Report 99-209

coastal passenger and freight ferry *Arahura*

premature release of rescue boat

near Picton, Marlborough Sounds

21 May 1999

Abstract

At about 1200 hours on Friday, 21 May 1999, as the passenger and freight ferry *Arahura* was approaching Picton near the end of a scheduled Wellington to Picton service, the master slowed the vessel to about 5 knots to allow the starboard rescue boat to be launched as part of a drill. As the rescue boat was being lowered, the single quick-release hook attaching the boat to the launching davit released prematurely and the boat fell some 15 m to the sea. A preventer chain fitted as security against such an event parted as the boat fell. One of the 4 crew was left hanging on to a lifeline, 2 crew fell with the boat and suffered serious injuries, and one crew member was fatally injured after managing to hang on momentarily to a lifeline before falling into the boat.

The quick-release hook was not in a good state of repair and failed to carry the load of the rescue boat because it was probably not fully engaged.

Safety issues identified included:

- the crew not being familiar with the safe operation of the rescue boat and its launching system
- the failure to gain maximum safety benefit from a similar non-injury incident some years before the accident
- the loss of "institutional memory" owing to restructuring of management within the operator and the regulator
- the requirement for equal acceptance of a safe ship management system by both shore management and sea staff
- the design and inspection requirements for rescue boats and their launching equipment.

Safety recommendations were made to the managing director of Tranz Rail Limited and the director of maritime safety to address the safety issues.

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

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Arahura

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List of Abbreviations

DNV	Det Norske Veritas (classification society)
HB	Brinell hardness (unit of measure for metal hardness)
HV	Vickers hardness (unit of measure for metal hardness)
IR	integrated rating
IMO	International Maritime Organisation
ISM Code	International Safety Management Code
kg	kilogram(s)
kW	kilowatt(s)
m	metre(s)
mm	millimetre(s)
mm^2	square millimetre
MPa	mega Pascal
MSA	Maritime Safety Authority
M&I	Marine and Industrial
nm	nautical mile(s)
RFD	Reginald Foster Dagnell (manufacturer of life saving equipment)
SOLAS	International Convention for Safety of Life At Sea
t	tonne(s)
UHF	ultra high frequency
UTC	universal time (co-ordinated)
VHF	very high frequency

Glossary

aft	rear of the vessel
bridge	structure from where a vessel is navigated and directed
bulkhead	nautical term for wall
fall	rope by which a boat is raised or lowered
knot	one nautical mile per hour
port	left-hand side when facing forward
starboard	right-hand side when facing forward

Marine Accident Report 99-209

Data Summary

Vessel Particulars:

Name:	*Arahura*
Type:	passenger and freight ferry (roll-on roll-off)
Class:	II (coastal passenger)
Classification:	Det Norske Veritas ✣1A1, R2 (NZ coastal waters) Car and Train Ferry A
Length (overall):	148.4 m
Breadth (extreme):	20.5 m
Tonnage (gross):	13 621 t
Built:	1983 in Denmark
Propulsion:	four 3800 kW diesel-driven generators supplying 4 electric propulsion motors coupled to 2 shafts, each with a 4-bladed controllable-pitch propeller
Service speed:	19 knots
Owner/operator:	Tranz Rail Limited
Port of registry:	Wellington, New Zealand
Maximum people capacity:	passengers: 997 crew: 65

Location:	near Picton, Marlborough Sounds, New Zealand
Date and time:	Friday, 21 May 1999, at 1205[1]
Injuries:	passengers: nil crew: 1 fatal, 2 serious, 1 minor
Investigator-in-Charge:	Captain Tim Burfoot

[1] All times in this report are New Zealand Standard Time (UTC + 12 hours) and are expressed in the 24 hour mode.

1. Factual Information

1.1 Narrative

1.1.1 On Thursday, 20 May 1999, on board the passenger and freight ferry *Arahura*, the first mate and master discussed holding a safety drill which would involve launching the starboard rescue boat while the *Arahura* was at sea. According to the record of inspection on board, the rescue boat had not been launched and manoeuvred on the water since 28 December 1998.

1.1.2 Opportunities to conduct such a drill were not frequent, owing either to the reasonably tight 24-hour schedule of the service, or to inclement weather. The first mate had calculated that the *Arahura* would experience favourable tides and weather on the 0930 service from Wellington to Picton the following day, so the drill was scheduled to take place at midday on Friday the 21st when the *Arahura* was approaching Picton.

1.1.3 The first mate informed the extra[2] chief integrated rating (IR) and the chief engineer of the plan. He intended to take charge of the rescue boat himself during the drill, and for the deck trainee to accompany him as part of his training. He left the extra chief IR to appoint the remainder of the boat and launching crew. The chief engineer appointed the third engineer to go with the rescue boat.

1.1.4 At about 0930 on Friday, 21 May 1999, the *Arahura* departed from Wellington on its scheduled service across Cook Strait to Picton in the Marlborough Sounds. The trip across the strait and through the sounds was uneventful.

1.1.5 At about 1130 the extra chief IR assembled with 2 other ratings on the boat deck and began to prepare the boat for the drill. The preparations included: removing the boat cover and lashings that held the boat in its cradle, hoisting the boat on the single-arm davit until clear of the cradle, manually slewing the davit outboard until the boat was over the side, lowering the boat on the davit until it was level with the embarkation deck, and then manually winding the davit inboard until the boat was resting against the side of the ship to facilitate easy and safe boarding.

1.1.6 The rescue boat was suspended on a single wire fall under a single-arm slewing davit, connected to it by an off-load quick-release hook which snapped on to the lifting frame of the boat (see Figure 1). As a defence against the quick-release hook letting go prematurely, an additional preventer chain and hook had been fitted between the lifting frame of the boat and the end of the wire fall.

[2] An additional crew member who was under rehabilitation from injuries.

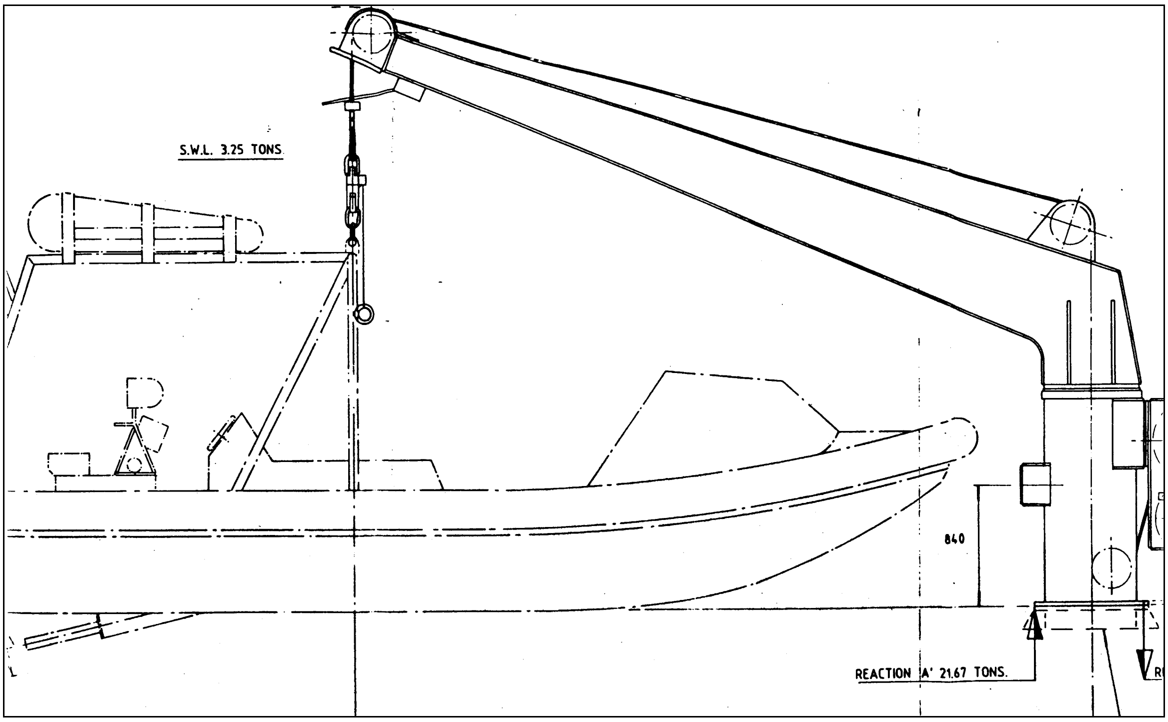


Figure 1
Profile of rescue boat and launching arrangement

1.1.7 The maintenance IR who had been assigned to the rescue boat arrived as it was being swung outboard. The first mate and deck trainee arrived once it was at embarkation level and immediately embarked, the first mate having first asked the extra chief IR if the boat was ready to go, "or words to that effect", to which he acknowledged that it was. The third engineer arrived shortly after and he and the maintenance IR embarked also. All of the boat crew were wearing life-jackets, non-skid sea-boots and safety helmets.

1.1.8 While preparations were being made for launching the rescue boat, the *Arahura* was about 6 nm from Picton. On the bridge the master had telephoned the engine room at about 1145 and had begun slowing the vessel from its service speed of about 19 knots to facilitate the launching. By 1155 the speed of the *Arahura* was about 5 knots.

1.1.9 In the rescue boat, the first mate was in contact with the master using ultra high frequency (UHF) radio. At about 1157, having started the engine, he called the master and said that the boat was ready to be launched. The master reduced the speed combinator another notch and gave the all-clear for the boat to be launched.

1.1.10 In the rescue boat, the first mate was at the helm. The third engineer was seated behind him, facing aft, and the maintenance IR and deck trainee were standing in the fore part of the boat holding on to the lifelines[3]. The deck trainee had been instructed to hold on firmly to the lifelines when the boat was being lowered.

[3] Heavy knotted manila ropes attached to the head of the launching davit and coiled down onto the foredeck of the rescue boat, meant for the crew to hold on to in case the boat should suddenly drop. As the boat is lowered, the crew pass the rope hand-over-hand. The ropes were sometimes referred to as man ropes. The history of their use goes back many years to when they were used by the last person aboard a sinking ship to climb down into the last lifeboat launched.

1.1.11 At about midday, the launching crew slewed the davit outboard to clear the rescue boat from the side of the ship and, on the instruction from the first mate, began to lower away on the electric motor. As the boat began to lower, it pivoted about the quick-release hook with the bow swinging inboard. The maintenance IR in the fore part of the boat let go of his lifeline and fended the bow off the side of the ship. The davit operator momentarily stopped lowering to allow the IR to fend the bow off, and was about to lower again when the quick-release hook released and the rescue boat fell some 15 m to the sea.

1.1.12 As the boat fell, the preventer chain parted without offering any appreciable resistance. The port bow of the rescue boat struck the rubbing strake that protruded from the side of the ship near the waterline, but despite this the boat landed in the water upright. The rescue boat engine remained idling in neutral as the boat was being towed alongside the ship by the painter[4] secured at the bow.

1.1.13 The first mate and third engineer fell with the boat. They were both seriously injured and unable to take any part in the subsequent rescue.

1.1.14 The maintenance IR who had been in the fore part of the rescue boat was able to maintain his grip on the lifeline and was left hanging from it as the boat fell from under him.

1.1.15 The deck trainee fell with the boat for the first few metres until he was able to slow his fall by gripping the lifeline. Shortly before the boat landed in the sea below him, the deck trainee lost his grip on the lifeline and fell the remaining distance into the fore part of boat, landing awkwardly. He was fatally injured in the fall.

1.1.16 On the bridge of the *Arahura*, the officer-of-the-watch saw the rescue boat fall and alerted the master. The master checked that no-one was in the water and then used the engines astern to take the way off the ship.

1.1.17 A private launch *Super Time* was close by when the accident occurred and immediately came over to assist. The master of the *Arahura* got his crew to shout to the launch skipper and request him to tow the rescue boat into Picton. Meanwhile, the launching crew had started to prepare one of the motor lifeboats for launching with the idea of lowering it to the water with medical assistance.

1.1.18 With the *Arahura* losing way through the water, the rescue boat began to drift away from the side of the ship. The *Super Time* was attempting to push the rescue boat alongside the ship again to allow the IR to climb down the lifeline into it, but the skipper was finding it difficult to manoeuvre close in to the rescue boat owing to the *Arahura* still carrying some residual way through the water.

1.1.19 The master of the *Arahura* noticed the rescue boat drifting away from the ship, so he put the engines on minimum speed ahead and as the ship picked up speed the rescue boat was drawn back into the side of the ship directly under the lifelines.

1.1.20 The maintenance IR then climbed down the lifeline into the rescue boat and assessed the situation. He could see that the first mate and third engineer were seriously injured and needed immediate medical attention, and suspected that the deck trainee had died from his injuries. The rescue boat engine was still idling in neutral and the sea conditions were calm so, although he had never driven the rescue boat before, the IR let go the painter and drove the boat towards Picton at full speed, escorted by the *Super Time*.

[4] A line attached at the bow of the rescue boat by a quick-release toggle. The painter leads forward and is secured to the ship. Using the forward way of the ship, the boat can be manoeuvred away from the ship side, even without motive power.

1.1.21 When the master of the *Arahura* saw the rescue boat head for Picton, he contacted the harbour authorities and requested emergency services to stand by to receive the boat.

1.1.22 At about 1225 the rescue boat arrived at Picton, where ambulance staff attended to the injured and transported them to hospital. The deck trainee was pronounced dead on arrival.

1.1.23 The *Arahura* followed the rescue boat in to Picton and berthed at 1236.

1.2 Injuries and damage

1.2.1 The deck trainee was fatally injured on impact. It appears that he fell on to his forehead sustaining extensive injuries to his skull, brain, neck vertebrae and spinal column. The impact injuries were not survivable and death was instantaneous. The protective helmet the deck trainee was wearing suffered major structural damage.

1.2.2 The first mate suffered head and facial injuries when he was thrown down and forward onto the control console. He was knocked unconscious for a short period. He also suffered serious spinal injuries to the lower back.

1.2.3 The third engineer sustained serious lower back spinal injuries, cuts and bruising.

1.2.4 The maintenance IR who was able to hold on to the lifeline suffered severe rope burns to both hands.

1.2.5 Damage to the rescue boat was minimal. There was a dent in the aluminium plating below the soft belting near the port bow. The stainless steel box containing a fixed very high frequency (VHF) radio mounted under the lifting frame above the driver had partially torn loose from its mounting when the boat had hit the sea.

1.2.6 One link of the preventer chain had parted.

1.3 Vessel information (*Arahura*)

1.3.1 The *Arahura* was a roll-on roll-off passenger ferry capable of carrying rail rolling stock and other vehicles. The ship was purpose-built in 1983 for New Zealand Railways[5] to trade on the Wellington to Picton Interisland service across Cook Strait.

1.3.2 The *Arahura* provided a 24-hour passenger and freight service between North and South Islands of New Zealand. It was scheduled for 3 return crossings each day with about one hour turnaround time at each port.

1.3.3 The vessel was 148.4 m in length and 20.5 m extreme breadth. The life saving evacuation equipment was capable of catering for up to 1062 passengers and crew, and consisted of 4 motor lifeboats, a marine escape system and twelve 24-person life rafts.

1.3.4 The marine escape system used inflatable chutes that were launched through ports in the side of the ship. The chutes were serviced by eight 84-person life rafts which were, in the event of an evacuation, docked at the bottom of the chutes to receive the evacuees.

1.3.5 The starboard rescue boat was one of 2 boats placed on board the *Arahura* at new building as part of the marine escape system. Its main function was to marshal the life rafts to and from the docking stations and keep them together until help arrived.

[5] New Zealand Railways underwent several changes of standing as a company since 1987, as did the rail ferry division. The current name Interisland Line has been used throughout this report for consistency.

Figure 2
Starboard rescue boat on the stand following the accident

1.4 Vessel information (rescue boat)

1.4.1 The starboard rescue boat was a 7.74-m Watercraft Seaboat. The hull was constructed from aluminium and was shrouded around the gunwale by a solid synthetic collar that provided both protection for the hull and a little reserve buoyancy. The boat had an open self-draining cockpit. The hull was designed with a deep vee and, together with the buoyancy collar, made for a sea-kindly craft suited for rough weather applications (see Figure 2).

1.4.2 A steel roll frame was bolted to the hull which protected the driver and engine compartments, leaving the foredeck as a clear work area. A buoyancy block was strapped to the top of the roll frame which was designed to right the boat should it capsize.

1.4.3 The rescue boat was powered by a Sabre diesel engine driving a fixed-pitch propeller and was capable of reaching 25 knots when light, or about 15 knots when loaded. A typical crew consisted of 3 persons, but the boat was rated to carry 15 persons in total.

1.4.4 The rescue boat had a light displacement of about 2.0 t and a loaded displacement of about 3.25 t. The calculated weight of the boat and crew on the day of the accident was about 2.7 t.

1.4.5 The prime purpose of the rescue boat was to marshal life rafts associated with the marine escape system. Because the marine escape system could be deployed relatively quickly, the rescue boat was required to be quick-launching. The rescue boat was also used as a quick-response boat for man-overboard, or for assisting stricken craft in and around Cook Strait from time to time.

1.4.6 The rescue boat was required to be able to be launched and retrieved in the shortest possible time when loaded with its full complement. The boat was stowed in a cradle some 15 m above sea level near mid length of the ship. Its lifting point was a steel lug welded to the top of the roll frame to which a steel lifting ring was shackled.

1.4.7 The launching apparatus for the rescue boat was a single Schat slewing davit. The rescue boat was suspended under the davit on a single wire fall which culminated in a hard eye, to which the Cranston off-load, quick-release hook was shackled. The Cranston hook was connected to the lifting ring on the boat. In 1991, following an incident when the rescue boat released prematurely, the Interisland Line had added a preventer chain over the Cranston hook. One end of the preventer chain was shackled to the eye in the end of the wire fall and the other to a closable safety hook that was hooked on to the rescue boat lifting ring beside the Cranston hook (see Figure 3).

1.4.8 The wire fall wound onto a steel cable drum which was driven via a reduction gear box by an electric motor. The electric motor could be used for launching, or it could be disengaged and the boat gravity-lowered, controlled by a centrifugal brake.

1.4.9 A painter was attached to the bow of the rescue boat which led forward and was permanently attached to the ship. The purpose of the painter was to help the rescue boat driver maintain control as the boat became waterborne if the ship was making headway. The painter was fitted with a quick-release toggle for easy release.

1.4.10 The 2 lifelines attached to the davit head were required by regulation for open or semi-enclosed dual-fall lifeboats, but were not required on rescue boats such as those on the *Arahura*.

1.4.11 To launch the boat, it was first hoisted clear of its cradle and then the davit manually slewed outboard until the boat was over the side, clear of the embarkation deck. The boat was then lowered to the embarkation deck and the davit wound back inboard until the rescue boat rested against the side of the ship for easier and safer boarding. In an emergency, this latter step could be by-passed if the crew boarded the boat when it was still resting in its cradle.

1.4.12 Once the crew were aboard and the engine was running, the boat could be lowered to the water. Before the boat became waterborne a crew member was required to disconnect the preventer chain. When the boat was waterborne the crew could disconnect it from the wire fall by pulling the release cable on the Cranston hook. The hook would then open, releasing the rescue boat and leaving it attached to the ship only by the rope painter forward.

1.4.13 The recovery of the rescue boat involved essentially the reverse of the launching. When it was positioned under the davit, the hook was supposed to be first snap-closed, checked to ensure the lock pin was fully engaged, and then snapped on to the lifting ring via the spring loaded latch (see Figure 4). This procedure was essential to ensure that the hook was properly closed before lifting. Crew members trying to feed the open hook through the lifting ring and then snapping it closed risked failing to fully engage the lock pin into the hook locking face, particularly if the load came on the wire fall as they were trying to close the hook. The correct procedure was also faster and less likely to cause injury to fingers.

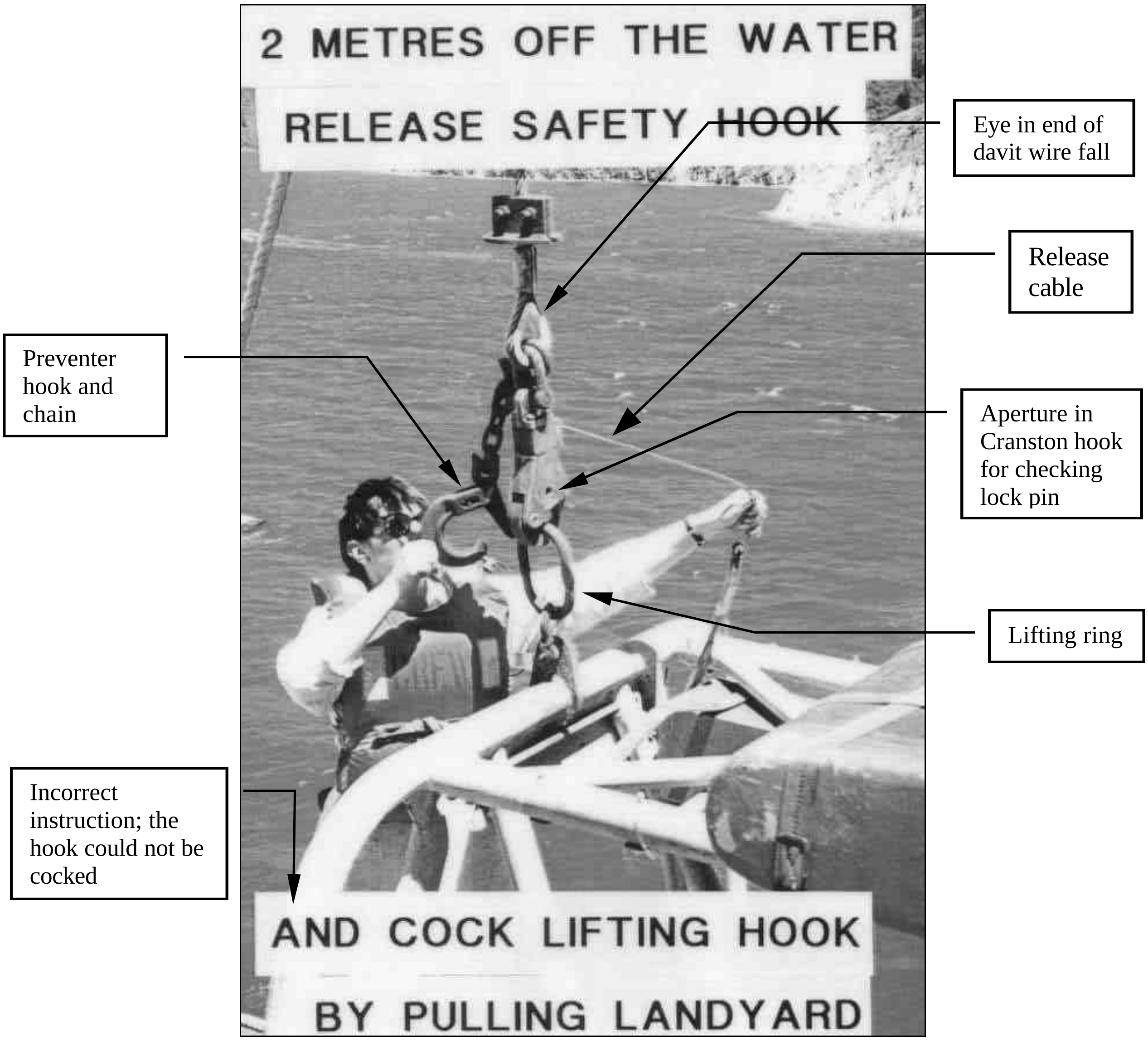


Figure 3
Lifting arrangement for rescue boat
(Photograph copied from launching instructions displayed at starboard rescue boat launching station)

1.4.14 The Cranston hook was a 3.5-t safe working load quick-release hook. It was designed to be able to release only when the load was off the hook. The hook assembly included a self-locking feature when a load was suspended from it, where the hook would pivot about an axle and engage the locking face on the bottom of the lock pin. The greater the load suspended from the hook, the greater the force required to lift the lock pin to release the hook. On the assembly drawings provided, the locking faces of both the hook and lock pin had a 10° reverse bevel making them interlock and improve locking performance (see Figure 4).

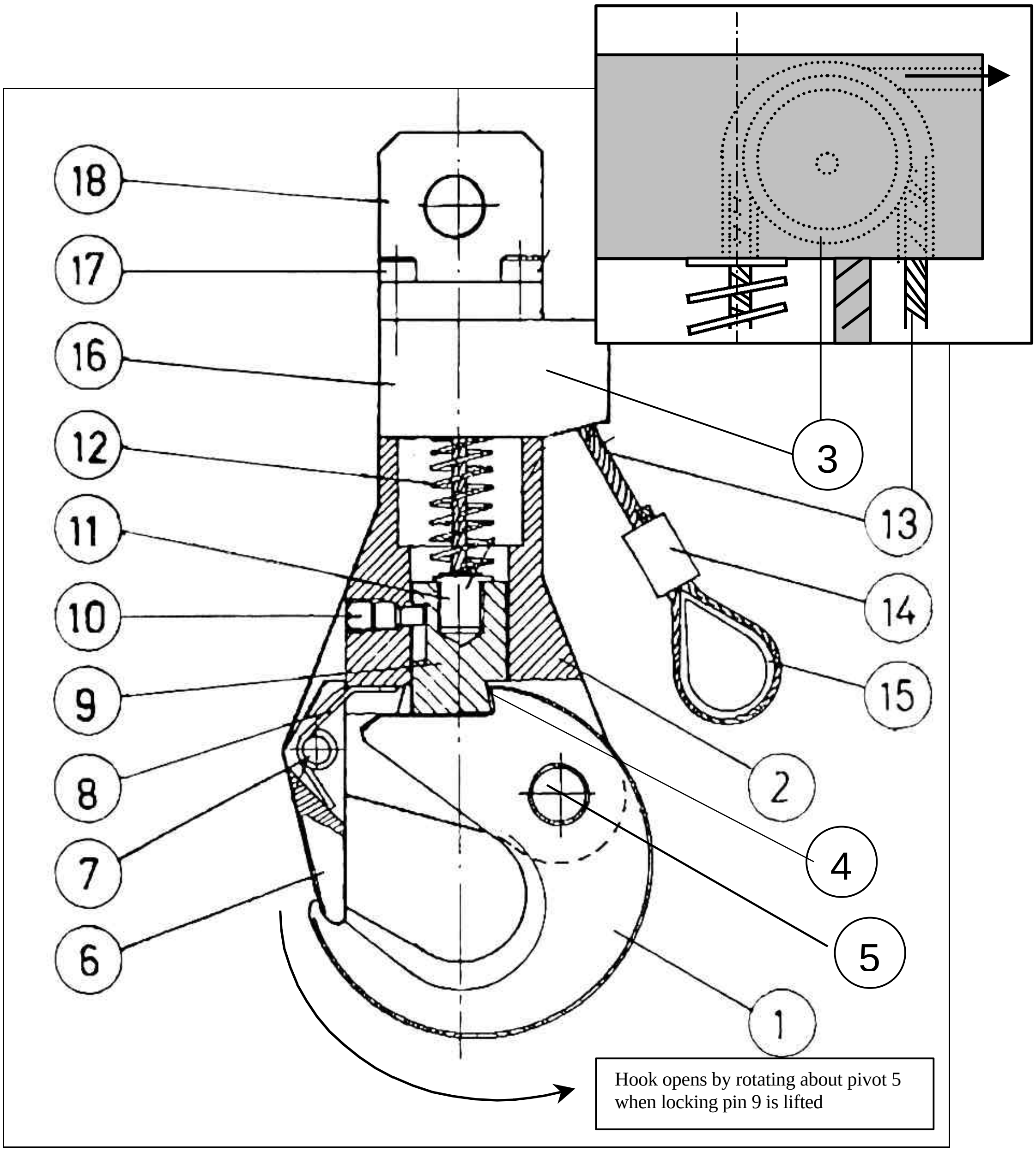
1.4.15 After the accident, the commission obtained from the manufacturer a set of drawings for a hook model number LRC35; however, the drawings were not dated. The hook involved in the accident was stamped with what appeared to be a serial number 0953. The manufacturer was able to provide a test certificate for a hook marked 0953, which was dated 1983. The model number referred to on the test certificate was CR 35-C, which was different from the LRC35 quoted on the drawings. The design engineer at the time of manufacture no longer worked for the company and could not be contacted. The manufacturer conceded that its record keeping back at the time of manufacture was not good, and that it could not guarantee that the drawings sent were those for the accident hook. The assembly drawings provided did differ in some respects from the accident hook.

1.4.16 One significant difference was the angle at which the lock pin release cable exited the release assembly block. The drawings depicted a bevel at the bottom of the block where the release cable exited. The accident hook did not have the bevel, and the cable exit hole had been drilled by the manufacturer at right angles to the base, as shown in the insert drawn on the hook assembly drawing, Figure 4. The manufacturer had drilled a second cable exit hole for applications where the hook was released from the side, rather than below (depicted by the arrow on the insert drawing on Figure 4).

1.4.17 The manufacturer's instructions stated that it would take a pull force on the release cable equal to approximately half of the load suspended on the hook to release the hook under load; that is, for an all-up weight of 2.7 t, a force of about 1.35 t would have to be applied to the release cable, provided the hook assembly was in good condition.

1.4.18 The instructions provided for Cranston hooks, which had been copied into the Safety of Life at Sea (SOLAS) training manual on board the *Arahura*, were as follows:

> <u>Hooking on:</u>
>
> 1 Close hook (there should be a sharp "snap" sound when the lock pin engages the hook).
> 2 Check that lock pin is fully engaged with hook (see through inspection holes in sides of hook body).
> 3 Hook on only through the hook latch (DO NOT OPEN HOOK FOR HOOKING ON).
>
> <u>Lifting/lowering:</u>
>
> 1 Before lifting or lowering a load, check that lock pin is fully engaged with hook.
> 2 Take special note that hook cable is absolutely free of interference from any and all structures, and that all personnel are clear of hook cable.
>
> <u>Release:</u>
>
> 1 Hook cable should be held with some slack (i.e. without a pulling force) until ready to make release.
> 2 A short steady pull on the hook cable will open the hook when the load is off of the hook (pull stroke is approx. 15 mm).
>
> <u>Marking:</u>
>
> The hook cable should be adequately marked with e.g. a red plastic tag indicating "CAUTION: BOAT RELEASE CABLE" or other suitable text.
>
> <u>Lubrication:</u>
>
> Use Silicon oil, or antifreeze in cold weather.
>
> <u>Pull force:</u>
>
> C-E cable release hooks are made for release WITHOUT LOAD.
>
> Note: On-load release force is approx. ½ of the load, e.g. 100 kg load requires approx. 50 kg pull on the cable to cause release.



1	hook	10	guide screw
2	hook body	11	talurit
3	internal cable pulley	12	spring
4	locking face with 10º reverse bevel	13	lock pin release cable
5	hook axle	14	talurit
6	latch	15	thimble
7	latch axle	16	release assembly
8	latch spring	17	socket head bolts
9	lock pin	18	lifting ear

Figure 4
Cranston hook assembly drawing
(The text and notes 3, 4 and 5 have been added by the commission. The insert diagram shows the arrangement for the accident hook, which differs from the hook shown)

1.4.19 A set of instructions for launching the rescue boat was posted on the bulkhead in the vicinity of the launching station. The instructions consisted of a series of frames each containing a photograph and text overlaid on them. One frame clearly guided the reader to check that the Cranston hook was fully engaged before raising or lowering the rescue boat. The last frame however, erroneously led the reader to believe that the Cranston hook had to be cocked by pulling on the release cable before the boat reached the water, contrary to the operating instructions contained in the SOLAS training manual (see Figure 3).

1.4.20 In addition to the launching instructions, a large forward-facing placard was fitted to the boat directly below the lifting ring, that read:

> Before hoisting or lowering check that hook lock pin is fully engaged. See through the inspection holes in sides. Do not open hook for hooking on. Hook on via hook latch.

1.5 Personnel information and procedures

1.5.1 The master of the *Arahura* had been at sea for some 46 years with various companies trading world wide. He joined Interisland Line in 1971 and had served as master on all of the various rail and fast ferries since then. He had been master of the *Arahura* for about 4 years prior to the accident.

1.5.2 The first mate of the *Arahura* had been at sea for some 27 years in various capacities. He joined Interisland Line in 1994 as a third mate and was promoted to acting first mate in late 1995. He had sailed as acting first mate on most of the company vessels, but had spent some 3 out of 4 years on the *Arahura*. The first mate had been away in the starboard rescue boat on about 4 occasions prior to the accident. He knew how to check if the Cranston hook was fully engaged, but was unsure of how the hook was supposed to operate as far as on-load/off-load capability was concerned.

1.5.3 The deck trainee had started his sea-going career as crew on the sail training ship *Spirit of New Zealand*. He then joined Interisland Line as an "ordinary seaman" in December 1998 and spent the summer on the high speed ferry *Condor 10*. In April 1999, he was taken on as deck trainee and was assigned to the *Arahura*, where he stayed until the time of the accident. He had not previously been away in the rescue boat, which was why he had been included in the launching drill as part of his training.

1.5.4 The third engineer had been at sea for some 45 years with various companies in various capacities. He had been employed on the rail ferries since 1969. He had joined the *Arahura* for the first time the day before the accident. On the day before the accident a lifeboat drill was held on board the *Arahura*. During the drill the third engineer was informed about the rescue boat drill the following day, and that he would be the designated engineer in the rescue boat. He spent some time that day familiarising himself with the engine operation before the drill. He knew little about the release arrangement for the boat.

1.5.5 The maintenance IR who was in the rescue boat had been at sea for some 30 years prior to the accident. He had been employed with Interisland Line for about 7 years, the last 3 being served on the *Arahura*. His job, as his title suggests, was predominantly conducting deck maintenance. He had been involved in several drills with the rescue boat and been away with the boat a few times. He was not aware of how to check if the Cranston hook was fully engaged, and was not fully aware of the documented procedure for launching the rescue boat. He had read the SOLAS training manual on board, but could not recall reading any launching instructions for the rescue boat.

1.5.6 The extra chief IR who was in charge of the launching crew had some 21 years' sea-going experience, 10 years of which had been spent on the *Arahura*. At the time of the accident, he was designated an extra crew member as he was under rehabilitation following an injury. He had been involved in launching and recovering the rescue boat on several occasions, but had never been part of the rescue boat crew. He could not recall having read any rescue boat instructions in the SOLAS training manual and he could not say whether the Cranston hook was on-load, off-load, or both, or how to check if it was fully engaged.

1.5.7 Of the other 2 ratings who assisted with the launching, one was a permanent maintenance IR and the other was an extra IR, who was also under rehabilitation from an injury. Both ratings were experienced seamen with extensive time on the *Arahura*. Like the extra chief IR, neither could describe the operation of the Cranston hook, and neither could say how to check if it was fully engaged. One of the ratings recalled reading the SOLAS training manual some considerable time before the accident, but could recall little of its content.

1.5.8 Of the 14 officers and ratings interviewed after the accident, some of them from the opposite roster at the time of the accident, only one was aware of the correct method for connecting the Cranston hook to the lifting ring of the rescue boat when retrieving it from the water.

1.5.9 International regulations and company policy required that each dedicated rescue boat be launched and manoeuvred on the water with its assigned crew aboard every month as far as was reasonable and practicable, but in all cases at least once every 3 months.

1.5.10 Records on board showed that the starboard rescue boat on the *Arahura* had been launched about once every 1.5 months during the second half of 1998, but that it had not been launched in the 5 months prior to the accident. Not recorded was that the crew on the opposite roster had launched the rescue boat 4 days before the accident, without incident.

1.5.11 The muster list on board the *Arahura* designated 3 specific crew members as "assigned crew": one deck officer, one engineer officer and one rating. According to international and company requirements, those 3 crew members were supposed to take part in each launching drill. In reality the assigned crew rarely took part in such drills. The reason given was that the schedule of the ship and the watch keeping routines were not conducive to them performing other such tasks. Consequently, it became an accepted practice on board the *Arahura* that the rescue boat crews were made up on an ad hoc basis.

1.6 Recorders

1.6.1 The rescue boat launching area and the surrounding decks were accessible to the passengers; consequently, a crowd had gathered to observe the launching. One passenger was using a video camera to record the drill, which was later analysed and proved useful in determining a number of facts.

1.6.2 The recording captured the drill from the time the boat had been swung outboard and all 4 crew were on board. From that time the following could be established:

- the engine was started before the rescue boat began to lower
- before the boat began to lower, the third engineer was sitting on the rear seat facing aft, the first mate was at the controls, the maintenance IR was standing in the forward port section of the foredeck holding on to one lifeline, and the deck trainee was sitting on the engine casing under the release cable with his left hand holding the other lifeline and his right arm resting by his side, possibly gripping the edge of the engine casing
- as the boat descended, its bow swung in to the side of the ship and the maintenance IR reached over and fended it off with one hand
- the deck trainee was letting his lifeline slide through his left hand as the boat descended

- the boat stopped descending momentarily as the maintenance IR fended it off the side of the ship
- when the descent had stopped, the deck trainee was leaning across to port and appeared to be using both hands trying to clear or untangle his lifeline from where it was coiled on the deck
- the Cranston hook released at the time the deck trainee was leaning over to the port side of the boat, after the boat had bounced once with the sudden stop in descent
- the boat began to fall and the preventer chain parted
- the deck trainee initially fell with the boat, his left hand sliding down the lifeline
- the deck trainee managed to slow his rate of descent by gripping the lifeline with his left hand while trying to pull his right arm across to grab the lifeline also
- the deck trainee lost his grip on the lifeline and fell into the boat below
- the maintenance IR slid down his lifeline for some distance but was successful in arresting his descent.

1.7 Laboratory tests and examination

1.7.1 After the accident the following items were recovered and taken for inspection and testing at an independent laboratory:

- the Cranston hook
- the preventer hook
- a Hammerlock joiner shackle linking the preventer chain and hook
- the shackles connecting the various components together
- the preventer chain, which included 2 intact links and half of the failed link (the other half was not recovered).

1.7.2 All the shackles in the release assembly were lock-wired using seizing wire. The shackles, the chain and the preventer hook were all covered in a thick layer of rust and remains of orange paint. The paint looked like the original paint. The Hammerlock joiner shackle would not flex due to the corrosion products.

Examination of the Cranston hook (refer to Figure 4 for details)

1.7.3 Before the Cranston hook was dismantled it was noted that the hook, the latch and the lock pin release cable were free to move. The following further observations were made:

- the bottom edge of the locking face on the lock pin was heavily deformed
- the locking face on the hook was covered in oxide that had become compressed. When the locking face was cleaned, it revealed a wide shiny band at the top of the locking face, but the top edge was not deformed in the same way as the bottom edge of the lock pin
- the lock pin release cable exited from the side hole normally reserved for side release application
- the lock pin release cable was kinked at the point of exit from the release assembly block
- at least 12 strands were fractured in the cable at the point of exit from the release assembly block; the strands had fractured after having become worn.

1.7.4 The hook was placed in the closed position by snapping it shut. The lock pin was moved upward in this movement and then snapped down into a closed position shown in Figure 6, some 4 to 5 mm short of being fully engaged. When the cable was pulled and released without disengaging the hook, the lock pin stopped even shorter, in the position shown in Figure 5, with the 2 locking faces only just engaged. The lock pin could be made to fully engage the hook by manually feeding the release cable further into the assembly block, thereby overcoming the friction of the cable and forcing the lock pin further down past the travel of the spring. This could only be achieved with no load on the hook.

1.7.5 The position of the lock pin at the end of the spring loading was measured by detecting the extent of the spring movement with a pointed probe bearing on the end of the lock pin. The end of the spring was found to be 4 to 5 mm short of forcing the lock pin down to fully engage the hook. This indicated that the spring would not have applied a downward closing force onto the lock pin when the lock pin was within 4 to 5 mm of the end of its travel when the hook was in the load-carrying position.

1.7.6 When disassembled, the inside of the hook was found to be fairly clean. Examination of the spring revealed that it was not damaged. It was of stainless steel construction and was made up of 2 spring parts joined together by a brass nipple. The uncompressed length of the spring was 42 mm, which was 8 mm shorter than the spring believed to have been fitted to the hook when new.

1.7.7 The lock pin release cable was a 5 mm multi-strand stainless steel cable, similar to the one described in the drawings supplied; however, a hand-written amendment had been made to the drawings by the manufacturer indicating that it had at some time been changed to a smaller 4.5 mm cable.

1.7.8 The cable pulley rotated inside the release assembly block as the cable was pulled through, but the passage of the cable through the assembly was impeded by a significant amount of friction, caused partly by the diameter of the cable in relation to the diameter of the cable holes, and partly by the relatively tight 34 mm cable pulley diameter and the 2.5 mm radius of the pulley groove, which equalled the radius of the cable. The friction increased significantly at the point when the kink and fractured strands entered the assembly block as the lock pin and hook were engaging.

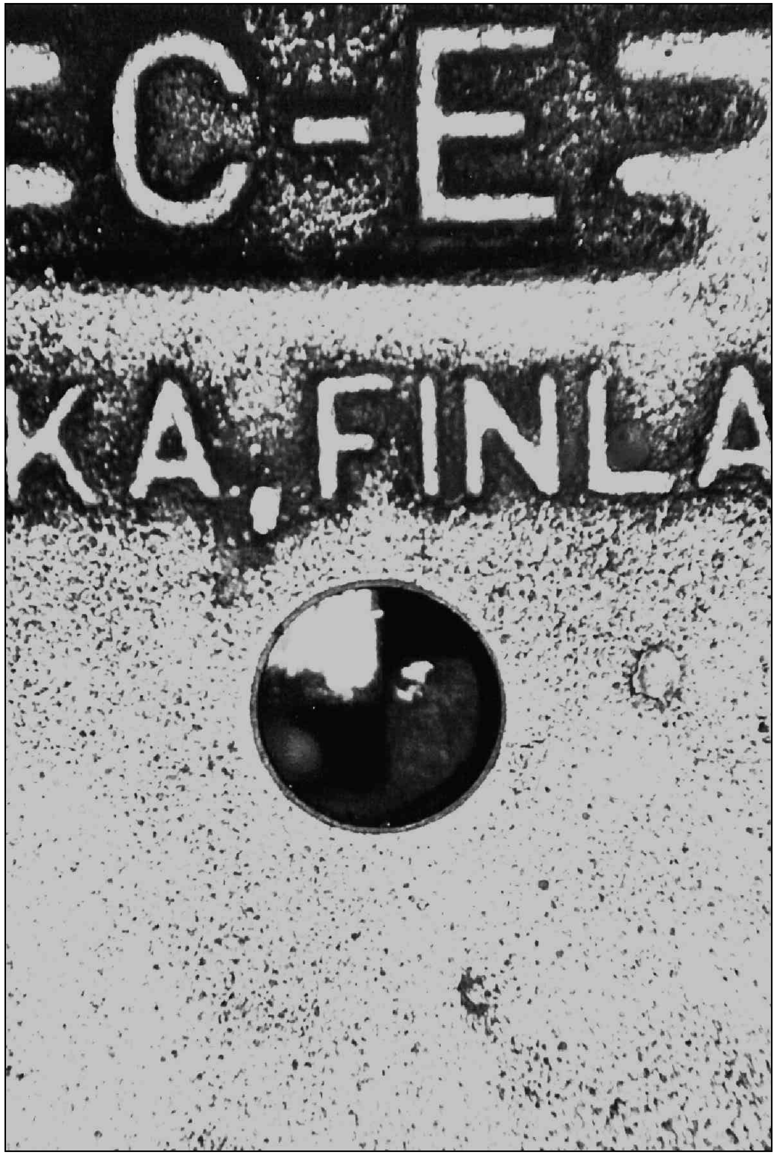


Figure 5
View through the aperture showing hook locking face only just engaged with the edge of the locking pin

Figure 6
View through the aperture of the locking pin partially engaged with the hook locking face (by about 3 to 4 mm

1.7.9 A closer examination of the damage at the bottom of the lock pin revealed that a distinct step had formed on the locking face, as seen in Figure 7. When the lock pin was fully engaged with the hook the contact length of the locking face should have been 9 mm. The bottom load-bearing face of the lock pin was deformed in a 3 to 4 mm band. The location of the upper limit of this band was consistent with the limit of travel of the lock pin under force from the spring, leaving some 5 mm not engaged with the hook. A sharp step was present at the bottom of this band where the edge was heavily deformed.

1.7.10 The lock pin had been manufactured without the 10º reverse bevel shown in Figure 4, and as a result of the stepped deformation, the locking face had achieved a forward bevel which would encourage the locking face to release under load rather than discourage it.

1.7.11 The hook locking face did not have a reverse bevel as shown in Figure 4. It could not be established if it ever did have, or whether the reverse bevel had been worn away over the years by the action of snap connecting and releasing the hook. The manufacturer thought that the reverse bevel may have been a design improvement made in 1984, one year after the manufacture date for the accident hook.

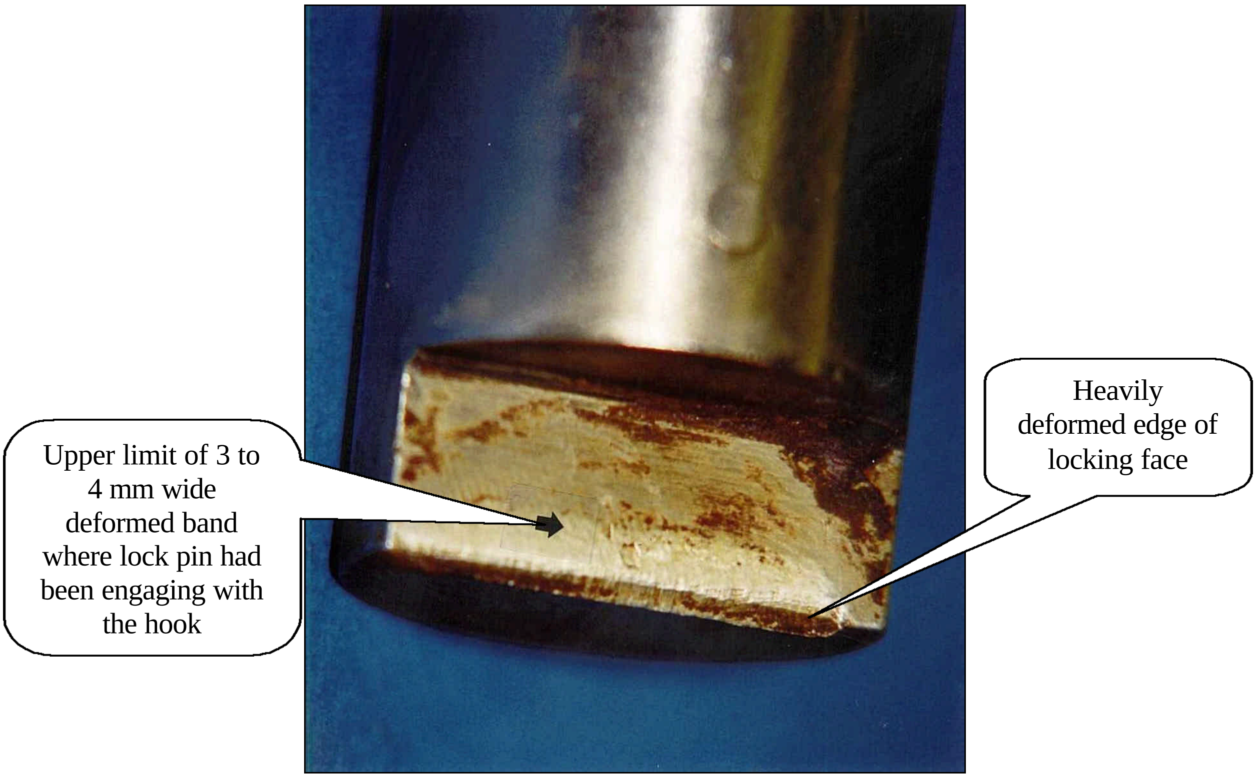


Figure 7
Photograph of lower part of lock pin

Fractographic examination of the failed chain link

1.7.12 The failed chain link had fractured at 2 locations. One of these was located half way along one side of the link. This fracture had a brittle failure appearance. The other fracture surface was typical of a ductile overload failure, evidenced by the adjacent material being necked down and bent as a result of the link opening out.

1.7.13 The ductile overload fracture appeared to have occurred after the brittle fracture and after the chain had partially opened.

1.7.14 The brittle fracture appears to have occurred in the middle of a weld, evidenced by the adjacent material being slightly larger in diameter. There were 2 distinct areas on the brittle fracture face: an area covered with red/brown oxide and an area covered by dark brown/black oxide (see Figure 8). The black oxide was thicker and covered an area of about 120 mm² out of a total 160 mm² cross section. The brittle fracture was sectioned to allow one half of it to be examined in detail. After the removed section was chemically cleaned it revealed a number of obvious corrosion pits on the fracture surface.

Figure 8
Brittle fracture of failed link from preventer chain

Metallography and hardness testing of the failed chain link

1.7.15 A small section was removed from the chain link away from the weld. Both this section and the section from the brittle fracture revealed uniform tempered martensite structure, with no obvious weld or heat-effected zone present adjacent to the brittle fracture, indicating that the chain had been heat treated after welding.

1.7.16 Corrosion pits were present in the outer surface of the chain link to depths up to 1 mm.

1.7.17 Vickers hardness (HV) tests were carried out on the samples. An average of 409 HV (10 kg) was obtained in each area. A hardness of 409 HV is estimated to be equivalent to about 390 HB (Brinell) and a tensile strength of 1320 MPa[6].

[6] The Mechanical and Physical Properties of the British Standard EN Steels, J Woolman and R A Moltran, Volume 1, 2, and 3.

Site testing

1.7.18 Following the laboratory testing, the Cranston hook was reassembled and taken to Picton where the rescue boat was resting on the hard, supported by keel blocks and side stays.

1.7.19 The hook was suspended from a crane above the rescue boat and a series of 20 tests conducted which involved closing the hook, snap connecting it onto the lifting ring via the spring-loaded latch, taking the partial weight of the boat with the crane and then trying to release the hook.

1.7.20 The amount of weight taken by the crane was not measured, and the total weight of the boat could not be taken up for fear of dislodging the supporting side stays; however, the load on the hook in each case was close to the weight of the empty boat.

1.7.21 With 15 of the tests the hook closed with only the bottom 3 to 4 mm of the lock pin engaging the locking face of the hook, similar to the laboratory tests (see Figure 6). In each case the hook released under load with a steady strong pull on the lock pin release cable.

1.7.22 With 3 of the tests, the hook was closed and the lock pin manually forced down to fully engage the hook locking face. In each of these cases the hook would not release, even with a strong sharp pull on the lock pin release cable.

1.7.23 With 2 of the tests the hook was closed and then the lock pin release cable pulled and released while holding the hook closed. When the lock pin re-engaged the hook, it did so with only its bottom edge, similar to that shown in Figure 5. In this condition the hook could be released under load with minimal pull on the lock pin release cable.

1.7.24 A general examination of the rescue boat revealed that it was in a condition commensurate with its age, although there were several items that would have benefited from some maintenance or attention. Of significance was a missing exposure cover designed to protect the occupants from the weather, and the seizing wire locking the shackle connecting the lifting ring to the roll frame had rusted through.

1.7.25 The rescue boat did not appear to comply fully with the New Zealand regulations for seating. Seats were provided for the driver and one other person near the stern. The crew member stationed forward could sit either on top of the engine casing, or down on the foredeck, but neither of these positions were marked as such, as required by the regulations.

1.7.26 The driver’s seat was not a seat as such, but a padded thigh and back support against which a driver could brace in a rough sea. The back support was narrow and difficult to fit into. The result was an uncomfortable stance for the driver. The rear seat was padded but had no back support.

1.8 History of the rescue boat, the quick-release hook and applicable legislation

1.8.1 The Cranston hook was manufactured and tested in Finland in 1983, and then supplied to the Schat davit manufacturer which on-sold it to the shipyard in Denmark, where it was fitted to the *Arahura* as part of a complete rescue boat and launching system.

1.8.2 When the *Arahura* left the shipyard in 1983, on board were instructions and drawings for the rescue boat and its launching davit, but there was no record of there having been an assembly drawing or operating instructions for the Cranston hook, nor a test certificate (a copy was supplied to the commission by the manufacturer after the accident).

1.8.3 At the time of build, there was no SOLAS or New Zealand requirements regarding the testing and servicing of quick-release hooks on rescue boats. The only documented reference to inspections was contained on the test certificate, which stated:

> Gear not required to be heat treated but required to be thoroughly examined once at least every 12 months.

1.8.4 At some time over the next 2 years the manufacturer made some design modifications to the Cranston hook, which included changes to the release assembly block. The angle at which the lock pin release cable exited the assembly block was altered, the 10º reverse bevel on the locking faces of the hook and lock pin was introduced and a smaller diameter wire was used. These changes were not disseminated to known receivers of the older hooks, and no modification option was offered. No records of these changes and the reasons why they were made were kept by the manufacturer.

1.8.5 During the first few years of operation, the rescue boat and its launching appliance began to develop a number of problems, mainly of a mechanical and design nature. The boat gained a reputation among the crew as being unreliable. Of the crew spoken to after the accident, none could remember any specific initial problems with the Cranston hook.

1.8.6 The project manager for Interisland Line when the *Arahura* was built did, however, recall several problems with the Cranston hook; mainly that the crew had difficulty trying to release it. He recalled the hook being sent to Interisland Line's preferred engineering firm on several occasions for stripping down and freeing up.

1.8.7 Meanwhile, during this period, the *Arahura* underwent a safety equipment survey each year. The surveys were conducted by a surveyor from the then Marine Division of the Ministry of Transport. The annual survey normally included a launching drill involving one of the rescue boats.

1.8.8 In 1987, Interisland Line management attempted to convince the Marine Division that the rescue boats were not required under the life saving equipment regulations, and requested that the rescue boats be dispensed with. The Marine Division rejected the claim citing their requirement to be part of the marine escape system.

1.8.9 During 1991, changes were taking place within the Marine Division of the Ministry of Transport. The task of surveying ships was to be privatised, with the principal surveying company being Marine and Industrial (M&I). With the changes some surveyors moved across to M&I, while others remained in the head office of the Marine Division.

1.8.10 On 6 February 1991, an incident occurred on board the *Arahura* in which the starboard rescue boat released prematurely from about embarkation deck level. There was no-one on board the boat when it dropped. The boat had been launched, tested and retrieved earlier that day.

1.8.11 Following the incident, the Cranston hook was inspected jointly by a nautical surveyor and an engineering surveyor of boilers, lifts and cranes from M&I.

1.8.12 The engineering surveyor submitted a Surveyor's Repairs Memorandum Supplementary Sheet which described the hook as follows:

> Hook found in need of servicing and broken spring heavily corroded into 2 pieces which had been joined with a brass nipple. Spring must be replaced with stainless spring and hook load tested.

1.8.13 The memorandum included a sketch of the 2 parts of the spring joined by a brass nipple. The sketch looked similar to one provided by the hook manufacturer after the accident in 1999. The combined length of the corroded springs was recorded as 49 mm. Together with the width of the brass joiner, this gave an overall length of 51.8 mm.

1.8.14 The sheet went on to record:

> There is some doubt that this hook will not release if loaded. This should be checked out with the boat just above the water and the lanyard then pulled to prove it will not release under load.

1.8.15 From the memorandum an engineering report was formed. The report stated:

> Investigation
>
> When I inspected the hook I found that the mechanism was in working order but that the trigger was sluggish in the barrel, and the rope tail was in need of replacement due to fibre deterioration.
>
> Upon dismantling I found that the spring chamber contained grease which had deteriorated and that the spring was corroded and had broken into 2 pieces some time ago and had not been renewed but had been refitted with a nipple supporting the 2 pieces.
>
> Conclusion
>
> The premature release of the hook may have been caused by the sluggish action of the trigger, due to the loss of tension in the spring and the deteriorated grease, causing the trigger not to fully engage.
>
> Recommendation
>
> This hook should be serviced once a year by a competent person. The crew should be instructed to check through the ports provided for this purpose, that the trigger is latched correctly before loading the hook.

1.8.16 The nautical surveyor also submitted a Surveyor's Repairs Memorandum Supplementary Sheet. He referred to the engineering report in his memorandum. His memorandum contained the point:

> Interisland Line instructed to order new hook for immediate delivery and fitting.

1.8.17 The nautical surveyor's rationale for the instruction was that the hook was an integral unit that should not have been repaired or modified.

1.8.18 There was no record available showing what work was carried out on the hook following the 1991 incident, but a test certificate dated 22 February 1991 was issued for the hook. A test load of 5.25 t had been successfully applied to the hook, but there was no record of the operation of the hook under load having been tested.

1.8.19 When the hook was returned on board, some of the crew were not happy. They felt that the hook was unsafe. One crew member suggested to the Interisland Line project manager that they fit a preventer chain over the Cranston hook as an additional safety measure. The project manager thought it was a good idea and sought the approval of the nautical surveyor who had conducted the initial inspection. The project manager recalled that the surveyor gave verbal approval to fit the preventer. The nautical surveyor was not able to recall the request, nor could he recall having ever sighted the preventer.

1.8.20 The preventer chain and hook as described in section 1.4 were fitted some time in February 1991. A number of test certificates were kept on board the *Arahura* relating to the various components of the preventer. The safe working load of each component was similar to the maximum weight of the rescue boat. In calculating the size of each component, no allowance was made for shock loading on the preventer in the event of the Cranston hook failing, and no calculations were made to determine the load transfer to other components in the launching appliance, such as the wire fall, in the event of the rescue boat falling from the hook and being checked by the preventer chain.

1.8.21 There was no record in the *Arahura* file held by the Maritime Safety Authority (MSA) relating to the fitting of the preventer, nor was there any record of the Cranston hook having been tested under load.

1.8.22 The project manger for Interisland Line recalled keeping detailed records of all such events; however, he left the company in 1995 and a succession of management restructures between then and the 1999 accident resulted in most of those records being lost.

1.8.23 At the time of the 1991 incident, the Marine Division of the Ministry of Transport did not have a system for flagging unusual items for repeat surveys, such as the annual inspection of the Cranston hook. The repair and maintenance system on board the *Arahura* had been developed from an engine room maintenance and spare part system and did not really cater for deck-related maintenance.

1.8.24 On 19 March 1991, the Marine Division of the Ministry of Transport wrote to the marine superintendent of Interisland Line, outlining the surveyors' reports and enquiring who was to assume responsibility for servicing the Cranston hook in future and what arrangements were being made to ensure that the crew were thoroughly familiar with its operation.

1.8.25 On 22 August 1991, the marine superintendent wrote back advising that new operating instructions had been included in the ship training manual, which emphasised the importance of visually checking that the hook was fully locked before weight was put on the hook, and that the hook was going to be serviced annually by the New Zealand agents for Reginald Foster Dagnell (RFD) as had been happening with the liferaft davit self-releasing hooks on the other company vessels.

1.8.26 No mention was made of the engineering surveyor's recorded concern that the Cranston hook may have been capable of releasing under load.

1.8.27 There is no record of the Cranston hook having been subsequently sent ashore for annual service.

1.8.28 In 1994 there was a further attempt from the Interisland Line to convince the Marine Division of the Ministry of Transport that the rescue boats were not required as part of the vessel life saving equipment. The request came following a number of repairs that had to be conducted on the rescue boat and its launching davit. Again the request was denied and the rescue boats remained as part of the marine escape system.

1.8.29 In the late 1980s the International Maritime Organisation (IMO) became concerned that management standards in shipping were becoming a major factor contributing to accidents. In 1987 the IMO adopted a resolution which required the Maritime Safety Committee to develop guidelines concerning shipboard and shore based management. From these the International Safety Management (ISM) Code was developed.

1.8.30 The purpose of the code was to provide an international standard for the safe management and operation of ships and pollution prevention. The code was adopted by the IMO in 1993 and was to be implemented on passenger ships by 1 July 1998, regardless of their date of construction.

1.8.31 The code required operators to develop documented safety systems for their shore based and shipboard operations, against which they could be audited.

1.8.32 The advent of the ISM code represented a major shift in focus for safety, from a system where the administrations set the standards and then inspected participants in the industry to ensure that the standards were met, to one where a greater responsibility was placed on the participant to comply with those standards.

1.8.33 For a safe ship management system to be truly successful, an acceptance of the principle was required, not only from shore management, but also from the shipboard crews.

1.8.34 Later in 1994 the Marine Division of the Ministry of Transport was replaced by the MSA. In early 1995, the introduction of the Maritime Transport Act 1994 signalled the intention to ensure that participants in the maritime industry were responsible for their actions.

1.8.35 Soon after, a rule was introduced under the Maritime Transport Act adopting the principles of the ISM code to New Zealand registered SOLAS ships, and applying the same principles of the code to New Zealand domestic ships. The rule came into force in August 1997 for SOLAS ships, and in February 1998 for domestic ships.

1.8.36 Not being a SOLAS vessel, the *Arahura* was required to comply with the New Zealand safe ship management system; however, Interisland Line opted to comply with the ISM code instead, which required similar if not higher standards.

1.8.37 In early 1996, Interisland Line began to enter the *Arahura* into class with Det Norske Veritas (DNV) classification society. In addition to conducting class surveys DNV was authorised to conduct surveys required under New Zealand rules, on behalf of the MSA. Additionally, DNV was authorised to conduct ISM audits. By mid 1996, Interisland Line had begun the implementation of ISM, and the *Arahura* had successfully entered into DNV class. All subsequent surveys were conducted by DNV.

1.8.38 DNV was not aware of the 1991 incident involving the rescue boat or of any previous correspondence over the Cranston hook. In 1996 it assumed the role of conducting the safety equipment surveys, which involved observing a drill using the starboard rescue boat. The drills went without incident.

1.8.39 In January 1996, the crew were conducting a routine on-board inspection of the life saving equipment and found that the lock pin release cable was badly frayed where it exited the release assembly block.

1.8.40 Disassembly of the hook revealed that the lock pin and its release cable were an integral unit. At the request of Interisland Line, RFD attended the *Arahura* to have the cable replaced; however, RFD did not have the required spare parts, and was not an authorised agent for Cranston, so it opted not to repair the Cranston hook, but offered to supply a similar hook of its own brand instead.

1.8.41 According to Interisland Line management at the time, they tried to locate the Cranston manufacturer, but were unsuccessful.

1.8.42 The Cranston hook was then sent to Interisland Line's preferred engineering company, which manufactured a new lock pin and release cable, using the measurements of the old components. According to the engineering company, no work was done involving the spring or any other component of the hook.

1.8.43 There is no record of any repair or maintenance to the Cranston hook from that time until the time of the accident some 3 years later.

1.8.44 In July 1998, SOLAS amendments 1996 came into force, which covered among other items, new requirements for testing on-load quick-release hooks. The new requirement was for such hooks to be subject to a thorough examination and test during renewal survey for the Safety Equipment Certificate by properly trained personnel familiar with the system, and further, an operational test under a load of 1.1 times the total mass of the life or rescue boat with its full complement of persons and equipment every 5 years. The same requirement was not made of off-load quick-release hooks such as the one that twice failed on the *Arahura*.

1.8.45 Four days before the accident, the crew on the opposite roster conducted a similar drill involving the starboard rescue boat while the *Arahura* was approaching Wellington. The drill was uneventful, but had not been entered into the record of drills and inspection on board at the time of the accident 4 days later. It was established that during the retrieval of the rescue boat, the crew had not followed the correct procedure for hooking on. Instead of closing the hook and hooking on via the spring latch, the hook was passed through the lifting ring and then snap-closed.

1.8.46 After the accident the section of a SOLAS training manual that referred to the starboard rescue boat was removed for the purposes of the investigation. Included in the section were instructions for a later series of Cranston hook, which had somehow been obtained in 1991 and inserted in the SOLAS manual in response to the engineering surveyor's recommendation that all crew be made familiar with launching procedures. Although the instructions were for a different series of hooks, they were essentially the same as those for earlier models which were eventually supplied to the commission by the manufacturer.

1.8.47 At the bottom of the instruction page in the SOLAS training manual was a telephone number for the manufacturer, which proved to be still current some 8 years later.

2. Analysis

2.1 History

2.1.1 The history of this accident goes back over a period of some 16 years. Some of the persons involved in previous events were not available for comment; those who were, in the absence of accurate record keeping, relied mainly on their memory to form a reasonable account of events. Inevitably, there were conflicting accounts.

2.1.2 The following comments are made to allow the reader to fully understand: firstly, how significantly the loss of "institutional memory" can adversely affect events for some considerable time in the future; secondly, how change in a regulatory regime can require a significant change in organisational culture; and thirdly, the importance of staff and management working on organisational culture as a team, rather than as one adversary to another.

2.1.3 There were a number of latent failures that occurred many years before this accident that had a significant bearing on events leading up to and on the day of the accident; failures that lay dormant for many years awaiting to combine with an unfortunate sequence of proximate events to culminate in the accident. Those events came together in 1991 when the Cranston hook first failed and the rescue boat fell to the sea, fortunately with nobody on board.

2.1.4 The design of the Cranston hook on the rescue boat of the *Arahura* was basically sound, and although later models incorporated many improved design features, this can be considered a normal process in the evolution of any new concept. If the hook had been appropriately maintained, and those who were using it had understood the principles and limitations of the hook, then it should have provided many years of safe and efficient service.

2.1.5 The correct operation and maintenance of the Cranston hook were essential to the safety of the rescue boat occupants, and to the safety of others who depended on the rescue boat for their own survival. When the hook was put into service, it should have been accompanied by the appropriate instructions for use and maintenance. Somewhere between leaving the manufacturer and arriving on board the *Arahura* at new building, the instructions for the Cranston hook were lost. Had they been on board, at least the crew would have had the opportunity to study and familiarise themselves with them.

2.1.6 Ideally, when the manufacturer subsequently made modifications to the Cranston hook, this information should have been passed on to known users of its product. In reality, ships and their components change hands often and it is difficult for manufacturers to keep track of their customers. The onus is therefore put back on the ship owner to contact the manufacturer if they encounter problems with a component, a difficult but not impossible task if the ship owner does not know who the manufacturer is.

2.1.7 It appears that the spring inside the hook when new comprised 2 "rust proofed" mild steel springs joined together over a brass nipple, a combined length of 50 mm. When the engineering surveyor disassembled the hook after the 1991 incident, he recorded the spring as 51.8 mm and heavily corroded. The Interisland Line project manager at the time recalled the hook being stripped down on several occasions before 1991 owing to the hook being difficult to release. It is likely that the spring sighted by the surveyor in 1991 was the original one; however, this could not be conclusively established.

2.1.8 The 5 mm steel release cable was of too large a diameter for the pulley and cable ducts in the assembly, and probably contributed to the poor hook performance. The manufacturer appears to have recognised this and down-sized the cable, another modification made by the manufacturer unbeknown to Interisland Line.

2.1.9 Before 1991 the crew were generally unaware of the correct procedures to follow for operating the Cranston hook. Although there were no specific instructions on board the *Arahura* for the hook, there was the conspicuous placard on the rescue boat which explained its fundamental safety requirements in simple terms. As most of the problems had been with the hook not letting go when required as opposed to premature release, the crew probably had not considered the danger.

2.1.10 During the period up to 1991, Interisland Line appeared to be intent on dispensing with the rescue boats altogether, probably inspired by the ongoing problems in general it was experiencing with the starboard rescue boat and its launching davit, and the corresponding cost to the company. Additionally, the boat had gained a reputation with the crew for being unreliable. The rescue boat was at that time effectively an unwanted item.

2.1.11 Although a ship operator should not be criticised for wanting to reduce costs, the removal of the starboard rescue boat in this case would have represented a reduction in the capability of the life saving equipment on board the *Arahura*, and therefore a reduction in safety for those on board.

2.1.12 The latent failures that contributed to the 1991 incident were:

- the crew's unfamiliarity with the operation of the hook
- the lack of documentation on board about the hook
- the apparent repairs that had been made to the hook without the benefit of drawings or consultation with the manufacturer
- the company's and crew's indifferent attitude towards the need for the rescue boat
- the wear on the locking faces of the lock pin and the hook.

2.1.13 The most likely cause of the rescue boat releasing prematurely in 1991, as identified by the engineering surveyor at the time, was that the lock pin had not properly engaged with the hook as a result of the poor condition of the spring and the friction caused by the build-up of debris within the release assembly.

2.1.14 After the incident occurred in 1991, there was the ideal opportunity to identify and eliminate all of the latent and local factors that had contributed to the incident, and that was almost done; however, a series of other events occurred around that time which precluded this from happening and were to eventually contribute to the fatal accident in 1999.

2.1.15 The restructuring taking place within the Marine Division of the Ministry of Transport at the time resulted in several persons from several different departments being involved in the investigation and analysis of the 1991 incident, with the predictable result of the problem being passed from one department to the next, during which time the benefit of some valuable advice was lost.

2.1.16 Perhaps the most significant oversight within the regulatory system at the time was the failure to address the engineering surveyor's concern that the hook may release under load. With such a concern, the very least that should have been done was to perform the on-load test after the hook had been repaired; the best would have been to have sought the advice of the manufacturer, which was easily contactable despite protestations to the contrary.

2.1.17 The advice to replace the hook spring and clean the spring chamber was a short-term solution which was given without the benefit of having hook drawings or instructions to refer to. It is likely that at this time the hook and lock pin locking faces had suffered considerable wear. It appears that the hook may have been manufactured without any reverse bevel on the locking faces of the hook and lock pin. With any wear of the 2 locking faces into a positive bevel, the ability of the hook to function properly under load would have been substantially reduced.

2.1.18 Had the nautical surveyor's advice of replacing the hook been heeded, the new hook would have included any design improvements and probably included a set of diagrams and instructions, and above all, established contact with the manufacturer. While this would have been the more expensive option in the short term, in the long term it would have proved to have been cheaper in monetary terms, and the most effective option for maintaining safety.

2.1.19 The advice given to have the hook inspected annually by a competent person was good and would have provided an opportunity each year for someone with the required knowledge and expertise to identify the shortcomings with the hook, but unfortunately, in spite of Interisland Line undertaking to have the hook inspected annually by RFD, this was never done.

2.1.20 Neither the Interisland Line's repair and maintenance system for deck equipment nor the regulatory system at the time had provision for flagging additional items for independent survey or on-board inspection. Currently DNV does have such a system, but with the restructuring of both the regulatory system and Interisland Line management, the resulting loss of "institutional memory" allowed the history of problems involving the hook to remain only in the memory of those involved at the time.

2.1.21 A significant event that occurred following the 1991 incident was the fitting of the preventer chain and hook over the Cranston hook. The incident had done little for the crews' trust in the starboard rescue boat. The fitting of the preventer provided a psychological feeling of comfort for the crew using the rescue boat, yet in reality it was going to afford little protection. The existence of the preventer appears to have lulled the crew into a false sense of security that may have affected their diligence in inspecting, maintaining and operating the Cranston hook.

2.1.22 It is unclear whether the preventer was fitted with the approval of the Marine Division, but it clearly had been fitted without fully assessing the resultant shock loads it would be subjected to in the event of a Cranston hook failure, nor had any thought been given to the possible transfer of shock loads to other components in the davit launching system. The exact loads on the davit are difficult to calculate, but basic calculations show that if the Cranston hook had released prematurely, and the preventer had not failed, the shock load transfer to the davit wire fall may have been sufficient to part the wire.

2.1.23 One positive outcome from the 1991 incident was that, from somewhere, a set of instructions together with an assembly drawing for Cranston hooks was located and incorporated in the SOLAS training manual on board. Although the drawing and instructions were for a later series of Cranston hooks, the principle of operation was the same. Unfortunately, this incorporation of information into the SOLAS training manual appeared to go largely unnoticed by the crew, as evidenced after the 1999 accident by their displayed general lack of knowledge on how the hook was supposed to be operated.

2.1.24 Even in later years when the launching instructions posted on the bulkhead near the launching area were updated, they contained the instruction for crew to cock the hook by pulling on the release cable before the boat was waterborne. This instruction was contrary to the manufacturer's instructions that had been included in the SOLAS training manual, which instructed crew to stay well clear of the release cable until the boat was waterborne. This erroneous instruction alone had the potential to cause the boat to drop prematurely during any launching drill, had the crew taken heed of it.

2.1.25 Notwithstanding the confusion over the correct procedure for launching and retrieving the rescue boat, there was enough information on board in the form of the SOLAS training manual, the launching instructions on the bulkhead at the launching station and the placard on the rescue boat. The concept of the hook was a relatively simple one for those who took the time to study it. Regardless of what the crew and management thought of the starboard rescue boat and its launching arrangement, the fact remained that it was required to be there and was required to be used. It is perplexing how so many officers and ratings could know so little about an item so essential to the safety of themselves and the passengers, even if only in the interests of self preservation.

2.1.26 The reason the crew treated the Cranston hook with nonchalance could be explained in part by the false sense of security the preventer chain gave them, but also by the fact that rescue boat crews were put together on an ad hoc basis, giving those who mistrusted the hook the opportunity to not take part in drills. Had the dedicated rescue boat crew taken part in every drill and launching, as required by legislation, then they may have taken the time to: firstly, ensure they were thoroughly familiar with its operation, and secondly, ensure that it was in good condition.

2.1.27 When the Cranston hook again required maintenance in 1996, little had changed except that the regulator (by then the MSA) was not involved in deciding what course of action to take regarding the hook. This was the first occasion that RFD was called in for advice, advice that was subsequently ignored when it suggested renewal of the hook.

2.1.28 The decision to manufacture a new lock pin and release cable without the aid of drawings, and without the advice of the manufacturer, was an example of how management and crew have on occasions failed to apply a similar level of responsibility to repair and maintenance to that which may have been applied by a surveyor under the old inspection regime. The cost of fitting a new hook appears to have outweighed the advice given by 2 competent persons to renew the hook, once by the nautical surveyor in 1991 and once by RFD in 1996.

2.1.29 Over the years subsequent to the 1991 incident, the focus for the responsibility of maintaining and operating ships in safe and good order shifted from the administration to the operator and crew. This has proved to be a long and difficult transition for some operators, particularly when it has been attempted in parallel with operators streamlining operations for greater efficiency.

2.1.30 During interviews after the 1999 accident, it became apparent that there was a certain degree of tension between management and sea staff, largely born from a number of matters over the years.

2.1.31 A good safe ship management system operating under the principles of the ISM code should be able to withstand the disruption of restructures, either on board or within the operator management, or even within a regulatory regime; however, a successful safe ship management system is reliant on equal commitment from both management and crew, regardless of other matters.

2.1.32 The safe ship management system in place for the *Arahura* appeared at face value to have been logical and well thought out and had undergone some refinement since its implementation; however, there was evidence to suggest that the concept had not been wholly endorsed by some of the crew, and was being treated more as a task that was required by management to be done, rather than a task to improve safety within their own working environment.

2.1.33 Subsequent to 1996, DNV had carried out several class surveys and surveys on behalf of the MSA. Additionally the *Arahura* had undergone a port state inspection by the MSA. Each survey and inspection had involved the starboard rescue boat but nothing untoward had been noted regarding the Cranston hook.

2.1.34 Meanwhile, the on-load/off-load quick-release hooks for the life rafts on other company vessels continued to be sent ashore for annual service, but not the Cranston hook on the rescue boat.

2.1.35 It is disappointing that the off-load hook did not enjoy the same level of maintenance and inspection as the dual on-load/off-load hooks within Interisland Line. Equally disappointing is that when the new SOLAS regulations regarding quick-release hooks came into force in 1998, there too the off-load hooks were not included in the new rigid requirements for inspection and testing. It is difficult to find any reason why. A failure of a quick-release hook could have disastrous consequences, regardless of what type it is.

2.2 Premature release of the Cranston hook

2.2.1 The Cranston hook was a reasonably simple device. It was not difficult to look at it and figure out the principles of how it worked.

2.2.2 Two logical explanations for the hook being able to release under load were:

- if it was not in a good state of repair; or
- if it was not fully engaged in the locked position when the rescue boat was lowered.

Both are considered to have contributed to the rescue boat falling to the sea.

2.2.3 The examination of the hook showed that the hook had not been fully engaging in the locked position for some time. This was in part due to the high friction created by the lock pin release cable as it passed through the release assembly block, and in part due to the lack of travel in the spring that was supposed to force the lock pin down to fully engage the lock face of the hook.

2.2.4 The friction created by the lock pin release cable was a result of the following:

- the cable was kinked and strands were broken at the exit point from the square block
- the cable was 5 mm in diameter and passed around a 34 mm diameter sheave which had a 2.5 mm radius groove
- lack of lubrication of the cable
- possible build-up of debris around the pulley.

The first 2 items were probably the most significant.

2.2.5 The spring had an uncompressed length of 42 mm, some 10 mm shorter than the spring fitted to the hook at the time of the 1991 incident. It could not be established if the shorter spring was fitted in 1991 or at some subsequent time, but it was clearly of insufficient length to fully engage the hook under normal operation.

2.2.6 The video recording taken by the passenger indicated that none of the crew of the rescue boat was holding on to the release cable when the boat was being lowered. It was possible but unlikely that the release cable may have become entangled in one of the lifelines as the boat was lowered. No one could recall seeing this happen, and even if it did, the pull on the cable should not have been sufficient to cause the hook to release if it had been properly engaged.

2.2.7 The Cranston hook failed to carry the load of the rescue boat and crew because the lock pin was probably not in the fully locked position. If the lock pin had been engaged by 3 to 4 mm as shown in Figure 6, the hook would have been unlikely to have released without some strong steady pull on the release cable, as proved in the post-accident tests conducted on the boat. As there was no evidence of anyone on board pulling on the release cable at the time the rescue boat dropped, the lock pin was probably in a position similar to that shown in Figure 5; only just engaged with the edge of the hook locking face.

2.2.8 Taking into account the leverage in the hook, the force on the locking face was about half the load on the hook, about 1.35 t. This force was probably sufficient to deform the end of the lock pin and release the hook. This would have been assisted by the sideways movement of the lock pin in the block, allowing it to tip slightly and the load to not be applied in a direction that was normal to the locking face owing to the rotation of the hook. The effect would have been exacerbated by the locking faces of both the hook and lock pin having worn to a positive bevel, discouraging the faces to lock rather than interlocking as designed to do with a 10º reverse bevel.

2.2.9 The rescue boat bouncing slightly as the descent was stopped probably provided the final extra force required to disengage the hook.

2.2.10 It could not be positively established if the deformation at the bottom of the lock pin occurred as a result of this one incident, but numerous small polished indents were present in the area of wear on the lock pin, suggesting that it had regularly been loaded in a similar manner.

2.2.11 It is not known how the locking pin came to rest in the position that it did. It could have occurred when it was last hooked on during retrieval of the boat from the water 4 days prior (it was established that the incorrect method for hooking on had been used during that recovery) or the release cable could have been pulled by anyone while the rescue boat was resting in its cradle over the 4 days before the accident. Regardless of how it came to be in that position, it was apparent that none of the launching or boat crew properly checked the security of the hook before boarding and lowering the boat.

2.3 Failure of the preventer chain

2.3.1 The chain link probably failed at the weld from a pre-existing defect. Chain links are normally resistance butt-welded. The presence of defects in this type of weld is not unknown. During the welding process there is occasionally a lack of fusion defect, which was probably the case in this situation. The dark area shown in Figure 8 was the pre-existing defect that covered about two thirds of the cross section of one side of the chain link. Due to corrosion of the fracture surfaces it was not possible to determine if the defect had grown in service; however, this was unlikely as the chain had probably not been loaded in its operational life.

2.3.2 The chain link was heat treated (quenched and tempered) to give a hardness of about 390 HB. Heat-treated chains normally have an acceptable hardness of 302 to 352 HB. Chains with hardness in excess of 375 HB are particularly prone to brittle failure from small defects; therefore a hardness of 390 HB was probably excessive.

2.3.3 The tensile strength of the chain was estimated to be about 1320 MPa. For each side of the chain link, this equated to a force of about 21.5 t for an area of 160 mm^2. If the chain link was defect free and uniformly loaded, failure would be expected to occur at a load of 43 t. This is 16 times greater than the weight of the boat on the day of the accident; however, the intact cross section of one of the legs of the chain was only about 40 mm^2. As a result the load at failure of this side of the chain would have been about 5.4 t if it failed in ductile overload. It however failed in a brittle manner. Under these circumstances the required failure load would be significantly lower.

2.3.4 When the Cranston hook failed to carry the calculated 2.7 t load of the rescue boat, the load would be transferred to the chain. The loading rate would have been very rapid. Under shock loadings the applied load would have been significantly greater than the 2.7 t static load. The effect of this is difficult to calculate as it depends on the stiffness of the system; however, one leg of the chain link failed in ductile overload. If this failed in pure overload it indicates that the load was in excess of 21.5 t, that is, 8 times the weight of the boat. The failure of the other side of the chain link to the initial failure suggests that the chain was not adequately sized for the task it was required to carry out, even if it had been defect free.

2.3.5 The corrosion present on the links of the safety chain was excessive. One flexible link had seized as a result of corrosion products and the lock wire securing the various components against opening was corroded. The corrosion pits were present in the chain links up to a depth of 1 mm. The overall condition of the preventer chain and hook suggested that little, if any, maintenance had been conducted on it since it was fitted in 1991.

2.4 Survivability

2.4.1 The concept of the rescue boat was that of a boat required to be launched quickly in adverse conditions and by a highly trained crew. On the *Arahura* the boat was rarely launched and operated by its designated crew, and rarely did the drills test the crew's ability to launch it quickly, but instead it was prepared by the launching crew some time before the boat crew arrived.

2.4.2 The operation of such a fast response boat requires special driving skills, particularly if it is to be operated in rough seas. It appeared that of the crew spoken to, few would have had adequate training to operate the boat safely in an emergency situation, in rough seas.

2.4.3 The lifelines fitted to the head of the rescue boat davit were not required by legislation, but instead were meant for open double-fall lifeboats. Of the 4 crew on board only 2 had access to a lifeline. The 2 who fell with the boat were seriously injured, but did survive. Of the 2 who were holding on to the lifelines, one managed to hold on and save himself from what would probably have been serious injury; the other, the deck trainee, died probably as a result of his momentarily holding on to the lifeline, which allowed the boat to fall beneath him and then him to fall into the boat.

2.4.4 The use of lifelines in a single-fall, quick-response rescue boat needs to be reviewed. While they probably do not pose too much of a problem in a controlled launching in calm water, they have the potential to hinder a launching or retrieval in adverse sea conditions.

2.4.5 An appropriate arrangement for such a rescue boat might be to have a reliable release arrangement, no lifelines but instead a dedicated seat and harness for all crew, each seat adequately fitted with padding, hand grips and back support. With such an arrangement, provided the crew were properly trained, they would probably fare better than those involved in this accident.

2.4.6 The height and manner in which the deck trainee fell into the rescue boat made this accident, for him, not survivable. The impact forces at the end of the fall were extreme and transmitted to vital organs, despite his wearing a protective helmet. The helmet provided impact attenuation and resisted penetration as designed, but eventually sustained structural failure as the extreme forces exceeded its designed performance. It is unlikely that other types of practicable headwear would have made his fall survivable.

3. Findings

Findings and safety recommendations are listed in order of development and not in order of priority.

3.1 The weight of the rescue boat and crew were within the design limits of the launching equipment when the rescue boat fell to the sea.

3.2 The starboard rescue boat fell some 15 m to the sea when the Cranston quick-release hook failed to carry the load of the boat and crew, and released prematurely. The premature release of the Cranston hook was not caused by any person pulling the release cable.

3.3 The Cranston hook was probably not fully engaged when the crew boarded the rescue boat and began to lower it to the sea. It is unlikely that any member of the crew checked the hook for correct engagement.

3.4 Several components of the Cranston hook were in a poor state of repair, which contributed to it not fully engaging under normal operation, and contributed to it being able to release under load, something it was not designed to do.

3.5 The preventer chain that had been fitted by Interisland Line as a defence against premature release of the Cranston hook failed to arrest the fall of the rescue boat when it parted at a defect in one of its links.

3.6 The preventer chain was not adequately sized for its intended task, even if it had not been defective. A thorough analysis of the effect of the preventer chain on the launching system had not been carried out. If the preventer chain had not failed, it was possible that the shock load transferred to other components may have caused some other failure instead.

3.7 The Cranston quick-release hook had failed in a similar manner in 1991, some 8 years before the accident. Although most of the factors contributing to this earlier failure were identified by the regulatory administration responsible for approving corrective action at that time, restructuring within the administration resulted in an incomplete final analysis of the cause.

3.8 Interisland Line did not heed the advice of the administration regarding the Cranston quick-release hook following the 1991 incident, and the administration did not have an effective system in place to follow up on advice given.

3.9 The lessons learned from the 1991 incident and through other correspondence regarding the rescue boat and the Cranston quick-release hook appeared to have been lost along with the "institutional memory" of both the regulatory administration and the operator through successive restructures. Any one of those lessons could have prevented this accident.

3.10 The principles of the International Safety Management Code have the potential to retain "institutional memory" through such restructuring, provided they are applied in full.

3.11 An effective ship safety management system requires equal acceptance from both shore management and onboard crew. The relationship between shore management and crew on the *Arahura* appeared to be hindering the success of the safety system.

3.12 The launching and rescue boat crews were not familiar with the correct operation of the Cranston quick-release hook, nor were a number of other crew spoken to during the investigation, in spite of its relatively simple concept. This unfamiliarity appeared to be a product of not having a dedicated, fully trained crew, which was a requirement of the safety system on board.

3.13 The design requirements of quick-response rescue craft with regard to seating and launching arrangements require some change to ensure maximum safety for the crews.

3.14 The 1996 SOLAS amendments for inspecting, maintaining and testing quick-release hooks for rescue craft were incomplete in that they did not apply the same standards to off-load hooks as they did to dual on-load/off-load hooks.

3.15 The height and manner in which the deck trainee fell from the lifeline made this accident, for him, not survivable.

3.16 The actions of the integrated rating who drove the rescue boat to Picton for medical help probably minimised the effect of the crew's injuries, and were commendable.

4. Safety Recommendations

4.1 On 6 April 2000 the commission recommended to the managing director of Tranz Rail Limited that he:

4.1.1 conduct a review of the repair and maintenance systems on each company vessel to identify and include any critical components that may not currently be included in the system (012/00)

4.1.2 conduct a review of the emergency muster lists on board each vessel and implement a programme of familiarisation and training that ensures each survival craft is crewed with personnel that have the skills commensurate with the function of the craft (013/00)

4.1.3 critically review each rescue boat and its launching arrangement in the Interisland Line fleet and ensure that the crew are afforded a level of protection against mishap that is commensurate with the function of the craft, paying particular attention to seating arrangements in craft purchased in future (014/00)

4.1.4 implement a programme to enhance the sea staff's awareness of:

- the principles of a safe ship management system
- the importance of following a safe ship management system in practice as opposed to following it in a manual. (015/00)

4.2 On 14 April 2000 the managing director of Tranz Rail Limited responded as follows:

4.2.1 Recommendation 012/00
We are continuing to review the repair and maintenance systems in line with the Recommendation and expect this to be completed by early August.

4.2.2 Recommendation 013/00
This training and familiarisation is continuing with drills and practices. It is ongoing.

4.2.3 Recommendation 014/00
This review is completed. The seating in rescue craft (as opposed to fast rescue craft) is really not of a type that can be enhanced. Any new rescue craft purchased will be Type Approved.

4.2.4 Recommendations 015/00
The Safety Management System (SMS) has been in place now for just under two years. We have made numerous changes to it as a result of input largely from seagoing personnel. This process will continue. The system is audited internally twice a year, verifications are being carried out continuously by masters and system reviews are carried out by masters and management. An external audit of the office is carried out annually and twice in five years for the ships. Audits in addition to those required by the system are also being planned. During the audits the opportunity is always taken to educate and support personnel in the operation of the Safe Management System. Further training of staff will be undertaken before 30th September this year. A change of systems and culture of this magnitude will take time particularly when it is being carried out concurrently with large changes in maritime legislation.

4.3 On 6 April 2000 the commission recommended to the director of maritime safety that the New Zealand Maritime Safety Authority delegate to IMO bring to the attention of the appropriate IMO committee the final version of this report and make a recommendation to the committee that it:

4.3.1 consider reviewing the requirements for rescue boats to include a dedicated seating or bracing arrangement designed to minimise injury to the operating crew in the event of mishap or heavy weather operation (016/00)

4.3.2 consider extending the requirements of the 1996 SOLAS amendments regarding on-load quick-release hooks, to include off-load quick-release hooks. (017/00)

4.4 On 17 April 2000 the director of maritime safety wrote to the head of maritime safety division at IMO as follows:

4.4.1 On Thursday 20 May 1999, an "off load" release hook failed when the hook released prematurely and a rescue boat fell some 15 metres to the sea surface.

The contibuting factors were many and varied, but amongst them was the fact that the "off load" release hook was not thoroughly examined, at least once every 12 months, and it was not overhauled as a matter of routine. The

Transport Accident Investigation Commission (TAIC) in New Zealand have recommended that the Maritime Safety Authority (MSA) bring to your attention the following points of view:

1. That the IMO consider reviewing the requirements for rescue boats to include the type and disposition of safer bracing and supporting arrangements for the operating crew. These to be designed to minimise injury in the event of mishap and heavy weather operation.

2. That IMO consider extending the maintenance requirements of Regulation 20 of the 1996 SOLAS amendments regarding “on load” quick release hooks, to include “off load” quick release hooks.

The latter consideration, had the maintenance regime been in place, might have prevented this accident happening. It would seem likely that the reason for omitting “off load” release hooks from regulation 20.11 must have been that they are not as vulnerable to inadvertent release as are “on load” hooks. However, the accident illustrated in the report which accompanies this letter, would appear to reinforce the need to include “off load” release hooks in this regulation too.

I look forward to receiving any comments IMO may have as to reasons why “off load” hooks were not referred to in Regulation 20 before considering making any further submissions regarding amendment to this Regulation.

Approved for publication 12 April 2000

Hon. W P Jeffries
Chief Commissioner