

Inquiry 11-204: Container ship MV *Rena* grounding,  
on Astrolabe Reef, 5 October 2011

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# Final Report

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Marine inquiry 11-204  
Container ship MV Rena grounding  
on Astrolabe Reef, 5 October 2011

# Transport Accident Investigation Commission

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## About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of the occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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## **Important notes**

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### **Nature of the final report**

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

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### **Citations and referencing**

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1980 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

### **Photographs, diagrams, pictures**

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.



The MV Rena aground on Astrolabe Reef (photograph taken 6 October 2011)



Location of accident

Source: [mapsof.net](#)

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## Abbreviations

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ATSB	Australian Transport Safety Bureau
CIEL	CIEL Shipmanagement S.A.
Commission	Transport Accident Investigation Commission
EMSA	European Maritime Safety Agency
EU	European Union
FAST	Fatigue Avoidance Scheduling Tool
GPS	global positioning system
IMO	International Maritime Organization
ISM Code	International Safety Management Code
MetService	New Zealand Meteorological Service
SOLAS Convention	International Convention for the Safety of Life at Sea 1974
STCW Convention	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978
VHF	very high frequency (radio)

## Glossary

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able-bodied seaman	an ordinary seaman who has been trained in certain skills
automatic identification system	a system used to locate and track vessels electronically. The system works by a vessel electronically exchanging data, such as its unique identification, position, heading and speed, with nearby vessels and base stations via very-high-frequency (VHF) radio
autopilot	a system used to maintain a vessel's heading without assistance from a human being
bearing	a geographical direction given in degrees notation
course line	a single, continuous line drawn on a chart to show the planned route for a vessel
differential global positioning system	an enhancement of a global positioning system (GPS) that yields improved accuracy on position
digital selective calling	a standard for sending predefined digital messages via maritime radio systems
draft	the distance between the surface of the water in which a vessel is floating and the bottom of the vessel
global maritime distress and safety system	a set of radio equipment and communication protocols used to increase safety and to help rescue distressed vessels
global positioning system (GPS)	a navigational system that uses data from a satellite network to give a geographical location. The system uses changes in location over time to give other navigational information, such as speed and direction
ground track	a vessel's track in relation to the seabed
gyrocompass	a type of non-magnetic compass that uses gyroscopic principles to find true north automatically
gyro heading	the direction of a vessel as read on its gyrocompass
heading	the direction in which a vessel is pointing, taken as parallel to the centreline of the vessel and expressed in degrees notation
Inmarsat	a global satellite network that provides mobile satellite communication
interested person	a person or an organisation whose conduct is referred to in this report as being relevant to the occurrence, or any other person or organisation that the Commission believes may have a significant interest in matters relating to its inquiry
parallel index	an offset electronic navigation line(s) set up on a radar screen parallel to a ship's heading
screenshot	an image captured from an electronic display screen that is a copy of what was on the screen at that time
second mate	referred to on the <i>Rena</i> as the second officer (navigating)

squat	the phenomenon where a ship sinks bodily in the water when travelling at speed. The effect can be enhanced when the distance between the keel and the seabed is small
third mate	referred to on the <i>Rena</i> as the second officer (safety)
voyage data recorder	a device on board a vessel that records data from various sensors. The inputs include (but are not limited to) time, audio from the bridge, GPS positions, vessel speed and gyro heading, and radar screenshots
watchkeeper	a crew member (sometimes referred to as a navigation watch rating) whose role is to assist the officer of the watch to keep watch and keep look-out

## Data summary

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### Vessel particulars

**Table 1: Vessel particulars**

Name:	Rena
Type:	container ship
Class:	American Bureau of Shipping
Limits:	unlimited
Classification:	‡A1 <sup>1</sup> , e <sup>2</sup> , ‡AMS <sup>3</sup> , ‡ACCU <sup>4</sup>
Length:	224.5 metres
Breadth:	32.2 metres
Gross tonnage:	37,209 tonnes
Built:	1990
Propulsion:	single fixed-pitch propeller driven by one Sulzer 8RTA76 (21,680 kilowatts)
Maximum service speed:	20 knots
Owner/Manager:	Daina Shipping Co./CIEL Shipmanagement S.A.
Port of registry:	Monrovia

**Table 2: Incident particulars**

Date and time: 0214<sup>5</sup> on 5 October 2011

Location:	Astrolabe Reef, Bay of Plenty, New Zealand 37° 32.4'S 176° 25.7'E
Persons involved:	vessel's crew
Injuries:	nil
Damage:	the hull was severely damaged during the initial grounding. The hull girder structure subsequently failed, leading to the vessel breaking in two. The aft section moved off the reef and sank. About 200 tonnes of heavy fuel oil were lost to the sea. A substantial amount of cargo in the containers was lost. The vessel was a total loss

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<sup>1</sup> Hull and equipment built to survey under American Bureau of Shipping.

<sup>2</sup> The anchors and chain cable of the vessel were in compliance with American Bureau of Shipping.

<sup>3</sup> Machinery, boiler and systems built to survey under American Bureau of Shipping.

<sup>4</sup> Shipboard automation systems built to survey under American Bureau of Shipping.

<sup>5</sup> All times in this report are New Zealand Daylight Time (universal co-ordinated time + 13) and expressed in the 24-hour mode.



## 1. Executive summary

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- 1.1. The Liberian-registered container ship *Rena* had left the New Zealand port of Napier at 1020 on 4 October 2011 and was bound for the New Zealand port of Tauranga. The master had given an estimated time of arrival at the Tauranga pilot station of 0300 the next day. The master calculated the estimated time of arrival by dividing the distance to go by the *Rena*'s normal service speed. The calculation did not account for the unfavourable currents that normally prevailed down that stretch of coastline.
- 1.2. After departure from Napier the master learned from notes on the chart of the unfavourable currents. He then authorised the watchkeepers to deviate from the planned course lines on the chart to shorten the distance, and to search for the least unfavourable currents.
- 1.3. The *Rena*'s second mate took over the watch shortly after midnight on 4 October. He calculated that the *Rena* would arrive at the port of Tauranga pilot station at 0300 at the ship's then current speed. Times for ships entering and leaving Tauranga Harbour are limited by the depth of water and the strength of the tidal currents in the entrance channel. Tauranga Harbour Control informed the second mate that the latest time the *Rena* could take the harbour pilot on board was 0300.
- 1.4. The planned course to the Tauranga pilot station was to pass two nautical miles north of Astrolabe Reef before making the final adjustment in course to the pilot station. The second mate decided to reduce the two miles to one mile in order to save time. The second mate then made a series of small course adjustments towards Astrolabe Reef to make the shortcut. In doing so he altered the course 5 degrees past the required track and did not make an allowance for any compass error or sideways "drift", and as a consequence the *Rena* was making a ground track directly for Astrolabe Reef. Meanwhile the master had been woken and arrived on the bridge to prepare for arrival at the port.
- 1.5. The master and second mate discussed preparations for arrival at the pilot station. The master then assumed control of the ship, having received virtually no information on where the ship was, where it was heading, and what immediate dangers to navigation he needed to consider.
- 1.6. During this period of handover no-one was monitoring the position of the ship. At 0214 the *Rena* ran aground at full speed on Astrolabe Reef. The ship remained stuck fast on the reef and in the ensuing months it broke in two. The aft section moved off the reef and sank. About 200 tonnes of heavy fuel oil were lost to the sea. A substantial amount of cargo in the containers was lost. The vessel became a total loss on 11 October 2011.
- 1.7. The Transport Accident Investigation Commission (the Commission) concluded that the *Rena* grounding was not in any way attributable to the malfunction of any on-board machinery or equipment, including on-board navigational equipment. Factors that directly contributed to the grounding included the crew:
  - not following standard good practice for planning and executing the voyage
  - not following standard good practice for navigation watchkeeping
  - not following standard good practice when taking over control of the ship.
- 1.8. **Safety issues** that the Commission identified in the wider context included:
  - CIEL Shipmanagement S.A.'s oversight of the *Rena*'s safety management system was not sufficient to prevent a high number of port state control deficiencies identified during two port state control "initial" inspections about three months prior to the grounding, and routine violations of some company procedures for voyage planning and navigation
  - an independent audit had found that the Philippines' maritime education, training and certification system did not meet the mandatory standards specified in the Convention

on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (the STCW Convention)

- the current auditing protocols of the STCW Convention lack the transparency that would assist member states to decide whether other countries' training systems meet the standards of competency required by the STCW Convention, and therefore whether to recognise certificates of competency issued by those countries.
- 1.9. The report also discusses two other considerations that were raised during the inquiry – whether there is a need for ship routing in some form around the New Zealand coast, and how far maritime authorities should go in marking hazards to navigation such as Astrolabe Reef. The Commission identified two issues: first, with regard to shipping, there is insufficient data being collected to make a meaningful analysis of shipping movements around the New Zealand coast; and secondly, with regard to marking hazards, a new type of "virtual aid to navigation" is being used for marking hazards to navigation before this system has been fully tested and endorsed by the International Association of Marine Aids to Navigation and Lighthouse Authorities.
- 1.10. The Commission made **recommendations** to:
- CIEL Shipmanagement S.A. to evaluate the effectiveness of its safety management system to ensure that the issues identified with that system as applied on board the Rena do not affect other vessels within its fleet
  - Maritime New Zealand to promote, through the International Maritime Organization, the transparency of the system for auditing countries' seafarer training systems
  - Maritime New Zealand to collect sufficient data on shipping movements around the New Zealand coast, and monitor and control the use of virtual aids to navigation around the New Zealand coast.
- 1.11. The **key lessons** learnt from the inquiry into this accident were:
- ship managers must ensure that their safety management systems are delivering safe ship operations for every ship in their fleets
  - ships' crews must comply with the mandatory requirements and recommended best industry practice for passage planning, navigation and watchkeeping if similar groundings and other equally catastrophic maritime casualties are to be avoided
  - countries' maritime education, training and certification systems must be capable of meeting the standards required by the STCW Convention to ensure that seafarers emerging from the system are trained to an appropriate standard.

## **2. Conduct of the inquiry**

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- 2.1. The purpose of the Commission's inquiry, as set out in section 4 of the Transport Accident Investigation Commission Act 1990, is to determine the *causes* and *circumstances* of accidents with a view to avoiding similar occurrences in the future. The Commission's inquiry is not for the purpose of ascribing blame, and its reports cannot be used in any proceeding by or against any person.
- 2.2. The *Rena* ran aground on Astrolabe Reef at about 0214 on 5 October 2011. The Rescue Coordination Centre New Zealand notified the Commission of the grounding at 0237 the same day. The Commission immediately opened an inquiry into the accident under section 13(b) of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge. The accident was a "very serious casualty" as defined in the International Maritime Organization (IMO) Casualty Investigation Code.
- 2.3. The scope of the Commission's inquiry was limited to determining the causes and circumstances of the grounding. The inquiry did not consider the subsequent salvage operations or the oil spill response.
- 2.4. Throughout the first day the Commission gathered information through the Maritime New Zealand Emergency Response and Rescue Coordination Centres. Once it had been established that access to the stricken vessel was possible, the chief investigator and investigator in charge travelled to Tauranga to start the site investigation that same day, 5 October.
- 2.5. The state of registry for the *Rena* was Liberia. The Commission notified the Liberian International Ship & Corporate Registry of the accident and offered to conduct the "marine safety investigation" on behalf of Liberia. The IMO Casualty Investigation Code required that a "marine safety investigation" be conducted into every "very serious casualty". Liberia elected to appoint an investigator to conduct its own investigation and requested assistance from the Commission. The Commission provided whatever assistance it could under New Zealand law.
- 2.6. Both the Director of Maritime New Zealand and the Chief Executive of Bay of Plenty Regional Council requested permission to conduct their own investigations at the site of the *Rena* grounding. The Commission granted permission under section 14(3) of the Transport Accident Investigation Commission Act 1990 to the Director on 5 October and to the Chief Executive on 7 October 2011.
- 2.7. The Commission's investigators boarded the *Rena* on 6 October 2011 and interviewed the master, the second mate and the watchkeeper (the crew who were on the bridge at the time the *Rena* grounded). The investigators re-boarded the *Rena* on 7 October and removed documents and the computer and portable data module from the voyage data recorder.
- 2.8. The crew were evacuated from the *Rena* on Tuesday 11 October. On Thursday 13 October two Commission investigators returned to Tauranga and conducted second interviews with the master, the second mate and the watchkeeper. They also interviewed the third mate.
- 2.9. While salvage operations were underway to remove oil from the *Rena*, environmental conditions were weakening the vessel's structure, so on Saturday 22 October the Commission's investigators re-boarded the vessel and removed a significant number of documents and equipment that were pertinent to the inquiry. Maritime New Zealand was conducting its own inquiry into the grounding independently of the Commission. The exercise to remove the documents and equipment was observed by an investigator from Maritime New Zealand to allow Maritime New Zealand and the Commission to formally record the chain of custody of the documents and equipment.
- 2.10. The voyage data recorder that had been removed from the *Rena* earlier was undamaged and valid data was successfully downloaded. On 10 November 2011 two investigators interviewed the master and second mate of the *Rena* for a third time.

- 2.11. This report includes information from the crew interviews, information retrieved from the voyage data recorder, information from log books, charts and other documents either removed from the *Rena* or supplied by the *Rena*'s owner, and information retrieved from the automatic identification system. Raw automatic identification system data is transmitted from the vessel and recorded by several shore stations. The raw automatic identification system data used in this report was provided by a maritime consultant, Marico Marine NZ Limited, and was verified with data from the voyage data recorder.
- 2.12. On 9 December 2011 the Commission approved a draft interim report for circulation to interested persons. The interested persons were the master of the *Rena*, the second mate of the *Rena*, the third mate of the *Rena*, the watchkeeper on watch at the time of the grounding, the vessel's owner, the vessel's charterer, Maritime New Zealand, Bay of Plenty Regional Council, Port of Tauranga Limited and the Crown Law Office. The draft report was assessed and amended after a consideration of the submissions received from the interested persons. The submissions raised a number of matters more relevant to the final analysis that had not been addressed in the interim report. The interim report was approved for publication on 23 February 2012, and publicly released on 8 March 2012.
- 2.13. The crew had received their formal training through the Philippines' training system. A delegation from the Philippine administration arrived to meet with the Commission on 27 February 2012. The delegation spent three days with the Commission, discussing the scope of the inquiry and the Philippines' maritime education, training and certification system.
- 2.14. On 18 May 2012 two investigators from the Commission travelled to Tauranga to conduct further interviews with the master and second mate.
- 2.15. Maritime New Zealand engaged an expert on marine safety management and IMO's International Safety Management Code (ISM code) to review and report on the safety management system and compliance with the ISM Code with respect to the operation of the *Rena* (Dr Anderson). The Commission obtained Dr Anderson's preliminary reports for Maritime New Zealand, but as the legal proceedings were settled out of court, Maritime New Zealand terminated his work without his having produced final reports. The Commission obtained and initially used this work in its own enquiries. However, because Dr Anderson's work had never been finalised, and was based on a substantial amount of unverified information, the Commission also undertook its own review and analysis of the raw data to verify or correct information as required.
- 2.16. Maritime New Zealand engaged a team of expert navigators (through The Nautical Institute in Auckland) to reconstruct 30 of the *Rena*'s past voyages, as near as practicable using passage plans, charts and log book records from the ship. The Commission obtained the results of this work. The Commission then conducted its own reconstructions by using raw data to plot the voyages and to verify the plotting undertaken by the expert navigators. The Commission also obtained the original charts from the *Rena* that covered the six most recent coastal voyages of the *Rena* (in the eight days leading up to and including the accident voyage). The record of these six voyages had not been erased from the charts. These charts and the reconstructed voyages were used to analyse the functioning of the safety management system on board the *Rena* with respect to voyage planning and voyage execution.
- 2.17. Maritime New Zealand engaged an expert on fatigue, sleep and human cognitive performance to review and report on those aspects of the *Rena*'s grounding (Professor Gander). The Commission obtained a copy of Professor Gander's report.
- 2.18. On 8 October 2012 two investigators from the Commission travelled to Manila, Philippines, to meet with officials from the Philippine administration and also representatives from various training institutes. The investigators were in Manila for five days. While there the two investigators visited five training institutes and observed the training system first hand. The investigators also had access to various European Maritime Safety Agency (EMSA) audits of the Philippines' training and certification system and its compliance with international standards.

- 2.19. During the course of this inquiry investigators from the Commission researched various IMO instruments, including the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (STCW Convention).
- 2.20. Information was also sought from CIEL Shipmanagement S.A. (CIEL), the Liberian International Ship & Corporate Registry, and the company to which the *Rena* was time chartered.
- 2.21. On 25 July 2013 the Commission approved a draft final report for circulation to interested persons.
- 2.22. The draft final report was sent to the following persons and organisations:  
CIEL; the Maritime Industry Authority (Philippines); the Liberia Maritime Authority; the Mediterranean Shipping Company S.A.; Maritime New Zealand; Bay of Plenty Regional Council; Port of Tauranga; IMO; and the master, second mate, third mate and watchkeeper of the *Rena*.
- 2.23. The Commission received and considered substantial submissions from CIEL on 30 November 2013. The Commission also received and considered submissions from the following persons and organisations:  
The Maritime Industry Authority (Philippines); the Liberia Maritime Authority; the Mediterranean Shipping Company S.A.; Maritime New Zealand; and the second mate (no comments).
- 2.24. The submissions were considered and the draft final report was substantially revised and sent back to CIEL, the Liberia Maritime Authority, the Maritime Industry Authority (Philippines) and IMO for further comment on 13 May 2014.
- 2.25. Further submissions were received from CIEL on 6 June 2014.
- 2.26. As a result of CIEL's submissions questioning the reliance on Dr Gander's report alone to analyse whether fatigue was a factor in the accident, the Commission sent the relevant raw data to and sought additional advice from human factors specialists at the Australian Transport Safety Bureau (ATSB). The ATSB provided its draft report on 8 August 2014, which was sent to CIEL the same day. The ATSB's final report was received on 26 August 2014 and sent to CIEL on 28 August 2014. The Commission considered and weighed both reports, alongside interviews with crew members and further submissions from CIEL dated 3 September 2014, in reaching conclusions on whether fatigue might have been a cause of or circumstance in the grounding.
- 2.27. As a result of CIEL's submissions questioning the use of port state control data to draw inferences about the *Rena*'s and CIEL's safe ship management system, the Commission sought additional independent advice from Mr Mike Pearson of GBT International about port state data, passage planning and safe ship management systems and how these were considered in its draft report. Mr Pearson's report was received on 7 July 2014 and was provided to CIEL. The Commission also revised its statistical analysis based on updated information provided by CIEL, including the dates that vessels entered and exited its fleet. The Commission also sought clarification on port state data through various international memoranda of understanding and then further considered what, if any, inferences or broader safety issues could be drawn from the revised data on port state deficiencies.
- 2.28. The Commission also heard directly from legal representatives of CIEL, and its safe ship management consultant, in person at a hearing in Wellington on 12 August 2014. Following that hearing CIEL made further representations to the Commission by a letter dated 24 September 2014.
- 2.29. The Commission considered all further submissions, including points made orally by CIEL representatives on 12 August 2014, and further submissions received after that date, in reaching the findings and recommendation contained in this final report.

2.30. The Commission approved its final report for publication on 19 November 2014.

### **3. Factual information**

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#### **3.1. Note on terminology**

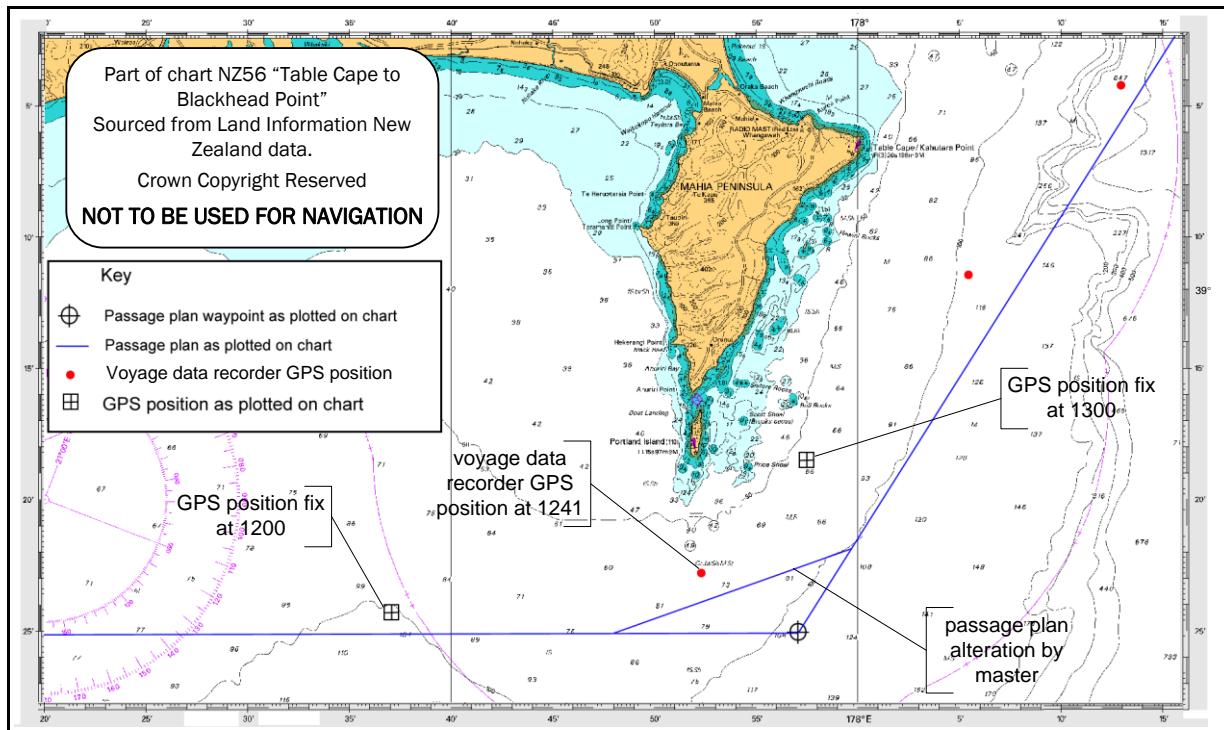
- 3.1.1. A number of terms are used in this report to describe the direction in which a vessel travels and the direction in which a vessel is pointing. A brief description of these terms is given below.
- 3.1.2. As part of planning a vessel's passage from one location to another, the planned route will be drawn on a chart as a single, continuous line. This line is referred to as the course line.
- 3.1.3. From any position on Earth, true north is in the direction of the geographical North Pole. The lines of longitude on a nautical chart are aligned to true north and true course lines are expressed in degrees relative to true north.
- 3.1.4. Gyro heading is the direction of a vessel as read on its gyrocompass (a compass in which the direction of true north is maintained by a gyroscope). If there is no gyrocompass error, the gyro heading and the true heading will be the same.
- 3.1.5. The wind and the waves can cause a vessel to move sideways through the water, giving a resultant water track that is different from its actual heading. The difference between actual heading and a vessel's water track is called leeway.
- 3.1.6. Additionally, the body of water through which a vessel is tracking can be moving due to current and tidal streams, causing the vessel's resultant track in relation to the seabed (ground track) to differ from its water track. The difference between a vessel's water track and its ground track is called set.
- 3.1.7. The difference between a vessel's gyro heading and its ground track will be caused by any set, leeway and gyrocompass error.
- 3.1.8. The Rena was being steered by autopilot for most of the voyage from Napier, including the whole period from midnight to the time of the grounding. The Rena's autopilot operated off its gyrocompass. The Rena's global positioning [navigation] system (GPS) recorded the vessel's position in relation to the ground and thus calculated the Rena's ground track. This report is concerned, in part, with the difference between the Rena's gyro heading, to which the autopilot was referenced, and the ground track. These two sets of data were obtained from the voyage data recorder and the automatic identification system. A description of these can be found in the glossary.

#### **3.2. Narrative**

- 3.2.1. The Rena departed Singapore on 5 September 2011 and called at Fremantle, Melbourne and Sydney before arriving at Bluff in New Zealand on 28 September. The vessel then called at Port Chalmers, Lyttelton and Wellington before arriving at Napier in the early morning of 3 October.
- 3.2.2. At 0620 cargo operations commenced in Napier. Cargo operations had not been completed by the time another vessel that had a priority booking for the Rena's berth arrived off the port. The Rena moved to anchor off the port, where it lay for about 13 hours before it could return to the berth and resume cargo operations.
- 3.2.3. Cargo operations in Napier were completed by 0920 on 4 October. The vessel sailed immediately, the pilot disembarked the vessel at 1006, and the Rena was at full sea speed at 1018.
- 3.2.4. Prior to departure the master had asked the second mate for an estimated time for the passage to Tauranga, which the second mate had calculated using the vessel's passage plan. The master told the shipping agent that the vessel would arrive at Tauranga at 0230. The estimate was based on a vessel speed of 17 knots and keeping to the passage plan. Once the Rena had sailed from Napier the master sent his departure report to the charterer. In that

report he updated his estimated time of arrival to 0300 at the Tauranga pilot station. This was to make an allowance for the actual time of departure; for time to speed up to full service speed; and for time to slow down to pilot boarding speed by the time the ship arrived at the Tauranga pilot station.

- 3.2.5. The master modified the vessel's planned passage on the chart to shorten the distance around Mahia Peninsula, as seen in Figure 1. The master handed control of the Rena to the third mate at 1100 as the vessel approached Mahia Peninsula. The passage plan that was in use during the voyage required that the vessel's position be plotted hourly, which was typically done using co-ordinates from the GPS. At times during the voyage the position was plotted more frequently than hourly.



**Figure 1**  
Part of chart NZ56 showing passage plan, plotted positions and GPS positions obtained from voyage data recorder on passage around Mahia Peninsula

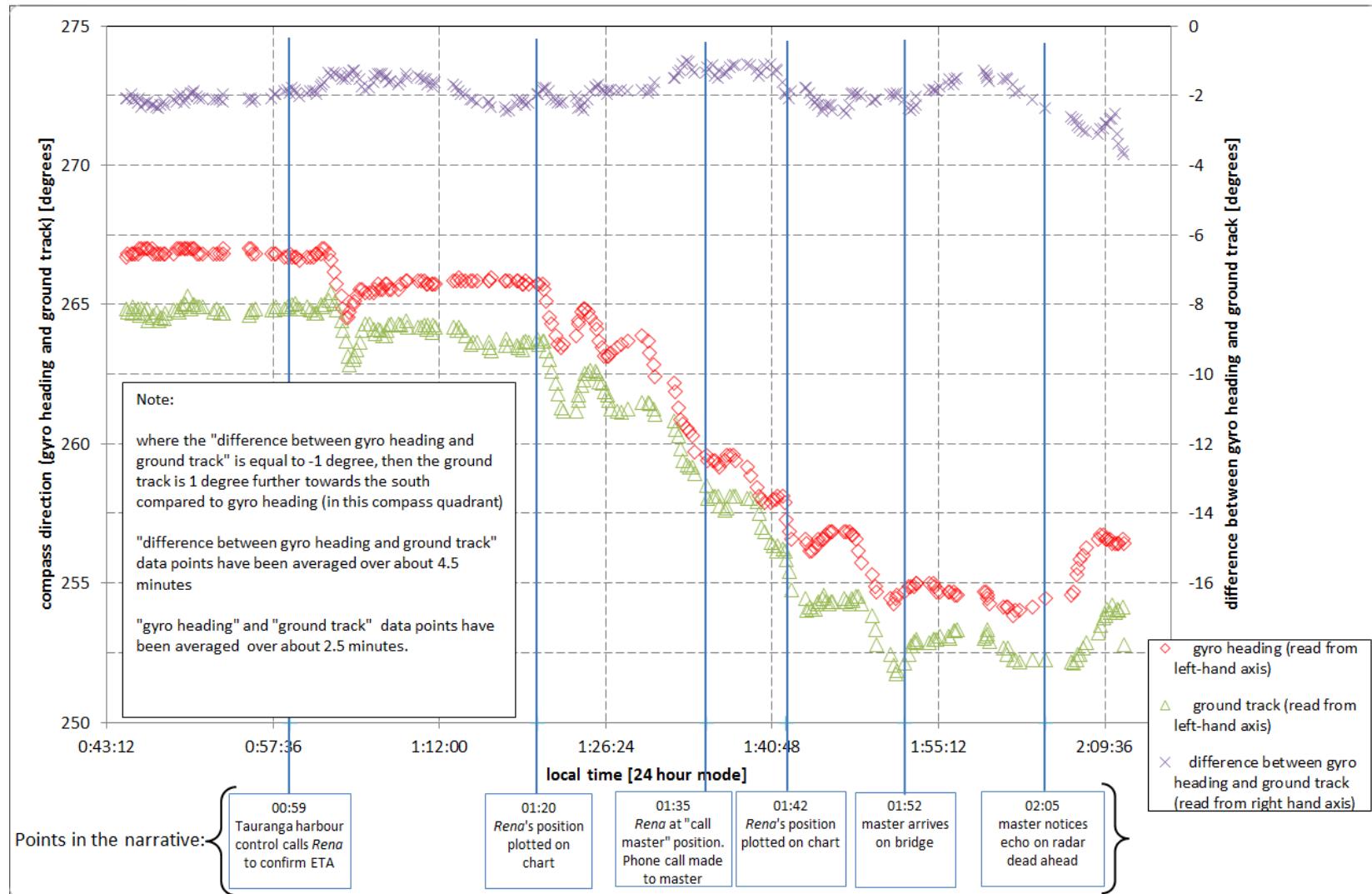
- 3.2.6. At 1200 on 4 October the second mate took over the bridge watch from the third mate. The master returned to the bridge shortly afterwards and told the second mate to proceed on the inshore side of the course lines plotted on the chart that showed the passage plan around Mahia Peninsula. He said this in order to assess the strength and location of any unfavourable current (currents were known to flow generally in a southward direction in this area). The master also instructed the second mate to navigate the Rena either side of the course lines on the chart while steaming up the east coast in search of the least unfavourable current. The master did not tell him how far from the planned course he could deviate.
- 3.2.7. The Rena rounded Mahia Peninsula at about 1300 and proceeded up the coast. The plotted positions were always inshore of the course lines up to the end of the second mate's watch at 1600. A position plotted on the next chart used in the passage (NZ55) included a position at just over 5 nautical miles inshore of the planned passage.
- 3.2.8. The chief officer took over the watch at 1600, and the track took the Rena steadily away from the coast to re-join the planned course lines at about 1900. The vessel then altered gyro heading to round East Cape at about 1930. The third mate took over the watch again at 2000.
- 3.2.9. At about 0001 on 5 October the second mate took over the watch again from the third mate. The second mate was supported by a watchkeeper, an able-bodied seaman. The gyro heading

of the vessel at the time of handover was about 272 degrees. During the handover discussion the third mate reminded the second mate that the passage plan would require an alteration on to the next course line a few minutes later.

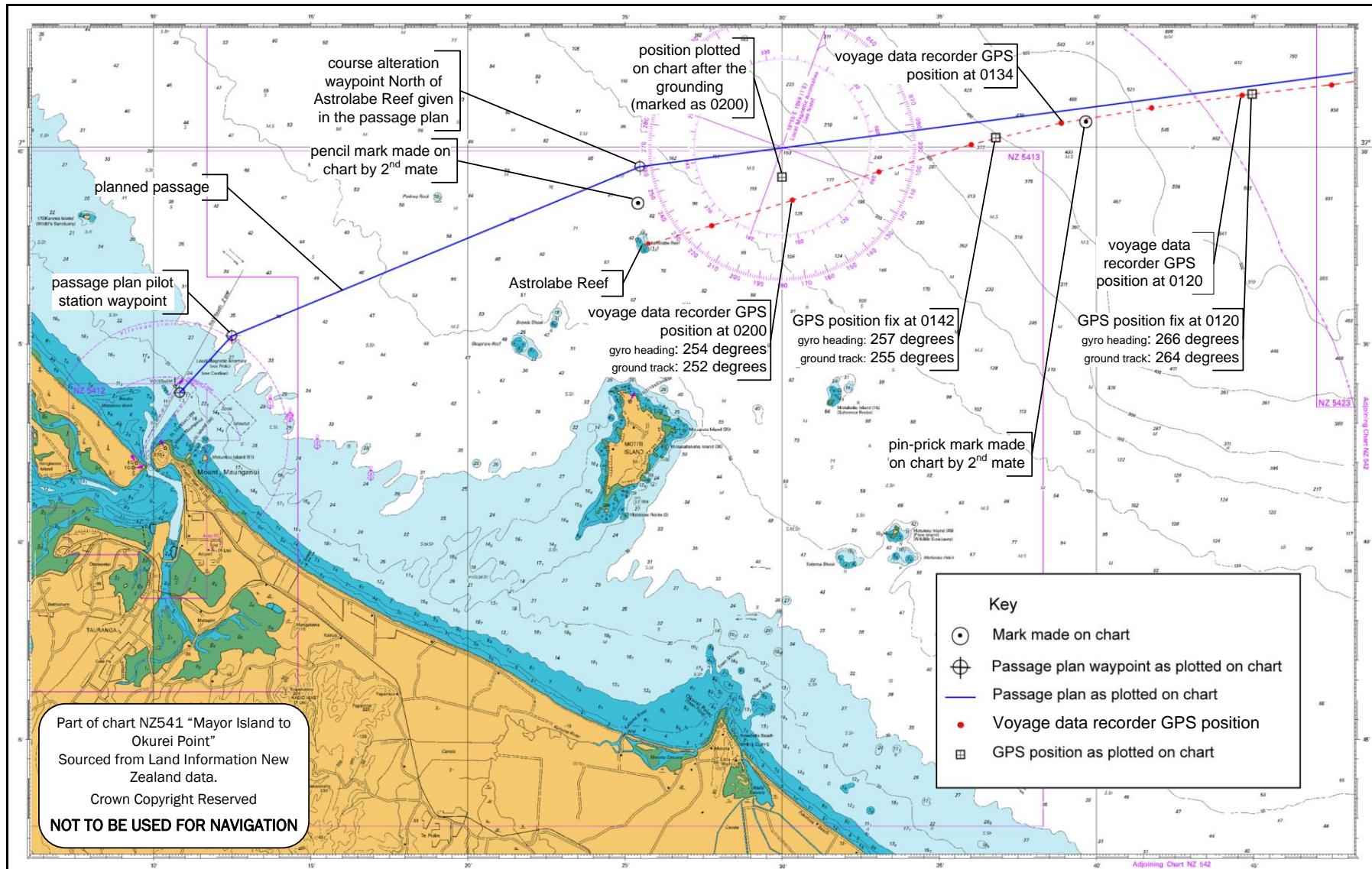
- 3.2.10. At about 0014 the *Rena*'s gyro heading was altered to about 263 degrees. The ground track at this time was about 262 degrees. The vessel's gyro heading was progressively altered during the following 30 minutes to bring it to a gyro heading of 267 degrees and a ground track of about 265 degrees. In other words the vessel was making 2 degrees to the south of the vessel's gyro heading under the influence of set, leeway and gyrocompass error. The automatic identification system data showed that the *Rena* was making about 2 degrees to the south of the vessel's gyro heading from at least midnight until it grounded on Astrolabe Reef. The *Rena*'s ground track was approximately parallel to, and about a quarter of a nautical mile to the south of, the planned passage until about 0130.
- 3.2.11. At 0015 Tauranga Harbour Control called the *Rena* on very-high-frequency (VHF) radio to discuss the vessel's estimated time of arrival and pilot boarding time. The *Rena* told Tauranga Harbour Control that its estimated time of arrival at the pilot station was 0300. Tauranga Harbour Control advised the *Rena* that 0300 was the end of the time window<sup>6</sup> for pilotage, and also requested the *Rena* to make best speed for the pilot station.
- 3.2.12. Tauranga Harbour Control called the *Rena* again at 0059 to confirm its estimated time of arrival at 0300 and ask for the *Rena*'s arrival draft.
- 3.2.13. Figure 2 shows the *Rena*'s gyro heading and ground track and the difference between the two. This data was taken from the automatic identification system and includes any error from that system. For clarity the data scatter was "smoothed" by taking an average over several data points. The bottom axis shows the time of day beginning at 0043 on 5 October 2011 and ending at around 0215 the same day. The vessel's gyro heading and ground track are read from the left-hand axis, which shows the gyro heading as recorded by the automatic identification system. The difference between the gyro heading and the ground track of the vessel is read from the right-hand axis. Some points in the narrative have been superimposed on the data for reference.
- 3.2.14. At about 0101 the gyro heading was altered to the south by about 1 degree as seen in Figure 2. Between 0120 and 0150 the gyro heading and ground track altered a further 10 degrees to the south, resulting in a gyro heading of about 255 degrees at about 0150.
- 3.2.15. Positions were plotted on the chart at 0100 and again at 0120. These positions were taken from the GPS and plotted by the watchkeeping able-bodied seaman. Vessel positions plotted by the able-bodied seaman were then checked by the second mate. The 0100 position was marked on chart NZ54 and the 0120 position was marked on the larger-scale chart NZ541, as seen in Figure 3 (Mayor Island to Okurei Point). However, neither of the charts had both positions marked. In other words no position was transferred from one chart to the other when changing charts. The *Rena*'s gyro heading was 266 degrees at that time and the ground track was about 264 degrees, indicating that the *Rena* was making about 2 degrees to the south of the gyro heading. Both of the plotted positions were already south of the course lines plotted on the chart.

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<sup>6</sup> Shipping movements in and out of the port were restricted by the available depth of water and the strong tidal currents in the entrance channel.



**Figure 2**  
Automatic identification system data showing vessel gyro heading and ground track and the difference between the two.  
Some points of the narrative have been overlaid on the plot (automatic identification system data provided by Marico Marine NZ Limited)



**Figure 3**  
Part of chart NZ541 showing passage plan (course line), plotted positions and voyage data recorder GPS positions on approach to Tauranga

- 3.2.16. The master had placed a mark on the chart, with a written instruction for the second mate to call him when the *Rena* reached that position. At 0135 the vessel reached the marked position and the second mate called the master on the telephone. During the discussion the second mate confirmed that the vessel would be at the pilot station by 0300 and also discussed an alteration of course that would shorten the distance to the pilot station, to which the master agreed. The second mate had already begun to make that alteration progressively to gyro heading.
- 3.2.17. The second mate's plan was to navigate closer to Astrolabe Reef. He said he placed a mark on the chart about one nautical mile north of Astrolabe Reef (shown in Figure 3), which was the point to which he intended to navigate the *Rena* before making the final gyro heading adjustment to the pilot station.
- 3.2.18. The second mate said that he took the *Rena*'s position from the GPS and marked this point with a "prick" using a drawing instrument. He did not mark this position in pencil on the chart. The pinprick mark on the chart was nondescript and was not immediately obvious to anyone other than the person who had made it.
- 3.2.19. The *Rena*'s position was taken again from the GPS at 0142 and plotted on the chart. This position was plotted by the watchkeeping able-bodied seaman. At this time the gyro heading of the vessel was about 257 degrees, but the ground track was about 255 degrees, meaning the vessel was still making about 2 degrees southward towards Astrolabe Reef.
- 3.2.20. The second mate set up a parallel index on one of the *Rena*'s radars at 0142. He set it up on the northern tip of Motiti Island. The purpose of a parallel index is normally to monitor a vessel's progress as it tracks along its course lines. In this case if the vessel had deviated from the intended course the second mate would have been able to detect this as a relative movement between the line on the radar and the radar image of Motiti Island. By 0150 the *Rena*'s gyro heading was about 255 degrees, a shift of about 11 degrees from the *Rena*'s heading at 0120, towards Astrolabe Reef. At 0150 the ground track averaged about 252 degrees, about 3 degrees lower (southwards) than the gyro heading towards Astrolabe Reef. At this point the *Rena* was making directly for the reef.
- 3.2.21. The voyage data recorder captured a screenshot of the *Rena*'s radar at about 15-second intervals. Figure 4 shows a radar screenshot captured at the time the parallel index (referencing Motiti Island) was set up. The screenshot has been annotated with labels to identify:
- The course line alteration waypoint north of Astrolabe Reef given in the passage plan
  - The *Rena* and its vector showing where it will be in six minutes
  - The radar echo showing the location of Motiti Island
  - The parallel index lines referenced to Motiti Island.
- 3.2.22. The master arrived on the bridge<sup>7</sup> at about 0152. The master and the second mate had a discussion over the radar screen, after which the next waypoint that the GPS was monitoring was moved from the one just north of Astrolabe Reef to the one over the pilot station (shown in Figure 3). At 0158 the master removed the parallel index lines from the radar because he thought they were cluttering the radar screen. The master and the second mate then moved into the chartroom behind the wheelhouse and were discussing preparations for the Tauranga arrival. While they were having this discussion, the watchkeeping able-bodied seaman came into the chartroom with the intention of plotting the *Rena*'s 0200 position. The able-bodied seaman read the position off the GPS in the chartroom and recorded it in the position log

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<sup>7</sup> The bridge included the wheelhouse and the chartroom. At night the chartroom was normally curtained off to preserve the night vision of those on the bridge who were keeping a look-out.

book. The master and second mate were leaning over the chart as they talked, so rather than interrupt them the able-bodied seaman did not plot the 0200 position on the chart. The 0200 position was plotted after the grounding and was plotted in a position further north than the Rena's position at the time. The position written in the position log book by the watchkeeping able-bodied seaman was amended to match the 0200 position later plotted on the chart.

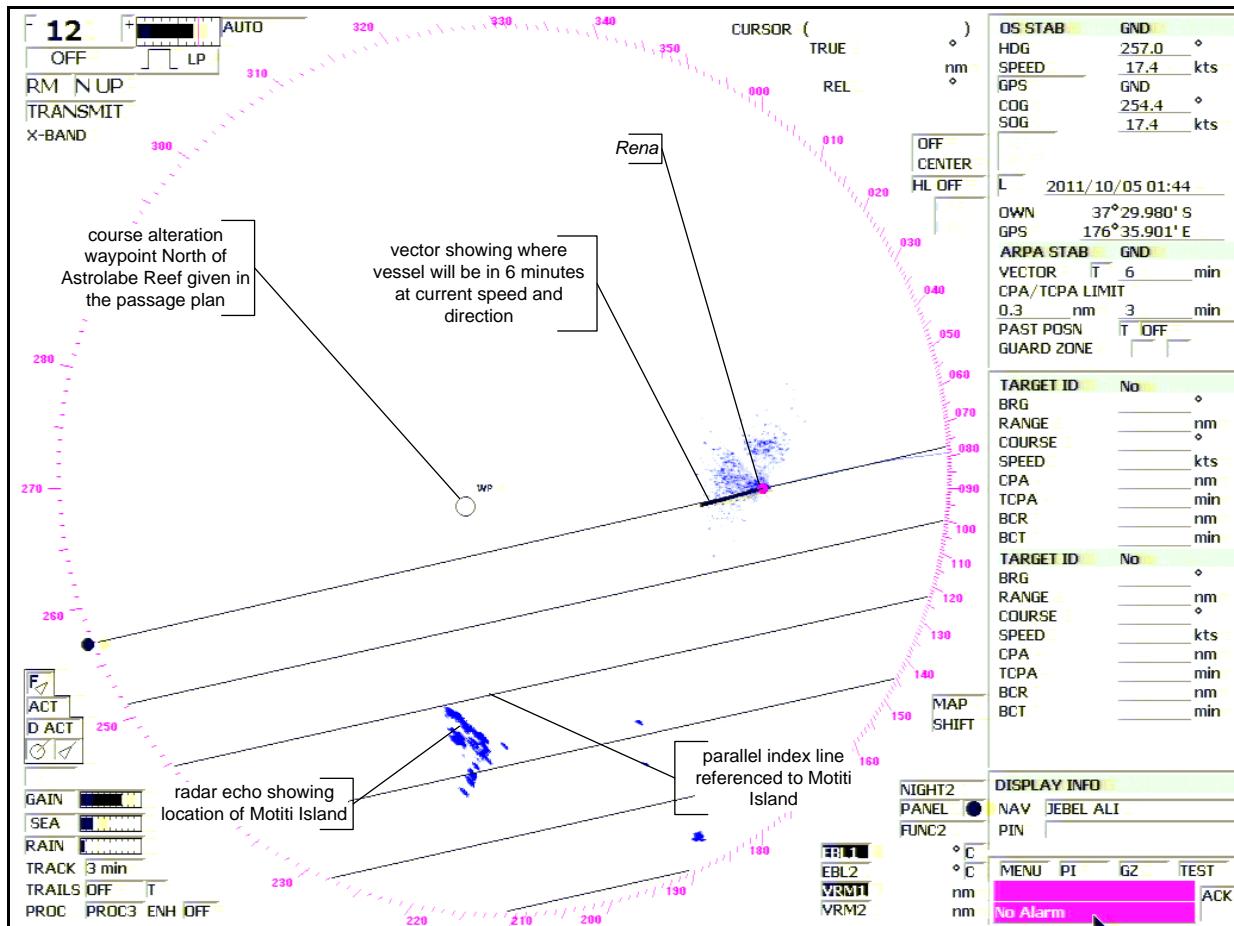


Figure 4  
Annotated screenshot of the Rena's radar (colour reversed for clarity)

- 3.2.23. The master discussed the preparation of the pre-arrival documents with the second mate, then went into the wheelhouse to become familiar with the situation of the vessel and monitor the radar. In his submission to the interim report the second mate said he showed the master the charts and pointed out the amended (passage) plan, including the mark one nautical mile off Astrolabe Reef. The master said he did not study the charts.
- 3.2.24. At about 0205 the master noticed an intermittent echo on the radar. The echo was about 2.6 nautical miles dead ahead of the Rena. The master showed the echo on the radar to the watchkeeping able-bodied seaman and they used binoculars to look through the windows of the bridge for the cause of the echo. They could not see anything, so they moved to the bridge wing to look from there. When again nothing could be seen the master said that he decided to plot the Rena's position on the chart, so began to walk through the wheelhouse to the chartroom.
- 3.2.25. At 0214, as the master made his way to the chartroom, the Rena struck Astrolabe Reef while travelling at a speed of 17 knots.
- 3.2.26. The crew reported the grounding to Tauranga Harbour Control. The crew made soundings of all compartments and established that the ship had suffered major damage with multiple compartments breached. The Rena remained stuck fast on the reef for the ensuing months

and eventually broke in two while the salvage company that had been appointed worked to salvage the ship and its cargo. About 200 tonnes of heavy fuel oil were lost to the sea.

### 3.3. Personnel information

- 3.3.1. The master held a current certificate of competency as master mariner issued by the government of the Republic of the Philippines in accordance with the STCW Convention. He had a licence of competence for a merchant marine officer (master) issued by the Republic of Liberia on 12 December 2007. The master started his sea-going career as deck cadet in 1990. He sailed with various shipping companies, rising up through the various ranks in the following 17 years. He joined CIEL as first mate in 2007 and sailed on three of its ships in that capacity. During that period he was formally assessed by the various masters under whom he sailed, which included a period of assessment while he was acting as master under the guidance of a senior CIEL captain. Following that last assessment the master was formally promoted and signed on as master of a CIEL container ship in January 2008. He then signed on to the *Rena* as master on 21 November 2010 until 7 February 2011, and again as master on 25 March 2011 (see Appendix 2 for a more detailed account of the master's career and qualifications).
- 3.3.2. The second mate (the navigating officer) began his sea-going career as a deck-boy in 2000. He first served on container ships operated by Costamare Inc.<sup>8</sup> from November 2003. He first signed on as an officer of a container ship operated by CIEL in late 2009. At the time of the grounding the second mate held a certificate of competency as officer-in-charge of a navigational watch issued on 28 September 2010 by the government of the Republic of the Philippines in accordance with the STCW Convention. He had a licence of competence as a merchant marine officer (navigational watch officer) issued by the Republic of Liberia on 5 November 2010. He had signed on to the *Rena* as an officer in November 2010 (see Appendix 2 for a more detailed account of the second mate's career and qualifications).
- 3.3.3. The able-bodied seaman watchkeeping on the bridge at the time of the grounding held a current certificate of competency as a deck rating issued by the government of the Republic of the Philippines in accordance with the STCW Convention.

### 3.4. Vessel information

- 3.4.1. The *Rena* was built to American Bureau of Shipping class by Howaldtswerke Deutsche Werft in Germany in 1990. At the time of the grounding the *Rena* was owned by Daina Shipping Co. of Liberia. The International Convention for the Safety of Life at Sea 1974 (SOLAS Convention) safety management company was CIEL. Daina Shipping Co. was owned by Costamare Inc., which was incorporated in the Marshall Islands. The vessel was operating under time charter to the Mediterranean Shipping Company S.A. A time charter is an arrangement whereby the owner of the vessel is responsible for managing it, and the charterer directs the vessel's trading schedule.
- 3.4.2. The *Rena*'s general particulars can be seen in Table 1.
- 3.4.3. Charts that were relevant to the passage from Napier to Tauranga and in use on board the *Rena* were NZ56, NZ55, NZ54 and NZ541.
- 3.4.4. The bridge navigation and communications equipment installed on board the *Rena* is listed in Table 3. The S-band automatic radar plotting aid radar, course recorder and depth sounder were not in use at the time of the accident.

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<sup>8</sup> Including CIEL Shipmanagement.

**Table 3: Navigation and communication equipment installed on board the Rena**

System	Manufacturer
Global maritime distress and safety system medium frequency/high frequency console	Sailor
Inmarsat "C"	Sailor
Inmarsat fleet broadband	JRC
VHF/global maritime distress and safety system/digital selective calling	Sailor
Automatic identification system transponder	Sailor
Radar (S-band automatic radar plotting aid)	Atlas Electronik
Radar (X-band automatic radar plotting aid)	JRC
Gyrocompass system	Anschutz Kiel
GPS	Furuno
Differential GPS	Koden
Depth sounder	Elac
Course recorder	Anshchutz Kiel
Speed log	JRC
Navigational telex	JRC
Weather facsimile	JMC
Voyage data recorder (simplified)	Totem

### 3.5. Environmental information

- 3.5.1. The accident happened in the “Plenty” coastal waters forecast area. The New Zealand Meteorological Service (MetService) issued coastal waters forecasts at regular times.
- 3.5.2. The coastal waters forecast issued on 5 October 2011 at 0027 for the Plenty coastal area was:
- PLENTY  
Northerly 10 knots, tending easterly 15 knots this afternoon. Sea slight. Northerly swell 2 metres easing. Fair visibility in a few showers developing this evening.  
OUTLOOK FOLLOWING 3 DAYS: Thursday morning becoming variable 10 knots
- 3.5.3. MetService said that coastal weather forecasts were valid within 60 nautical miles of the New Zealand coastline. Because most coastal forecast areas cover some thousands of square nautical miles, the forecast only describes in a general sense the expected weather conditions. In small parts of a forecast area (for example, off a particular headland in a particular wind flow), weather conditions could be significantly different from those forecast.
- 3.5.4. Port of Tauranga had numerous meteorological sensors around the port, which were used to produce a picture of the conditions within the port and its approaches. The prevailing conditions at “A” beacon at the time of the accident were light airs, about one knot (0.5 metres per second) from a south-south-westerly direction, a significant wave height of 1.16 metres and a tide of 1.79 metres.

- 3.5.5. On board the *Rena*, the last weather observation recorded in the bridge log book, which was at midnight on 5 October 2011, remarked that there was a clear sky with a moderate breeze and sea with good visibility. The wind was noted as being force 5 (Beaufort notation) (8.75 to 10.80 metres per second) from the northwest.
- 3.5.6. The New Zealand Nautical Almanac included Tauranga as a standard port for tidal prediction. The National Institute of Water and Atmospheric Research provided an online service to determine the tidal height at any position around the New Zealand coast. After the grounding this service was used to determine the times of high and low water for the actual incident location. The calculated times for high and low water at Tauranga and Astrolabe Reef for 5 October are shown in Table 4.

**Table 4: Tidal heights for 5 October 2011**

Date: 05/10/2011		High water	Low water	High water	Low water
Tauranga	Time Tidal height (metres)	0153 +1.7	0800 -0.2	1432 +1.8	1938 -0.3
Astrolabe Reef	Time Tidal height (metres)	0121 +0.73	0736 -0.82	1400 +0.80	2015 -0.67

- 3.5.7. The Bay of Plenty was affected by both ocean currents and tidal streams, and the port of Tauranga was a tidal port. Owing to the tidal flow and manoeuvrability of large vessels, Port of Tauranga controlled entries to and exits from the port with prescribed time windows of opportunity for pilotage. The ocean currents and tidal streams to the north and east of New Zealand were complex, as described in the admiralty sailing directions of the United Kingdom Hydrographic Office 2010:

... The currents N and E of New Zealand are complex, varying with the seasons; their general movement can best be seen on the diagrams. To the N of North Island the South Sub-Tropical Current setting SW meets a current setting E to NE from the Tasman Sea. To SE of South Island the Southern Ocean current extends ENE, having rounded Stewart Island. Off the E coast of New Zealand, between these two broad developments, secondary eddies are formed. In the N part of this area, some of the water from Tasman Sea sets SE among the offshore islands and along the coast into the Bay of Plenty, before topographical diversion sends some of this water NE into the general oceanic drift. The remainder continues around East Cape, thence S to Hawke Bay and on to the entrance of Cook Strait...

... Current sets generally S into Bay of Plenty but is not much felt. In the vicinity of East Cape it is SE where part is deflected offshore and the remainder sets generally S to the vicinity of Cape Turnagain...

... Tidal streams along the coast set W with the flood and are greatly influenced by the prevailing conditions, see information on the chart. Off East Island (37°42'S 178°35'E), and in the channel W of the island, the rates of the tidal streams are much greater than off the open coast.

- 3.5.8. On 5 October 2011, sunrise at Tauranga was calculated to be at 0645. Moonrise was at 1150 on 4 October 2011 and moonset was at 0236 on 5 October 2011. The moon was between half-moon and full moon.

## 4. Analysis

### 4.1. Introduction

- 4.1.1. The Rena was travelling at near full speed when it ran aground on Astrolabe Reef. The ship and most of its cargo was a total loss. This accident was equivalent to what in aviation terms is sometimes referred to as controlled flight into terrain – where a fully functional aircraft [ship] is inadvertently flown [navigated] into the ground by its crew.
- 4.1.2. The Commission found that no technical or mechanical failure contributed to the accident. The ship and its navigational equipment were, or were capable of, functioning properly. The crew inadvertently directed the ship on a collision course with Astrolabe Reef.
- 4.1.3. There were a number of acts and omissions on the crew's part that directly contributed to the grounding. They fundamentally involved the crew not complying with some mandatory standards for passage planning and watchkeeping standards that are described in the STCW Convention. Those acts and omissions and how they directly contributed to the Rena grounding are described in the first two sections:
- planned passage
  - watchkeeping standards.
- 4.1.4. To understand why the crew did what they did and why they were not complying with mandatory standards, it is necessary to understand the wider system in which they were operating. Gaps and safety issues within this wider system can contribute to the way a crew performs. With international shipping that system is a complex arrangement between international and domestic standards – in this case domestic standards for Liberia and the Philippines.

#### Overview of the international maritime system

- 4.1.5. International standards are published by IMO. IMO facilitates forums, during which member states agree through resolutions on various instruments such as conventions, codes and guidelines that set or recommend minimum standards covering all aspects of ship design, construction and the way ships are operated. Conventions are mandatory. Codes can be mandatory or non-mandatory, depending on the resolution. If a code is mandatory it becomes, in effect, part of any convention to which it relates. Guidelines are non-mandatory but are generally considered “best practice”. States elect which IMO instruments they will adopt. Once a state signs up to a mandatory IMO instrument, it is responsible for adopting the standards in the instrument into its domestic legislation and checking that ships under its registry comply with them. Refer to Figure 5.

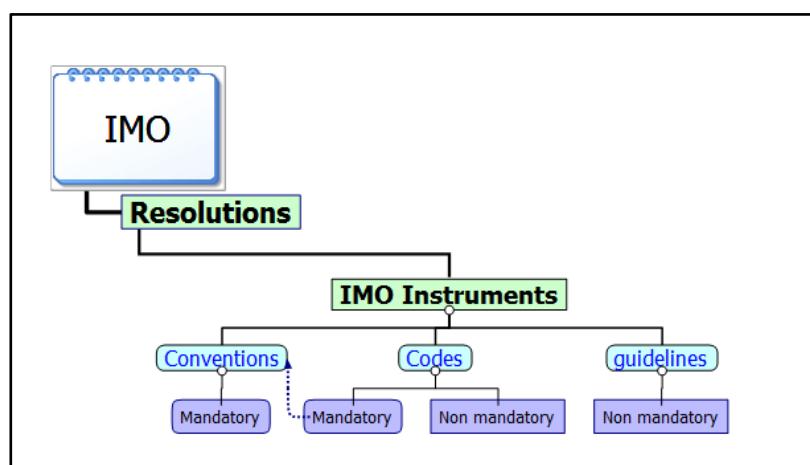


Figure 5  
Diagram of structure showing IMO instruments

- 4.1.6. The relevant IMO conventions in this case are the SOLAS Convention and the STCW Convention.
- 4.1.7. The main objective of the SOLAS Convention is to set out minimum standards for the construction, equipment and operation of ships, compatible with their safety.
- 4.1.8. The main objective of the STCW Convention is to establish basic requirements for training, certification and watchkeeping for seafarers on an international level.
- 4.1.9. A relevant IMO code in this case is the ISM Code. The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for pollution prevention.
- 4.1.10. A relevant non-mandatory instrument in this case is Resolution A.893(21), Guidelines for Voyage Planning (the IMO Voyage Planning Guidelines). These guidelines describe the objective, development process, content and end use of a passage plan.
- 4.1.11. Another guideline relevant to this case is Bridge Team Management – a Practical Guide, published by The Nautical Institute<sup>9</sup>. The Nautical Institute is an international representative body for maritime professionals involved in the control of sea-going ships. This publication is a practical guide that sets out how to prepare and execute a navigational plan. While this guideline is not mandatory, it sets out industry best practice.
- 4.1.12. The Rena was owned by a company domiciled in Greece, and it was managed by another company, CIEL . The owner placed the Rena on the Liberian Registry, and manned the ship with Philippine nationals.
- 4.1.13. Liberia was responsible for conducting technical surveys of the Rena to check that it was maintained to the mandatory national (and IMO) standards. Liberia could provide its own surveyors to undertake these surveys, but also entered into arrangements with classification societies for their surveyors to undertake the surveys on its behalf (usually once annually). Liberia then issued the Rena with Liberian maritime documents that acknowledged that the mandatory standards had been met at the time of the surveys.
- 4.1.14. The crew on board the Rena were required to hold Liberian licences of competence. Both Liberia and the Philippines had signed up to the STCW Convention. The Philippines had a domestic maritime education, training and certification system that was required to comply with the STCW Convention. It issued Philippine certificates of competence to its seafarers. Liberia recognised the certificates of competence issued by the Philippines and on that basis issued Liberian licences of competence to seafarers wishing to crew Liberian ships.
- 4.1.15. In compliance with the ISM Code, CIEL was required to have its own safety management system (the CIEL safety management system) to show how its function of day-to-day management of its fleet would ensure compliance with all the mandatory technical and operational requirements of (in the Rena's case) Liberian domestic maritime law. This system was subject to external verification<sup>10</sup> and both internal and external audits. When the ISM Code was adopted, some Classification Societies added external verification and auditing of ISM Code systems to their customer portfolios. The CIEL safety management system in this case was verified and audited annually by the Classification Society Germanischer Lloyd on behalf of Liberia.
- 4.1.16. Each ship was required to have its own safety management system linked to the parent system of its shore management. Each ship system was also subjected to internal audit and external verification and audit. Germanischer Lloyd also conducted an external pre-audit of

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<sup>9</sup> Captain AJ Swift, 1993.

<sup>10</sup> Verification includes pre-audits and assessments of a new system. The system is later audited, once it has been operating for enough time to build up a history that will show whether the system is functioning properly.

the Rena's safety management system on behalf of Liberia in November 2010. The company conducted an internal audit in April 2011 and Germanischer Lloyd conducted an external audit and verification of the Rena's safety management system in May 2011.

- 4.1.17. Port state control is another mechanism for checking the compliance of individual ships with domestic and international requirements. Any state has the right to inspect any ship entering its ports. Ships can be detained or issued with deficiency notices. Port state control records are available on a regional basis through the applicable port state memorandum of understanding organisations. The memoranda are between the maritime administrations of States in the same region. They were formed to provide a continuous record of port state control inspections, aimed at minimising duplicate inspections being conducted on ships. Ship managers, surveyors and auditors sometimes use the number of deficiencies that are found and/or the number of times a ship is detained as an indicator of the general health of a safety management system. This comes with the broad caveat that the areas in which a ship trades and the veracity of the port state control systems of the states within those areas are factors that should be taken into account.
- 4.1.18. This overview describes the relationship between the international and domestic maritime systems and how they interacted to set and monitor technical and operational standards for ships. The Commission has identified safety issues in the two sections:
  - safety management systems
  - training.

#### **Other issues raised**

- 4.1.19. The Commission also considered two issues that were raised by the industry during the inquiry:
  - coastal routing for ships
  - visual aids to navigation, such as lights and beacons.

#### **4.2. Planned passage**

*Safety issue – The standard of passage planning on board the Rena often, and in some respects, did not comply with the company safety management system, or with the vessel's safety management system, or with the STCW Convention.*

- 4.2.1. The planning of a ship's passage from one location to the next is critical to the safe operation of the ship. Poor planning of the passage will increase the risk to the vessel, and therefore the likelihood of an accident. The Commission has reviewed all aspects of planning and executing a voyage on board the Rena, and compared this with recognised industry best practice.
- 4.2.2. The CIEL safety management system<sup>11</sup> guidelines on passage planning were extensive and specifically referenced and paraphrased the IMO Voyage Planning Guidelines.
- 4.2.3. The CIEL safety management system guidelines stated the need to have the most up-to-date charts and publications relevant for the area to be navigated and for the watchkeepers to be given all information on navigational hazards, environmental conditions and any other matters that could affect the safety of navigation. The largest-scale and most appropriate chart was required to be used and the chart was to be marked to highlight the intended path of the ship and any special considerations or hazards that the watchkeeper might encounter.
- 4.2.4. However, the corresponding company passage planning form VS.OPS.002 (Appendix 1) was not well suited to implementing the passage planning requirements in the CIEL safety management system. VS.OPS.002 had two parts. The first part was a comprehensive checklist for the considerations laid out in the guidelines. The second part was a form to be

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<sup>11</sup> Section 10.3 Passage Planning.

filled in with the actual planned passage. The second part did not have the capacity to cover all of the considerations prompted by the checklist. It recorded waypoint positions, and course line and distances between waypoints. It also allowed for some but not all of the other information normally seen in a good passage plan.

- 4.2.5. For example, the form did not provide for speed alterations en-route or under-keel clearances for critical areas. On the latter point, a generic single space to provide the under-keel clearance for the entire voyage was provided. Under-keel clearance is a factor that should be considered for each leg of the voyage, and highlighted when it becomes, or could become, a hazard.
- 4.2.6. Similarly there was only a single space provided to record the “squat”<sup>12</sup> on each page of the passage plan. Ships often transit areas of narrow and shallow water during voyages, not necessarily only when entering and leaving ports. It is sometimes necessary for ships to reduce speed while transiting areas of shallow water to reduce the effects of squat in order to prevent the ship running aground. In the passage plan for the grounding voyage, an arbitrary figure of one metre was recorded for squat. There is no way of determining the location on the vessel to which this referred, or what ship’s speed was used in the calculation. The under-keel clearance was recorded as “5 metres minimum” on the first page of the passage plan for the accident voyage, and “2 metres minimum” on the second page. Presumably these figures referred to the departure from Napier and the arrival at Tauranga respectively, but this was not clear and there was no way of knowing whether they included an allowance for squat or the speed of the ship through the water. The Rena’s draft and available depth of water from Napier to Tauranga meant that under-keel clearance was not a critical factor, provided the ship kept to the passage plan. Nevertheless, these are all factors that should have been routinely considered for each leg of the voyage and the passage plan form should have been designed to display such information in a clear and unambiguous way.
- 4.2.7. Environmental conditions, such as prevailing winds, tides and currents, that can significantly affect the passage of a ship should be recorded, but the passage planning form had no useful space to record such comments.
- 4.2.8. In this case, for the accident voyage the currents were not mentioned or accounted for in the passage plan. Neither the master nor the second mate said they referenced any document other than the nautical chart for information regarding tide and/or currents off the east coast of New Zealand. Had they done so as part of their planning the master would have been better informed of the unfavourable currents for a good part of the passage to Tauranga. A calculation taking account of the currents would have shown that his expectation of reaching the pilot boarding ground at 0300, before the end of his chosen tidal window, was unrealistic.
- 4.2.9. According to the Rena’s charterer there was no pressure for the master to make the early-morning tide, and the master confirmed this. The Rena’s charterer simply needed to know the tidal window in which the ship would arrive so that it could pre-order labour to work the cargo. The pressure the master put on himself and the bridge watchkeepers to achieve the unrealistic arrival time was a consequence of miscalculating how long the passage would take, and thus miscalculating the time of arrival. The pressure to achieve this unrealistic arrival time was ultimately what led to the series of ill-thought-out deviations from the passage plan, the last of which directly contributed to the grounding.
- 4.2.10. Areas of danger to navigation should be highlighted on the chart as part of planning the passage. Not all areas of danger to navigation were highlighted on the chart, including Astrolabe Reef. In this case, however, highlighting the reef on the chart may not have averted the grounding. The second mate was aware of its existence<sup>13</sup> and the master did not refer to

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<sup>12</sup> The phenomenon where a ship sinks bodily in the water when travelling at speed. The effect can be enhanced when the distance between the keel and the seabed is small.

<sup>13</sup> The second mate placed a mark on the chart one nautical mile north of Astrolabe Reef when planning for the final shortcut.

the chart anyway before taking over control of the ship. Nevertheless, it is recommended best industry practice and should have been adhered to.

- 4.2.11. The largest-scale chart should be used wherever possible. A larger-scale chart was available (Chart NZ5413: Approaches to Tauranga) for the area covering the approach to Tauranga. This chart was not on board the *Rena* and it was not listed on the passage plan form. The chart would have been the next chart that should have been available to use if the *Rena* had not grounded.

#### [Other voyages of the Rena](#)

- 4.2.12. Given these shortcomings, the Commission looked at whether the deficiencies on this accident voyage were evident in any other voyages of the *Rena*, and whether the safe ship management system relevant to the operation of the *Rena* had systemic shortcomings.
- 4.2.13. Maritime New Zealand engaged a team of expert navigators (through The Nautical Institute in Auckland) to reconstruct 30 of the *Rena*'s past voyages, as near as practicable using passage plans, charts and log book records from the ship. The Commission obtained the results of this work. The Commission then conducted its own reconstructions by using raw data to plot the voyages and to verify the plotting undertaken by the expert navigators. The same master and second mate who were on board during the accident voyage were on board for most of the voyages that were re-constructed. The Commission also obtained the original charts from the *Rena* that covered the six most recent coastal voyages of the *Rena* (in the eight days leading up to and including the accident voyage). The record of these six voyages had not been erased from the charts. These charts and the reconstructed voyages were used to analyse the safety management system on board the *Rena* with respect to voyage planning and voyage execution.
- 4.2.14. The Commission verified the accuracy of the voyage reconstructions and used this information to help understand the quality of passage planning and navigation by the bridge team during those voyages, in comparison with the standards noted on the accident voyage. The charts for the previous five voyages into and between New Zealand ports before the *Rena* departed Napier were recovered from the ship. The markings on these charts had not been erased. Consequently it was not necessary to reconstruct those voyages in the manner described above. For the earlier voyages, there was insufficient information to reconstruct each voyage with total accuracy. For example, not all position fixes the crew might have marked on the chart could be recalled – only those that were recorded in the log book (usually GPS positions). Also, there may have been valid reasons for deviating from a passage plan, such as manoeuvring for the avoidance of other traffic as required by the international collision regulations.
- 4.2.15. Notwithstanding these caveats, for most of the reconstructed voyages there were some aspects of the planning and execution that did not meet the industry best practices required by the safety management system on board the *Rena*. Examples of some of the deficiencies were:
- incorrect chart identification numbers
  - inappropriate charts listed, or required charts not listed
  - some nautical publications were identified, but no information from them brought into the passage planning form
  - sometimes magnitudes of squat and under-keel clearance were given, but there was no record of how these had been calculated, or to which leg of the voyage they had been applicable
  - the position fixing frequency was often only hourly, and often without regard to the vessel's location or proximity to navigational hazards
  - the master did not always sign the passage plan (although the passage plan for the accident voyage was signed by the master).

- 4.2.16. Some of these examples were minor or typographical in nature. Others were more serious. CIEL said in its submission that none of these examples directly contributed to the grounding and the Commission agrees. As mentioned in the caveat above, there could in some cases be reasonable explanations for acts or omissions. However, the repetitive nature of the acts and omissions from one voyage to the next, and the fact that similar issues were evident for the most recent six coastal voyages (including the accident voyage), indicate that the failures in the design and execution of the passage plan that led to the grounding were not one-off failures, but indicative of a wider systemic safety issue.

### ***Deviation from planned passage***

*Safety issue – The Rena crew occasionally deviated from the passage plan in an ad-hoc manner and did not always incorporate those deviations into the plan – nor did they adequately monitor the ship's progress against the deviations. Deviating from the passage plan was one factor directly contributing to the grounding.*

- 4.2.17. The reconstruction of these other voyages showed occasional deviations from the passage plans, sometimes to shorten the distances travelled and at other times possibly for legitimate reasons. It also showed that it was routine for watchkeepers to fix the ship's position hourly and use GPS only, when the passage plans required that position fixes be made using GPS and radar, and the master's standing orders stated that "in coastal waters [the watchkeeper] should take fixes on a paper chart at frequent intervals of 10-15 minutes using more than one method". The master's standing orders for his watchkeepers, therefore, were not consistent with the passage plan that the master [usually] signed as approved.
- 4.2.18. The passage plans did not always conform with the company's safety management system, and the watchkeepers did not always follow the passage plans anyway. The passage plan for the accident voyage was one such example, as was the act of deviating from it.
- 4.2.19. On the accident voyage the master altered the passage plan marked on the chart in order to save time rounding Mahia Peninsula. He then told the second mate to take the *Rena* closer inshore of the new line he had marked on the chart. The master also told the second mate to take the ship either side of the planned passage marked on the chart while travelling up the east coast in search of the least unfavourable current. In doing so the master effectively gave the second mate approval to deviate as far from the planned course as he felt he needed to.
- 4.2.20. The vessel's original planned passage marked on the chart would have taken the *Rena* two nautical miles to the north of Astrolabe Reef before approaching the pilot station. The pilot window cut-off was 0300 and the *Rena* was running close to that cut-off. When allowing for a controlled slowing of the ship to a speed at which the pilot could be boarded, they were not going to achieve the window. The second mate decided to shorten the distance to the pilot station by moving the course line alteration point closer to Astrolabe Reef. This deviation would have saved about one minute<sup>14</sup>. His decision to do so was based on pressure he felt to reach the pilot station by 0300.
- 4.2.21. There is nothing wrong in principle with deviating from the voyage plan in response to changes in weather or after encountering a situation that has not been planned for.
- 4.2.22. The IMO Voyage Planning Guidelines recommend that "any changes made to the plan should be made consistent with these guidelines and be clearly marked and recorded". They also recommend that if a decision is made during a voyage, or it is "necessary for the ship to deviate substantially from the planned route for other reasons, then an amended route shall be planned prior to deviating substantially from the route originally planned"<sup>15</sup>.
- 4.2.23. The appropriate procedures for any course change would have included the following steps:

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<sup>14</sup> The second mate was heard on the bridge voice recorder repeatedly calculating the time and distance to go to reach the pilot station by 0300.

<sup>15</sup> STCW Convention A-VIII/2 – Deviation from planned route.

1. Plot the new position for the course line alteration point north of Astrolabe Reef
  2. Plot the vessel's position
  3. Draw a new line to the new course line alteration point north of Astrolabe Reef
  4. Make the alteration of gyro heading and closely monitor the ship's progress along that track. The ship's progress should have been monitored more closely than before the deviation from the passage plan, given the higher risk created by the new track.
- 4.2.24. The second mate did none of the above. The alteration to the gyro heading was not a single change to the vessel's heading but rather a progressive change over about 30 minutes. The true course between the pin-prick he made on the chart and the new intended alteration point one nautical mile north of the reef was about 260 degrees.
- 4.2.25. The incremental alteration to the gyro heading suggests that the second mate had not fully considered what the new gyro heading would be. While altering the vessel's heading (set by the automatic pilot) the second mate went 5 degrees past the 260-degree required track and he did not account for set, leeway or gyrocompass error. The deviation was done in an ad-hoc manner and no consideration was given as to how the *Rena*'s progress would be measured against the amended plan. Once the vessel's heading had stabilised on about 255 degrees at about 0150 the *Rena* was heading for a collision with Astrolabe Reef, and the crew were not aware of the imminent danger.

**Findings:**

1. The *Rena* grounding was not in any way attributable to the malfunction of any on-board machinery or equipment, including on-board navigational equipment.
2. The *Rena*'s passage plan from Napier to Tauranga on the accident voyage did not meet the standards documented in the CIEL safety management system or the IMO Voyage Planning Guidelines. Nor did it meet best industry practice as documented in The Nautical Institute's Bridge Team Management – A Practical Guide.
3. The second mate deviated from the passage plan to take the *Rena* closer to Astrolabe Reef to save time. The deviation unnecessarily increased the risk of the ship running aground and directly contributed to the grounding.
4. The *Rena* grounded on Astrolabe Reef because the bridge crew progressively adjusted the automatic pilot to an incorrect heading and without making allowance for any leeway, set or gyrocompass error. The resultant ground track took the ship directly over the reef. Not monitoring the progress of the ship against the deviation contributed directly to the grounding.
5. The failure of the crew to follow industry best practice guidelines for making and executing the passage plan on the accident voyage was not an isolated case. A review of previous voyage plans revealed a number of acts and omissions similar to those made on the accident voyage.

### 4.3. Watchkeeping standards

*Safety issue – The standard of watchkeeping on board the Rena for the accident voyage and particularly the watch period during which the grounding occurred, in almost all respects, did not comply with the industry best practice described in the IMO Voyage Planning Guidelines and The Nautical Institute's Bridge Team Management – a Practical Guide.*

- 4.3.1. The master and the watchkeepers had the prime responsibility for navigating the ship from one point to the next in accordance with the passage plan. The previous section discussed the passage plan and how in this case it was flawed in several ways and was not adhered to. However, these factors alone need not have resulted in the Rena running aground.
- 4.3.2. If the watchkeeping on the bridge that night had met the required standards and followed industry best practice, the grounding would probably not have occurred. The Rena would probably have passed one mile north of Astrolabe Reef as the second mate intended. The following section discusses how that went wrong.

#### *Monitoring the ship's progress*

*Safety issue – The crew were not adequately monitoring and fixing the Rena's position as the ship approached Astrolabe Reef and the port of Tauranga.*

- 4.3.3. It is important that a watchkeeper be fully aware of where a ship is at all times, and be (for example) fully aware of all factors that affect the ship's progress, or are likely to in the immediate future. Knowing about environmental factors such as wind, sea, current and tide is important – so too is knowing the status of the navigation equipment used to direct and monitor the progress of the ship. This is often referred to as the watchkeeper maintaining "situational awareness".
- 4.3.4. Some factors such as current and tide can be predicted and countermeasures taken to offset their estimated effects. Frequently plotting and monitoring of a ship's position is key to knowing the resultant effect of all these factors on the ship's progress. The closer the ship is to navigational hazards, the more often the ship's position should be checked. It might be reasonable to plot the ship's position hourly when crossing an ocean (deep sea) because the ship deviating off the track is not immediately critical. When navigating a narrow channel, the ship's position should be monitored continuously, because the slightest deviation can result in its grounding. When navigating a coast, the frequency of position fixing should be somewhere in between, depending on the closeness of the intended track to navigational hazards. This practice was reflected in the Rena master's standing orders, in the IMO Voyage Planning Guidelines, and in the safety management system on board the Rena.
- 4.3.5. The STCW Convention requires that the situation be fully appraised to manage the "risk of collision, stranding and other dangers to navigation"<sup>16</sup>. In particular, the STCW Convention states that<sup>17</sup>:
  - during the watch, the gyro heading steered, position and speed shall be checked at sufficiently frequent intervals, using any available navigational aids necessary, to ensure that the ship follows the planned course
  - the officer in charge of the navigational watch shall have full knowledge of the location and operation of all safety and navigational equipment on board the ship and shall be aware and take account of the operating limitations of such equipment
  - officers of the navigational watch shall make the most effective use of all navigational equipment at their disposal.

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<sup>16</sup> STCW Convention A-VIII/3.

<sup>17</sup> STCW Convention A-VIII/3 Performing the navigational watch.

- 4.3.6. The IMO Voyage Planning Guidelines recommend that “the progress of the vessel in accordance with the voyage and passage plan should be closely and continuously monitored”<sup>18</sup>.
- 4.3.7. The CIEL safety management system guidelines state that, “when the vessel is navigating in coastal waters the primary responsibility of the [watchkeeper] is to ensure that the ship is following the predetermined passage plan by fixing the position of the vessel and whenever circumstances permit, he must use more than one fixing method, such as three bearing lines, radar ranges/bearings and instant readouts of one of the electronic position systems e.g. LORAN, GPS”<sup>19</sup>.
- 4.3.8. However, despite the various guidelines and company instructions to the contrary, it had become routine on board the Rena for the position to be, in the most part, fixed only hourly, and usually on the hour, as shown by the reconstruction of previous voyages. The coastal passage from Napier to Tauranga on the accident voyage was no different up to the point where the second mate adjusted the course to cut the corner north of Astrolabe Reef. Except for one position fix, GPS was the only method used to fix the Rena’s position.
- 4.3.9. On the morning of the grounding the position was fixed hourly until the watchkeeping able-bodied seaman placed a GPS fix on the chart at about 0120, before the deviation from the planned passage; then again at about 0142. When the watchkeeping able-bodied seaman entered the chartroom to do the hourly position fix at 0200, the master and the second mate were standing in front of the chart. The watchkeeping able-bodied seaman could not access the chart and would not interrupt the master or second mate, so this position was never plotted on the chart. Had the position been plotted, it would have shown that the Rena was tracking toward Astrolabe Reef, and the grounding may have been averted.
- 4.3.10. The watchkeeping able-bodied seaman was the designated “look-out” and should not therefore have been engaged in any other tasks that could affect his ability to keep a good look-out. The STCW Convention says, “the look-out must be able to give full attention to the keeping of a proper look-out and no other duties shall be undertaken or assigned which could interfere with that task”<sup>20</sup>. It is not necessarily unsafe for the look-out to be assigned to other tasks if the responsibility of look-out is taken over by someone else. However, in this case there was no-one acting as look-out while the watchkeeping able-bodied seaman made the position fix.
- 4.3.11. Given that Astrolabe Reef was submerged and unlit, this deficiency did not in itself have a causative influence on the grounding. The deficiency did, however, reflect the general systemic failures on the vessel.

### ***Using bridge equipment effectively***

*Safety issue – The watchkeeper was not making the most effective use of the bridge navigation equipment on board the Rena before the grounding.*

- 4.3.12. The STCW Convention says that, “officers of the navigational watch shall make the most effective use of all navigational equipment at their disposal”<sup>21</sup>. The STCW Convention standard was reiterated in the master’s standing orders, which said, “All bridge equipment [is] always at your disposal and must be used to their optimum, as per makers instructions for use”.
- 4.3.13. The Rena’s radar had automatic radar plotting aid capability and a feature that enabled maps and the locations of hazards to navigation to be programmed into the radar. This feature was

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<sup>18</sup> IMO Resolution A.893(21) Guidelines for voyage planning.

<sup>19</sup> CIEL Shipmanagement S.A. QSMS Section 10.3 SM10.5 (in part).

<sup>20</sup> STCW Convention A-VIII/2 part 3.

<sup>21</sup> STCW Convention A-VIII/3 Performing the navigational watch.

not used by the Rena's crew on the accident voyage. Any such features programmed into the radar would have showed on the radar screen. It would have been a simple task to program the position of Astrolabe Reef into the radar. This action would almost certainly have prevented the grounding because the radar was the first equipment that the master used when he took control of the bridge. Astrolabe Reef would have been clearly shown on the radar as being directly ahead of the ship.

- 4.3.14. Parallel indexing is another effective use of the radar to monitor continuously the progress of a ship in relation to a known hazard. The second mate set up parallel indexing on the radar. However, the settings were continuously adjusted during the several minutes that it was in operation. The voice recording from the voyage data recorder suggested that the second mate was demonstrating to the watchkeeping able-bodied seaman how parallel indexing worked, rather than actually using the parallel indexing to monitor the Rena's progress against the intended course. Had the second mate used the parallel index to monitor the Rena's progress against the intended course after he deviated from the passage plan towards Astrolabe Reef, it would have shown him that the Rena was drifting towards Astrolabe Reef under the influences of leeway, set, tide and any compass error.
- 4.3.15. Finally, the second radar was not switched on. There are two reasons for it being good practice to have both radars switched on when approaching a port. First, it is a time when two people are involved in navigating the ship – one controlling and the other monitoring. The second reason is that the radars work on different bandwidths (frequencies), and therefore between the two radars there is an increased chance of detecting a faint target, such as Astrolabe Reef just on the sea surface.

#### ***Monitoring compass error***

*Safety issue – The compass error was infrequently checked and was not checked at all on the voyage from Napier to Tauranga.*

- 4.3.16. A ship's compasses are principal pieces of navigational equipment and they have an inherent margin of error. Knowing the error in each is critical to safe navigation, particularly when navigating close to hazards and in narrow channels.
- 4.3.17. The STCW Convention says that the "standard compass error is to be determined at least once a watch [six times daily] and when possible, after any major alteration of gyro heading; the standard and gyro-compasses are to be frequently compared and repeaters are to be synchronized with their master compass"<sup>22</sup>. It will not always be possible or practicable to achieve these standards and they were developed for when ships had a greater reliance on the magnetic compass as opposed to the gyrocompass. Nevertheless, the conditions on the voyage from Napier to Tauranga did allow compass errors to be obtained. It would appear from the data analysed that the consistent drift southward of the gyro course being steered, toward Astrolabe Reef, was in part attributable to gyrocompass error.
- 4.3.18. The log book and compass error book showed that the compass error on board the Rena was usually determined fewer than four times a day, and often only once or twice. The compass error was not checked at all during the passage from Napier to Tauranga. It is important to know the gyrocompass error, because it is the gyrocompass that the automatic pilot uses to control the heading of the ship.

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<sup>22</sup> STCW Convention A-VIII/3.34.2 Performing the navigational watch.

### *Taking control of the ship*

Safety issue – *There was no clear delineation of who had control of the Rena at the time of the grounding, and the master, having assumed that he had taken control, had received virtually no information on where the ship was, where it was heading and what immediate dangers to navigation he needed to consider.*

- 4.3.19. Handing over the watch between watchkeepers, and to and from the master, is a very important process. The importance of the master (in this case) being totally aware of the situation cannot be overstated. As with all other aspects of watchkeeping, this was well covered in the STCW Convention and the CIEL safety management system procedures.
- 4.3.20. The STCW Convention states, “Prior to taking over the watch, relieving officers [in this case the master] shall satisfy themselves as to the ship’s estimated or true position and confirm its intended track, [gyro heading] and speed, and [engine] controls as appropriate and shall note any dangers to navigation expected to be encountered during their watch”<sup>23</sup>.
- 4.3.21. The STCW Convention goes further in saying (in part), “Relieving officers shall personally satisfy themselves regarding the:
  - standing orders and other special instructions of the master relating to navigation of the ship;
  - position, gyro heading, speed and draft of the ship;
  - prevailing and predicted tides, currents, weather, visibility and the effect of these factors upon [ground track] and speed;
  - navigational situation, including but not limited to: the operational condition of all navigational and safety equipment being used or likely to be used during the watch; the errors of gyro- and magnetic compasses; and the conditions and hazards likely to be encountered during the watch”.
- 4.3.22. The master arrived on the bridge at about 0152, which was 22 minutes before the Rena struck Astrolabe Reef. He had a discussion over the radar screen with the second mate. Their discussion was about whether they were going to be in time to pick up the pilot, and preparing the ship for arrival at the pilot station. They did not discuss the Rena’s position, the deviation from the course line or the location of Astrolabe Reef. Nor did the master study the chart.
- 4.3.23. The master gave the second mate the task of preparing pre-arrival documentation and then began controlling the ship. The second mate assumed that the master had taken control, then worked in the chartroom preparing the documentation.
- 4.3.24. The master later said that he had had confidence in the second mate’s watchkeeping ability, and had assumed that the ship was in a safe position. The radar navigation system was changed to monitor the pilot station arrival navigation waypoint when neither the second mate nor the master was aware that Astrolabe Reef lay between the Rena and that destination. This non-adherence to standard practice for handing over the watch (or conduct of the ship) was the last active failure that contributed to the grounding. It was the last opportunity for realising the peril the ship was in.
- 4.3.25. The master acknowledged that he had (in his own mind) taken control of the ship when he set the second mate another task. He also said that he had assumed the second mate would continue to monitor the progress of the ship. It is difficult to understand how the second mate could have monitored progress when he had just been given another task that would require his full attention.

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<sup>23</sup> STCW Convention A-VIII/3 Taking over the watch.

- 4.3.26. On this issue the STCW Convention says, “the officer in charge of the navigational watch shall continue to be responsible for the safe navigation of the ship, despite the presence of the master on the bridge, until informed specifically that the master has assumed that responsibility and this is mutually understood”<sup>24</sup>.
- 4.3.27. On this issue the CIEL policy says, “Even if the master is present [on the bridge], continue being responsible for the safe navigation of the vessel until such time as the master expressly informs [the watchkeeper] that he takes the [control] of the vessel”<sup>25</sup>.
- 4.3.28. Although there was no formal watch handover it was assumed by both the master and the second mate that the master was in control of the vessel, even though the master did not expressly say so. There should have been a formal verbal exchange between the master and the second mate acknowledging that the master had taken control (and responsibility) for the navigation of the ship. If the master had acknowledged that responsibility it may have prompted him to seek more information before taking control of the vessel.

**Findings:**

- 6. The standard of watchkeeping on board the *Rena* for the accident voyage, and particularly for the watch period during which the grounding occurred, in almost all respects did not comply with the requirements of the STCW Convention, the IMO Voyage Planning Guidelines, the CIEL safety management system or industry best practice described in The Nautical Institute’s Bridge Team Management – a Practical Guide.
- 7. The *Rena*’s crew were not following company procedures with respect to monitoring the progress of the ship in relation to known dangers to navigation for the entire voyage from Napier to the time of the grounding. A failure to monitor adequately the progress of the *Rena* contributed directly to the grounding.
- 8. The second mate was not making the most effective use of the bridge navigation equipment on board the *Rena* before the grounding – had he done so either he or the master would have been alerted to the presence of Astrolabe Reef in time to avert the grounding.
- 9. The master assumed control of the *Rena* when the ship was tracking directly for Astrolabe Reef. There was no clear delineation of who had control of the *Rena* at the time of the grounding, and the master, having assumed that he had taken control, had received virtually no information on where the ship was, where it was heading, and what immediate dangers to navigation he needed to consider.

<sup>24</sup> STCW Convention A-VIII/3 Performing the navigational watch.

<sup>25</sup> CIEL Shipmanagement S.A. Quality and Safety Management System 10.5 Bridge operations at sea (in part).

#### **4.4. Fatigue**

- 4.4.1. Fatigue in maritime operations is a safety issue that the IMO has been addressing through its various instruments for many years. The *Rena* had called at five New Zealand ports in six days. The grounding occurred at 0214 on the eighth day. These circumstances prompted the Commission to consider whether fatigue could have been a factor contributing to the grounding.

*Safety issue – The performance of both the master and the second mate was likely to have been at least mildly affected by fatigue during the work period midnight to 0215, the period leading up to the grounding.*

- 4.4.2. The STCW Convention A-VIII/1 Fitness for duty requires that all persons who are assigned duty as officers in charge of a watch, or as ratings forming part of a watch, shall be provided with a rest period of not less than 10 hours in any 24-hour period, and 77 hours in any seven-day period.
- 4.4.3. The hours of rest may be divided into no more than two periods, of which one shall be at least six hours in length, and the intervals between consecutive periods of rest shall not exceed 14 hours.
- 4.4.4. The hours of rest must be recorded in a standardised format to allow monitoring and verification of compliance with the provisions of the STCW Convention A-VIII/1 Fitness for duty.
- 4.4.5. The *Rena*'s master was not a designated watchkeeper. The officer-of-the-watch function was shared by the first, second and third mates. A review of the second mate's normal watchkeeping schedule and his actual hours of work in the 72 hours prior to the grounding showed that his work/rest routine was compliant with the STCW Convention.
- 4.4.6. The hours of rest for the crew of the *Rena* were analysed by an expert in fatigue, sleep and human cognitive performance (Professor Gander) using the recorded hours of rest as the primary source of data. The recorded hours of rest data was supplemented with post-accident crew interviews and a review of other verifying records.
- 4.4.7. Professor Gander's analysis was limited by the data available, and there was some uncertainty in that data. There were some inconsistencies between the recorded hours of rest and the known and/or claimed actions of the crew or vessel. For example, the recorded hours of rest indicated that on the day of the grounding the master was awake from midnight until the grounding, although during interviews the master claimed to have been awoken by the telephone call from the bridge at about 0135.
- 4.4.8. The Commission also engaged the ATSB to provide a human factors report, commenting on whether fatigue could have been a factor contributing to the grounding.
- 4.4.9. The ATSB report made the following statement on the limitations of its analysis:

“Evaluation of fatigue requires consideration of many factors. Hours of sleep is a primary determinant, as is time of day of both sleep and work. These factors were considered in this analysis. However, limited data was available regarding:

- quality of sleep
- workload and/or sustained attention
- level of adaptation to split-schedule rosters and length of time on the current schedule
- use of fatigue countermeasures
- subjective alertness levels
- sleep disorders
- other physiological factors such as nutrition, general health, use of caffeine or other stimulants, etc

This analysis considered the potential for fatigue impairment. It did not consider whether fatigue contributed to any event or actions. Such an analysis would require consideration of factors such as error types and their established association with fatigued performance, and the extent to which there are alternative explanations for the actions. It also must be noted that the effect of restricted sleep on performance is highly individualised, meaning that modelling outcomes will never represent a perfect fit for any one person.

Further, noting that the unique requirements of merchant shipping operations frequently require changes to planned work and sleep schedules, the assumptions of consistent sleep and work patterns built into this analysis are likely to represent a more favourable outcome than was the case.”

- 4.4.10. Four questions to decide whether fatigue was a contributing factor to the grounding were considered. The questions were as follows:

#### **At what time did the grounding take place?**

The grounding occurred at about 0214. Professor Gander said that at this time in the body clock circadian cycle, “the functional capacity of the crew would be expected to be close to its daily minimum and physiological sleepiness close to its daily maximum”. The ATSB report noted that the time the grounding occurred was “highlighted as a risk factor” when using the biomathematical fatigue prediction software, Fatigue Avoidance Scheduling Tool (FAST)<sup>26</sup>.

#### **Was the crew’s normal circadian rhythm disrupted?**

Although the master was not scheduled to work nights, the master had been on duty for each of the three preceding nights. Professor Gander said, “... it is reasonable to conclude that his normal circadian rhythm was disrupted.” Professor Gander also said that the second mate’s duty period “required displacing his sleep from the optimal time in the circadian body clock cycle, thus it is reasonable to conclude that his normal circadian rhythm was disrupted”.

However, the ATSB noted that “a key consideration of fatigue assessments is the extent to which a person has been able to adapt to a specific schedule. It would appear that the master had no fixed schedule, making the extent of adaptation difficult to assess. However, it is possible that some level of adaptation could occur to a split-shift schedule that could give less adverse results”.

For the second mate, the ATSB added, “the time-of-day factor result must be interpreted cautiously as it does not account for the second mate’s adaptation to this night time watch, which will be determined by the length of time he had been operating on this schedule, amongst other individual factors”.

#### **For how many hours had the crew been awake at the time of the grounding?**

The master was asleep in his cabin until the second mate telephoned him at about 0135, and at the time of the grounding he had been awake for about 38 minutes. Professor Gander said that “extended wakefulness was thus not a factor”. However, immediately after being awoken from sleep a person will have a transitional period of reduced task performance. This condition is known as sleep inertia. Professor Gander said that the master “could have been experiencing cognitive impairment associated with sleep inertia

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<sup>26</sup> FAST is underpinned by the Sleep, Activity, Fatigue and Task Effectiveness model, which asserts that (a) a circadian process influences both performance and sleep regulation, and (b) sleep regulation is dependent on hours of sleep, hours of wakefulness, current sleep debt, the circadian process and fragmentation (awakenings during a period of sleep). The ATSB preferred the FAST model over the Prior-Sleep-Wake model as it took consideration of time of day and sleep quality effects.

when he initially responded to the telephone call from the bridge. Sleep inertia effects would be expected to have dissipated by the time of the grounding". The second mate had been awake for a little over two hours at the time of the grounding, so Professor Gander said extended wakefulness was not a factor.

In respect of sleep inertia, the ATSB report commented, "the severity of sleep inertia can be influenced by the duration of the prior sleep, but more significantly by the sleep stage prior to awakening. If woken from slow-wave sleep, sleep inertia will be more severe than if woken from stage 1 or 2 sleep (Tassi P. &, 2000). To that extent, if an individual is carrying a sleep debt, and is therefore more likely to be in a deep (slow-wave) sleep, there is an increased risk for sleep inertia upon wakening".

The ATSB report commented further, "severity of sleep inertia effects have also been shown to be related to time of day of awakening. That is, if woken during the period of the circadian trough (approximately 0200 to 0600), the effects of sleep inertia may be more severe. Further, sleep inertia has been found to last from as little as 1 minute, to up to 4 hours. In the absence of major sleep deprivation however, sleep inertia effects rarely exceed 30 minutes (Tassi, P., Muzet, A, 2000). Without access to information regarding the quality of the master's preceding sleep episode, or his alertness levels on waking, it is difficult to assess the likelihood of the severity or duration of sleep inertia effects".

### Does the 72-hour sleep history suggest a sleep debt?

Professor Gander said the 72-hour history suggests that the master and the second mate had "minimal opportunity for night time sleep in that time and are therefore likely to have been experiencing the cumulative effects of sleep debt". The master did not have a minimum rest period of six hours on any of the six days preceding the grounding.

Where the data for certain periods conflicted, the ATSB conservatively gave priority to the reported sleep, and where there were gaps in the evidence it assumed that sleep was consistent with the person's "usual" sleep periods.

The ATSB report said that based on the evidence provided, "Rena's master reportedly obtained about 11 hours of sleep in the 24 hours leading up to the grounding (that is, from 0200 on 4 October) and about 15½ hours of sleep in the 48 hours prior (from 0200 on 3 October). The second mate reportedly obtained about 8½ hours of sleep in the 24 hours prior to the grounding and about 18 hours of sleep in the 48 hours prior. If these sleep estimates are accurate, based on the prior sleep-wake model, this suggests that neither the master nor the second mate were at risk of **significant** performance impairment (emphasis added) attributable to fatigue during the watch period preceding the accident".

The ATSB report said that when considering the master's five-day work/rest pattern, the FAST analysis demonstrated that "during most of the work periods reported between 2 October and 5 October, the master's performance was likely to have been **at least mildly** affected by fatigue (emphasis added). During the work period 2200 on 3 October to 0300 on 4 October, the FAST program indicated that the master's fatigue risk reached an 'unacceptably' high level (red zone<sup>27</sup>), by the end of the shift, with time of day, recent sleep length and accumulated sleep debt all highlighted as risk factors for this period".

The ATSB report said that when considering the second mate's five-day work/rest pattern, the FAST analysis highlighted that his schedule of work and sleep placed him at, at least, a mild to moderate risk for fatigue-impaired performance. Further, "that for each of the second mate's watch periods, his fatigue risk was within the yellow zone<sup>28</sup>, and over the course of each of the 0000 to 0600 work periods, his predicted effectiveness fell below the dotted criterion line, indicating performance equivalent to that of a person who has missed an entire night's sleep.

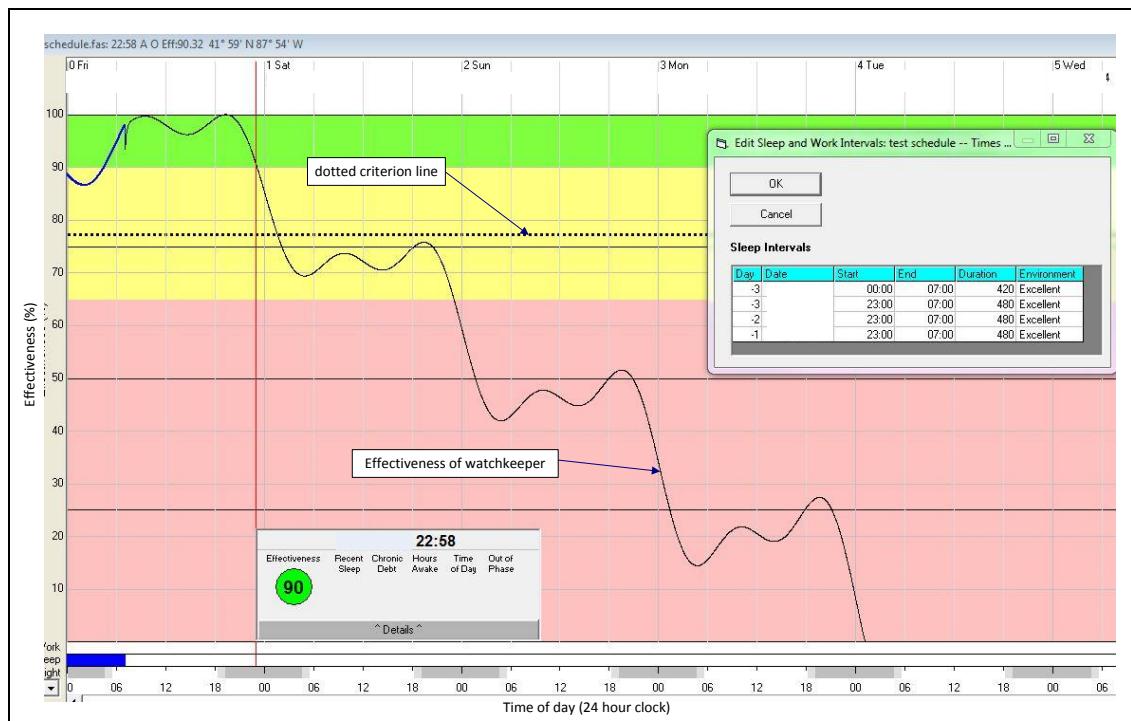
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<sup>27</sup> Performance is indicated to be less than 65% effectiveness.

<sup>28</sup> Performance is indicated to be between 65% and 90% effectiveness.

Specifically, for the period preceding the grounding, the second mate's cognitive effectiveness has been assessed as being within the yellow zone, with time of day being highlighted as a risk factor".

- 4.4.11. The terminology used by the FAST software developers refers to the yellow zone and then the dotted criterion line within the yellow zone. Entering the yellow zone starts occurring during the night when someone is missing an entire night's sleep. That is, a watchkeeper may start drifting into the yellow zone as they start not getting their normal sleep. If they go a whole night without sleep (awake for 24 hours) they will fall below the dotted criterion line within the yellow zone. As a watchkeeper approaches the time that they would normally sleep on the second night (effectively 40 hours without sleep) they will begin to enter the red zone.
- 4.4.12. Figure 6 shows a sample screenshot for a watchkeeper who begins with normal sleep and no work (green zone), then data is entered for obtaining no sleep in successive days.



**Figure 6**  
Sample screenshot for FAST fatigue modelling software

- 4.4.13. The Commission considered the reports of Dr Gander and the ATSB. The methodology used in each was different, but both agreed that the extent to which fatigue contributed to the grounding was difficult to quantify. The ATSB said that the FAST analysis of the work/sleep evidence showed that both the master's and the second mate's performance was at least mildly affected by fatigue. The ATSB also said that their actions and omissions on the night of the grounding were consistent with fatigue. However, those same actions and omissions were occasionally demonstrated throughout the Rena's voyages as discussed earlier in this report. For example, the lack of cross-checking information during the watch handover from second mate to master on the morning of the grounding was consistent with fatigue, but it was also consistent with typical watch handovers between the second mate and the master on other voyages.
- 4.4.14. The effects of sleep inertia could have been significant for the master, particularly when he answered the wake-up call from the second mate at 0135 and agreed to his deviating from the passage plan to save time, and again when he first arrived on the bridge and began assuming control of the ship from the second mate. However, as the experts noted above, this is difficult to determine without evidence of the sleep stage from which he was woken at 0135.

- 4.4.15. The FAST analysis showed that both the master and the second mate were at **risk** of their cognitive performance being impaired by fatigue at times during the 72 hour period before the grounding. However, their **actual** levels of impairment are difficult to quantify without having more information on the seven factors mentioned in the ATSB's "limitations in analysis" mentioned above (paragraph 4.4.9). The accuracy of that information was either questionable or not available to the Commission. Consequently, it was not possible to determine whether their actions leading up to the grounding were attributable to fatigue.

**Findings:**

10. The master's work and sleep schedule in the three days preceding the accident placed him at risk of his cognitive performance being impaired by fatigue. The combination of the effects of time of day for sleep and work, sleep duration, and sleep fragmentation acted to create significant sleep debt.
11. The second mate's work and sleep schedule in the three days before the accident meant that there was, at least, a mild to moderate risk of his cognitive performance being impaired by fatigue.
12. The performance of both the master and the second mate was likely to have been at least mildly affected by fatigue during the work period midnight to 0215, the period leading up to the grounding, but there was insufficient evidence to determine whether their actions leading up to the grounding were attributable to fatigue.

## 4.5. Safety management system

### *Background*

- 4.5.1. A number of very serious maritime accidents that occurred during the late 1980s were manifestly caused by human errors, with management faults also identified as contributing factors. In response, the ISM Code was developed and made mandatory by Chapter IX of SOLAS<sup>29</sup>.
- 4.5.2. The ISM Code requires a safety management system to be established by the "ship owner or any person who has assumed responsibility for the ship". The objectives of the ISM Code are to ensure safety at sea, the prevention of human injury or loss of life, and the avoidance of damage to the environment, in particular to the marine environment and to property.
- 4.5.3. The ISM Code says that the safety management objectives of the company should, inter alia:
- provide for safe practices in ship operation and a safe working environment
  - establish safeguards against all identified risks
  - continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.

The ISM Code also says that the safety management system should ensure:

- compliance with mandatory rules and regulations
- that applicable codes, guidelines and standards recommended by the Organization, Administrations, classification societies and maritime industry organizations are taken into account.

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<sup>29</sup> International Safety Management Code Resolution A.741(18) as amended by MSC.104(73), MSC.179(79), MSC.195(80) and MSC.273(85).

- 4.5.4. The ISM Code further says that in order to comply with the ISM Code, each vessel must have a working safety management system, which will typically consist of the following elements:
- commitment from top management
  - a Top Tier Policy Manual
  - a Procedures Manual that documents what is done on board the ship, during normal operations and in emergency situations
  - procedures for conducting both internal and external audits to ensure the crew are following procedures as laid out in the Procedures Manual
  - a Designated Person Ashore to serve as a direct link between the vessel's crew and senior management ashore, and to verify the safety management system implementation
  - a system for identifying where actual practices do not meet those that are documented and for implementing associated corrective action
  - regular management reviews.
- 4.5.5. There are two aspects to the ISM Code system. The first is the safety management system from the perspective of the vessel manager (CIEL), which was subject to both external audits on behalf of the flag state Liberia and internal audits. The second aspect was the safety management system as applied on board the *Rena*.
- 4.5.6. When safety issues were identified with the standard of voyage planning and navigation on board the *Rena*, the Commission examined those aspects of the *Rena's* working safety management system and CIEL's oversight of those aspects. The Commission also considered the port state control records for the *Rena* and other ships managed by the *Rena's* owners. Port state control records provide one indicator as to how well a safety management system is functioning.

### ***Safe ship management system on board the Rena***

*Safety issue – The CIEL oversight of the safety management system as applied on board the Rena was not sufficient to prevent a high number of port state control deficiencies and violations of some company procedures for voyage planning and navigation.*

- 4.5.7. The design of the safety management system applied on board the *Rena* (what the company says the crew will do) went some way to meeting the intent of the ISM Code. However, the documentation that the crew were required to read in order to find out what was required of them was excessive. For example, the system relied only on reference to nautical publications such as The Nautical Institute's Bridge Team Management – A Practical Guide as the standard to be met. While such publications are helpful and essential, the requirements would be better summarised and included in simple templates, flow-diagrams, checklists and quick reference guides for the crew to use.
- 4.5.8. In its submission on the draft final report CIEL said that this suggestion was an “outdated approach” to ISM Code implementation because it was “overly prescriptive and discourages active analysis and application by the crew involved”. The Commission does not agree. It is true that safety management systems should avoid being overly prescriptive. However, it is equally important that the system does not place too much reliance on crew having to extract key information from large documents that, realistically, will rarely be read. Extracting the key points relevant to a particular shipboard operation is a useful method of highlighting important information to the crew. CIEL has used this approach in summarising the key elements of other IMO documents.
- 4.5.9. The safety management system as applied on board was subject to external audits on behalf of the flag state Liberia, and internal audits. The Commission obtained the internal audit reports conducted on the *Rena* by CIEL. Internal audits are a system for identifying where actual practices do not meet those that are documented and for implementing associated corrective actions referred to in the ISM Code. They are an important process because if done

properly they show a company commitment to ensuring that the documented system is implemented on the vessel and is working.

- 4.5.10. The CIEL safety management system<sup>30</sup> said that the objectives of internal audits were to:
  - determine the implementation and effectiveness of the safety management system
  - determine conformity or non-conformity of safety management system elements with specified contractual requirements
  - provide a basis for improvement of the safety management system
  - meet regulatory requirements.
- 4.5.11. A single audit cannot realistically cover every aspect of a ship's operation, but monitoring indicators of past and present performance is a good method for deciding on the areas on which to focus.
- 4.5.12. In April 2011 the *Rena*'s Designated Person Ashore<sup>31</sup> sailed on the vessel for four days, during which time he conducted a CIEL internal ISM Code audit of the *Rena*'s safe ship management system. The Designated Person Ashore was a qualified master-mariner and would therefore have been well qualified to detect any navigational deficiencies. It is possible that the Designated Person Ashore's audit plan did not include assessments of watchkeeping and navigation procedures, but a lot can be covered in four days and it would be surprising if the safety-critical function of bridge operations had not in some way been assessed.
- 4.5.13. The audit report did list several deficiencies associated with the bridge, including that the compass error was not being determined at least once every watch. This finding showed that bridge procedures were covered by the audit to some degree. However, these observations need to be tempered by the knowledge that crew generally lift their performance immediately before and during a planned audit. This makes it more difficult for the auditor to identify any non-conformities or observations that would otherwise be raised. Also, an auditor would not necessarily focus in so much detail on one aspect of shipboard operations as an investigation does after an accident or incident has occurred, unless that area of operation was of particular interest for some reason.
- 4.5.14. While he was on board, the crew were not complying with the safety management system with respect to passage planning/execution and position fixing. Evidence of this was found in documents recovered from the *Rena* and from the voyages reconstructed after the grounding. However, the Designated Person Ashore's audit report did not note any other deficiencies regarding navigation or watchkeeping practices.

#### ***Port state control***

*Safety issue – The number of port state control deficiencies identified against the Rena and its detention in Fremantle for non-compliance with statutory requirements indicates that the safety management system as applied on board the Rena was not meeting the objectives of the ISM Code.*

*Safety issue – Eight of the 12 vessels managed by CIEL had higher rates of deficiencies per inspection than the average of all other vessels subjected to port state control inspections in the Asia-Pacific region in the same period. The Rena's deficiency rate was almost twice the average. This indicated that the CIEL safety management system for the vessels operating in the Asia-Pacific region, and for the Rena, was not functioning as it could have been according to the ISM Code.*

- 4.5.15. The discussion above refers only to voyage planning and navigation standards. A port state can inspect a vessel to ensure that it is operating safely and in compliance with regulatory

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<sup>30</sup> CIEL Shipmanagement Quality and Safety Management System Office Manual.

<sup>31</sup> The Designated Person Ashore is described in the ISM Code as the person providing the link between the ship and the highest level of management ashore.

requirements while in its waters, which is also a primary purpose of a vessel's safety management system. Thus, the port state control inspection record can be used as an indicator of how effectively a vessel's safety management system is working.

- 4.5.16. To better co-ordinate the port state control inspection of ships, IMO has encouraged the establishment of regional port state control organisations that operate to agreements on port state control (memoranda of understanding). Such memoranda cover all of the world's oceans. The system was set up to avoid duplication of inspections on ships trading exclusively in one area, and to ensure that any deficiencies raised in one State are recorded, tracked and, when rectified, closed out (possibly by another State).
- 4.5.17. When an inspection is carried out the resultant report is submitted to the relevant co-ordinating organisation. New Zealand, for example, is a signatory to the Tokyo Memorandum of Understanding, which covers the Asia-Pacific region<sup>32</sup>.
- 4.5.18. Port state control inspections are usually conducted by the states' maritime administrations and typically check ship and crew certification as well as ships' safety equipment and maintenance. For example, an inspection of the bridge may include checking that the charts for the voyage are valid and up to date. An obsolete or out-of-date chart would be identified as a deficiency in the port state control inspection report.
- 4.5.19. When a deficiency is identified and recorded, the crew must rectify that deficiency. Each deficiency is recorded using one of six classification codes according to the nature and severity of the deficiency. The classification then gives the timeframe to rectify the problem. The six classification codes are given in Table 5. Two categories of particular interest are Code 17 and Code 30. A classification of Code 17 means the vessel should not sail until the deficiency is rectified. A classification of Code 30 means the deficiency is serious enough to detain the vessel until it has been rectified to the satisfaction of the port state control officer. A Code 30 deficiency will also be reported to the flag state, which will usually trigger a flag state inspection of the vessel.
- 4.5.20. The Commission obtained the port state control records for the *Rena*, and also those records for other ships operated by CIEL and the other two management companies of Costamare Inc. Of 18 deficiencies recorded against the *Rena* in China, 12 were classified as Code 17 (required to be rectified before departure) and six were classified as Code 16 (required to be rectified within 14 days). (See Appendix 3 for the full inspection report.)
- 4.5.21. About two weeks later the *Rena* underwent another "initial"<sup>33</sup> port state control inspection in Freemantle, Australia. That inspection resulted in a further 17 new deficiencies, of which:
  - three were classed as Code 30 (the ship was detained)
  - 11 were classed as Code 17 (required to be rectified before the vessel sailed)
  - two were classed as Code 16 (required to be rectified within 14 days)
  - one was classed as Code 18 (required to be rectified within three months).
- 4.5.22. The Code 18 deficiency was related to CIEL's safety management system as applied on board the *Rena*. "The ISM has not ensured maintenance of the ship and equipment, as evidenced by 15 deficiencies [Code 16 and 17 deficiencies]." (See Appendix 4 for the full inspection report.)

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<sup>32</sup> The following states have accepted the Tokyo Memorandum of Understanding: Australia, Marshall Islands, Canada, New Zealand, Chile, Papua New Guinea, China, Philippines, Fiji, Russian Federation, Hong Kong (China), Singapore, Indonesia, Solomon Islands, Japan, Thailand, Republic of Korea, Vanuatu, Malaysia and Vietnam.

<sup>33</sup> An initial inspection is considered a new inspection because the vessel is considered by the port state to be due, usually judged on the time since the last inspection. An initial inspection may identify new deficiencies.

- 4.5.23. All but one of the port state control deficiencies newly identified in China and Australia had been closed out in follow-up<sup>34</sup> inspections in Fremantle, Melbourne, Sydney, and Bluff. The exception was the Code 18 deficiency relating to the ISM Code, which had a timespan of three months to allow the ship and ship management company to make the necessary adjustments to the safety management system.

**Table 5: Port state control deficiency codes**

Code identification	Action required	Example of deficiency identified on board the Rena
Code 10	Deficiency rectified	-
Code 15	Rectify deficiency next port	-
Code 16	Rectify deficiency within 14 days	Charts not correctly updated
Code 17	Rectify deficiency before departure	Funnel fire damper unable to close
Code 18	Rectify deficiency within three months	ISM has not ensured maintenance of ship and equipment
Code 30	Detainable deficiency	Hatchway cover securing arrangements defective
Code 99	Other	-

- 4.5.24. The port state control inspection record of the vessels owned by subsidiaries of Costamare Inc. were analysed for the period from 1 June 2009 to 31 December 2011. The source data for this analysis was taken from Maritime New Zealand, records seized from the Rena<sup>35</sup>, port state control memoranda of understanding databases, and information provided by CIEL.
- 4.5.25. The vessels owned by subsidiaries of Costamare Inc. were managed by three vessel management companies that were established to serve the Costamare fleet of container ships<sup>36</sup>. The three management companies were Costamare Shipping Company S.A., Shanghai Costamare Shipmanagement Co. Ltd. and CIEL.
- 4.5.26. Costamare Inc. operated 76 vessels in three fleets. A broad overview of the port state control inspection record for those 76 identified vessels is given in table 6.
- 4.5.27. The fleet managed by CIEL had a higher rate of deficiencies per inspection than the other two fleets. Even so, CIEL's rate of 2.5 deficiencies per inspection was lower than the corresponding memoranda average for all vessels, which was 3.0 deficiencies per inspection. This result suggests that overall the CIEL safety management system was operating effectively.

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<sup>34</sup> A follow-up inspection is different from an initial inspection. A follow-up inspection usually only looks at verifying and closing out previously identified deficiencies; the purpose is not to identify new deficiencies.

<sup>35</sup> Not all vessels used in this analysis were owned and/or operated by a subsidiary of Costamare Inc. for the entire period. A number of vessels were taken out of and/or brought into the fleets during this period.

<sup>36</sup> Established by either the chairman of Costamare Inc. or the founder of Costamare Inc.

**Table 6: Port state control inspection record for Costamare Inc. (a 30-month period)**

Ship manager	Number of vessels	Number of port State control inspections	Number of detentions	Number of deficiencies	Average number of deficiencies per inspection
Costamare Shipping Company S.A.	32	133	0	125	0.9
Shanghai Costamare Shipmanagement Co. Ltd.	12	71	2	113	1.6
CIEL	32	105	4	264	2.5

- 4.5.28. However, there are practical variations in the nature of port state control inspections in the different memoranda regions. Because different fleets can operate exclusively in one or more of these regions, a better comparison of port state control performance can be obtained by considering the data within each region. That is, the vessels are inspected against the same criteria.
- 4.5.29. The CIEL fleet vessels had been inspected under at least six port state control memoranda of understanding, and there were also some inspections carried out by the United States Coast Guard. Not all memoranda statistics were available and so a comparison of the CIEL fleet against the corresponding memoranda was possible for only three of the memoranda of understanding (which accounts for 63% of all CIEL inspections). Table 7 shows a comparison of CIEL against the corresponding memoranda of understanding.
- 4.5.30. The vessels managed by CIEL accrued a rate of deficiencies per inspection that was significantly lower than the average in at least two of the port state control regions (24% of inspections). However, 39% of CIEL inspections were accrued under the Tokyo Memorandum of Understanding where the rate of deficiencies was slightly higher than the average. The relevant data was not available to make a comparison for the remaining 37% of inspections (which covered the regions of another three memoranda of understanding and the United States Coast Guard).
- 4.5.31. CIEL had four detained vessels in 30 months within its fleet, of which two were under the Tokyo Memorandum of Understanding.

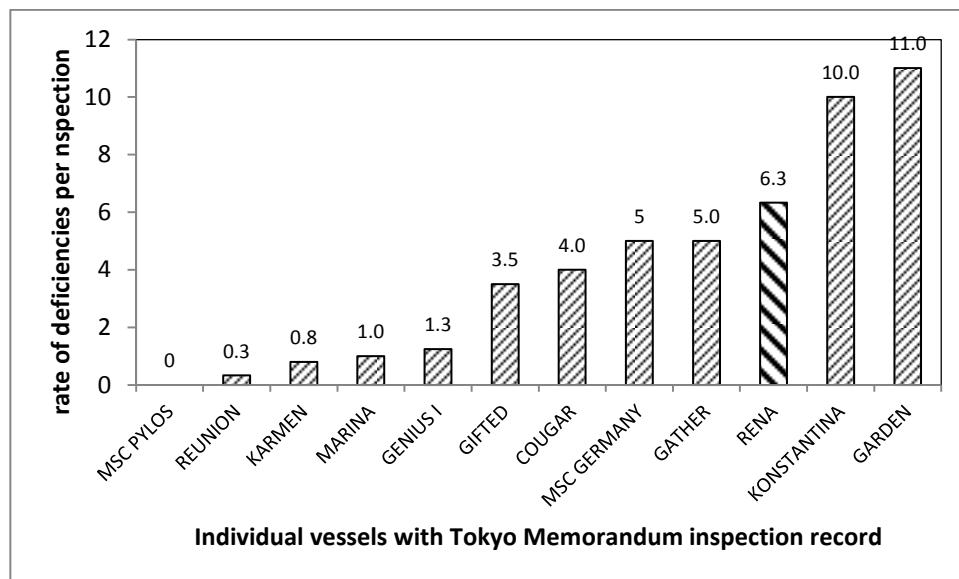
**Table 7: Comparison of CIEL fleet against corresponding port state control memoranda of understanding**

Memorandum of understanding (MoU)	Average number of deficiencies per inspection		% of total CIEL inspections*	Average number of deficiencies per inspection for Rena
	MoU	CIEL		
Tokyo	3.4	3.6	39%	6.3
Indian Ocean	3.2	1.2	15%	-
Paris	2.8	1.8	9%	-

\*Note: relevant data was not available for the remaining 37% of inspections

- 4.5.32. CIEL managed 12 vessels that accrued inspection records under the Tokyo Memorandum of Understanding. The deficiency per inspection rate for each of those vessels is given in Figure 7. The average rate of deficiencies per inspection for all vessels inspected under the Tokyo

Memorandum of Understanding was about 3.4 (Table 7). Seven of the 12 vessels inspected accrued rates at or above that average, and five accrued a rate below that average.



**Figure 7**  
**Rate of deficiencies per inspection for CIEL vessels inspected under  
Tokyo Memorandum of Understanding**

- 4.5.33. In late 2010 the Rena was purchased by a subsidiary of Costamare Inc. and brought into the fleet managed by CIEL. The port state control record for all inspections of the Rena while under the management of CIEL is given in Table 8. With a deficiency per inspection rate of 6.3 (Figure 7), the Rena's rate was higher than the Tokyo Memorandum of Understanding's average of 3.4. Nearly half of those deficiencies were classified as Code 17 and thus were required to be rectified before the vessel sailed for the next port. The three Code 30 deficiencies, which resulted in the detention of the vessel in Fremantle, triggered a Class survey the following day, which identified five of the port state control deficiencies as "statutory deficiencies"<sup>37</sup>. The detention also triggered a Special Safety Inspection by the flag state Liberia in July 2011, and also a Class survey in August 2011.

**Table 8: Rena's port state control inspection record**

Vessel name	Total number of port state control inspections	Number of newly identified Code 30 deficiencies (detainable)	Number of newly identified Code 17 deficiencies (rectify before departure)	Number of deficiencies	Average number of deficiencies per port state control inspection
Rena	8	3	23	38	4.8

<sup>37</sup> Statutory deficiencies are deficiencies that contravene the statutes of the state of registry for that vessel. The statutes of the state of registry will include those IMO conventions to which the state is a signatory, for example SOLAS.

- 4.5.34. The reported deficiencies were an indication that the CIEL safety management system was not ensuring that the *Rena* was maintained and operated in accordance with regulatory requirements, an observation supported by the 17th deficiency raised in Fremantle – “ISM related deficiency/maintenance of the ship and equipment – ISM has not ensured maintenance of ship and equipment as evidenced by deficiencies 1-15”.

#### *Summary of safety management systems*

- 4.5.35. Port state control inspections are an indicator of the effectiveness of a vessel’s safety management system in achieving its purpose. An effective safety management system should ensure compliance with mandatory rules and regulations. The port state control record for vessels managed by CIEL indicates that the CIEL safety management system was operating relatively effectively in the regions considered.
- 4.5.36. However, the number of deficiencies identified against the *Rena* and its detention in Fremantle for non-compliance with statutory requirements indicate that the safety management system as applied on board the *Rena* was not meeting the objectives of the ISM Code. Also, there were clear indications that the safety management system on board the *Rena* was not functioning properly with respect to bridge and navigation procedures.
- 4.5.37. CIEL’s safety management system was integral to the vessels it managed, including the *Rena*. Therefore if the *Rena*’s safety management system was not meeting the objectives of the ISM Code, neither were some aspects of the CIEL safety management system.
- 4.5.38. When the Commission asked CIEL whether any audits, reviews or safety actions had been undertaken in response to the *Rena* grounding, it responded, “Ciel’s position is the same as has been established in the court process in New Zealand and as evidenced by the information provided. The incident was caused by unfortunate human errors and the negligent discharge of duties by well qualified officers who had been tested over time in their roles – not by any non-conformity with the system or deficiency in the system”<sup>38</sup>.
- 4.5.39. The Commission agrees that human error was one factor contributing to the grounding, but there were several other contributing factors that stemmed from safety issues within broader systems. There is some evidence that the CIEL safety management system, for its vessels trading in the Asia-Pacific region, was not adequate to ensure safe ship operation and compliance with regulatory requirements. However, the Commission did not conduct an investigation into CIEL’s safety management system for all its vessels, and CIEL did not provide the Commission with information relevant to the broader system when the Commission asked for it. The Commission is accordingly unable to determine whether broader issues with the CIEL safety management system contributed to the accident.
- 4.5.40. With respect to port state control records, other vessels managed by CIEL also had higher rates of deficiencies than the average for the Tokyo Memorandum of Understanding. CIEL may wish to evaluate the effectiveness of its safety management system to ensure that the issues identified with that system as applied on board the *Rena* do not affect other vessels within its fleet.
- 4.5.41. CIEL’s submission about the qualifications and experience of the crew is discussed in the following section – International seafarer training and certification systems.

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<sup>38</sup> At the outset of the investigation CIEL invited the investigators to travel to Greece to see first hand its safety management system. The investigators did not travel at that time because they were still in the early phase of the investigation. Given CIEL’s response to these questions, the Commission decided the cost of travel to Greece would outweigh the benefits.

**Findings:**

13. The master and crew of the *Rena* were not following navigation and watchkeeping standards and procedures set down in the safety management system on board the *Rena* for at least the six coastal voyages leading up to the grounding. The failure to follow these standards set out in the *Rena*'s safety management system was a factor contributing to the grounding.
14. There were clear indications that the safety management system on board the *Rena* was not functioning properly with respect to bridge and navigation procedures.
15. The number of port state control deficiencies identified against the *Rena* and its detention in Fremantle for non-compliance with statutory requirements indicate that the safety management system as applied on board the *Rena* was not meeting the objectives of the ISM Code.

#### **4.6. International seafarer training and certification systems**

- 4.6.1. The standard of watchkeeping on the bridge of the *Rena* was not consistent with the requirements of the STCW Convention. Given the deficiencies identified with the performance of the master and crew of the *Rena*, the Commission considered their initial and ongoing training, and the broader system in which that training had taken place. The Commission further considered whether improvements could be made to the international seafarer training and certification system that would assist in minimising the risk of future accidents and incidents similar to the *Rena* grounding.

##### ***Rena* bridge team training and development**

- 4.6.2. Both the master and the second mate on board the *Rena* when it grounded on Astrolabe Reef had received initial and ongoing training through the Philippines' maritime education, training and certification system, between 1990 and 2007 for the master and 1995 and 2010 for the second mate.
- 4.6.3. The performance of a seafarer is dependent not only on the standards set by their initial and ongoing training, but also on the performance standards and culture of the companies within which they have carried out their service.
- 4.6.4. The master had been employed by a number of different companies before, during and after completing his training for master qualification. He had been employed by CIEL since 2007, initially as first officer and then as captain.
- 4.6.5. The second officer had been employed by CIEL since 2003. He had initially been employed as an able-bodied seaman and was then progressively promoted to junior officer, third officer and then to second officer on board the *Rena*, all under the master in command of the *Rena* when it ran aground.
- 4.6.6. Both the master and the second mate had therefore been trained and had worked in the same systems for a number of years. The Commission considered whether the training received by the crew might have played a part in their actions leading up to the grounding.
- 4.6.7. Independent audits and inspections of the Philippines' training system were conducted by EMSA in the period 2006 to the present. They established that there were serious deficiencies with that system and its compliance with the standards required by the STCW Convention during the period in which the crew received training. The reports raised the more general possibility that seafarers coming through the Philippines' training system during this period could have received training that did not meet the requisite standards.

- 4.6.8. Whilst the deficiencies in the Philippines' training system coincided with the period of ongoing training of the master and crew of the Rena, the Commission is unable to make any definitive findings that any issues with the ongoing training contributed to the accident, as it was not possible to undertake the broad review required to support such a finding. Nor did the Commission have specific information relating to the Rena crew's individual training experiences in the Philippines to find that their training contributed to the Rena's grounding.
- 4.6.9. While not a factor specific to this accident, the Commission's enquiries nevertheless raised broader issues about the transparency of seafarer training standards under the STCW Convention, which may have broader safety implications for marine transport.

### ***Background of the STCW Convention***

- 4.6.10. An intended outcome of IMO was global uniformity of shipping standards, so that vessels trading internationally could do so as seamlessly as possible, and to the same standards. The objective of the STCW Convention was to ensure that common minimum standards applied to the crew of those vessels. The purpose of the STCW Convention was to "promote safety of life and property at sea and the protection of the marine environment by establishing in common agreement international standards of training, certification and watchkeeping for seafarers". The STCW Convention was amended in 1991, 1994, 1995, 1997, 1998 and 2006, and most recently in 2010. A chronological history of the amendments and a summary of the changes made are included in Appendix 5.
- 4.6.11. By 2002 there were 82 States that were signatories to the STCW Convention, including the Philippines. The Philippines estimated that it had issued more than 300,000 seafarer certificates of competence prior to 2002.
- 4.6.12. The achievement of common standards of seafarer training and certification is important as crew who have been trained in one State may go on to man vessels registered in other States. The State in which a vessel is registered has some responsibility for ensuring that the seafarers to whom it issues licences of competence have been trained to the standards required by the STCW Convention.
- 4.6.13. All States in the maritime community also rely on the training and certification of seafarers provided by other States, as vessels with crew trained in other jurisdictions come into the territorial waters of other States. The international training and certification system is accordingly important to all States, including New Zealand.
- 4.6.14. The Commission accordingly considered whether the deficiencies identified by EMSA in the audit process were appropriately addressed by the broader training and certification system.

### ***Philippines' seafarer training system***

*Safety issue – Independent audits had found that the Philippine seafarer training system did not meet the standards specified by the STCW Convention at both systemic and training institute levels.*

- 4.6.15. EMSA conducted the audit of, and follow-up reports on the Philippines' seafarer training system. It is one of the European Union's (EU's) decentralised agencies. The agency provides technical assistance and support to the European Commission and member states in the development and implementation of EU legislation on maritime safety, pollution by ships, and maritime security.
- 4.6.16. EMSA began auditing the Philippines' maritime education, training and certification system in 2004. The initial audit was to review the suitability of the EU states to continue to recognise certificates issued by the Philippines. The timing of the EMSA audit corresponded with the Philippines' five-yearly audit required by the STCW Convention (as discussed in the next section, Implementing the STCW Convention). Consequently the EMSA audit served both purposes.

- 4.6.17. EMSA issued its first audit report in 2006, which investigators from the Commission were able to view, although a copy of it was not made available. The Commission obtained copies of EMSA's 2010 report of its follow-up inspection, and a draft of the 2012 report of its further follow-up inspection. These reports found that at a higher level there were deficiencies and "dysfunction" between the several agencies that had a role in administering the Philippines' seafarer training system. There were also deficiencies at the level of individual training institutes.
- 4.6.18. In 2011 the Philippines had submitted a response report to EMSA detailing corrective measures taken following the 2010 follow-up inspection and report. The 2012 draft report of the further follow-up inspection continued to record significant deficiencies, however.
- 4.6.19. Although the 2012 EMSA draft report acknowledged progress, it still found serious issues with the maritime education, training and certification system. In November 2012 the European Commission issued "Information"<sup>39</sup> to EU member States "about shortcomings in compliance by the Philippines' training system and certification of seafarers with the requirements of the STCW Convention". The Information said that:
- recent actions undertaken by the Philippines' government have brought the country's regulatory framework in line with the requirements of the STCW Convention on the certification of seafarers and the quality standard system to be implemented by the administration. However, it also appears that administrative practices are still not in line with this new regulatory framework. As a result, there are still deficiencies at the level of the administration<sup>40</sup>.*
- 4.6.20. The Information went on to say that the deficiencies were "mirrored in the shortcomings detected at the schools' level, relating to programmes, methods, use of equipment and the absence of equipment itself"<sup>41</sup>.

- 4.6.21. The Information concluded as follows:

*In conclusion, there is a clear constant trend in the Philippines as regards ensuring the full compliance with the requirements of the STCW Convention. However, this degree of compliance has not been achieved yet. Should this trend slow down and should full compliance with the requirements of the STCW Convention not be achieved in a reasonable time-span – also considering the time that has already elapsed since the first inspection – then, the withdrawal of EU recognition of the Philippines in relation to its training and certification system of seafarers should be fully taken into consideration.*

- 4.6.22. When the Commission's investigators visited Manila in October 2012, a major restructure of the Philippines' maritime education, training and certification system had begun in response to the 2012 EMSA report. Details of the corrective actions are shown in the Safety actions section (section 6) of this report.
- 4.6.23. Given the deficiencies that EMSA identified with the Philippines' maritime education, training and certification system over a period of time the Commission considered the IMO system for implementing the STCW Convention in order to identify whether improvements to that system might assist in reducing the risk of future accidents and incidents to which deficiencies in the training of crew may have contributed.

### ***Implementing the STCW Convention***

- 4.6.24. The STCW [1995] Convention required member States to submit to IMO, by August 1998, information on the steps taken by the States to "give the STCW [95] Convention full and complete effect"<sup>42</sup>. The intention was that IMO publish a list of States whose seafarer training

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<sup>39</sup> 2012/C 367/01.

<sup>40</sup> Paragraph 11 (2012/C 367/01).

<sup>41</sup> Paragraph 12 (2012/21012/C 367/01).

<sup>42</sup> STCW [1995] Convention Section A1/7.

systems could give full and complete effect to the STCW [1995] Convention. This list became known as the “White List”.

- 4.6.25. The White List was published in December 2000. A statement released by IMO (see Appendix 6. said that “A position [of a State] on the White List entitles other [States] to accept, in principle, that certificates issued by or on behalf of [States] on the White List are in compliance with the Convention”.
- 4.6.26. The acceptance of a State on the White List did not, however, involve any assessment on whether its seafarer training system did in fact meet those standards. It merely indicated that it “could” do so. Regulation I/10 of the STCW [1995] Convention continued to place the responsibility on the member States to satisfy themselves that other States’ systems were compliant before recognising certificates issued by them.
- 4.6.27. It became apparent that there was uncertainty over the significance of the inclusion of a State on the White List, however. As a result of an STCW [2010] Convention meeting, IMO published (in June 2013) a circular<sup>43</sup> that contained the following to remind parties of their obligations under Regulation I/10 regardless of the White List:

The Committee draws the attention of maritime administrations, ship owners, ship operators and managers, ship masters and other parties concerned to the following:

- .2 the fact that a Party is listed in the annex [the White List] does not relieve those concerned of their obligations under the STCW Convention.

- 4.6.28. Regulation I/10 (as applied at the time of the Rena grounding) read:

#### **“Regulation I/10**

##### *Recognition of certificates*

- 1 Each Administration shall ensure that the provisions of this regulation are complied with, in order to recognize, by endorsement in accordance with regulation I/2, paragraph 5<sup>44</sup>, a certificate issued by or under the authority of another Party to a master, officer or radio operator and that:
  - .1 the Administration has confirmed, through all necessary measures, which may include inspection of facilities and procedures, that the requirements concerning standards of competence, the issue and endorsement of certificates and record keeping are fully complied with; and
  - .2 an undertaking is agreed with the Party concerned that prompt notification will be given of any significant change in the arrangements for training and certification provided in compliance with the Convention.”

- 4.6.29. Because the Rena was registered in Liberia, the Commission considered the process that Liberia had followed in meeting its obligations under Regulation I/10 when it recognised the Philippine certificates of competency.

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<sup>43</sup> MSC 1/circ.1164 Rev 11 of 7 January 2013.

<sup>44</sup> Regulation I/2[5] An Administration which recognises a certificate under Regulation I/10 shall endorse such certificate to attest its recognition. The endorsement shall only be issued if all requirements of the Convention have been complied with.

## *Liberian Registry*

*Safety issue – The Liberian Registry recognised by endorsement certificates issued by the Philippines in accordance with STCW Convention Regulation I/10, when independent audits found that the Philippines' maritime education, training and certification system did not meet the standards specified in the STCW [95] Convention.*

- 4.6.30. The Liberian Registry is administered by the Liberian International Ship & Corporate Registry. Liberia is also included on the White List, not as a provider of trained seafarers but as a State that relies on the recognition of certificates issued to seafarers by other States. The STCW Convention Regulation I/10 is therefore of particular relevance to the Liberian Registry.
- 4.6.31. The Liberian Registry entered a memorandum of understanding with the Philippines in 2002. The memorandum covered the following points:
  - identification of the parties as competent authorities
  - the right to visitation/inspection/audit of the facilities of the Certificate Issuing Party
  - scope of such visits
  - [points of contact] for the parties
  - notification of significant changes for training and certification provided in compliance with the Convention
  - citing examples of such changes that should trigger notification
  - process of termination of the [memorandum] by either Party.
- 4.6.32. The memorandum of understanding agreed that the Philippines “shall make available to [Liberia] the results of the external audit reports on the quality standards evaluations conducted in accordance with paragraph 3, Section A-1/8 of the STCW Code” (the five-year evaluations).
- 4.6.33. The Philippines did not offer, nor did Liberia ask for, copies of the EMSA audit and follow-up reports produced between 2006 and 2012. Neither did the Philippines notify Liberia that it was making major changes to the administration of its maritime education, training and certification system during 2012, which was a requirement under the memorandum of understanding.
- 4.6.34. The Liberian Registry submitted that Liberia, in accordance with the STCW Convention and pursuant to Regulation I/10, recognised the Philippines’ certificates issued to the Philippine seafarers serving on board the Rena. It said that the inclusion of the Philippines on the White List meant that it was “deemed to have given full and complete effect to the standards of the STCW [1995] Convention”. As indicated above, however, the inclusion of a State on the White List did not mean that the State had met all its obligations. Between 2000 (when the White List was published) and 2009, the Liberian Registry did not visit or approve any training institutes. The Liberian Registry visited and “approved” 15 different training institutes in the Philippines between June 2009 and April 2013.
- 4.6.35. The Liberian situation may not be unique. It is a good example of how transparency in the audit results could assist it and other member States in ensuring that the basis for recognising seafarer certificates issued by other States is robust, without having to repeat the full audit process themselves and risk overburdening the entire global training system.
- 4.6.36. If the terms agreed in the memorandum of understanding between the Philippines and Liberia had been followed, Liberia could have been alerted as early as 2006 to problems the Philippines’ maritime education, training and certification system was having in ensuring that the standards specified in the STCW Convention were met, and then taken whatever action was needed to satisfy its obligations under STCW Convention Regulation I/10.

### *The practicality of verifying other States' seafarer training systems*

Safety issue – The STCW Convention protocols for auditing countries' maritime education, training and certification systems lacked the transparency that would assist other countries to assess easily whether to recognise the qualification certificates issued by those countries as compliant with STCW standards.

- 4.6.37. States are required by the STCW Convention to have independent evaluations made of their seafarer training systems at intervals not exceeding five years<sup>45</sup>. The auditors raise any deficiencies or non-compliances with the States concerned, together with the corrective actions required to close them out. The Philippines said that the evaluations carried out by EMSA had served the purpose of the five-yearly audit. This process has been described in more detail above.
- 4.6.38. Consolidated audit reports from the five-yearly evaluations must be submitted to IMO. IMO evaluates the content and publishes a list of member States that have demonstrated "that they were giving full and complete effect to the relevant provisions of the STCW Convention"<sup>46</sup>. However, the audit reports are not disclosed to other member States. Thus other states are theoretically required to undertake their own enquiries or audits to satisfy the requirements of STCW Convention Regulation I/10 (to ensure that their training and certification systems meet STCW Convention standards).
- 4.6.39. If this were to occur, it could lead to maritime administrations being overwhelmed by auditors, arguably to the detriment of administering their own training and certification systems. This requirement seems to contemplate an unnecessary duplication of resources that could be avoided if the system were more transparent. Until transparency can be achieved, it will be difficult to achieve uniformity of standards among the global training systems, which was the purpose of introducing the STCW Convention. For example, the consolidated reports submitted to IMO could be made available to other member States. The Commission acknowledges that there may be countervailing interests to consider around maintaining the confidentiality of audits, but these are likely to be outweighed by the benefits of achieving greater transparency and reducing duplication of effort in achieving consistently high standards of seafarer training globally.

### *Future status of the IMO White List*

- 4.6.40. The publication of the White List was the first time that IMO had been given a direct role in the implementation of one of its instruments. The intention behind creating the White List was to lift the global standard of seafarer training. However, there was ambiguity created by IMO publishing the White List and there is now a question about the status that the White List should be given and what a State's inclusion on it actually signifies.
- 4.6.41. Further, there is no agreed mechanism for States to be removed from the White List should their systems subsequently be found to not meet the standards of the STCW Convention. The majority of IMO's member States do not have access to information that could or should be used to determine whether a State should remain on it – important information that member States should have to assist them to confirm "through all necessary measures" whether the system in question complies with the STCW Convention.

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<sup>45</sup> STCW Code Section A-I/8(3) National Objectives and quality standards.

<sup>46</sup> MSC 1/circ.1164 Rev 11 of 7 January 2013.

**Finding:**

16. The STCW Convention protocols for auditing countries' maritime education, training and certification systems lacked the transparency that would assist other countries to assess easily whether to recognise the qualification certificates issued by those countries as compliant with the STCW Convention standards. Better transparency of this process could avoid unnecessary duplication and expedite the harmonisation of global seafarer training and certification systems.

#### **4.7. Summary of issues affecting standards of navigation**

- 4.7.1. The passage planning and navigation during the *Rena*'s final voyage was substandard and contributed to the grounding. The sections above highlight safety issues with the *Rena*'s safety management system and with the Philippines' and global seafarer training and certification systems. These factors have their origins in the wider systems in which many other ships worldwide are operating.
- 4.7.2. The description of the global seafarer training system given in this report, and how that could affect the standards of navigation on board ships worldwide, is a salient reminder that ship owners and operators cannot afford to be complacent about relying on the qualifications and experience of the crews they employ.
- 4.7.3. The issue involving the implementation of the Philippines' maritime education, training and certification system may not be unique. Other training administrations could have similar issues. It may therefore be some considerable time before true harmonisation of the STCW Convention standards can be achieved globally.
- 4.7.4. Safety management systems are intended to ensure that industry best practice and mandatory regulatory requirements are met, as a minimum. It is therefore incumbent on ship owners, operators and managers to ensure that their safety management systems achieve that on board their ships. A good safety management system should manage the risk that some crews are poorly trained in spite of their holding recognised maritime qualifications. Requiring and enforcing high standards on board their ships will help to manage that risk.

#### **4.8. Coastal ship routing**

- 4.8.1. During the inquiry it was put to the Commission that the introduction of mandatory ship routing around the New Zealand coast, and in particular around the approaches to the port of Tauranga, was necessary to prevent similar accidents to the *Rena* grounding occurring again. The topic has also been debated in the media.
- 4.8.2. The Commission considered this issue and concluded that the introduction of ship routing for all coastal New Zealand is not justified at this time. There may, however, be a justification for adopting some form of ship routing on a localised scale where a risk assessment based on real data on shipping movements reveals the need for such a system. The Commission has made a broad search for data on shipping movements around New Zealand and has concluded that the data currently available is not sufficient to say one way or another whether the introduction of ship routing would be justified for any local coastal area. If ship routing in any form were to be introduced, either Maritime New Zealand or local government would need to collect sufficient data to support a proper risk assessment. A credible risk assessment should give a credible answer as to whether ship routing is justified in a given location.
- 4.8.3. IMO is recognised as the only international body for developing guidelines, criteria and regulations on an international level for ships' routing systems. To understand the concept of

ship routing, it is necessary to refer to the SOLAS Convention Regulation 5 and IMO General Provisions on Ships' Routing<sup>47</sup>.

- 4.8.4. The SOLAS Convention says that “ship routing systems should be submitted to IMO for adoption, but if a Government decides not to do so then they are encouraged to take into account the guidelines and criteria developed by IMO”. There is a safety benefit if ships navigating internationally can do so using ship routing systems designed to the same criteria. This is consistent with the purpose of IMO – harmonisation of standards across the globe.
- 4.8.5. IMO’s General Provisions on Ships’ Routeing states that the objective for ship routing is to: “improve the safety of navigation in converging areas and in areas where the density of traffic is great or where freedom of movement of shipping is inhibited by restricted sea-room, the existence of obstructions to navigation, limited depths or unfavourable meteorological conditions”.
- 4.8.6. The precise objective of any IMO routing system is described as “including some or all of the following:
  - The separation of opposing streams of traffic so as to reduce the incidence of head-on collisions;
  - The reduction of dangers of collision between crossing traffic and shipping in established traffic lanes;
  - The simplification of the patterns of traffic flow in converging areas;
  - The organization of safe traffic flow in areas of concentrated offshore exploration or exploitation
  - The organisation of traffic flow in or around areas where navigation by all ships or by certain classes of ships is dangerous or undesirable;
  - The reduction of risk of grounding by providing special guidance to vessels in areas where water depths are uncertain or critical;
  - The guidance of traffic clear of fishing grounds or the organisation of traffic through the fishing grounds”.
- 4.8.7. The shipping traffic around the New Zealand coast cannot be described as dense in comparison with other areas around the world such as Europe and Asia, where IMO-approved ship routing systems are prevalent. A sample review of recorded automatic identification system data for the coastal area between East Cape and Auckland showed that typically there were only about 15 ships<sup>48</sup> in the area at any one time. By comparison, in the aforementioned regions the number of ships in such an area would be counted in thousands.
- 4.8.8. When the *Rena* was making its approach to the port of Tauranga, traffic density was not a safety issue. There were as few as three other vessels in the immediate area and none was so close to the *Rena* that it would be considered a factor in the grounding. Astrolabe Reef was an obvious navigational hazard to avoid, but it was well charted and the *Rena* crew had planned to avoid it by two nautical miles in their initial passage plan. There are literally thousands of other such navigational hazards for ships to avoid as they navigate the New Zealand coast<sup>49</sup>.
- 4.8.9. A safety issue in this case was poor navigational practices rather than the crew being overwhelmed by traffic density or hampered by difficult navigational conditions. Automatic identification system data showed other prior incidences of large ships passing close to, and

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<sup>47</sup> IMO Resolution A.572(14) and SOLAS Safety of Navigation/Chapter V/Regulation 10.

<sup>48</sup> Larger vessels that are required to have automatic identification systems fitted, which would exclude fishing and private vessels and smaller commercial vessels.

<sup>49</sup> What constitutes a hazard will depend on several factors, such as the size of the ship, its manoeuvrability and the depth it draws.

even inside, Astrolabe Reef. Tauranga is one of New Zealand's busiest ports, and shipping does converge near its entrance at designated times governed by the state of the tide<sup>50</sup>. If there had been some form of mandatory ship routing that required ships to stay a safe distance off Astrolabe Reef, the *Rena*'s crew would more than likely have heeded those mandatory directions and the grounding would likely have been avoided.

- 4.8.10. Tauranga is one example where local government could conduct a risk assessment to determine whether implementing a ship routing system off the port is justifiable.

#### 4.9. **Aids to navigation**

- 4.9.1. During the inquiry it was put to the Commission that Astrolabe Reef should have been marked with a light beacon or some other aid to navigation, and that if it had been the grounding would have been prevented. To put this argument in context, there are many other safety issues identified in this report that, had they never arisen, the grounding probably would not have happened. Nevertheless the Commission considered this issue.
- 4.9.2. The Commission agrees that had there been a light beacon placed on Astrolabe Reef it is highly likely that the grounding would have been prevented. The presence of a flashing light would have been a stark indicator to the bridge crew that their ship was heading directly for Astrolabe Reef, particularly when the master noticed the echo of the reef on his radar and began looking for what was causing it.
- 4.9.3. However, there are many rocks, reefs and other navigational hazards around the New Zealand coast. Installing and maintaining navigation aids on remote hazards is costly. Some years ago Maritime New Zealand consulted the industry on the need to maintain lighthouses and light beacons around the New Zealand coast. After that it relocated and automated the main lights to both reduce cost and improve their reliability.
- 4.9.4. Historically coastal lights were installed as visual aids to navigation in an era when electronic aids to navigation were few and less advanced than the modern GPS and other electronic systems that are available today at minimal cost.
- 4.9.5. Cultural and environmental factors related to installing and maintaining aids to navigation must also be considered with respect to the Resource Management Act 1991.
- 4.9.6. The *Rena* bridge was not fitted with an electronic chart plotter with a GPS feed. Such equipment is inexpensive to install and most large ships are fitted with it. An electronic chart plotter would have shown at a glance the *Rena*'s position in relation to Astrolabe Reef.
- 4.9.7. Astrolabe Reef was well displayed as a danger to surface navigation on the chart being used by the *Rena* bridge team. There was sufficient surrounding topography in the vicinity and the *Rena* had sufficient bridge navigational equipment, even without a chart plotter, to avoid colliding with the reef without needing the aid of a light beacon on the reef.
- 4.9.8. A more cost-effective option is being trialled by the International Association of Marine Aids to Navigation and Lighthouse Authorities – that is, “virtual aids to navigation”. In its draft guidelines on virtual aids to navigation, the International Association of Marine Aids to Navigation and Lighthouse Authorities describes them as “a virtual aid to navigation [that] does not physically exist but is a digital information object promulgated by an authorized service provider that can be presented on navigational systems”.
- 4.9.9. Simply put, a virtual aid to navigation is a navigational aid that is normally communicated by VHF radio signal in an automatic identification system message. A virtual aid to navigation could be projected on to Astrolabe Reef and this would show up as a symbol on a ship’s radar and other electronic navigation equipment set up to receive the signal.

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<sup>50</sup> Strong tidal streams in the entrance channel restrict the times that ships can transit the channel inbound and outbound depending on ship size and draft.

- 4.9.10. This technology will likely in future provide a recognised alternative to physically placing lights and beacons on navigational hazards.
- 4.9.11. When researching this matter the Commission noted that there were several examples of virtual aids to navigation already being used by port companies and regional councils near port approaches. Some caution needs to be exercised when using a new type of navigation aid before proper research has been conducted and performance standards developed for its use.
- 4.9.12. There is also the matter of educating mariners in the concept of virtual aids to navigation, and the reliance that can be placed on them to navigate ships. An over-reliance on the accuracy of electronic aids to navigation has been causal in many ship groundings over the years.
- 4.9.13. The Commission has raised this safety issue with the Director of Maritime New Zealand in its recommendations.

**Findings:**

17. A light beacon placed on Astrolabe Reef is another measure that probably would have alerted or reminded the bridge team to the presence of Astrolabe Reef, and would likely have prevented the *Rena* grounding. However, this needs to be seen in the context of:
  - the number of other dangerous rocks and reefs around the New Zealand coastline
  - the cost versus the benefits of fitting and maintaining light beacons on all such rocks and reefs
  - the availability and prevalent use of more modern and accurate navigation systems for avoiding such navigational dangers
  - further advanced systems such as virtual and synthetic aids to navigation that are likely to replace physical light beacons in future
  - relevant Resource Management Act considerations.
18. A simple stand-alone chart plotter or a chart plotter integrated with the radar was a low-cost and effective aid to navigation that would have visually alerted the *Rena*'s bridge team that the *Rena* was tracking directly towards Astrolabe Reef.
19. The use of virtual aids to navigation could be one alternative method for highlighting dangers to navigation. However, they should not be introduced before proper research into, and the development of performance standards for them have been completed.

## 5. Findings

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- 5.1 The *Rena* grounding was not in any way attributable to the malfunction of any on-board machinery or equipment, including on-board navigational equipment.
- 5.2 The *Rena*'s passage plan from Napier to Tauranga on the accident voyage did not meet the standards documented in the CIEL safety management system or the International Maritime Organization Voyage Planning Guidelines. Nor did it meet best industry practice as documented in The Nautical Institute Bridge Team Management – A Practical Guide.
- 5.3 The second mate deviated from the passage plan to take the *Rena* closer to Astrolabe Reef to save time. The deviation unnecessarily increased the risk of the ship running aground and contributed directly to the grounding.
- 5.4 The *Rena* grounded on Astrolabe Reef because the bridge crew progressively adjusted the automatic pilot to an incorrect heading and without making allowance for any leeway, set or gyrocompass error. The resultant ground track took the ship directly over the reef. Not monitoring the progress of the ship against the deviation directly contributed to the grounding.
- 5.5 The failure of the crew to follow industry best practice guidelines for making and executing the passage plan on the accident voyage was not an isolated case. A review of previous voyage plans revealed a number of acts and omissions similar to those made on the accident voyage.
- 5.6 The standard of watchkeeping on board the *Rena* for the accident voyage, and particularly for the watch period during which the grounding occurred, in almost all respects did not comply with the requirements of the International Convention on Standards of training, Certification, and Watchkeeping for Seafarers 1978 (STCW Convention), the IMO Voyage Planning Guidelines, the CIEL safety management system or industry best practice described in The Nautical Institute's Bridge Team Management – a Practical Guide.
- 5.7 The *Rena*'s crew were not following company procedures with respect to monitoring the progress of the ship in relation to known dangers to navigation for the entire voyage from Napier to the time of the grounding. A failure to monitor adequately the progress of the *Rena* contributed directly to the grounding.
- 5.8 The second mate was not making the most effective use of the bridge navigation equipment on board the *Rena* before the grounding – had he done so either he or the master would have been alerted to the presence of Astrolabe Reef in time to avert the grounding.
- 5.9 The master assumed control of the *Rena* when the ship was tracking directly for Astrolabe Reef. There was no clear delineation of who had control of the *Rena* at the time of the grounding, and the master, having assumed that he had taken control, had received virtually no information on where the ship was, where it was heading, and what immediate dangers to navigation he needed to consider.
- 5.10 The master's work and sleep schedule in the three days preceding the accident placed him at risk of his cognitive performance being impaired by fatigue. The combination of the effects of time of day for sleep and work, sleep duration and sleep fragmentation acted to create significant sleep debt.
- 5.11 The second mate's work and sleep schedule in the three days before the accident meant that there was, at least, a mild to moderate risk of his cognitive performance being impaired by fatigue.
- 5.12 The performance of both the master and the second mate was likely to have been at least mildly affected by fatigue during the work period midnight to 0215, the period leading up to the grounding, but there was insufficient evidence to determine whether their actions leading up to the grounding were attributable to fatigue.

- 5.13 The master and crew of the *Rena* were not following navigation and watchkeeping standards and procedures set down in the safety management system on board the *Rena* for at least the six coastal voyages leading up to the grounding. The failure to follow these standards set out in the *Rena*'s safety management system was a factor contributing to the grounding.
- 5.14 There were clear indications that the safety management system on board the *Rena* was not functioning properly with respect to bridge and navigation procedures.
- 5.15 The number of port state control deficiencies identified against the *Rena* and its detention in Fremantle for non-compliance with statutory requirements indicate that the safety management system as applied on board the *Rena* was not meeting the objectives of the ISM Code.
- 5.16 The STCW Convention protocols for auditing countries' maritime education, training and certification systems lacked the transparency that would assist other countries to assess easily whether to recognise qualification certificates issued by those countries as compliant with the STCW Convention standards. Better transparency of this process could avoid unnecessary duplication and expedite the harmonisation of global seafarer training and certification systems.
- 5.17 A light beacon placed on Astrolabe Reef is another measure that probably would have alerted or reminded the bridge team to the presence of Astrolabe Reef, and would likely have prevented the *Rena* grounding. However, this needs to be seen in the context of:
- the number of other dangerous rocks and reefs around the New Zealand coastline
  - the cost versus the benefits of fitting and maintaining light beacons on all such rocks and reefs
  - the availability and prevalent use of more modern and accurate navigation systems for avoiding such navigational dangers
  - further advanced systems such as virtual and synthetic aids to navigation that are likely to replace physical light beacons in future
  - relevant Resource Management Act considerations.
- 5.18 A simple stand-alone chart plotter or a chart plotter integrated with the radar was a low-cost and effective aid to navigation that would have visually alerted the *Rena*'s bridge team that the *Rena* was tracking directly towards Astrolabe Reef.
- 5.19 The use of virtual aids to navigation could be one alternative method for highlighting dangers to navigation. However, they should not be introduced before proper research into, and the development of performance standards for, them have been completed.

## 6. Safety actions

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### General

- 6.1. The Commission classifies safety actions by two types:
- (a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation
  - (b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

### Safety actions addressing other safety issues

[None identified]

### Safety actions addressing safety issues identified during an inquiry

- 6.2. Philippines' maritime training and certification system

In 2006 when EMSA concluded its initial evaluation of the Philippines' seafarer training system it found the system did not meet the standards specified in the STCW Convention.

Recent actions undertaken by the Philippines government have brought the country's regulatory framework in line with the requirements of the STCW Convention on the certification of seafarers and the quality standard system to be implemented by the administration.

The Philippines' seafarer training system is still under review by the European Commission to ensure that the Philippines continues to work towards giving full and complete effect to the STCW Convention. Consequently there is no need for the Commission to make recommendations to address the safety issues already identified by the European Commission.

- 6.3. In a report forwarded to the Commission by the Philippines it has summarised its corrective actions, as of July 2013, in response to EMSA as follows (*inter alia*):

*Please be assured that the Philippine Government takes seriously the EMSA [European Maritime Safety Agency] findings and that it is committed not only to passing the last and final audit scheduled in October but also to ensuring full compliance with STCW [Convention] standards. As such, we would like to provide you with the following updates on actions being taken by MARINA with regard to its most important function of oversight of the concerned agencies in the Philippines to ensure compliance with our country's obligations under the STCW [Convention].*

- *On the National Quality Standards System (NQSS), MARINA is closely coordinating with the concerned members agencies to fast track the alignment of their respective QSS to the NQSS. After directing all member agencies to finish their self-assessment audits by June, MARINA has now commenced its audit of the member agencies.*
- *On the conflict of interest of assessors/evaluators, MARINA is ensuring that its criteria for selecting Technical Evaluators shall be adopted by the Professional Regulation Commission (PRC) and that appropriate revisions to the forms being used in examination and certification will be made. Likewise, the Commission on Higher Education (CHED) has already reconstituted its Technical Panel for Maritime Education (TPME) to avoid conflict of interest.*
- *On the monitoring of maritime schools, CHED issued Special Order No. 24 deputizing the monitoring of maritime schools to MARINA. President Benigno S. Aquino III has approved the release of additional budget in*

*order to reinforce MARINA's capacity to monitor the maritime education and training system nationwide.*

MARINA, together with its sister agencies involved in ensuring compliance with our obligations under the STCW Convention, are working continuously to put in place a monitoring framework that will permanently address the systemic deficiencies that have led to the less than favourable outcome of last April's audit. We shall keep you informed from time to time of further actions taken in this regard.

## 7. Recommendations

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### General

- 7.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, recommendations have been issued to CIEL and Maritime New Zealand.
- 7.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

### Recommendations to CIEL

- 7.3. On board the *Rena*, the master and crew were not following the navigation and watchkeeping standards and procedures set down in the *Rena*'s safety management system for at least the six coastal voyages leading up to the grounding.

With respect to port state control records, other vessels managed by CIEL also had a higher than average rate of deficiencies than the average for the Asia-Pacific region.

The Commission recommends that CIEL evaluate the effectiveness of its safety management system to ensure that the issues identified with that system as applied on board the *Rena* do not affect other vessels within its fleet. (010/14)

- 7.3.1. On 11<sup>th</sup> December 2014, CIEL Shipmanagement replied, in part:

1. We understand the first two paragraphs of recommendation 010/14 are given by way of introduction or summary of the conclusions in the report. However, you will also appreciate from our previous submissions, we do not agree with these two paragraphs.
  2. The first two paragraphs are statements of facts and opinions and are not recommendations. It is not possible to implement anything asserted in the first two paragraphs as has been suggested.
  3. CIEL strongly objects to the content and utility of these two paragraphs in the recommendation for the reasons [given].
- ...
11. With regard to the actual recommendation in the third paragraph CIEL had implemented such a review. This included an internal review of the safety management system and the performance of vessel audits, including navigational audits.

### Recommendations to Maritime New Zealand

- 7.4. Member States are required to undergo five-yearly independent evaluations of their seafarer training systems. However, those evaluations remain confidential between the IMO, the auditing States and the States being assessed. According to Regulation I/10, member States are required to verify for themselves the effectiveness of other States' maritime education, training and certification systems before recognising certificates issued by those States. However, this can only be realistically achieved through a full systemic audit of the seafarer training system. If this were to happen it is likely that the global training system would be unnecessarily overburdened. This safety issue could be resolved if reports made after the five-yearly independent evaluations were required to be made available to other member states.

The Commission recommends that the Director of Maritime New Zealand promote, through the appropriate IMO forum, the importance of sharing amongst member states information regarding the quality of member states' maritime education, training and certification systems,

including a consideration of making the five-yearly evaluations of member states' available to other member states. (012/14)

7.4.1. On 28 November 2014, Maritime New Zealand replied:

The Director of Maritime New Zealand understands this recommendation to be aimed at improving transparency under the existing STCW Convention regime as opposed to revisiting the underpinning principles of that regime. To that end the Director accepts the recommendation and will include it in the work programme (Goal 1) underpinning the Strategy for New Zealand's Engagement in the IMO.

- 7.5. It is probable that if an aid to navigation of some type had been installed on Astrolabe Reef, the Rena grounding would have been prevented. However, there are many such isolated dangers to navigation around the coast of New Zealand. Installing and maintaining physical navigational aids on remote hazards is costly. Virtual aids to navigation are potentially a cost-effective means of marking such isolated dangers. However, these are still being trialled by the International Association of Marine Aids to Navigation and Lighthouse Authorities and no performance criteria have yet been set regarding their accuracy and intended use. The Commission noted during its inquiry that although the technology is relatively new and there is no regulatory framework in place, some port authorities are already beginning to use virtual aids to navigation. There is a potential safety issue around the use of aids to navigation that have not been fully tested.

The Commission recommends that the Director of Maritime New Zealand consider the use of virtual aids to navigation and monitor progress through the International Air Transport Association (IATA) of the development of performance criteria for them, but meanwhile work with regional councils and port companies to control the use of virtual aids to navigation until they have been fully assessed and appropriate performance criteria set by IATA and Maritime New Zealand. (013/14)

7.5.1. On 13 October 2014, Maritime New Zealand replied:

The Director of Maritime New Zealand accepts this recommendation (noting that the references to IATA are erroneous and should be a reference to IALA) and notes that in its Statement of Intent 2014-2020 Maritime New Zealand has included a Review of Coastal Navigation Safety as a key strategic review of the safety regulatory system. The Director of Maritime New Zealand initiated this review in August 2014 and the review will consider the use of navigation aids (including virtual aids) as part of its inquiry. The Terms of Reference for the review are attached and include timelines for key deliverables.

In addition The Director of Maritime New Zealand established (in 2012) a joint MNZ/Regional Council CEOs' group to facilitate cross agency engagement and promotion of navigation safety matters. A significant initiative, led by Maritime New Zealand, in the first year of the establishment of the group has been the conduct of an environmental scan of the New Zealand Port and Harbour Marine Safety Code. The findings of that scan will inform the Coastal Navigation Safety Review and the cross-agency co-ordinated responses to the findings are expected to address the recommendations of the Commission.

- 7.6. There is insufficient data available on the New Zealand coast to make any meaningful analysis of shipping routes, density of ship traffic or potential areas of shipping convergence that might warrant the introduction of local ship routing systems.

The Commission recommends that the Director of Maritime New Zealand begin to collate national data on shipping movements around the New Zealand coast that will in future enable Maritime New Zealand and local government authorities to monitor the potential need to introduce ship routing of some form. (014/14)

7.6.1. On 13 October 2014, Maritime New Zealand replied:

The Director accepts this recommendation and notes that the Review of Coastal Navigation Safety currently underway (as per details provided in the response to

recommendation 013/14) will specifically consider the issue of ship routing around the New Zealand Coast.

## **8. Key lessons**

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- 8.1. Ship managers must ensure that their safety management systems are delivering safe ship operations for every ship in their fleets.
- 8.2. Ships' crews must comply with the mandatory requirements and recommended best industry practice for passage planning, navigation and watchkeeping if similar groundings and other equally catastrophic maritime casualties are to be avoided.
- 8.3. Countries' maritime education, training and certification systems must be capable of meeting the standards required by the STCW Convention to ensure that seafarers emerging from the system are trained to an appropriate standard.

## **9. References**

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Captain A J Swift. (1993). *Bridge Team Management*. London: The Nautical Institute.

Tassi, P. & Muzet, A. (2000). Sleep Inertia. *Sleep Medicine Reviews*, 4 (4), 341-353.

## Appendix 1: CIEL form VS.OPS.002

### CIEL SHIPMANAGEMENT S.A.

Form No: VS.OPS.002

File B-2(A)

30/05/2006

Page 1 of 2

### Passage Planning.

Considering a passage plan the Navigator should take note of the following areas of concern:

PASSAGE PLANNING CHECKLIST	
No	Check Points
1	All charts to be used are corrected and up to date
2	All the largest scale charts have been employed.
3	Course tracks and distances plotted with respective margins of safety.
4	Next chart indication to allow positional transfer.
5	Traffic separation schemes and relevant references.
6	All relevant navigation warnings have been received and where applicable applied.
7	Determine, in consultation with Chief Engineer, the need of the intended voyage in Fuel, Water, Lubricants, Provisions and any other requirements.
9	Take note of all positions of high interest with regard to potential marine hazards.
10	Compare intended route with sailing directions and routes advised by Ocean Passages for the World and Pilot Charts
11	Assess with care all landfall position for shallows, currents and other possible dangers.
12	Tidal streams with indicated max/min rates and directions
13	Crossing traffic of known areas of heavy traffic density.
14	Highlight " NO CROSS AREAS"
15	The load-line regulations are not infringed.
16	Ports of refuge identified en-route.
17	Security measures have been taken as per SSP in accordance to present vessel security level.

CIEL SHIPMANAGEMENT S.A.

Form No: VS.OPS.002

B-2(A)

Passage Planning

01/02/2003

Page 2 of 2

Plan Prepared By  
NAV. OFFICER:

Checked By  
MASTER

**NOTES:**

- ENSURE THAT THE PASSAGE PLANNING COVERS THE ENTIRE VOYAGE FROM BERTH TO BERTH.
- FIX METHODS: G / GPS, R / RADAR, C / CELESTIAL NAV.

## Appendix 2: Rena bridge crew service and training record

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### Summary of service record for the master of the Rena

<b>Rank</b>	<b>Date</b>	<b>Manning agency/principal</b>
Deck cadet	08/08/1990	Prime Marine Manning Inc., Denholm Ship Management/Denk lav
Able-bodied seaman	10/04/1991	Prime Marine Manning Inc., Denholm Ship Management/Denk lav
Carpenter	22/09/1993	Prime Marine Manning Inc., Denholm Ship Management/Denk lav
Bosun	11/04/1995	Prime Marine Manning Inc., Denholm Ship Management/Denk lav
Third officer	19/02/1997	Citadel Shipping, Denholm Ship Management, PTC/P&O Nedlloyd
Second officer	16/07/2000	Citadel Shipping, Denholm Ship Management, PTC/P&O Nedlloyd
Chief officer	20/07/2004	PTC/P&O Nedlloyd, (from 2007) C-Man Maritime/CIEL
Master	01/08/2008	C-Man Maritime/CIEL

### Summary of training for the master of the Rena

<b>Training</b>	<b>Date</b>
Navigational watchkeeping	1990
Radar observers with simulator	1993
Automatic radar plotting aid	1993
Basic safety and emergency	1994
Global maritime distress and safety system	1996
Satellite communications	1996
Chief mate (Philippines)	2002
Safety and quality management	2003
Electronic chart display and information system	2003
Bridge resource management with simulator	2005
Master mariner (Philippines)	2006
Licence of competency to marine officer (Liberia)	2007
Company quality management	2010
Company quality management	2011

### Summary of service record for the second officer of the Rena

<b>Rank</b>	<b>Date</b>	<b>Manning agency/principal</b>
Deck boy	2000	
AB	2001	(from 2003) C-Man Maritime/CIEL
Third officer	2009	C-Man Maritime/CIEL
Second officer	2010	C-Man Maritime/CIEL

### Summary of training for the second officer of the Rena

<b>Training</b>	<b>Date</b>
Deck watchkeeping	1995
Basic safety training and instruction	1997
Associate of science in marine transport	2002
Officer's examination (Philippines)	2007
Ship simulator and bridge resource management	2007
Global maritime distress and safety system	2008
Radar navigation and automatic radar plotting aid	2008
Certificate of competency as officer-in-charge (Philippines)	2010
Licence of competence as merchant marine officer (Liberia)	2010

## Appendix 3: Port state control inspection report (Shenzhen)

**FORM A**

**REPORT OF INSPECTION IN ACCORDANCE WITH THE MEMORANDUM  
OF UNDERSTANDING ON PORT STATE CONTROL IN THE ASIA-PACIFIC REGION\***

**Authority:** MARITIME SAFETY ADMINISTRATION OF  
THE PEOPLE'S REPUBLIC OF CHINA  
**Add:** 11, Jiangwumennei Ave, Beijing, 100736  
**Tel:** +86-10-6529-2876  
**Fax:** +86-10-6529-2875  
**Cable:** MINOCOM  
**Telex:** 222ZC CMSAR CN  
**E-mail:** China-psc@mva.gov.cn

Copy to: Master  
Head office  
PSCO  
If ship is detained, copy to:  
Flag State  
IMO  
Recognize organization, if applicable

1 name of reporting authority MSA CHINA 2 name of ship RENA  
 3 flag of ship LIBERIA 4 type of ship CONTAINER 5  
 6 IMO number 8006802 7 gross tonnage 37209 8  
 9 year keel laid 1980 10 date of inspection 02-07-2011 11  
 12 classification society ABS 13 date of release from detention\*  
 14 IMO company number 4557389 14b particulars of company CIEL SHIP MANAGEMENT LTD

15 name and signature of master to certify that the information under 14 is correct:  
Name OBERT WARD B-PAL-D-100 Signature

**16 details of ship certificates**

1	0110 Cargo Ship Safety Equipment Cert	A/B/S	20-12-2010	20-06-2015
2	0111 Cargo Ship Safety Construction Cert	A/B/S	23-11-2010	30-09-2016
3	0113 Cargo Ship Safety Radio Cert	A/B/S	23-11-2010	30-09-2015
4	0114 Cargo Ship Safety Cert			
5	0116 Document of Compliance	G. L	20-05-2007	25-04-2012
6	0117 Safety Management Cert	G. I	04-05-2011	03-10-2011
7	0120 Load line Cert.	A/B/S	23-11-2010	30-09-2015
8	0135 Minimum Safe Manning Document	FLAG STATE	23-11-2010	
9	0150 IOPP Cert	A/B/S	23-11-2010	30-09-2015
10	0157 ISPP Cert	A/B/S	23-11-2010	30-09-2015
11	0160 ISS Cert	A/B/S	23-11-2010	30-09-2015
12	0165 APP Cert	A/B/S	02-05-2011	21-05-2016
13	0180 Tonnage	A/B/S	23-11-2010	30-09-2015
14	0199 OtherCertificates)	A/B/S	02-12-2010	
15	2820 Contingency arrangements			

15 2020 Continuous Synopsis Record No. 17785  
Anti-foulants cost  
d information on last intermediate or annual survey  
Date Surveying authority

1	0110	
2	0111	
3	0113	
4	0114	
5	0116	
6	0117	Intermediate
7	0120	
8	0135	
9	0150	
10	0157	
11	0160	Intermediate
12	0165	
13	0180	

17 deficiencies  
18 ship detained  
19 supporting documentation

no  yes (see attached FORM B)  
 no  yes \*\*\*  
 no  yes \*\*\*

Issuing Office: SHENZHEN M.S.A

Name \_\_\_\_\_

Total 120 m/s

Telephone +86-755-  
Fax +86-755-

This report must be retained on board for period of two years and must be available for consultation by Port State Control Officers at all times.

- \*) This inspection report has been issued solely for the purpose of informing the master and other port State that an inspection by the port State, mentioned in the heading, has taken place. This inspection report cannot be construed as a seaworthiness certificate in excess of the certificates the ship is required to carry.

\*\*) To be completed in the event of a detention.

\*\*\*) Masters and companies are advised that detailed information on a detention may be subject to future publication.

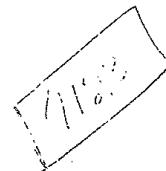
L0102

**FORM B**

**REPORT OF INSPECTION IN ACCORDANCE WITH THE MEMORANDUM  
OF UNDERSTANDING ON PORT STATE CONTROL IN THE ASIA-PACIFIC REGION\*)**

Authority: MARITIME SAFETY ADMINISTRATION OF  
THE PEOPLE'S REPUBLIC OF CHINA  
Add: 11, Jianguomennei Ave, Beijing, 100736  
Tel: +86-10-6529-2872  
Fax: +86-10-6529-2245  
Cable: MINOCOM  
Telex: 222258 CMSAR CN  
E-mail: [apjanscc@public.bta.net.cn](mailto:apjanscc@public.bta.net.cn)

Copy to: Master  
Head office  
PSCO  
If ship is detained, copy to:  
Flag State  
IMO  
Recognized organization, if applicable



2 name of ship	2 IMO number				
10 date of inspection	11 place of inspection				
20 number	21 code	nature of deficiency <sup>4)</sup>	convention <sup>5)</sup> reference	22 action taken <sup>6)</sup>	23 responsible RO <sup>5)</sup>
1. N60.		CHART ROOM NOT CARRIED UP TO DATE		16	(OK)
2. 0611.		PORTABLE RADIOTEL TEL CABLE OVER BREAKER		17	(OK)
3. 0613.		REINFORCING FOR RELEASE UNIT PORTSIDE LIFEBOAT		17	(OK)
4. 1648.		ANTENNA SPAR SECURED BY TEMPORARY STRUT. ON MONKEY ISLAND		16	(OK)
5. 1699.		BARD. SHARP FOR BARTH WIRE TO ANTENNA BROKEN		16	(OK)
6. 0708.		TRIMAR. PART DAMPER RABBLE TO BE CLOSED FULLY		17	(OK)
7. 0833.		MANY LOSSES SPARE PARTS STORED IN WAY OF BOLTER		17	(OK)
8. 1410.		PLASTIC HOSE USED NOT APPROVED BY CLASS FOR INSULATOR		16	(OK)
9. 1410.		CYLINDER OIL LEAKING FOR MAIN ENGINE		17	(OK)
10. 0789.		MAIN ENGINE PUMP LEAKING SEPARATELY		17	(OK)
11. 0530.		ACCUMULATION OF WATER IN MAIN ENGINE PUMP SPACE		17	(OK)
12. 0520.		LEAKT TUBE IN CO. ROOM OUT OF WORK		17	(OK)

Name [REDACTED]  
(duly authorized PSCO (if reporting authority))

Signature [REDACTED]

- 4) This inspection was not a full survey and deficiencies listed may not be exhaustive. In the event of a detention, it is recommended that full survey is carried out of and all deficiencies are rectified before an application for re-inspection is made.  
 5) To be completed in the event of a detention.  
 6) Applicable Deficiency Action Codes (see reverse side of copy) to be entered.

Ver/2005

**FORM B**

**REPORT OF INSPECTION IN ACCORDANCE WITH THE MEMORANDUM  
OF UNDERSTANDING ON PORT STATE CONTROL IN THE ASIA-PACIFIC REGION\***

**Authority:** MARITIME SAFETY ADMINISTRATION OF  
THE PEOPLE'S REPUBLIC OF CHINA  
**Address:** 11, Jianguomennei Ave, Beijing, 100736  
**Tel:** +86-10-6529-2872  
**Fax:** +86-10-6529-2245  
**Cable:** MINOCOM  
**Telex:** 222258 CMSAR CN  
**E-mail:** [amnmsa@public.bat.net.cn](mailto:amnmsa@public.bat.net.cn)

**Copy to:** Master  
Head office  
PSCO  
**If ship is detained, copy to:**  
Flag State  
IMO  
Recognized organization, if applicable

Name \_\_\_\_\_  
(duly authorized PSCO of reporting authority)

- 4) This inspection was not a full survey and deficiencies listed may not be exhaustive. In the event of a detention, it is recommended that full survey is carried out of and all deficiencies are rectified before an application for re-inspection is made.  
5) To be completed in the event of a detention.  
6) Applicable Deficiency Action Codes (see reverse side of copy) to be entered.

Vcr/2005

## Appendix 4: Port state control inspection report (Fremantle)

### FORM A

#### REPORT OF INSPECTION IN ACCORDANCE WITH THE MEMORANDUM OF UNDERSTANDING ON PORT STATE CONTROL

copy to: master  
head office  
PSCO

If ship detained copy to: Flag State  
IMO  
recognized organization, if applicable

1 name of reporting authority 035 - Australia

3 flag of ship 375 - Liberia

4 type of ship 53 - Container ship

2 name of ship RENA

5 call sign/MMSI A8XJ7/636014911

6 IMO number 8806802

7 gross tonnage 37209

8 deadweight

9 year of build 1989

10 date of inspection 21.07.2011

11 place of inspection 9476 - Fremantle,

WA

12 classification society 906 - American Bureau of Shipping

13 date of release from detention 22.07.2011

14a IMO Company number 1998297

14b particulars of company Ciel Shipmanagement

SA

15 name and signature of master to certify that the information under 14 is correct:

name \_\_\_\_\_

signature \_\_\_\_\_

16 list of relevant certificate(s):

code	title	issuing authority	terms		annual or intermediate survey		
			date of issue	date of expiry	date	surveying authority	place
0110	Cargo ship safety equipment (including Exemption)	American Bureau of Shipping	30.12.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0111	Cargo ship safety construction (including Exemption)	American Bureau of Shipping	23.11.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0113	Cargo ship safety radio (including Exemption)	American Bureau of Shipping	23.11.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0116	Document of Compliance (DoC/ISM Code)	Germanischer Lloyd	30.05.2007	25.04.2012	05.07.2011	Germanischer Lloyd	ATHENS
0117	Safety management certificate (SMC/ISM Code)	Germanischer Lloyd	30.05.2011	03.05.2016			
0120	Load lines	American Bureau of Shipping	23.11.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0135	Minimum safe Manning document	Liberia	22.11.2010				
0150	Prevention of pollution by oil (IOPP)	American Bureau of Shipping	23.11.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0157	International sewage pollution prevention certificate	American Bureau of Shipping	23.11.2010	30.04.2015			
0160	International ship security certificate	Liberia	02.05.2011	01.05.2016			
0165	International Air Pollution Prevention Certificate (IAPP)	American Bureau of Shipping	23.11.2010	30.04.2015	11.07.2011	American Bureau of Shipping	SINGAPORE
0176	International Anti-fouling-System Certificate (IAFSC)	American Bureau of Shipping	23.11.2010				
0180	Tonnage	American Bureau of Shipping	02.12.2010				

Inspection actions taken:

- 26 - Competent security authority informed
- 27 - Ship expelled on security grounds
- 40 - next port informed
- 45 - rectify detainable deficiencies at next port
- 50 - flag state/consul informed
- 55 - flag state consulted
- 70 - recognized organization informed
- 85 - investigation of contravention of discharge provisions (MARPOL)

17 deficiencies

18 ship detained

yes

19 supporting documentation

yes/no

**FORM B**

**REPORT OF INSPECTION IN ACCORDANCE WITH THE MEMORANDUM OF  
UNDERSTANDING ON PORT STATE CONTROL**

copy to: master  
 head office  
 PSCO  
 if ship detained copy to: Flag State  
 IMO  
 recognized organization, if applicable

2 name of ship RENA

10 date of inspection 21.07.2011

6 IMO number 8806802

11 place of inspection 9476 - Fremantle, WA

20 list of deficiencies

No.	code	nature of deficiency	convention	action(s) taken	responsible RO code	images
1	1570	SAFETY OF NAVIGATION/nautical publications, Sailing directions NP13, list of lights Vol K, List of Radio Vol 6/4 not corrected.		17 - rectify deficiency before departure		
2	1623	RADIOCOMMUNICATIONS/MF/HF radio installation, MF/HF unable to operate on reserve power source		17 - rectify deficiency before departure		
3	1568	SAFETY OF NAVIGATION/Voyage data recorder (VDR), VDR data memory capsule wrapped in canvas.		17 - rectify deficiency before departure		
4	0692	LIFESAVING APPLIANCES/operational readiness of lifesaving appliances, Std lifeboat - secondary means starting failed		17 - rectify deficiency before departure		
5	0610	LIFESAVING APPLIANCES/lifeboats, Lifeboat windows opaque.		16 - rectify deficiency within 14 days		
6	0692	LIFESAVING APPLIANCES/operational readiness of lifesaving appliances, Std lifeboat - steering not responding promptly to helm.		17 - rectify deficiency before departure		
7	0950	STABILITY, STRUCTURE AND RELATED EQUIPMENT/electric equipment in general, Earth fault 220V @ Emergency Switchboard.		17 - rectify deficiency before departure		
8	0950	STABILITY, STRUCTURE AND RELATED EQUIPMENT/electric equipment in general, Earth monitoring equipment 440V @ emergency switchboard disconnected.		17 - rectify deficiency before departure		
9	1499	PROPELLION AND AUXILIARY MACHINERY/other, Doublers fitted to SW piping serving -- Emerg fire pump, No 1 Fire pump & ballast ejector overboard - no evidence of Class involvement		17 - rectify deficiency before departure		
10	0746	FIRE SAFETY MEASURES/jacketed piping system for high pressure fuel lines, Securing arrangements missing several locations for jacketed piping system serving high pressure fuel lines.		17 - rectify deficiency before departure		
11	1745	MARPOL - ANNEX I/15 PPM alarm arrangements, 15PPM alarm arrangement - wiring modified & no evidence of Class involvement.		17 - rectify deficiency before departure		
12	1110	CARRIAGE OF CARGO AND DANGEROUS GOODS/stowage of cargo, Cargo not stowed and secured as per cargo securing manual	Solas 2009 ChVI R5	30 - detainable deficiency		
13	1250	LOAD LINES/covers (hatchway-, portable-, tarpaulins, etc.), Hatchway cover securing arrangements defective	LL66/ANI/R16	30 - detainable deficiency	906	
14	0710	FIRE SAFETY MEASURES/fire prevention, Build up oil grease in galley uptake.		17 - rectify deficiency before departure		
15	1581	SAFETY OF NAVIGATION/rudder angle indicator, Rudder angle indicators on bridgewings - markings faded		16 - rectify deficiency within 14 days		
16	2099	SOLAS RELATED OPERATIONAL DEFICIENCIES/other, Vessel has not been maintained between surveys as evidenced by deficiencies No 1 - 15 above.	Solas 2009 ChI R 11	30 - detainable deficiency		
17	2550	ISM RELATED DEFICIENCIES/maintenance of the ship and equipment, ISM has not ensured maintenance of ship and equipment as evidenced by deficiencies No 1 - 15 above.		18 - rectify deficiency within 3 months		

PSCO name: \_\_\_\_\_

signature: \_\_\_\_\_

## **Appendix 5: Chronology of amendments to IMO STCW Convention 1978**

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STCW 78 – Adoption: 7 July 1978

Entry into force: 28 April 1984

### **Amendment Procedure**

Amendments to the 1978 STCW Convention's technical Annex may be adopted by a Conference of STCW Parties or by IMO's Maritime Safety Committee, expanded to include all Contracting Parties, some of whom may not be members of the Organization.

Amendments to the STCW Annex will normally enter into force one and a half years after being communicated to all Parties unless, in the meantime, they are rejected by one-third of the Parties or by Parties whose combined fleets represent 50 per cent of world tonnage.

### **The 2010 amendments**

The Manila amendments to the STCW Convention and Code were adopted on 25 June 2010, marking a major revision of the STCW Convention and Code. The 2010 amendments are set to enter into force on 1 January 2012 under the tacit acceptance procedure and are aimed at bringing the Convention and Code up to date with developments since they were initially adopted and to enable them to address issues that are anticipated to emerge in the foreseeable future.

Amongst the amendments adopted, there are a number of important changes to each chapter of the Convention and Code, including:

Improved measures to prevent fraudulent practices associated with certificates of competency and strengthen the evaluation process (monitoring of Parties' compliance with the Convention);

Revised requirements on hours of work and rest and new requirements for the prevention of drug and alcohol abuse, as well as updated standards relating to medical fitness standards for seafarers;

New certification requirements for able seafarers;

New requirements relating to training in modern technology such as electronic charts and information systems (ECDIS);

New requirements for marine environment awareness training and training in leadership and teamwork;

New training and certification requirements for electro-technical officers;

Updating of competence requirements for personnel serving on board all types of tankers, including new requirements for personnel serving on liquefied gas tankers;

New requirements for security training, as well as provisions to ensure that seafarers are properly trained to cope if their ship comes under attack by pirates;

Introduction of modern training methodology including distance learning and web-based learning;

New training guidance for personnel serving on board ships operating in polar waters; and

New training guidance for personnel operating Dynamic Positioning Systems.

### **The 2006 amendments**

Adoption: May 2006

Entry into force: 1 January 2008

The amendments added new minimum mandatory training and certification requirements for persons to be designated as ship security officers (SSOs). The amendments to the STCW Convention and to parts A and B of the STCW Code include Requirements for the issue of certificates of proficiency for Ship Security Officers; Specifications of minimum standards of proficiency for ship security officers; and Guidance regarding training for Ship Security Officers.

Further amendments to part A of the STCW Code added additional training requirements for the launching and recovery of fast rescue boats. The amendments have been prepared in response to reports of injuries to seafarers in numerous incidents involving the launching and recovery of fast rescue boats in adverse weather conditions.

The 1998 Amendments

Adoption: 9 December 1998

Entry into force: 1 January 2003

Amendments to the STCW Code are aimed at improving minimum standards of competence of crews, in particular relating to cargo securing, loading and unloading on bulk carriers, since these procedures have the potential to put undue stresses on the ship's structure. The amendments concern sections A-II/1 and A-II/2 under "Cargo handling and stowage at the operational and management levels".

The 1997 Amendments

Adoption: June 1997

Entry into force: 1 January 1999

The amendments concern training for personnel on passenger ships. The amendments include an additional Regulation V/3 in Chapter V on Mandatory minimum requirements for the training and qualifications of masters, officers, ratings and other personnel on passenger ships other than ro-ro passenger ships. Related additions are also made to the STCW Code, covering Crowd management training; Familiarization training; Safety training for personnel providing direct service to passengers in passenger spaces; Passenger safety; and Crisis management and human behaviour training.

The 1995 amendments

Adoption: 7 July 1995

Entry into force: 1 February 1997

The 1995 amendments – a major revision

Ensuring compliance with the Convention

Port state control 1995 amendments – chapters II, III, IV

1995 amendments – Chapter V: Special training requirements for personnel on certain types of ships

1995 amendments – Chapter VI: Emergency, occupational safety, medical care and survival functions

1995 amendments – Chapter VII: Alternative certification

1995 amendments – Chapter VIII: Watchkeeping

The STCW Code

The "White List"

## The 1995 amendments – a major revision

The 1995 amendments, adopted by a Conference, represented a major revision of the Convention, in response to a recognized need to bring the Convention up to date and to respond to critics who pointed out the many vague phrases, such as “to the satisfaction of the Administration”, which resulted in different interpretations being made.

Others complained that the Convention was never uniformly applied and did not impose any strict obligations on Parties regarding implementation. The 1995 amendments entered into force on 1 February 1997. However, until 1 February 2002, Parties may continue to issue, recognize and endorse certificates which applied before that date in respect of seafarers who began training or seagoing service before 1 August 1998.

One of the major features of the revision was the division of the technical annex into regulations, divided into Chapters as before, and a new STCW Code, to which many technical regulations have been transferred. Part A of the Code is mandatory while Part B is recommended.

Dividing the regulations up in this way makes administration easier and it also makes the task of revising and updating them more simple: for procedural and legal reasons there is no need to call a full conference to make changes to Codes.

Some of the most important amendments adopted by the Conference concern Chapter I – General Provisions. They include the following:

### Ensuring compliance with the Convention

Parties to the Convention are required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention. This represented the first time that IMO had been called upon to act in relation to compliance and implementation – generally, implementation is down to the flag States, while port state control also acts to ensure compliance. Under Chapter I, regulation I/7 of the revised Convention, Parties are required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention, education and training courses, certification procedures and other factors relevant to implementation.

By 1 August 1998 – the deadline for submission of information established in section A-I/7 of the STCW Code – 82 out of the 133 STCW Parties had communicated information on compliance with the requirements of the revised Convention. The 82 Parties which met the deadline represent well over 90% of the world's ships and seafarers.

The information is reviewed by panels of competent persons, nominated by Parties to the STCW Convention, who report on their findings to the IMO Secretary-General, who, in turn, reports to the Maritime Safety Committee (MSC) on the Parties which fully comply. The MSC then produces a list of Parties in compliance with the 1995 amendments.

The first list of countries was approved by the MSC at its 73rd session held from 27 November to 6 December 2000 – it included 71 countries and one Associate Member of IMO.

### Port state control

The revised Chapter I includes enhanced procedures concerning the exercise of port state to allow intervention in the case of deficiencies deemed to pose a danger to persons, property or the environment (regulation I/4). This can take place if certificates are not in order or if the ship is involved in a collision or grounding, if there is an illegal discharge of substances (causing pollution) or if the ship is manoeuvred in an erratic or unsafe manner, etc.

Other regulations in chapter I include:

Measures are introduced for watchkeeping personnel to prevent fatigue.

Parties are required to establish procedures for investigating acts by persons to whom they have issued certificates that endanger safety or the environment. Penalties and other disciplinary measures must be prescribed and enforced where the Convention is not complied with.

Technical innovations, such as the use of simulators for training and assessment purposes have been recognized. Simulators are mandatory for training in the use of radar and automatic radar plotting aids (regulation I/12 and section A-I/12 of the STCW Code).

Parties are required to ensure that training, certification and other procedures are continuously monitored by means of a quality standards system (regulation I/8).

Every master, officer and radio operator are required at intervals not exceeding five years to meet the fitness standards and the levels of professional competence contained in Section A-I/11 of the STCW Code. In order to assess the need for revalidation of certificates after 1 February 2002, Parties must compare the standards of competence previously required with those specified in the appropriate certificate in part A of the STCW Code. If necessary, the holders of certificates may be required to undergo training or refresher courses (regulation I/11).

## Chapter II: Master and deck department

The Chapter was revised and updated.

## Chapter III: Engine department

The Chapter was revised and updated.

## Chapter IV: Radio communication and radio personnel

The Chapter was revised and updated.

## Chapter V: Special training requirements for personnel on certain types of ships

Special requirements were introduced concerning the training and qualifications of personnel on board ro-ro passenger ships. Previously the only special requirements in the Convention concerned crews on tankers. This change was made in response to proposals made by the Panel of Experts set up to look into ro-ro safety following the capsizing and sinking of the ferry Estonia in September 1994. Crews on ro-ro ferries have to receive training in technical aspects and also in crowd and crisis management and human behaviour.

## Chapter VI: Emergency, occupational safety, medical care and survival functions

The Chapter incorporates the previous Chapter VI: Proficiency in survival craft and includes mandatory minimum requirements for familiarization, basic safety training and instruction for all seafarers; mandatory minimum requirements for the issue of certificates of proficiency in survival craft, rescue boats and fast rescue boats; mandatory minimum requirements for training in advanced firefighting; and mandatory minimum requirements relating to medical first aid and medical care.

## Chapter VII: Alternative certification

Regulations regarding alternative certification (also known as the functional approach) are included in a new Chapter VII. This involves enabling crews to gain training and certification in various departments of seafaring rather than being confined to one branch (such as deck or engine room) for their entire career. Although it is a relatively new concept, the 1995 Conference was anxious not to prevent its development. At the same time, the new Chapter is intended to ensure that safety and the environment are not threatened in any way. The use of equivalent educational and training arrangements is permitted under article IX.

## Chapter VIII: Watchkeeping

Measures were introduced for watchkeeping personnel to prevent fatigue. Administrations are required to establish and enforce rest periods for watchkeeping personnel and to ensure that watch systems are so arranged that the efficiency of watchkeeping personnel is not impaired by fatigue.

### The STCW Code

The regulations contained in the Convention are supported by sections in the STCW Code. Generally speaking, the Convention contains basic requirements which are then enlarged upon and explained in the Code.

Part A of the Code is mandatory. The minimum standards of competence required for seagoing personnel are given in detail in a series of tables. Chapter II of the Code, for example, deals with standards regarding the master and deck department.

Part B of the Code contains recommended guidance which is intended to help Parties implement the Convention. The measures suggested are not mandatory and the examples given are only intended to illustrate how certain Convention requirements may be complied with. However, the recommendations in general represent an approach that has been harmonized by discussions within IMO and consultation with other international organizations.

### The “White List”

The first so-called “White list” of countries deemed to be giving “full and complete effect” to the revised STCW Convention (STCW 95) was published by IMO following the 73rd session of the Organization’s Maritime Safety Committee (MSC), meeting from 27 November to 6 December 2000.

It is expected that ships flying flags of countries that are not on the “White List” will be increasingly targeted by port state control inspectors. A Flag State Party that is on the “White List” may, as a matter of policy, elect not to accept seafarers with certificates issued by non “White List” countries for service on its ships. If it does accept such seafarers, they will be required by 1 February 2002 also to have an endorsement, issued by the flag State, to show that their certificate is recognized by the flag State.

By 1 February 2002, masters and officers should hold STCW 95 certificates or endorsements issued by the flag State. Certificates issued and endorsed under the provisions of the 1978 STCW Convention will be valid until their expiry date.

The list will be kept under review and may be added to as other countries meet the criteria for inclusion. Latest link of confirmed parties.

## Appendix 6: IMO announcement – publication of White List

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### 71 countries make IMO's initial STCW White List

*Maritime Safety Committee - 73rd session: 27 November - 6 December 2000*

The so-called "**White List**" of countries deemed to be giving "full and complete effect" to the revised STCW Convention (STCW 95) has been published by IMO. The 73rd session of the Organization's Maritime Safety Committee (MSC), meeting from 27 November to 6 December 2000, formally endorsed the findings of a working group established to examine a report made by the Secretary-General to the MSC, which revealed that 71 countries and one Associate Member of IMO had met the criteria for inclusion on the list.

The 1995 amendments to STCW (the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) which entered into force on 1 February 1997, revised and updated the original 1978 Convention, setting out clearly defined minimum competency requirements for all seafarers and taking into account developments in technology since the 1978 Convention was adopted. A position on the White List entitles other Parties to accept, in principle, that certificates issued by or on behalf of the parties on the list are in compliance with the Convention.

#### Tighter PSC targeting expected

It is expected that ships flying flags of countries that are not on the White List will be increasingly targeted by Port State Control inspectors. A Flag state Party that is on the White List may, as a matter of policy, elect not to accept seafarers with certificates issued by non White List countries for service on its ships. If it does accept such seafarers, they will be required by 1 February 2002 also to have an endorsement, issued by the flag state, to show that their certificate is recognized by the flag state. By 1 February 2002, masters and officers should hold STCW 95 certificates or endorsements issued by the flag State. Certificates issued and endorsed under the provisions of the 1978 STCW Convention will be valid until their expiry date.

It was stressed at the meeting that giving "full and complete effect" to the revised Convention may not be the same for all Parties. Some may choose not to have any maritime training institutes at all and rely on recognition of certificates issued to seafarers by other states. Similarly, some Parties may only provide a limited scope of training, such as for ratings only.

The fact that a Party is not listed on the White List does not invalidate certificates or endorsements issued by that Party. Nothing in the STCW Convention prevents the employment of any seafarer who holds a valid certificate or endorsement issued by a Party to the Convention. Nevertheless, the White List will become one of several criteria, including the inspection of facilities and procedures, that can be applied in the selection of properly trained and qualified seafarers. Countries not initially included in the White List will be able to continue with the assessment process with a view to inclusion on the list at a later stage.

The publication of the list marks the end of the first stage of a ground-breaking verification procedure in which, for the first time, IMO has been given a direct role in the implementation of one of its instruments. Panels of experts have spent much of the past two years engaged in rigorous assessment of information presented to them by Parties to the Convention concerning their ability to meet the standards enshrined in STCW 95. Panel members were selected, as far as possible, to give a wide geographical spread and a broad coverage of the different facets of the Convention - deck and engineering knowledge, for example. These panels submitted their findings to IMO Secretary-General William O'Neil, who in turn reported to the MSC which has now approved and issued the list.

#### Challenging task

For most countries, preparation of the submissions to the Secretary-General represented a demanding and challenging task. It required not only reporting on national laws, training requirements, standards and systems in place, but also ensuring that all of those elements met the revised Convention requirements and could pass the scrutiny of persons with detailed knowledge of those requirements.

According to Mr O'Neil, the publication of the White List is a clear demonstration that the global regulatory process for shipping is taking ever greater account of the human element. He said, "The revised STCW Convention and the ISM Code, which takes full effect in 2002, are both aimed squarely at addressing human issues in shipping. Although technical matters will retain their importance, improving the standards of seafarers is a vital part of the safety equation. The White List shows that the human element is taking its proper place in the industry's priorities."

#### Expanded role for IMO?

Mr O'Neil also said he believed the verification process pointed the way towards a new and expanded role for IMO in the future. "The fact that the authority for assessing implementation of STCW 1995 was delegated to IMO by Member States," he said, "indicates that the will to give the Organization a greater role in implementation does exist." He added, "If this approach can be extended into other areas where quality assurance needs to be reinforced and the name of IMO would lend credibility, then IMO is ready to respond."

It has been estimated that some 80 per cent of marine casualties are due in some part to human error. In setting out unambiguously which countries are meeting the latest standards and requirements, the White List marks a significant step forward in IMO's global effort to rid the world of sub-standard ships and shipping. For the first time, it provides an IMO "seal of approval" for countries that have properly implemented the provisions of a Convention.

**Parties included on the "White List" at 6 December 2000**

Argentina	Latvia	Ukraine
Australia	Liberia	United Kingdom***
Bahamas	Luxembourg	Uruguay
Bangladesh	Malaysia	USA
Belgium	Maldives	Vanuatu
Brazil	Malta	Venezuela
Bulgaria	Marshall Islands	Viet Nam
Canada	Mexico	Hong Kong China**
Colombia	Morocco	
Croatia	Netherlands	
Cuba	New Zealand	
Cyprus	Norway	
Chile	Pakistan	
China	Panama	
Denmark*	Peru	
Egypt	Philippines	
Estonia	Poland	
Finland	Portugal	
France	Republic of Korea	
Germany	Romania	
Ghana	Russian Federation	
Greece	Samoa	
Honduras	Singapore	
Iceland	South Africa	
India	Spain	
Indonesia	Sri Lanka	
Ireland	Sweden	
Israel	Thailand	
Italy	Tonga	* Includes Faeroe Islands
Jamaica	Trinidad and Tobago	** Associate Member
Japan	Turkey	***Includes Isle of Man, Bermuda, Cayman Islands, Gibraltar
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