame 56 on the centre line. The approved stability data under "watertight integrity" stated:

> *"As the stability of this vessel relies on the watertight integrity of the forecastle and side houses, as well as of the hull, the doors giving access from the deck to the fan rooms, deck stores and forward accommodation and down to the lower decks are to be kept closed at all times when the vessel is at sea."*

Normal access between the accommodation and the engine-room was by way of a space on the port side

of the main deck (that doubled as the laundry) via the stairs to a cross alleyway and thence through the watertight door at frame 51. In addition to the normal access doors, there was an emergency escape from the engine-room through a dogged door into the starboard coffer-dam space and, by ladder, through a hatch on to the main deck. The aftermost compartment, connected to the engine-room by the watertight door at frame 14, contained the steering gear. Escape from this compartment was by a dogged hatch on the starboard side.

The engine-room extended from frame 14 to frame 51. The vessel was powered by two General Motors 16.645E2 diesel engines producing 2869kW driving two variable pitch propellers. Each engine was connected through a gear box to a shaft driving the respective propeller. Electrical power was supplied by three diesel generators, two General Motors Detroit diesels type 6-71 and one Caterpillar type D353. Two main fire pumps were located on the port side of the engine-room.

The Northern Tide's fuel tanks were adjacent to the engine-room space. Three sets of tanks were arranged on either side of the engine-room between the subdivision bulkheads at frame 14 and 52, extending from the underside of the main deck to the bottom plating and were 1.829m in width. At the fore end of the engine-room, between frames 42 and 47, a series of further fuel storage tanks, including the daily service tank, were arranged between the side tanks, with a further double bottom tank (No 3) between frames 47 and 52.

The vessel's engine-room space was not equipped to operate in an unmanned machinery space mode, nor was it required that the space should be fitted with a fixed fire detection system. Accordingly, no such system was fitted.

In the event of fire, the engine-room could be isolated and fuel to machinery shut off by a series of emergency controls remote from the engine space, situated at the main deck level between frame spaces 47 and 56. The fuel oil quick-closing controls were accessible from the open deck in way of the port funnel casing. The main engines could also be stopped from the bridge.

The remote stops for the engine-room and accommodation fans, the general service bilge and ballast and oil fuel-transfer pumps were situated in the laundry space. The CO_2 fire-smothering controls were also in the laundry, adjacent to a stairwell providing access to the engine-room and tank spaces forward of the engine-room.

The ship was equipped with a bow-thrust propeller for manoeuvring the vessel, the diesel engine for which could be started and controlled from the bridge. The bow thrust engine space was situated forward, between frames 73 and 77. The space could be reached through the lower crew accommodation via companion ways and the alleyways, or by two vertical ladders through three watertight hatches, that provided an escape route from the spaces in the forecastle to the forecastle head deck. The bow thrust engine also powered the emergency fire pump, but to operate the pump it had to be clutched into the engine by a clutch mechanism, which could only be operated from the bow-thrust space itself. The batteries for starting the bow

thrust engine and the diesel fuel tank for that engine were both located in the bow-thrust space.

The Northern L

In November 1987 the Northern 'Kde was sold to Karina Fisheries Pty Ltd, and later the vessel was converted to a purse-seine fishing vessel and the name changed to Northern L. It was reclassed with ABS and assigned class notations "+AlE Fishing Service, +AMS (class notation for hull and machinery of a fishing vessel). The conversion to a fishing vessel was overseen by ABS to conform to their rules and the vessel subsequently remained in class.

Marine Orders Part 31 (Ship Survey and Certification 31.21.3) provides that:

> *A fishing vessel regisrered in Australia in respect of which there is in force a valid classification certificate for the hull and machinery issued by a survey authority, is exempt from survey under subsection 193(l) of the Navigation Act in respect of those items of the vessel.*

To convert the offshore support vessel to a purse-seine fishing vessel, significant modifications were undertaken for Karina Fisheries, in 1988 by Singmarine Dockyard and Engineering Pty Ltd, Singapore, resulting in the vessel being assigned a new overall length of 55.02m.

Vessels built under the provisions of the Navigation Act 1912 must conform to Marine Orders Part 12 (Ship Construction) and Marine Orders Part 15 (Ship Fire Protection, Fire Detection and Fire Extinction) if the keels of the vessels were laid or they were at a similar stage of construction on or after 25 May 1980. But, as the Northern L was an existing vessel, built before 25 May 1980, the provisions of the Navigation (Construction) Regulations and the Navigation (Fire Appliances) Regulations apply to it and to any subsequent conversion.

Below the main deck the engine-room space was modified by reducing the fuel capacity and converting the aftermost port and starboard fuel tanks (frame 14 to frame 24) to carry fresh water and the small tank spaces above and either side of the daily service tank were converted to oil overflow tanks.

Under ABS rules for fishing vessels, only three watertight bulkheads were required below the main deck. The watertight door at the forward part of the engine-room was not required to meet the subdivision standard. According to the Australian Maritime Safety Authority (AMSA) , a plan was submitted to remove the watertight door at frame 51 and plate over the entrance. The Authority's surveyors state that this door was removed at conversion and a subsequent deficiency report issued during survey on 30 April 1991 refers to the engine-room watertight door in the singular. However, the ABS surveyor who attended the vessel in Singapore advised that as far as he could recollect, "the watertight door at frame 51 was not removed at the time of the conversion". From statements made by the Australian crew it seems that the door was not removed.

However, the hatch between the main deck and the engine-room between

frames 42 and 45 was modified to effectively make it the normal engine-room access. The original access by the cross alleyway to the port side of the vessel forward of frame 51, was partially obstructed by new pipework.

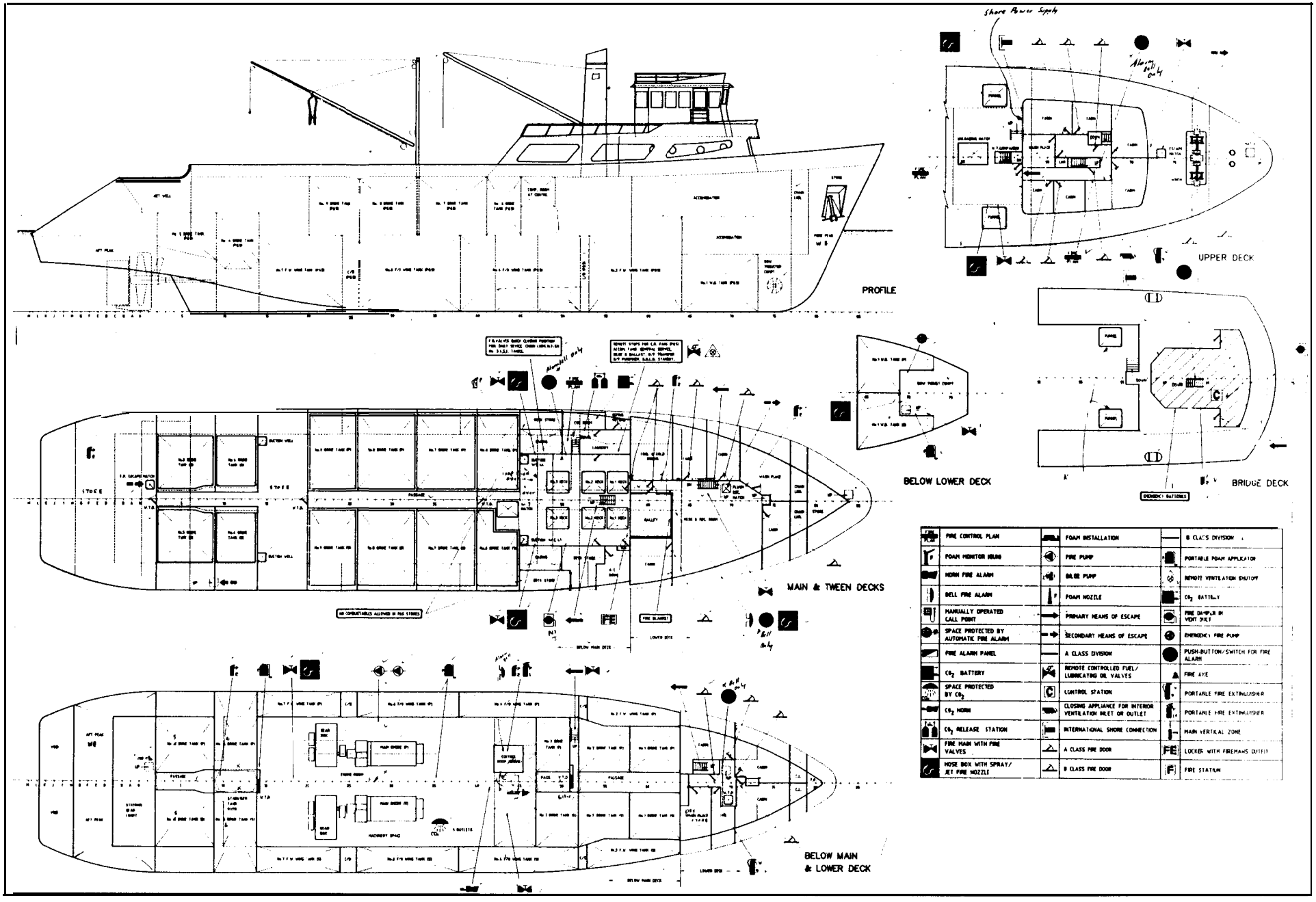
Other modifications outside the engine space involved the crew accommodation and other tank spaces.

The conversion involved creating an upper deck by extending the forecastle deck to the stern of the ship, so that it terminated at a net well and ramp aft of frame 5. This deck became the bulkhead deck. As a fishing vessel, the Northern L was not required to be assigned a load line. However, the modifications resulted in a significant increase in draught. A maximum permissable was assigned by the Department of Transport and Communications, stipulating that the vessel should not be loaded deeper than a draught of 6.172m at midships, an increase of 1.93m, bringing the deepest permissable water-line above the main deck level.

The positions of the existing remote emergency controls (engine-room CO_2, fuel and pump shut offs and ventilation fan stops) were retained on the main deck as originally built. The position of the remote control for the watertight door or doors also remained the same, although in the modified vessel the controls were below the new bulkhead deck.

The enclosed main deck space was subdivided by four watertight bulkheads and associated watertight doors, the existing door to the accommodation at frame 58 and new hinged watertight doors at bulkheads in way of frames 40, 14 and 2. The original stern structure was removed and the vessel's length extended by some 3m.

A series of 18 brine tanks (nine port and nine starboard) were created to take the fish catch. The original cement tanks and chain locker spaces below the main deck, between frames 47 and 64, were converted to brine tanks, four new tanks were constructed on the main deck, and the stabiliser tank and deep tank at the after end of the engine-room had also been converted. Access hatches (or necks) to all but the three sets of the forward brine tanks were let into the upper deck to allow the loading of fish. Access to the three forward brine tanks below the main deck was by way of a hatch constructed in the upper deck, on the centre line, between frames 49 and 53, with dimensions of about 2m x 1.4m. Fish were loaded into the converted tanks, from the main deck, by "necks" let into the main deck forward of frame 47.



Northern L - Fire control plan

The brine tanks were of double steel plate construction separated by wooden beams fixed to existing steel stiffeners. The space between the plates was filled with injected foam insulation.

An additional refrigeration compressor unit was fitted aft, above the steering gear space and below the net well. Originally designed to service the blast freezer, the unit had been connected to the overall system and could be used, together with the forward compressor, as refrigeration plant for the brine tanks. Both systems worked on the inert refrigerant gas, Fluoron.

The escape hatch from the steering-gear compartment was sealed and a new escape hatch was cut in way of frames 1 and 2, just to the port side of the centre line immediately adjacent to the door between the steering gear compartment and the tunnel to the engine-room.

Among other modifications a fashion plate was fabricated around the accommodation on the forecastle deck and two sets of derricks for fish and net handling were fitted in way of frames 52 and 33. The towing winch on the fore part of the deck was removed.

A 7.1 m aluminium self-propelled skiff, stowed on the starboard quarter on the ramp to the net-well, was used for deploying the purse-seine net. This was winched on to the ramp and secured by ropes and shackles.

Two 25-man capacity SOLAS standard liferafts were carried, one either side of the wheelhouse.

The original trim and stability information book was withdrawn and a new book containing intact stability information was submitted by consultant naval architects and approved by the Department of Transport and Communications. With the changed operating criteria required of a fishing vessel, reference to the requirement to keep weather-tight doors closed was omitted. The new book detailed operating conditions relating to the maximum allowable draught and the number of brine tanks permitted to be "slack" at any one time.

The vessel was remeasured for tonnage after the modifications and re-entered service early in 1989.

The ship was surveyed by an AMSA surveyor at Rabaul, Papua New Guinea, in June 1989 for annual endorsement of the Certificate of Survey for a Fishing Vessel, which expired in June 1990. The ship continued in service with an expired certificate until surveyed by AMSA at Port Lincoln in April and May 1991. This survey took place before the vessel returned to Singapore for dry docking and refit. Deficiency notices were issued on 30 April and 17 May, detailing outstanding items that needed to be rectified before the issue of a survey certificate.

On 23 May 1991, the deficiencies recorded had been addressed and a report of survey completed, effectively recommending the issue of a certificate, conditional on:

- *"CO2 cylinders one additional cylinder to connect to manflold at dry docking*

- *Daily service tank quick closing (in-stanter) valve to renew at dry dock."*

A Certificate of Survey for a Fishing Vessel was issued on 2 July 1991.

The Northern L went into dry dock at Sembawang Maritime Ltd, Singapore on 18 October 1991, to carry out painting to the hull, the ranging of both anchors and cables, and for work to the tail shaft. The vessel undecked on 24 October and moved to a repair berth where further work, including maintenance of the engine-room, compressed air receivers, the starting system on the bow-thrust/emergency fire pump, opening up the emergency fire pump for survey and for maintenance on the main and auxiliary engines.

It is not clear from the records relating to the refit whether or not the two outstanding deficiencies of 23 May, relating to the CO2 bottle and the remote closing of the daily service tank on which the issue of the certificate of survey was conditional, were rectified.

In the second half of 1991, Karina Fisheries made the decision that the Northern L should reposition to Cebu City in the Philippines, after the vessel's refit, where the fishing crew would be recruited.

A new fire-control plan was prepared by consultants on behalf of the owners, but this was not approved by AMSA before the vessel sailed from Singapore on 24 November. This plan, together with the other drawings of the vessel after conversion, was based on the original drawings of the Northern Tide and their accuracy can not be relied on.

THE CREW

As a fishing vessel on overseas voyages, the Northern L was required to conform to the provisions of Marine Orders Part 51, (Fishing Vessels) in respect to the qualification of the crew.

Marine Orders Part 51 give effect to International Maritime Organization Resolution A.539 (13), that requires a person in charge of a navigational watch, and the chief and second engineers of a fishing vessel to be qualified to the satisfaction of the flag state authority, in accordance with the table of qualifications in the Appendix to the Orders.

Six crew were engaged to make the positioning voyage from Singapore to the Philippines. The master and two Australian "deck hands" were regular crew members. A mate (an Indian national), and a chief and second engineer (Indonesians) were engaged for the voyage.

The master, a Philippine national, held a mates certificate of competency for a vessel of any gross tons, issued by the Board of Manila, Philippines This certificate, together with details of service and certificates relating to courses completed in accordance with the provisions of the International Convention on the Standards of Training, Certification and Watch-keeping for Seafarers 1978, was accepted by AMSA as meeting the qualification requirements of the Marine Orders, for a fishing vessel of over 24m.

According to the owners the mate, and the chief and second engineers all held certificates of competency, consistent with their duties, issued by their respective national marine administrations.

One of the two deck hands was also the owners' representative. He had 13 years experience as a commercial fisherman and had sailed on the Northern L for the preceding two years, some of that time as mate when the vessel was in Australian waters. He held a qualification as Skipper grade 1 and Marine Engine Driver Grade 1 both issued in 1980 by the South Australian Department of Marine and Harbours. As a Marine Engine Driver Grade 1, he was qualified to sail as second engineer on fishing vessels with engine power of less than 3000kW. Although entered in the crew list as an "Able Seaman" for the purposes of the positioning voyage, he kept an engine-room watch. When fishing, he was normally in charge of the purse-seining operation.

The other seaman was the regular skiff coxswain. He had not undertaken a marine survival course and did not hold any formal marine qualification as either a navigational watchkeeper or engineer.

THE VOYAGE

On 21 November 1991, the Northern L took delivery of 200 metric tonnes of diesel (gas) oil, with an API gravity of 0.864 at 15 degrees Centigrade and a flash point of 80 degrees Centigrade. At 1305 local time on 24 November 1991, the vessel sailed from Singapore bound for Cebu, a distance of 1355 miles.

Initially the ship was operated with both main engines on reduced power, but it was decided to use only one engine, which gave a speed of 7.5 knots.

Those on board divided into a three watch system, with the master, mate and the unqualified deck hand keeping a four-on eight-off bridge watch and the two engineers and the owners' representative maintaining the same regime in the engine-room.

A little after 1800 on 29 November, the Northern L cleared the Balabac Strait and entered the Sulu Sea. At 0000 on 30 November, the master took over the navigation watch from the unqualified seaman and the owner's representative took over the engine-room watch. The wind was north-easterly, with a light breeze and slight sea.

During the 0000 to 0400 watch the owner's representative decided that he should start to chill down brine tanks 7,8 and 9. At about 0230, he left the engine-room and went to the after compressor room, leaving the engine-room unattended. Before starting the chilling process he decided to change the oil in the after compressor and also check the bearings, becasue they had not been checked for some time. He isolated the compressor, drained the oil and opened up the inspection covers. While he was completing this operation he was alerted by a smell and noticed smoke coming from the hatch between the compressor room and the steering flat below.

He began along the main deck level between the brine tanks to warn the other crew but as he moved forward the smoke increased and became overpowering. He was forced to gain the upper deck through the escape hatch on the starboard side to the upper deck. Once on the upper deck he saw flames and smoke coming from the open unloading hatch. As he arrived at the accommodation he met the master and he recalled that the fire alarm was sounding. He continued into the accommodation and went down to the mess deck to rouse the other crew members. Shortly after the alarms were sounded, the ship blacked out.

Brief, sworn statements were made to the master of the Nagasaki Spirit on 1 December 1991, by all six survivors from the Northern L.

According to a statement made by the master of the Northern L, at about 0330 he noticed flames and smoke coming out of the unloading hatch that lead to the main deck and the engine-room space. He immediately sounded the fire alarm and manoeuvred the vessel's bow into the wind and stopped the engine.

Except for the two people on watch, all crew members were in their respective cabins asleep. They were all woken by the fire alarm, and smelt and saw smoke. One Australian seaman opened his cabin door and found the galley

area filled with smoke. He heard the other Australian seaman calling him and he grabbed an extinguisher and, clad in only shorts and a T-shirt, he hurried with the other crew out on to the open upper deck aft of the accommodation. All the crew reported smoke and flames coming from the hatch to the main deck level. The deck above the engine-room space, particularly in the area adjacent to the hatch to the main deck and engine-room space, was too hot to stand on and all six men retreated to the stern of the vessel.

Both Australians described the smoke as thick. but white.

The master secured all the passports, together with the log book, EPIRB and portable emergency radio. One of the passports was subsequently lost.

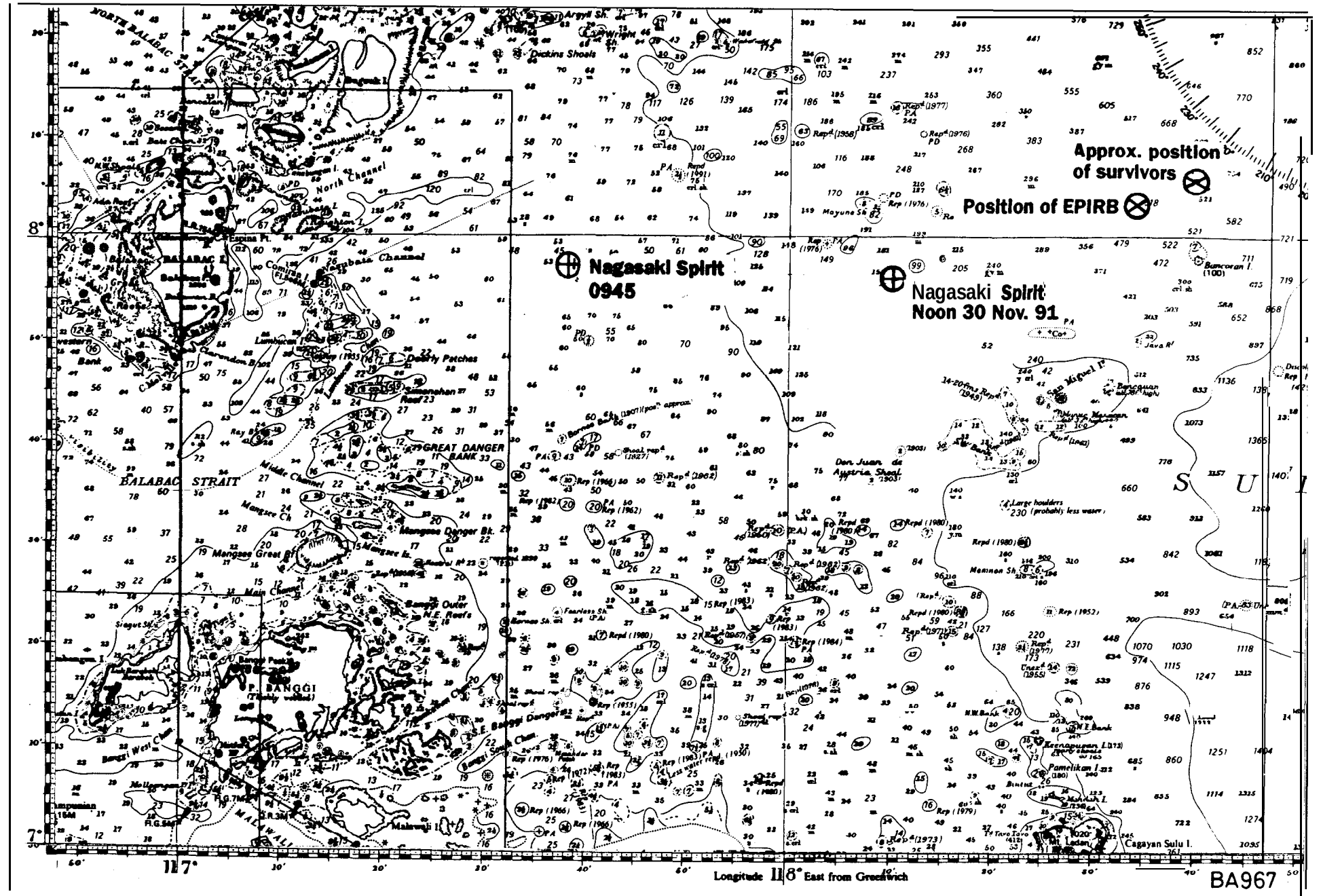
Neither the watertight door or doors, nor the ventilation system were closed, nor was the CO_2 system activated. The fire pump was not running and there was, therefore, no water pressure on the fire main. The emergency forward pump was not started. The vessel was equipped with self-contained breathing apparatus, but this was not secured.

The crew waited at the after end of the vessel to see if the fire would burn itself out. At a time put by the Master as 0445 the crew abandoned the Northern L by the skiff positioned at the net ramp. The crew transferred the 406 mHz EPIRB and portable emergency radio, then boarded and waited off the vessel to allow the fire to burn out. The fire seemed to engulf the bridge.

The survivors waited in the skiff about 100m from the Northern L. After a lapse of time, put at about 10 or 15 minutes, two explosions were heard. Although it was still dark, the owner's representative stated that his impression was that the vessel settled with a list to starboard and subsequently sank stern first.

Shortly afterwards, the survivors saw lights close at hand and discovered that the liferafts secured on board by hydrostatic releases, had floated to the surface. The liferafts were recovered and the stores and water subsequently transferred to the skiff. Attempts to bring the liferafts on board the skiff were eventually successful, and the canopy of one raft was cut free to cover the exposed skiff and provide shelter for the survivors.

With sunrise, at about 0604 local time (2204 UTC), the survivors took stock of the situation and activated the 406 EPIRB. They had by this time motored in a north-westerly direction away from the area of the sinking and any debris from the Northern L would have drifted south in the prevailing southerly current.



From Chart 967 South China Sea- Palawan

At 0732 Eastern Australian Summer time (2232 UTC) on 29 November 1991, the Australian MRCC received a distress alert from the United States Rescue Coordination Centre in Washington and the French RCC in Toulouse.

MRCC identified the code number as the Northern L and passed the information to the Japanese RCC (WESTPAC/RCC) at Kadena Airforce Base and Manila RCC.

At 0945 local time (UTC +8, 0145 UTC), the Nagasaki Spirit, a Liberian tanker en route between Dulang, Malaysia and Santan, Indonesia, detected a faint distress message on 2182 kHz. The position was uncertain but seemed to lie along the tanker's course line. The tanker was at this time in approximate position 07 degrees 57.1 minutes North, 117 degrees 38.4 minutes East on a course of 092 degrees.

At 1130 local time (0330 UTC), the Nagasaki Spirit received a telex from WESTPAC/RCC giving the search and rescue satellite coordinates from the signal transmitted by the Northern L's EPIRB, requesting that the tanker go to position 08 degrees 03.3 minutes North, 118 degrees 34.3 minutes East.

The Nagasaki Spirit altered course to 076 degrees, in calm seas, with a light breeze and good visibility.

At 1245, the Nagasaki Spirit sighted an orange canopy and informed WESTPAC/RCC. Five minutes later, distress flares and orange smoke were sighted. At 1300 VHF radio contact was established between the Nagasaki Spirit and the Northern L survivors and it was confirmed that there were no injuries and all were safe.

At 1315, the Nagasaki Spirit manoeuvred alongside the skiff and by 1340 all six survivors were aboard the Nagasaki Spirit and the skiff and liferafts were recovered using the tanker's hose handling crane. WESTPAC/RCC was informed and passed the information to MRCC.

The master, mate and the two engineers were landed at Santan in Indonesia and subsequently repatriated.

On 14 December, the Nagasaki Spirit anchored off Brisbane and the two Australian survivors were landed ashore. Arrangements were also made to land the aluminium skiff and the life rafts.

COMMENT AND ANALYSIS

General

Evidence that the fire occurred is limited to the written statements made by the master and crew members of the Northern L aboard the Nagasaki Spirit, and to the statements made by the two Australian crew to the Inspector. The master of the Nagaski Spirit stated that by the time the tanker rescued the fishing vessel's crew there was no debris or other evidence of the Northern L, other than the survivors, the aluminium skiff, the liferafts and the documents the survivors had secured. Examination of the liferafts by a liferaft technician, about **15** days after the incident, showed no obvious signs of damage by fire or diesel oil. Similarly the vessel's log book showed signs of water damage, but had not been affected by fire or smoke.

Therefore, there is no hard evidence as to the cause of the fire that forced the abandonment and subsequent loss of the Northern L. All real evidence was lost with the vessel. No definitive statement can be made as to the cause of the fire or the cause of the sinking. But it is considered that the two events are linked.

Only two of the six crew were available to the Inspector for interview. Although the Northern L was an Australian registered vessel, the master (a foreign national) did not return to Australia and could not be interviewed. It is understood that he subsequently left the employ of Karina Fisheries. Similarly the mate, chief engineer and second engineer did not return to Australia. All had left the company's employ and could not be interviewed. Other evidence is essentially circumstantial, based on the known configuration of the ship and its equipment and documents relating to the vessel's surveys and repairs.

The times of the events are not reliable. The Northern L was maintaining a zone time of UTC +8. In the position of the sinking of the vessel, civil twilight would have been at 0542 and sunrise at 0604.

The fire

The owner's representative stated that when he left the engine-room, at a time put at about 0230, the port main engine and other machinery were running normally. All temperatures seemed normal and there was nothing untoward. He was not a smoker and he could not recall whether the other engineers smoked or not.

He first detected smoke coming from the after hatch to the steering gear approximately one hour after he had left the engine-room. It is apparent from subsequent statements relating to flames and the heat on the deck adjacent to the accommodation housing and the hatch to the engine-room, that the seat of the fire was below the main deck, in the engine-room, and could not have been in either the steering flat, or in the after compressor room, or the tunnel space leading to the engine-room.

Descriptions of the smoke suggested that it was white and there was no

recollection of taste or any other sensation. This would suggest virtually complete combustion. It would seem to exclude the polyurethane insulation of the brine tanks, any solid carboniferous material, oil soaked lagging or oil that was not substantially mixed with air, all of which would generate heavily discoloured smoke and distinctive fumes. The refrigerant gas, fluoron, is inert and will not burn.

There was conflicting evidence between the two seamen interviewed as to whether there was any welding gas stored either in a store on the main deck or in the engine-room. An oxy-acetylene set was moved from the main deck and secured on the forecastle deck with the bottles lashed to the housing before the vessel sailed from South Australia to Singapore. It is not known whether the oxy-acetylene was removed from its stowed position during the refit and possibly taken to the engine-room, or whether any additional spare bottles were carried and, if so, where they were carried.

Based on the limited evidence available, it is most probable that the fuel feeding the fire was diesel oil mixed with air, and that the seat of the fire was in the engine-room. The most likely fuel source would have been from a fracture in a pressurised fuel line to either the main engine or the diesel generator. The most probable source of ignition would be a hot surface, such as an exhaust manifold. While a static electrical charge could theoretically have been generated by escaping diesel oil and caused ignition, it is considered unlikely.

The two main engines were situated aft of frame 36. According to the General Motors diesel, 16.645E2 service manual:

> *"the engine fuel system consists of the fuel injectors, fuel pump, the engine mounted fuel filter and fuel supply and return manifolds.*
>
> *Components external to the engine such as the fuel tank, fuel suction strainer and connecting lines complete thefue system.*
>
> *In operation, fuel from the fuel tank is drawn up by the fuel pump through a suction strainer and is delivered to the engine mounted filter. It then passes through the filter elements to the fuel manifold supply line and injector inlet filter at each injector is pumped into the small portion of the fuel supplied to each injector is pumped into the cylinder at VW high pressure, through the needle valve and spray tip of the injector."*

Fuel to the engines is at relatively low pressure of a maximum of 345 kPa (50 psi). The fuel oil pump and supply lines enter the system at the fore part of the engine and are relatively clear of any hot surface connected with the exhaust system.

All high pressure oil to the main engines is contained within the top cover (enclosing the cylinder heads and injectors). If any pipe containing the very high pressure oil at the injector were fractured, any spray would have been contained by the top cover. It is probable that the top cover for the engine was in place, for if the engine is run without the cylinder head covers in

place, lubricating oil would have been sprayed extensively, and could not go unnoticed.

The auxiliary machinery running at the time included at least one of the diesel generators. The main engine was stopped by the master at about 0330, when he realised that the vessel was on fire. However it would appear that the fuel source continued to feed the fire, which burned very fiercely.

The ship blacked out shortly after the master sounded the alarms. It cannot be established whether this was due to the electrical circuit failing, through the electric cable insulations being burnt through and shorting, or the generators stopping. However, with the loss of power, the emergency batteries should have automatically supplied 24-volt power for emergency lighting and the alarms, however the crew were all on the main deck and with the fire uppermost in their minds were not in a position to note whether the emergency lighting and alarms were, in fact, activated.

The engine-room should have been attended by a qualified individual at all times. The Northern L was not classed or equipped to operate with an unmanned machinery space and there was no remote sensing system to alert the vessel's staff to an emergency in the engine space. By leaving the engine-room unattended there was neither a human nor a remote fire detection system to warn of the ignition of the fire.

The evidence given by the two crew members interviewed, was that all watertight doors, connecting spaces above and below the main deck, were open. It is also apparent that the hatch between the upper deck and the main deck, and the engine-room access hatch between the main deck and the engine-room space, were also open.

Containlng the fire

Apart from securing a water charged fire extinguisher, no equipment was used to fight the fire: the fuel system was not shut down, or the engine-room isolated to prevent the spread of the fire.

Once the fire had started, the engine-room would have filled with smoke very quickly and within a few minutes, with the heat trapped by the deckhead, the temperature would have risen to a level that would have made access to the engine-room to fight the fire impossible. The only option was to isolate the engine-room, closing all doors, hatches and ventilation. With this achieved, release of the CO_2 should have extinguished the fire, or failing this, the space would have been starved of oxygen. Either of these actions, coupled with boundary cooling might have saved the Northern L.

When the vessel was converted to a fishing vessel, the remote stops for the ventilation fan and engine-room pumps, the remote quick closing fuel oil valves, the CO_2 and watertight door control were all enclosed by the upper deck. With the smoke filling the accommodation, the reported ferocity of the fire and the heat at the upper deck hatch area, it would not have been possible to gain entry to the area in which the remote controls were without breathing apparatus, fire hoses and personnel proficient in their use. The breathing apparatus, stowed

at the entrance to the mess room, and firemen's apparatus, kept underneath the ladder leading from the upper deck to the wheelhouse, had also been cut off by the flames and heat.

There is little doubt that the unrestricted spread of the fire was accelerated by air being supplied to the fire through the open watertight doors, which in turn allowed the spread of flame outside the engine-room space. The open engine-room door and access hatch to the upper decks provided a natural chimney accelerating the effect of the fire. Unless these openings had been secured, the release of CO_2 into the engine-room would in all probability have had a limited and short-lived effect.

The position of the remote controls for closing off the fuel and ventilation, and for stopping the fuel pump were required to conform to the Navigation (Fire Appliance) Regulations. The requirements under the Regulations were that the controls should be outside the space protected.

Under the Navigation (Fire Appliance) Regulations the release of CO_2 had to be:

> *"capable of being controlled by valves or cocks:*
>
> *b) that are readily accessible*
>
> *c) that are not readily cut off from use by the outbreak of fire."*

In the event, the CO_2 controls and the means for isolating the engine-room and stopping the fuel supply were cut off by fire and smoke. With the hatch to the engine-room unsecured, the main deck was effectively common with the engine-room and the conditions for the remote controls to isolate the engine and release the CO_2 were not met.

The regulations do not specify that the controls for the engine-room CO_2 fire smothering system should be outside the space protected. The requirement is as quoted above, together with the need for a warning apparatus to allow time for people in the space to escape.

Further, if the door at the forward engine-room bulkhead (frame 51) was either removed or was left habitually open, the engine-room space was effectively extended to the crew accommodation bulkhead at frame 64 and, by way of the transverse alleyway (in way of frames 51/52), to the crew laundry in which the remote stops for the fans and engine-room pumps were situated. Under such circumstances, these remote controls were effectively within the engine-room, contrary to the regulations.

Under the provisions of sub-regulation 45 (1) of the Navigation (Construction) Regulations (Number 25 of 1968), remote manual controls for sliding watertight doors are required to be placed above the "bulkhead" deck. In the regulations the "bulkhead" deck is defined as the deck of the ship determined by the Minister to be the bulkhead deck. With the construction of the sub-divided upper deck and the increasein the vessel's maximum permissable draught, the upper deck became the logical "bulkhead" deck and the American Bureau of Shipping assumed it to be so. Therefore, after conversion, on a strict reading of the regulations, the remote watertight door controls were incorrectly sited.

It should be stated that while the watertight doors are a subdivision requirement, they also form part of a bulkhead, which when closed, restrict the ingress of oxygen and the spread of fire.

Had the watertight doors been closed during passage and the engine-room hatch been secured, it is likely that the remote controls in the crew laundry and the remote fuel stops in way of the funnel casing would not have been cut off, at least in the initial stages of the fire, notwithstanding the position of the controls in the enclosed main deck area.

Similarly, access to the bow-thrust space to start and clutch in the emergency fire pump was through the smoke filled accommodation, either by companion ways and alleyways, or via the emergency escape ladders and watertight hatches forward. Any attempt to start the emergency fire pump would not have been a practical proposition, without breathing apparatus worn by properly drilled individuals, supported by a proficient back-up team.

Without water for the fire hoses and the lack of containment, as a result of openings in the engine-room bulkhead and deckhead not being secured, there was little that the crew could do to fight the fire. Only three of the crew had sailed on the vessel before, and it seemed from interviewing the two Australian crew members that neither they nor the other crew members, either understood or had a full knowledge of the fire fighting systems or equipment, nor had they undertaken any effective fire drills or training.

While the cause of the fire cannot be established with certainty, the fracturing of a pipe on the oil delivery system would seem the most consistent with the description of the initial stages of the fire as described by the Australian crew members.

The foundering

For the Northern L to sink, the watertight integrity of the hull had to be breached. The owner's representative stated that he heard several explosions and soon afterwards, possibly 10 minutes, the ship listed slightly to starboard and then sank by the stern.

The Northern L was not built with double bottoms in the engine-room space, but was constructed with side tanks. This effectively meant the ship's bottom was of single-skin construction and its side was effectively a double hull.

Tests conducted by the Department of Scientific Services, Singapore, on the samples of oil from the bunkering operation on 21 November, established the flash point of the sample of the diesel oil bunkers supplied in Singapore as 96 degrees Centigrade (205 degrees Fahrenheit) and within the delivery specification of 80 degrees Centigrade. Given that the fire had burnt unchecked for a time put at over two hours, it is probable that the tank bulkheads within the engine-room would have become distorted and might have ruptured. Also the temperature of the oil in bunker tanks adjacent to the engine-room would have been raised to its flash point. In this event, conditions for an explosion might

have occurred within one or more of the fuel tanks, particularly the daily service tank situated on the centre line at the forepart of the engine-room. It is possible that any explosion within the ship side tanks could have breached the hull.

Diesel gas oil of the type on board has an auto-ignition point of between 350 degrees Centigrade and 360 degrees Centigrade. The rise in temperature in the engine-room would have been extreme causing a marked rise in temperature in the surrounding spaces and the possibility of the oil in the vessel's fuel tanks being raised to auto-ignition temperature cannot be discounted. However, in the case of the ship side bunker tanks, the rise in temperature would have been offset to a certain extent by the cooling effect of the sea water on the shell plating. It seems unlikely that the auto ignition temperature would have been reached by the diesel oil in the side tanks.

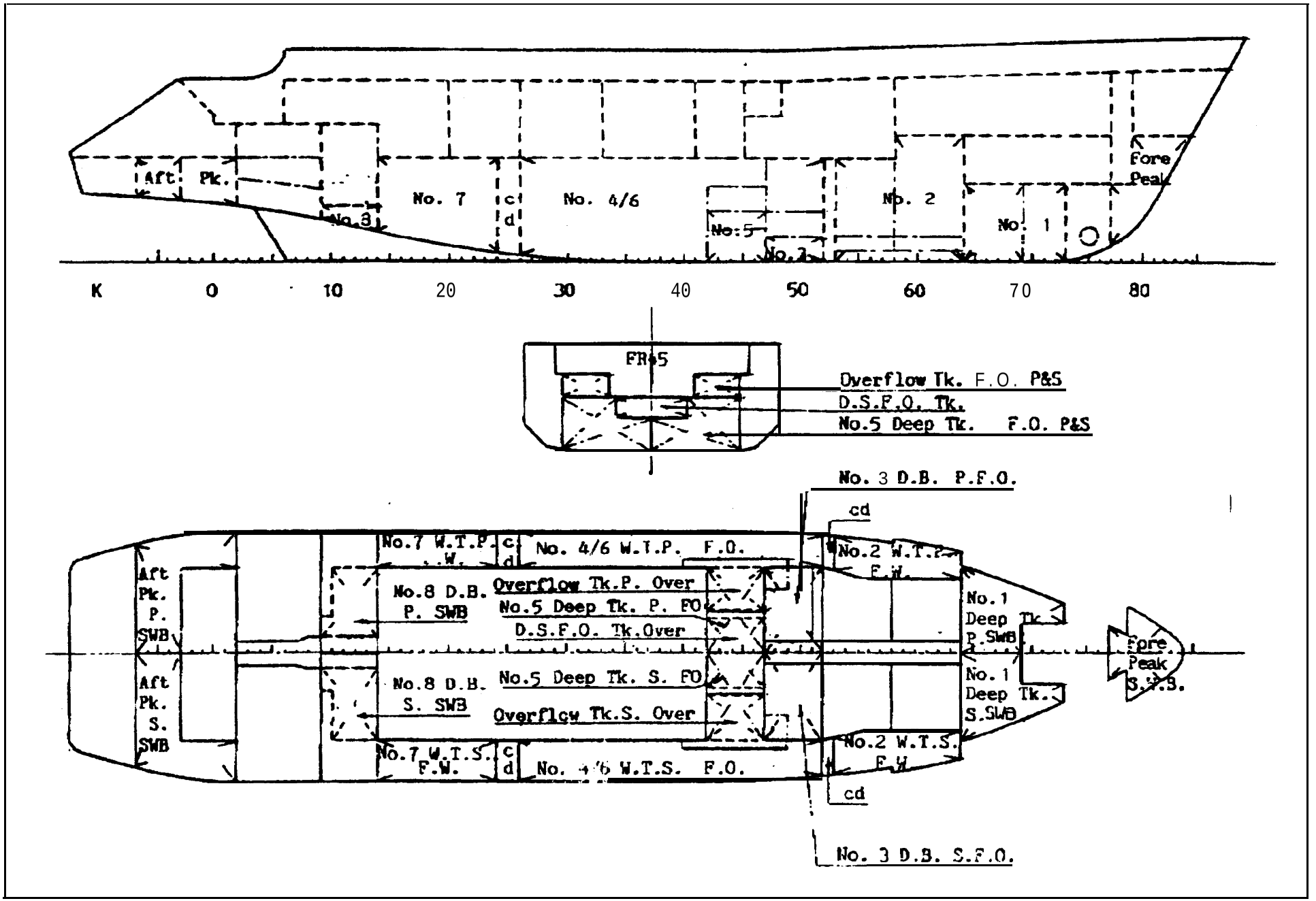
It was stated that the oxygen and acetylene bottles had been removed from the enclosed decks and stowed against the deck housing. The Inspector accepts that this information was given in good faith, but the possibility remains that some bottles of gas might have been taken to the engine-room during the refit in Singapore and not removed. Any gas cylinder in the engine-room is likely to have exploded because of the intense heat, causing damage to the surrounding structures, including breaching the surrounding fuel tanks.

Another possible source of explosion was the compressed air receivers, primarily for supplying compressed air to the engines. Four air receiver relief valves had been removed and overhauled in Singapore. Once surveyed, they had been reassembled and, according to the repair yard's records, the relief valves had been tested. In view of the work carried out on the air receivers and the subsequent tests, the relief valves should have operated, and it is unlikely that the air receivers (cylinders) exploded.

There were a number of possible sources for the explosions on board the Northern L, reported by the survivors. It is not possible to determine whether the explosions originated from any of the causes outlined, or from some other cause.

The cooling water system to the engines relied on flexible couplings on the line between the sea inlet on the raw salt water delivery line. It is possible that one or more of these were destroyed in the intense heat of the fire, resulting in the ingress of water. In this event, the flooding under this scenario would have probably been relatively slow.

It is not possible to determine whether the sinking was brought about by the hull being breached by the explosions, or whether the flexible couplings on the raw salt water line failed allowing an ingress of water, or whether the sinking was the result of some other cause. However, with the watertight doors on board open, the engine-room was common with the spaces either side of it, from the after end of the steering flat (frame C) to frame 64, and sinking of the vessel was inevitable once the hull was breached.



MV Northern L -Arrangement of Tanks

GENERAL OBSERVATIONS

In issues of basic safety, there should be no differentiation between the obligations placed on the owners, masters and crew of a trading vessel and a fishing vessel. Both are subject to the same basic rules of seamanship, collision avoidance and stability. When circumstances are beyond their control, both have a right to expect assistance from other ships and shore authorities, as was rendered in this incident. In turn, both should be expected to do their utmost to follow basic safety procedures and maintain their vessel in such a way that it is not put at risk or causes risk to others.

This requires proper management of the ship at all levels to direct and ensure safe operation of the vessel. It was apparent that the owners of the Northern L had not issued any comprehensive instructions with regard to the vessel's operational procedures other than for fishing.

Under Marine Orders Part 51, for fishing vessels over 24m in length, all masters and persons in charge of a watch, whether navigational or engine-room should have attended an approved fire fighting course and have a knowledge of fire fighting systems and procedures. The master held a certificate certifying that he had completed a course in fire fighting and fire prevention in accordance with the International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers, 1978. However, the Inspector gained the firm impression that those on board the Northern L had neither a full grasp of the fire fighting equipment on board, nor had they carried out drills to familiarise themselves with the equipment. In the event, with no fire pump operating and access to the emergency fire pump effectively denied them, this lack of knowledge and training did not affect the outcome.

The Inspector considers that the incident was affected by the general operational standards that prevailed aboard. It was admitted that the watertight doors were habitually left open, the reason given simply that it was "a fishing boat". The Northern L was a large ocean going fishing vessel certificated to carry a crew of 24 people, whose safety depended upon the watertight integrity of the hull, the forecastle space and the side-houses and, in the event of fire, the prevention of the spread of flames and smoke between spaces. This was apparently not appreciated by any of the crew, including the owner's representative, who had sailed as mate on certain voyages.

Notwithstanding the Inspector's view that the primary spread of the fire was through the open hatch between the engine-room and the enclosed maindeck (frames 42-45), the status of the door at the forward end of the engine-room (Frame 51) raises an important issue relating to the implementation and control of standards on fishing vessels. The fact that neither the AMSA nor the American Bureau of Shipping could confirm with certainty whether or not the door was removed suggests a lack of liaison between the two bodies and a lack of definition regarding their respective responsibilities.

CONCLUSIONS

1 The circumstances described and without evidence to the contrary it is concluded that the loss of the vessel was due to fire and the unrestricted flooding of the engine-room and the adjacent spaces below the main deck.

2 It is concluded that the fire originated in the engine-room. It is not possible to determine with certainty the cause of the fire or the reason for the sinking. However, the most likely cause may be attributed to the escape of diesel oil from a fractured fuel line spraying on to a hot machinery surface, igniting the oil and causing intense heat in the confined spaces of the engine-room. Fuel from the bunker fed the fire.

3 The outbreak of fire occurred while the engine-room was unattended. Had the person on watch been in the engine-room the fire would have been detected at an early stage and therefore it is probable that it could have been controlled and extinguished.

4 The supply of air to the fire and the fire's rapid unrestrained spread were the direct result of the engine-room not being isolated from the spaces either side of it or above it. It was accepted practice on board to operate with all doors, watertight or not, open.

5 Access to the remote controls to the engine-room fuel supply, the vessel's ventilation units and the engine-room CO2 fire smothering system was cut off by the fire, due to the engine-room not being secured and the access to the engine-room at frame 51 being open.

6 It is not possible to determine the source or sources of the explosions reported by the survivors. It is possible that the explosions were as a result of the rupturing of pressure vessels and/or the fuel in the tanks being heated to a level whereby the oil's flash point was reached.

7 Whatever the level of proficiency of the master and crew, the absence of any water on the fire main, compounded by the inability to secure any breathing apparatus, rendered the crew totally unable to fight the fire. Evacuation of the vessel to await the outcome of the fire was their only option.

8 The quality of the operational procedures and standards practised (or not practised) aboard the Northern L created the conditions in which accidents were more likely to occur, and where emergencies were more likely to get out of hand.

9 The position of the controls for the remote shutting down of the fuel supply from engine-room fuel tanks and the release of the engine-room CO2 flre smothering syste.m were in accordance with the relevant legislation, notwith-

standing that on this occasion access to them was cut off by the fire. However, their position within the enclosed main deck was not an optimum position, given the construction of the upper deck at conversion.

10 If the engine-room door at frame 51 had been removed, or was left open as a standard practice, the remote stops for ventilation and engine-room pumps were positioned contrary to the regulations.

11 The controls for the watertight doors were not above the bulkhead deck, as required by the regulations.

12 The diesel gas oil shipped in Singapore was within the declared specifications.

13 The liaison in 1989, between the Department of Transport and Communications, and subsequently the Australian Maritime Safety Authority, and the American Bureau of Shipping was deficient in ensuring that the converted vessel met the letter or spirit of the Austrahan regulations in respect of fire control and subdivision.

ATTACHMENT

Particulars of Ship

Name	Northern L (ex Northern Tide)
Flag	Australian
Lloyd's Number	7333652
Call Sign	VNT
Owners	Karma Fisheries Ply Ltd
Class Society	American Bureau of Shipping
Builder	Carrington Slipways Pty Ltd, Newcastle, NSW.
Year of Build	1974
Converted	1988
Type of Conversion	Purse-seine
Shipyard	Singmarine Dockyard Pty Ltd Singapore
Length	55.02m
Breadth	12.2m
Depth	8.76m
Maximum Draught	6.172m
Gross Tonnage	1211
Net Tonnage	363
Engine	Two General Motors 16.645E2
Engine Power	2869kW
Generators	Two General Motors 6-71, one Caterpillar D353
Propeller	Two variable pitch
Bow Thrust	One
Crew maximum	24
Crew actual	6