Final Preliminary Report

Prepared by the Transport Accident Investigation Commission

for

The Royal Commission of Inquiry into the Sinking of the MV Princess Ashika

15 February 2010

Abstract

In the Kingdom of Tonga, at about 2354 on 5 August 2009, the interisland passenger and cargo ferry **Princess Ashika** capsized and sank after taking on water. The ship was about 47 nautical miles north of Nuku'alofa on passage to Ha'afeva in the Ha'apai group of islands. The search and rescue mission that followed recovered 54 persons alive and 2 deceased. A total of 72 persons remain missing, presumed drowned, with the majority likely to be interred in the ship. A remotely operated vehicle was able to identify positively the vessel laying in about 105 metres of water.

On 10 August His Royal Highness King George Tupou V established a Royal Commission of Inquiry into the Sinking of the MV **Princess Ashika**, and the Transport Accident Investigation Commission of New Zealand was requested to provide assistance in the gathering of evidence and to give technical advice.

The Princess Ashika in Fiji on 26 March 2009

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Abbreviations

ATSB	Australian Transport Safety Bureau
CEO	chief executive officer
EPIRB	emergency position indicating radio beacon
FIMSA	Fiji Islands Maritime Safety Administration
GS	general service (pumps)
IMO	International Maritime Organization
ISM Code	International Safety Management Code
JTSB	Japan Transport Safety Board
kW	kilowatt(s)
° (M)	degrees magnetic (course)
m	metre(s)
MetService NZ	Meteorological Service of New Zealand
mm	millimetre(s)
PA	public address system
Patterson's	Patterson Brothers Shipping
RCCNZ	Research Coordination Centre New Zealand
RNZAF	Royal New Zealand Air Force
ROV	remote-operated vehicle
SAR	search and rescue
SOLAS	the International Convention for the Safety of Life at Sea 1974, the Protocols relating to that Convention and the annexes to the Convention and those Protocols
STCW 95	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 and 1997
t	tonne(s)
° (T)	degrees true (course)
TAIC	Transport Accident Investigation Commission of New Zealand
Tonga	Kingdom of Tonga
TMPI	Tonga Maritime Polytechnic Institute
TSB	Transportation Safety Board of Canada
UTC	universal coordinated time
VCG	vertical centre of gravity
VHF	very high frequency
ZLM	Taupo Maritime Radio call sign

Glossary

bosun	person who is in charge of, and a member of, the deck crew of a ship
bulwark	solid rail around the deck of a vessel to prevent entry of the sea
casing	an enclosed space on a vessel
con(ning)	direct(ing) the course and speed of a ship
deadweight	total weight of cargo, stores, fuel and ballast carried by a ship
freeboard	distance from the waterline to the deck edge
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
heel	a transverse inclination of a ship owing to external forces such as wind pressure and wave action
lightship	the actual weight of the ship with no fuel, people, cargo or water on board
list	a transverse inclination of a ship owing to the disposition of internal weights
net tonnage	derived from gross tonnage by deducting spaces allowed for crew and propelling equipment
SOLAS vessel	a foreign-going passenger or non-passenger ship of 500 gross tonnage or more that is required to comply with the design, construction and equipment requirements of the International Convention for the Safety of Life at Sea, 1974 (SOLAS) and its further amendments
stove in	where hull plating is forced inwards by an external force
telegraph	device used to relay engine commands from bridge to engine room
trim(med)	difference between the forward and aft draughts of a floating vessel

Data summary

Vessel particulars

Name:	**Princess Ashika**	
Type:	interisland passenger and vehicle ferry	
Class:	originally classed for “smooth water” in Japan	
Limits:	not prescribed, but the application for Tongan survey stated that the vessel was to be used in the “near coastal” area of operation	
Length - overall:	50.5 metres (m)	
Breadth - extreme:	13.21 m	
Moulded depth - mid-length:	3.8 m	
Moulded draught - mid-length:	2.5 m	
Gross tonnage:	677.15	
Net tonnage:	301.33	
Deadweight:	222.99 tonnes (at time of launching)	
Built:	1972, Shikoku Dockyard, Japan	
Propulsion:	2 x 6DSM-26, 4-stroke, single acting, in-line 6-cylinder Daihatsu diesel engines, with a Maximum Continuous Rating of 820 kilowatts at 720 revolutions per minute, each driving a single 1.9 m diameter fixed-pitch propeller through a reversible 2.45:1 reduction gearbox	
Service speed:	designed for 12 knots, but usual speed 7 to 8 knots	
Owner:	Kingdom of Tonga	
Operator:	Shipping Corporation of Polynesia	
Port of registry:	Nuku’alofa	
Crew:	32	
Date and time:	5 August 2009 at 2354[1]	
Location:	20° 24’S 174° 56’W	
Persons on board:	crew:	32
	passengers:	96
Injuries:	crew:	4 missing, presumed drowned
	passengers:	2 fatal; 68 missing, presumed drowned
Survivors:	passengers	26
	crew	28
Damage:	Total loss	
Investigator-in-charge:	Captain Doug Monks	

[1] Times in this report are Tonga Local Time (UTC + 13 hours) and are expressed in the 24-hour mode.

Introduction

The accident

At about 2354 on 5 August 2009, the interisland passenger and cargo ferry **Princess Ashika**, capsized and sank after taking on water in position 20° 24' S 174° 56' W. The ship was about 47 nautical miles north of Nuku'alofa, in the Kingdom of Tonga (Tonga), on passage to Ha'afeva in the Ha'apai group of islands. The search and rescue (SAR) mission that followed recovered 54 persons alive and 2 deceased. A total of 72 persons remain missing, presumed drowned, with the majority likely to be interred in the ship. On 18 August 2009, a remote-operated vehicle (ROV) operated by the Royal New Zealand Navy was able to identify positively the vessel lying in about 105 metres (m) of water.

The Transport Accident Investigation Commission's involvement

The day after the accident, the Transport Accident Investigation Commission (TAIC) received a request from the government of Tonga via the New Zealand Ministry of Foreign Affairs and Trade to help the Tongan government with its inquiry into the accident by gathering evidence and providing technical advice. TAIC immediately established a technical investigation team, which began working on 10 August 2009.

On 12 August 2009, His Majesty King George Tupou V established a Royal Commission of Inquiry into the Sinking of the MV **Princess Ashika** (Royal Commission), however, because of logistical and administrative matters, including the appointment of its commissioners; the Royal Commission did not become fully operational until the end of August 2009. During this interim period TAIC reported to the Tongan government, through Tonga's Attorney General, and held all evidence gathered by it until the Royal Commission was ready to receive it. Once the chair of the Royal Commission was appointed, TAIC began reporting to the Royal Commission.

On 4 September 2009, in response to a request from TAIC, the Royal Commission issued a procedural minute confirming that:

> *The primary purpose of our inquiries will be to determine the circumstances and causes of the sinking of the MV Princess Ashika ("Ashika"). It is not the Commission's function to engage in an inquiry to establish criminal liability, or civil responsibility. Those tasks belong to the Tongan Police Force and ultimately to our civil courts. Rather, the emphasis is on obtaining a full understanding of the circumstances of this disaster from our investigation and to seek the truth, in so far as humanly possible, of the causes of the Ashika's sinking in order that The Kingdom may learn lessons to prevent the future reoccurrence of such tragic events and with some care make recommendations for improved Maritime Safety in our waters (paragraph 1.2 of the Procedural Minute).*

This approach was consistent with TAIC's own statutory function, which was to determine the circumstances and causes of accidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person. TAIC's function, in turn, was in accord with international conventions, particularly the IMO's Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (IMO, 2008).

Report status and caveats

On 12 November 2009, TAIC and the Royal Commission approved formal letters of engagement, confirming the nature of TAIC's involvement in the inquiry and the tasks it would perform for the Royal Commission. These letters of engagement confirmed that TAIC would provide the Royal Commission with:

- an interim factual report by 30 November 2009, which would set out the key facts of the accident but not an analysis of those facts or any proposed findings and recommendations; and

- a draft preliminary report by 5 February 2010 for the Royal Commission to comment on in time for TAIC to prepare its final preliminary report by 15 February 2010. This report would contain the key facts of the accident, an analysis of those facts and proposed findings and recommendations.

On 30 November 2009 TAIC provided the Royal Commission with an interim factual report.

On 5 February 2010, TAIC submitted its draft preliminary report entitled *Draft Technical Investigation Report* to the Royal Commission for comment in accordance with the letters of engagement. On 15 February 2010, the closing date for receiving comments, the Royal Commission advised TAIC that it had elected not to provide any comment to TAIC.

This report is, therefore, the final preliminary report, which contains the key facts of the accident, an analysis of those facts, and proposed findings and recommendations.

The information contained in this report is derived from the initial investigation conducted by the technical investigation team, and from information obtained from the Royal Commission's hearing process, up to 20 January 2010. Any information about the accident obtained or known after 20 January 2010, therefore, has not been analysed and included in this report.

It is important to understand that, in preparing the technical investigation report, the team has assembled and analysed a significant amount of evidence in considerably less time than is usual for a major international accident investigation of this nature. A more realistic timeframe, based on other major overseas investigations, would have been 18 to 24 months. In addition, the investigation team did not interview passenger survivors directly but instead reviewed their police statements and their testimonies to the Royal Commission. There were also other witnesses whom TAIC would have preferred to have interviewed or re-interviewed but because of time and logistical constraints this was not possible.

Because of these factors, and also because of the nature and magnitude of the accident, and the significant number of complex issues that arose from the technical investigation team's own investigation and the Royal Commission's own inquiries, it was necessary for the technical investigation team to focus its attention more on the technical and operational circumstances and causes of the accident rather than on the wider financial, social and economic factors. Although the team did consider these as part of its analysis, it did not have time or the resources to fully examine them. A key example is the financial status of the Shipping Corporation of Polynesia, particularly its financial ability to operate and maintain a vessel like the **Princess Ashika**, which was at the end of its economic and operational life.

Report content has not been subject to review by persons mentioned in the report whose actions or inactions may be inferred to have contributed to the circumstances of the accident or to revision or qualification in light of any submissions received from those persons. These discussion and submission processes, envisaged in our letters of engagement, are recommended in the interests of natural justice, accuracy and completeness.

Technical investigation team composition, mandate and activity

A technical investigation team assembled and led by TAIC has been working since 10 August 2009 to assist the Royal Commission. The team comprises personnel from TAIC, the Australian Transport Safety Bureau (ATSB), the Transportation Safety Board of Canada (TSB), and Maritime New Zealand (the New Zealand regulatory authority). The Japan Transport Safety Board (JTSB) has assisted in obtaining vessel information from the shipyard where the ship was built and from the original owner.

TAIC, ATSB, TSB and JTSB are transport accident investigation agencies with empowering legislation that is in accord with international conventions. These international conventions require investigations to be conducted for the purposes of determining the circumstances and causes of an accident in order to avoid recurrences, rather than to apportion blame. The IMO's Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (IMO, 2008) apply in the case of marine casualties. Section 1.1 of the IMO Code states, in part:

> *Marine safety investigations do not seek to apportion blame or determine liability. Instead a marine safety investigation, as defined in this Code, is an investigation conducted with the objective of preventing marine casualties and marine incidents in the future... A marine safety investigation should be separate from, and independent of, any other form of investigation. However, it is not the purpose of this Code to preclude any other form of investigation, including investigations for action in civil, criminal and administrative proceedings. Further, it is not the intent of the Code for a State or States conducting a marine safety investigation to refrain from fully reporting on the causal factors of a marine casualty or marine incident because blame or liability may be inferred from the findings. (IMO, 2008)*

The investigation team has provided technical assistance in accordance with this IMO Code.

The technical investigation team comprises 2 master mariners, a marine engineer, a naval architect, a maritime regulatory specialist, a human factors specialist, an air accident investigator, and a liaison and administration officer.

The liaison and administration officer arrived in Tonga on 10 August 2009 and worked with a TAIC commissioner, already in the country on other business, to help establish initial working relationships and logistical arrangements.

Five investigators arrived on 12 August 2009 and, with the liaison officer, remained in the country until 27 August. The team was assisted for much of its time by a former senior Tonga Police Force officer, and received some interpretation and translation assistance from court staff.

The in-country investigators were provided with personal professional indemnities by the Attorney-General.

A naval architect from TSB, working remotely, was joined to the team.

The liaison and administration officer returned to Tonga on 14 September and stayed until 23 September 2009. Two investigators conducted interviews in New Zealand on 14 September, returned to Tonga on 15 September and stayed until 21 September 2009, then gathered evidence in Fiji from 21 September until 26 September 2009.

By 26 September, the technical investigation team had completed 59 interviews with 53 different individuals, with a total duration of about 90 hours. The interviewees included: the masters and crew of the vessel from the delivery voyage from Fiji to Tonga and in service in Tonga; some of the survivors; staff and directors of the Shipping Corporation of Polynesia and its consultants; chief executive officers (CEOs) and staff of several ministries; several Cabinet Ministers; and staff of

Tongan and regional maritime organisations. The team had also reviewed relevant witness statements given to the Tonga Police Force, conducted an informal review of the MV **Olovaha** and MV **Pulupaki**, and registered and reviewed about 360 items of evidence, some of which were themselves files of numerous items. Paper and electronic copies of the evidence collected were handed to the Royal Commission secretariat.

The 7 members of the field technical investigation team met in Wellington from 19 October until 23 October 2009 to review the investigation progress, the timeline, focus areas and ongoing and future work required, and to begin shaping the analysis to be included in a future report.

Work since October 2009 has included finalising interview transcripts, sourcing further evidence directly or via the Royal Commission hearing process, analysing interviews, hearing testimonies and exhibits, and preparing this technical investigation report for the Royal Commission. All of the evidence collected by TAIC has been provided to the Royal Commission.

1 Factual information

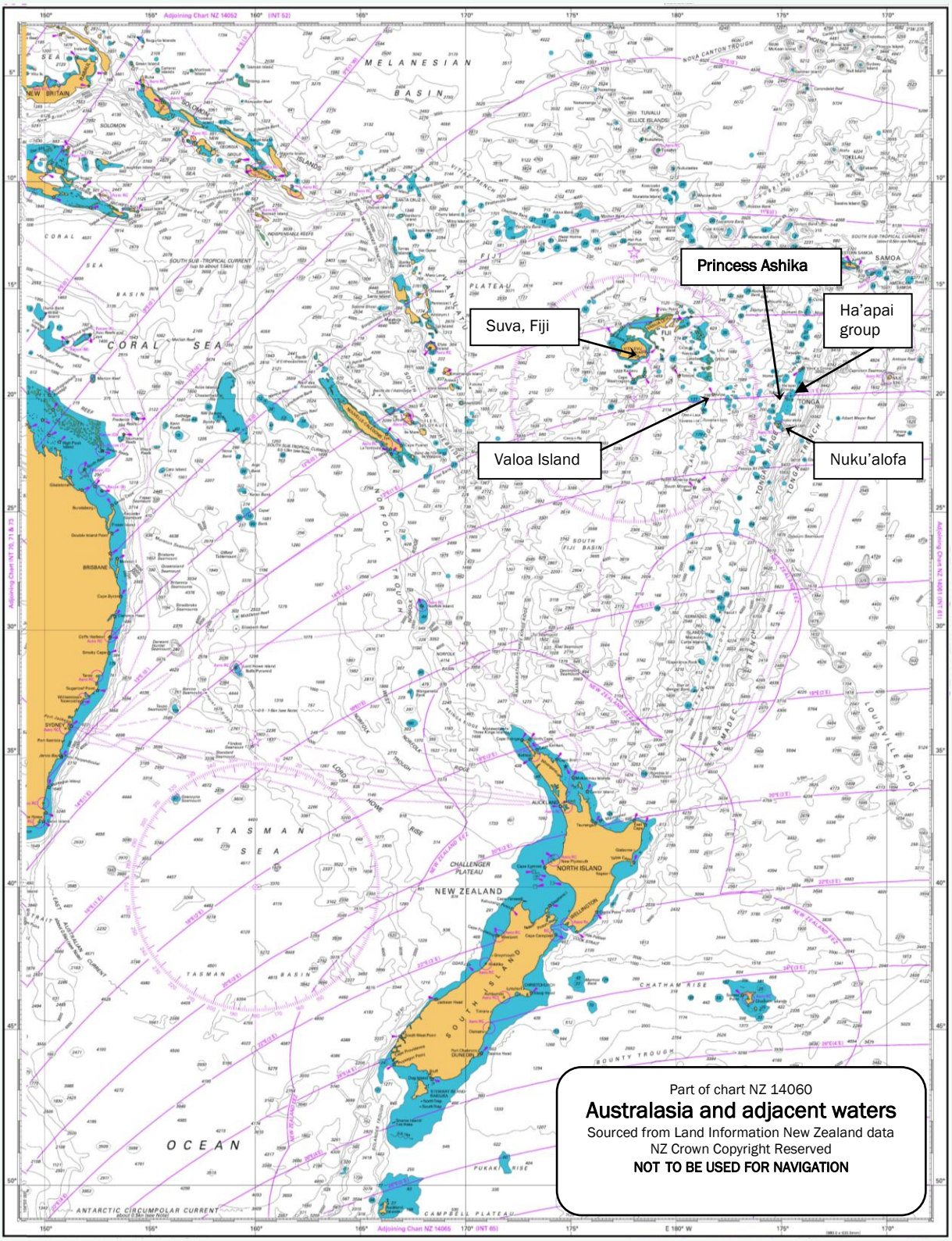


Figure 1 Chart of the general area

1.1. Vessel information

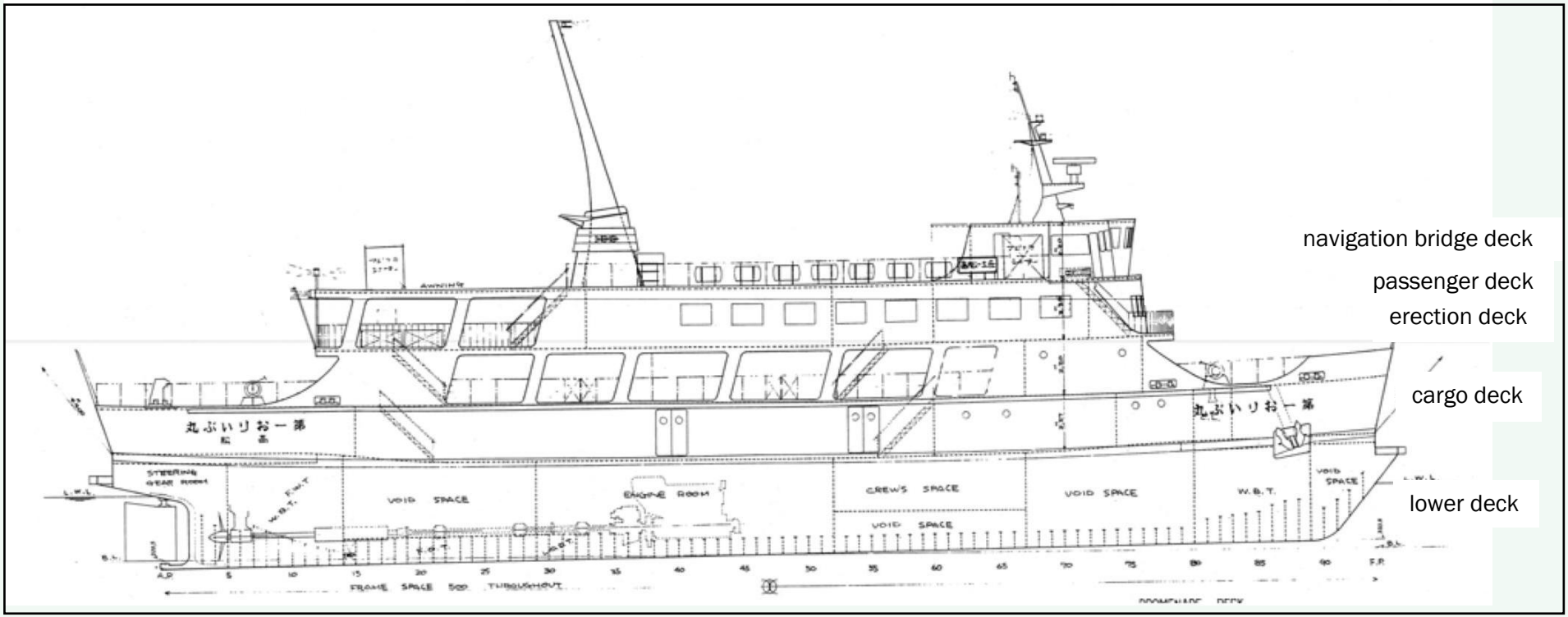
1.1.1. The keel for the **Princess Ashika** was laid in Japan in 1971 and the ship was launched in 1972 as the **Olive Maru No 1** (see Figure 2). It was used as a passenger and car ferry operating out of Takamatsu, a port on the Inland Sea of Japan.

1.1.2. The **Olive Maru No 1** was constructed of steel and had a length overall of 50.5 m, a breadth of 13.21 m, a moulded depth of 3.8 m and a moulded draught of 2.5 m with a trim of 0.641 m by the stern. The gross tonnage was 677.15, net tonnage 301.33 and the deadweight was 222.99 tonnes (t). When it was launched it was designed to carry 700 passengers and 15 crew, and vehicular cargo of 8 buses and 4 cars on short voyages of about one hour duration in "smooth water". The ship was powered by 2 Daihatsu 6-cylinder in-line 6DSM-26 diesel engines that produced 820 kilowatts (kW) (1100 horsepower), giving a design service speed of 12 knots.

Photograph courtesy of the original Japanese owner

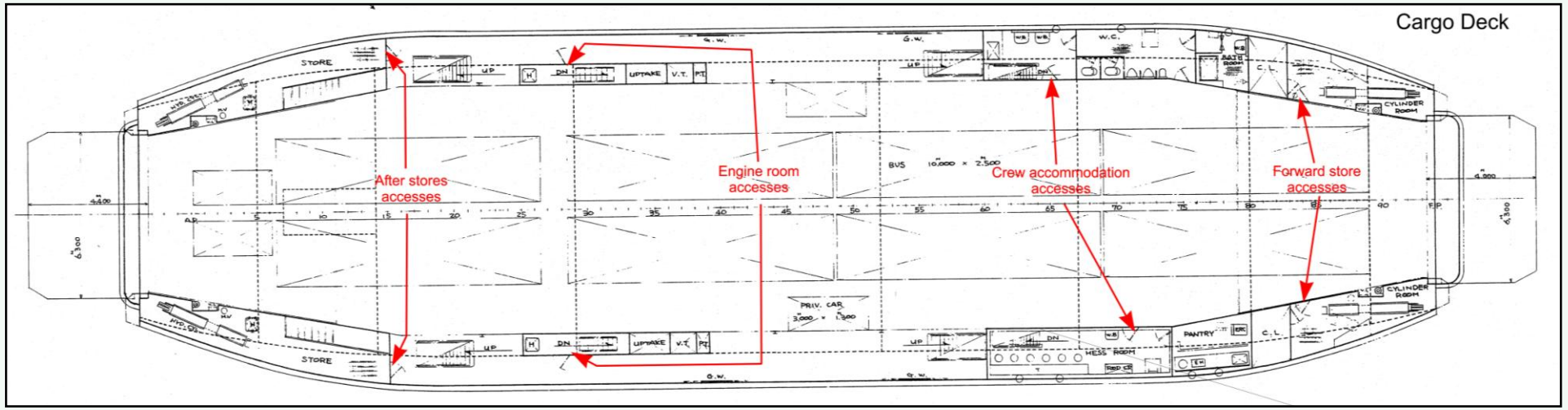
Figure 2 The Olive Maru No 1

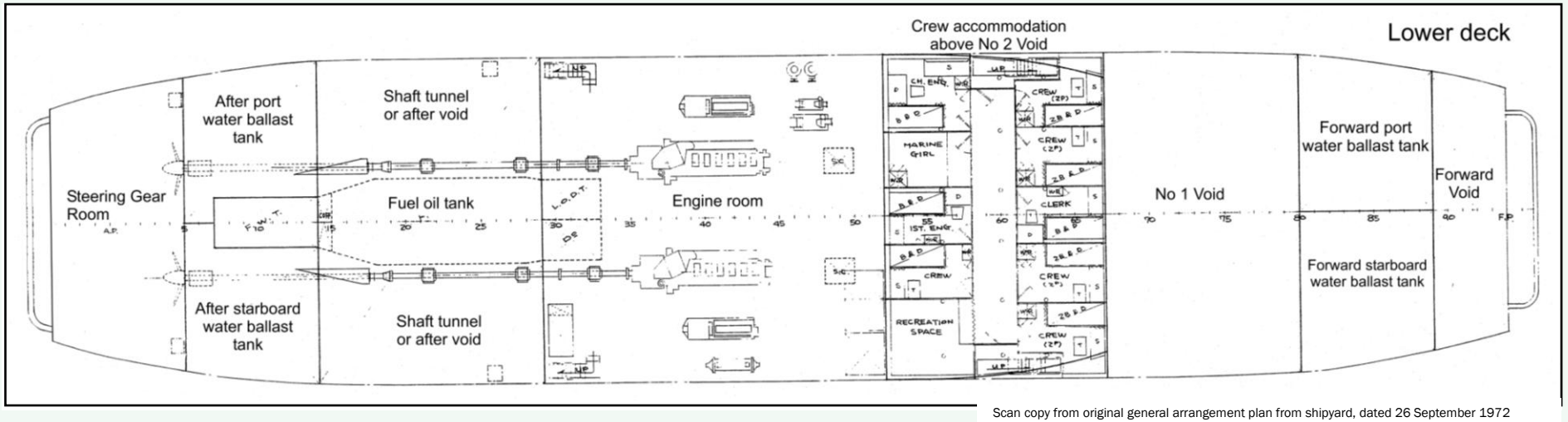
1.1.3. Steering was by way of a hydraulic system that operated a single rudder located on the centreline, aft of and between the 2 propellers.



Scan copy from original general arrangement plan from shipyard, dated 26 September 1972

Figure 3 Side elevation of the Princess Ashika





Scan copy from original general arrangement plan from shipyard, dated 26 September 1972

Figure 4 Plans of the lower deck and the cargo deck of the Princess Ashika

1.1.4. There were 5 decks on the ship. From the bottom, they were as follows (see Figures 3 and 4):

- the hull or lower deck of the ship, which included the engine room, crew accommodation, void spaces and tanks
- the wagon or cargo deck. On either side of the cargo deck there were casings that provided storerooms and additional accommodation areas for the mess room, galley and bathrooms. The casings also provided access to stairways leading to the crew accommodation and the engine room in the lower deck. The cargo deck extended over the main hull structure by about 1.1 m on each side of the vessel (see Figure 5). This cantilevered portion of the deck was supported by external frames
- the erection deck, which comprised partial decks at mid-height of the cargo space on either side of the ship above the casings
- the promenade or passenger deck, which comprised 2 passenger lounges, a shop kiosk and a covered outer deck
- the navigation bridge deck, which included the wheelhouse, the cabins of the master and chief officer, and the liferaft cradles.

There was a non-weathertight ramp at each end of the ship that allowed vehicular cargo to be loaded via one ramp and discharged through the other without the need to turn vehicles or reverse them off the vessel. This type of vessel is commonly referred to as a roll-on roll-off (or Ro-Ro) vessel.

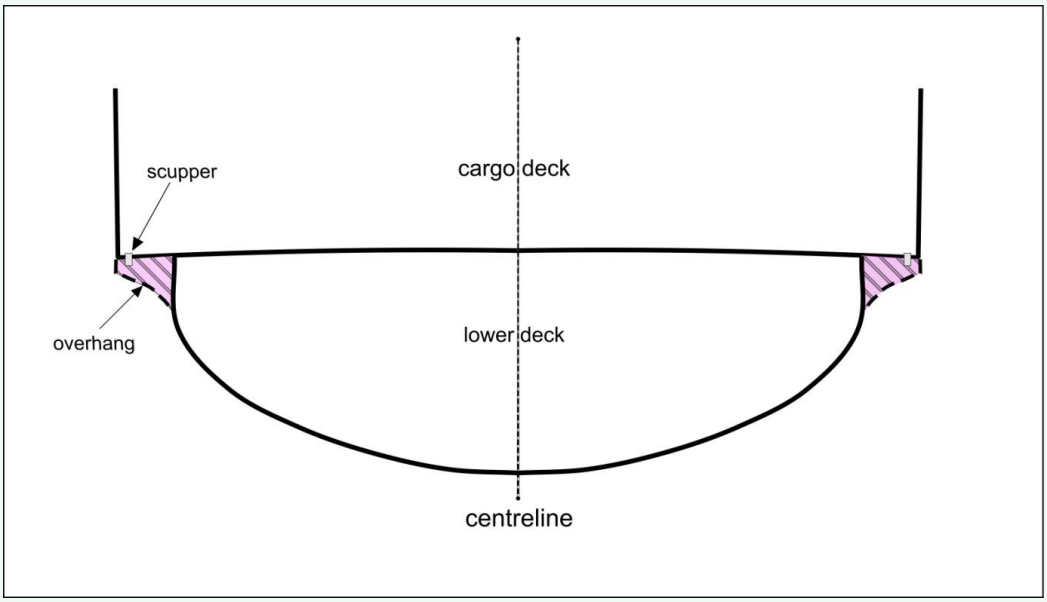


Figure 5 Cross section of the hull

1.1.5. The hull of the vessel was divided into 8 spaces by 7 main transverse bulkheads located at frame numbers 5, 14, 29, 52, 67, 80 and 89. The bulkheads were designed to be watertight, but at some time before the vessel was sold to the Government of Tonga a door had been cut into the port side of the bulkhead between the engine room and the after void space or shaft tunnel. Owing to problems with the fixed fuel oil transfer system, a portable pump and temporary hose were connected between the main fuel oil tank in the after void space and the daily service tank in the engine room. The hose passed through the doorway between the 2 spaces, preventing any watertight subdivision between those compartments.

1.1.6. The main compartments below the cargo deck, from forward to aft (see Figure 4), were:

- the forward or collision void space
- the forward port and starboard water ballast tanks
- the No 1 void space
- the crew accommodation and below that the No 2 void space
- the engine room
- the shaft tunnel or after void space
- the after port and starboard water ballast tanks
- the steering gear room.

1.1.7. Access to the crew accommodation and the engine room was by stairways through casings on the cargo deck. Access to the void spaces and tanks was through nominally watertight hatchways.

Electrical installation

1.1.8. The ship was fitted with 2 diesel generator sets, one of 90 kW and the other of 65 kW, but only one could be run at any time because the main electrical switchboard did not have the provision to synchronise 2 alternators. Synchronisation would have allowed the 2 generators to be connected to the switchboard simultaneously and share the load. Consequently, changing from one generator to the other required the engineer to disconnect the operating generator, causing the ship to lose electrical power momentarily before the incoming generator could be put on line; this is also known as a "blackout changeover".

1.1.9. The **Princess Ashika** was not equipped with an emergency diesel generator to provide electrical power if the main generators failed. The ship had an emergency 24-volt battery supply for some lights and communication equipment. The 24-volt battery bank was located in the engine room shaft tunnel space.

Pumps

1.1.10. The ship was equipped with 3 fixed electrically driven pumps located in the port forward corner of the engine room. Two of these were general service (GS) pumps, either one of which could be used as a fire and bilge pump, and one of them could also be used to supply cooling water to the main engines. When built, the original GS pumps were driven by a 5.5 kW electric motor and rated at up to 40 cubic metres per hour. The third engineer said that because of the piping system only one of the GS pumps could be used at a time. The third and largest pump was a ballast pump, which was driven by an 11 kW electric motor and was originally rated at up to 80 cubic metres per hour. Using the large ballast pump required that the larger diesel generator be in service. The ballast tanks could be pumped using the ballast pump or the GS pumps. However, the larger generator was needed to run the ballast pump, so that pump was not usually used and the GS pumps were almost exclusively used to fill or empty the ballast tanks. About one hour was needed to fill or empty the forepeak tank using the smaller pumps, and about 45 minutes to fill the after peak tank to a depth of about 1.5 m.

1.1.11. At the time of the accident, the smaller generator was providing the power to the ship, so the ballast pump could not be used without blacking out the ship to change to the larger generator.

1.1.12. There was fixed piping to the void spaces, the engine room bilges and the steering flat through which the pumps could draw. There was also a bilge suction on the centreline of the bulkhead between the engine room and the crew accommodation space, behind the main switchboard, through which the bilge pump could draw water from the crew accommodation in the event of an accidental flooding, but an engineer said that it was not in the best position and was not used to pump the space. There were 2 portable pumps, one an electrically driven submersible pump and the other a diesel-driven emergency fire and bilge pump that had been transferred from the **Olovaha**. During the fourth voyage of the **Princess Ashika** in Tonga, the fixed fuel transfer system had failed and as a temporary measure, the electrically driven submersible pump was used to transfer fuel oil through flexible hoses. The fault in the fuel transfer pump had not been repaired at the time of the accident voyage, so the electrically driven submersible pump was still being used to transfer fuel.

1.2. Accident voyage

1.2.1. At about 1635 on 5 August 2009, the **Princess Ashika** left Nuku'alofa en route for Ha'afeva in the Ha'apai group of islands to the north. On board were 32 crew including the master, and 96 passengers[2].

1.2.2. The master conned the ship through the shallow areas to the north of Nuku'alofa until about 1730 when he handed over to the first mate. The master then went to sit on the port bridge wing where he talked to the chief engineer. At 1755, about the time that the ship cleared the outer reef, the first mate sent a trip report to coast radio at Nuku'alofa. In that message the following was reported:

> *MV **Princess Ashika** A3Cl2 report that she departed at 1635 hrs from Nuku'alofa bound Ha'afeva, will arrive at 0300 hours/06th, with 45 passengers, 27 crewmembers, 110 tons of cargo, speed 7.5 knots, course 020° True.*

1.2.3. At about 1830, the catering trainee, who held a master class-5 certificate[3], took over the bridge watch from the first mate, who then went to the port bridge wing to talk with the master and chief engineer. Shortly after 1900, the master and chief engineer went to their cabins to sleep and the first mate, who had complained of feeling unwell, had one of the crew bring him some bedding and paracetamol tablets. He took the Panadol™ and lay down on the lee (port) side bridge wing to sleep.

1.2.4. At some point before 2000, probably soon after clearing the outer reef of Nuku'alofa and when exposed to the open sea, the ship started to take water through the bow ramp. In response, the first mate told the watch officer to ask the engineers to pump out the forward ballast tanks, which he did. The third engineer, who was on the 4-to-8 watch, remembered being asked and pumping out those tanks 3 times during his watch.

1.2.5. The ship continued on its course of about 015° (true [T]) 000° (magnetic [M]) at a speed of a little over 7 knots. Hourly, the watch officer marked the ship's position on the GPS track plotter and completed the deck logbook.

1.2.6. Some time shortly before 2000, water was noticed in the crew's accommodation. The bosun and 6 crewmembers used buckets to bail water from that space.

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[2] The number of passengers thought to have been on board changed many times during the SAR phase. After extensive reconciliation, the total number of passengers was calculated to have been 96.

[3] The catering trainee was acting as the officer in charge of the navigation watch and will be referred to as the watch officer for the remainder of the report.

1.2.7. At 2000, deckhand 1 and deckhand 2 took over as lookout and helmsman, rotating between each of those duties at 30-minute intervals. In the engine room, the third engineer handed over the watch to a motorman. Below decks, other crewmembers continued to bail out the crew accommodation and used cloths to plug holes in those parts of the galley and mess room decks that formed part of the cargo deck overhang on the starboard side. The cloth plugs helped to reduce the amount of water ingress due to waves sloshing up through the corroded overhanging deck.

1.2.8. At about 2030, deckhand 1 noticed during his rounds that there was only a small amount of water in the accommodation and the crew had stopped bailing. He also noticed a small amount of water on the cargo deck.

1.2.9. At about 2130, deckhand 1 on his next rounds noticed that the level of water in the crew's accommodation had risen and the crew had resumed bailing. He also noticed that the cloth used to plug the holes in the deck in the mess room and galley area had been displaced by the force of the water hitting the underside of the deck. Deckhand 1 also noticed that the seas were slightly heavier and that the ship had a slight list to starboard.

1.2.10. After each of his rounds made after 2100 and 2200, deckhand 2 reported the extent of the water in the cargo deck to the first mate resting on the bridge wing.

1.2.11. Between 2205 and 2210, a crewmember and the bosun went to the bridge and woke the first mate to report that there was a significant amount of water on the starboard side of the main deck. The first mate went down to the starboard side of the erection deck, the deck immediately above the cargo deck, from where he saw water to a depth of about 500 millimetres (mm) amidships on the starboard side of the cargo deck. The first mate then returned to the wheelhouse and told the watch officer to tell the engineers to pump out the aft starboard water ballast tank. At about 2220, using the bridge-to-engine-room telephone, the watch officer instructed the motorman on watch to start pumping out the aft starboard ballast tank. The first mate returned to the bridge wing to lie down. After another 10 minutes, as had been suggested by the first mate, the watch officer telephoned the motorman to check that the tank was being pumped.

1.2.12. At 2240, deckhand 1 noted during his rounds that the water on the cargo deck was now on the port side and was towards the front of the vessel, indicating that the ship was now trimmed by the head. On his return to the wheelhouse he informed the watch officer of what he had found. At about the same time the second engineer, who was in the passenger cabin playing electronic games, realised that the ship was listing to port. He went to the wheelhouse and telephoned the motorman and ordered him to stop pumping out the after starboard ballast tank.

1.2.13. At about 2300, the chief engineer woke to the sound of water and when he got out of his bunk he stepped into about 200 mm of water on the deck of his cabin, which was on the port side of the crew accommodation close to the stairway up to the cargo deck. As he left his cabin, he saw a steady stream of water pouring down the port side stairs from the cargo deck. Realising that there was danger, he woke the crew who were in the accommodation including one who was travelling with his young son. Because of the water streaming down the port side stairs, he used the starboard side, going out through the mess room area. As he entered the cargo deck, he saw a great deal of water on the port side and he estimated that the ship was listing about 5° to port.

1.2.14. On arrival in the engine room, the chief engineer found a considerable amount of water on the port side. His crew were using the GS pump to pump the water from the engine room, but the level continued to increase. Eventually the flywheel of the port main engine began to pick up water and spray it around the engine room. The chief engineer went to the bridge to advise the master.

1.2.15. At about 2310, deckhand 1 took over the helm and noted that the ship was more difficult to steer than usual. The seas had become heavier, and although the engine room telegraph was still set at full ahead the ship's speed was decreasing.

1.2.16. At about 2320, the bosun woke the first mate again to report that the water on the cargo deck was now on the port side and was increasing in depth even though the crew were bailing it out with buckets. After going down to the cargo deck to check on the situation, the first mate returned to the bridge and told the watch officer to order the engineers to start pumping water back into the after starboard ballast tank. Shortly after, between 2335 and 2340, the first mate woke the master and informed him of the situation. It was reported that at about this time the ingress of water over the port bow had increased and the ship was listing up to 50° to port.

1.2.17. Once on the bridge, the master ordered "slow ahead" on the engines and told the first mate and deckhand 1 to rig the diesel-driven portable fire pump on the cargo deck to pump the water from that deck. The master also ordered an alteration of course to port, back to approximately the original course of 000° (M). Shortly after 2345, the portable fire pump was brought from the engineer's store and placed on some drums on the port side of the cargo deck. The crew did not get the pump to operate. Initially they could not find the necessary hoses then, having jury-rigged a suction hose, they could not start the diesel engine.

1.2.18. Also at about 2345, the chief engineer went to the bridge to inform the master of the amount of water in the engine room, and that the port main engine needed to be stopped because its flywheel was submerged. The chief engineer said that shortly afterwards he heard a wave strike the starboard side, which caused the ship to heel heavily to port. The master instructed the watch officer to call everyone to the muster station. To do this, the watch officer ran down to the passenger deck and from there called to those on deck and in the passenger lounge.

1.2.19. At about 2348, the port engine was stopped. At about this time, the water level in the engine room had risen to cover the electric motors of the GS pump and it too needed to be stopped.

1.2.20. At 2350 on 5 August 2009, the Coast Watch radio station at Nuku'alofa (Nuku'alofa Radio) logged the following call on the international distress frequency 6215 hertz:

> *MAYDAY, MAYDAY, this is* ***Ashika****, A3CI2. We are going to sink in this position 20 degrees 24 minutes south, 174 degrees 56 minutes west.* (see Figures 1 and 6)

The same call was logged (but at 2348) by Taupo Maritime Radio (call sign ZLM) in New Zealand. No further messages were received from the **Princess Ashika**. The operator at ZLM alerted the duty officer of Rescue Coordination Centre New Zealand (RCCNZ).

1.2.21. The vessel continued to list further to port and the seawater started to enter the cargo deck freely through the side openings in the superstructure and over the bulwarks on the forward side of the erection deck. Soon the cargo started to slide towards the port side, further increasing the speed with which the vessel listed to port. At around 2351 the master made an announcement over the public address system (PA) that included an instruction to put on lifejackets.

1.2.22. Almost immediately, the vessel rolled onto its port side, then continued to capsize until it was inverted. There were reports that the starboard propeller continued rotating for some minutes after the ship had capsized. People were variously swept or jumped into the sea as the vessel succumbed.

1.2.23. At 2353, Nuku'alofa Radio logbook showed that the receipt of the mayday call had been confirmed by ZLM. Almost immediately, Nuku'alofa Radio informed another interisland trading ship, the **Pulupaki**, which was behind and following a similar route to that of the **Princess Ashika**. The master of the **Pulupaki** gave an estimated steaming time to the reported sinking position of one hour and 40 minutes.

1.2.24. At 2356 the operator at Nuku'alofa Radio sent out a mayday relay message to all stations asking that all vessels in the vicinity report their positions and intentions. A Tongan fishing vessel nearby, the **Albacoa**, later claimed not to have heard this despite having its radios on and having used them.

1.2.25. As the vessel capsized, the float-free emergency position indicating radio beacon (EPIRB) activated, and at 2359 an unconfirmed beacon distress message was received by RCCNZ. The RCCNZ duty officer requested that a Royal New Zealand Air Force (RNZAF) P3 Orion aircraft be made available to conduct a search.

1.2.26. Reports from survivors indicated that many of the liferafts deployed in a close group as the ship capsized, and these were quickly boarded by survivors. At least 4 liferafts had not inflated and required crew to inflate them manually by pulling the painters. Five of the 6 liferafts that had deployed in a group were lashed together to improve their visibility and survivability. The sixth liferaft had been punctured and was set free.

1.2.27. Almost all the survivors managed to board one of the 5 joined liferafts; however, there was a report that 3 or 4 people were seen on a pack of timber. Their identities and fates were not determined; however, the master and a passenger reported that they had initially taken refuge on a pack of timber before swimming to a nearby liferaft. No other people were seen who had escaped the vessel but not boarded a liferaft.

1.2.28. Some of the crew were aware that the **Pulupaki** was due to pass their position shortly, so they decided to conserve the pyrotechnic flares until the time they estimated the **Pulupaki** would be able to see them.

1.2.29. Earlier, at about 2300, the master of the Tongan fishing vessel the **Albacoa**, which was at anchor and not maintaining a radio watch, had seen the **Princess Ashika** pass close by. The master of the **Albacoa** had switched on his radio to warn the **Princess Ashika** of his anchor lines, but he had received no reply. Later a crewmember on the **Albacoa** saw red flares and assumed that another fishing vessel was trying to get the attention of the **Princess Ashika**. The master of the **Albacoa** did not investigate the flare sighting or report it to Nuku'alofa Radio.

1.2.30. As the **Pulupaki** approached the reported accident location, its master saw lights ahead and slowed the vessel, but the lights turned out to be the lights of the **Albacoa**. The master of the **Pulupaki** informed the master of the **Albacoa**, by very-high-frequency (VHF) radio, that the **Princess Ashika** had sunk, but the **Albacoa** did not join the SAR effort. The master of the **Albacoa** later advised Nuku'alofa Radio that his vessel had not had sufficient fuel to be able to assist. He later claimed that operating in a debris field with poor lighting would have endangered his ship, crew and any survivors swimming in the water. He continued fishing, believing that his station would be useful to any swimming survivors.

1.2.31. The crew of the **Pulupaki** soon came across some empty lifejackets, some with their water-activated lights illuminated, and empty liferafts. No evidence was found to suggest that any survivors had donned lifejackets.

1.2.32. Shortly before 0230, the **Pulupaki** found the survivors in the joined liferafts and they were all rescued by about 0345. At about 0430, about 9 nautical miles west southwest from the sinking location, the **Pulupaki** found 2 more liferafts, including one containing the master and a passenger.

1.2.33. By 0635 on 6 August, 3 vessels were searching for survivors: the **Pulupaki**, the **Capitaine Tasman** and the Tongan naval vessel **Voea Pangai**. All known survivors of the sinking were rescued before daybreak. The only bodies recovered, one male and one female, were found soon after daylight, one by the **Molonai** (transferred to the **Pulupaki** at Ha'afeva for transportation to Pangai) and the other by the **Southern Lily** (transferred to the **Voea Pangai**).

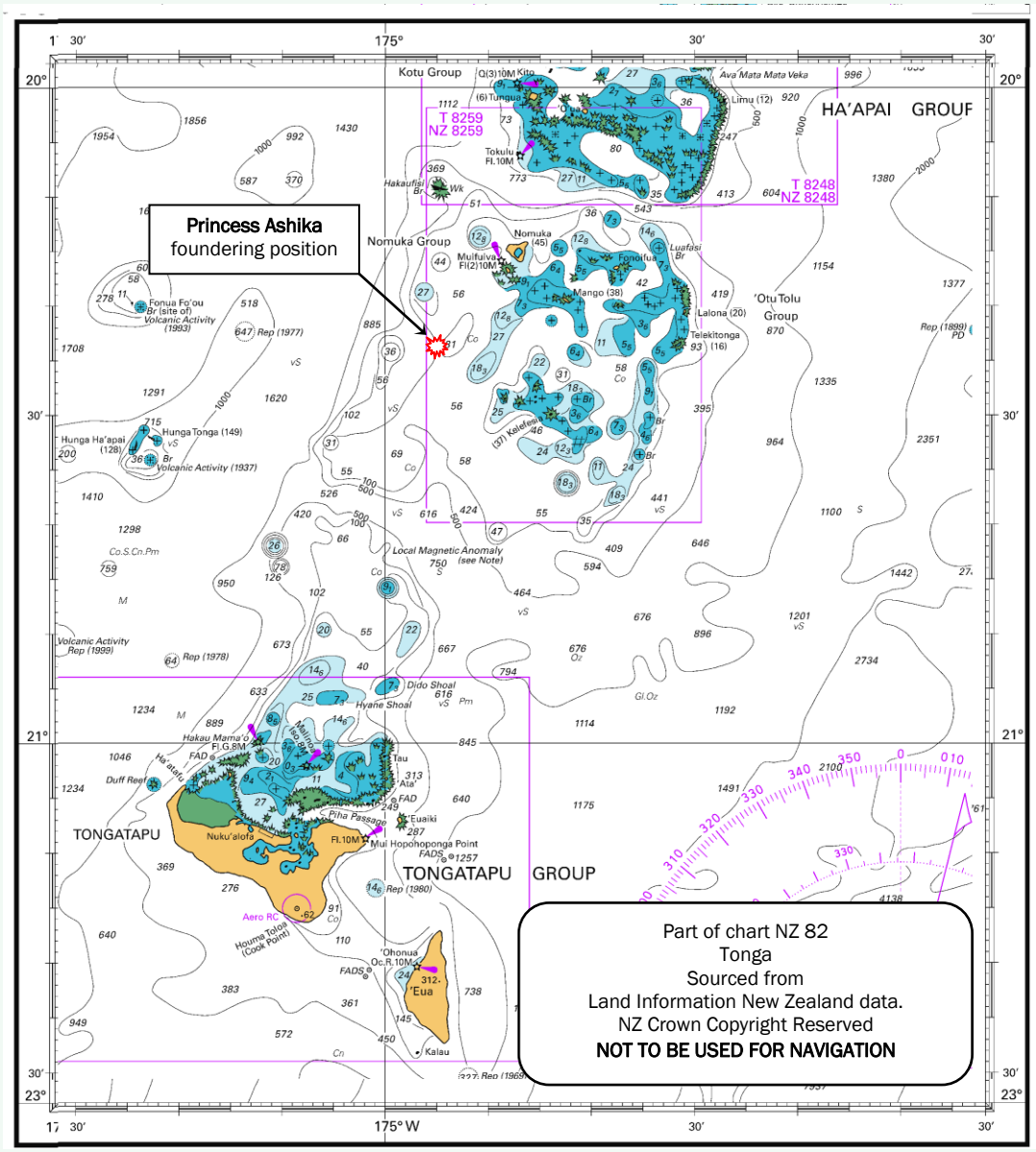


Figure 6 Accident site marked in red, Tongatapu and Ha'apai groups

1.2.34. The early report that the **Pulupaki** had rescued 40 of the initially presumed 45 persons on board resulted in RCCNZ and the RNZAF postponing the departure of a P3 Orion search aeroplane. As soon as it was realised that there had been many more persons on board the **Princess Ashika** than had been manifested, RCCNZ activated the Orion, **Kiwi Rescue 225**, and it departed from New Zealand. **Kiwi Rescue 225** arrived on scene close to daybreak on 6 August, and commenced its search pattern at 0700.

1.2.35. At 0835 a situation report to RCCNZ indicated that there had been 52 persons rescued (it was later determined that that number comprised 28 crewmembers and 24 passengers. This total was later proved to be incorrect with a total of 28 crewmembers and 26 passengers being recovered alive).

1.2.36. The search vessels had been coordinating their actions by radio and advising these to Nuku'alofa Radio, but once **Kiwi Rescue 225** was on the scene, the aeroplane crew coordinated the search and directed the vessels to items of interest. Liferafts from which survivors had already been rescued or that had not been occupied were not recovered initially, which resulted in some confusion as search vessels were sent to check them again.

1.2.37. By 0900, the **Pulupaki**, with all of the known survivors, had left the scene for Ha'afeva and Pangai, where it arrived at 1420 and disembarked the majority of the survivors.

1.2.38. The MV **Southern Lily** joined the search at about 1000. The charter motor yachts **Nai'a** and **Escapade** were later made available at the request of RCCNZ, but only the **Escapade**, which recovered 2 lifejackets (one marked "**Olovaha**"), took part.

1.2.39. At 1106, a Tongan passenger airline, Chathams Pacific, advised RCCNZ that its 3 aeroplanes based in Tonga were available for charter, but those aeroplanes were not used.

1.2.40. At 1344, another Orion, call sign **Kiwi Rescue 238**, joined the search.

1.2.41. At about 1800, the **Capitaine Tasman** and **Southern Lily** were released from the search because of low fuel, and **Kiwi Rescue 238** ceased searching at 1845 and returned to New Zealand. **Kiwi Rescue 225** searched until the end of daylight at 1944 and remained overnight at Nuku'alofa.

1.2.42. By the evening of 6 August, 13 liferafts had been recovered and another seen submerged and possibly snagged on an object. That evening, RCCNZ heard survivors' reports that the ship had rolled over and sunk in a very short time, allowing only those already on the upper deck to escape. That knowledge was a factor in the evolving search plan.

1.2.43. The official search continued for another 9 days, but no further survivors or bodies were found.

1.3. History of the Princess Ashika

The Princess Ashika in Japan, including its design and construction

1.3.1. The **Princess Ashika** was launched at the Shikoku Dockyard, Takamatsu, Japan on 22 July 1972. It was designed to transport passengers and vehicular cargo across the Bisan Seto between Shikoku and Honshu, 2 of the 4 main islands of Japan. At that time ferries were the only means of communication and transport between the islands.

1.3.2. According to the stability book issued when the vessel was launched, the ship was permitted to carry passengers and vehicular cargo in "smooth water" for between 1.5 and 3 hours. A later ship inspection certificate specified voyages of under 1.5 hours. The Japanese Ship Safety Act pictorially prescribed the operating areas (see Figure 7). The "smooth water" areas included harbours, lakes, navigable rivers and sections of the inland sea where the sea conditions were unlikely to become excessively rough.

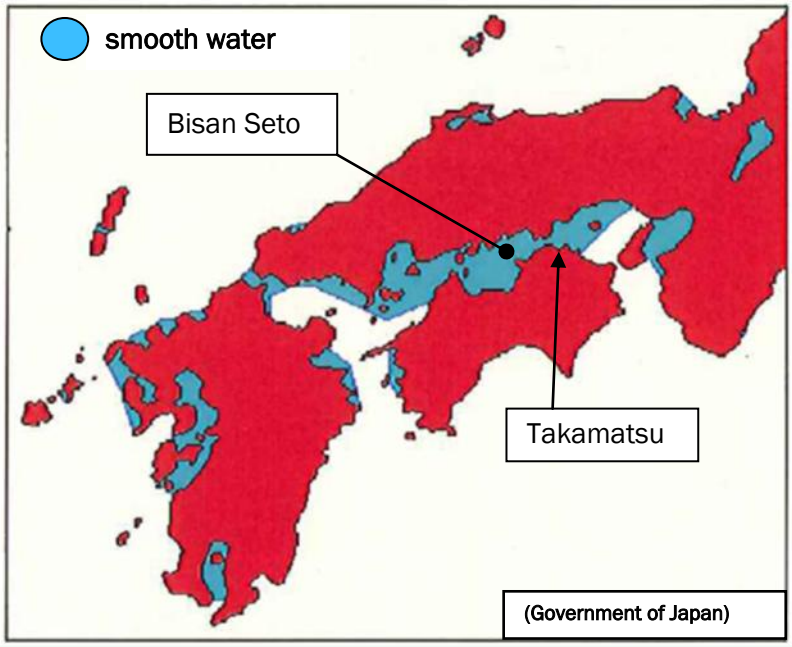


Figure 7 Diagram to show the smooth water areas of operation

1.3.3. There were several design features that suggested the **Princess Ashika** was designed for short trips in sheltered waters:

- the vessel had limited protection against the sea and a limited ability to shed any water that was shipped on the cargo deck
- the height of the bow was less than would have been required by the International Convention on Load Lines, 1966. Under that Convention a vessel engaged on international voyages would require a minimum bow height of about 2.41 m, whereas the height of the bow of the **Princess Ashika** was significantly less, about 1.4 m
- the bow and stern ramps were primarily fitted to provide access to load and discharge vehicles. The ramps did provide a physical barrier to prevent waves washing freely onto the deck. From photographs, it was evident that there was no intention for a rubber seal to be fitted between the ramps and the ship's superstructure, so they could not be considered weathertight as defined in the International Convention on Load Lines 1966 and the International Convention for the Safety of Life at Sea 1974, as amended (SOLAS)[4]
- the flat shape of the bow was not suitable for navigation in open seas and the ramps were never designed to withstand the load impact from "green" seas. The ramps did not represent a continuation of the side casings and therefore did not add to the overall structural strength of the vessel and its ability to withstand waves from ahead or astern. No protection visor was fitted in front of the forward ramp
- the cargo deck was exposed, with the side casings and bulwarks forming a deep open well, with the mid-length portion being slightly lower than the bow and stern owing to the sheer of the deck, and the sides being lower than the centreline owing to the camber of the deck, causing any water that entered the cargo deck to drain towards the sides in the mid-length section. The International Convention on Load Lines required that ample provision be made for rapidly freeing decks of water and for draining them[5]. In this instance, no freeing ports were fitted in the superstructure plating, however on both sides of the cargo deck there were 7 scuppers fitted with

[4] International Convention on Load Lines 1966, Annex I, Regulation 3 and SOLAS, Chapter II-1, Regulation 2.

[5] International Convention on Load Lines, 1966, Annex I, Regulation 24.

non-return devices, each with a nominal diameter of 100 mm. There was no fixed method of pumping water from the cargo deck (Figure 8)

- the external framing for the portion of the cargo deck that overhung the main hull was a potential source of corrosion but, more importantly, in open seas these overhangs would severely increase the ship's coefficient of friction, slowing the vessel, increasing its fuel consumption and reducing its sea-going performance
- the passenger accommodation and services were designed for short voyages and would have been less than ideal for long voyages, particularly with large numbers of passengers
- no automatic pilot was fitted to the steering system, so a crewmember was required to steer manually. At the time of building, few ships that were designed for extended voyages relied exclusively on manual steering
- the drawings available did not show sufficient detail to determine whether the items prescribed in the International Convention on Load Lines[6] relating to the conditions of assignment of freeboard, such as hatchways, doorways, ventilators and air pipes on the exposed cargo deck and the first tier of the superstructure deck (erection deck), met the requirements of the Convention.

1.3.4. The **Princess Ashika** continued to operate in and around the Inland Sea of Japan until the early 1980s, when a bridge and causeway were built between Shikoku and Honshu, resulting in the ferry becoming surplus to requirements. In late 1984 Northwest Shipping Lines and Agencies of Suva, Fiji, bought the **Princess Ashika**.

The Princess Ashika in Fiji

1.3.5. On 24 November 1984, a Fijian tonnage certificate was issued. On 31 December 1984, a certificate of registry was issued to Northwest Shipping for the **Princess Ashika**. The ship often worked between the ports of Natovi Landing on the east coast of Viti Levu, Levuka on the eastern side of the island of Ovalau, Nabouwalu on the southwest coast of Vanua Levu and Ellington Wharf on the north coast of Viti Levu. In later years, its service was limited, by regulatory action, to between Natovi Landing and Buresala on the western side of the island of Ovalau (see Figure 9).

[6] International Convention on Load Lines, 1966, Annex I, Chapter II.

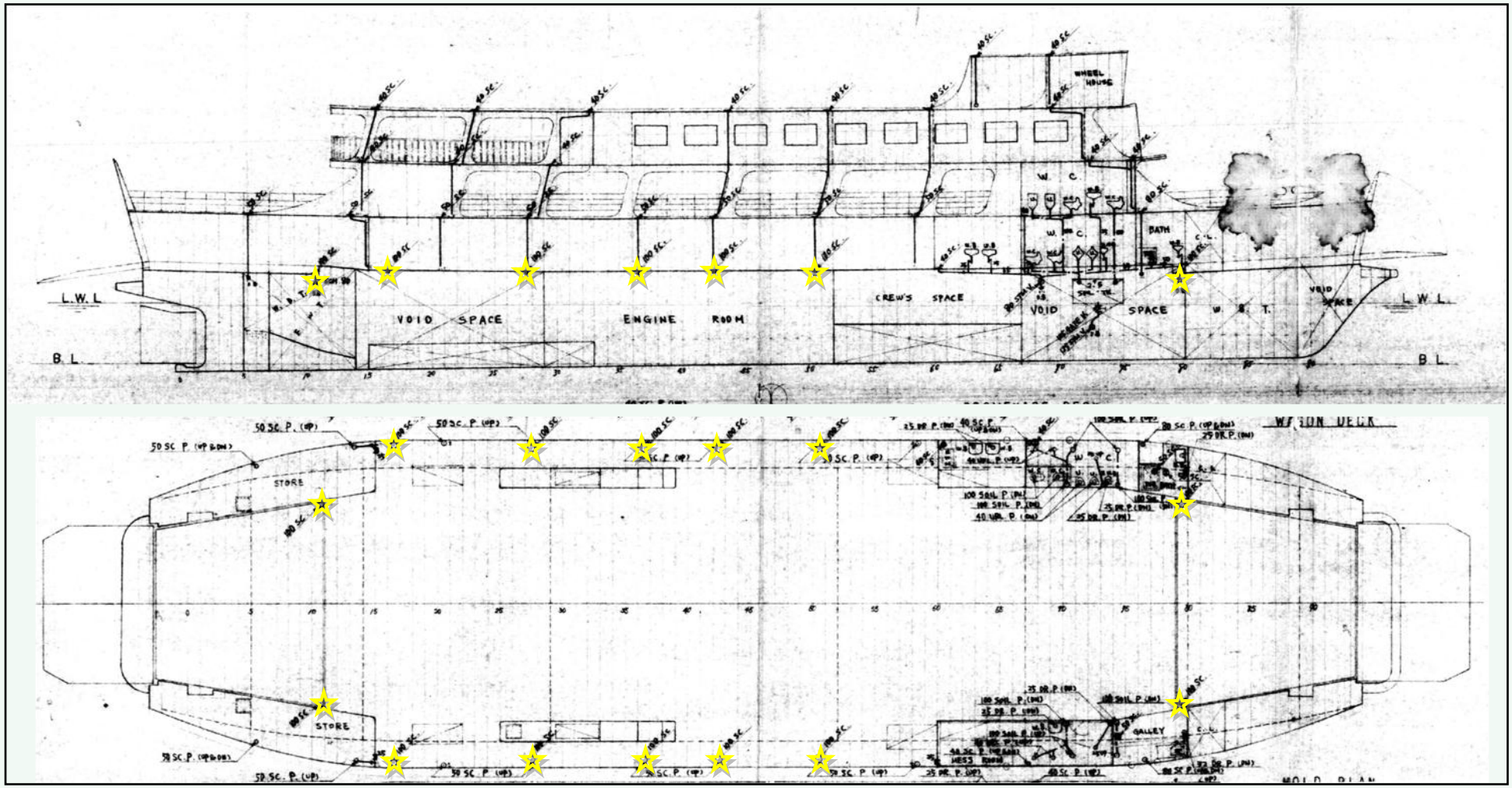


Figure 8 Layout of scuppers on the cargo deck

1.3.6. On 13 March 1985, the principal surveyor of the Fiji Marine Board wrote to Northwest Shipping Lines expressing concerns over the **Princess Ashika**'s suitability for operating around the Fijian islands. The letter stated that, in the case of the **Princess Ashika**, the Marine Board:

> - *Require you to seek the services of a fully qualified Naval Architect to examine your vessel, in relation to the sea and trading conditions under which you currently operate.*
> - *Produce clear stability information, according to IMO recommendations.*
> - *Advise the board as to conversion of the vessel to ensure there can be no danger of the vessel losing stability as a result of flooding of the car deck by heavy seas or trapping of fire fighting water.*
> - *Advise the Board that the vessel can operate safely within the present trade routes after such conversion.*
> - *Advise the Board that proper steps are regularly being taken, each time the ship sails, to ensure that passengers are aware of emergency procedures and that the crew know and understand their emergency duties.*

With regard to the conversion of the vessel, the principal surveyor was of the opinion that:

> *... the vessel should be enclosed to stop water coming over the bow, at the sides; through the sliding doors; and that there should be larger (and non-return) clearing drains through the sponsons amidships on each side to clear any trapped water.*

Records are no longer available, but recent photographs indicate that no modifications were made to the superstructure as suggested by the principal surveyor. Notwithstanding that, the **Princess Ashika** was permitted by the Fiji Marine Board to continue operating.

1.3.7. On 26 July 1988, Patterson Brothers Shipping (Patterson's) took over the ownership of the **Princess Ashika**. Patterson's was a family-owned shipping company founded in 1935. Since 25 March 1983, Patterson's had operated another Ro-Ro passenger vessel, the **Ovalau II**. Both the **Princess Ashika** and the **Ovalau II** operated ferry services throughout the Fijian islands, visiting a variety of ports including Nabouwalu, Suva, Natovi, Levuka, Buresala and Ellington (see Figure 9).

1.3.8. By 1997, the **Princess Ashika** was 27 years old. The ship continued to be surveyed every 6 months and slipped annually according to the Fiji Marine Board's survey requirements. The survey defect list made by the Fiji Marine Board in September 1997 included holes in the plating in the bow, the void spaces and the engine room, all of which required patches to be welded over them. When the ship was slipped in November 1998 and again in September 1999, more holes that needed to be repaired were found in the hull.

1.3.9. In 1999, Patterson's purchased the Ro-Ro ferry **Island Navigator** from the Samoa Shipping Corporation. That ship had been built in Australia in 1977 and was originally named the **Queen Salamasina**. It was 45 m long and had a deadweight of 60 t.

1.3.10. In March 2001, the **Princess Ashika** was slipped for its annual survey. The starboard main engine was fully rebuilt and the port main engine underwent extensive maintenance.

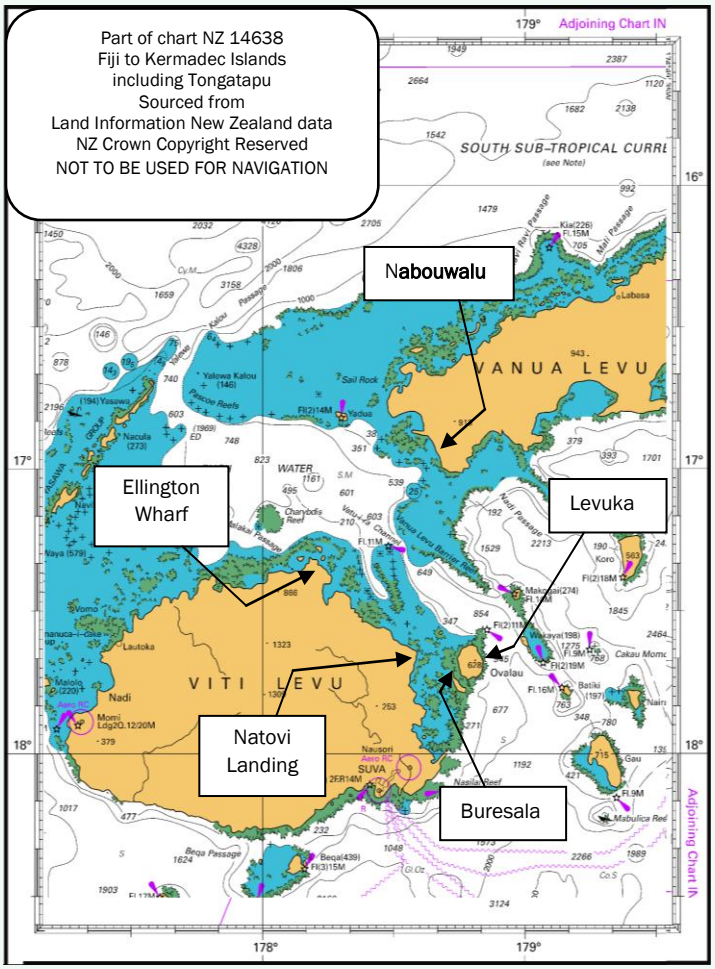


Figure 9 Fijian ports serviced by the Princess Ashika

1.3.11. On 15 October 2002, the director of the Fiji Islands Maritime Safety Administration (FIMSA) sent a letter to Patterson's expressing concern that the ship was being surveyed afloat and was not due to be slipped until March 2003, a period of 2 years since the last slipping. The director recommended that, because of the ship's age and condition, it be slipped immediately or taken out of service until March 2003 when the vessel was to be slipped. On 21 October 2002, Patterson's slipped the **Princess Ashika** as recommended. The hull was thickness tested and several holes in the hull plating were repaired.

1.3.12. On 9 May 2003, following a 6-monthly in-water survey, the ship was restricted to operating between Natovi and Buresala until the survey defects, including several holes in the deck, were rectified. Natovi to Buresala was a distance of about 10 nautical miles through sheltered, shallow water.

1.3.13. On 23 August 2003, another company vessel, the **Ovalau II**, began taking in water through a hole in the engine room shell plating shortly after it had departed Ellington Wharf, Fiji. The ship's engines were stopped and the ship began to drift. About 7 hours later, the **Princess Ashika** arrived on the scene and attempted to tow the **Ovalau II** back to Ellington Wharf. The level of flooding continued to increase, so all of the passengers were taken off the **Ovalau II**. At about 1850, it listed to port and sank in a position about 1.5 nautical miles north of Nananu-i-ra Island.

1.3.14. A Court of Marine Inquiry was held in Fiji into the loss of the **Ovalau II** and its report was published on 5 January 2005. In summary, the report found that the actions of the master and crew had been ineffective in managing the ingress of water. The report also criticised FIMSA because it had not followed the appropriate marine regulations or procedures and had not identified that the hull was heavily corroded, rendering its survey ineffective.

1.3.15. The Inquiry report attributed "the responsibility of the casualty to the owners of the vessel" because it had been their responsibility to see that the vessel was correctly managed in all respects. Leaks that had been discovered in the ship's shell plating had been temporarily repaired using sandwich plates[7], but a permanent repair of the holes was not effected because the ship had not been slipped. The report also stated that the owners of the vessel had been "negligent in the course of their duty to ensure that the **Ovalau II** was maintained in a seaworthy condition, which they failed to do, thus contributing to her unfortunate demise".

1.3.16. When the **Princess Ashika** was slipped for its annual survey on 23 October 2004, a new ballast pipe was fitted for the forepeak tank and extensive repairs were carried out on the ship due to heavy corrosion and wastage of the hull and framing, particularly in the void spaces forward of the engine room.

1.3.17. It was reported that due to the age and condition of the ship, holes continued to form regularly. On 5 July and 5 November 2005, several holes were temporarily repaired by a diver using sandwich plates. These holes were permanently repaired with welded patches when the ship was slipped on 17 November 2005.

1.3.18. The November 2005 slipping addressed many of the annual survey items and hull repairs, but did not fully address all the major machinery items required as part of a 4-yearly survey, such as rudderstock and tail-shaft bearings. Patterson's informed FIMSA that it had a booking for the slipway for March 2006 and intended to address these items at that time.

1.3.19. During the slipping in November 2005, an undated FIMSA memorandum to the shipping officer from the senior engineering surveyor at the time expressed concern over the delays in completing all the survey items, stating in part:

> *Generally speaking, FIMSA has given them [Patterson's] opportune time to prepare themselves for the Four Yearly Survey, especially the machinery aspects.*
>
> *In view of the non-conformity with all that has to be done, I am in a position to say that I would be unethical to call the Ashika a 'safe vessel'.*
>
> *We understand that, the Port State Control inspection and procedures were designed to have stringent measures to eradicate substandard vessels. Flag State nations were to police the operation and manning of such ships. Even for non convention vessels like MV **Temurai** and the sunken **Ovalau II**, just to name a few, would fall under the said category, namely 'SUBSTANDARD'.*
>
> *With the same token, the vessel **ASHIKA** falls in the same category if they do not rectify items under this schedule. It would be suicidal and of course a repetition of the **Ovalau II** saga if we are to re-entertain such procedures that we have erred from.*

1.3.20. Even with that comment, the ship was granted a survey certificate that was valid until the slipping that was scheduled 4 months later.

[7] A sandwich plate was a temporary repair that was placed over a hole in an underwater plate to stop or reduce the amount of water entering a vessel. It consisted of a steel plate with a rubber gasket inside the hull, with the same outside the hull, secured by nuts and bolts through the entire patch.

1.3.21. In March 2006, the slipway in Suva was out of service, so the **Princess Ashika** could not be slipped. Many of the defects noted in the November 2005 survey report were still outstanding, so FIMSA issued a certificate of survey for one month only so the necessary work could be undertaken, allowing for the fact that the slip was unavailable. On 3 March 2006, the director of FIMSA wrote to Patterson's, stating:

> *Close scrutiny of the recent survey records carried out on your company's vessel M.V.* ***ASHIKA*** *have revealed longstanding mechanical and structural defects.*
>
> *Our records show that these items have been outstanding for over two years and promises to rectify them have not eventuated. If given the right conditions it can easily contribute to an undesirable situation.*
>
> *With the unavailability of the Slipway for some time, the only option would be to slip the vessel for repairs in a neighbouring country.*
>
> *In the interest of safety for the travelling public the Fiji Islands Maritime Safety Administration and the Fiji Marine Board have reluctantly decided not to extend the validity of its survey certificate until these pending items are rectified.*

1.3.22. Any of the outstanding items that could be attended to while the vessel was afloat were completed. New shaft seals were purchased and retained on board. On 17 March 2006, the ship was surveyed at Natovi and granted a 3-month survey certificate. The surveyor recommended that the ship be slipped as soon as the slipway became available. A further special survey was conducted on 13 June 2006 and a further one-month certificate granted.

1.3.23. On 21 June 2006, the **Princess Ashika** damaged its starboard propeller on the chain securing a mooring buoy while manoeuvring near the Buresala jetty. This disabled the vessel until it could be repaired.

1.3.24. The ship was slipped at the end of July 2006. The propeller was repaired and the outstanding defects from the November 2005 survey were addressed.

1.3.25. In March 2007, Patterson's purchased the Ro-Ro passenger cargo ferry **Spirit of Harmony** from Japan. It had been built in 1991 and was originally named the **Ferry Sazan**. At 65 m in length and with a deadweight of 558 t, it was much larger than the **Princess Ashika** and it became Patterson's flagship.

1.3.26. During the annual survey of the **Princess Ashika**, on 4 October 2007, the surveyor noted that corrosion on the vessel was "at a very high rate". On 15 October, the surveyor noted that the repairs in the ballast tanks and voids were being done without the removal of the cement boxing, and he declared the repairs to be substandard and marked the survey as incomplete. From 26 November to 13 December, the defects were rectified and the ship's survey was completed on 13 December, with a validity of 6 months.

1.3.27. On 11 June 2008, FIMSA undertook a sight survey of the **Princess Ashika** and a survey certificate was issued for 6 months, when the ship would be slipped again for its annual survey.

1.3.28. Late in 2008, the **Island Navigator** experienced a crankshaft failure in one of its main engines. The cost of replacement parts was prohibitive, so the ship was laid up at anchor in Suva indefinitely.

1.3.29. On 12 November, the **Princess Ashika** began its annual survey on the slipway. The surveyor's notes included the comments:

> *We found 56 holed areas; some had single holes whilst others had multiple holes, which showed the rate of corrosion existing in the vessel was very high since its last dry-docking and annual slip survey*
>
> *Corrosion was widespread invading the whole vessel and had reached a conquering stage, which showed that this vessel should and must be condemned from sea transportation of any nature, since it is a danger to the public and the crew who man her.*

The survey was incomplete at this time and the FIMSA surveyor planned to inspect all of the ship's void spaces and tanks on 15 December. On 16 December, following the inspection of the tanks and void spaces, the surveyor found that the condition of the tanks was poor, with most of them being heavily corroded. He stated:

> *The vessel is now 36 years old and the condition it is in now if allowed to trade will cause a Maritime Disaster and will be the cause of pollution. It is about time the vessel be condemned for good since its condition will continue to deteriorate further. The vessel is beyond repair and is no longer fit for sea service of any nature. We cannot ignore the fact that she is truly unseaworthy.*

The surveyor presented this report to the principal surveyor. The principal surveyor did not entirely agree with this strong viewpoint, stating that it was that particular surveyor's opinion. A different surveyor was assigned to complete the **Princess Ashika**'s survey, during which discussions were held with the ship's owner about ongoing major structural repairs that were considered necessary for the continued operation of the vessel.

1.3.30. The **Princess Ashika** was unslipped on 24 December. However, as soon as the vessel was in the water many leaks in the hull were found, so the vessel was immediately hauled out again in order to repair the holes. Further unsuccessful attempts were made to unslip the vessel on 29 December, 2 January 2009 and 3 January, but on each occasion there was leakage into the hull and the vessel had to be hauled out again. The **Princess Ashika** was successfully unslipped on 5 January.

1.3.31. The survey reports showed that there were weaknesses in the ship's hull plating, which needed to be repaired, and the structural members under the vehicle deck were in such a poor condition that they needed to be replaced. FIMSA had required Patterson's to provide documentary evidence that it was obtaining quotes for the repairs and that the vessel would be slipped at the end of April. On 7 January 2009, Fiji Ships and Heavy Industries Limited provided an estimate of costs of Fiji $56 700 for repairs to the No 1 void space as required by FIMSA surveyors. On receipt of this information and assurances from the owner, a one-month survey certificate was issued on 13 January 2009. Owing to the quantity of lifesaving equipment on board the ship, the **Princess Ashika** was restricted to carrying a maximum of 285 passengers and crew and the certificate was endorsed:

> *Vessel to operate only between Natovi and Buresala with reduced cargo.*

The distance from Natovi to Buresala was only about 8 nautical miles and would have taken about 45 minutes for the **Princess Ashika** to complete the voyage.

1.3.32. In addition, owing to the condition of the ship's shell plating and the concrete patches on the hull in the void spaces, the ship's crew were required physically to enter the void spaces 3 times per day to check visually that there were no leaks in the ship. It was reported that because of the requirement to inspect the void spaces, the manhole covers for the void spaces were only placed over the openings, and either not secured or left with the securing nuts only finger-tight.

1.3.33. On 10 February, a survey was conducted and a survey certificate valid for one month was issued. The quantity of in-service lifesaving equipment was further reduced to a maximum of 160 passengers and crew. The survey certificate endorsement was expanded to include "reduced speed":

> *Vessel to operate only between Natovi and Buresala with reduced cargo at reduced speed.*

The monthly survey certificate was renewed again in March and in April with the same endorsements and passenger numbers. When the certificate expired on 7 May, the owner did not apply to FIMSA for a new survey, so the certificate lapsed. The ship was laid up at anchor at Natovi.

1.3.34. On 22 May, Patterson's wrote to FIMSA, informing it that it was selling the **Princess Ashika** to the Shipping Corporation of Polynesia. Patterson's requested that to allow for the familiarisation of the Tongan crew, the ship's survey certificate be renewed for one month, still only operating between Natovi and Buresala.

1.3.35. FIMSA sent 2 surveyors to Natovi specifically to inspect the ship's void spaces for water ingress and to check the certificates and lifesaving equipment. The principal surveyor instructed the surveyors not to inspect any items other than the void spaces. On 26 May, FIMSA renewed the ship's survey certificate, with the same endorsements, for the period up to 16 June, a period of less than 3 weeks.

1.3.36. In early June, with 6 Tongan crewmembers on board, the ship made a number of runs from Natovi Landing to Buresala. On or about 6 June, the ship sailed from Natovi to Suva, encountering moderate weather during which it shipped some water onto the cargo deck.

1.3.37. The ship was deleted from the Fiji registry on 9 June 2009.

Purchase by the Government of Tonga

1.3.38. Towards the end of 2008, the Minister of Transport was made aware that the building of a new ferry to replace the **Olovaha** by the Japanese International Co-operation Agency had been delayed. There had been delays in the tendering process and some of the aid money for this project had been diverted to provide a new hospital. Therefore, the new, larger ferry was not due to enter service until late 2010.

1.3.39. On 17 March 2009, the board of Shipping Corporation of Polynesia acknowledged that the **Olovaha** was becoming increasingly unreliable and that an interim vessel would be required until the new ship arrived. In the previous 12 months, the **Olovaha** had experienced a number of operating problems, including fuel contamination, corrosion in the ballast and water piping, clutch problems that prevented one main engine from running astern, and an engine room fire in December 2008 that had disabled most of the ship's automated systems.

1.3.40. At the March meeting, the board considered 2 options: spend significant additional resources to keep the **Olovaha** in service; or buy a temporary replacement for the **Olovaha** until the new Japanese ferry arrived. After analysing the costs, the board determined to replace the **Olovaha** with a temporary vessel.

1.3.41. The managing director of the Shipping Corporation of Polynesia began to search for a suitable replacement. He used internet resources to search and contacted several shipbrokers in the region. One shipbroker informed him that Patterson's in Fiji had a vessel, the **Island Navigator**, that might be suitable.

1.3.42. Before going to Fiji, the managing director of the Shipping Corporation of Polynesia met with the Tongan director of marine and ports, to find out what documentation he should sight. The standard list he was given included the tonnage certificate, load-line certificate, radio certificate, current survey certificate, dry dock report and other charts and publications.

1.3.43. On 24 March, the managing director of the Shipping Corporation of Polynesia travelled to Fiji to inspect the **Island Navigator**. He immediately decided that the ship was too small and would be unsuitable for use in Tonga. Furthermore, based on his experience with the **Olovaha**'s engine problems, he was very concerned about the need for the crankshaft to be replaced on the **Island Navigator**. Patterson's informed the managing director that it had another vessel available that was surplus to its requirements, the **Princess Ashika** (see Figure 10).

1.3.44. On 25 March, the managing director visited the **Princess Ashika** and took a return voyage from Natovi to Buresala on board the ferry. While on board, he used a checklist, which had been prepared for the **Olovaha**, to record the ship's characteristics. He later said that he had also sighted the ship's certificates.

1.3.45. On 26 March, back in Suva, Patterson's made the ship's file available for inspection by the managing director of the Shipping Corporation of Polynesia and he said that he had checked the ship's maintenance records to assess the reliability of its machinery. He did not complete the comprehensive check of the certificates and documentation that the director of marine and ports had suggested.

1.3.46. On 27 March, the managing director of the Shipping Corporation of Polynesia returned to Tonga. He had been impressed with what he saw of the **Princess Ashika** and considered that it would be ideal to replace the **Olovaha**.

Figure 10 The Princess Ashika in Fiji in March 2009

1.3.47. On 30 March, the managing director of the Shipping Corporation of Polynesia met with the director of marine and ports to discuss the process for bringing a ship in from overseas and registering it in Tonga. He told the director that the ship was in "good condition" and showed him a checklist that was headed:

> **"Princess Ashika IMO 385168**
>
> **50m x 11m x 3.5@GT 680 tonnes 390 pax 15 crew 370 tonnes cargo**
>
> **Survey December 2008 Valid to December 2010 – Fiji Marine Board – Rusiate Waqa"**

On analysis, the heading information was incorrect because:

- the FIMSA survey certificate that was valid at that time had restricted the ship to a 160 total complement of passengers and crew

- due to weight growth of the ship, the deadweight of the ship should have been lower than the original 222.99 t. The 370 t of cargo were probably calculated wrongly by subtracting the net tonnage of 301.33 from the gross tonnage of 677.15, which gave a figure of 375.82
- there was never a survey issued in December 2008. The nearest survey to that date was that for which a certificate was issued on 12 January 2009, valid for one month
- Rusiate Waqa was a Fijian radio surveyor (he had signed the June 2008 radio survey report), not a marine surveyor.

It is unclear where the managing director obtained this, mostly incorrect, information.

1.3.48. Later, a number of revised versions of this checklist, often referred to as the "2008 survey checklist" (see Appendix 1) were presented by the managing director of the Shipping Corporation of Polynesia as part of bundles of documents used to support the purchase of the **Princess Ashika** and to obtain Tongan certification for the ship.

1.3.49. On 6 April, the managing director of the Shipping Corporation of Polynesia returned to Fiji with a gearbox technician, who had been temporarily employed by Shipping Corporation of Polynesia to assist with the maintenance of the **Olovaha**, to re-inspect the **Princess Ashika**. Because of his experience with mechanical problems on the **Olovaha**, the managing director of the Shipping Corporation of Polynesia was particularly concerned about the mechanical reliability of the **Princess Ashika**, so he requested that a marine diesel fitter, who was already in Fiji on another assignment, join them in the inspection of the engines, gearboxes and associated equipment. The 3 men sailed with the ship from Natovi to Levuka and stayed overnight at a property owned by Patterson's, before returning to Natovi on the ship the following day.

1.3.50. Based on this inspection trip, the managing director of the Shipping Corporation of Polynesia prepared an "audit report" (see Appendix 2). This "audit report" stated that the ship's certificates had been reviewed and the previous dry docking report checked. It also implied that the ship's structure, void spaces and tanks had been inspected during the trip. The "audit report" included, in summary:

> *While built in '72 in Japan the **Princess Ashika** is an example of good preventative maintenance. The vessel's 'easy' design has enabled excellent engine room management on a 'day to day' basis. While rust is expected in a vessel of any age the rust has been minimised in all structural areas and painting is ongoing.*

This "audit report" became part of the bundle of documents that was used to support the purchase of the **Princess Ashika**. In some instances, the report identified the Shipping Corporation of Polynesia managing director, the gearbox technician and the marine diesel fitter who conducted the inspection, but the report was not signed by them. In other instances, the "audit report" had signatures alongside the names, and on a further occasion there was a "pp" before the marine diesel fitter's signature. The managing director of the Shipping Corporation of Polynesia later confirmed that he had added the marine diesel fitter's signature without that person's consent or knowledge.

1.3.51. The managing director of the Shipping Corporation of Polynesia returned to Tonga on 10 April. He amended the original "2008 survey checklist" to include additional information, erroneously stating that the ship had a 6-month survey due in May 2009 (see Appendix 3). He also noted, with regard to the bow ramp, "No need for seals as the ramp closure is well above the water unlike the **Olovaha**".

1.3.52. On 17 April, the managing director of the Shipping Corporation of Polynesia wrote a letter to the Minister of Transport concerning the replacement of the **Olovaha**. He provided supporting documentation including the "2008 survey checklist" and "audit report" mentioned above, and a financial analysis of the costs of the replacement vessel compared with the cost of retaining the **Olovaha**.

1.3.53. On 20 April, the Minister of Transport and the Minister of Finance and National Planning, who was also the Minister of Public Enterprises and Information, submitted to the Cabinet a memorandum supporting the purchase of the **Princess Ashika** (see Appendix 4). They included the information submitted by the managing director of the Shipping Corporation of Polynesia. In their submission the Ministers recommended:

> *That the Ministry of Transport complete due diligence on the technical suitability and sea worthiness of the M.V **Princess Ashika**.*
>
> *That, subject to the successful completion of (1) above, the Minister of Finance and National Planning source funding for the purchase of the vessel and for any requirements to ensure rapid deployment into service.*
>
> *That, subject to the successful completion of (2) above, the Minister of Public Enterprises and Information and the Ministry of Transport determine the ownership and on-lease of the vessel to the Shipping Corporation of Polynesia.*

1.3.54. At the board meeting of 21 April, the managing director of the Shipping Corporation of Polynesia presented his findings to the board. Included in the managing director's information was the "audit report" of the **Princess Ashika**, which suggested that the vessel was suitable. The board unanimously agreed to:

> *1. recommend to H.M. Government that they purchase the m.v. **Princess Ashika**;*
>
> *2. remit to the Managing Director to negotiate with H.M. Government (for submission to the board for approval) terms for a Time Charter by Demise of the new vessel to Shipping Corporation of Polynesia, preferably in NYPE (New York Produce Exchange) format;*
>
> *3. authorise the Managing Director to travel to Fiji as required to assist with survey, inspection and acquisition of the new vessel.*

1.3.55. Following the board meeting, the managing director of the Shipping Corporation of Polynesia wrote to the Minister of Transport suggesting that ownership by the Government of Tonga would be the best option. He also wrote to the Minister of Public Enterprises, informing him that:

> *After having reviewed the information relating to '**Princess Ashika**', this option meets the needs of the Government of Tonga with reliability and capacity.*

1.3.56. On 23 April, the Cabinet of the Government of Tonga discussed the submission to the Cabinet recommending the replacement of the **Olovaha** and decided, in Cabinet Decision No 300:

> *1 That the report from Ministry of Transport on the Vessel to Replace the MV **Olovaha** be noted.*
>
> *2. That the Hon. Minister of Transport, assisted by the Hon. Attorney General & Minister of Justice to proceed with the arrangements to do with MV **Princess Ashika** and because of the urgency of this matter, that necessary deposit and other financial arrangements be finalised with the Hon. Minister of Finance, National Planning and Information, who is hereby authorized to endorse or otherwise the proposed transaction, and a report be later tabled in Cabinet.*

3. *That discussions with the Government of Japan to continue to ascertain that there are no further delays on the delivery of the new ferry to replace the MV* ***Olovaha****.*

1.3.57. On the week ending 24 April, the managing director of the Shipping Corporation of Polynesia gave the director of marine and ports information on the **Princess Ashika**, including a copy of the "2008 survey checklist". The review document prepared by the managing director of the Shipping Corporation of Polynesia showed that all of the appropriate certificates, including the current survey certificate, were in order. He also indicated that the bow ramp would be sealed and watertight, and that only the stern ramp would be used.

1.3.58. On 6 May, the Minister of Transport wrote to the Crown solicitor [solicitor-general] to request a legal opinion of the sale and purchase documents. On 7 May, the solicitor-general replied, highlighting several issues that had not been adequately addressed and that would not stand up to audit scrutiny. These issues included no documented Cabinet approval for the purchase and a concern that:

> *... the Marine and Ports division of your Ministry has not conducted the auditing of the vessel. As the Governments shipping experts, who should at least endorse the audit conducted by consultants.*

The Minister of Transport replied, stating that he had undertaken due diligence on the survey documents supplied from the Fiji Ministry, the latest survey of December 2008 and the audit report of the engineers. He added that the Ministry was satisfied that the **Princess Ashika** met all of its seaworthiness and mechanical requirements.

1.3.59. At that time, however, the Tonga Ministry of Transport had not been in contact with FIMSA to obtain a copy of the ship's file or survey records, and no surveyors from Tonga had seen the vessel. All of the information that the Minister had received had been provided to him by the managing director of the Shipping Corporation of Polynesia.

1.3.60. On 8 May, the managing director of the Shipping Corporation of Polynesia sent a signed copy of the purchase agreement to Patterson's to be finalised. The agreed purchase price was Fiji $600 000. A deposit of Fiji $90 000 was paid on 8 May, once the purchase agreement had been signed.

1.3.61. The Procurement Committee was first contacted about the purchase of the **Princess Ashika** on 11 May 2009. The only information the Committee was given was a copy of the Cabinet decision of 23 April 2009, in which the Cabinet had decided to purchase the **Princess Ashika**, and a copy of the signed sale and purchase agreement that had been already faxed to Fiji before 8 May 2009. The Procurement Committee requested further documentation on 12 May 2009 and was provided with that sometime after 13 May 2009.

1.3.62. The documentation was reviewed by members of the Committee, who later said they had discussed their concerns that the required process for such a large procurement had been bypassed and that the Cabinet had already agreed to the purchase of the vessel. On 1 June 2009, the Procurement Committee advised the Ministry of Transport that it had approved the contract for the purchase of the vessel.

1.3.63. On the same day, 6 crewmembers, including the first mate, second engineer, bosun, 2 deckhands and a motorman, were sent to Fiji to familiarise themselves with the ship and to be part of the delivery voyage crew.

1.3.64. On 3 June, the managing director of the Shipping Corporation of Polynesia returned to Fiji to finalise the purchase.

1.3.65. The same day, Patterson's wrote to FIMSA to inform it that it was in the final stages of selling the **Princess Ashika** and it requested that the ship be deleted from the Fiji register.

1.3.66. On 5 June, the purchase of the vessel was finalised and the remaining Fiji $510 000 was transferred into Patterson's' bank account in Fiji.

1.3.67. The next day, the **Princess Ashika** sailed from Natovi to Suva. The weather experienced was moderate, and small amounts of water entered the cargo deck.

1.3.68. On 9 June, the **Princess Ashika** was deleted from the Fijian ship register. Before it was legally able to undertake any further voyages, the ship needed to be registered. Therefore, on 8 June, the managing director of the Shipping Corporation of Polynesia completed an Application for a Registration of a Tongan Vessel form, onto which the word "provisional" had been handwritten. To support the application, a number of documents were presented, including copies of:

- the Fijian survey certificate for the period 9 April 2009 to 7 May 2009 (see Figure 11)
- another Fijian survey certificate for the period 19 December 2006 to 17 January 2007
- the "2008 survey checklist"
- an unsigned version of the "audit report".

1.3.69. In a later comparison with the FIMSA file copy of the Fijian survey certificate for the period 9 April 2009 to 7 May 2009 (see Figure 11 and Appendix 9), it was evident that the endorsement section of the certificate that accompanied the application had been altered by obliterating the restriction:

> *Vessel to operate only between Natovi and Buresala with reduced cargo at reduced speed.*

1.3.70. At the same time, the managing director of the Shipping Corporation of Polynesia made an application for a safe manning certificate for the delivery voyage. Two Fijian safe manning certificates, dated 9 May 2006 and 17 June 2008, and a list of the proposed crew and their qualifications were used as supporting documentation.

1.3.71. On receipt of the applications, the director of marine and ports, Tonga issued a provisional certificate of registration (see Appendix 5), a provisional minimum safe manning certificate for the voyage (see Appendix 6) and a dispensation under SOLAS Regulation 4 (a) Part A of Chapter 1 for the delivery voyage (see Appendix 7).

1.3.72. The Prime Minister's Office allocated it a provisional radio call sign A3CI2 for the voyage to Tonga (see Appendix 8).

Delivery voyage from Fiji

1.3.73. On 10 June, the **Princess Ashika** departed Suva, bound for Tonga, a distance of 411 nautical miles. A total crew of 13, comprising the existing Fijian master and Fijian chief engineer, 2 mates, 3 other engineers, a bosun, a greaser and 4 able seamen, was on board for the delivery voyage. Six of the crew were from Tonga and the rest were from Fiji. The ship did not carry any cargo or passengers.

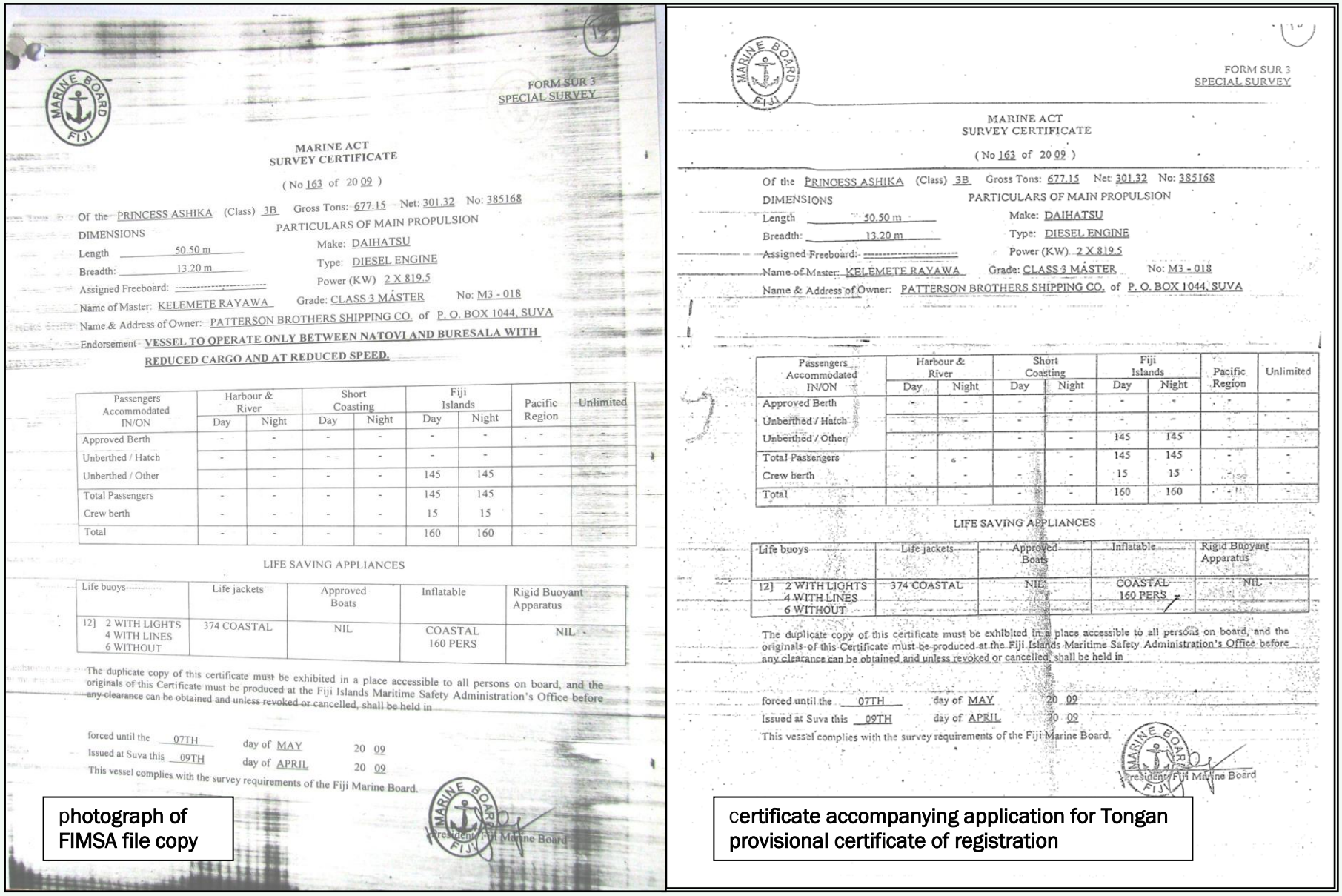
1.3.74. While the ship was still in Suva Bay, the crew attempted to haul the starboard anchor using the windlass, but the anchor cable failed and the anchor and remaining cable were lost. They could not be recovered so were left on the bottom of the bay.

1.3.75. As the voyage progressed, the weather deteriorated. The winds were up to 35 knots from the east and the seas were rough. The ship was pitching heavily and taking on water as spray over the bow ramp and the open sides of the vehicle deck, and green water from under the bow ramp, past the hinges. The water flowed out of the vehicle deck through the open scuppers, but also came in through them when waves struck the underside of the overhanging portion of the cargo deck. Water found its way down the stairs into the crew's accommodation and into the engine room. The crew bailed the water from the accommodation using buckets, and the engine room was pumped using the fixed bilge pump.

1.3.76. On 12 June, about 2 days into the voyage after they had passed the island of Valoa (see Figure 1, page 1) and were over halfway to Tonga, the pounding of the sea stove in the bow ramp and caused the lugs holding the bottle screws onto the ship's structure to tear free, which allowed the ramp to fall open.

1.3.77. The crew slowed the ship and turned it around to put the weather astern. They then closed the ramp again by passing a mooring line around it and hauling it up using a mooring winch. The mooring line was secured and remained in place to keep the ramp closed. At about the same time, the stern ramp also fell open. It had been held closed using the brakes on the after winches but these had come loose, allowing the ramp slowly to open. That too, was hauled closed and secured with a rope around its exterior.

1.3.78. Despite being closer to Tonga than Fiji, the master elected to return to Fiji for repairs. This put the weather astern and reduced the chance of more damage to the bow ramp and the continued ingress of water. On 13 June, the **Princess Ashika** arrived back in Suva and berthed at a lay-up berth near the slipway.



FORM SUR 3
SPECIAL SURVEY

MARINE ACT
SURVEY CERTIFICATE

(No 163 of 20 09)

Of the PRINCESS ASHIKA (Class) 3B Gross Tons: 677.15 Net: 301.32 No: 385168

DIMENSIONS
Length 50.50 m
Breadth: 13.20 m
Assigned Freeboard: ----------

PARTICULARS OF MAIN PROPULSION
Make: DAIHATSU
Type: DIESEL ENGINE
Power (KW) 2 X 819.5

Name of Master: KELEMETE RAYAWA Grade: CLASS 3 MASTER No: M3 - 018

Name & Address of Owner: PATTERSON BROTHERS SHIPPING CO. of P. O. BOX 1044, SUVA

Endorsement VESSEL TO OPERATE ONLY BETWEEN NATOVI AND BURESALA WITH REDUCED CARGO AND AT REDUCED SPEED.

Passengers Accommodated IN/ON	Harbour & River		Short Coasting		Fiji Islands		Pacific Region	Unlimited
	Day	Night	Day	Night	Day	Night		
Approved Berth	-	-	-	-	-	-	-	-
Unberthed / Hatch	-	-	-	-	-	-	-	-
Unberthed / Other	-	-	-	-	145	145	-	-
Total Passengers	-	-	-	-	145	145	-	-
Crew berth	-	-	-	-	15	15	-	-
Total	-	-	-	-	160	160	-	-

LIFE SAVING APPLIANCES

Life buoys	Life jackets	Approved Boats	Inflatable	Rigid Buoyant Apparatus
12] 2 WITH LIGHTS 4 WITH LINES 6 WITHOUT	374 COASTAL	NIL	COASTAL 160 PERS	NIL

The duplicate copy of this certificate must be exhibited in a place accessible to all persons on board, and the originals of this Certificate must be produced at the Fiji Islands Maritime Safety Administration's Office before any clearance can be obtained and unless revoked or cancelled, shall be held in

forced until the 07TH day of MAY 20 09
Issued at Suva this 09TH day of APRIL 20 09
This vessel complies with the survey requirements of the Fiji Marine Board.

President, Fiji Marine Board

photograph of FIMSA file copy

certificate accompanying application for Tongan provisional certificate of registration

Figure 11 Fijian survey certificates issued 09 April 2009

1.3.79. Welders from Patterson's repaired the bow ramp by cutting it vertically along its centreline, before straightening it, re-welding it and using doubling plates to reinforce the repaired section. To prevent the ramp falling open again should the ship encounter heavy seas, the shore workers welded lengths of angle iron between the side casings and the inside of the ramp to hold the ramp closed and also to reduce the ingress of water (see Figure 12). To further reduce the ingress of water, the gap at the base of the bow ramp was filled with cement. While these repairs were being carried out, the crew replaced the starboard anchor, which had been recovered from the harbour.

Figure 12 Welded bow ramp with cement covering the hinge

1.3.80. On 29 June, the **Princess Ashika** again departed Suva for Tonga. The weather on this voyage was much calmer than on the first voyage and the ship made good about 10 knots throughout the voyage.

Service in Tonga

1.3.81. At about 0600 on 1 July 2009, the **Princess Ashika** arrived in Nuku'alofa, Tonga, initially berthing at Queen Salote wharf, before moving to number 3 berth at about 1030.

1.3.82. On 2 July, 3 surveyors from the Marine and Ports division conducted a certification survey using checklists that they had prepared for the task. The senior engineering surveyor inspected the engine room and tested some of the ship's machinery. He checked the operation of the main engines, generators and the ballast and bilge pumps. He was satisfied with the condition of the machinery. After surveying the engine room, he accompanied the deck surveyors and noted that the side plating was very thin.

1.3.83. The senior deck surveyor examined the cargo deck, void spaces, crew accommodation and deck machinery while the other deck surveyor examined the ship's documentation and inspected the lifesaving equipment and the wheelhouse.

1.3.84. The senior deck surveyor was very concerned about the condition of the ship. He reported that it was very rusty and there were patches welded to the deck. He noticed several rust holes through the side of the ship above the waterline. He also noticed that the deck scuppers had no flap or non-return arrangement to prevent water coming in through them. In addition, he noted the cargo ramps did not close properly and did not seal (see Figure 13) and the void spaces were heavily corroded (see Figures 14 and 15).

Figure 13 Ramp not fully closed

1.3.85. The senior deck surveyor remembered having seen the ship on the slip in Fiji several years earlier and at that time he had noticed a watermark above the load line, suggesting that the ship's load line was usually submerged. On 2 July, as part of his survey, he specifically checked the load line and found it to be submerged (see Figure 16). At that time, the ship had on board no cargo, the remaining fuel from the delivery voyage, an unknown amount of fresh water and an unknown amount of ballast water.

1.3.86. The surveyors found that there was insufficient safety equipment on board the ship for the intended number of passengers, so the Shipping Corporation of Polynesia staff transferred fire extinguishers, lifebuoys, a diesel-driven portable fire and bilge pump, portable radios, liferafts and lifejackets from the **Olovaha** to the **Princess Ashika**.

1.3.87. During 2 July, a welder from the Shipping Corporation of Polynesia workshop built up the gear teeth on the starboard anchor windlass because the teeth were heavily corroded and worn to the extent that the rope drum could not be effectively engaged.

1.3.88. At about 1300, the surveyors left the ship and returned to their office to finalise their survey report and defect list. At about 1700, the crew began loading cargo for the first voyage.

Figure 14 Corroded void space

Figure 15 Hole in deck above No 1 void space

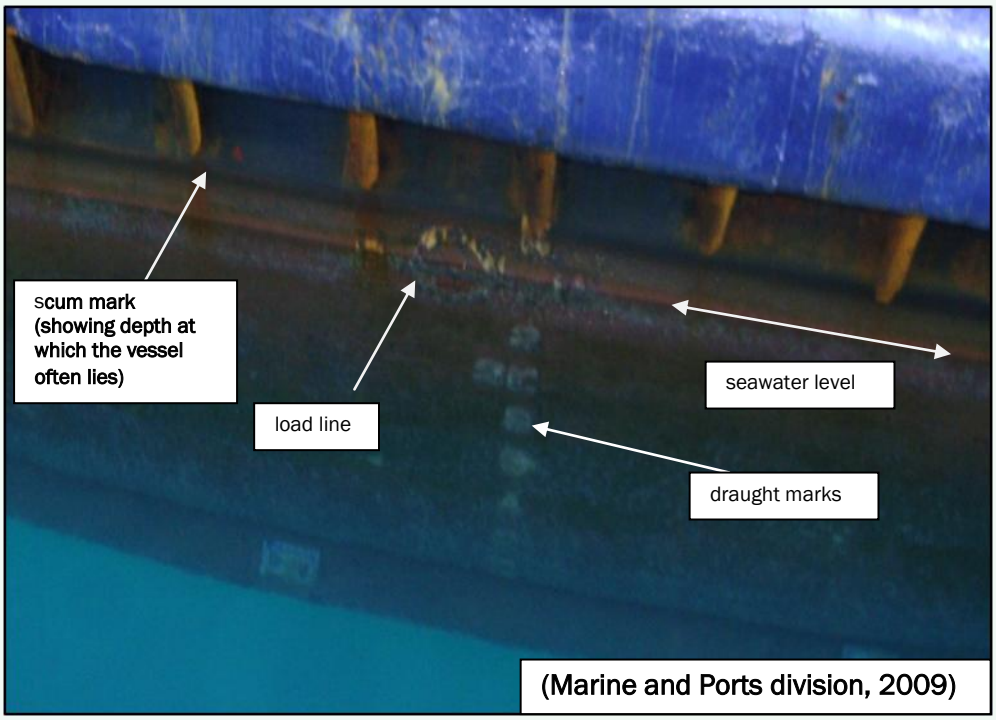


Figure 16 Submerged load line on 2 July 2009

1.3.89. On 3 July, the acting director of marine and ports met 2 of the surveyors to discuss the survey and to consolidate the survey findings. While they were meeting, the **Princess Ashika** was prepared for departure on its first commercial voyage in Tonga, carrying delegates from a church conference back to their home islands. At about 1100, the **Princess Ashika** was shifted from the cargo ramp at number 3 wharf to starboard side alongside number 4 wharf by means of its mooring lines. After the ship had been moved, several government ministers and church elders held a prayer service on board the ship before its departure

1.3.90. A provisional certificate of survey (see Appendix 9 page 1) was issued for the ship under section 126 of the Shipping Act, signed by the acting director of marine and ports and dated 2 July. This certificate stated:

> *This is to certify that **Princess Ashika** has been surveyed and declare that the Tonnage registration of the said vessel is 677.15 and that the condition of the Hull, Rigging, Tackle, Boats and Machinery is such as to comply with the provisions of the Shipping Act. The above vessel as far as can be ascertained is considered to be seaworthy.*

1.3.91. Attached to the provisional certificate of survey was a survey report and defect list dated 3 July (see Appendix 10). The acting director of marine and ports had endorsed the defect list in his own handwriting to reinforce 4 serious issues. They were:

1. *The bow and stern ramp must be watertight to the satisfaction of the surveyor before departure.*
2. *Also the scuppers must be repaired to surveyors satisfaction.*
3. *Load line must not be submerged in any case on departure.*
4. *Any other item that may be advised by the surveyor on the spot.*

1.3.92. Also on 3 July, the acting director of marine and ports signed a new provisional certificate of registration, valid until 2 October 2009 (see Appendix 11).

1.3.93. At about 1200, the **Princess Ashika** departed. The trip report message sent to Nuku'alofa Radio indicated that departure was at 1145 and that there were 320 passengers and 300 t of cargo on board. The Port Authority of Tonga departure clearance form indicated that there were 340 passengers and 342 t of cargo; the ship's manifest indicated 341.4 t and 300 passengers. When the vessel arrived at Ha'afeva, the Marine and Ports representative and the local police officer counted 367 passengers.

1.3.94. It is unclear whether the provisional certificate of survey and the endorsed defect list had been handed to the master before the ship sailed. It is possible that the provisional certificate of survey dated 2 July had been presented to Shipping Corporation of Polynesia on the afternoon of 2 July together with the typed defect list without the endorsements by the acting director for marine and ports. Nevertheless, the ship sailed before the Marine and Ports surveyor could return to the ship to check whether the additional, handwritten, defects had been addressed.

1.3.95. The managing director of the Shipping Corporation of Polynesia realised that the ship had sailed before it had been cleared by the Marine and Ports surveyors, so he wrote an unaddressed letter, which was almost certainly intended for the acting director for marine and ports. The letter commented on the action taken to address the additional handwritten defects, which were:

1. *The scuppers as carried out on the Fiji voyage were temporarily sealed and steps are being taken for installing non-return valves.*
2. *The Bow and Stern Ramp were temporarily sealed.*
3. *The Bow ramp will be permanently sealed.*
4. *The passenger/crew manifest declaration as 302 in total.*
5. *The total tonnage on the manifest is 100 tonnes.*
6. *Manifests lodged with Port Authority.*

The letter also stated that the master attested to the above information. The master, when asked later, could not remember making such comments or agreeing to them. Neither could the master remember being given a copy of the letter, even though the letter indicated that he had received a copy. The master was unaware of any remedial work carried out before the vessel sailed on its first voyage, with the exception that a forklift was used to assist in closing the stern ramp by pushing on it so that it could be more tightly closed.

1.3.96. During the first voyage, superstructure plating on the starboard side of the cargo deck became holed when struck by waves. On 6 July, when the **Princess Ashika** returned to Nuku'alofa, welders from the Shipping Corporation of Polynesia workshop cut out a section of heavily corroded plate around the holed area and welded new plates in place.

1.3.97. On 9 July, the ship took 18 000 litres of diesel fuel oil bunkers before it sailed from Nuku'alofa on its second voyage to Ha'apai and Vava'u. The Port Authority of Tonga's departure clearance for that voyage indicated that there were 220 t of cargo and 56 passengers on board. The master, in consultation with the managing director of the Shipping Corporation of Polynesia, decided that because of the shallow and shelving berths in Ha'afeva and the Niuas, they would need to use the bow ramp because it was longer and would also reduce the possibility of damage to the propellers and rudders. As a result, during the return voyage to Nuku'alofa, the master ordered the ship's crew to return the bow ramp to service by chipping away the cement from the lower part of the ramp and around the hinges. This was contrary to the assurance in the letter from the managing director of the Shipping Corporation of Polynesia on 3 July that the bow ramp would be permanently sealed.

1.3.98. While the ship was away from Nuku'alofa on the second voyage, the Shipping Corporation of Polynesia workshop staff prepared materials to repair the ship's decks, which they did when the ship returned to Nuku'alofa on 12 July.

1.3.99. On 15 July, the ship departed Nuku'alofa on its third commercial voyage to Ha'apai and Vava'u. The Port Authority of Tonga's departure clearance indicated that there were 177 t of cargo and 28 passengers on board.

1.3.100. While the ship was away from Nuku'alofa on this voyage, the Shipping Corporation of Polynesia workshop staff manufactured some wooden plugs to block the open scuppers until the non-return valve parts arrived and were fitted to the scuppers.

1.3.101. On 17 July, the ship returned to Nuku'alofa, where the Shipping Corporation of Polynesia workshop welders again built up the windlass gear teeth and continued to repair the corrosion holes in the ship's sides. The shore workers fitted 5 wooden plugs to the "fire scuppers" on board the **Princess Ashika**.

1.3.102. On 21 July, the ship took 18 600 litres of diesel fuel oil.

1.3.103. On 23 July, the **Princess Ashika** departed on its fourth voyage. This was the ship's first voyage to the Niuas island group. The Port Authority of Tonga's departure clearance indicated that the ship was carrying 367.82 t of cargo (more than one and a half times the maximum deadweight of the vessel), including timber and containers of building materials for the construction of a new church, and 89 passengers.

1.3.104. During the voyage, there was an engine breakdown, which the chief engineer found had been caused by the fuel line between the transfer pump and the fuel service tank being blocked. Other crew members reported that the fuel line was corroded and was leaking fuel oil into the engine room. To repair the fault, the chief engineer opened the manhole cover on the fuel bunker tank and used the portable electric submersible bilge pump to transfer the fuel to the service tank. The hose from the temporary transfer pump passed through the doorway between the shaft tunnel space and the engine room, preventing the door being closed with the risk of progressive flooding in the case of damage to either space. This pumping arrangement remained in place during the accident voyage, with the manhole cover not being replaced.

1.3.105. During the fourth voyage the winds were strong and the seas were choppy; the worst sea conditions the ship had experienced since it commenced service in Tonga. Water started splashing into the vehicle deck from under the bow ramp. The engineers were asked to pump out the forepeak tanks to raise the bow as high as possible. Even with the change of trim, a considerable amount of water continued to be shipped onto the cargo deck. The crew noticed that water was not draining through the scuppers and was splashing the cargo. Some of the scuppers were blocked by wooden plugs, which the crew removed using an axe; that did not clear the water sufficiently quickly, so one of the crew used the axe to cut a hole in the superstructure bulkhead, forming a makeshift freeing port that allowed the water to disperse rapidly.

1.3.106. On 31 July, the **Princess Ashika** arrived back in Nuku'alofa following the voyage to the Niuas island group. The workshop staff repaired the superstructure bulkhead plates around of areas of corrosion, including the section where the axe had been used to cut a hole.

1.3.107. On 4 and 5 August, a surveyor on contract to the ship's Protection and Indemnity (P&I) Club[8] surveyed the ship as part of its underwriting process. He found the ship to be in poor condition, with scuppers open to the sea (see Figure 17) and large areas of heavy corrosion covered by many doubling plates (see Figure 18).

(P&I surveyor, 2009)

Figure 17 Ship's scupper on 5 August

[8] Protection and Indemnity Club – A "mutual association" formed by ship owners to provide protection against the financial loss of one owner by the combined contributions of other owners in the association. P&I clubs cover third-party claims not covered by ship owners' hull and machinery policies.

Figure 18 Corrosion on deck, with multiple doubling plates

1.3.108. The P&I surveyor also noticed a large gap between the ship's bow ramp and surrounding structure (see Figure 19). On the morning of 5 August, as part of the survey, he had the forward ballast tanks filled. However, he said, it took too long for them to fill, so he cancelled the test when they were only partly filled. At that time, he noted that the manhole to the forward port ballast tank, which was located in the port forward store on the vehicle deck, did not have a cover either fitted or adjacent to the opening (see Figure 20).

Figure 19 "Gap" beside bow ramp after cement removed

Figure 20 Forward port water ballast tank manhole access

1.3.109. The P&I surveyor believed the ship to be unseaworthy, but he did not complete his survey report and he did not inform the ship's managers of his findings before the ship sailed. He completed his survey report on 7 August.

1.3.110. On the morning of 5 August, the **Princess Ashika** took 18 000 litres of diesel fuel oil. At about 1100, the crew started loading cargo.

1.4. Condition of the Princess Ashika on departure from Nuku'alofa, 5 August 2009

1.4.1. When the **Princess Ashika** left on the fifth and final voyage in Tonga, its general condition was little different from that noted during recent surveys. Table 1 summarises the findings of survey reports from FIMSA during the survey period from February 2008 to May 2009, from the Marine and Ports division on 2 July and from the P&I surveyor on 4 and 5 August. In addition to the surveyors' observations, evidence of deficiencies from crew and witnesses has been incorporated into the table. Many of the findings were noted by more than one of the agencies or witnesses.

1.4.2. The general condition of the vessel was poor, with many of the deficiencies having a direct impact on its watertight integrity. The extensive corrosion and relative ease by which water could enter the cargo deck through the ramps or scuppers caused concern to the surveyors. Similarly, there was extensive corrosion on the cargo deck that allowed water to flood down into what should have been the watertight hull of the vessel. The number of mechanical deficiencies was small, but they appeared to occur sufficiently regularly and frequently to make the ship unreliable. The faults with the steering and engine controls were sufficient to cause problems when manoeuvring the vessel.

1.4.3. The condition of the vessel was dependent on not only its physical state, but also the way the crew operated it. The Tongan surveyors' notes suggest that they were concerned that the proper precautions were not being taken with the securing of watertight openings, in particular manholes for void spaces and ballast tanks, and watertight doors into the crew's accommodation and the engine room being lashed in the open position. There was no effective safety management or comprehensive procedures in use on the ship.

1.4.4. The absence of correct and complete statutory certification, such as a load line certificate, indicated that there was a level of non-compliance in the operation of the ship while it was in Fiji, which continued when it arrived in Tonga.

1.4.5. The lifesaving appliances, although possibly not entirely within service date, were in plentiful supply because the existing equipment had been supplemented with that from the **Olovaha**. The absence of a general alarm or a functioning ship's whistle did restrict the ability to alert the entire ship's complement to a developing emergency.

1.4.6. In addition to the many deficiencies that did contribute or could have contributed to the loss of stability and eventual capsize and sinking, there were many, such as the deterioration of the anchor cable and windlass, that were symptomatic of the generally poor condition of the ship.

1.5. Stability and seaworthiness concepts

Buoyancy and stability

1.5.1. A vessel's stability is its tendency or ability to return to its original position when disturbed, after the disturbing force has been removed. The ability depends on the forces of gravity and buoyancy acting on the vessel and their relative position of action, which are represented by the centre of gravity and centre of buoyancy respectively.

1.5.2. The centre of gravity is a function of weight distribution; its position varies with loading, by shifting weight in the vessel, or by adding or removing weight. However, with all weights stationary, the centre of gravity remains fixed regardless of the movement of the vessel. The positions of the vessel's centre of gravity and displacement are determined by an inclining experiment carried out after the vessel's construction.

1.5.3. The centre of buoyancy is located at the centroid of the submerged hull form or underwater portion of the hull. Its position is solely a function of the shape of the underwater volume, which varies with trim and heel. The buoyancy of all other enclosed watertight spaces above the waterline is therefore residual buoyancy, more commonly referred to as reserve buoyancy. As it relates to stability, the vessel's freeboard is the distance from the waterline to the watertight deck, and this provides an indication of the reserve buoyancy. A vessel with lots of freeboard has more reserve buoyancy than a vessel with very little freeboard.

1.5.4. The disturbing forces may be caused by internal or external forces, for instance by the shifting of onboard weights, the addition or removal of weights, wave action or wind.

Defect	Relevance to accident
Broken safety rails	Safety of passengers and crew
Corroded and unserviceable tank vents	Watertight integrity
No 1 void corroded centre girder	Structural
No 1 void corroded transverse floors	Structural
Corrosion of the pillars supporting the upper superstructure	Structural
Corrosion around cargo deck	Watertight integrity
Corrosion holes in decks, multiple areas	Watertight integrity
Forward or collision void space holes	Watertight integrity
Hole in ballast tanks	Watertight integrity
Holes in bow “horns”	Watertight integrity
Holes in void shell plating covered in cement	Watertight integrity
Corroded ballast pipe	Watertight integrity
Poor paint and corrosion under paint on superstructure	Structural and watertight integrity
Shell plating corrosion	Watertight integrity
Emergency lighting could not be tested	Safety of passengers and crew
Crew accommodation in poor condition	General safety
Fire and general alarm not working or not fitted	Safety of passengers and crew
Ship’s whistle not working	Safety of passengers and crew
Inadequate cargo lashings	General safety
No cargo lashing system	General safety
Passenger accommodation in poor condition	General safety
Blocked scuppers	Watertight integrity
Bottle screw missing from ramp	Watertight integrity
Bow ramp damaged/corroded	Watertight integrity
Hatches and watertight doors not watertight	Watertight integrity
Load line submerged in ballast	Watertight integrity
No manhole cover on forward port water ballast tank	Watertight integrity
Ramps not watertight	Watertight integrity
Watertight doors lashed open	Watertight integrity
Anchor stoppers to be replaced	General condition of the vessel
Steering gear – bleed steering gear – limit 15° each way	Ship handling
Engine control system on the bridge inoperable (port)	Repaired prior to sailing
Engine control system on the bridge inoperable (starboard)	Engine had to be controlled from the engine room
Fairleads frozen	General condition of the vessel
Fuel transfer system	Hose through watertight doorway and pump unavailable elsewhere
Hydraulic oil leaks	General condition of the vessel
Leaking fire hydrant pipes	General condition of the vessel
Only 5 shackles of cable for each anchor	General condition of the vessel
Port anchor cable undersized	General condition of the vessel
Severely worn windlass gear teeth	General condition of the vessel
Starboard stern tube leaking (trickle not drip)	Watertight integrity
Life saving appliances shortages and defects	Safety of passengers and crew
One port liferaft cradle corroded so liferaft lashed to deck	Safety of passengers and crew
Passenger area escape routes not clearly marked	Safety of passengers
Missing statutory certificates	Demonstrates lack of compliance
No oily water separator	General condition of the vessel
Safety management system not effectively implemented on board	Less effective onboard procedures and safety awareness

Table 1 Summary of known deficiencies of the Princess Ashika

1.5.5. A vessel floating at rest, with or without list and trim, is in static equilibrium; that is, the forces of gravity and buoyancy are equal and acting in opposite directions in line with one another. As the centre of buoyancy shifts with a heel, the 2 opposing forces act along separate and parallel lines (see Figure 21). The forces establish the couple that tends to return a stable vessel to the upright position. The distance between the lines of action of the centre of gravity and the centre of buoyancy corresponds to a righting arm, commonly referred to as the GZ. This righting arm is represented in a stability curve as a function of the angle of heel.

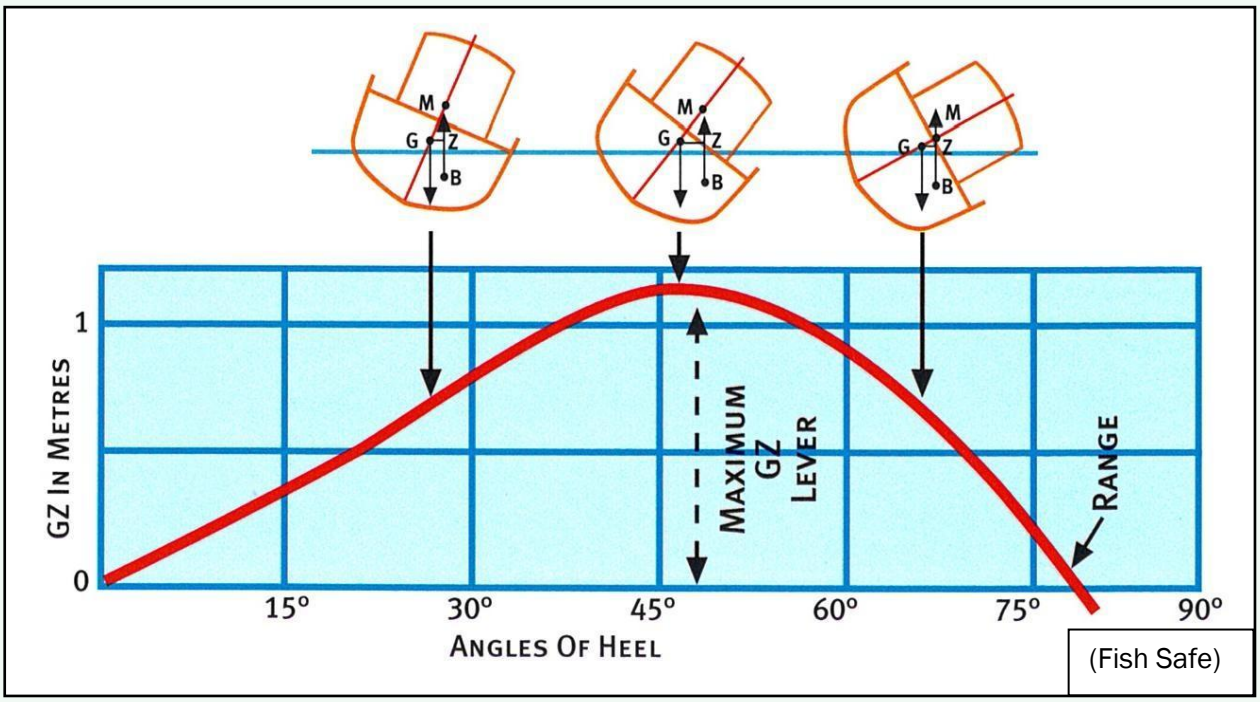


Figure 21 Stability curve

1.5.6. The area under the stability curve is a measure of the vessel's ability to absorb energy imparted by winds, waves or other external forces (see Figure 22). A vessel with very little area (righting energy) under its stability curve could be rolled past its range of stability and capsized by even a momentary disturbance.

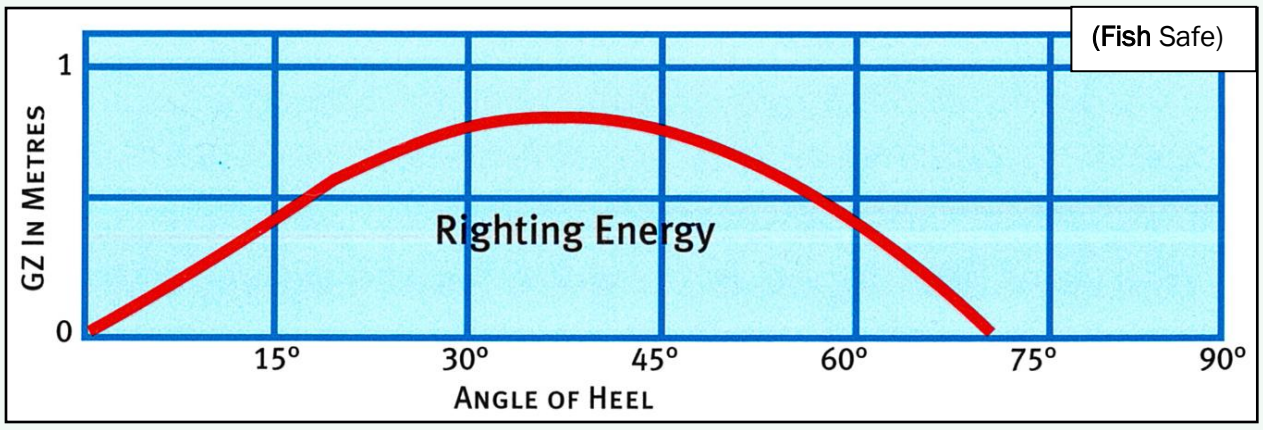


Figure 22 Righting energy

1.5.7. The vessel's stability characteristics in various loading conditions reflecting the operation of the vessel can be calculated and are usually presented in a stability book as graphs, tables and curves. The master of the vessel should be supplied with a copy of the stability book in a format approved by the maritime authority. The use of this book will enable the master to obtain accurate guidance as to the stability of the vessel and assure them that the vessel has sufficient stability throughout the voyage.

1.5.8. The vessel stability may be compromised by multiple factors that could deplete righting energy:

- overloading – Added weight means the freeboard has been reduced and deck immersion will occur at smaller angles of heel. Vessels also get heavier as they get older. This can be due to accumulated equipment on board. Beyond a certain limit, usually established during the load line assignment process, the reserve stability may become insufficient by the addition of weights and overloading. Moreover, if weights are added above the initial position of the centre of gravity, the centre of gravity of the vessel is raised
- deck edge immersion – This will happen sooner where there is reduced freeboard. When deck immersion occurs, the shape of the underwater portion of the hull changes and this reduces the righting energy available to return the vessel to the upright
- free surface effect (see Figure 23) – When a vessel with a partially filled tank or with free water on its deck is heeled, the liquid will seek to remain parallel with the waterline and will flow to the low side. The centre of gravity of the liquid, being the centre of its volume, will move with the liquid towards the lower side of the vessel and this will cause the vessel's centre of gravity to shift, thereby reducing the vessel's stability. The greater the surface area covered by liquid, the greater the effect. The area covered with water is more significant than the depth of water, and this is especially true for water on deck

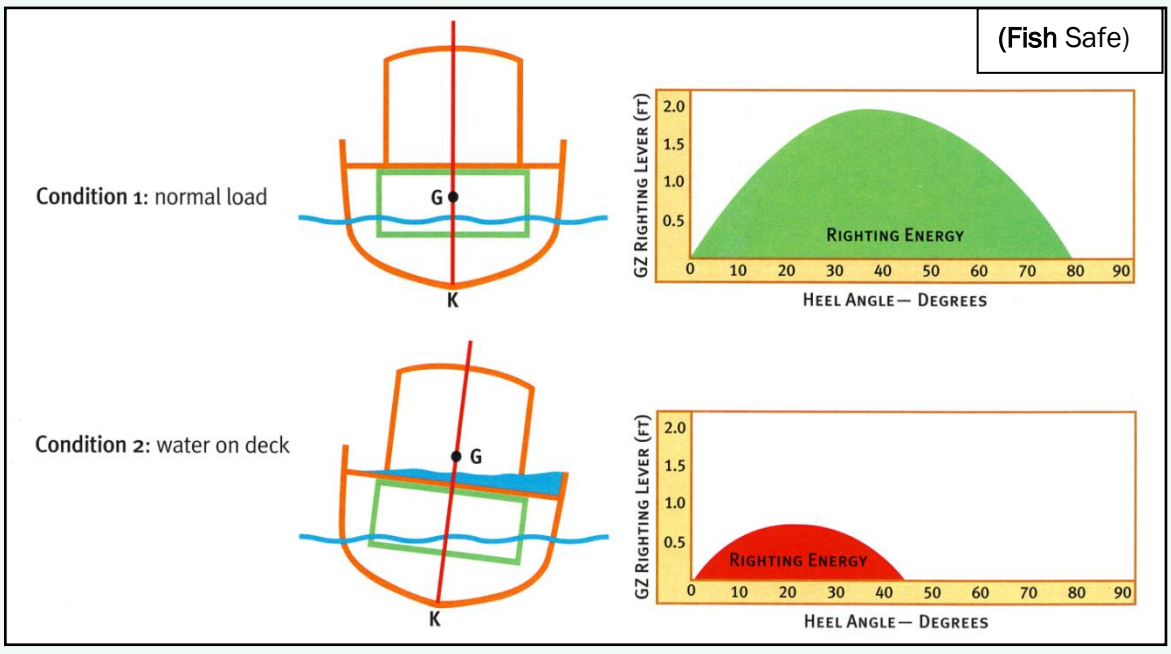


Figure 23 Water on deck

- downflooding (see Figure 24) – Downflooding is the entry of water into the hull that results in progressive flooding with which pumps cannot keep up. Watertight and weathertight integrity is necessary to prevent downflooding. Downflooding introduces free surface, which raises the centre of gravity, increases the draught and reduces freeboard. Consequently, it reduces the reserve buoyancy and stability, and if no corrective action is taken quickly enough to stop it, it may cause an extreme list and represent a progressive loss of stability that may finally result in capsize

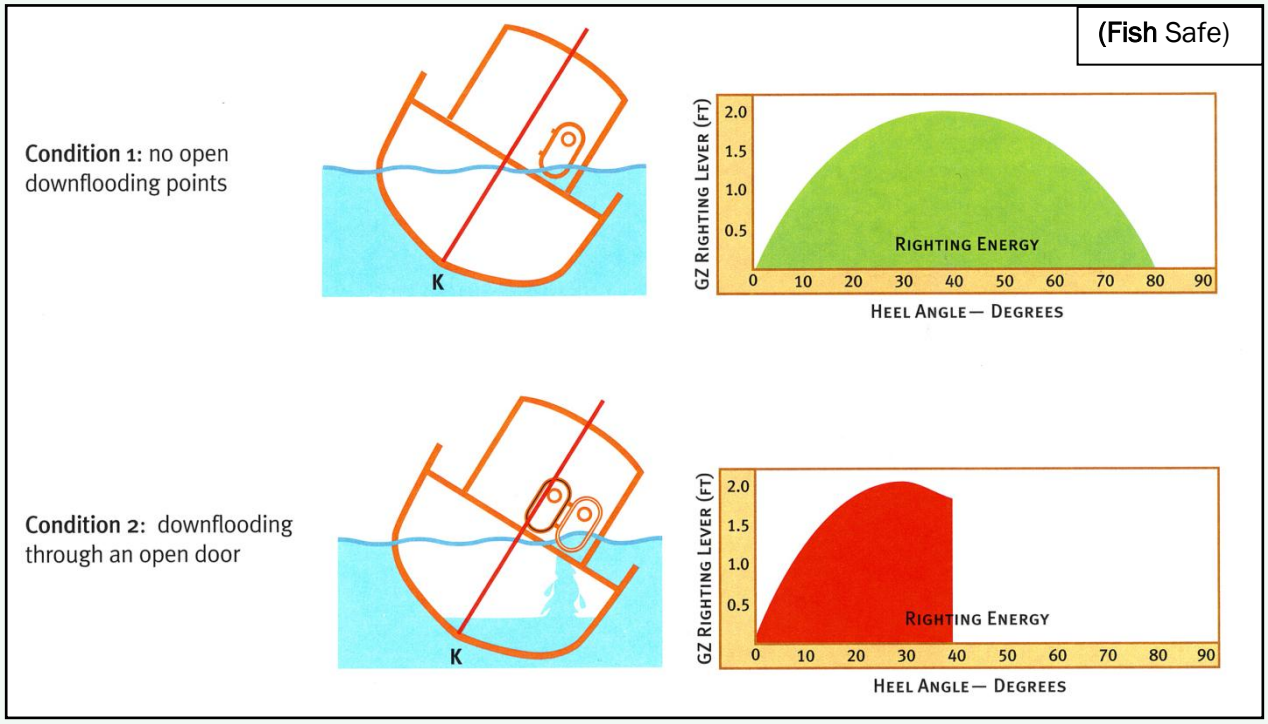


Figure 24 Downflooding

- the accident voyage of the **Princess Ashika** is a good illustration of the phenomena. The buoyancy and stability were compromised by the progressive and cumulative effect of the factors mentioned above, until the vessel capsized (see Figure 25).

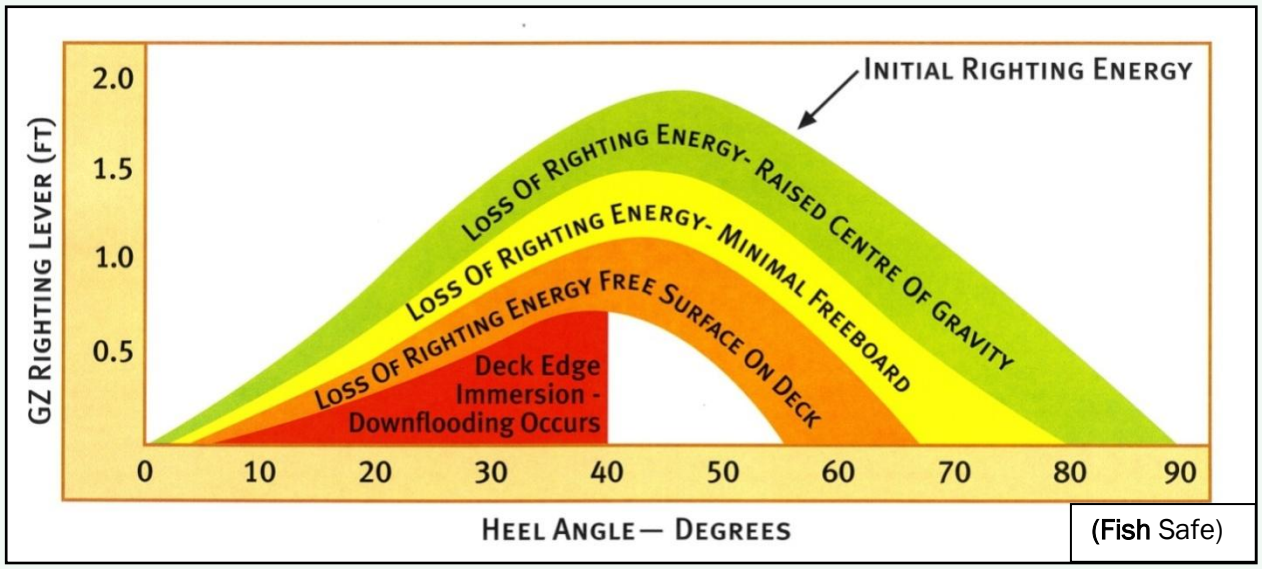


Figure 25 Compromised stability

Seaworthiness

1.5.9. A vessel's seaworthiness may be defined as its sufficiency (or suitability) in materials, construction, equipment, crew and outfitting for the trade or service in which it is employed[9]. This suitability is initially obtained through suitable design and construction. The suitability of design is usually verified by the submission of vessel drawings for approval by the marine authority or the classification society before the initial certification. Seaworthiness, however, must also be maintained by proper operation, by inspections and surveys, and by maintenance and repair.

1.5.10. In the case of the **Princess Ashika**, the suitability of design has been briefly dealt with in a previous section of the report.

1.5.11. In the maritime industry, the expression "fit for purpose" is often used to describe not only the condition of the vessel and its compliance with the relevant standards, but also the suitability of its design for the intended purpose or trade for which it is to be used. Needless to say, fit for purpose is from the point of view of safety of life at sea.

1.5.12. Suitability or seaworthiness during the operation of the vessel must be achieved in various ways, one of them being maintaining the vessel integrity as follows:

- structural integrity of the hull and the superstructure
- watertight integrity of the main hull and the main bulkheads
- weathertight integrity of the superstructure
- structural and weathertight integrities of the conditions of assignment of freeboard (i.e. hatchways, doorways, manholes, ventilators, air pipes, scuppers, et cetera).

1.5.13. Assigning load lines and freeboard to a vessel[10] is one of the most efficient ways to ensure a vessel's integrity, as it:

- ensures that the vessel structure is not subjected to excessive or unacceptable stresses
- maintains sufficient reserve stability
- maintains the reserve buoyancy
- protects weathertight openings from the sea
- ensures sufficient height of the bow and of the working platform above the waterline to prevent the ingress of water.

1.5.14. Submerging the load lines by overloading can have multiple adverse consequences. The structure will be subjected to excessive stresses, thereby increasing the possibility of distortion, deformation and fracture of the structural components with subsequent ingress of water. Reserve buoyancy and stability will also be reduced and might become insufficient or non-compliant with the international standards. Moreover, watertight closing appliances, such as the connection to the shell, will be subjected to a greater hydrostatic pressure and the weathertight closing appliances will be more exposed to the sea and thereby more prone to damage, leakage and ingress of water. Finally, the vessel, the cargo, the crew and the passengers will be exposed to greater risks.

[9] International Maritime Dictionary, René de Kerchove, second edition.

[10] The load line survey and the load line certificate for the Princess Ashika were not available to this investigation.

1.5.15. As previously mentioned, seaworthiness is also achieved through proper inspection, maintenance and repair. For instance, for a passenger vessel engaged in exposed waters, inspections and surveys of the hull and appendages must be done periodically in dry dock. Compartments, tanks and structural elements, including the bulkheads and the connections to the shell, must also be inspected periodically. The extent of these inspections will vary depending on the age of the vessel. The tanks must also be periodically visually inspected and pressure tested. Following these inspections and tests, some replacement of plating or structural members may be required. These repairs have to be done properly and inspected by a representative of a maritime authority or a classification society.

1.5.16. In this occurrence, the seaworthiness of the **Princess Ashika** was breached in many ways. As mentioned earlier, the shell plating and the internal structural elements of the hull and the superstructure were significantly deteriorated and corroded and with reduced thickness, very likely beyond acceptable limits. This extremely poor condition had been identified on many occasions during surveys carried out in the years before the accident. The structural condition would create excessive stresses on the already corrosion-weakened residual strength members of the ship and possibly further impair its watertight integrity. There was leakage or potential ingress of water at various places in the vessel. The poor condition of the closing appliances for the doorways, ventilators, air pipes and scuppers presented the same risks.

1.6. Stability of the Princess Ashika during the accident voyage

1.6.1. No current stability data was available to the investigation, with the only existing copy of the stability book said to have been on board the **Princess Ashika** when it sank. A specialist naval architect from the TSB modelled the ship, estimated its condition and prepared a summary of its statical stability. His methodology and conclusions follow.

Methodology and assumptions

1.6.2. The following original drawings and documents produced in 1972 for the **Princess Ashika** were available for this investigation:

- general arrangement
- midship section
- profile and decks
- shell expansion
- transverse sections of watertight bulkheads with some intermediate frames; longitudinal sections of main girders; structural arrangement above the cargo deck
- arrangement of electrical equipment
- curves of half breadth, half areas and moments for 6 different draughts
- hydrostatics curves and cross curves of stability
- some basic intact and damage stability information.

These drawings and documents were examined, reconciled and validated. A list of the main particulars was then established for this vessel. According to the original stability information, the displacement at the maximum draught of 2.78 m was 873 t.

1.6.3. The stability-related information gathered by the TAIC investigation and that from the proceedings of the Royal Commission were also examined.

1.6.4. As an initial approach to assessing the vessel's buoyancy, the volume of all main compartments up to the waterline at 2.9 m was established using the curves for the half areas. The volume between that waterline and the main deck for the main compartments located in the area where a parallel-middle body existed (engine room and accommodation space) was also established.

1.6.5. To clarify and demonstrate why the vessel capsized, it was decided to create a computerised model of the main hull; this included the main compartments and tanks and the first tier of superstructure. As no lines plan was available, a table of offsets was created using information extracted from the original structural drawings. The model was then used to calculate hydrostatic curves and cross curves of stability for the vessel, which were validated using the original curves. Tank capacity tables were also generated.

1.6.6. After its completion in 1972, the vessel was inclined and the lightship displacement and centre of gravity were determined. In 1976 a new heavy oil tank was fitted in the shaft tunnel and a new lightship, seemingly based on the original lightship, was established to include this new tank[11]. Table 2 describes the loading conditions that were considered and modelled in the stability analysis.

1.6.7. It appears that no further lightship surveys or inclining experiments were carried out on the vessel during its life[12]. However, a comparison of the drawings with some recent photos and videos indicated that there had been no major modifications made to the hull. Therefore, lacking any more recent information and without evidence of any major modifications, the lightship characteristics derived in the 1976 stability information were used as the basis for a stability assessment, and loading condition No 1 – Original Lightship– was established.

Loading Condition	Name of Condition	Description
1	Original Lightship	Lightship as established in 1976
2	Original Lightship Plus Accident Loading	Original lightship plus 110 t of cargo, 128 persons, fuel oil full, fresh water 50%, no bilge or ballast water
3	Estimated Lightship July 2009	Original lightship plus addition for concrete, doubling plates, weight growth and liferafts
4	Arrival in Tonga July 2009	Based on estimated lightship July 2009 plus tank loads sufficient to simulate the condition noted during survey 2 July 2009, i.e. slight starboard list, small forward trim and starboard load line mark submerged
5	Accident Voyage Departure	Based on condition No 3 plus 110 t of cargo, 128 persons, fuel oil full, water in aft water ballast tanks, forward void, No 1 and 2 void spaces, and bilge water throughout other compartments; forward water ballast tanks pumped out

Table 2 List of loading conditions up to the accident voyage departure

1.6.8. In order to appreciate the stability of the vessel as built, a hypothetical loading condition was created that added the accident voyage cargo of 110 t and an allowance for the 128 persons on board to the original lightship characteristics, and thus condition No 2 – Original Lightship Plus Accident Loading – was established.

11 The deviation of the new lightship displacement compared with the original displacement was not exceeding 2% and the deviation of the new longitudinal centre of gravity was not exceeding 1% of the length of the vessel. Had this been greater, the vessel would have had to be re-inclined.

12 Nowadays this is required every 5 years in accordance with SOLAS, Chapter II-1, Regulation 22.

1.6.9. It is likely, however, that numerous minor weights were added to the vessel over the years, and other weights were routinely kept on board. For instance:

- a significant amount of concrete (cement boxes) and doubling and sandwich plates were placed in various tanks and compartments to reduce the ingress of water, restore structural strength or control corrosion[13]
- concrete was added on the promenade deck and in the passenger lounges
- a vessel of this age was likely to be subject to natural weight growth owing to corrosion
- ballast water was known to have been routinely carried
- it was probable that water was leaking into void spaces and not being detected by the crew.

These additional weights had to be taken into consideration in the vessel stability assessment as being part of the displacement. Therefore, condition No 3 – Estimated Lightship July 2009 – was established.

1.6.10. Then the loading condition of the vessel on its arrival in Tonga on 1 July 2009 was examined and the following information was taken into consideration and assumptions made:

- the upper edge of the horizontal line intersecting the disc of the load line mark on the starboard side was submerged by about 25 mm (see Figure 16), with a starboard list of 1° or 2° at maximum. The condition of trim was unknown but assumed to be close to level or with a slight trim by the head
- there was neither cargo nor passengers on board
- the fresh water tank, the fuel oil tanks and the small tanks in the engine room were at their working levels
- the forward and after water ballast tanks contained an unknown quantity of water, except that the after port ballast tank could only be filled up to a sounding of 1.5 m before leaking in the shaft area
- considering the poor condition of the hull plating, the forward void space was levelled with the sea assuming ingress through the hull
- there was a high probability of water in bilges throughout the other tanks and compartments.

1.6.11. Using this information, and following many iterations, a most probable condition satisfying the status of the vessel on its arrival was established, namely condition No 4 – Arrival in Tonga July 2009.

1.6.12. Finally, condition No 5 – Accident Voyage Departure – was established by adding 110 t of cargo and 128 persons to condition No 3 (Estimated Lightship). In addition, a significant quantity of water was assumed to have accumulated in the No 1 void space (aft of the forward water ballast tanks) since the vessel had arrived in Tonga, and the forward water ballast tanks were pumped out shortly after departure from Nuku'alofa.

[13] These practices are usually considered as temporary measures and "condition of class" until next dry-docking.

1.6.13. To reflect the progressive ingress of water that occurred during the accident voyage, a sequence was established based on information given in the various witness statements. A series of conditions was then simulated to reflect this sequence of events. Finally, the vessel stability was assessed for all loading conditions and compared with the criteria regarding righting lever curve properties from the international standards[14].

1.6.14. Tables 3 and 4 presents the sequence of the stability-related significant events that occurred during the accident voyage as described by witnesses.

Step	Time	Reported Water Ingress			Vessel Condition	Condition No
		Crew's Accommodation	Cargo Deck	Engine Room		
					Forward water ballast tank (WBT) pumped out	5
1.	2000	Water noticed (25 mm on starboard)			List of 2° to starboard; forward WBT pumped out	5A
2.	2030	110 mm	Small amount; 300 mm near bow; 300 mm			5B
3.	2100		250 mm near bow ramp		Pump out forward WBT	
4.	2130	Level risen -0-	300 mm		Slight list to starboard	
5.	2210		500 mm amidships			
6.	2220				Start pump out starboard aft WBT	5C
7.	2230	50 mm	300 mm			
8.	2240		Water on port side		Trim by head. List to port. Stop pump out starboard aft WBT	
9.	2300	200 mm on port		Considerable amount in bilges, mainly port		5D
10.	2320	200 mm	Increased amount 600 mm		Order to start pump in starboard aft WBT or engine room	5E
11.	2340	450 mm	1.5 m		List 50° port	
12.	2345		2 m	Port engine submerged		
13.	2350		Water enters freely over erection deck			
14.	2351				Capsized on port	

Table 3 Sequence of events for accident voyage

[14] IMO, International Code on Intact Stability, 2008, Section 2.2.

Loading Condition	Name of Condition	Description
5	Accident Voyage Departure	Based on condition No 3 plus 110 t of cargo, 128 persons, fuel oil full, water in aft water ballast tanks, foward void, No 1 and 2 void spaces, and bilge water throughout other compartments; forward water ballast tanks pumped out
5A	Accident voyage step 1	Based on condition No 5 plus water ingress in crew accommodation to a depth of 25 mm on starboard side
5B	Accident voyage steps 2 to 5	Based on condition No 5A plus water ingress in cargo deck and more water in crew accommodation – water depth on cargo deck starboard forward corner of 220 mm and depth in crew accommodation of 110 mm on starboard side
5C	Accident voyage steps 6 to 8	Based on condition No 5B and with aft starboard water ballast pumped down to give port list
5D	Accident voyage step 9	Based on condition No 5C plus water downflooding in the engine room to a level equivalent with lowest part of port engine flywheel
5E	Accident voyage steps 10 to 14	Based on condition No 5D plus more water on cargo deck sufficient to cause total loss of stability; water on cargo deck to depth of approx 300 mm at port forward corner

Table 4 List of loading conditions during accident voyage

Results

1.6.15. Tables 5 and 6 present a summary of the results of the stability calculations for the conditions described above. Detailed results may be found in Appendix 12.

	Loading Conditions				
	1	2	3	4	5
	Original Lightship	Original Lightship Plus Accident Loading	Estimated Lightship July 2009	Arrival in Tonga July 2009	Accident Voyage Departure
Displacement (t)	669.21	830.82	700.61	877.66	1092.29
Draught amidships (m)	2.315	2.677	2.39	2.797	3.239
Trim over length between perpendiculars (m) (+ aft)	+ 0.038	+ 0.209	+ 0.005	- 0.670	- 1.279
Heel (°) (+ starboard)	0	0	0	+0.22	+2.03
Freeboard to bow ramp (m)	1.854	1.578	1.762	1.007	0.163
GM fluid (m)	2.019	2.153	2.062	1.623	1.610
Range of righting angle (degree)	0 – 44	0 – 39	0 – 44	0 – 36	2 – 19

Table 5 Results of the stability assessments (up to accident voyage departure)

	Loading Conditions					
	5	5A	5B	5C	5D	5E
	Accident Voyage Departure	Accident Voyage Step 1	Accident Voyage Steps 2 to 5	Accident Voyage Steps 6 to 8	Accident Voyage Step 9	Accident Voyage Steps 10 to 14
Description of event		Ingress in crew accommo-dation	Ingress in crew accommo-dation cargo deck	Starboard aft WBT pump out	Ingress in engine room	Ingress to loss of stability
Quantity of water ingress (t)	Crew accomm-odation	0.08	0.6	0.6	0.6	0.6
	Cargo deck	-	8.7	8.7	8.7	17.4
	Engine room	(bilge only)	(bilge only)	(bilge only)	38.5	38.5
Displacement (t)	1092.29	1092.38	1101.61	1085.24	1116.71	1125.43
Draught amidships (m)	3.239	3.239	3.256	3.222	3.288	3.308
Trim over length between perpendiculars (m) (+ aft)	- 1.279	- 1.280	-1.366	- 1.577	- 1.528	-1.617
Heel (°) (+ starboard)	+2.03	+2.03	+2.92	-0.20	-0.31	-0.59
Freeboard to bow ramp (m)	0.163	0.162	0.052	0.150	0.163	0.065
GM fluid (m)	1.610	1.609	1.148	0.938	0.114	0.189
Range of righting angle (°)	2 – 19	2 – 19	0 – 22	0 – 25	0 – 11	1 – 6

Table 6 Results of the stability assessments (during accident voyage)

Observations

1.6.16. A comparison of condition No 1 and condition No 3 indicated that the estimated lightship weight growth and change in the vertical centre of gravity (VCG) of the vessel between 1976 and 2009 had little impact on vessel stability (see Figure 26).

1.6.17. The midship draught for condition No 5 indicated significant overloading with respect to the original maximum draught (3.239 m compared with 2.78 m).

1.6.18. The overloading was the result of loading ballast in addition to cargo and passengers, as well as a failure to ensure that void spaces were reasonably dry; this was illustrated by comparing condition No 2 (hypothetical condition with bilges dry and no ballast) with condition No 5 (actual departure condition with water ballast and significant accumulation of bilge water) (see Figure 27).

1.6.19. A comparison of the stability curves for conditions No 2 and 5 demonstrated the impact on stability of the overloading (combined with free surfaces of water). The hypothetical condition No 2 was close to compliance with IMO stability criteria, whereas the curve for condition No 5 is drastically reduced, representing approximately one-third of the IMO criterion for area under the curve (see Figure 27).

1.6.20. In condition No 5 (departure), the vessel had a starboard list and significant trim by the head with freeboard to the bow ramp of approximately 160 mm. This would have resulted in an increased probability of ingress of water via the bow ramp, and thereafter permit the water to accumulate in the starboard forward corner, as reported by witnesses.

1.6.21. A comparison of conditions No 5 and 5a showed that at a very early stage of water ingress (small amount of water accumulating in crew accommodation only) the impact on initial stability was negligible (see Figure 28).

1.6.22. A comparison of conditions No 5 and 5b indicated the significant impact on the initial stability of water accumulation on the cargo deck and in the crew accommodation. For example, increases in draught, trim and heel resulted in further reduced freeboard at the bow ramp. Furthermore, this resulted in reduced righting ability as the result of increased VCG, a large free surface of fluids and a reduction in reserve buoyancy (see Figure 28).

1.6.23. A comparison of conditions No 5b and 5c demonstrated that the impact of the crew decision to pump out the aft starboard water ballast tank was a small improvement in the vessel's righting ability, primarily due to a reduction in heel angle (now to the port side) (see Figure 28).

1.6.24. Condition No 5d demonstrated the impact of increased water ingress into the engine room which increased draught and heel to port, but most significantly increased the negative influence of a large volume of water contained within the hull. A comparison with condition No 5 indicated a reduction in righting ability of over 50% from the initial departure condition (see Figure 28).

1.6.25. Condition No 5e demonstrated that only a small increase in the depth of accumulated water on deck would have been necessary for the vessel to lose all righting ability. Note that this does not account for the ingress of water that would have been occurring elsewhere in the vessel over the course of the voyage – such as in the forward port water ballast tank, crew accommodation, etc (see Figure 28).

Conclusions

1.6.26. The vessel left port with very limited righting capability (stability) and minimal freeboard at the bow owing to its overloaded condition. Despite cargo and passenger loads being within acceptable limits, the crew did not empty water ballast tanks and did not ensure that void spaces were clear of water. Nor did anyone verify that the load line marks were not submerged before departure from the port.

1.6.27. The minimal freeboard, combined with the deteriorated condition of the bow ramp, permitted the accumulation of water on the cargo deck, which started a sequence of downflooding and increasing water accumulation. This had a significant impact on the vessel stability owing to the reduction in freeboard and large free surface effect created by water in many tanks and on deck.

1.6.28. At an intermediate stage, the crew decided to pump out the after starboard water ballast tank. While this decision did not worsen the stability situation, it did increase the trim by the head, so allowed more water to enter the cargo deck around the bow ramp. At an early stage, the focus of the crew should have been on eliminating the accumulation of water on the cargo deck. In the absence of such action, the situation worsened until the vessel lost all stability and reserve buoyancy.

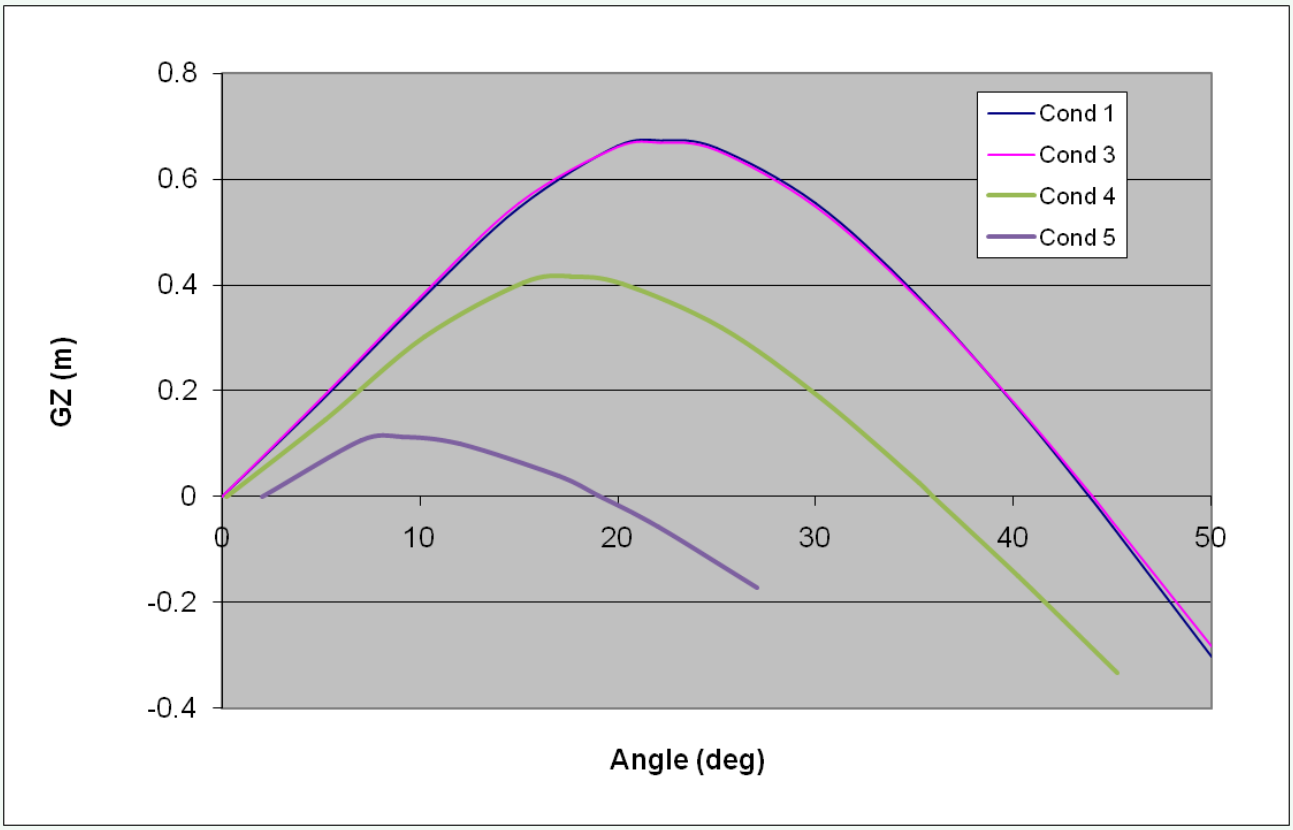


Figure 26 Changes in stability up to the accident voyage

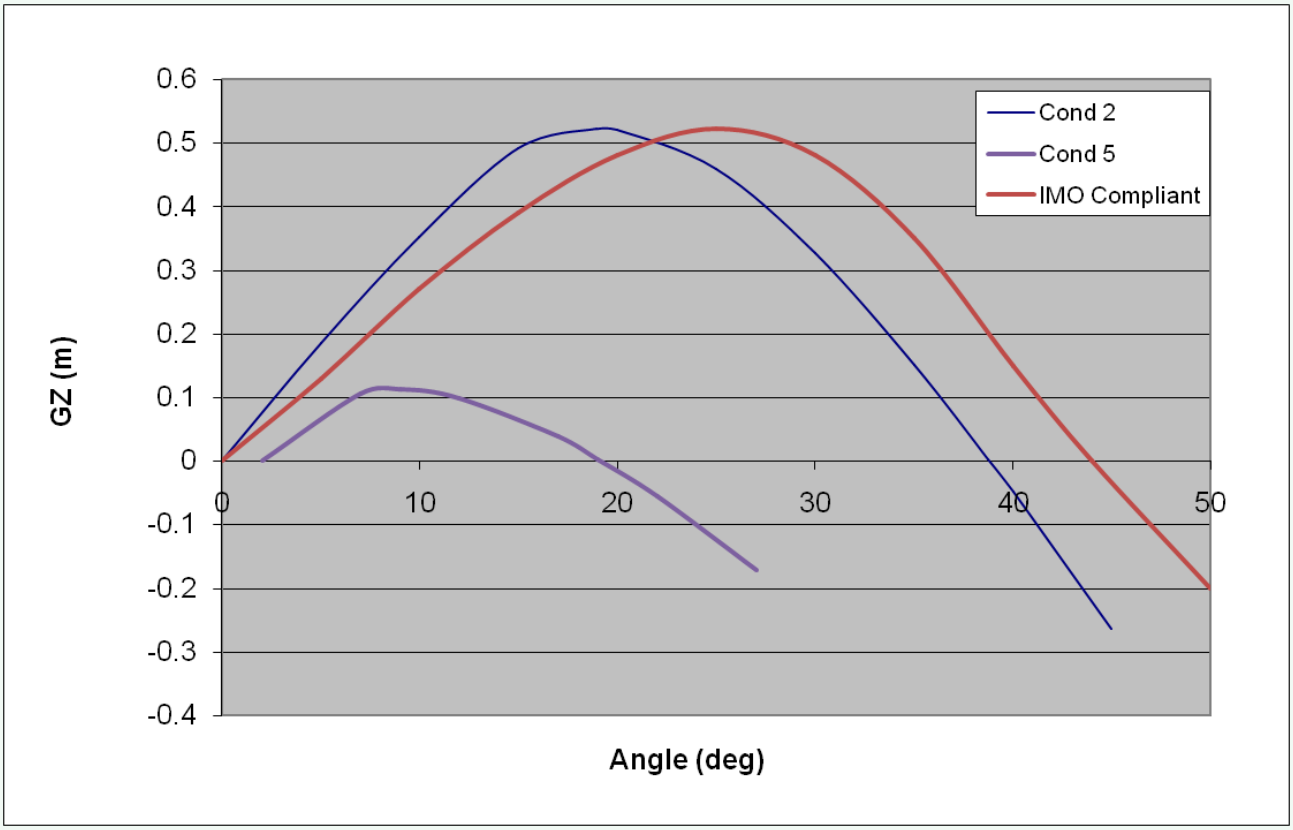


Figure 27 Princess Ashika stability compared with IMO compliance

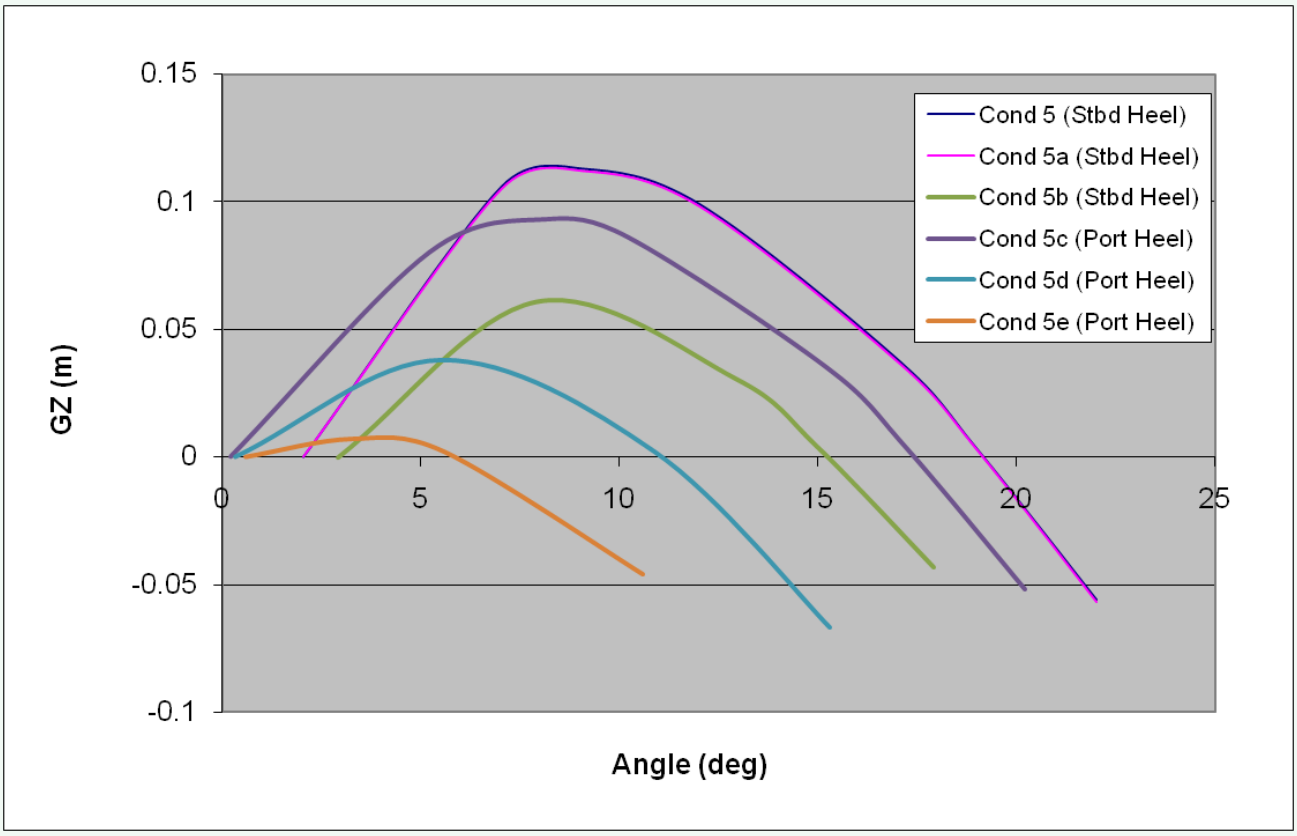


Figure 28 Accident voyage stability curves

1.7. Geography of Tonga

1.7.1. Tonga, like many Pacific nations, is a collection of many islands scattered over a large area of ocean. It is formed on a sub-ocean ridge that stretches from the north of New Zealand, through the Kermadec Islands and on through Tonga to finish at Samoa. The depth of water between the islands of Tonga is relatively shallow in comparison with the deep waters of the Tongan trench to the east and the Lau Basin to the west. Between Tongatapu and the Ha'apai group of islands, the depth of the seabed is mostly less than 100 m except for a narrow trench of about 5 nautical miles in width, running east-west about 30 nautical miles to the north of Nuku'alofa.

1.7.2. The country lies just off a north-south line and comprises 4 main island groups:

- Tongatapu includes the capital Nuku'alofa, which is on the northern coast of the main island. Tongatapu is the southernmost of the groups of islands and includes the main port for the country. The small island of 'Eua lies off its south-eastern coast
- Ha'apai encompasses a large number of reefs and small islets and lies between 40 nautical miles and 100 nautical miles to the north of Tongatapu, and spreads about 45 nautical miles in an east-west direction. It has the island port of Ha'afeva in the Kotu group and the larger port of Pangai on the island of Lifuka
- Vava'u is another 60 nautical miles to the north of Lifuka and has the second-largest port of Neiafu
- the Niuas island group comprises 2 isolated groups of islands: Niuatoputapu, which lies 155 nautical miles to the north of Vava'u; and Niuafo'ou a further 105 nautical miles to the west-northwest.

1.7.3. Sea communications are vital for the economical transportation of large numbers of passengers and also for the carriage of goods and produce between the population centres. In addition, regular church conferences require large numbers of people from the outer islands to congregate in the capital. At the end and beginning of terms, large numbers of children are transported to and from Tongatapu to attend secondary schools.

1.7.4. The alternative to sea communications is air travel. There are 6 airfields in Tonga: Fua'amotu international airport on Tongatapu and domestic-only airports on the islands of 'Eua, Ha'apai, Vava'u, Niuafo'ou and Niuatoputapu. The restricted capacity of the domestic aircraft and cost of passage limit their use to the carriage of small numbers of passengers and high-value cargoes.

1.7.5. In 1985, the Kingdom bought a small fleet of aeroplanes for domestic services. The airline was re-named Royal Tongan Airlines in 1991 before starting international services within the South Pacific. However, international services stopped when the jet aircraft being used by the airline was repossessed in April 2004. The airline ceased all operations a month later (Royal Tongan Airlines.).

1.7.6. Since 2007, domestic air services have been provided by Chathams Pacific, a subsidiary of Air Chathams Limited, an established airline in New Zealand. Chathams Pacific's website states that the airline has a long-term view of providing services within Tonga ("Chathams Pacific", n.d.). A number of international airlines provide services from Tonga to Fiji, New Zealand, Australia and Samoa.

1.7.7. The remoteness of Tonga and the limited international communication cause difficulties in maintaining and servicing sophisticated machinery, including transport vehicles. In the maritime sector, vessels require a certain amount of infrastructure to enable them to be maintained properly. For example, they need to be taken regularly from the water for maintenance and survey, but there are no in-country dry dock facilities for larger vessels. Consequently, any out-of-the-water maintenance and surveys need to be conducted overseas, usually in Fiji, New Zealand or Australia, with the inherent factors of time and cost. Similar problems occur with the servicing and replacement of safety equipment such as inflatable liferafts, which international regulations require to be serviced annually at an authorised service centre. The nearest of these to Tonga are in Fiji and New Zealand. This is not a unique problem to Tonga; many Pacific nations face the same dilemma.

1.8. Personnel information

Crew members of the Princess Ashika

1.8.1. The ship had a crew of 32 at the time of the accident. There was a master and 2 mates, a chief engineer and 2 engineer officers, 7 deck crew, 3 motormen, 6 catering staff, 4 cadets, 2 security men, one forklift driver, the Ha'afeva agent, a Japanese volunteer electrician, and an ice man.

1.8.2. The master began his basic seafarer training at the Tonga Maritime Polytechnic Institute (TMPI) in August 1988. He was employed as a trainee deck officer and was sponsored by the Shipping Corporation of Polynesia. He initially spent some time as an ordinary seaman on the Shipping Corporation of Polynesia vessels **Olovaha** and **Gao**, then from 1989 worked as a seaman on overseas-owned international trading vessels, eventually being promoted to bosun. In 1998, he gained his master class-4 certificate. He then worked on the **Olovaha** as second mate, and as third mate on the **Fua'kavenga**, a Tongan-registered SOLAS vessel[15] trading in the Pacific. Between 2001 and 2005, he spent part of his time as master of the coastal vessels **Olovaha** and **Otu Tonga**, and part as second and third mates on the **Capitaine Tasman**, another Tongan-registered SOLAS vessel, which had been launched as the **Fua'kavenga II**. In 2005, he was made permanent master of the **Olovaha** and worked on that exclusively. In September 2008, he returned to TMPI where he gained his master class-3 certificate. After the arrival of the **Princess Ashika** in Tonga on 1 July 2009, he was appointed master. He was due, in September 2009, to receive a scholarship to study at the New Zealand Maritime School for a second mate foreign-going certificate.

1.8.3. The first mate completed his basic training at TMPI in 2001 and worked as a trainee seaman on the vessels **Kalimoana**, **Fangasa** and **Otu Tonga**. In 2003, he gained a watchkeeping certificate and sailed as an ordinary seaman on the **Olovaha** until 2005 when he joined the **Fua'kavenga**, also as an ordinary seaman. In 2006, he gained his master class-4 certificate, and in 2007 sailed as second mate on the **Olovaha**, being promoted to first mate in 2008. In September 2008, he gained his master class-3 certificate. On 1 June 2009, the first mate was sent to Suva to familiarise himself with the **Princess Ashika** and he returned to Tonga on the delivery voyage as second mate under a Fijian master and first mate. When the **Princess Ashika** commenced operations in Tonga, he was appointed the permanent first mate.

1.8.4. The second mate completed his basic training at TMPI in 1998 and worked on domestic fishing vessels until 2003 when he gained his master class-5 certificate. In 2004, he gained his master class-4 certificate and worked as second mate on various domestic passenger vessels, joining the **Olovaha** as second mate in January 2009. When the **Princess Ashika** commenced operations in Tonga, he was appointed the permanent second mate.

1.8.5. The catering trainee (watch officer) completed his basic training at TMPI in 2004 and worked on fishing vessels. In 2005, he gained his master class-5 certificate and started work on domestic passenger vessels as an able seaman. He joined the **Olovaha** in 2007, continuing to work as an able seaman. In 2008 he completed the course for master class-4 and the written examination, but he did not sit the oral examination so was not issued with the certificate. After the arrival of the **Princess Ashika** in Tonga, he was not automatically transferred to it as part of the deck crew, but on its second voyage in Shipping Corporation of Polynesia service, he joined the vessel as a relieving second mate. On subsequent voyages, there were no vacancies for deck crew on the vessel, so he was employed as a steward.

1.8.6. The bosun completed his basic training at TMPI in 2007 and worked on the **Olovaha** as a seaman. In 2008, he was promoted to bosun of the **Olovaha**. In June 2009, he was sent to Fiji as part of the deck crew for the delivery voyage of the **Princess Ashika**.

[15] A SOLAS vessel is a foreign-going passenger or non-passenger ship of 500 gross tonnage or more that is required to comply with the design, construction and equipment requirements of SOLAS 1974.

1.8.7. Deckhand 1, one of the 8-to-12 watchkeepers[16] on the accident voyage, completed his basic training at TMPI in 2005 and worked on domestic passenger vessels as an able seaman. He joined the **Olovaha** in 2007 and stayed there until he joined the **Princess Ashika** after its arrival in Tonga.

1.8.8. Deckhand 2, the other 8-to-12 watchkeeper on the accident voyage, completed his basic training at TMPI in 2008, then worked on the **Olovaha** as an ordinary seaman. In 2009, he returned to TMPI to sit his watchkeeper certificate. He continued to work on the **Olovaha** until he joined the **Princess Ashika** after its arrival in Tonga.

1.8.9. The chief engineer went to sea in 1990 as an engineer trainee, working on the **Olovaha**. In 2000, he gained his marine engineer class-4 certificate. He then worked on several ships, including the **Norfolk Guardian**, **Sitka** and **Marieke**, that traded overseas. In February 2009 he returned to the **Olovaha** and transferred to the **Princess Ashika** after its arrival in Tonga.

1.8.10. The second engineer went to sea in 2005 and worked initially on a domestic long-line fishing vessel. In 2008, he gained a marine engineer class-4 certificate. He then joined Shipping Corporation of Polynesia as a third engineer on the **Olovaha**. On 1 June 2009 he was sent to Suva to familiarise himself with the **Princess Ashika** and to be second engineer on the delivery voyage. He remained second engineer on the ship once the **Princess Ashika** started operations in Tonga.

1.8.11. The third engineer completed his basic training at TMPI in 2002 and was employed on the **Otu Tonga** and the **Olovaha**. In 2004, he did an engine room watchkeeper rating course and was then employed on the **Fua'kavenga** as a motorman. In 2006, he went to the **Olovaha** as a motorman, and in 2008 returned to TMPI and gained a marine engineer class-4 certificate. He went to Fiji to join the **Princess Ashika** as a motorman for its delivery voyage. He was a motorman when the **Princess Ashika** started operations in Tonga, and one month before the accident he was promoted to third engineer.

Fijian delivery crew

1.8.12. The master on the delivery voyage was a Fijian national and held a master class-3 certificate. He had worked exclusively for Patterson's and had spent the majority of his time with that company working on the **Princess Ashika**.

1.8.13. The chief engineer on the delivery voyage was a Fijian national and had been at sea since 1976. He held a marine engineer class-3 certificate and had been on the **Princess Ashika** since 2006.

1.9. Training, examinations and certification

1.9.1. Almost all the Tongan crew of the **Princess Ashika** had been trained at TMPI to varying levels of certification. TMPI had been established in 1985; it had been sponsored by the German Government and was run in conjunction with the Tongan Ministry of Education. When it was opened, the school was led by a captain superintendent from Germany, but in 1990 the school was handed over to the Government of Tonga to administer and operate.

[16] The 8-to-12 watch includes both the 0800 to 1200 and the 2000 to 0000 watches on a 4 hours on and 8 hours off roster.

1.9.2. The training at TMPI was initially based on a syllabus provided by the German Government, but later the South Pacific Maritime Code (South Pacific Bureau for Econoimic Co-operation, 1986) was adopted to give the syllabus and basic structure for the courses in each grade of maritime certificate. The Code was compiled to assist member countries of the South Pacific Forum to develop uniform standards with respect to the certification of seafarers. In 2002 the Code was replaced by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995 and 1997 (STCW 95, IMO). This Convention placed responsibility on member administrations to ensure that their seafarers were trained and certificated to a minimum standard.

1.9.3. Principally, TMPI was set up to train Tongan seafarers for employment on foreign-owned SOLAS ships, thus providing a source of international revenue. Eventually TMPI developed to educate up to master and engineer classes 4 and 5. There was an intake of about 20 students per annum. The development of seafarers started with pre-sea training that included basic safety training and a course for a deck or engine room rating, which included basic shipboard practices and routines. Following that, the newly qualified ratings went to sea, a few going directly to overseas ships, but mostly they were engaged on local vessels, either the passenger/cargo ferries or fishing vessels. After a period at sea of at least 6 months, they were able to return to TMPI to take a watchkeeper rating (deck or engine) course. Following further periods at sea and courses at TMPI, seafarers were able to progress to master or engineer class-5 and -4.

1.9.4. Up until 2008, qualifications higher than master class-4 were obtained overseas, usually in Fiji, Australia or New Zealand. However, in July of that year TMPI, with the support of the Fiji School of Maritime and Fisheries, was able to run a master class-3 course. Qualified trainers from the Fiji school, with assistance from the local lecturers, conducted the course at TMPI. There were 12 students, including the master and first mate of the **Princess Ashika**, on the course. All 12 students successfully completed the course, but 3 of those had to re-sit the oral examination before they gained their certificates.

1.9.5. All teaching materials and the majority of instruction are in English, with some use of the Tongan language to explain the English content. Practice exams, also in English, often include similar or identical questions to the real exams. Evidence at the Royal Commission hearings from a number of recent students at TMPI confirmed that many students struggled with comprehension and were likely to miss key-concepts and content while concentrating on readying themselves to pass the exams.

1.9.6. The Regional Maritime Programme of the Secretariat of the Pacific Community was the implementing agency for the IMO in the Pacific region. It offered many training courses for maritime school trainers and maritime administration personnel such as surveyors. Its technical cooperation programme provided model courses based on STCW 95 principles, which included training and assessment guides and student resource material for each subject module of the various grades of seagoing qualification.

1.9.7. One of the other functions of the Regional Maritime Programme of the Secretariat of the Pacific Community was to conduct audits of maritime training facilities and marine administrations. An audit of TMPI was conducted in December 2008. The report of the Review of the Tonga Maritime Polytechnic Institute (Secretariat of the Pacific Community, 2008) noted the repetition of non-conformities previously identified in an audit conducted on 13 June 2003. In the executive summary of the December 2008 report, the following recommendations were made:

> *Essential training facilities such as the fire fighting training simulator and the life boat launching davits is not up to standards and need to be urgently renewed. These facilities are either beyond repair or in a state of total disrepair, and are considered vital components of the safety training requirements that all seafarers have to undergo;*
>
> *TMPI is coming up to its second five year assessment period to satisfy the requirements of the international convention on the Standards of Training, Certification and Watchkeeping for seafarers 1978 as amended 1995, (STCW 95) and if Tonga wants to remain on the International Maritime Organization (IMO) "white list[17]", then it is the prerogative of the Ministry of Transport as the representative of the Contracting Government to ensure that this independent audit is conducted and results are submitted to IMO;*
>
> *Assessment of training equipment, teaching aids, teaching material and college instructors has been included in the body of the report to suit current and or future course objectives. Under the STCW 95 Convention and Code all of these items must have met the Maritime Administration's approval before courses are run;*
>
> *Instructors must be qualified technically and should be able to effectively deliver training on maritime subjects at any training institution. All STCW 95 certifications are issued only after a successful competency based assessment of students;*
>
> *The reviewed Quality Manual dated 17th October 2009 is current using at the school was not given to the Administration (Marine Division, MOT) for reviewing, amending and lastly approving of the Quality Manual in order to comply with STCW 95 requirements.*
>
> *An appropriate remuneration package is recommended for instructors in order to attract and retain them at the institute. The package should include retraining them to become qualified instructors; and*
>
> *Some consultation is needed between TMPI and the industry to align the training to current industry needs.*

1.9.8. In May 2009, an STCW audit of TMPI was conducted by the Regional Maritime Programme of the Secretariat of the Pacific Community (Secretariat of the Pacific Community, Regional Maritime Programme, 2009). The audit produced 7 system improvement notices. Most of the notices had regard to the standard of the Quality Manual and adherence to it. The report also suggested that there be better monitoring by the maritime administration (the Marine and Ports division) and that it should approve the courses taught by TMPI. The standard of the fire-fighting and survival infrastructure was deficient and was due for a major overhaul; this improvement notice had not been closed out from the 2003 and 2008 audits.

[17] A list of those countries whose information communicated to the IMO has been evaluated and found to be giving full and complete effect to STCW 95.

1.9.9. According to the Tongan Shipping (STCW Convention) Regulations 1998, the **Princess Ashika** was operating on near-coastal voyages. The regulation under section 2(2) defined 2 operating limits:

> *near-coastal voyage means a voyage between a port or place in Tonga and another port or place in Tonga; and unlimited voyage means a voyage between a port or place outside the area bounded by:*
>
> *(a) the parallels of latitude 15° North and 47° South; and*
>
> *(b) the meridians of longitude 130° East and 130° West; and*
>
> *another port or place inside that area, or outside it.*

1.9.10. The vessel was 677.15 gross tonnage, and had a total of 1640 kW engine power. For such a vessel the regulation required that the crew have the minimum certificates of competency as shown in Table 7.

Deck Department					
ship gross tonnage	master	chief mate if required	watchkeeper if required	additional watchkeeper if required	watchkeeper ratings if required
1000 to 500 gross tonnage	master class-4	master class-5	master class-5	not prescribed	rating

Engineering Department					
engine power	chief engineer	second engineer as required	watchkeeper as required	additional watchkeeper as required	watchkeeper ratings as required
3000 kW to 750 kW	class-2 restricted engineer	class-3 restricted engineer	not prescribed	not prescribed	rating

Table 7 Certificates required for operating on near-coastal voyages

Deck Department				
master	chief mate if required	watchkeeper if required	additional watchkeeper if required	watchkeeper ratings if required
class 3 master	class 3 master	class 4 master	not prescribed	5 ratings

Engineering Department				
chief engineer	second engineer as required	watchkeeper as required	additional watchkeeper as required	watchkeeper ratings as required
class-3 engineer	class-4 engineer	class-5 engineer	class-4 engineer	one rating

Table 8 Certificates required for the Princess Ashika's delivery voyage

1.9.11. On 8 June 2009, prior to the delivery voyage of the **Princess Ashika**, a provisional minimum safe manning certificate had been issued by the director of marine and ports (see Appendix 6). The certificate was for "one voyage Fiji/Tonga" and required the minimum certificates of competency as shown in Table 8.

1.9.12. No further minimum safe manning certificate was issued after the vessel arrived in Tonga and before it sank. However, on the accident voyage all of the officers and ratings, with the exception of the chief and second engineers who held engineer class-4 certificates and one of the engine room watchkeepers who did not hold an engineer class-5 certificate, met the requirements prescribed in the Shipping (STCW Convention) Regulations 1998, and exceeded those required on the expired provisional minimum safe manning certificate.

1.9.13. The watch system for the deck officers differed from the normally accepted roster on board vessels. The navigation watches were divided into the legs of the voyage rather than fixed time durations. For example, the watch for the voyage between Nuku'alofa and Ha'afeva was held by the first mate up to the entrance to the reefs of the Kotu group of islands. The master then conned the ship into Ha'afeva. The next leg of the voyage to Pangai was through narrow, reef-strewn waters, so the master remained on watch throughout that sector. Pangai to Vava'u was open water, so once clear of the berth the second mate stood that leg of the voyage until they reached the entrance to Vava'u harbour.

1.9.14. It was usual for a ship's master to write orders for the navigation watchkeepers to follow through the night while he was sleeping. There was often a standard set of instructions to which specific notes for that night were added, called night orders. When the watch was changed, the incoming officer was required to read and sign that they had read and understood the orders. On the **Princess Ashika**, it seems that that routine did not exist; there was a set of standing instructions that remained from its operation in Fiji, but the master was not accustomed to completing orders before he retired for the night.

1.9.15. In addition to navigational duties, the first and second mate supervised loading and discharging the cargo, which was usually carried out by members of the crew.

1.9.16. Six members of the deck crew were allocated to stand the traditional forenoon and afternoon watches of 8 to 12, 12 to 4 and 4 to 8. Each watchkeeper worked a 4-hour on 8-hour off roster, with 2 of them covering each watch; one to act as lookout and the other as a helmsman, swapping roles every 30 minutes.

1.9.17. The third engineer and 2 of the motormen kept 4-hour watches, similar to those of the deck crew. The chief and second engineer did not maintain a watch in the engine room. The other motorman and engine room trainees worked during daytime on maintenance and repairs under the supervision of the chief and second engineers. When the ship was manoeuvring, the chief engineer was on the bridge operating the main engine controls and the second engineer stood by in the engine room with the watchkeeper.

1.9.18. On the accident voyage, the first mate was meant to be standing the navigation watch from Nuku'alofa to Ha'afeva. However, he was feeling unwell, so he took advantage of the watch officer holding a master class-5 certificate and his previous short experience as a second mate to assist him by keeping the watch. The master was unaware of this arrangement.

1.9.19. The master was due to take further training in New Zealand in September 2009, and there had been discussions between the master, first mate and the managing director of the Shipping Corporation of Polynesia regarding manning of the vessel while he was away. It had been proposed, although not confirmed, that the first mate would be temporarily promoted to the master's position, the second mate being promoted to first mate and the watch officer becoming second mate. To facilitate this, on the previous voyage the master had been instructing the first mate on the pilotage of the vessel through the reefs and around the harbours.

1.9.20. The first mate said that he thought it would be good training for the watch officer to stand the watch while he rested on the bridge wing. The bridge watchkeepers, deckhand 1 and deckhand 2 and the other crewmembers seemed to be unsure which officer was actually on watch; some of them reported to the watch officer and others to the first mate; some reported to both. The watch officer said that he was unsure of what the role of watch officer required, so when the watchkeepers told him about the volume of water in the crew accommodation and on the cargo deck he took no action. After about 2200, when the bosun woke the first mate and he ordered that the after starboard ballast tank be emptied, the watch officer deferred to the first mate even though he again lay down on the bridge wing.

1.9.21. The master, first mate and chief engineer had worked on deep-sea trading vessels during their careers as junior officers. In that environment they took draughts prior to sailing, followed procedures for loading cargo, recorded soundings and pumped ballast as necessary. The routines used on the deep-sea trading vessels do not appear to have been transferred to the domestic shipping industry.

1.10. Government and public office organisation in 2009

The Kingdom of Tonga

1.10.1. The Kingdom of Tonga is a constitutional monarchy. As Head of State, the Monarch presides over a Privy Council of Cabinet Ministers plus the Governors of the Ha'apai and Vava'u island groups.

1.10.2. The population of Tonga is approximately 100 000, with more than two-thirds of the population living on the main island of Tongatapu. Tonga's complex social structure is essentially broken into 3 tiers; the Monarch, nobles and commoners.

1.10.3. Economically, Tonga is a small nation with a large non-monetary sector. The economy is subject to seasonal and external factors over which the country has little control. Tonga is heavily dependent on overseas development assistance and remittances from Tongans who live and work abroad, including seafarers.

Legislative Assembly

1.10.4. The Kingdom of Tonga has a single house, the Legislative Assembly, which comprises the Cabinet (up to 16 ministers), 9 nobles' representatives chosen by the noble families and 9 people's representatives elected by Tongans aged 21 years and over.

Government of Tonga

1.10.5. As a constitutional monarchy, Tonga has a national government. Traditionally, the Monarch appoints the Cabinet, which consists of the Prime Minister, the Governors of the Ha'apai and Vava'u island groups and 10 other Ministers. The Prime Minister is appointed by the King. The other Ministers were previously appointed by the Monarch and in 2005, 4 additional Ministers, 2 people's representatives and 2 nobles' representatives were appointed from within the Legislative Assembly. Since 2006, the Prime Minister has had the right to make decisions on who should fill ministerial portfolios.

1.10.6. Tonga has been undergoing democratic reform for a number of years, which has seen times of industrial or political unrest and, in 2006, riots. In late 2009 the Constitutional and Electoral Commission presented a report proposing reforms.

Ministry of Transport

1.10.7. The Ministry of Transport is one of 18 ministries and public offices in the Government of Tonga and is the transport regulator. The Ministry of Transport was formed in 2007, when the previous individual transport mode ministries were combined under a single head. Figure 29 depicts the organisational structure. The Ministry of Transport has 5 separate divisions: Civil Aviation, Marine and Ports division, Land Transportation Services, Meteorological Services (which incorporates the Coast Watch Communication division) and Corporate Services, responsible for the general administration of the Ministry.

1.10.8. A significant area of responsibility for the Ministry of Transport is that of marine safety and security oversight, which is delegated to the Marine and Ports division, which is also responsible for the administration of the Shipping Act

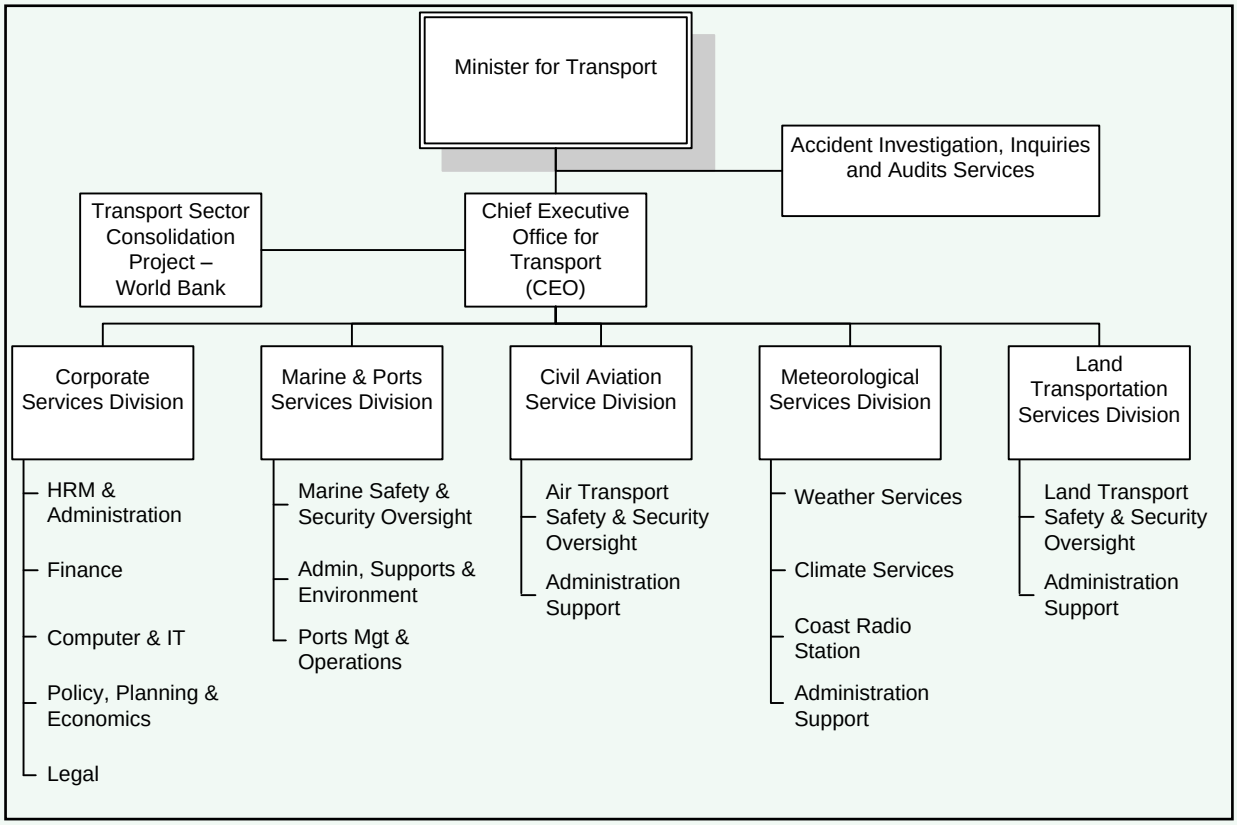


Figure 29 Ministry of Transport organisational chart

1.10.9. The Minister of Transport at the time of the accident was appointed by His Majesty King George Tupou V in May 2006. The Minister previously had 23 years' experience, including senior management roles, in the airline industry.

1.10.10. An acting CEO led the Ministry of Transport and was responsible for the 5 divisions of the Ministry. In 2008, she was employed as director of land transport, but in October 2008 was appointed as acting CEO of the Ministry. Prior to becoming director of land transport she worked in the police force for approximately 20 years before becoming the King's private secretary, then clerk to the Privy Council.

1.10.11. The Marine and Ports division was led by a director (see Figure 30) who reported to the CEO of the Ministry of Transport. The acting director for marine and ports was appointed to that role following the retirement of the previous director. He had gone to sea as a deck officer cadet in 1972. He started working as an instructor at TMPI in 1985. He gained a second mate's certificate of competency in 1989 and a chief mate's certificate in 1993. He was deputy port master from 2003 to 2005. In September 2008, he was appointed as principal surveyor for the Marine and Ports division, his main role being to oversee an external audit of TMPI by the Secretariat of the Pacific Community.

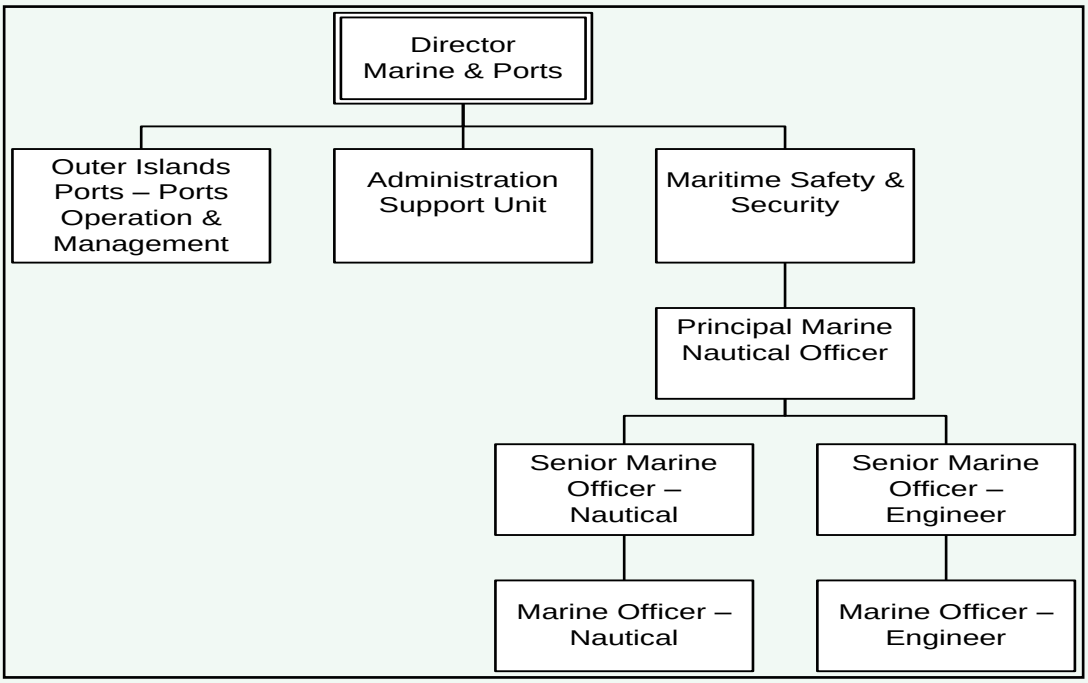


Figure 30 Marine and Ports division organisational chart

1.10.12. The immediate past director for marine and ports had retired on 8 June 2009. He had gone to sea as a deck officer trainee in 1957, and gained a foreign-going master mariner certificate in 1969. He had extensive experience in the Pacific, serving both as a navigation officer and as a harbour pilot in Papua New Guinea. In 2001, he was employed as a senior lecturer at TMPI. In 2002, he was appointed assistant secretary to the Ministry of Marine and Ports. In 2004, he assumed the position of secretary on the retirement of the incumbent. In 2007, as part of the amalgamation of the transport ministries into a single Ministry of Transport, the title for the head of the Marine and Ports division was changed from secretary to director.

1.10.13. Three marine officers performed the surveying function of the Marine and Ports division. They had the following experience:

- the senior marine nautical officer went to sea as a cadet officer in 1976. He operated mainly domestic ships around the Pacific and gained a Tongan limited master certificate, which had been converted to a master class-3 certificate. He had worked for the Marine and Ports division since January 2008
- the senior marine engineering officer went to sea in about 1986 as an engine room hand and in 1996 gained a marine engineer class-3 certificate. In 2001, he lectured in engineering at TMPI. He had worked at the Marine and Ports division since 2004
- the marine nautical officer went to sea in 1973 working in the Pacific. He gained a second mate foreign-going certificate in 1987. He spent time on the **Olovaha** as first mate and master. In 2005 he joined the Marine and Ports division as a marine officer

Ministry of Public Enterprises

1.10.14. A Public Enterprises division was established in 2000/2001 under the Ministry of Finance. When it was formed, the Public Enterprises division's mission statement was to:

> *Develop effective policies to improve the performance of the public sector and strengthen the transition to greater reliance on goods and services provided by the private sector.*

1.10.15. The primary responsibilities of the Public Enterprises division were to ensure:

- that borrowing for development purposes was undertaken only for carefully appraised and high-priority purposes with high rates of return
- that borrowings for general purposes of government were undertaken only to meet the essential requirements of the Government and were on terms favourable to the Kingdom and consistent with the Government's fiscal and monetary policies
- that the Government's debt servicing obligations were met fully and on schedule
- that the level, structure and overall terms of outstanding and committed debt were as advantageous as possible for the Kingdom and were at all times consistent with the Government's and the Kingdom's ability to service and repay such debt.

1.10.16. In 2002, Tonga formed an Act to establish the objectives, rules and procedures relating to public enterprises, entitled the Public Enterprises Act 2002. The Act defined a public enterprise as:

> *... a statutory board, company or other entity in which the government holds a controlling interest....*

The Act stipulated the formation and ownership of public enterprises, directorships, accountabilities and the appointment and duties of a CEO for a public enterprise. Of relevance to this investigation were section 13 and section 26(2) of the Act:

> *13 Directors' Roles*
>
> *A director shall act in good faith in the best interests of the public enterprise and shall –*
>
> *Not act, or agree to the public enterprise acting, in a manner that contravenes the law or the constitution of the public enterprise;*
>
> *Not agree to, cause or allow the business of the public enterprise to be carried on in a manner likely to create a substantial risk of serious loss to the enterprise's creditors;*
>
> *Not agree to the enterprise incurring an obligation unless the director believes at the time on reasonable grounds that the enterprise shall be able to perform the obligation when it is required to do so.*
>
> *26 Chief Executive Officer*
>
> *(2) The Chief Executive Officer shall be employed under a written performance based contract of employment with the public enterprise, which shall contain the following minimum provisions:*
>
> *(a) the objectives to be achieved by the public enterprise;*
>
> *(b) the performance expected of the public enterprise;*
>
> *(c) a review of the performance of the Chief Executive Officer;*
>
> *(d) adherence by the Chief Executive Officer to the public enterprise statement of corporate intent produced under this Act.*

1.10.17. When the Public Enterprises Act 2002 came into law, it listed 13 public enterprises, one of which was the Shipping Corporation of Polynesia. Since 2002, the number and type of public enterprises had changed and at the time of the accident, there were approximately 15 public enterprises.

1.10.18. In 2006, it was determined that the Public Enterprises division should be a separate Ministry. In October that year, the Ministry of Public Enterprises was formed and the Minister of Finance was appointed to be the Minister of Public Enterprises.

Procurement Committee

1.10.19. On 23 April 2003, the Cabinet decided to establish a Procurement Committee comprised of the following people:

- Minister of Finance (Chair)
- director of works
- auditor-general
- solicitor-general
- commissioner of revenue
- secretary for finance and accountant general (secretary)
- representatives of line ministries (as appropriate).

The terms of reference for the Procurement Committee were:

- to assess all proposed procurements of individual items costing over $20 000 which were to be financed from the Tonga Government funds in the annual budget estimates
- to monitor the procurements of goods and services to be acquired on behalf of the Government in financing agreements under multilateral and bilateral aid and loan programmes
- to develop proposals for a long-term procurement policy framework, with the commissioning of the assistance of an expert in procurement, as appropriate
- to undertake any other tasks approved by the Cabinet.

1.10.20. Procurement procedures were established for all ministries and departments to follow. There were increasingly onerous requirements as the value of the goods and services being purchased increased. Initially, purchases of more than $20 000 were required to be assessed by the Procurement Committee. In the intervening years, the threshold values were amended twice, lastly on 16 August 2005 when they were set as per Table 9.

Thresholds on procurement of goods		
Amount	**Government Procurement Policy**	**Action**
Less than 500 Tonga pa'anga (TOP)	Discretionary Shopping receipt	Client ministries Procurement entity
TOP 500 – TOP 2000	Required 2 document quotations	Client ministries Procurement entity
TOP 2000 – TOP 100 000	Required 3 written quotations	Client ministries Procurement entity
More than TOP 100 000	International competitive bidding	Procurement carried out through BAC and Procurement Committee

Table 9 Government procurement policy, 16 August 2005

1.10.21. At the time of the purchase of the **Princess Ashika**, the Procurement Committee was active, with a full complement of members and a secretariat.

Shipping Corporation of Polynesia

1.10.22. The Shipping Corporation of Polynesia was a public enterprise that operated a shipping service and acted as a manpower management company. Since 1981, the Shipping Corporation of Polynesia had operated the passenger/cargo ferry **Olovaha** under a charter agreement with the Kingdom of Tonga, which owned the vessel. In about July 2008, the Government of Tonga gave the **Olovaha** to the Shipping Corporation of Polynesia as payment for administration fees owed to the Corporation. The Shipping Corporation of Polynesia also acted as a manning agency, providing Tongan seafarers to several international shipping lines. In addition, the Shipping Corporation of Polynesia had an agreement with TMPI to provide berths for students who graduated from the school in order for them to earn sea time to progress their skills and qualifications.

1.10.23. The chair of the Shipping Corporation of Polynesia board had a legal background and had risen through the Crown Law Office to the rank of solicitor-general. In 2006, His Majesty King George Tupou V appointed her to the position of Minister of Justice and Attorney-General and, at the same time, to the chair of Shipping Corporation of Polynesia. On 31 May 2009, she resigned from the post of Minister of Justice and Attorney-General, but continued as chair of the Shipping Corporation of Polynesia.

1.10.24. The managing director of the Shipping Corporation of Polynesia was a New Zealander who trained as a teacher before turning to a career in sales and marketing. In 2007, while he was looking for a business development opportunity in Tonga, he was approached by the Minister of Transport to apply for the position of CEO of the Shipping Corporation of Polynesia. Originally, the position of CEO was not a board member, but in early 2009 the position was co-opted onto the board and the title was changed to managing director.

1.10.25. One of the directors, who held a Master of Commerce degree, was an ordained minister of the Free Wesleyan Church and held the post of financial secretary for the church.

1.10.26. A fourth director had resigned from the Shipping Corporation of Polynesia board on 9 July 2009. He held a marine engineer class-1 certificate and had sailed on overseas- and Tongan-registered ships before joining the Ministry of Marine and Ports. He stayed with the Ministry for about 8 years until appointed general manager of the Shipping Corporation of Polynesia in 2002. In 2005, he left the Shipping Corporation of Polynesia to operate his own surveying and engineering consultancy business and to lecture part time at TMPI. In 2006, he was appointed to the board of the Shipping Corporation of Polynesia, but from mid-2008, owing to conflict within the board, his involvement with the board was limited. He had not attended a board meeting since 21 November 2008, and had not been consulted on the purchase of the **Princess Ashika**.

1.10.27. A marine superintendent was employed by the Shipping Corporation of Polynesia between 2006 and February 2009. He had first gone to sea in 1985 and had been sponsored by the Government of Germany, working on German-registered ships. In 1989, he attended the New Zealand Maritime School and passed a second mate foreign-going certificate. In 1996, he gained a foreign-going master certificate. In later years, he worked on ships operating in the Pacific, including the **Fua'kavenga**, operated by the Shipping Corporation of Polynesia. In 2006, he was asked by the then general manager of the Shipping Corporation of Polynesia to join a team that was designing a vessel to replace the aging **Olovaha**. Once the design phase of that project was completed in 2008, the marine superintendent relieved as first mate on the **Olovaha** while the incumbent master and first mate sat the master class-3 certificate examination. During that time, he was told that there would not be any further work for him in 2009 and he should seek alternative employment. In early 2009, he was appointed as a part-time lecturer at TMPI. He left the employment of the Shipping Corporation of Polynesia in February 2009. The Shipping Corporation of Polynesia did not retain the position of marine superintendent.

1.10.28. The company secretary of the Shipping Corporation of Polynesia had a background in law, having been a QC and part-time judge in Scotland, as well as deputy transport commissioner. The secretary arrived in Tonga in 1991 and served on the Kingdom's Supreme Court before retiring in 1995. He then held a number of public appointments in the Kingdom. He was co-chair of a Tongan Royal Commission and had been chair of the Tonga Electric Power Board since 2002. In 2003, he was giving marine law advice to the Shipping Corporation of Polynesia and was appointed company secretary by the Shipping Corporation of Polynesia board. In July 2008, he was appointed by His Majesty King George Tupou V as one of 4 Law-Lords-in-Waiting to form a Judicial Committee of the Privy Council. The Law Lords provided advice to the King on the exercise of his judicial powers, including those relating to appointments, clemency, royal commissions, and terms and conditions of the judiciary.

1.10.29. At the time of the accident, the Shipping Corporation of Polynesia governance and management structures did not contain anyone who had maritime experience. However, the Shipping Corporation of Polynesia did have an engineering advisor or superintendent who was employed to maintain the **Olovaha**. He held a foreign-going chief engineer certificate and had sailed as chief engineer of the **Fua'kavenga**. In 2006, after the **Fua'kavenga** had been sold, he was asked by the then general manager of the Shipping Corporation of Polynesia to put in place a maintenance programme to keep the **Olovaha** operating until a replacement vessel was delivered which, at that stage, was expected to be in 2009. In February 2009, the advisor left Tonga for medical treatment and convalescence. He did not return to Tonga until 10 August 2009 and had no involvement with the purchase and operation of the **Princess Ashika**.

1.10.30. In February 2009, a gearbox technician from Auckland, New Zealand was called in to repair the starboard gearbox of the **Olovaha**. Once he had completed the repair, he was asked by the managing director of the Shipping Corporation of Polynesia to remain in Tonga to assist in the maintenance of the **Olovaha**. He was an experienced gearbox mechanic, but had no maritime qualifications and little or no maritime experience.

1.11. Maritime law in Tonga

International conventions

1.11.1. Tonga has acceded to a number of international maritime conventions. Those relevant to this investigation are:

- United Nations Law of the Sea – ratified 2 August 1995
- Convention on the International Regulations for Preventing Collisions at Sea, 1972 – entered into force 15 July 1977
- International Convention on Load Lines, 1966 – entered into force 12 July 1977
- Protocol of 1988 relating to the International Convention on Load Lines, 1966, – entered into force 15 September 2000
- SOLAS – entered into force 25 May 1980
- Protocol of 1978 relating to SOLAS – entered into force 18 December 2003
- Protocol of 1988 relating to SOLAS – entered into force 15 September 2000
- STCW 95 – entered into force 7 May 1995
- International Convention on Tonnage Measurement of Ships, l969 – entered into force 10 September 2000
- International Convention on Maritime Search and Rescue, 1979 as amended – entered into force 18 October 2003.

Tongan marine legislation

1.11.2. The Shipping Act 1998, as amended, was the primary mechanism for the regulation of shipping. This Act made provision for the registration of ships in Tonga and provided rules for navigation by ships registered in Tonga and any ship in Tongan waters and for matters related to navigation. The Act also provided for the appointment of the Minister of Marine and director of marine. The Act was broad in scope, with 18 parts and 210 sections dealing with all aspects of the regulation of shipping. (For comparison, the New Zealand Maritime Transport Act 1994 has 485 sections and 7 schedules.)

1.11.3. The Act was amended in 1999, 2001, 2002 and 2003. The 2001 amendment had the most far-reaching effect because it repealed the entire Part 3 – Registration of Ships of the principal Act and substituted a new section that, among other things, removed the provision for issuing a provisional certificate of registry. The Act applied to all vessels registered under the Act or regulations on any voyage in any waters but did not apply to a vessel of less than 8 m in length.

1.11.4. Section 206 of the Act gave the Minister power to make such regulations and provided guidance on the matters for which regulations might be made. At the time of the accident the pertinent regulations in force were:

- the Shipping and Navigation Regulations 1988

Prescribed the requirements for ascertaining the tonnage of ships, examinations of masters, mates and engineers, sea service requirements and arrangements for examinations of seafarers and the recognition of survey certificates from classification societies.

- the Shipping (STCW Convention) Regulations 1998

Section 58 of the Act gave STCW 95 force of law in Tonga, and the 1998 regulations prescribed the detailed requirements of STCW 95. The regulations were in 11 parts and 3

schedules. The key parts set down the responsibilities of owners, masters and seafarers, the watchkeeping arrangements on ships and the training and certification of seafarers.

- the Shipping (Registration) Regulations 2002, amended in 2003

Section 8 of the Act set out the requirements for the registration of ships in Tonga, and the 2002 regulations prescribed the detailed requirements for registration.

- the Shipping Life Saving Appliances Regulations 1958, as revised in 1988

Set out the requirement for lifesaving appliances on ships operating on home trade or international voyages. The regulations were outdated, despite a revision in 1988. For example, they referred to the chief harbour master as the authorised person, where today such a regulation would be administered by the Marine and Ports division.

1.11.5. Under the Shipping Act, the King could appoint a Minister of Marine. The Minister of Marine could then appoint a director of marine and any suitably qualified persons to be surveyors. The powers that a surveyor could exercise were specified in their certificate of appointment issued by the Minister of Marine.

1.11.6. Section 8 of the Shipping Act required every Tongan cargo ship, fishing vessel or pleasure craft over 15 m in length to be registered. Any vessel carrying passengers for reward had to be registered.

1.11.7. Before an application to register a ship was made, the owner was required to have the ship surveyed by a surveyor acceptable to the secretary (the director of marine and ports). The tonnage of the ship had to be ascertained in the prescribed manner. On completion of the survey, the surveyor was required to issue a certificate specifying the ship's tonnage and other particulars descriptive of the ship. An existing ship could be exempted from the requirement to undergo a survey in Tonga providing its tonnage had been ascertained in accordance with the Tonnage Convention.

1.11.8. Before registration, a ship needed to be marked with her name, port of registry, official number and draught marks in accordance with the Shipping (Registration) Regulations.

1.11.9. Tongan ships were required to carry the certificates required by the relevant international conventions to which Tonga was a party.

1.11.10. A Tongan ship was required to carry a sufficient and efficient crew who were properly qualified and fit for their duties. The crew were required to hold the appropriate certificates for their positions.

1.11.11. The director of marine was required to issue certificates in accordance with STCW 95 to persons who met the appropriate requirements.

1.11.12. Part 6 of the Shipping Act dealt with the safety of passengers and outlined the responsibility of the owner and master to maintain minimum standards, which included:

- passenger protection from the sea and weather
- an adequate supply of drinking water and suitable sanitary facilities
- adequate deck space for each passenger
- sufficient medical stores.

The master was also required, at the commencement of the voyage, to record in the deck log the number of passengers on board. Further, the Act required that a ship must not proceed to sea with more passengers than it was certified to carry or with deficient lifesaving appliances.

1.11.13. Part 7 of the Shipping Act was concerned with the application of safety and, in particular, the powers of the director and surveyors to conduct surveys, issue certificates, detain ships and be provided with stability information.

1.11.14. With regard to load lines, every ship was required to have the appropriate safety, load line and survey certificates before it sailed, and to be marked with load line, deck line and draught marks. No ship was allowed to be so laden as to submerge the load line when upright in salt water.

1.11.15. The Part prohibited specifically the sending of an unseaworthy ship to sea. Unseaworthy was defined as:

> *Unseaworthy" means, in relation to a ship, that—*
>
> *(a) the material of which the ship is made;*
>
> *(b) the condition of the hull of the ship;*
>
> *(c) the construction of the ship;*
>
> *(d) the condition of the ship's equipment, boilers or machinery;*
>
> *(e) the ship's safety equipment;*
>
> *(f) the qualification of the ship's master;*
>
> *(g) the number, description or qualifications of the crew of the ship, including its officers;*
>
> *(h) the weight, description or stowage of cargo or ballast on board the ship; or*
>
> *(i) the ship's draft, trim or heel;*
>
> *(j) is not of a reasonable standard, is not in accordance with the ordinary practice of seamen, is in contravention of this Act or the regulations or is prejudicial to safety of life at sea and, as a consequence, the ship is not in every respect fit for the proposed voyage or service*

1.11.16. Part 9 dealt with collisions and accidents and the apportionment of liability. With regard to accidents, the owner or master was required to report accidents, injuries or where material damage was sustained that affected the seaworthiness of the ship. Such occurrences were to be reported within 48 hours, or as soon thereafter as possible after arrival at the first port.

1.11.17. The Shipping Act referred to and relied upon the South Pacific Maritime Code, which was superseded in 2002 by the Safety Regulations for Non-Convention Vessels 2002 that were produced by the Regional Maritime Programme Secretariat of the Pacific Community.

1.11.18. The Safety Regulations for Non-Convention Vessels 2002 were part of a suite of model legislation issued by the Regional Maritime Programme Secretariat of the Pacific Community, which were promoted to standardise the legal requirements for shipping in the Pacific region. The explanatory notes for the Safety Regulations for Non-Convention Vessels 2002 outlined the purpose of the regulations:

> *... the Regulations provide a regional safety standard for new non-convention trading vessels and barges and, as appropriate, existing vessels and convention-sized vessels that trade regularly and consistently on non-international voyages. The provisions of the Regulations are intended to facilitate the operations of small vessels to which the relevant Conventions are not applicable but for which the application of the basic safety principles embodied in*

the Conventions, if applied, would ensure a higher level of safety for the vessels and personnel on board.

Therefore, the safety principles that are contained in the Conventions identified below have been incorporated, as far as practicable, in the present Regulations. They are principally intended to be applied to new vessels. The Regulations also contain provisions to enable Pacific Island Maritime Administrations, as far as practicable and reasonable, to apply the same standards to existing vessels if they need to do so. Existing vessels registered under the Flag of a Pacific Island Country for the first time may be required to meet, in part or in full, the requirements of the Regulations in order to achieve an appropriate level of safety.

1.11.19. The provisions specified in the Regulations take into account the provisions specified in the following conventions:

1 *The International Convention for Safety of Life at Sea (SOLAS), 1974, as amended;*

2 *The International Convention on Load Lines (LL), 1966, as amended;*

3 *The International Regulations for Preventing Collisions at Sea (COLREG), 1972, as amended.*

1.11.20. The technical annexes contain a number of specifications adapted from the standards of the IMO, from the Australian National Standard for Commercial Vessels (the successor to the Uniform Shipping Laws Code, which formed the basis of many of the standards and requirements of the South Pacific Maritime Code) and from other sources. Chapter 1 made it clear that the compliance of a vessel with the Australian National Standard for Commercial Vessels, or compliance in full with any other comprehensive and coherent body of regulations, was equivalent to compliance with the Regulations. Provision was also made for the acceptance by individual countries of other appropriate technical standards, which might be national or industry standards.

1.11.21. The International Safety Management Code (ISM Code) has been in force since 2002 as an amendment to SOLAS and is mandatory for all signatories to SOLAS. Whilst the ISM Code is generally thought of as being applicable to larger ships trading internationally, the text of the ISM Code states that "the requirements of this Code may be applied to all ships". The ISM Code is in fact capable of adaptation for all types and sizes of ship and trading area. The ISM Code requires a company to develop, implement and maintain a safety management system which includes the following:

- a safety and environmental protection policy
- instructions and procedures to ensure the safe operation of ships and the protection of the environment, in compliance with relevant international and flag state legislation
- defined levels of authority and lines of communication between, and amongst, shore and shipboard personnel
- procedures for reporting accidents and non-conformities with the provisions of the Code
- procedures to prepare for and respond to emergency situations
- procedures for internal audits and management reviews.

1.11.22. A safety management system is audited and approved by the flag state or an organisation, such as a classification society, approved by the flag state. On approval of a vessel's safety management system a document of compliance is issued, which can be suspended if later audits reveal significant deficiencies.

1.11.23. The adoption of the Safety Regulations for Non-Convention Vessels 2002 opened the way to introduce the requirement for ships to have a safety management system, which must be audited by the Minister or director, or by an approved third party.

1.12. Pacific shipping

1.12.1. The Tongan people, together with the other Polynesians, have travelled the vast distances between the Pacific islands for hundreds, if not thousands, of years. They were adept at traditional navigation methods to find their way between islands, using various means including the sun and stars, sea conditions and migratory paths of birds (Finney, 1976). Traditionally for long voyages, their vessels took the form of large canoes, sometimes single-hulled with outrigger(s), but more often multi-hulled. For shorter voyages, single-hull canoes with outriggers were the preferred type.

1.12.2. In recent years, vessels from other parts of the world have been introduced to the Pacific. These have included interisland passenger/cargo vessels, fishing vessels and small runabouts; generally they have improved the transportation network. Vessels that are more modern are usually able to carry more cargo and passengers economically and with a greater degree of reliability. They have possibly provided more comfort, and nearly always improved protection from the elements. These improvements have allowed outlying islands to have improved communications with the larger islands and access to improved exporting opportunities, thus improving the commerce for those smaller communities. However, these changes have raised an expectation of ongoing communication at an affordable cost and placed pressure on governments to provide a shipping service on a social rather than financially viable basis. On the negative side, such vessels tend to be expensive to buy and operate, with relatively sophisticated technical equipment that requires specialist attention and regular ongoing maintenance.

1.12.3. Because of the high cost of running such a shipping service, it has often fallen on the government of a country to provide it, and most Pacific countries have or have had a government-owned shipping company. In some cases, certain routes operated by private operators have been subsidised. In Tonga, the Government held a 100% shareholding in Shipping Corporation of Polynesia.

1.12.4. The monthly voyage to the outlying Niuas island group is uneconomic and the most difficult service to maintain. The voyage to the Niuas adds an additional 480 nautical miles' steaming to the more frequent weekly trips to Ha'apai and Vava'u. Passenger numbers and cargo volumes are irregular and the voyage is over open ocean with no shelter or port of refuge. The uneconomic Niuas service is subsidised by the Government of Tonga. At the time of the accident, Shipping Corporation of Polynesia held the contract for the service.

1.12.5. Substandard shipping, dictated by economics and geography, is common in many parts of the world. Most Pacific nations face the same challenges, maybe even more so because of the huge distances involved. The United Nations' maritime arm, the IMO, promotes technical assistance for emerging nations to assist them to improve the standard of shipping in their countries by encouraging them to adhere to minimum international standards. In the Pacific, the Regional Maritime Programme of the Secretariat of the Pacific Community facilitates programmes to improve the safety of shipping in the area. One such initiative is the holding of seminars on substandard shipping, the most recent being in August 2007.

1.12.6. In his presentation to the Seminar on Substandard Shipping in the Pacific Region (Secretariat of the Pacific Community, 2007), Mr Justin Smith, the managing director of a Fijian shipping company, quoted from a 1997 United Nations Economic and Social Commission for Asia and the Pacific Study (United Nations, 1997), which identified the problems associated with maintaining shipping services to outlying islands:

> *Inter-island Shipping services play a crucial role in providing the fundamental means of transportation in the South Pacific, however the services are handicapped by long distances between sparsely populated islands and the seasonal demand for passengers transport reaching peak levels at certain times. The limited revenues available to shipowners places them in a financially difficult situation in which they are often unable to replace obsolete and sometimes unsafe vessels. As a result, the average age of the fleet in the Pacific is excessive and even those brought into service are often of an age and condition which are far from ideal.*

That quote outlines the basic problems that operators encounter when trying to provide shipping services in the Pacific.

1.12.7. Many island nations in the Pacific rely heavily on aid to supplement their gross domestic product. Often the maintenance of the transportation infrastructure is reliant on donations of equipment and funds to assist with the maintenance of plant and equipment. Often where interisland passenger/cargo vessels are built by donor countries, spare parts and experienced personnel are provided for a fixed-period (often 5 years) to assist and train the local personnel in the maintenance and operation of the ships.

1.12.8. In the early 1980s, the Federal German Government donated the passenger/cargo ship **Olovaha**, together with expertise to maintain it. At the same time, Shipping Corporation of Polynesia was established to operate the ship, again with the assistance of Germany. After about 5 years, the Federal German Government withdrew from the project and the Shipping Corporation of Polynesia continued the operation of the ship under a charter agreement with the Government of Tonga. At that time, the ship was in class with Germanischer Lloyd classification society and was maintained in accordance with the Germanischer Lloyd rules. However, over the years the condition of the **Olovaha** deteriorated until, in April 2002, Germanischer Lloyd withdrew the classification of the vessel. The vessel continued to operate under a flag state or in-country inspection regime, but experienced increasing mechanical problems until in late 2008 and early 2009 it was decided that the **Olovaha** was no longer suitable for the transportation of passengers and alternative arrangements needed to be made. However, the demand for passenger transportation meant the **Olovaha** had to continue operating until the arrival of the **Princess Ashika**.

1.13. Meteorology and environment

1.13.1. Appendix 13 is a full report on the weather conditions at the time of the loss of the **Princess Ashika** prepared by the Meteorological Service of New Zealand (MetService NZ). The director of meteorology of Tonga also issued a report that contained forecasts and observations for the time of the accident (see Appendix 14). The following is a summary of those reports and observations from survivors.

1.13.2. The weather forecast issued by the National Weather Forecasting Centre, Fua'amotu (Tonga Meteorological Service of the Ministry of Transport) at 1100 on 5 August was for:

> *... east to southeast winds 15/20 knots gusting to 25 knots over most coastal waters, moderate to rough seas with a moderate southeast swell.*

The Fiji Meteorological Service forecast for the Tongan area was:

> *... east to southeast winds of 20 to 25 knots and up to 30 knots at times. Rough to very rough seas.*

This pattern of weather was typical of the south-easterly trade winds that were usual at this time of the year about the Tropic of Capricorn (around 22°S).

1.13.3. The aftercast report provided by MetService NZ said that the wind was about 25 knots in the late afternoon, easing to 20 to 25 knots in the evening. The combined wind and swell wave height was calculated at 3.5 m in the afternoon easing to 3.3 m in the evening.

1.13.4. Consideration was given to the possibility that the wave length reduced, with a corresponding increase in wave height, as the swell waves crossed the relatively shallow waters of the Tongan ridge. The MetService NZ report said, "wave length will noticeably shorten over the shallower water, and the sea state may appear to be relatively higher". The extent of the effect, if any, on the sea conditions near the course of the **Princess Ashika** was not quantified, but there were no reports from the survivors of the **Princess Ashika** or those on the **Pulupaki** of any extraordinary wave formations.

1.13.5. Many experienced mariners appearing before the Royal Commission have confirmed that they had not experienced any local exceptional wave conditions in the vicinity of the accident.

1.13.6. There were meteorological observation stations at Fua'amotu Airport and at Ha'apai. The position where the **Princess Ashika** sank was about midway between the stations. The station at Fua'amotu Airport was some way from the coast and as such, the recorded wind speed at the station was likely to have been influenced by the wind moving over land. The actual wind recording in the hours before and after the accident are shown in Table 10.

Time (Tongan local)	Fua'amotu Airport		Ha'apai	
	Direction	Speed (knots)	Direction	Speed (knots)
1800	100	8	080	20
1900	100	10	080	21
2000	100	7	No observation	
2100	100	9	No observation	
2200	110	7	No observation	
2300	110	9	No observation	
0000	110	9	No observation	
0100	110	10	090	17
0200	110	10	090	17
0300	110	8	090	11
0400	110	6	090	10

Table 10 Wind speed at Fua'amotu and Ha'apai

1.13.7. The weather reported by the crew of the **Princess Ashika** was consistent with the forecasts. It was reported to have been rough, but not exceptionally so. None of the survivors said that the weather they experienced after they got into the liferafts was exceptionally bad.

1.13.8. The predicted tides at Nuku'alofa were a high tide of 1.34 m at 1938 on 5 August and a low tide of 0.54 m at 0128 on 6 August (Commonwealth of Australia Bureau of Meteorology, 2008). There was little, or no difference, between the tides experienced at Nuku'alofa and those at the accident location.

1.13.9. A full moon rose at 1739 on 5 August and set at 0659 on 6 August. Sunset was at 1824 on 5 August and sunrise was at 0710 on 6 August. Nautical twilight on 6 August began at 0620 (Time and Date for Tonga, 2009).

1.14. Survivability

Organisation of search and rescue in Tonga

1.14.1. Tonga is located in the New Zealand SAR region, an internationally agreed area that covers much of the South Pacific. RCCNZ is responsible for coordinating major maritime and aviation SAR missions within the New Zealand SAR region. RCCNZ is supported by the Maritime Operations Centre, a radio service that provides VHF and high-frequency radio services within that region, including the continuous monitoring of radio frequencies for distress messages. The Maritime Operations Centre operates under the name Taupo Maritime Radio, and its radio call sign is ZLM.

1.14.2. Part of the Ministry of Transport of Tonga, the Meteorological and Coast Watch division operated the local radio station under the name of Nuku'alofa Radio, with a radio call sign of A3A. It provided a maritime radio service similar to that of the Maritime Operations Centre for vessels operating in Tongan waters.

1.14.3. The Governments of Tonga and New Zealand had signed an Arrangement (Government of New Zealand and the Government of Tonga, 2005) on SAR procedures that, among other things, gave Tonga the responsibility for the conduct of SAR operations within the territorial waters (12 nautical miles) of Tonga. The **Princess Ashika** sank close to the limit of Tongan territorial waters.

1.14.4. Nuku'alofa Radio responded immediately after receiving the distress message by tasking the **Pulupaki** to provide assistance. Within a matter of minutes, an EPIRB alert was received by RCCNZ, which then took over the coordination of the SAR response, with ongoing assistance from Nuku'alofa Radio. Although RCCNZ exercised primary responsibility for the coordination of the SAR mission, the control of distress radio traffic remained initially with Nuku'alofa Radio because the distress situation was a local event. RCCNZ used automated communication means that Nuku'alofa Radio did not have to advise other shipping of the distress situation[18]. These warnings were repeated regularly for the duration of the SAR effort.

Shipboard safety systems and practices

1.14.5. The passengers on this voyage, as with those on earlier voyages of this ship and its predecessor, the **Olovaha**, were not given any safety briefing. There were few posters to inform the passengers of the location and use of the lifesaving appliances carried by the ship or of the procedures that should be followed in the event of an emergency, and at least one "muster station" sign. The posters and sign were in English and remained from when the vessel had been operated in Fiji. They had not been replaced or amended when the vessel arrived in Tonga. There was no evidence that the passengers were told to familiarise themselves with these notices.

1.14.6. Since the ship had been operating in Tonga, the crew had conducted one emergency drill; this had taken place in Nuku'alofa on a Saturday morning between voyages. Only about 60% of the crew attended the exercise even though the entire crew, except those who had worked overnight, were expected to be present.

[18] For example, one system could select and communicate with ships known to be within a certain distance of a specified position only.

1.14.7. Survey reports from Fiji indicated that the ship did not have alarm bells or any other alarm system to alert passengers should there be an emergency. The usual means of communicating with the passengers was the PA, which the master used in the minutes before the vessel sank. There also was a pneumatic ship's whistle, mounted on the mast above the wheelhouse, which in an emergency would normally be used to indicate or supplement a signal on the alarm bells. However, the master said later that the whistle was inoperable because of a problem with the pneumatic system that powered it.

1.14.8. The survey checklist from 2 July 2009 indicated that the ship was equipped with 12 inflatable liferafts that could accommodate a total of 315 persons: one 15-person liferaft, seven 20-person, two 25-person and two 55-person. These liferafts were in containers mounted on cradles located on each side of the bridge deck, and were those fitted to the **Princess Ashika** when it left Fiji. To meet the requirements for the 387 passengers and 18 crew that the ship was certified to carry in Tonga, 8 additional liferafts were transferred from the **Olovaha**. The capacity of the additional liferafts, how they were fitted and whether they had hydrostatic release units was unknown. The video of the sunken ship showed that on the port side there were 6 liferaft cradles forward of the funnel and 2 aft of the funnel. It would be usual for the configuration to be duplicated on the starboard side, giving a total of 16 possible liferaft locations, but the ROV was unable to view the entire starboard side so it could not be confirmed.

1.14.9. Securing straps for liferafts could be released manually or automatically by a hydrostatic release unit that sensed the increased water pressure when the unit was submerged to a depth of between 1.5 m and 4 m. When a liferaft was deployed, it did not inflate until the painter was fully extended. The liferaft end of the painter was connected to a trigger that activated a gas cylinder to inflate the liferaft. To prevent a liferaft being dragged down with a sinking ship, the shipboard end of a liferaft painter was usually connected to a weak link on the hydrostatic release unit that broke free. From the underwater video, it was apparent that 3 liferafts had not deployed from their cradles. At least one liferaft had not deployed because it was fouled by an unidentified line. It could not be determined whether the other 2 liferafts had been improperly secured to the cradles or had also become tangled, or the hydrostatic release units had failed to operate. There were reports from survivors that they had to inflate manually a number of liferafts by pulling on the painters, indicating that the painters had not been attached correctly.

1.14.10. The survey checklist from 2 July listed 8 lifebuoys that were provided at a number of locations around the ship. The underwater video showed that some of the lifebuoys had not floated free as the ship sank. The checklist listed 348 coastal lifejackets on board, almost all stowed in boxes in the passenger lounges. SOLAS required that a lifejacket be carried for each person on board plus an additional 10% of that number suitable for children. Following the survey, an unknown number of lifejackets had been transferred from the **Olovaha** to the **Princess Ashika** to supplement or replace those already carried.

1.14.11. A 406-kilohertz EPIRB was fitted on the deck above the bridge. June 2008 was the most recent radio survey before the **Princess Ashika** left Fiji. That survey report indicated that the EPIRB battery was due to expire in December 2011. The hydrostatic release unit that secured it had expired on May 2007. There was no evidence that that release unit had been exchanged before the accident, but the EPIRB did deploy and operate correctly.

General search and rescue issues

1.14.12. Real-time surface water movement provided by satellites, and proven SAR planning software enabled RCCNZ to calculate and update regularly the likely drift rates of flotsam and refine the search area. RCCNZ was confident of the SAR origin position because of the proximity of the master's transmitted position of sinking, the EPIRB position and the position where the survivors were rescued. The day after the sinking an oil slick was also discovered in the same area.

1.14.13. On 7 August, **Kiwi Rescue 255** continued the air search. The area of interest was continually assessed and modified to account for observed sea and wind conditions. The Orion searched, without success, extensive debris fields and nearby islands.

1.14.14. The RNZAF noted that the relatively high search speed of the P3 made it less than ideal for looking for people in the water or on flotsam. However, there were no recorded helicopters and few fixed-wing aeroplanes suitable for SAR in Tonga. The provision of a helicopter from another country was considered, but rejected because of the time required to have one available on scene, particularly if re-assembly of the helicopter were required, and because no signs of further potential survivors had been seen since the rescue of those in the liferafts.

1.14.15. At 1100 on 7 August, the estimated number of persons who had been on board the **Princess Ashika** was amended to 119. The Tonga Police Force continued to reconcile the number of persons on board, and it was more than 2 weeks before it was determined that a total of 128 passengers and crew had been on board at the time of the accident. There were several reasons why the total number of people on board the ship was uncertain:

- children under 2 years of age were carried free of charge and were not ticketed
- it was usual for stowaways to be on the ship
- friends and relatives of crewmembers were usually un-ticketed and were known not to be recorded on the passenger manifest
- tickets could be bought at the gangway and often did not appear on the manifest given to the Port Authority of Tonga by the Shipping Corporation of Polynesia office staff
- passengers going to outer islands sometimes had their tickets paid on arrival at their home port
- many people in Tonga go by names sufficiently different from their legal names to cause some persons to be recorded twice as missing
- the ship's dues to the Port Authority of Tonga were calculated according to the number of passengers and the weight of cargo, so underreporting of both was a common practice.

Ultimately, the difficulty in establishing the number of persons on board was a consequence of the operator's procedure for ticket sales and boarding, and the lack of pre-departure reconciliation.

1.14.16. RCCNZ continued to coordinate the search efforts in the areas of highest probability, confident that those areas were appropriate, based upon the flotsam that continued to be found and even though no more people had been located. On 8 August, a low cloud base and reduced visibility prevented continued searching by the P3 and the decision was made by RCCNZ to terminate further searches by the RNZAF. At the same time, RCCNZ determined that further search efforts by surface vessels would be better coordinated by the Tonga authorities and set about the formal handover.

1.14.17. Prior to handover to the Tonga Police Force, RCCNZ reviewed its own mission checklist, which included the following considerations:

- re-evaluation of the distress position, drift factors, intelligence, search decisions, assumptions and scenarios. RCCNZ had high confidence that the right areas had been and were being searched
- review of the search areas and plans that had been developed, the assigned search areas and the likelihood that what was being looked for would have been sighted. RCCNZ had high confidence that potential survivors, whether in the water or in

liferafts, would have been in the areas that were searched and that it was unlikely that they had moved beyond these areas

- consideration of survivability aspects, such as the elapsed time since the sinking, environmental conditions such as sea state (moderate), wind (moderate with very little chill factor), water temperature (25° centigrade, which was a small risk in itself but increased the risk of attention from sharks) and physical condition of potential survivors. The fact that no survivors or bodies had been found since the early hours of the search indicated that there was a low probability that more persons would be found.

The search was handed over to the Tonga authorities at 1235 on 9 August 2009.

1.14.18. At about 1630 on 6 August, searchers found a rope that was thought to be attached to the **Princess Ashika**. On 7 and 8 August, a combined Royal Australian Navy and Royal New Zealand Navy dive team was deployed to Tonga. Initially they used a remote environmental and underwater system to search the area from the Tongan defence vessel the **Voea Pangai**. On 12 August, after some delays owing to adverse weather, an image was identified on the seabed at a depth of about 110 m in a position close to that given by the master in his final radio call and the EPIRB. The depth precluded an attempt to search the vessel using normal dive techniques.

1.14.19. On 15 August the diving support ship **HMNZS Manawanui** arrived in Tonga. The combined force used a Sea Eye Falcon ROV to search for the sunken ship, and by 18 August it had been able to confirm the identity of the **Princess Ashika** and to video the vessel and the surrounding area.

1.14.20. The Tonga Police Force's coordinated search operations continued for a further 9 days, until on 18 August, after consultation with RCCNZ and consideration of all the factors affecting the SAR effort, it was determined that further searching was unlikely to find any more survivors and that suspension of the search was justified.

2 Analysis

2.1. Overview

2.1.1. The **Princess Ashika** was designed to operate in smooth or inland waters. Its original design incorporated features or defences to mitigate the risk of foundering should it unexpectedly encounter adverse weather, but it was not designed for continued operation in such weather. The limits of its design were apparently not tested throughout its second life of some 25 years operating in Fijian waters, even through waters for which the ship was not designed.

2.1.2. With the passage of time, the effectiveness of those defences was eroded through a combination of age and a minimalistic approach to maintenance, which increased the risk of the vessel foundering. FIMSA had identified the vulnerability of the vessel, and had in later years imposed an increasing number of conditions designed to mitigate the growing risk.

2.1.3. By the time the **Princess Ashika** began its third life in Tonga, the condition of the vessel was beyond economic repair and the only value of the ship was as scrap (which might have been a negative value in any case). Nevertheless, the ship was put into service on the Tonga domestic trade in waters that were more severe than those it had plied in Fiji. In addition, the operating conditions imposed by FIMSA were not applied by Tonga.

2.1.4. The result was that the **Princess Ashika** began operating in the most challenging sea environment in which it had ever been, while it was in its worst condition ever. That it would soon founder was predictable.

2.1.5. The **Princess Ashika** tragedy was the worst recorded maritime disaster in the history of Tonga. A loss of 74 lives from a total population of 100 000 was a high percentage, and did negatively impact on the entire population.

2.2. How the Princess Ashika sank

Voyages in Tonga and the vessel's condition on departure

2.2.1. During the **Princess Ashika**'s last months of operation in Fiji, increasingly more restrictive conditions were placed on its operation. In January 2009, FIMSA restricted the **Princess Ashika** to short trips of about 10 nautical miles in the shallow reef-bound waters between Natovi and Buresala, with "reduced cargo and speed". In February the total passenger and crew numbers were reduced to 160. The reason for reduced speed, and what that speed should be, was not specified, but would have been to reduce the risk of wave damage to the corrosion-weakened hull. Similarly, "reduced cargo" was not quantified, but it was reasonable to assume that it would have been considerably less than the original design deadweight of the ship (223 t) less any fuel, ballast water and other consumables.

2.2.2. The restrictions placed on the vessel reflected the increasing level of concern within FIMSA about the condition of the vessel. Its concern might have increased after the sinking of a similar vessel, the **Ovalau II** in 2003, when it was being operated by the same owner. The ensuing inquiry levelled criticism at both the owner and FIMSA over the poor standard of maintenance and the ineffective standard of surveying.

2.2.3. The **Princess Ashika** made 4 voyages in Tonga before the accident voyage. On each voyage the ship was overloaded; in 3 cases, significantly so. The first voyage was made with 342 t of cargo and 340 passengers, the subsequent voyages were made with 220 t, 177 t and 368 t of cargo on board (see Table 11). Even 177 t of cargo would have exceeded the total assigned deadweight of 223 t when fuel, ballast water and other consumables were included.

Voyage	Date of departure from Nuku'alofa	Cargo (t)	Passengers (as per Port Authority of Tonga clearance forms)
1	3 July 2009	342	340
2	9 July 2009	220	56
3	15 July 2009	177	28
4	23 July 2009	367.82	89
5	5 August 2009	110	41

Table 11 Passenger and cargo loadings for the 5 voyages in Tonga

2.2.4. Had it been routine for the ship's officers to check the load line and the draught marks, they may have become aware that the ship was overloaded. However, none of the officers looked for or saw the load line, nor did they record the draught immediately before the ship sailed. Witness accounts and photographs supplied by surveyors show that the **Princess Ashika**'s load line was usually submerged even before any passengers or cargo were loaded. This was attributable to natural weight growth owing to corrosion, a substantial amount of cement that had been placed in the vessel to control corrosion and stem leaks in the hull, ballast water known to have been routinely carried, and probably water in void spaces not detected by the crew. Once the passengers and cargo were loaded, the vessel's load line would have been well submerged, which meant a reduced freeboard. Any reduction in what was by design a small freeboard would have increased the likelihood of the vessel shipping water on deck when at sea.

2.2.5. After the second voyage, to return the bow ramp to use, the crew had removed the concrete used to block the gaps around the ramp. That action increased free access of seawater onto the cargo deck. Reports indicated that water had freely entered the deck, but when the seas were slight and the vessel trimmed by the stern, water was able to drain out through the deck scuppers unhindered.

2.2.6. The severe weather experienced on the fourth voyage allowed water to accumulate on the cargo deck, with the amount increasing to such an extent that a hole was punched in the superstructure plating to allow the water to drain. As water was lying on the deck for most of the voyage, and given the condition of the deck in way of the casings and that there was at least one hole in the deck itself, it is almost certain that a substantial amount of water entered No 1 void during that voyage. Water also had to be bailed from the crew accommodation during that voyage. Therefore, it was likely that some water also drained into No 2 void space through the unsecured manhole in the crew accommodation cross alleyway. Added to that, the poor condition of the tank and void space air vents on the cargo deck would have allowed water into the void spaces below.

2.2.7. When the ship left Nuku'alofa for Ha'afeva on the accident voyage, it had 128 persons and an estimated 110 t of cargo on board, considerably less than it had carried on the fourth voyage.

2.2.8. Witness accounts had the **Princess Ashika** departing on the accident voyage with a slight starboard list, and possibly trimmed by the head owing to cargo disposition and ballast that had been pumped into the forepeak tank earlier in the day at the request of the P&I surveyor. This ballast was reportedly pumped out as the ship left Nuku'alofa Harbour, which would have reduced the trim by the head, possibly bringing it to even keel or slightly by the stern. The crew did not take draught readings before departure, nor did they record the departure condition of the tanks or calculate the statical stability of the ship, so it was difficult to determine the actual condition of the vessel at departure. The vessel was, by all accounts, simply loaded with whatever cargo was presented for shipping and refuelled, then departed.

2.2.9. Contrast that process with what should normally happen with a fully compliant vessel. The cargo, passenger and other consumable weights would have been measured, the draughts checked and the stability calculated before the vessel departed the wharf. The reasons for following such a process were logical. The crew would have known the disposition of weights on board and could have identified the source of any unknown weight, they would have known how much reserve stability the vessel had and whether it complied with the relevant minimum requirements, and they would have better understood the risk to the vessel in the event of any unusual event, such as the accumulation of water on deck.

2.2.10. The void spaces were said to have been checked occasionally but not the 3 times every day that were required when the **Princess Ashika** operated out of Fiji. In addition, none of the crew appeared to be aware of the No 1 void space, so it was likely that that tank had not been checked since the vessel arrived in Tonga. It was not established whether any of the void spaces had been checked since the previous trip, when the vessel had encountered adverse weather and had experienced similar problems with water on the cargo deck as it encountered on the accident voyage. There was evidence that the manhole cover for No 1 void space was secured by only 2 or 3 securing nuts that were only hand-tight, and there was at least one corrosion hole in the cargo deck above that void (see Figure 16, page 33). Consequently, it was almost certain that water existed in that void before the voyage began, but the quantity could not be established.

2.2.11. Soon after clearing the harbour, the master departed the bridge and shortly after the first mate went to sleep on the bridge wing. The master was required to be awake at about 0200 the following morning to pilot the ship into Ha'afeva, so it was reasonable for him to rest before he was required for that duty. The first mate being asleep while the watch was taken by the watch officer would have been acceptable if it had been organised properly. The first mate had said that he was unwell and also that he wanted to give the suitably qualified watch officer some experience, as such this could be considered to have been a good use of resources and an ideal opportunity for the trainee to gain experience. However, for it to have been effective, a more formal handover of responsibility was required, together with a clear expectation of the level of watch the reliever was to keep. This caused the chain of command to be blurred, as indicated by the number of crew who were unsure of who was in charge of the navigation watch. Had there been a formal handover, the watch officer might have accepted more responsibility and taken more positive action, including waking the master, when he was told about the extent of water in the cargo hold.

Stability and watertight integrity considerations on the accident voyage

2.2.12. The **Princess Ashika** was steaming in moderate sea conditions, generally from the east to southeast direction. In a weather assessment made by MetService NZ after the accident, it described a significant wave height of about 3 m to 3.5 m from the east to southeast quadrant, accompanied by 20- to 25-knot winds from the same direction. This assessment was higher than but close to witness accounts. With the **Princess Ashika** on a course close to 020° (T), the vessel would have been taking the seas broadly on its starboard beam.

2.2.13. The **Princess Ashika** was on its fifth voyage in Tonga. On the previous voyage, the same crew had had to contend with seawater accumulating on the cargo deck. On that voyage, the vessel was heavily overloaded (368 t of cargo) and the sea conditions were similar to those encountered on the accident voyage. On that occasion, the crew used ballast to list the vessel away from the direction from which the waves were coming to reduce the amount of water coming on board and induce the water to flow across the deck and overboard. They removed the wooden plugs from the overboard scuppers to allow the water to escape, but still had to revert to punching a makeshift freeing port in the steel side structure to allow the water to escape quickly. This makeshift freeing port was repaired on return to Nuku'alofa, but no effort was made to improve the watertightness of the vessel. Also on that voyage, water had entered the accommodation via the galley and mess room, and the crew had bailed with buckets, as they did on the accident voyage. The crew's actions in removing water from the cargo deck exhibited at least some concern over it being there, but whether that concern was for the stability of the ship or protection of the cargo was unclear.

2.2.14. The **Princess Ashika** started taking on water soon after leaving the sheltered waters of the Tongatapu group of islands. Water began accumulating on the cargo deck through gaps in the bow ramp and from sea spray over the starboard bow. The open scuppers on the starboard side did not assist in clearing the deck of water, and may have actually allowed more water to enter the cargo deck. Witness reports from about 2000 were that the accumulated water tended to lie along the forward two-thirds of the starboard side of the vessel, indicating that the ship was probably on even keel, or trimmed by the head, and listed to starboard. Water also started to accumulate in the crew accommodation, entering that space via the galley and crew mess room, also on the starboard side.

2.2.15. Free or uncontained liquids in a vessel will gravitate to the lowest point, so if a ship has an existing list the water will flow to that side, thereby increasing the list. The reported initial list to starboard when the **Princess Ashika** departed Nuku'alofa would have increased as water was taken on board, reducing the freeboard on the starboard side further and thereby progressively increasing the rate of water coming on board. Without intervention, the vessel would likely have eventually capsized to starboard.

2.2.16. What could not be determined was whether water had entered the hull from other sources, but there was a high probability it had. The heavily corroded condition of the hull meant that leaks into ballast tanks and void spaces had frequently developed, as evidenced by the amount of cement used in these spaces, by the previous use of sandwich plates to repair temporarily unexplained leaks in the underwater hull, by the survey records from Fiji, and by FIMSA preoccupation with the crew frequently checking these spaces. The vessel's severely corroded and wasted sides were repeatedly holed above the waterline during its Tongan service. Overloading the **Princess Ashika** and operating it in areas of heavier seas would have placed additional stresses on its structure, leaving it more prone to failure at points weakened by corrosion.

2.2.17. When water was noticed in the crew accommodation and accumulating on the cargo deck, the vessel was effectively sinking, but would probably have been recoverable if its peril (rather than its discomfort) had been realised and effective action taken. The crew had succeeded in lowering the water level in the accommodation by using cloths jammed in holes corroded in the galley deck to stem the inward flow, and manually bailing using buckets, but nothing had been done to stop the accumulation of, and to remove, the water from the cargo deck.

2.2.18. In the ensuing hours, water continued to accumulate on the cargo deck and the crew resumed what was to be a losing battle against the water rising in the accommodation. On 2 occasions the deckhands that were on watch woke the first mate and reported the conditions down below, and on each occasion the first mate was interested enough to look at the water, but not concerned enough to wake the master. From witness accounts, the first mate displayed some annoyance towards the messenger and went back to sleep. The first mate's propensity to sleep and the master not being called were significant factors leading to the eventual sinking, because during this time the water level on the cargo deck rose high enough (500 mm from reports) to downflood into compartments below, either over the sills of the open watertight doors or through holes corroded in those sills.

2.2.19. When the first mate eventually realised that action was required, he took the same action he had on the previous voyage when water accumulated on the cargo deck: pumped out ballast from the starboard side to list the vessel to port, only this time there was also a significant amount of water below deck. Pumping out the aft starboard ballast tank had 2 effects. The first was to trim the vessel by the bow, which increased the amount of seawater coming on deck through gaps in the bow ramp. The second, once the vessel came upright, was that any free water in the ship would move to the port side, resulting in the vessel assuming a greater list to port because there was now an imbalance in ballast water.

2.2.20. Another significant factor leading to the sinking was that neither the course nor the speed of the **Princess Ashika** had been adjusted prior to the master arriving on the bridge. Witness accounts closer to the time of the capsize described water "boiling" over the port bow bulwarks, while downflooding increased through open or ineffective weathertight doors on the port side of the cargo deck. The **Princess Ashika** was literally driving itself under the water. By this time, the **Princess Ashika**, with water flooding into the major spaces below the cargo deck, was unrecoverable. Any action taken at this time would only have delayed the final sinking and reduced the loss of life.

2.2.21. There were reports that at least one of the weathertight doors on the port side had been closed in an attempt to stop the downflooding, but given the poor condition of the watertight doors, this at best would have only slowed the rate of downflooding. Another significant factor was that the manhole covers to the forward ballast tanks had been left off. These were located in the storerooms either side of the cargo deck, behind watertight doors. Both these manhole covers and the watertight doors were routinely left open. However, on this occasion the ROV video did show that the port forward storeroom door was closed. Even so, the condition of the door was such that it would still have likely allowed water into the storerooms then into the ballast tanks, once the water level on the cargo deck reached the height of the sills.

2.2.22. The void spaces forward of and beneath the crew's accommodation contributed to the buoyancy of the ship. An accumulation of water in these compartments would have had 2 significant effects: first, an increase in weight would result in the ship sinking deeper in the water, and second, the free surface effect of the water in the partially filled void spaces would have reduced reserve stability.

2.2.23. The manhole for No 1 void space forward of the crew accommodation was in the middle of the cargo deck, and although always in place, was never screwed down with anything more than 2 or 3 hand-tight nuts. Water running across the cargo deck would have been trickling into this space through this unsealed cover as well as through at least one corrosion hole in the cargo deck.

2.2.24. The access to No 2 void space was through a manhole located in the crew's accommodation cross alleyway. The manhole cover for this was not secured, so water accumulating in the crew's accommodation deck would most likely have found its way into this void space.

2.2.25. To summarise, seawater was finding its way into what should have been the watertight hull of the ship at a progressively accelerating rate. The more water that penetrated the hull, the deeper in the water the vessel sank and the further it listed; the deeper it sank, the more water was able to penetrate the hull. The situation escalated from one where water was seeping or trickling into the hull, which should have been controllable had all of the pumping arrangements on the vessel been working and fully utilised, to uncontrollable downflooding leading to the loss of stability, capsize and sinking.

2.3. Survivability

Emergency preparedness

2.3.1. The evidence shows that most, if not all, of the passengers and crew who escaped from the hull as the ship capsized survived. Of those who are missing, presumed drowned, it is almost certain that most were trapped in the passenger lounge.

2.3.2. Four factors contributed to the high loss of life when the **Princess Ashika** sank:

- the slow response of the crew to recognise the seriousness of the situation
- since the arrival of the ship in Tonga the crew had only had one emergency muster and abandon ship drill, and even then not all of the crew attended that drill
- there were no general emergency alarm bells, and the ship's whistle was not working
- the passengers were not briefed on what to do in the event of an emergency or hearing any alarm signal.

2.3.3. The one partially attended emergency muster or abandon ship exercise conducted since the ship started operation in Tonga did not prepare crew for the call to abandon ship, which happened at night and immediately before the ship capsized. However, even if the call to abandon ship had been made earlier, the chances of it proceeding efficiently were low. Emergency drills are a statutory requirement for ships such as the **Princess Ashika** and the omissions of the master, ship management and the surveyors to each ensure the crew were practised in them was serious.

2.3.4. There were no alarm bells for calling passengers and crew to muster stations. This was another serious omission by all involved in the operation and survey of the vessel, although it was questionable as to what difference having alarms would have made under the circumstances, because the passengers had not been given a safety briefing on what to do if they heard them. Nevertheless, when the master did give the order for the bridge watch officer to prepare the passengers to abandon ship, he had little time to do so. An alarm bell would have at least woken most of the passengers and would possibly have increased the number who managed to escape the capsizing vessel. As mentioned before, the survival rate for those who escaped was high.

2.3.5. Ship alarm bells are usually the prime means for sounding the abandon ship signal, but they are usually supplemented with a signal on the ship's whistle to alert people who might not hear the internal alarm bells. However, the ship's whistle was not working either.

2.3.6. A PA was the usual method of making mass announcements on passenger ships, and on this occasion the master did use this system to warn the passengers of the impending disaster. However, the master's announcement was immediately before the vessel capsized, was only given once, was only heard by some of those on board and did not give the passengers and crew who did hear and understand it time to react.

2.3.7. The **Princess Ashika** was listed heavily to port when the master instructed the watch officer to call everyone to muster stations. The watch officer had physically to go down to the passenger lounge and outside deck and call out to the passengers. The announcement that the master made over the PA was for everyone to don lifejackets. Many of the passengers were still sleeping, so would not have heard the warnings. However, to those passengers who did hear the announcement, it would have helped little, as most would not have known where the lifejackets were stowed or where the muster station was.

2.3.8. Crews are trained in sea survival and usually have a working knowledge of the ship and its lifesaving apparatus. Passengers, however, do not, and rely almost totally on the crew for guidance. By the time of the capsize, most of the crew were awake, on duty or getting ready to take over watches at midnight, or attempting to bail the water from the crew accommodation and cargo decks. It was unclear whether there were any crewmembers assigned to assist the passengers in the event of an emergency, but the ordinary practice of seafarers was that there should have been. However, most of the crew were preoccupied with trying to save the ship and did not consider assisting the passengers. At the end of the accident sequence, the capsize occurred rapidly and did not allow time for crewmembers to guide passengers to the muster station and show them how to don lifejackets or launch liferafts. The rapidly evolving situation, shown by the fact that no one managed to don a lifejacket, resulted in the crew being able only to fight for their own survival.

2.3.9. Early preparations and planning are essential for an effective muster and abandon ship operation. Even in the absence of a well trained and practised crew given more time an effective evacuation could have taken place. This would have required an early recognition of the danger that vast quantities of water on and below the cargo deck posed to the vessel and a decision at that time to prepare for the worst. The person who was best experienced and qualified to make that decision, the master, was not called.

2.3.10. The master was not woken until about 10 minutes before the ship sank. By that time the ship was unrecoverable, with the list rapidly increasing and downflooding continuing unabated. He had little time to assess the situation and make decisions. The opportunity to recognise the peril facing the ship had arisen much earlier, when the crew first reported the water on deck to the first mate. At that time, the first mate should have taken control of the operation to clear the water and should have called the master. His lack of appreciation of, or interest in, what was happening to the ship may have influenced others, such as the watch officer, in their decision not to call the master earlier, in spite of their obvious concern for the ship taking on water. The first mate was, after all, a senior person on board whose training and experience should have alerted him to the danger that was developing.

Lifesaving apparatus

2.3.11. The **Princess Ashika** was fitted with more than enough liferafts to accommodate all of the persons on board, although it could not be determined if they were stowed correctly or what their condition was. From the survey records, most of the liferafts were past or near their dates for survey. Nevertheless, at least 8 of the liferafts did deploy automatically, as they were designed to when the ship sank, although some had to be inflated manually. One was seen to deflate but it could not be established what caused that.

2.3.12. In the event of capsize it would not be a surprise for some liferafts to become entangled in the wreck and not reach the surface. In this case, the underwater video showed that 3 liferafts remained in their cradles, but it could not be determined whether they had been inappropriately lashed in place or had simply become entangled.

2.3.13. Had the maximum permitted number of persons been carried, the liferafts that failed to deploy could have been significant in terms of survivability, particularly if passengers had not had access to lifejackets.

2.3.14. The survey records showed that there were 348 lifejackets on board, but did not refer to children's lifejackets. In this event, very few lifejackets were recovered. They were stowed in lockers inside the passenger lounge and few passengers would have known where to find them because they had not been briefed. Some lifejackets were seen floating during the SAR operation, but whether there had been some attempt to distribute them or they had floated free from the sinking vessel could not be determined. However, no one who survived the sinking had managed to don a lifejacket.

2.3.15. The survey records showed that the hydrostatic unit for the EPIRB was 2 years out of date, but despite this it did operate and the EPIRB floated free and activated. However, the radio survey in June 2008, recorded that the EPIRB release unit was one year out of date. This is another example of surveyors allowing a vessel to continue operating with out-of-date safety equipment.

Search and rescue

2.3.16. From most accounts and upon review, the SAR operation was well coordinated. It started well with an accurate reporting of the nature of the distress, and an accurate position from both the master's mayday message and the activation of the EPIRB.

2.3.17. The distress call was picked up by both Nuku'alofa Radio and RCCNZ. With the location of the sinking being close to or on the boundary of responsibilities, the 2 organisations coordinated the operation well.

2.3.18. It was opportune that the **Pulupaki** was only a few hours behind the **Princess Ashika**, but other vessels in the area also came to assist. With most, if not all of the survivors in liferafts, and with moderate sea conditions and warm ambient air and sea temperatures, it is likely that those who escaped the vessel and entered the liferafts could have survived for some time.

2.3.19. A crewmember on board the fishing vessel **Albacoa** saw distress flares but took no action to report them. The master of the **Albacoa** did not report the sighting of red flares to Nuku'alofa Radio or take any action to investigate them. He was in breach of his obligations under the United Nations Convention on the Law of the Sea to render assistance to a vessel in distress.

2.3.20. The search for survivors lasted 12 days, with a high degree of confidence that the search was conducted in the areas of highest probability. That confidence stemmed from knowing the exact location of the sinking and the use of software programs to calculate the drift patterns of potential survivors. The accuracy of the search areas was verified from time to time with the location and recovery of debris from the **Princess Ashika** as the search progressed.

2.3.21. Had there been other survivors in liferafts, it was highly likely that they would have been detected early in the search pattern by the aircraft, so the search was focused on looking for survivors in the water. Given the degree of confidence in the search areas, the length of time elapsed since the sinking, and the low probability of persons surviving in the moderate sea conditions for that length of time, the authorities made an appropriate decision to stop the search after 12 days.

2.3.22. By day 12 after the sinking, the facts of the sinking were beginning to emerge, and it was evident from those facts, and from those subsequently established, that there was a high likelihood that the missing persons had been trapped in the vessel as it capsized and sank.

2.3.23. Although the SAR mission was well coordinated, there were, as always, some lessons for improving future searches. The most significant was the danger of poor processes to record the number of persons onboard vessels. SAR resources are assigned based on the scale of the problem and the likelihood of success. When the **Princess Ashika** sailed from Nuku'alofa with 96 passengers on board, the master reported only 45 passengers on board to Nuku'alofa Radio. When the initial reports came through that 40 of the 45 declared passengers had been recovered within a matter of hours, RCCNZ delayed the departure of the P3 Orion search aircraft. Once it was established that there were significantly more persons missing than initially thought, the Orion was dispatched and arrived on the scene shortly after daybreak.

2.3.24. Although in this case the delay in assigning the search aircraft probably did not affect the outcome, it could well have done in other circumstances. As it was, it took the Tonga Police Force more than 2 weeks of extensive enquiries to reconcile the number of passengers and crew on board to give an accurate number of those who were still missing. This accident serves as a stern reminder to ship operators of the importance of accurate reporting and good record-keeping of the numbers on board every voyage.

2.3.25. The P3 Orion is a well suited aircraft for covering large areas of ocean when looking for large objects and floating debris, but its high minimum speed and small observation windows limit its effectiveness for small search areas and detecting people in the water. The running costs of such an aircraft are high, so rescue organisations have to have regard to its probable effectiveness when it is deployed.

2.3.26. An ideal search aircraft for this type of search would typically be smaller, have a slower minimum speed and larger observation windows. Such an aircraft, suitably equipped and manned by trained personnel, would be ideal for this type of search, but one is not available within the New Zealand SAR area, or if it is it is not generally known.

2.3.27. Other smaller aircraft, such as small fixed-wing aircraft, that might be immediately available locally can be beneficial when deployed quickly. Helicopters are better suited for recovery than search, but the operating costs and the need for precise maintenance regimes can make them prohibitively expensive to operate in remote areas.

2.3.28. It was apparent that little was known about the availability of such aircraft in the immediate area, although some, such as the Chathams Pacific aircraft, were available but not necessarily well set up for SAR capability. A project to set up a database of known aircraft and other resources available in New Zealand, Australia and the Pacific region would assist greatly in future SAR missions. Such a database would need to be kept updated, and some specific aircraft be set up with the appropriate communications and other search capabilities. The possibility of setting up dedicated medium-sized SAR aircraft for work in the Pacific could be explored. Such an aircraft could be useful as a lower-cost option for customs and fisheries patrols to offset the prohibitive cost of having such a dedicated non-revenue earning aircraft.

2.4. How fit for purpose was the Princess Ashika?

2.4.1. "Fit for purpose" is a term that is used to describe not only the condition of a vessel and its compliance with the relevant standards but also the suitability of its design for the intended purpose or trade for which it is to be used. The 2 considerations are directly related because changing one can affect the other. If, for example, the trade in which a vessel is engaged changes, often a different set of standards applies. Conversely, as the condition of a vessel deteriorates, the area of trading can be adapted to require lesser standards, in much the same way as FIMSA had treated the **Princess Ashika**.

2.4.2. The design of a vessel might be entirely appropriate for its use in smooth or sheltered waters for example, but even if it is in good condition, the same vessel might not be fit to ply less sheltered waters, because the design does not incorporate features to mitigate the increased risk posed by higher waves.

Design of the Princess Ashika

2.4.3. The **Princess Ashika** was not designed to operate in areas of open sea such as those around the Tonga islands, and therefore could not be considered fit for its intended purpose. The original stability book referred to "smooth water" and for voyages between 1.5 and 3 hours long. The length of intended voyage would typically have been reflected in the design of passenger spaces and facilities, and the fact that no automatic steering was fitted, but more importantly the smooth water limitation related to the construction of the hull, freeboard, stability and watertight integrity.

2.4.4. The International Convention on Load Lines 1966 required vessels trading on international voyages to have a minimum bow height of 2.41 m, whereas the **Princess Ashika**'s was about 1.4 m to the bottom of the ramp. The ramps were not designed to be weathertight because there were no rubber seals fitted and there was no bow visor ahead of it to deflect seas. The flat design of the bow and ramp made it vulnerable to damage from wave impact, as happened on the delivery voyage from Fiji to Tonga.

2.4.5. The main cargo deck was essentially an open well, bounded by the bulwarks on the sides and the ramps at either end. Any kind of wave large enough to cause the vessel to pitch was likely to result in water penetrating the gaps around the bow and stern ramps and accumulating on the cargo deck, creating a large free surface effect.

2.4.6. Open-sea-going ships were required to have freeing port arrangements to facilitate the rapid freeing of water from the decks. The **Princess Ashika** was instead fitted with seven 100 mm scuppers on each side, more in line with freeing small quantities of water such as rain, sea spray, water from washing-down or fire-fighting activities, and any water that might penetrate the deck around the bow and stern ramps. They were not designed to remove large quantities of water quickly. The philosophy behind the **Princess Ashika**'s design was therefore one of operating the ship in waters that were unlikely to result in large quantities of water depositing on deck.

2.4.7. Water accumulating on an open deck of any vessel can have severe consequences. The vessel sinks bodily in the water from the sheer weight, which reduces the freeboard and leaves the vessel more prone to taking on more water. The effect of free surface, where the water is free to move from side to side as a vessel rolls to the seas, can seriously erode the stability of the ship, leading to capsize. If the ship is not rolling significantly, as in the case of the **Princess Ashika**, the water tends to accumulate on one side, creating a serious list and further eroding the stability.

2.4.8. The accumulation of large quantities of water on the **Princess Ashika**'s cargo deck was a serious safety issue that should have been recognised and attended to by the master and crew. The fact that water from the deck was also penetrating down into what should have been the watertight compartments of the vessel made the situation far more serious.

Condition of the vessel

2.4.9. The condition of the **Princess Ashika** leading up to and at the time of its sinking was a major safety issue. Not only was the design of the vessel not fit for trading in Tongan waters, the physical condition of the vessel would have rendered the vessel not fit to trade even in the "smooth waters" for which it was originally designed.

2.4.10. The defects and operational deficiencies that have emerged from witness statements and survey records are too numerous to repeat here, but have been itemised in the factual section of the report and its appendices. Operational deficiencies, such as having procedures for and crew trained in emergency preparedness, can be easily rectified with time and expertise. If the structure of the vessel had been sound, it would have been economical to attend to many of the technical defects, such as the alarm systems, ship's whistle and having serviceable life rafts, but it did not.

2.4.11. The hull and superstructure of the **Princess Ashika** had reached an advanced stage of corrosion. Survey reports and witness accounts show that the corrosion was not limited to above-water structures, but had severely eroded the underwater structure as well. Reports of several attempts to refloat the vessel in Fiji following an out-of-water survey because of leaks in the shell plating, and the advanced state of corrosion in the void spaces, including the support structure for the cargo deck, indicated that the vessel was then beyond economic repair.

2.4.12. This fact was recognised by FIMSA and obviously by the owner as well. The Fiji owner had purchased another vessel to replace the **Princess Ashika** and laid the vessel up at anchor rather than carry out the repairs required by the surveyors. The Fiji owner had made no apparent recent attempts to market the vessel for sale as a going concern, until contacted by the managing director of the Shipping Corporation of Polynesia.

2.4.13. The true economic value of the **Princess Ashika** was no more than the scrap value for the remaining steel structure and some fittings. To realise that value, the vessel would have had to be taken to a place with the facilities to break the vessel and recycle any salvageable steel. The cost of that exercise would have exceeded its value, according to a witness before the Royal Commission. If that opinion was accepted, the condition of the **Princess Ashika** rendered the vessel a liability rather than an asset to its owner, unless another administration like the Tongan one was to accept a lesser standard of safety than had been accepted when the vessel was operating in Fiji, and that could only happen in contravention of the various IMO standards to which Tonga had acceded

2.5. Standards of survey - Princess Ashika and the South Pacific

2.5.1. There was a process that should have been followed to have the **Princess Ashika** surveyed before it was entered into the Tonga register, before it was allowed to make the trip from Fiji to Tonga, and before it entered service in Tonga. What should have happened, differed significantly from what actually did in respect of surveying and the issuing of certificates.

2.5.2. The Tongan Shipping Act provided sufficient mechanisms for the **Princess Ashika** to have been surveyed properly before entry into service in Tonga. The Minister of Transport and the director of marine and ports, and by delegation his appointed surveyors, had all of the necessary powers to prevent the vessel entering service, and once in service, to detain the vessel for any contravention of the Shipping Act and its underlying regulations. If the Shipping Act had been properly complied with, the **Princess Ashika** would never have left Fiji.

2.5.3. The Shipping Act made it an offence to send a ship to sea in an unseaworthy condition. The definition of "seaworthy" said every aspect of the ship had to be of a "reasonable standard" and "in accordance with the ordinary practice of seaman". Those words might appear to have given the Minister or director some discretion when making such a judgement, but it was clear in this case from the various survey reports that the **Princess Ashika** was not in a fit condition to pass any survey that was conducted to a reasonable standard.

2.5.4. The voyage from Fiji to Tonga should have been made either under the Fiji flag with Fijian certificates or under the Tongan flag with Tongan certificates; neither was the case. The ship was removed from the Fiji ship register, which effectively nullified the Fijian certificates. The new owner (the Government of Tonga) and the operator (the Shipping Corporation of Polynesia) then allowed the ship to sail from Fiji without the appropriate Tongan-issued certificate of survey, something they were not empowered or entitled to do.

2.5.5. The director of marine and ports would have been entitled to issue a Tongan certificate of survey based on a current Fijian certificate, at his discretion, but before doing so would have needed to review the Fiji survey records or consulted FIMSA. It would have been unwise for the director to issue any certificates without doing so, but in this case the director issued a provisional certificate of registry based on the provision of a Fijian survey certificate. This was a lost opportunity to prevent the sale of the **Princess Ashika** and prevent it entering service in Tonga.

2.5.6. Another lost opportunity was FIMSA not fulfilling its obligation to ensure the vessel was fit to depart its waters for the intended trip to Tonga. FIMSA had a statutory duty and right to administer port state control of vessels trading internationally. FIMSA was well aware of the **Princess Ashika**'s poor condition, knew it was being sold as a going concern, and arguably had a moral if not statutory duty to raise concerns over the vessel's condition with the Tonga administration. A check of the vessel's documentation would have shown that the master was not in possession of a valid certificate of survey.

2.5.7. The Tongan authorities did not ask the FIMSA for this information, nor was it offered. The lack of communication between the 2 authorities is surprising given that they both work under the guidance of the Regional Maritime Programme of the Secretariat of the Pacific Community with its focus on safety.

2.5.8. Another opportunity for the acting director of marine and ports to intervene was when the **Princess Ashika** sustained damage to the bow ramp on the first attempted delivery voyage. The master was required to report that incident to the director, although technically, through a poorly worded section of the regulations, not until the master returned to Tonga. The damage affected the seaworthiness of the vessel and, as such, the repairs should have been overseen by the Tongan surveyors or by FIMSA surveyors on their behalf. The incident was, however, not reported to either and the repairs were carried out by the previous owners, unsupervised by either the FIMSA or the Tongan marine and ports surveyors. The damaged sustained was an indication that the **Princess Ashika** was not designed to operate in those open waters, which were not dissimilar to the Tongan waters in which it was to operate.

2.5.9. The first time the Tongan marine and ports surveyors were involved in surveying the **Princess Ashika** was on its eventual arrival in Tonga, at which time the vessel had already been purchased and paid for. The results of that survey have already been described in previous sections of this report. The vessel should have been detained at that point.

2.5.10. In evidence and testimony to the Royal Commission, the acting director of marine and ports said he was under some pressure not to detain the **Princess Ashika.** He recounted times in the past when he was engaged in other sectors of the maritime industry where surveyors had attempted to detain the **Olovaha** for serious defects, but the vessel was never detained because of pressure being applied from government officials.

2.5.11. The Marine and Ports division's survey on the vessel's arrival in Tonga was completed in about 3 hours. While this was long enough to compile a lengthy defect list, it would not have been sufficient to carry out an appropriate thorough survey for a vessel of its age and condition. Such a survey would have included, but not been limited to, checking all the ship's certificates, an inspection of the vessel including all tanks and void spaces, and ensuring the proper functioning of all mechanical and safety equipment. Alone, the absence of a load line certificate would have required a comprehensive survey that would have taken at least a whole day.

2.5.12. There were a number of apparent reasons why the **Princess Ashika** was not detained on arrival in Tonga. The acting director of marine and ports was unsure of the process he should follow, or what powers he had to detain the vessel, having only been acting in the position for a short time. The handover process from the previous director to him was short and scant. The outgoing director had dealt with the managing director of the Shipping Corporation of Polynesia and the Minister of Transport over the purchase of the **Princess Ashika**. Given that the incoming director was going to be responsible for receiving, surveying and monitoring the vessel in future, there would have been some benefit in his being involved from the beginning. The lack of handover and the lack of clearly documented processes for the new director and his surveyors to follow were factors that contributed to the vessel being allowed to enter service in an unseaworthy condition.

2.5.13. Another contributing factor was the managing director of Shipping Corporation of Polynesia's evident lack of regard for or understanding of the survey process. From the timeline of events it was probable that he intended to load and sail the vessel regardless of the outcome of the survey, and that is what happened. That aside, the director allowed the vessel to return and sail 3 times with no intervention or follow-up on what he had listed and presented to the managing director as serious defects requiring corrective action to surveyor satisfaction before departure.

2.5.14. There was a direct conflict of interest with the Government of Tonga being the owner of the vessel and the director being employed by that same Government; the applicant on the unsigned registration application was listed as the Ministry of Transport. This conflict of interest should have been recognised and explicitly managed. Anecdotal evidence was also received by the investigation team from a range of sources that over the years the same standards of survey that were required of private operators were not applied to Government-owned vessels.

2.5.15. The Shipping Corporation of Polynesia was reported to have been in financial difficulty, and with the failure of the **Olovaha** was in a position where it had no ships that could operate safely. This investigation did not review in detail the financial records of the Corporation, but without a ship, the company had no incoming revenue other than from the management fees for its unprofitable crewing contracts. The pressure to find a replacement for the **Olovaha** was significant, and replacements that the Government of Tonga could afford were not readily available. Having the **Princess Ashika** arrive in Nuku'alofa, already purchased, registered and with cargo and passengers booked for its first trip would have been difficult to ignore for the acting director of marine and ports and his surveyors. The Government had effectively purchased a vessel well above its real value, which might have been a negative sum. If it had been declared unfit for purpose or unseaworthy, it would have been a source of some embarrassment for the Government, and the Shipping Corporation of Polynesia would still not have had a ship to operate.

Safety culture in the South Pacific

2.5.16. Putting this case into context with the wider Pacific region, the director of marine and ports was working in a system where a safety culture had developed over the years where substandard shipping had become accepted by crews, operators, regulators, governments and even the travelling public. This safety culture has effectively developed over many years, possibly in part owing to insufficient funds being available to purchase high quality vessels and maintain them to a good standard. The average age of ships in the South Pacific was high and they had become increasingly unreliable as faulty systems were left in that state and worked around.

2.5.17. Ships often entered the Pacific region in an aged and poorly maintained state, and because of the difficulty in sourcing funds and expertise to upgrade or maintain them, they deteriorated further until either they were scrapped or became total constructive losses through failure of major components like the main engine, for example, or, as in this case, they were lost through some maritime disaster with inevitable casualties.

2.5.18. Operating and accepting substandard shipping increases the risk profile of the industry in the South Pacific, and as long as that situation exists, a higher-than-average number of casualties can be expected.

2.5.19. While the actions or non-actions of individuals associated with the operation and regulation of the **Princess Ashika** could be considered proximate factors that contributed to it sinking, those individuals were operating within a wider system that in itself requires substantial development if the risk profile of the shipping industry in the South Pacific is to be lowered.

2.6. The purchase of the Princess Ashika

The procurement process

2.6.1. There was a process in place in Tonga for the procurement of high-cost items such as the **Princess Ashika**, and if that process had been followed it is highly unlikely that the **Princess Ashika** would have been considered at all. But the process was not followed.

2.6.2. The Procurement Committee set up by the Government had a full complement of members and was active at the time of the negotiations to purchase the vessel. According to Government policy, any purchase over 100 000 Tonga pa'anga was to be subject to international competitive bidding and carried out through the Procurement Committee.

2.6.3. The Procurement Committee first learned about the **Princess Ashika** on 11 May 2009. It received a copy of the Cabinet decision to make the purchase and a copy of the sale and purchase agreement, which had already been signed and faxed to Fiji and a deposit paid to the **Princess Ashika**'s Fiji owner. Procurement Committee members felt the procurement process had been bypassed by the Cabinet and the Committee had essentially been presented with an irreversible transaction. The Committee requested and received more documentation, but it had little choice but to approve the purchase, or alternatively not approve it and risk losing the deposit paid if the Cabinet changed its mind in light of such a recommendation from the Committee. The Committee's approval was conditional on due diligence on the vessel being carried out by the Ministry of Transport, and in one case a member of the Committee annotated "…otherwise not approved".

2.6.4. Earlier, the Minister of Transport had written to the solicitor-general, who was also on the Procurement Committee, requesting a legal opinion on the sale and purchase documents. Prior to receiving this letter the then Minister of Justice and Chair of the Shipping Corporation of Polynesia had mentioned concerns over the procurement process to the solicitor-general. In reply to the Minister of Transport the solicitor-general questioned why the Marine and Ports division of the Ministry, as the "Government's shipping experts" had not been involved in the auditing of the **Princess Ashika**. The Minister's reply erroneously recorded that he had undertaken due diligence on the survey documents supplied by the Fiji Ministry, which he had not, and neither had the managing director of the Shipping Corporation of Polynesia. The only document that could be later sourced was a copy of the certificate of survey that, significantly, had been altered to hide the operating limitations imposed by FIMSA because of the poor condition of the vessel.

2.6.5. What the contents of the ship file that were shown to the managing director of the Shipping Corporation of Polynesia by the previous owner of the vessel in March 2009 are unknown. It would be hard to conceive why anyone who had seen the survey defect lists, the short-dated certificates and the quotes for remedial work would continue the purchasing process without referring to specialist assistance.

2.6.6. The decision to purchase the **Princess Ashika** was essentially driven by one person who, it could be argued, had a vested interest in the Shipping Corporation of Polynesia acquiring another ship. The perception and existence of a conflict of interest must be considered. With the (constructive) loss of the **Olovaha**, the managing director of the Shipping Corporation of Polynesia embarked on a course to find a replacement vessel and found the **Princess Ashika**, which on his first assessment was the answer to his problem.

2.6.7. The managing director of the Shipping Corporation of Polynesia, given the benefit of the doubt, might have thought he was acting in the best interests of the Shipping Corporation of Polynesia and the Government of Tonga's need to provide a service. Once he had seen the **Princess Ashika**, he appeared intent on promoting its purchase, even to the point of falsifying signatures on his "audit report" and including incorrect information on the "2008 survey checklist". These documents made it look as if proper due diligence had been carried out, where it had not. It is not known who altered the copy of the certificate of survey issued by FIMSA on 9 April 2009, but this was a key document and its alteration masked the true condition of the vessel and the extreme limitations under which it was operating.

2.6.8. What was required in this situation was a review of the shipping requirements with a whole-of-government approach, and the Procurement Committee was the obvious choice to achieve that. A new replacement vessel was due from Japan by the end of 2010, and as it later turned out the delivery of that vessel could have been brought forward. There was a privately owned vessel already servicing the inner islands, so the possibility of providing a reduced service while awaiting the arrival of the new vessel was another possibility, which would have been better than purchasing an interim vessel of dubious quality, which would have had no residual value once its replacement arrived.

2.6.9. The managing director was not employed for his maritime expertise and he had acquired little that was evident in several ways throughout the procurement process. He was focused on the mechanical reliability of the **Princess Ashika** and not the condition of the hull, possibly because it was mechanical problems that had plagued the **Olovaha**. His calculations used to put the business case forward to the Shipping Corporation of Polynesia board contained elevated figures for the cargo-carrying capability of the **Princess Ashika** compared with that of the **Olovaha**. Vessels have several tonnage figures used for different purposes, and the deadweight tonnage figure that he calculated appeared to be derived by summing the wrong tonnages, a basic error that went unchecked or unnoticed by him or others. In actual fact, it has been shown the operating deadweight of the vessel was considerably less than it had been when the vessel was new. The business case was therefore flawed.

2.6.10. There were other comments found in the managing director's notes taken during his assessment of the **Princess Ashika** that showed scant appreciation of the seaworthiness of a vessel. An example of this was his comments relating firstly to the need to seal the bow ramp and use the stern ramp only for loading, then changing this later to there being no need to seal the bow ramp because it was of sufficient height above the water. He wrote that the ship had been well maintained and corrosion had been kept under control, when really it had simply been recently painted to hide serious corrosion.

2.6.11. The Government of Tonga's procurement process should have provided a check or defence against the errors in judgement or knowledge gaps of an individual, but it did not. However, there was another defence that had failed, and that was the Shipping Corporation of Polynesia board.

Shipping Corporation of Polynesia

2.6.12. The Shipping Corporation of Polynesia board, which included the managing director, had no maritime expertise at its disposal to guide it through the process of purchasing a replacement vessel; neither was there any maritime expertise within the shore-based operational staff. Both the board and the management of the company had had such expertise previously, but as those people departed for various reasons they had not been replaced.

2.6.13. The one member of the board who did have substantial maritime expertise had become disaffected from the board over differences in opinion regarding the design of the replacement ship for the **Olovaha**, and had not been included in board matters for some considerable time.

2.6.14. Maritime experience obviously existed within the sea-going staff, but none of this was used in the decision-making process at management level. Evidence presented by the crew following the sinking showed that there was reluctance among sea staff to challenge management over safety issues.

2.6.15. Evidence presented at the Royal Commission showed that the Shipping Corporation of Polynesia board, except for the managing director, had little to do with the day-to-day running of the company. It appeared to be the case that whatever the managing director presented to the board was approved without meaningful challenge. The case put forward for the purchase of the **Princess Ashika** was an example of that.

2.7. Human and organisational factors

The concept of human factors

2.7.1. Human factors is a multidisciplinary science that applies knowledge about the capabilities and limitations of human performance to all aspects of the design, operation and maintenance of products and systems.

2.7.2. It considers the effects of physical, psychological, social and environmental factors on human performance in different task environments, including the role of human operators in complex systems.

2.7.3. The sinking of the **Princess Ashika** has a number of human factor issues running throughout the purchase and operation of the vessel. Some of the issues are considered in the relevant analyses of those areas, however the following issues were considered pertinent to the investigation so are considered separately.

Organisational influences

2.7.4. Organisational influences are defined as those conditions that establish, maintain or otherwise influence the effectiveness of an organisation's risk controls. There are 2 main types of organisational influence: internal organisational conditions and external influences (ATSB, 2009).

2.7.5. Organisational conditions are the safety management processes and other characteristics of an organisation that influence the effectiveness of its risk controls. Safety management processes include activities such as hazard identification, risk assessment, change management and training needs analysis.

2.7.6. External influences are the processes and characteristics of external organisations that influence the effectiveness of an organisation's risk controls and organisational conditions. These influences include the regulatory standards and surveillance provided by regulatory agencies. They also include a range of pressures, standards and other influences provided by organisations, such as industry associations and international standards organisations (ATSB, 2009).

2.7.7. One key concept that is often combined with that of organisational influences is the concept of safety culture. A safety culture is difficult to define, but the following useful definition was proposed by the United Kingdom Health and Safety Executive (cited in Reason, 1977):

> *The safety culture of an organisation is the product of individual and group values, attitudes, competencies, and patterns of behaviour that determine the commitment to, the style and proficiency of, an organisation's health and safety programmes. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures.*

2.7.8. Opinions on what makes up a good safety culture are wide ranging and varied, but it is important to note that a good safety culture is not something that can be bought or created overnight. However, it can be developed or engineered over time by paying careful attention to the quality of defences, safety management processes and organisational characteristics.

2.7.9. In the sinking of the **Princess Ashika**, it is clear that there were a number of organisational influences, both internal and external, within the Ministry of Transport, the Shipping Corporation of Polynesia and the wider Government of Tonga.

Shipping Corporation of Polynesia

2.7.10. While the Shipping Corporation of Polynesia had a safety management system philosophy statement, policies and some procedures in place, the actual practices were very different from the paperwork and there was scant commitment to, and practice of, a safety culture. The structure of the organisation also allowed one person much of the control and power, and the governance did not necessarily have the required skills, knowledge and experience to understand the organisation's operations and operating environment and the risks it faced.

2.7.11. The Shipping Corporation of Polynesia appeared to be resource limited and faced mounting pressure from the public, from the media and from the Government to provide a regular and reliable ferry service. It was also possible that the master and crew felt it was up to them to keep the ship operating, resulting in their taking the vessel to sea.

2.7.12. The onboard processes and procedures did not match the safety management system documentation that the company had. There were many areas where the shipboard practices were less than ideal, for example the watchkeeping arrangements, the absence of clear, concise written orders or instructions for the navigation watchkeepers, no recording of soundings and the absence of passenger briefings. All of these routines assist in maintaining a well run ship, help warn when something out of the ordinary is about to happen and guide operators on how to respond to unexpected situations.

2.7.13. In addition, it would appear that in deciding to recommend the purchase of the **Princess Ashika**, the board of the Shipping Corporation of Polynesia might have experienced an element of "groupthink" (ATSB, 2009; Janis, Groupthink: Psychological Studies of Policy Decisions and Fiascoes Second Edition, 1982; Janis, Victims of Groupthink, 1972). Groupthink occurs when an illusion of invulnerability emerges as part of the group process. While groupthink does not necessarily lead directly to an incorrect decision or belief, it has the potential to increase the likelihood of an incorrect decision or belief. It can also be characterised by an unfounded belief in the morality of the group; an illusion that any decisions that are made are unanimous; and often not looking for information that would question the validity of the decision-making process. It is also characterised by stereotyping those who oppose the group, which may lead to such persons being marginalised, as appeared to have happened to a recently resigned board member.

Ministry of Transport

2.7.14. The Ministry of Transport was in many ways similar to the Shipping Corporation of Polynesia. The Ministry of Transport was only formed in 2007 and had the issue of managing the change to a multimodal organisation. It had a relatively new structure in place, and the roles, responsibilities, authorities and training of key personnel was ongoing. The appointment of the acting CEO in late 2008 had once again changed the organisational structure. During the period of the purchase and survey of the **Princess Ashika** the personnel had again changed with the retirement of the director of marine and ports, who took with him extensive corporate knowledge. The incoming director had received a short and inadequate hand over, and there were few procedures for him to follow. The upper management of the Ministry did not necessarily have the required skills, knowledge and experience to understand the maritime operations, the operating environment or its stakeholders.

2.7.15. The Ministry of Transport would also appear to have been resource limited and may have faced external pressure to allow the **Princess Ashika** to sail as it provided a key service to the Kingdom of Tonga. Additionally, the Ministry of Transport did not communicate effectively with other groups outside the organisation, groups that might have provided input regarding the suitability of the **Princess Ashika**, such as other shipping operators, overseas administrations and shipbrokers. The Ministry of Transport relied solely on the information provided to it by the managing director of the Shipping Corporation of Polynesia without validating or seeking its own information regarding the **Princess Ashika**, including through the exercise of its regulatory functions.

Government of Tonga

2.7.16. The Government of Tonga had clear policies and procedures for the procurement of items; however, the practice that took place for the procurement of the **Princess Ashika** was very different. The specified policies and procedures for procurement were not followed and in fact the Procurement Committee was not officially informed of the potential purchase until after the Cabinet had made a decision to purchase the vessel. The communication within the Government regarding the purchase was insufficient. When individuals, including the solicitor-general, did raise concerns regarding the purchase, they were largely deflected or ignored.

2.7.17. In addition, the Government determined that it needed to operate a ferry service so that there was not a privately held monopoly on shipping services in Tonga. This may have inadvertently placed pressure on the Government as well as the Ministry of Transport and the Shipping Corporation of Polynesia to ensure a service was provided and that the **Princess Ashika** sailed.

2.7.18. At many stages throughout the purchase, initial operation and final voyage of the **Princess Ashika**, there were opportunities for the accident to be prevented. However, these opportunities were either not recognised or not taken owing to a number of factors described elsewhere in the report, and from a human factors perspective in the following sections.

Diffusion of responsibility and perception of risks

2.7.19. Diffusion of responsibility is a phenomenon that tends to occur in large groups or organisations. It occurs when an individual from within a group is aware of something that is wrong or risky, but that individual does not take action because they believe either that it is not their responsibility or that as they have noticed it others must surely have noticed it and would have taken action (Piliavin, 1969; Aronson, 2007).

2.7.20. In hierarchical organisations such as on board a vessel, diffusion of responsibility can easily occur where individuals lower in the structure claim that they were just following orders. This is also referred to as the "Nuremberg defence", where an individual claims they were following orders, which they had to do. In diffusion of responsibility, those higher up the structure can claim they were just issuing the orders and not doing the acts.

- Managing director of the Shipping Corporation of Polynesia

From the evidence obtained by the investigation, it was likely that the managing director of the Shipping Corporation of Polynesia did not understand the risks involved in the purchase and operation in Tongan waters of the **Princess Ashika**. He did not have the skills, experience or knowledge to run the organisation on his own or play a key role in the purchase of the **Princess Ashika**.

- Minister of Transport

The Minister of Transport, at the time of the purchase and operation of the **Princess Ashika**, was also likely to have been unaware of the risks associated with the vessel. It appears that he relied solely on the information provided to him by the managing director of the Shipping Corporation of Polynesia and was unaware of the risks associated with this.

- Marine and Ports division

When the **Princess Ashika** arrived in Tonga, it was surveyed by the Marine and Ports division. While the surveyors identified a number of issues with the vessel, only a few were specifically mentioned as needing to be rectified before the vessel sailed. While 2 of these items, the bow and stern doors and the load line, were of critical importance to the safe operation of the vessel, the perception of the risk and possibly external pressures were such that the Marine and Ports division continued to issue a certificate of survey to the **Princess Ashika**.

In addition, the surveyors were likely unaware of their powers to detain the vessel to stop it from sailing and felt the responsibility for this lay with the director of marine and ports. It was also likely that there was a general acceptance of risk relating to the condition of vessels operating in Tonga. Once the vessel had sailed on its first trip, for whatever reason, the Marine and Ports division had no further interaction with the **Princess Ashika**.

- Crew of the **Princess Ashika**

The master, first mate and chief engineer were relatively experienced seafarers. .However, they and many more of the crew when interviewed did not seem to appreciate or understand the risks associated with the operation of the **Princess Ashika** or with the actions that were or were not taken during the final voyage. It was likely that the crew felt pressured, either explicitly or implicitly, to operate the **Princess Ashika**, as it was likely they felt that if they did not take it to sea, the Shipping Corporation of Polynesia would find someone else who would, and they would be without employment.

Diffusion of responsibility was also a likely issue in the sinking. Several crew when interviewed stated that they were not required to think but just to follow orders. It was also likely that there was an acceptance of risk, as even with water coming into the crew accommodation or onto the deck, the crew did not perceive this, until very late in the accident sequence, as anything other than normal or of little consequence.

Summary of human and organisational factors

2.7.21. A number of individuals had the opportunity to recognize the risks associated with the purchase and operation of the **Princess Ashika** and to act accordingly, but did not. There is an evident greater acceptance of transport safety risks in Tonga, the condition of many of the vehicles on the road indicated that there is a lower-than-ideal risk threshold. While some of this will have an economic dimension, it is possible that cultural and social dimensions, including the overlay of hierarchy on the organisation and operation of public and private enterprises exacerbates diffusion of responsibility issues. Other possible and inter-related reasons contributing to this increased acceptance of risk include matters of training, selection, knowledge and organizational control.

2.8. Analysis summary

2.8.1. The **Princess Ashika** was an example of what has been identified as a wider problem with substandard shipping in the South Pacific region, possibly one of the worst examples. The ship had steadily deteriorated during the years in service in the Pacific, as ships do over time. The rate of decline was commensurate with how well it had been maintained.

2.8.2. By the time the ship came to the end of its service in Fiji, it was effectively at the end of its life and should have been disposed of at that time. FIMSA recognised this and placed operating restrictions on it to mitigate the risk. This may have been a pragmatic approach, but it did effectively promote the continued operation of a non-compliant vessel. The ship was unseaworthy and no level of risk management would have changed that, so by IMO or Safety Regulations for Non-Convention Vessels 2002 standards, the ship should have been either upgraded or withdrawn from service much earlier.

2.8.3. In the condition it was in, the **Princess Ashika** should never have been allowed to be sold as a going concern, and should never have been allowed to depart Fiji.

2.8.4. On the Tongan side, the procurement process should have identified the poor condition of the vessel and its unsuitability for the intended trade while it was still in Fiji and before it was chosen and purchased. The contract for purchase should have been conditional upon the ship passing a physical survey or a rigorous identification, assessment and acceptance of an existing survey certificate. Once the vessel had been purchased and arrived in Tonga, the survey system in Tonga should have prevented it leaving Nuku'alofa, because it was not in a fit condition to do so safely.

2.8.5. With the successive failures in the wider system to prevent the **Princess Ashika** entering service in Tonga, it then fell upon the master and crew to manage what was a very high-risk enterprise. The master and crew had sufficient knowledge to realise the **Princess Ashika** was not seaworthy. Ideally, they should have collectively declined to take the ship to sea, but they too were operating in the wider system where substandard shipping had become normalised, as had the acceptance of poor operating procedures and standards of training. The personal economic and social consequences of declining to operate the ship would have been significant for the individuals and families involved.

2.8.6. This investigation has concluded that the crew could have saved the **Princess Ashika** on the fateful voyage, had they been aware of the peril that the ship was in as the situation developed, and if they had followed the practices of good seamanship. However, each time the **Princess Ashika** put to sea the ship was at risk of foundering, and at some point in the future the circumstances would have come together and reached a point where sinking was inevitable, regardless of crew actions.

2.8.7. Any time any ship puts to sea there will be a degree of risk that is managed by good standards of maintenance and robust procedures. Part of that risk management is to operate the ship safely to prevent accidents, but the other part is to put in place safety measures to preserve life should an accident occur, such as lifesaving appliances and warning devices to alert passengers and crew to when and how the lifesaving appliances should be used. In addition, crews are supposed to be trained to a sufficiently high standard to respond to emergencies and abandon a ship in an orderly manner if all else fails. In this case, procedures and training were substandard, and that was the final defence that failed and resulted in a high number of casualties when the **Princess Ashika** capsized and sank.

2.8.8. Improving standards of shipping in Tonga and the wider South Pacific needs a coordinated approach from the region and support from regions with more developed standards of shipping. Already the Regional Maritime Programme of the Secretariat of the Pacific Community has become well established and made progress. Clearly though, there is more work to do before standards rise and the risk falls to an acceptable level.

2.8.9. The problem of providing economical services to islands is an issue, and according to the 1997 United Nations Economic and Social Commission for Asia and the Pacific Study, the problem is not unique to Tonga or even to the Pacific. There may in some cases be opportunities to share shipping resources between island groups, which would be made easier if there were a standard design of ships suited to the Pacific environment and the shore facilities to support that shipping. In other words, the Pacific would benefit from a whole-of-Pacific approach, rather than island groups operating independently yet focusing on the same problems that other island states are experiencing.

3 Findings

3.1. The foundering

3.1.1. The **Princess Ashika** foundered in moderate seas when en route between Nuku'alofa and Ha'afeva in the Tonga islands in latitude 20° 24'S longitude 174° 56'W, about 47 nautical miles north of Nuku'alofa.

3.1.2. The **Princess Ashika** foundered owing to the erosion of its reserve buoyancy caused by the progressive flooding of compartments below the freeboard deck, initially through corrosion holes in what should have been the watertight hull and weathertight superstructure, and eventually downflooding through unsecured or ineffective weathertight doors and watertight manholes leading to those compartments.

3.1.3. Water entering compartments through corrosion holes in the underwater hull before and during the accident voyage was possible given the vessel's history, although this could not be proven.

3.1.4. Water accumulated on the semi-open cargo deck through a poorly sealed bow cargo ramp, through the natural seawater spray created by the vessel's progress through the water, and through cargo deck scuppers that were corroded and not fitted with non-return valves. The accumulation of water on deck worsened as the vessel settled deeper in the water due to the flooding, and because it trimmed by the bow and listed further when the crew pumped ballast water out of the aft starboard ballast tank.

3.1.5. The overboard scuppers did not effectively clear the accumulated water on the cargo deck. This was due partially to some of the scuppers being blocked by debris and partially to the intermittent backpressure as the scuppers on the low side of the vessel became immersed in waves. The backpressure increased as the vessel settled lower in the water and the list increased. Once the scuppers became immersed, non-return valves would not have helped to clear the water from the deck, but they would have reduced the free ingress of water through those scuppers.

3.1.6. At some point shortly before the **Princess Ashika** foundered, it lost stability and capsized. The unsecured cargo did not shift until some minutes before the ship capsized, and although the cargo shift may have increased the speed of the final loss of any residual stability, the vessel was by that time unrecoverable.

3.2. Condition of the Princess Ashika

3.2.1. The **Princess Ashika** was unseaworthy when it was operating in Fiji at the time of its purchase by the Government of Tonga and should not have held a certificate to operate under any circumstances until major deficiencies that had been identified were rectified. However, FIMSA had imposed strict operating conditions, and short-dated certificates, on the vessel to mitigate the risk. FIMSA should not have allowed the vessel to sail from Suva in the condition it did.

3.2.2. The **Princess Ashika** was being operated in a sea area for which it was not originally designed, but had it been in a good state of repair, it should have been able to survive the sea conditions prevailing at the time of its foundering.

3.2.3. The **Princess Ashika** was unseaworthy when it departed on the accident voyage and should not have been issued with a certificate allowing it to operate under any circumstances until major deficiencies had been rectified.

3.2.4. The **Princess Ashika** sat deeper in the water than it should have in an empty condition, likely with its load line submerged, which was caused by natural weight increase due to corrosion as the ship aged, unnecessary ballast water being carried, and possibly undetected water in void spaces. The reduced freeboard would have made the vessel more susceptible to shipping water on deck.

3.2.5. The reported condition of the steelwork in the **Princess Ashika**'s hull, evidenced by Fiji survey records and special procedures around checking the void spaces for water 3 times each day, made it highly possible that water accumulated in the void spaces before departure or during the accident voyage.

3.2.6. Holes caused by uncontained corrosion in the watertight structure of the **Princess Ashika** were a major deficiency that directly contributed to the flooding of compartments below the freeboard deck, and the vessel foundering.

3.2.7. The large gaps around the bow ramp and the missing non-return valves on the cargo deck overboard scuppers were major deficiencies that allowed more water than usual to accumulate on the cargo deck.

3.2.8. The condition of the weathertight doors and various ventilator closing devices was a major deficiency that directly contributed to the downflooding of compartments below the freeboard deck during the latter stages of the vessel sinking. The crew's practice of routinely leaving weathertight doors and watertight manhole covers unsecured meant that once the flooding sequence progressed, downflooding was rapid and the vessel quickly became unrecoverable.

3.3. Actions of the crew of the Princess Ashika and other parties

3.3.1. The absence of routine night orders resulted in the navigation watch officers having no guidance as to what actions to take when an unusual event occurred, and in particular when the master should be called.

3.3.2. The crew's lack of routine surrounding the reading of the draught of the vessel before sailing and observing the load line resulted in them being unaware of risk to which the ship was exposed or how overloaded it was. Similarly, the absence of a procedure for sounding and recording tanks and void spaces left them unaware of the amount of water that was in the hull of the vessel.

3.3.3. With the master asleep, and the first mate's inclination to sleep on the bridge wing during his watch, the crew in control of the **Princess Ashika** did not have sufficient knowledge of stability to fully understand what was happening to their vessel, and in particular the effect of the free water accumulating on and below the freeboard deck.

3.3.4. The first mate's decision to pump out the aft starboard ballast tank in response to the starboard list trimmed the vessel by the head. This increased the rate of water ingress through the poorly sealed bow ramp and, once the vessel had come upright, the free water washed across to the port side, creating a bigger list to port. Both of these results accelerated the rate at which the **Princess Ashika** was sinking.

3.3.5. Had the peril been recognised earlier, before the after starboard ballast tank was discharged, the **Princess Ashika** might not have foundered. The ingress of water onto the freeboard deck could have been reduced had the vessel been slowed and its course adjusted. In addition, the crew missed the opportunity to pump the water from the spaces below the freeboard deck, and also to shed water from the cargo deck, as they had done on the previous trip by punching a temporary freeing port into the superstructure plating. Had any combination of these actions been taken, the eventual capsize might not have been avoided but would have been delayed and so allowed a more orderly abandonment to take place.

3.3.6. The ship sailed on 4 voyages in Tonga before the accident voyage. Before each of those voyages a number of people, who should have known that the vessel was unseaworthy, could have prevented the ship sailing:

- the acting director of marine and ports, who had the power to detain the ship
- the Marine and Ports surveyors through their director
- the master or chief engineer of the **Princess Ashika**
- the managing director of the Shipping Corporation of Polynesia
- the board of the Shipping Corporation of Polynesia

None did.

3.4. Survivability

3.4.1. The high number of passenger fatalities was due to a number of reasons:

- a delay in raising the alarm until capsize was imminent
- the absence of an emergency alarm to muster passengers
- a lack of abandon ship drills by the crew.

3.4.2. The delay in raising the alarm until capsize was imminent resulted in many passengers not being woken and crewmembers being unable to assist the passengers. Had more passengers been able to clear the accommodation, the survival rate would most probably have been significantly higher.

3.4.3. The **Princess Ashika**'s passengers received no instructions from the ship's crew when the vessel departed Nuku'alofa regarding emergency signals, emergency equipment, abandoning ship and the location and donning of lifejackets. The passengers were insufficiently pre-prepared to assist themselves in any emergency.

3.4.4. The distress message sent, the automatic activation of the EPIRB and the crew's use of pyrotechnics to attract the attention of rescue vessels resulted in a high rate of survival for those passengers and crew who escaped the sinking hull.

3.4.5. The SAR operation was well coordinated, but was hampered by the poor information available concerning the number of persons on board, and their identities.

3.4.6. The decision to end the search for missing persons after 12 days, having considered the search results and the factors affecting survivability, was appropriately made and justified.

3.5. Organisational and Human factors

3.5.1. The responsibility for the purchase of a suitable replacement for the **Olovaha** on behalf of the Tonga Government lay with the Minister of Transport who should, under normal circumstances, have enlisted the help of the director of marine and ports and his surveyors. Such an action, in conjunction with proper observance of Government of Tonga procurement guidelines, would have ensured that there was sufficient maritime expertise to ensure that the replacement ship was both fit for its intended purpose and fit to be entered into the Tonga ship register, while also achieving other desirable outcomes such as value for money.

3.5.2. Even if the Marine and Ports division were not to be party to the purchase of the **Princess Ashika**, it would have been prudent for the Government of Tonga to employ an independent surveyor to check that the vessel was fit for its intended purpose given the inherent conflict of interest in the Ministry of Transport being both nominal owner and regulator of the vessel.

3.5.3. The Shipping Corporation of Polynesia had, in the previous 2 years, lost all of its "in-house" shore-side maritime expertise, so in the period leading up to the accident it did not have sufficient maritime expertise, within either the board or its management, to operate vessels of any type safely, but particularly one that was in a poor condition and was not suitable for the area of operation.

3.5.4. Lack of maritime expertise within the Shipping Corporation of Polynesia lead to unsound assumptions about the revenue earning capability of the **Princess Ashika**, which culminated in the business case to support its purchase being flawed.

3.5.5. The limited funds available to the Government of Tonga and the prohibitive cost of the purchase and delivery of a more suitable vessel from other regions were factors likely to have influenced the decision at all levels of Government to purchase the **Princess Ashika**.

3.5.6. The Procurement Committee did provide an effective system for evaluating the purchase of large-value capital items, but in the case of the **Princess Ashika** it was effectively circumvented from performing its mandated duty. Had it been able to evaluate properly the business case for the vessel it would have been apparent that the ship did not represent value for money.

3.5.7. The actions of the managing director of the Shipping Corporation of Polynesia were not subjected to any effective checks and his opinions and decisions were not questioned. In transport safety parlance, such extreme autonomy would be termed one-man error, which often results in less-than-optimal decisions being made. Consequently, the interests of the Government of Tonga and the Tongan people were left exposed to poor or ill-advised decisions.

3.5.8. The FIMSA survey records clearly showed that the **Princess Ashika** was not fit to depart Fijian waters, or to trade between the islands of Tonga. These records were neither asked for nor offered for inspection as part of the Tonga procurement process.

3.5.9. The Fiji survey certificate used to obtain the Tongan provisional certificate of registration had been intentionally altered to hide the significant operating restrictions placed on the **Princess Ashika** by FIMSA. Had those operating restrictions and the reasons for them been known to the Tonga Government, it is unlikely that the Government would have approved the purchase. It could not be established by whom and where the survey document was altered. Several other documents that were used to support the procurement process contained forged or misrepresented signatures; again, without those documents it is unlikely that the Government of Tonga would have approved the purchase of the vessel.

3.5.10. The failure of the various groups from a high level of government down to the crew of the **Princess Ashika** to recognise the risks associated with the purchase and operation of the **Princess Ashika**, and to speak out against those risks, was likely due to a diffusion of responsibility and an acceptance of risk in the transport sector, an acceptance not uncommon within the shipping industry of the wider South Pacific region.

4 Safety recommendations

4.1. Search and rescue

4.1.1. To build and maintain an up-to-date register of search and rescue air and marine assets capable of being used for search and rescue operations within the southwest Pacific region.

4.1.2. To explore the possibility of dedicated search and rescue aircraft fitted with SAR equipment and trained crew being made available to conduct search and rescue operations in the New Zealand and Fiji SAR areas. Such aircraft could be multi-purpose to conduct other maritime and land-based activities such as customs and fisheries patrol.

4.2. Southwest Pacific

4.2.1. To form an independent group of auditors and marine surveyors to conduct a sample inspection of coastal and foreign-going vessels from every southwest Pacific island group, with the objective of understanding the extent of compliance with national, regional and international maritime standards and requirements within the region. From that information it will be possible to identify the areas that require the greatest attention to improve compliance and safety.

4.2.2. To amend the South Pacific Maritime Code to require a system of ongoing inspection, monitoring or auditing of a ship and its operation between statutory surveys in line with the International Safety Management Code.

4.2.3. To promote the work of the Regional Maritime Programme of the Secretariat of the Pacific Community in informing shipping operators and the vessels they operate within the southwest Pacific region about the principles of safe ship management.

4.2.4. To adopt a whole-of-Pacific approach to meeting, and where required raising, standards and lowering risks to shipping in the South Pacific rather than reviewing each country individually, and better coordinating foreign aid to the Pacific region for maritime projects to promote standardisation of shipping, shipping equipment and shipping facilities.

4.2.5. To adopt a standard design of passenger and freight carrying vessel suitable for operations in the coastal southwest Pacific region, with a view to achieving cost savings through synergies throughout the region by standardisation of design, building and fitting out such vessels. The design and specification should be made and owned by an independent South Pacific entity to facilitate future design improvements and flexibility of where each vessel is built.

4.3. Government of Tonga

4.3.1. To require the Shipping Corporation of Polynesia or any similar entity formed in the future to employ sufficient maritime expertise to govern and manage effectively the day-to-day running of a shipping company and its vessels.

4.3.2. To introduce and implement a functioning safety management system for any Tonga-based shipping operator and individual ships operated by it, in line with the International Safety Management Code.

4.3.3. To amend the Shipping Act to require a safety management system that would supplement the current statutory surveys. Such a system will include the ongoing inspection, monitoring and auditing of every registered ship and its operation, in line with the International Safety Management Code. The structure for this has been put in place through the Safety Regulations for Non-Convention Vessels 2002 produced by the Regional Maritime Programme of the Secretariat of the Pacific Community. Ultimately, such a safety management system would be specifically tailored to the needs of the Tongan domestic fleet.

4.3.4. To develop its maritime administration to ensure that Tonga can meet its own and international obligations. This will include the ability to oversee an efficient safety management system, which will require a solid base of surveying expertise to allow for meaningful inspections and audits of vessels and their systems.

4.3.5. To conduct a review to determine the required key outputs of TMPI. As part of that review, determine whether such a facility is financially and socially necessary for the country. Should it be determined to continue the operation of the school, it should be:

- adequately governed and resourced to provide training to the required level, including attracting the appropriate staff
- properly monitored by the Marine and Ports division, including audits of teaching methods and examination results.

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