Final report MO-2017-201: Passenger vessel *L'Austral* contact with rock Snares Islands, 9 January 2017

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

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

Final Report

Marine inquiry MO-2017-201
Passenger vessel *L'Austral* contact with rock Snares Islands,
9 January 2017

Approved for publication: February 2018

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. 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 and the public, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Peter McKenzie, QC
Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant
Commissioner	Paula Rose

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Richard Ford
General Counsel	Cathryn Bridge

Email	inquiries@taic.org.nz
Web	www.taic.org.nz
Telephone	+ 64 4 473 3112 (24 hrs) or 0800 188 926
Fax	+ 64 4 499 1510
Address	Level 16, 80 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

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.

Ownership of report

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this draft report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1982 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 report are provided by, and owned by, the Commission.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (Adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

L'Austral docking in Dunedin, January 2017

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Abbreviations

CATZOC	Category Zone of Confidence
Commission	Transport Accident Investigation Commission
ECDIS	electronic chart display and information system
ENC	electronic navigation chart
GPS	global positioning system
IMO	International Maritime Organization
LINZ	Land Information New Zealand
m	metre(s)
Ponant	Compagnie du Ponant
RHIB	rigid-hulled inflatable boat

Glossary

Category Zone of Confidence (CATZOC)	a symbol used in electronic chart display and information systems (ECDISs) for displaying the accuracy of the underlying data for a displayed chart (see Appendix 1)
classification society	an organisation that publishes its own classification rules (including technical standards' requirements) for the design, construction and surveying of ships
Chart datum	The level of water that charted depths displayed on a nautical chart are measured from
Double bottom	Hull design and construction method where the bottom of the ship has two complete layers of watertight hull surface.
Dynamic positioning	A computer-controlled system to automatically maintain a vessel's position.
Electronic chart display and information system (ECDIS)	an electronic charting system used as an alternative to paper charts
electronic navigational chart (ENC)	a digital chart viewable in ECDISs
Master	Responsible for safety of vessel and all on board
Navigation officer	the deck officer responsible for planning navigation and maintaining the chart catalogue
No-go zone	A way of visually representing an area the navigator does not want the vessel to enter
Officer of the watch	a deck officer assigned the duties of watch-keeping and navigation on a vessel's bridge
overfalls, eddies and breakers	a turbulent stretch of water caused by a strong current or tide over a submarine ridge, or by a meeting of currents
raster navigational chart	essentially an image or a photo of a paper chart
Sonar	A system for the detection of objects under water.
Voyage data recorder	a computer system containing a record of a vessel's operation and configuration for the purpose of accident investigation

Data summary

Vehicle particulars

Name:	*L'Austral*
Type:	passenger vessel
Class:	Bureau Veritas
Limits:	unlimited
Classification:	I ✠ HULL ✠ MACH passenger ship – unrestricted navigation COMF-NOISE 1, COMF-VIB 1, ✠ VeriSTAR-HULL, ✠ AUT-UMS, ✠ AUT-PORT, MON-SHAFT, CLEANSHIP, ICE CLASS IC, ✠ ALP, ✠ ALM
Length:	142.1 metres
Breadth:	18 metres
Gross tonnage:	10,944 tonnes
Built:	2010 by Fincantieri, Ancona, Italy
Propulsion:	two fixed-blade propellers driven by four INDAR electric SL ACP-900-X/14 (2,300 kilowatts each) electric engines
Primary means of navigation:	electronic chart display and information system
Service speed:	16 knots
Manager/Operator:	Compagnie du Ponant, of Marseille, France
Registered owner:	Ounas SAS
Port of registry:	Mata Utu, French international registry

Date and time	9 January 2017 at about 1508[1]
Location	south of Alert Stack, Snares Islands
Persons involved	156 crew and 200 passengers
Injuries	nil
Damage	loss of hull's watertight integrity through piercing and cracking into one void space

[1] Times in this report are in New Zealand Daylight Time (Co-ordinated Universal Time + 13 hours) and are expressed in the 24-hour format

1. Executive summary

1.1. *L'Austral* was a French-registered passenger vessel that was operating a 16-night cruise of New Zealand's South Island, including its sub-Antarctic islands. On 7 January 2017 *L'Austral* sailed from Lyttelton with 200 passengers and 156 crew on board, bound for the Snares Islands, south of New Zealand.

1.2. *L'Austral* arrived off the Snares Islands early on the morning of 9 January 2017. The passengers spent the morning making shoreline excursions in rigid-hulled inflatable boats, observing the wildlife. That afternoon the weather became unsuitable for small-boat excursions, so *L'Austral* rendezvoused with the boats in the sheltered water to the south of the islands to take them back on board.

1.3. While the master was focused on manoeuvring the ship to facilitate the safe recovery of the rigid-hulled inflatable boats, the ship drifted into a 300-metre unauthorised zone, where it contacted an uncharted rock. The rock pierced the hull in an empty void tank, which flooded with water. The damaged compartment had little effect on the ship's stability, and the ship was able to continue to another sub-Antarctic island before returning to New Zealand for temporary repairs. Nobody was injured.

1.4. The Transport Accident Investigation Commission (Commission) found that *L'Austral* inadvertently entered the 300-metre unauthorised zone, which the ship was not permitted to enter and in which the charts noted the existence of overfalls, eddies and breakers.

1.5. The uncharted rock was in an area that the Commission considers was not suitable for the safe navigation of ships the size of *L'Austral*.

1.6. The Commission also found: that the activity to recover the ship's rigid-hulled inflatable boats was not well planned; that the ship's position was not being adequately monitored; and that the standard of bridge resource management on board *L'Austral* did not meet good industry practice.

1.7. The Commission identified three safety issues:

- the voyage planning for the time in the Snares Islands and the standard of bridge resource management on the bridge leading up to the contact did not meet the International Maritime Organization standards or follow the guidelines published in other leading industry publications
- the operation of *L'Austral*'s electronic chart display and information system did not meet good practice as defined in the International Maritime Organization guidance or the standards set out in the operator's safety management system
- The Department of Conservation had insufficient maritime expertise applied to assessing the risks to ships and the environment.

1.8. The Commission made two recommendations to the operator to address the safety issues regarding the standards of voyage planning, the bridge resource management, and the training and use of electronic chart display and information systems.

1.9. The Commission made one recommendation to the Director-General of the Department of Conservation that, given the potentially harsh and sensitive environment in the sub-Antarctic islands and the likelihood that shipping activity will increase in future, he appoint a suitably qualified person to manage the safety of navigation in the sub-Antarctic islands.

1.10. The key lessons arising from this inquiry were:

- an electronic chart display and information system is a valuable aid to navigation. However, mariners need to understand fully and be familiar with all aspects of the system, otherwise relying on the electronic chart display and information system as a primary means of navigation can contribute to, rather than prevent, accidents

- every part of a ship’s voyage must be planned, and all members of the bridge team must be fully familiar with and agree to the plan. This is a cornerstone of good bridge resource management
- good bridge resource management relies on a culture where challenge is welcomed and responded to, regardless of rank, personality or nationality.

2. Conduct of the inquiry

2.1. The Transport Accident Investigation Commission (Commission) was advised of the accident by email from Maritime New Zealand on 13 January 2017, four days after the occurrence. The Commission opened an inquiry under section 13(1)b of the Transport Accident Investigation Commission Act 1990, and appointed an investigator in charge.

2.2. On 13 January 2017 two investigators deployed to Bluff where *L'Austral* had berthed the previous day. The two investigators interviewed the master and gathered perishable evidence.

2.3. On 13 January 2017 contact was established with the Bureau d'Enquêtes sur les Événements de Mer, (BEAmer) the French safety investigation authority. It was agreed that New Zealand would lead the marine safety investigation in accordance with the International Maritime Organization (IMO) Casualty Investigation Code, Chapter 7.

2.4. On 14 January 2017 *L'Austral* had temporary repairs completed and was cleared by Maritime New Zealand to sail.

2.5. On 24 January 2017 two investigators met *L'Austral* when it berthed in Dunedin. They conducted further interviews with the master, the officer of the watch[2] and the chief engineer.

2.6. On 3 April 2017 and 4 May 2017 two investigators interviewed Department of Conservation employees in relation to permits granted to *L'Austral*.

2.7. On 26 October 2017 the Commission approved the draft report for distribution to interested persons for comment.

2.8. The draft report was circulated to nine interested persons. Seven responses were received.

2.9. The Commission considered these submissions in detail and any changes as a result have been included in the final report.

2.10. The Commission approved the final report for publication on 21 February 2018.

[2] A deck officer assigned the duties of watch-keeping and navigation on a vessel's bridge.

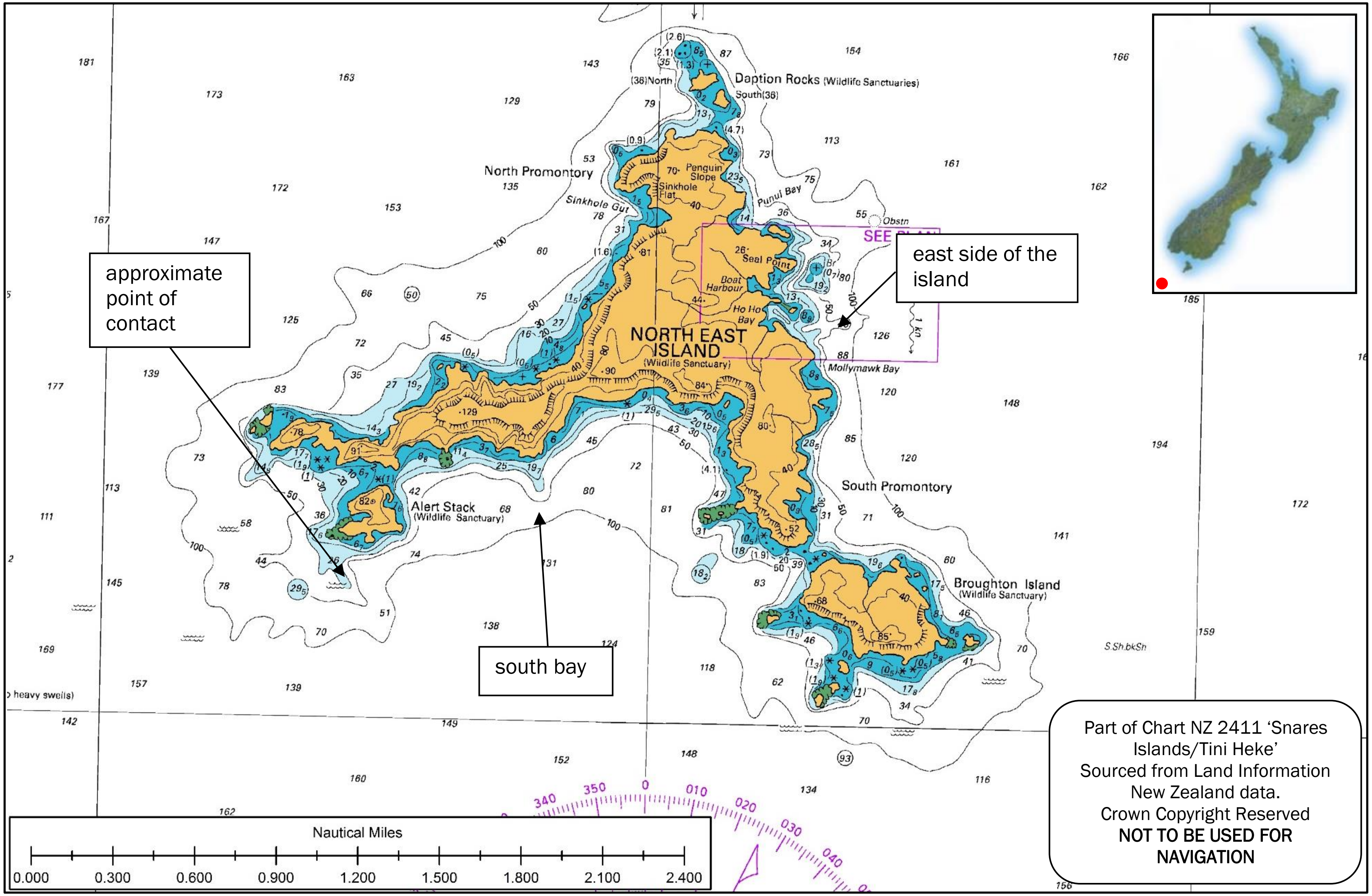


Figure 1
The general area of the accident

3. Factual information

3.1. Background

3.1.1. *L'Austral* was a French-registered passenger vessel that was operating a 16-night luxury cruise of New Zealand's South Island and the UNESCO World Heritage Site[3] sub-Antarctic islands. With a draught of five metres (m), it was capable of positioning close inshore, from where its own small, rigid-hulled inflatable boats (RHIBs) were used to get passengers close inshore to observe wildlife and scenery.

3.2. Narrative

3.2.1. On 7 January 2017 *L'Austral* sailed from Lyttelton with 200 passengers and 156 crew on board. The navigation officer[4] joined the ship in Lyttelton. It was her first time on the ship as navigation officer.

3.2.2. During the departure from Lyttelton the master altered the vessel's schedule to call first at the Snares Islands due to a favourable weather forecast.

Figure 2
Stern of *L'Austral* showing the 'marina'

[3] An area that reflects the world's cultural and natural diversity and is of outstanding universal value.

[4] The deck officer responsible for planning navigation, maintaining the chart catalogue, making decisions on steering and manoeuvring the ship, and controlling navigation and communications.

3.2.3. *L'Austral* arrived off North East Island in the Snares Islands group at about 0600 on 9 January 2017. Whilst the vessel manoeuvred close inshore, the passengers embarked onto the RHIBs from the stern platform (referred to on board as the marina – see Figure 2). The RHIBs then cruised around the east coast of the island, allowing the passengers to view the wildlife.

3.2.4. The master took control[5] of the vessel from the officer of the watch while the vessel was manoeuvring off North East Island.

3.2.5. The passengers returned to the vessel for lunch, while the boat crews took the RHIBs to the south of the island to assess if the weather conditions were suitable to take the passengers out in the afternoon.

3.2.6. At approximately 1200 the navigation officer took over the watch and continued to assist the master with the navigation.

3.2.7. The navigation officer used the electronic chart display and information system (ECDIS) to plan a route for repositioning the vessel south of the island (see Figure 3). The master and the navigation officer then took the vessel from the east side of the island around to the south bay. A helmsman steered the ship manually for this short trip.

3.2.8. However, the weather conditions were deteriorating, so the master cancelled the post-lunch passenger excursions. *L'Austral's* crew then started to recover the RHIBs back on board, but due to the prevailing weather conditions the recovery took longer than normal. To obtain the best sea conditions for recovering the RHIBs, the master manoeuvred the ship to maintain a southerly heading whilst drifting sideways to the west, as shown in Figure 3.

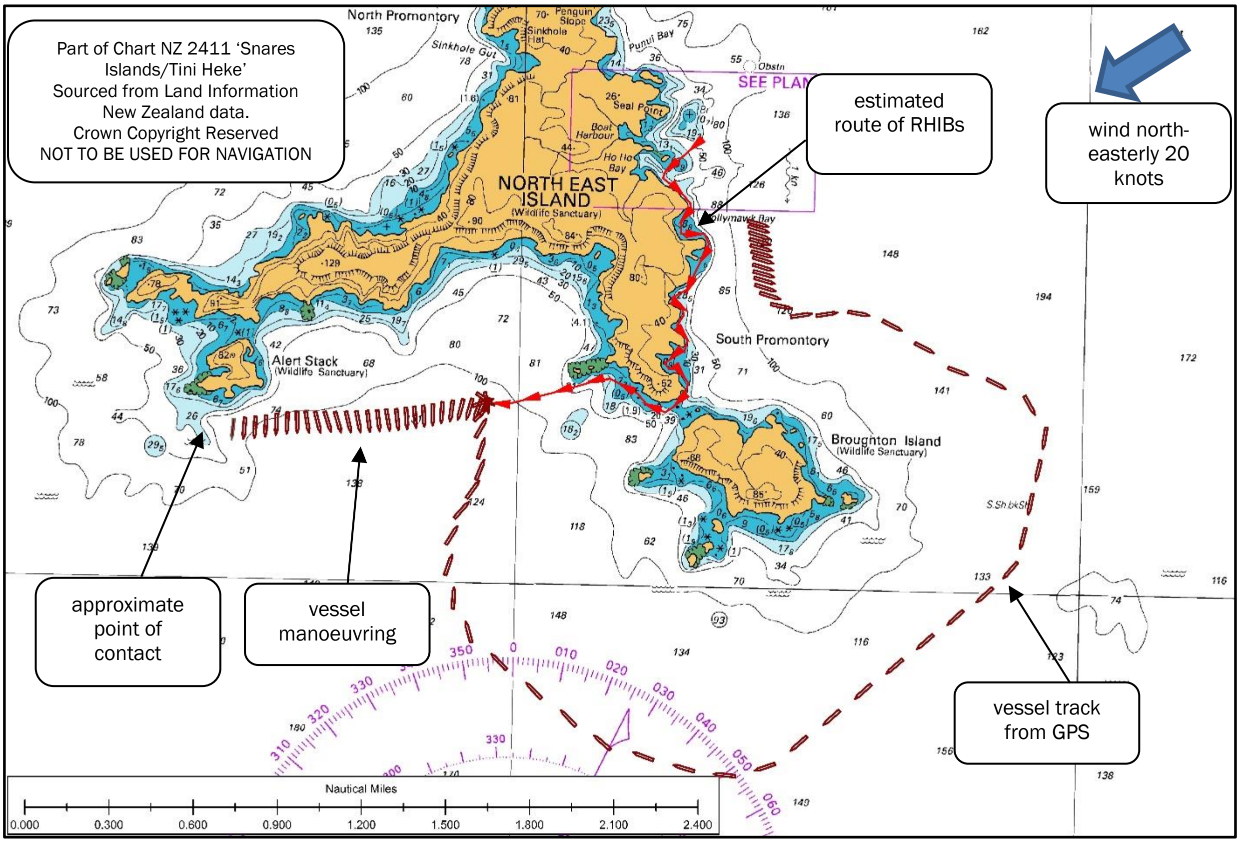


Figure 3
GPS position of *L'Austral*, ship delineation to scale

[5] Directing the navigation of the vessel.

3.2.9. *L'Austral* eventually drifted into an area marked on charts as overfalls, eddies and breakers[6] south of Alert Stack. At about 1508 the master and the navigation officer both heard an unusual sound at the stern, but thought it was caused by a wave "slamming" under the boarding platform at the stern. The navigation officer plotted the ship's position on the paper chart at this time.

3.2.10. At about 1510 both the port and the starboard flooding alarms sounded in the engine control room, indicating a flood in number 8C void space, which was forward of the engine room and near the longitudinal centre of the vessel.

3.2.11. The engineering officer of the watch sent a cadet[7] to investigate. The cadet removed the cap from the sounding pipe[8] for the void space. Water flowed out of the sounding pipe, so he re-secured the cap, returned to the engine control room and briefed the engineering officer, who informed the master on the bridge. The damage control team mustered on the bridge. They monitored the tanks and spaces adjacent to the flooded void space to ensure there was no further flooding.

3.2.12. It then became apparent to the crew that the unusual sound they had heard was in fact an underwater object that must have pierced the hull.

3.2.13. By about 1600 all of the RHIBs had been stowed on the upper deck and their crews were back on board.

3.2.14. At about 1630 the damage control team briefed the master. They confirmed that the adjacent compartments were dry and that flooding had been contained to just one void space. They recalculated the stability of the vessel, which confirmed that the ship's stability was not adversely affected by the flooded void space. The master contacted the vessel's operator, Compagnie du Ponant (Ponant), to report the damage and it in turn contacted the French authorities. The master then decided to continue the passage to Auckland Island, about 140 nautical miles south of the Snares Islands (Figure 4).

[6] A turbulent stretch of water caused by a strong current or tide over a submarine ridge, or by a meeting of currents.
[7] A junior member of the deck or engineering team under training.
[8] A steel pipe leading down to a void, through which a sounding line can be lowered to measure the depth of water in the void space.

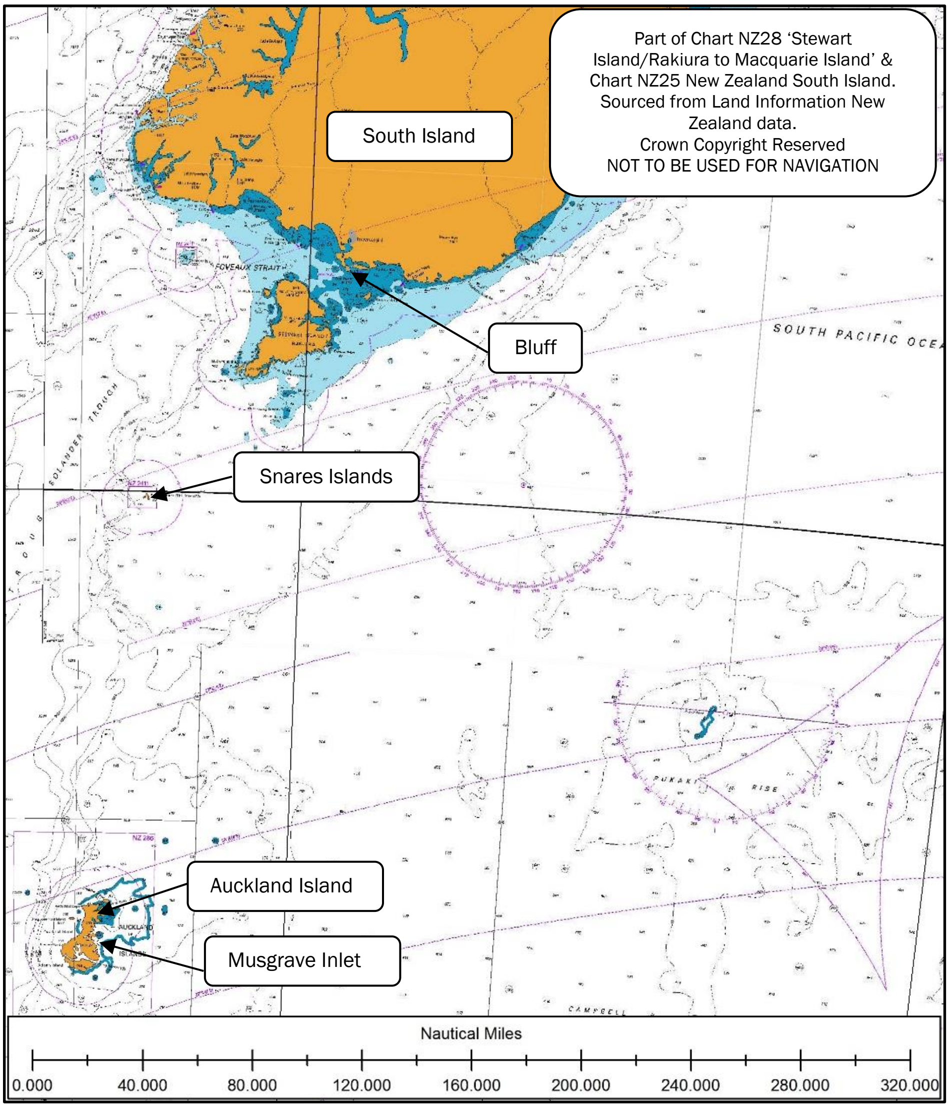


Figure 4
Chart showing location of Auckland Island

3.2.15. *L'Austral* arrived at Auckland Island on the morning of 10 January 2017. Two of the crew members used self-contained underwater breathing apparatus to dive under the vessel and take photographs of the breach in the hull.

3.2.16. The master was subsequently briefed on the damage and updated the report to the operator. The operator then directed the master to sail *L'Austral* to Bluff for repairs.

3.2.17. On the morning of 11 January 2017, *L'Austral* sailed south to Musgrave Inlet (Figure 4) so the passengers could cruise the inlet in RHIBs. The vessel then sailed for Bluff.

3.2.18. *L'Austral* arrived in Bluff (Figure 4) on the evening of 12 January 2017, where a classification society[9] surveyor and an underwater repair team were assembled to survey the damage and make temporary repairs.

[9] An organisation that publishes its own classification rules (including technical standards' requirements) for the design, construction and surveying of ships.

3.2.19. Maritime New Zealand inspected the vessel and detained it for the purpose of conducting a maritime compliance investigation.

3.2.20. On 14 January 2017 Maritime New Zealand released *L'Austral* from the detention orders. *L'Austral* sailed from Bluff and continued the cruise to the sub-Antarctic islands.

3.3. Vessel details

3.3.1. *L'Austral* was a passenger vessel built by Fincantieri, Ancona in Italy in 2010. The registered owner was Ounas SAS in France and it was operated by Ponant.

3.3.2. *L'Austral* had a length overall of 142.1 m, a breadth of 18 m and a maximum draught of 4.8 m. It was powered by four diesel-electric generators supplying two electric motors, each connected to a single fixed-pitch propeller. It had two high-lift Becker[10] rudders and a single 800-kilowatt bow-thruster[11].

3.3.3. *L'Austral* was fitted with a Class 1 dynamic positioning system that allowed the vessel to automatically maintain its position and heading with a high degree of accuracy. The dynamic positioning system was not in use at the time of the accident.

3.3.4. *L'Austral* was equipped with a long-range, forward-looking sonar, a system for detecting objects under water. The sonar was not in use at the time of the accident.

3.4. Environmental conditions

3.4.1. The coastal marine forecast on 9 January 2017 for the area six nautical miles north of the Snares Islands was for wind from the north-east at 15 knots rising to 25 knots in the afternoon. The sea state was forecast to become rough with a 2 m south-west swell.

3.4.2. At the time of the accident the wind was north-easterly about 20 knots and the swell was reported to be of 2-3 m from the south-west. The visibility was good. It was two hours before low tide at the time of the accident, which was 0.8 m above chart datum[12].

3.4.3. At the time of the accident there was little predicted tidal stream that could have contributed to the movement of the vessel.

3.5. Accident damage

3.5.1. The accident resulted in a number of penetrations to the hull, the main one being 600 x 80 millimetres in size. Two keel plates were slightly bent. One frame was distorted inside the penetrated void space.

3.5.2. The penetration damage was confined to void space 8C (Figure 5) in the vessel's double-bottom[13] arrangement. There was no pollution reported.

[10] Rudders fitted with articulated trailing-edge flaps that increase the air foil shape of the rudders and improve their effectiveness at higher rudder angles.
[11] A propeller mounted laterally in a cross-tube near the bow, used for thrusting the bow sideways.
[12] The level of water from which charted depths displayed on a nautical chart are measured.
[13] A ship hull design and construction method, where the bottom of the ship has two complete layers of watertight hull surface.

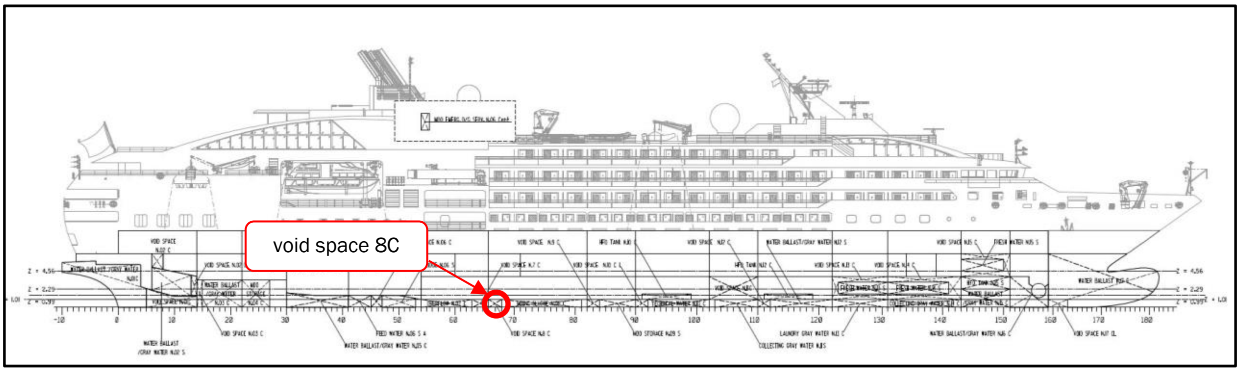


Figure 5
Location of penetrated void space

3.5.3. Whilst in Bluff, divers conducted temporary repairs to the outside of the hull and sealed the damaged internal compartment with cement. They also added baffles[14] to the void space to reduce its size in the event of re-flooding. The classification society carried out a hull occasional survey and issued two recommendations before the vessel sailed.

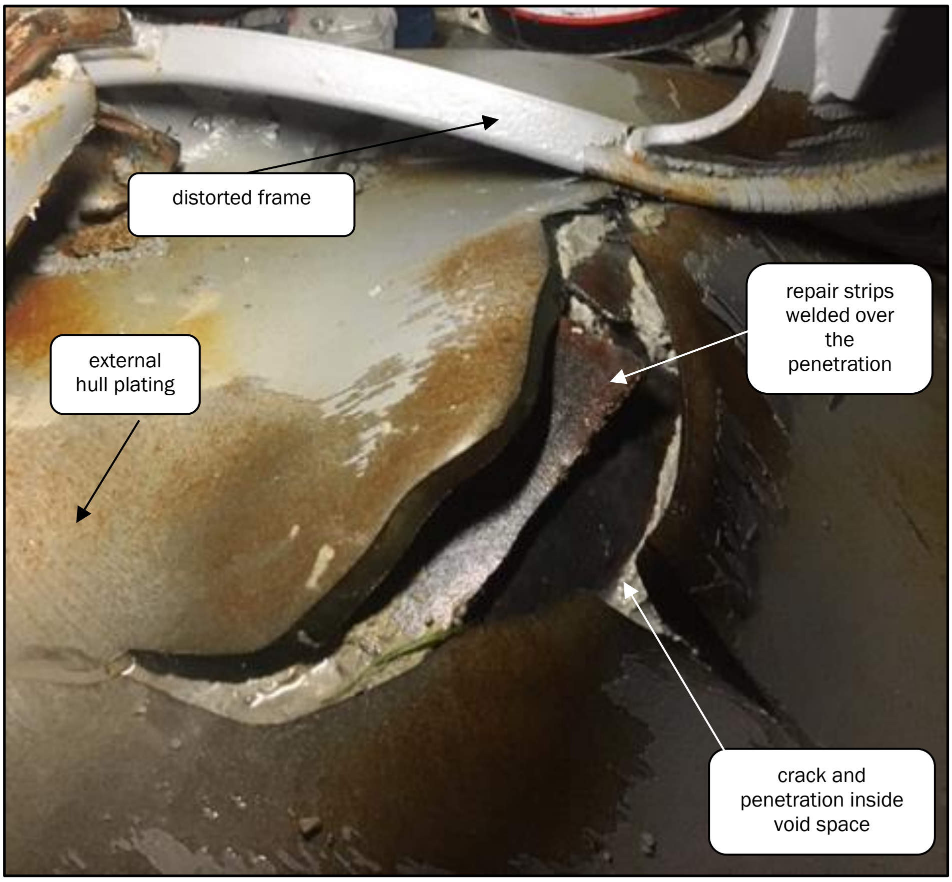


Figure 6
Damage inside the void space

3.6. Crew

3.6.1. The master had been at sea for 25 years and had obtained his STCW[15] II/2 certificate of competency limited to ships less than 15,000 gross tonnes. The master had worked for the operator for 22 years, during which time he had been responsible for the introduction of the

[14] A device used to restrain the flow of a fluid within a compartment.
[15] Standards of Training, Certification and Watchkeeping for Seafarers.

operator's safety management system. He had also been the training manager for two years. In January 2016 he had been the master of *Le Soléal,* a vessel similar to *L'Austral*, when it conducted a sub-Antarctic islands cruise.

3.6.2. The navigation officer held an STCW II/1 certificate of competency unlimited for both deck and engine room operations. She had worked at sea for four years. In April 2015, before leaving her last vessel, she had completed type-specific ECDIS training. The navigation officer had joined *L'Austral* in January 2017, having been ashore for 20 months. At the time of the accident it was the navigation officer's third bridge watch on *L'Austral*.

4. Analysis

4.1. Introduction

4.1.1. The operator of *L'Austral* had first begun offering its sub-Antarctic island cruise in 2015. The master had previous operating experience in the area. The operator held all of the necessary permits required from the Department of Conservation (see section 4.5) and had up-to-date paper and electronic charts for the area. The predicted and actual weather conditions were suitable for conducting passenger RHIB excursions off North East Island.

4.1.2. The rock with which *L'Austral* made contact was uncharted, having not been detected during a hydrographic survey of the islands in 1999.

4.1.3. The following analysis discusses the circumstances that led to the vessel making contact with the uncharted rock. Also discussed is one contributing and two non-contributing safety issues:

- the voyage planning for the time in the Snares Islands and the standard of bridge resource management on the bridge leading up to the contact did not meet the IMO standards or follow the guidelines published in other leading industry publications
- The operation of L'Austral's ECDIS did not meet good practice as defined in the IMO guidance or the standards set out in the operator's safety management system.
- The Department of Conservation had insufficient maritime expertise applied to assessing the risks to ships and the environment.

4.2. What happened

4.2.1. *L'Austral's* passengers had been cruising the east coast of North East Island in RHIBs on the morning of 9 January.

4.2.2. The weather was likely to be too uncomfortable for the passengers in the afternoon, so the RHIBs needed to be stowed back on board the vessel. To pick up the RHIBs from the south of the island the navigation officer first had to plan a route to the position where the vessel would meet the RHIBs. This plan consisted of six waypoints on the ECDIS and three parallel indexes[16] created on the radar. These tools allowed the navigation officer to monitor the vessel's progress on the route and make any corrections needed if the vessel deviated from the plan.

4.2.3. When *L'Austral* arrived at the south bay, the master began manoeuvring the vessel in order to facilitate the recovery of the RHIBs in the shelter provided by the South Promontory of the island (see Figure 3). There were only two people on the bridge – the master and the navigation officer. Once the master took control of the ship there was no agreed plan for where the vessel was to be or any areas to be avoided.

4.2.4. The master had made a mental note to avoid the area of overfalls, eddies and breakers depicted on the charts for the area south of Alert Stack. However, while the master was very likely focused on the recovery of the RHIBs, he did not notice that the ship had moved so far to the west, entered this area and made contact with the uncharted rock.

4.2.5. The operator was not permitted to operate *L'Austral* within 300 m of the shoreline under the conditions of its coastal permit. The uncharted rock with which *L'Austral* made contact was closer than 300 m to the shore.

4.2.6. Although the rock was uncharted, the description of the waters and the charted depth contours in the area were warning enough for operators of ships the size of *L'Austral* to give it a wide berth.

[16] An offset electronic navigation line(s) set up on a radar screen parallel to a ship's heading, used to monitor the ship's distance from prominent points.

4.2.7. The position of the uncharted rock was calculated from the GPS (global positioning system) position recorded in the ship's voyage data recorder[17]. The horizontal accuracy of the GPS was recorded as being ±0.9 m. The hull penetration was 52 m behind the GPS antenna. It was very likely that the uncharted rock was within the 300 m exclusion zone.

4.2.8. The unintentional breach of the coastal permit and the ship entering an area where the master had decided not to take it are indicative of a safety issue with the standard of planning and bridge resource management. This is discussed in the following section.

Findings

1. *L'Austral* inadvertently entered a 300-metre exclusion zone, which the ship was not authorised to enter and in which the charts noted the existence of overfalls, eddies and breakers.
2. *L'Austral* made contact with an uncharted rock inside the 300-metre exclusion zone.
3. The uncharted rock was in an area the Commission considers would not be suitable for the safe navigation of ships the size of *L'Austral* without having a high level of confidence in the accuracy of available hydrographic information.

4.3. Voyage planning and conduct of navigation

Safety issue – The voyage planning for the time in the Snares Islands and the standard of bridge resource management on the bridge leading up to the contact did not meet the IMO standards or follow the guidelines published in other leading industry publications.

Bridge resource management

4.3.1. To work together effectively on a bridge, it is crucial that the bridge team uses effective bridge resource management (sometimes referred to as non-technical skills). Leadership and communication are important aspects of bridge resource management. The bridge team are to build a shared understanding of what the plan is and how it is to be implemented. In that way any deviations from the plan can be challenged and errors can be detected and remedied without an accident occurring.

4.3.2. The recovery of the RHIBs so close to the shore would normally be considered 'manoeuvring'. The operator's safety management system detailed the safe manning for the bridge when manoeuvring as "Master and Staff Captain, and one qualified navigational watch keeping rating". The safety management system described this as three individuals sharing the workload to ensure safe navigation and lookout.

4.3.3. At the time of the accident there were just the master and the navigation officer on the bridge, less than the required complement. Notwithstanding the operator's bridge manning requirements, the task could still have been achieved safely had the master and navigation officer had an agreed plan and been communicating effectively.

4.3.4. However, the bridge audio recording from the voyage data recorder revealed little effective communication between the master and the navigation officer while they were on the bridge in the 20-minute period prior to the grounding. There was no agreement of a plan and nothing in the way of expectations from the master to the navigation officer and nothing in return from her.

[17] A computer system containing a record of a vessel's operation and configuration for the purpose of accident investigation.

4.3.5. Prior to the grounding the master was focused on three activities:

- recovering the RHIBs.
- communicating with the staff captain at the marina.
- manoeuvring the vessel.

It is very likely that the master became focused on these activities to the detriment of maintaining situational awareness.

4.3.6. The navigation officer was responsible for monitoring the vessel's progress, ensuring the master's actions had the desired effects, and challenging the actions of the master if necessary. Because there was no briefing from the master, the navigation officer had no clear understanding of where the master planned to position the vessel, so she was unsure of what and when to challenge.

4.3.7. During interviews with the crew there was an indication that bridge team members were reluctant to intervene with the actions of the master.

4.3.8. Such a reluctance to intervene is contrary to the principles of good bridge resource management. It leaves the ship vulnerable to one-person errors resulting in accidents. In this case the master succumbed to the normal human tendency to become focused on the task at hand and he lost awareness of the bigger picture, specifically where his ship was in relation to navigational hazards. Situations like this are easily rectified using a team approach, where the team share a common plan.

Radar

4.3.9. Figure 7 shows a screengrab[18] captured from the primary radar at the time of the accident. The dashed ring labelled 'variable range marker 1' was set at 300 m or 0.162 nautical miles to help ensure the vessel did not go within 300 m of the shoreline as defined in the operator's coastal permit. The master was surprised to learn that *L'Austral* had breached the 300 m limit. This is explainable because the centre of the 300 m circle is the radar scanner, which is positioned above the bridge. The distance from the radar scanner to the stern is about 90 m. For the variable range marker to have been used as a useful monitor to ensure the vessel did not go within 300 of the shoreline, it would have been appropriate to set it to at least 390 m.

4.3.10. The radar was set to a 1.5-nautical-mile range scale. Given the close proximity of the island, a smaller range scale such as 0.75 nautical miles would have better aided position monitoring.

4.3.11. While the radar gave an indication of the ship's distance from the shoreline, it alone was not a definitive tool for continuously monitoring where the ship lay in relation to navigational hazards not detectable by radar. A more appropriate tool for position monitoring would have been the ECDIS and the paper chart. The use of these is discussed below.

[18] A digital image taken of the radar and stored in the voyage data recorder.

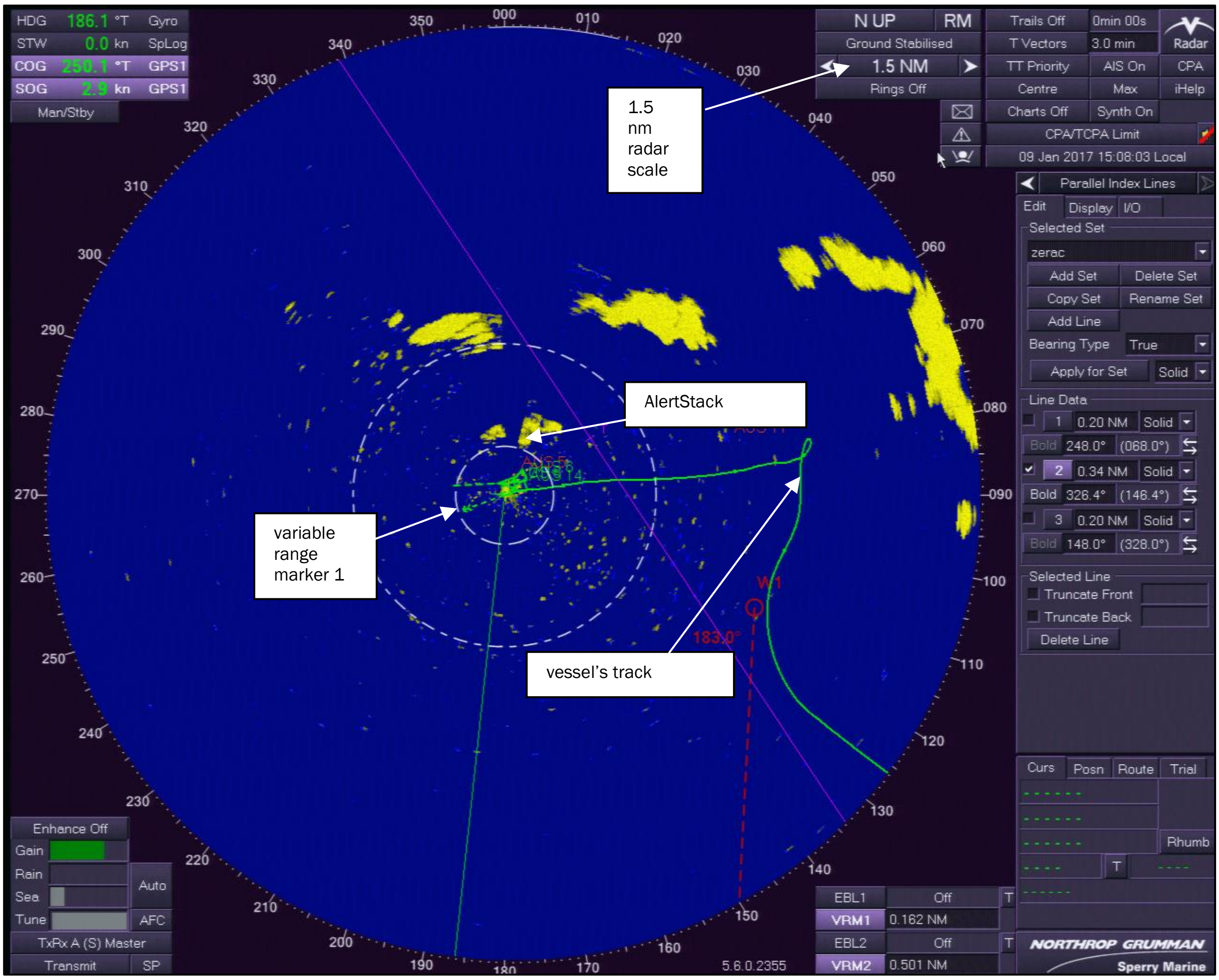


Figure 7
Radar screengrab from the time of the accident stored in the voyage data recorder

Position monitoring on paper charts

4.3.12. The area where *L'Austral* struck the submerged rock was surveyed in 1999 to a ±50 m positional accuracy and a ±1.6 m depth accuracy. Within these parameters it was possible that a rock pinnacle would not have been captured. The information captured during this survey was used to produce the paper chart NZ 2411.

4.3.13. The vessel's primary means of navigation was the ECDIS, comprising a primary unit and a back-up planning unit. The operator's safety management system referred to French law requiring *L'Austral* to have a paper chart back-up in addition to the secondary ECDIS unit. However, the operator had misinterpreted the legislation. Article 221-V/19 in French law stated that back-up devices for ECDISs could be paper or electronic. This was not a safety issue as such, as the ship had more than the minimum requirement, that being a primary and a secondary ECDIS, and a folio of paper charts. All three systems were up to date.

4.3.14. The use of either the ECDIS or the paper chart systems was acceptable, provided that the method was compatible with the situation. There were issues with the way in which the ECDIS was being used on board, which are discussed in the following section. However, there were also issues with the way in which the paper charts were used.

4.3.15. Figure 8 shows two position fixes on the paper chart that was in use at the time of the accident. The operator's safety management system stated that the officer of the watch shall "plot the ship's position on the appropriate chart and check at sufficiently frequent intervals depending on the prevailing conditions".

4.3.16. The vessel was manoeuvring very close to land, which was a high-risk activity requiring precise navigation techniques to monitor the vessel's position. Approximately 30 minutes passed between the time the vessel arrived at the south bay and the time the vessel struck the rock. Position 2 was added after the navigation officer heard the sound of the impact. Prior to this there was only one position marked on the chart.

4.3.17. An activity requiring constant manoeuvring of a ship close to a shoreline would normally be subjected to almost constant monitoring of the ship's position. This can be achieved with a combination of monitoring by radar, backed up by frequent fixing of the ship's position on a paper chart. Apart from the position fix at 1431 (see Figure 8), the radar was only being used to monitor the ship's distance off the shoreline to ensure there was no breach of the coastal permit restrictions, rather than to monitor the ship's position in relation to navigational hazards.

4.3.18. An ECDIS is ideally suited to constantly monitoring a ship's position, provided it is properly configured and utilised.

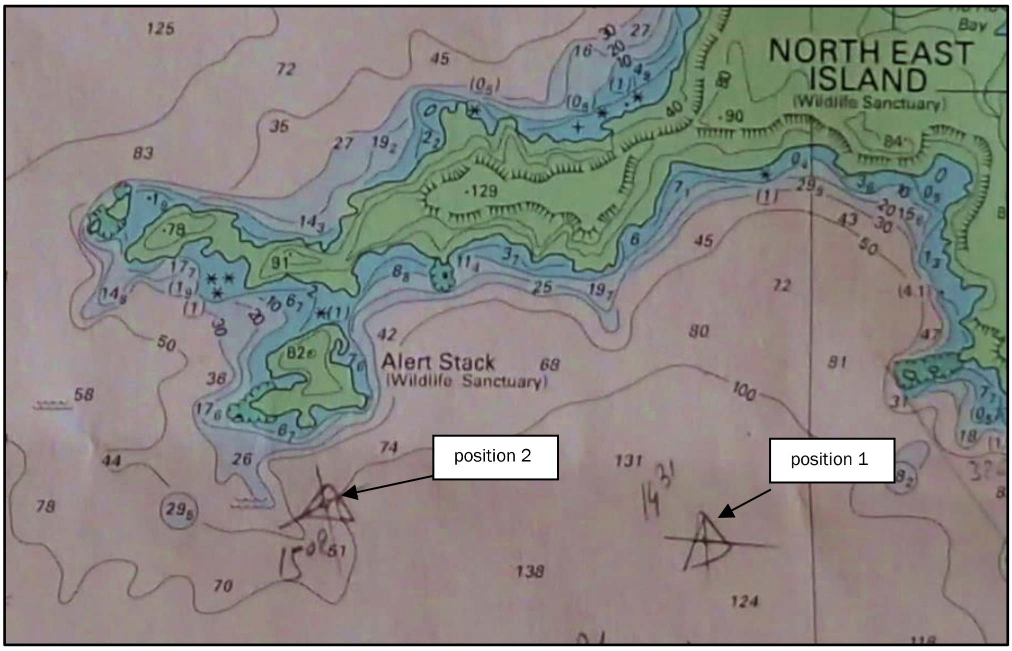


Figure 8
Extract of paper chart NZ 2411, in use at the time of the accident

Findings

4. The portion of the voyage plan related to recovering the ship's rigid-hulled inflatable boats was not well planned in accordance with the International Maritime Organization standards and the guidelines given in leading industry publications.
5. *L'Austral* inadvertently entered an unauthorised zone and an area the master had intended to avoid because the ship's position was not being adequately monitored.
6. The standard of bridge resource management on board *L'Austral* did not meet good industry practice.

4.4. Electronic chart display and information system (ECDIS)

Safety issue – The operation of L'Austral's ECDIS did not meet good practice as defined in the IMO guidance or the standards set out in the operator's safety management system.

Chart accuracy

4.4.1. The existence of uncharted dangers to navigation is a foreseeable risk for mariners. Paper charts are printed with 'source diagrams' that show the degree of accuracy of, or the level of confidence that a mariner can have in, that chart. ECDIS charts display Category Zone of Confidence (CATZOC)[19] symbols, which give visual representations of the accuracy of underlying data. A table detailing the different CATZOC values can be found in Appendix 1.

4.4.2. SOLAS[20] chapter V, regulation 2.2 describes an electronic navigation chart (ENC) or paper chart as one: "issued officially by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution and is designed to meet the requirements of marine navigation". The operator had a responsibility to ensure that all charts and ENCs delivered to the vessel were official nautical publications.

4.4.3. Land Information New Zealand (LINZ) is the recognised hydrographic office of New Zealand. It produces the paper chart NZ 2411 and the raster navigational chart[21] NZ 241102. LINZ had not created an ENC for the area of the Snares Islands at the time of the accident.

4.4.4. The ECDIS on board *L'Austral* was loaded with an unofficial ENC for the Snares Islands, which had been produced by C-MAP, a Norwegian company. The C-MAP ENC was derived from published electronic raster navigational charts where the local hydrographic offices had not produced ENCs. The ENC that was in use at the time of the accident is shown in Figure 9. The CATZOC U symbols denote that the "the quality of the bathymetric data has yet to be assessed"[22]. This low-confidence marker was also used as an indicator that it had not been produced by the local national hydrographic office, in this case LINZ.

4.4.5. The paper chart had a scale of 1:25,000, and in the area of the accident the underlying survey information was assessed as having a CATZOC of B; however, the ENC loaded in the ECDIS at the time of the accident had a CATZOC of U. This discrepancy was due to the CATZOC value denoting that the ENC had been produced by an unofficial source.

[19] A visualisation of the quality of the underlying chart data.
[20] The International Convention for the Safety of Life at Sea.
[21] Essentially an image or a photo of a paper chart.
[22] A measurement of the depths of oceans, seas and other large bodies of water.

Figure 9
Photograph showing the CATZOC of the unofficial ENC loaded in *L'Austral's* ECDIS

4.4.6. There is a requirement for shore-based personnel who have a responsibility to outfit ships with ECDIS ENCs to have undergone the IMO generic ECDIS training, to ensure they are familiar with the IMO requirements. The provision of the C-MAP chart portfolio containing unofficial ENCs for loading into *L'Austral's* ECDIS should have been accompanied by an alert, warning that some of the charts had not been produced by official hydrographic sources.

4.4.7. The bridge team on *L'Austral* did not appreciate that the CATZOC of U shown on their ECDIS at the time of the accident indicated that it had been produced by C-MAP, not by LINZ.

4.4.8. The master and deck officers of *L'Austral* had all received IMO mandatory generic ECDIS training, and additionally they had completed type-specific training for the Sperry VisionMaster FT as fitted to the *L'Austral*. The IMO requires this training to be supplied by the ECDIS manufacturer, or its designated providers. However, the navigation officer had received this training in-house from a captain who had undergone the manufacturer's training. This training may or may not have been adequate. It met the French flag requirement for type-specific training; however, it did not comply with the IMO standard[23].

4.4.9. The navigation officer had completed the type-specific training in April 2015, just prior to spending 20 months ashore. The International Safety Management (ISM) Code includes a requirement for operators to ensure that shipboard crew are thoroughly familiar with the systems and equipment with which they are working. There had been a strong case for the ship operator to arrange refresher training for the navigation officer before she joined *L'Austral* to ensure full familiarity with the ECDIS. There is no expiry date for type-specific training; however, considering the complexity of the ECDIS and that this officer had had little opportunity to utilise what she had learnt, it is likely that she would have benefited from some refresher training.

4.4.10. The Sperry VisionMaster FT ECDIS allows the user to set safety parameters and configure when a warning alarm will be activated. On *L'Austral* the master had stipulated that permanent ECDIS safety parameters were to be used (see Figure 12). By defining the safety parameters the bridge

[23] IMO MSC.1/Circ.1503 ECDIS – Guidance for good practice, extracts included in Appendix 2.

team were unable to change the way that the ECDIS displayed or alarmed and were therefore constrained by the information and warnings it provided them.

4.4.11. When a vessel is operating offshore, the look-head time is usually increased in recognition that the ship is navigating at a lower level of risk and to give the bridge team longer to react to any hazards. However, whilst in coastal areas it is normal to change the look-ahead to a shorter time period in recognition that the navigation officers are operating at a heightened level of vigilance and to reduce the number of 'nuisance' alarms. Similarly, when operating close to navigational hazards the look-ahead and shallow contour depth should be set relative to the topography of the seabed to visualise changes in depths and reduce the number of 'nuisance' alarms.

4.4.12. Alarms are configured by using a number of parameters, which are explained in Figures 10 and 11. They are triggered when a 'virtual region' defined by time, distance or depth around a ship is predicted to cross a charted danger.

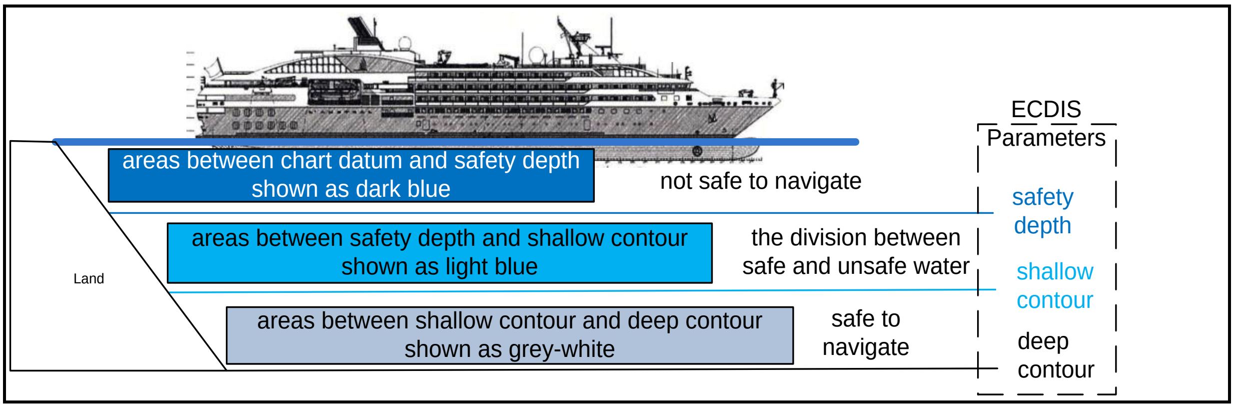


Figure 10
Description of ECDIS depth parameters

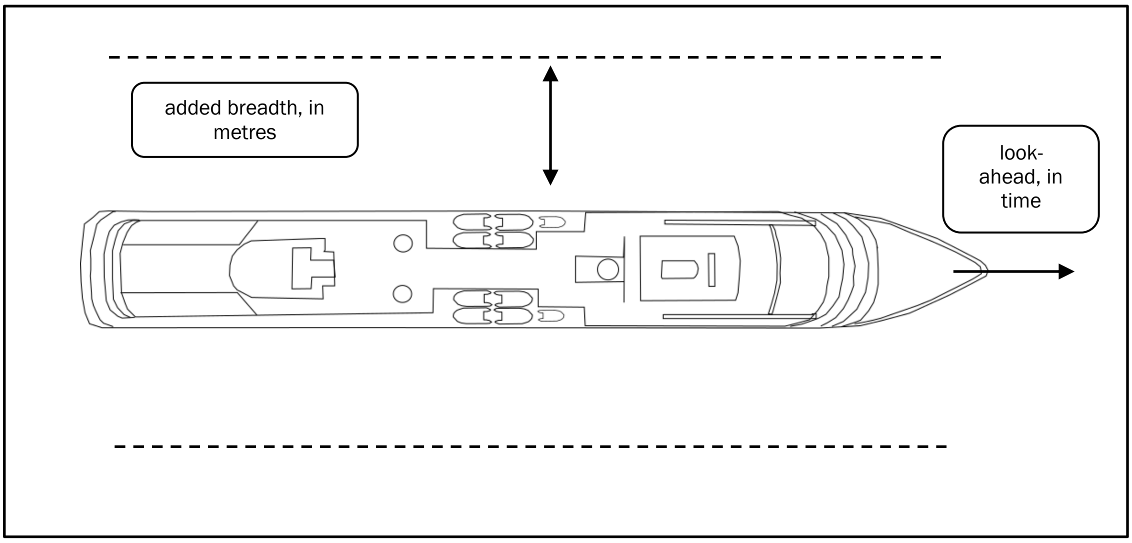
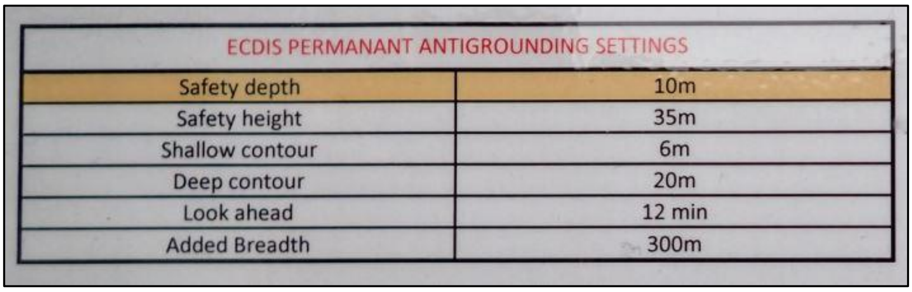


Figure 11
Description of ECDIS time and distance safety parameters

4.4.13. An ECDIS automatically rounds depth parameters to the next-deepest contour. As depth contours are usually in 10 m increments, setting the shallow contour at 6 m would have rounded up to 10 m on the ENC in use at the time of the accident. With this configuration the shallow contour did not show, as it was effectively the same as the safety depth. The shallow contour could have added a good visualisation that the ship was heading towards shallower water and could have been configured to alarm prior to the accident.



ECDIS PERMANANT ANTIGROUNDING SETTINGS	
Safety depth	10m
Safety height	35m
Shallow contour	6m
Deep contour	20m
Look ahead	12 min
Added Breadth	300m

Figure 12
Photograph of ECDIS parameters displayed on the bridge

4.4.14. The operator's safety management system required that the ECDIS safety parameters, or the "antigrounding [sic] settings", be adapted to the type of navigation: offshore, coastal or port approach. However, the prescribing of permanent safety parameters indicated that there was not a clear understanding of how the parameters could best be used to improve safety in different navigational situations.

4.4.15. Prior to the accident the ECDIS did not alarm because:

- the rock that the vessel struck was not charted
- the shallow contour was set at 6 m
- there was no user-defined prohibited area.

A warning could have been configured to alarm and alert the bridge team that the vessel was entering a potentially dangerous area.

4.4.16. If the shallow contour parameter had been set to 30 m, the ECDIS would have displayed a warning or alarmed when the vessel was predicted to cross the 30 m contour.

4.4.17. There were no prohibited areas defined in the ECDIS to the south of North East Island. User-defined prohibited areas are areas where the navigation officer does not wish the vessel to enter, similar to a no-go zone[24] on a paper chart. The master said that he did not want the vessel to enter the area indicated in Figure 13 as the chart showed the 'overfalls, eddies and breakers' symbol. Had this area been identified as a no-go area, the ECDIS would have alarmed as the vessel manoeuvred, affording the bridge team time to take avoiding action.

[24] A way of visually representing an area that a navigator does not want a vessel to enter.

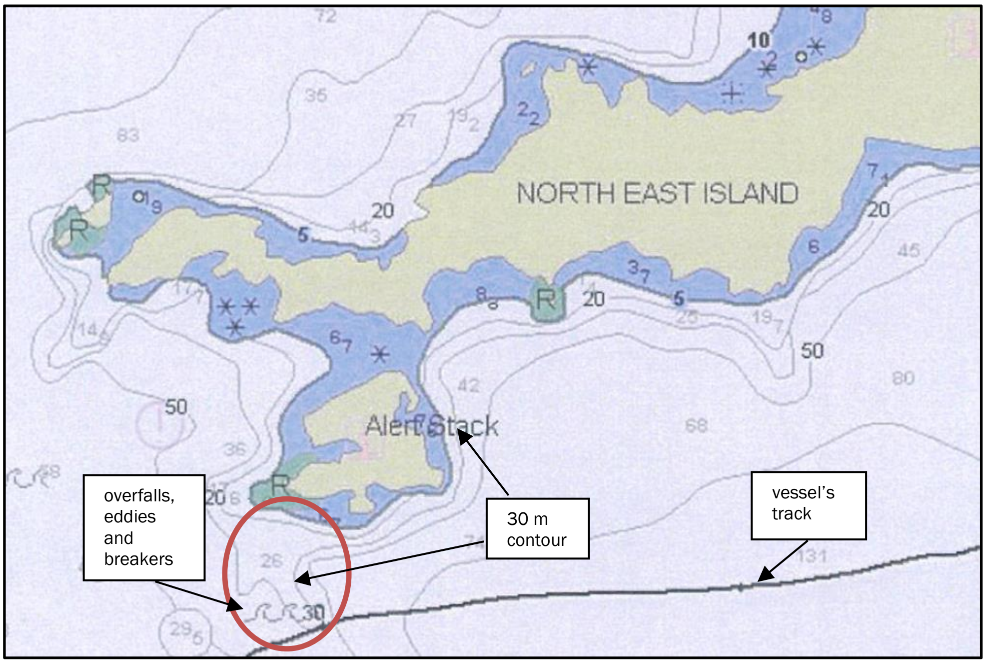


Figure 13
Screenshot from vessel's ECDIS after the accident

4.4.18. In summary, the ECDIS would have been an ideal aid to navigation when manoeuvring close to the Snares Islands. It could have been used to monitor the ship's position continuously in relation to chosen parameters, could have warned the bridge team that the ship was not where they wanted it to be, and drawn the master's attention away from the task of recovering the RIHBs to the more immediate concern – preventing the ship grounding.

4.4.19. Although the ECDIS was designated as the ship's primary navigation system, it was not being used as such and not being used to its full potential. It is likely that this was in part due to the concept of ECDIS not being fully understood by both the operator and the bridge team on the day.

Findings

7. The operator's system for providing and managing the provision of the electronic chart display and information system on board *L'Austral* did not meet the intent of the International Maritime Organization standards.
8. The electronic chart display and information system was the primary means of navigation on board *L'Austral*, yet the operating crew were not fully familiar with the capabilities and the limitations of the equipment, and were not making best use of it.

4.5. Department of Conservation permits

Safety issue – The Department of Conservation had insufficient maritime expertise applied to assessing the risks to ships and the environment.

To operate the sub-Antarctic cruise, that the operator offered, it had to obtain three types of permit from the Department of Conservation:

Permit Name	Permit Purpose	Valid for
Concession to operate in the sub-Antarctic islands	Allowed the operator to conduct guided walks up to two times a year at approved sites, subject to the terms of the entry permit	6 years 3 months
Coastal permit	Allowed *L'Austral* access to the coastal marine area of the sub-Antarctic islands by a vessel longer than 125 m, up to 300 m from the shore	5 years 9 months
Entry permit to Campbell and Auckland Island nature reserves	Allowed *L'Austral* to land passengers on these islands for guided walks within the nature reserves	1 year 3 months

Table 1
Details of Department of Conservation permits

4.5.1. In January 2016 *L'Austral* had been granted a coastal permit that prevented it navigating within 600 m of the mean high water springs mark (the shoreline) of any sub-Antarctic island. The 600 m limit did not allow the vessel to enter harbours at the Auckland and Campbell Islands. As a result passengers had to be transferred from outside the harbour limits to the landing sites by RHIBs. The Proposed Regional Coastal Plan for the sub-Antarctic islands included the table shown in Figure 14.

Distance to MHWS (metres)	Vessel Class (metres)				
	Ancillary Craft	Up to 25m	Between 25 - 75m	Between 75 - 125m	Large (>125m)
Up to 300m	Permitted	Discretionary	Prohibited	Prohibited	Prohibited
300m to 600m	Permitted	Permitted	Permitted	Discretionary	Prohibited
600m to 1000m	Permitted	Permitted	Permitted	Permitted	Discretionary
Excess of 1000m (extends out to 12 Nautical Miles)	Permitted	Permitted	Permitted	Permitted	Permitted

*MHWS: Mean High Water Springs

Figure 14
Extract from Proposed Regional Coastal Plan: Kermadec and sub-Antarctic islands, Snares Islands (at the time of the accident)

4.5.2. The ship operator had become concerned about the safety of transferring passengers to and from landing sites in RHIBs in what was sometimes rough water, so in 2016 the company applied for a new coastal permit, requesting that the vessel be allowed to navigate up to 300 m from the shoreline. This would allow the ship to enter the harbours, thereby reducing passenger's exposure to rough water.

4.5.3. As the relevant rules in the Proposed Regional Coastal Plan had not come into force, the operator could apply for a discretionary permit allowing the ship to navigate up to 300 m from the shoreline. This would have been prohibited if the coastal plan had been in force. Section 87B(1)(c) of the Resource Management Act 1991 states that if a rule is not in operation, the activity "it is to be treated as discretionary". This meant that the operator could apply for a coastal permit for any of the prohibited areas listed in Figure 14.

4.5.4. At the time the Department of Conservation received the application from the operator for a new discretionary coastal permit, it had no internal maritime expertise to assess the additional risks to ships and the environment in allowing the ship to navigate up to 300 m from the shoreline. The Department of Conservation had an informal agreement with a maritime professional who advised it that, *"considering the capabilities of this modern vessel it is unlikely that this activity poses a significant risk of a grounding incident".* This person was contacted on an informal basis and was not employed by the Department of Conservation. No formal risk assessment process was conducted.

4.5.5. The Minister of Conservation (through the Department of Conservation) has some of the responsibilities, duties and powers that a regional council has under the Resource Management Act, in respect of the sub-Antarctic islands[25].

4.5.6. When a regional council is responsible for a port or harbour it usually appoints a harbour master who is responsible for enforcing regulations and ensuring, safe navigation and security. Given the potentially harsh and sensitive environment in the region, and the likelihood that shipping activity will increase in future, the Commission recommends that the Department of Conservation appoint a suitably qualified person to manage the safety of navigation in the sub-Antarctic islands.

Finding

9. The Department of Conservation granted a coastal permit allowing *L'Austral* to navigate up to 300 metres from the shoreline in all of the sub-Antarctic islands, without conducting a formal risk assessment using the appropriate maritime expertise to ensure that the necessary risk controls were in place.

[25] Resource Management Act 1991, section 31A(1)(a).

5. Findings

5.1. *L'Austral* inadvertently entered a 300-metre exclusion zone, which the ship was not authorised to enter and in which the charts noted the existence of overfalls, eddies and breakers.

5.2. *L'Austral* made contact with an uncharted rock inside the 300-metre exclusion zone.

5.3. The uncharted rock was in an area the Commission considers would not be suitable for the safe navigation of ships the size of *L'Austral* without having a high level of confidence in the accuracy of available hydrographic information.

5.4. The portion of the voyage plan that related to recovering the ship's rigid-hulled inflatable boats was not well planned in accordance with the International Maritime Organization standards and the guidelines given in leading industry publications.

5.5. *L'Austral* inadvertently entered an unauthorised zone and an area the master had intended to avoid because the ship's position was not being adequately monitored.

5.6. The standard of bridge resource management on board *L'Austral* did not meet good industry practice.

5.7. The operator's system for providing and managing the provision of the electronic chart display and information system on board *L'Austral* did not meet the intent of the International Maritime Organization standards.

5.8. The electronic chart display and information system was the primary means of navigation on board *L'Austral*, yet the operating crew were not fully familiar with the capabilities and the limitations of the equipment, and were not making best use of it

5.9. The Department of Conservation granted a coastal permit allowing *L'Austral* to navigate up to 300 metres from the shoreline in all of the sub-Antarctic islands, without conducting a formal risk assessment using the appropriate maritime expertise to ensure that the necessary risk controls were in place.

6. Safety issues

6.1. The voyage planning for the time in the Snares Islands and the standard of bridge resource management on the bridge leading up to the contact did not meet the IMO standards or follow the guidelines published in other leading industry publications.

6.2. The operation of *L'Austral's* ECDIS did not meet good practice as defined in the IMO guidance or the standards set out in the operator's safety management system.

6.3. The Department of Conservation had insufficient maritime expertise applied to assessing the risks to ships and the environment.

7. Safety actions

General

7.1. 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; and

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

Safety actions addressing safety issues identified during an inquiry

7.2. None identified.

Safety actions addressing other safety issues

7.3. A notice to mariners has been published by Land Information New Zealand alerting mariners to the existence of an obstruction off Alert Stack, until a full survey can be conducted.

The presumed location of the obstruction off Alert Stack has been added to all paper and electronic charts.

Land Information New Zealand have published two official ENCs that cover the Snares Islands (NZ 424111 and NZ 502411).

8. Recommendations

General

8.1. 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 the Department of Conservation and the operator.

8.2. 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 the Department of Conservation

8.3. The Minister of Conservation (through the Department of Conservation) has some of the responsibilities, duties and powers that a regional council has under the Resource Management Act 1991 in respect of the sub-Antarctic islands. When a regional council is responsible for a port or harbour it usually appoints a harbour master who is responsible for enforcing regulations and ensuring safe navigation and security.

The Department of Conservation granted a coastal permit allowing *L'Austral* to navigate up to 300 m off the shoreline in all of the sub-Antarctic islands, without conducting a formal risk assessment using the appropriate maritime expertise to ensure that the necessary risk controls were in place.

On 23 February 2018 the Commission recommended that, given the potentially harsh and sensitive environment in the sub-Antarctic islands and the likelihood that shipping activity will increase in future, the Director-General of the Department of Conservation appoint a suitably qualified person to manage the safety of navigation in the sub-Antarctic islands. (001/18)

8.3.1. On 9 March 2018, Department of Conservation replied:

> I can confirm that the Director-General will implement the recommendation of the Commission.
>
> In order to implement the recommendation, the Department of Conservation intends to enter into a contractual arrangement with a suitably qualified person to manage the safety of navigation in the Subantarctic Islands. The intention is that this person will carry out the functions and services of a harbourmaster as are relevant to the Subantarctic (and Kermadec) Islands, albeit that the appointment will not be made pursuant to the Maritime Transport Act 1994.
>
> The Department intends to take the following actions in the first instance:
>
> a. Obtain advice from Maritime New Zealand as to what qualifications and experience are necessary for a "suitably qualified person" to deliver harbourmaster functions for the Subantarctic (and Kermadec) Islands. Advice will also be sought on which harbourmaster functions are relevant to the Subantarctic (and Kermedec) Islands.
>
> b. Request the same advice from Environment Canterbury Harbourmaster, an experienced harbourmaster, has provided the Department with expert maritime advice in the development of the regional coastal plan and during the appeal process. He is also personally familiar with both groups of islands.
>
> Depending on the advice we receive, options the Department will assess are likely to include asking Mr Dilley if he would consider a contractual arrangement to provide the harbourmaster functions, or, alternatively, whether two separate arrangements with harbourmasters in Whangarei and Southland would be more effective.
>
> I am not in a position at this stage (i.e. prior to receiving the advice outlined above) to advise when we anticipate this will be fully implemented.

To the operator

8.4. Taking into consideration that:

- the portion of the voyage plan that related to recovering the ship's RHIBs was not well planned in accordance with the IMO standards and the guidelines given in leading industry publications, and
- *L'Austral* inadvertently encroached an exclusion zone and an area the master had intended to avoid because the ship's position was not being adequately monitored, and
- the standard of bridge resource management on board *L'Austral* did not meet good industry practice.

On 23 February 2018 the Commission recommended that the Directeur D'exploitation at Ponant review the safety management system on board *L'Austral* and upgrade it to ensure that the standards of voyage planning, the standards of navigation and the level of bridge resource management met the requirements of the International Maritime Organisation and followed the guidelines in leading industry publications. (002/18)

8.4.1. On 15 March 2018, Ponant replied, in part:

> Ponant's Voyage Planning procedure was reviewed on 15 December 2017. This new procedure has been communicated to all Captains.
>
> Specific BRM training sessions provided by the French Marine Academy have been rolled out, starting from January 2017. To date 21 Ponant officers have undergone the training, 13 more are scheduled to undergo this training in 2018.

8.5. Taking into consideration that:

- the operator's system for providing and managing the provision of the ECDIS on board *L'Austral* did not meet the intent of the International Maritime Organisation standards, and
- the ECDIS was the primary means of navigation on board *L'Austral*, yet the operating crew were not fully familiar with the capabilities and the limitations of the equipment, and were not making best use of it.

On 23 February 2018 the Commission recommended that the Directeur D'exploitation at Ponant review the procedures for the setting up, training in and ongoing support for ECDIS systems on all of its ships, and ensure that all comply with mandatory requirements and that the ships' crews are fully conversant with good industry practice for the use of ECDIS. (003/18)

8.5.1. On 15 March 2018, Ponant replied, in part:

> Ponant has also started obtaining additional ECDIS training session program for its officers. Eleven officers received this training in 2016 and 2017 and we plan to train 15 more during 2018.
>
> We also plan to develop a specific Ponant's ECDIS training with e-learning methods, we are in the process of researching the best way of doing this. We intend to complete this by the end of 2018. We will provide TAIC with an update once we have completed this internal training program.

9. Key lessons

9.1. ECDIS is a valuable aid to navigation. However, mariners need to understand fully and be familiar with all aspects of the system, otherwise relying on the ECDIS as a primary means of navigation can contribute to, rather than prevent, accidents.

9.2. Every part of a ship's voyage must be planned, and all members of the bridge team be fully familiar with and agree to the plan. This is a cornerstone of good bridge resource management.

9.3. Good bridge resource management relies on a culture where challenge is welcomed and responded to, regardless of rank, personality or nationality.

Appendix 1: Description of category published by the United Kindom Hydrographic Office

Cartographers use Category Zone of Confidence (CATZOC) values to highlight the accuracy of data presented on charts. The following table outlines the positon accuracy, depth accuracy and seafloor coverage for each ZOC value to help you manage the level of risk when navigating in particular geographic area. The information and values use in this table has been taken from the IHO's 'Regulations of the IGO for International Charts and chart specifications of the IHO' white paper.

ZOC [1]	Position Accuracy [2]	Depth Accuracy [3]			Seafloor Coverage	Typical Survey Characteristics [5]
A1	± 5 m + 5% depth	=0.50 + 1%d	Depth (m) 10 30 100 1000	Accuracy (m) ± 0.6 ± 0.8 ± 1.5 ± 10.5	Full area search undertaken. Significant seafloor features detected [4] and depths measured.	Controlled, systematic survey [6] high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.
A2	± 20 m	= 1.00 + 2%d	Depth (m) 10 30 100 1000	Accuracy (m) ± 1.2 ± 1.6 ± 3.0 ± 21.0	Full area search undertaken. Significant seafloor features detected [4] and depths measured.	Controlled, systematic survey [6] achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder [7] and a sonar or mechanical sweep system.
B	± 50 m	= 1.00 + 2%d	Depth (m) 10 30 100 1000	Accuracy (m) ± 1.2 ± 1.6 ± 3.0 ± 21.0	Full area search not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth but lesser position accuracies than ZOC A2, using a modern survey echosounder [5], but no sonar or mechanical sweep system.
C	± 500 m	= 2.00 + 5%d	Depth (m) 10 30 100 1000	Accuracy (m) ± 2.5 ± 3.5 ± 7.0 ± 52.0	Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
D	*Worse than ZOC C*	Worse than ZOC C			Full search not achieved, large depth anomalies expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed - The quality of the bathymetric data has yet to be assessed					

Appendix 2: Extracts from IMO guidance for good practice (ECDIS)

INTERNATIONAL MARITIME ORGANIZATION

E

4 ALBERT EMBANKMENT LONDON SE1 7SR

Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

MSC.1/Circ.1503
24 July 2015

ECDIS – GUIDANCE FOR GOOD PRACTICE

The Maritime Safety Committee, at its ninety-fifth session (3 to 12 June 2015), approved the *ECDIS – Guidance for Good Practice,* as set out in the annex, drawing together relevant guidance from seven previous ECDIS circulars into a single, consolidated document.

The undeniable safety benefits of navigating with Electronic Chart Display and Information Systems (ECDIS) were recognized through Formal Safety Assessments submitted to the Organization and experience gained by the voluntary use of ECDIS for many years. ECDIS was mandated for carriage by High-Speed Craft (HSC) as early as 1 July 2008. Subsequently, the mandatory carriage of ECDIS for ships other than HSC (depending on the ship type, size and construction date, as required by SOLAS regulation V/19.2.10) commenced in a phased manner from 1 July 2012 onwards.

ECDIS is a complex, safety-relevant, software-based system with multiple options for display and integration. The ongoing safe and effective use of ECDIS involves many stakeholders including seafarers, equipment manufacturers, chart producers, hardware and software maintenance providers, shipowners and operators, and training providers. It is important that all these stakeholders have a clear and common understanding of their roles and responsibilities in relation to ECDIS.

ECDIS was accepted as meeting the chart carriage requirements of SOLAS regulation V/19 in 2002. Over the years, IMO Member States, hydrographic offices, equipment manufacturers and other organizations have contributed to the development of guidance on a variety of ECDIS-related matters. Over the years, IMO has issued a series of complementary circulars on ECDIS.

While most useful IMO guidance on ECDIS was developed in this incremental manner, the information needed to be consolidated, where possible, to have ECDIS-related guidance within a single circular, which could be easily kept up to date without duplication or need for continual cross-referencing. Such consolidation of information offers clear and unambiguous understanding of the carriage requirements and use of ECDIS.

The consolidated guidance termed "*ECDIS – Guidance for Good Practice*" is set out in the annex to this circular (referred to as "Guidance" hereafter). Ship operators, masters and deck officers on ECDIS-fitted ships are encouraged to use this guidance to improve their understanding and facilitate safe and effective use of ECDIS.

Members of the Organization and all Contracting Governments to the SOLAS Convention are invited to bring this circular to the attention of all entities concerned. In particular, port States are invited to make the guidance available to their port State control[26] inspectors, and flag States to shipowners, masters, recognized organizations, flag State control inspectors and surveyors. An electronic copy of this circular can be downloaded from the Organization's website at: (http://www.imo.org/OurWork/Circulars/Pages/Home.aspx).

This circular revokes MSC.1/Circ.1391, SN.1/Circ.207/Rev.1, SN.1/Circ.266/Rev.1, SN.1/Circ.276, SN.1/Circ.312, STCW.7/Circ.10 and STCW.7/Circ.18.

INTRODUCTION

The undeniable safety benefits of navigating with Electronic Chart Display and Information Systems (ECDIS) were recognized through Formal Safety Assessments submitted to the Organization and experience gained by the voluntary use of ECDIS for many years. ECDIS was mandated for carriage by High-Speed Craft (HSC) as early as 1 July 2008. Subsequently, the mandatory carriage of ECDIS for ships other than HSC (depending on the ship type, size and construction date, as required by SOLAS regulation V/19.2.10) commenced in a phased manner from 1 July 2012 onwards.

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This *ECDIS – Guidance for Good Practice*, referred to as "Guidance" hereafter, draws together relevant guidance from seven previous ECDIS circulars into a single, consolidated document.

It has been laid out in seven sections, namely:

Chart carriage requirement of SOLAS

Maintenance of ECDIS software

Operating anomalies identified within ECDIS

Differences between raster chart display system (RCDS) and ECDIS

ECDIS training

Transitioning from paper chart to ECDIS navigation

Guidance on training and assessment in the operational use of ECDIS simulators

This guidance is intended to assist smooth implementation of ECDIS and its ongoing safe and effective use on board ships. Ship operators, masters and deck officers on ECDIS-fitted ships are encouraged to use this guidance to improve their understanding and facilitate safe and effective use of ECDIS.

Although this guidance replaces seven IMO ECDIS-related circulars, there remain several other IMO circulars that also address ECDIS matters to varying degree and reference should also be made to these circulars where necessary. A list containing the IMO ECDIS performance standards, the seven IMO ECDIS-related circulars that have been replaced and the other IMO circulars that relate to ECDIS is provided in the referencesection.

CHART CARRIAGE REQUIREMENT OF SOLAS

[26] An internationally agreed regime for the inspection of foreign vessels in other nation's ports.

The mandatory carriage of ECDIS, as required by SOLAS regulation V/19.2.10, is subject to a staged entry into force between 1 July 2012 and 1 July 2018. As per SOLAS regulations V/18 and V/19, for a ship to use ECDIS to meet the chart carriage requirements of SOLAS, the ECDIS equipment must conform to the relevant IMO performance standards. ECDIS units on board are required to comply with one of two performance standards (either IMO resolution A.817(19), as amended or resolution MSC.232(82)), depending on the date of their installation. Essentially, where an ECDIS is being used to meet the chart carriage requirements of SOLAS, it must:

be type-approved;

use up to date electronic nautical charts (ENC);

be maintained so as to be compatible with the latest applicable International Hydrographic Organization (IHO) standards; and

have adequate, independent back-up arrangements in place.

According to SOLAS regulation V/18, ECDIS units on board ships must be type-approved. Type approval is the certification process that ECDIS equipment must undergo before it can be considered as complying with IMO performance standards. The process is carried out by flag Administration-accredited type-approval organizations or marine classification societies in accordance with the relevant test standards developed by, inter alia, the International Electrotechnical Commission (IEC) (e.g. IEC 61174).

In accordance with SOLAS regulation V/19.2.1.4, ships must carry all nautical charts necessary for the intended voyage. As defined by SOLAS regulation V/2.2, nautical charts are issued officially by or on the authority of a Government, authorized Hydrographic Office or other relevant government institutions. Ships required to fit ECDIS and ships choosing to use ECDIS to meet the chart carriage requirements of SOLAS should carry Electronic Navigational Charts (ENCs) or, where ENCs are not available at all or are not of an appropriate scale for the planning and display of the ship's voyage plan, Raster Navigational Charts (RNC) and/or any needed paper charts should be carried.

IHO provides an online chart catalogue that details the coverage of ENCs together with references to coastal State guidance on any requirements for paper charts (where this has been provided). The catalogue also provides links to IHO Member States' websites where additional information may be found. The IHO online chart catalogue can be accessed from the IHO website at: www.iho.int.

As per SOLAS regulation V/27, all nautical charts necessary for the intended voyage shall be adequate and up to date. For ships using ECDIS to meet the chart carriage requirement of SOLAS, all ENCs and RNCs must be of the latest available edition and be kept up to date using both the electronic chart updates (e.g. ENC updates) and the latest available notices to mariners. Additionally, ECDIS software should be kept up to date such that it is capable of displaying up-to-date electronic charts correctly according to the latest version of IHO's chart content and display standards.

Relevant appendices of IMO performance standards for ECDIS specify the requirements for adequate independent back-up arrangements to ensure safe navigation in case of ECDIS failure. Such arrangements include: 1) facilities enabling a safe take-over of the ECDIS functions in order to ensure that an ECDIS failure does not result in a critical situation; 2) a means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure.

MAINTENANCE OF ECDIS SOFTWARE

ECDIS in operation comprises hardware, software and data. It is important for the safety of navigation that the application software within the ECDIS works fully in accordance with the Performance Standards and is capable of displaying all the relevant digital information contained within the ENC.

ECDIS that is not updated to the latest version of the IHO Standards may not meet the chart carriage requirements as set out in SOLAS regulation V/19.2.1.4.

For example, in January 2007, Supplement No.1 to the IHO ENC Product Specification was introduced in order to include, within the ENC, the then recently introduced IMO requirements for Particularly Sensitive Sea Areas (PSSA), Archipelagic Sea Lanes (ASL) and to cater for any future safety of navigation requirements.

Any ECDIS which is not upgraded to be compatible with the latest version of the IHO ENC Product Specification or the Presentation Library may be unable to correctly display the latest charted features. Additionally, the appropriate alarms and indications may not be activated even though the features have been included in the ENC. Similarly, any ECDIS which is not updated to be fully compliant with the latest version of the IHO Data Protection Standard may fail to decrypt or to properly authenticate some ENCs, leading to failure to load or install. An up-to-date list of all the relevant IHO standards relating to ECDIS equipment can be accessed from the IHO website (www.iho.int).

The need for safe navigation requires that manufacturers should provide a mechanism to ensure software maintenance arrangements are adequate. This may be achieved through the provision of software version information using a website. Such information should include the IHO Standards which have been implemented.

Administrations should inform shipowners and operators that proper ECDIS software maintenance is an important issue and that adequate measures need to be implemented by masters, shipowners and operators in accordance with the International Safety Management (ISM) Code.

ECDIS TRAINING

The information provided below aims to assist Member Governments, Parties to the STCW Convention, companies and seafarers in ensuring that training programmes on the use of ECDIS provided to masters and deck officers[1] serving on ships fitted with ECDIS meet the mandatory training requirements of the STCW Convention:

under the provisions of the STCW Convention and Code, all officers in charge of a navigational watch on ships of 500 gross tonnage or more must have a thorough knowledge and ability to use nautical charts and nautical publications (refer STCW Code Table A-II/1);

masters and officers in charge of a navigational watch (both at management and operational level) serving on ships fitted with ECDIS should as a minimum, undertake appropriate generic ECDIS training, meeting the competence requirements of the 2010 Manila Amendments to the STCW Convention and Code;

the 2010 Manila Amendments to the STCW Convention and Code have reinforced ECDIS training requirements and introduced several additional specific competencies in the use of ECDIS for officers both at management and operational level serving on ECDIS-fitted ships (refer to STCW Code Tables A-II/1 and A-II/2). Training in accordance with the 2010 Manila Amendments became effective from 1 July 2013;

masters and officers certificated under chapter II of the STCW Convention serving on board ships fitted with ECDIS are to be familiarized (in accordance with STCW regulation I/14) with the ship's equipment including ECDIS;

STCW Convention regulation I/14, paragraph 1.5, as well as sections 6.3 and

6.5 of the International Safety Management (ISM) Code, require companies to ensure seafarers are provided with familiarization training. A ship safety management system should include familiarization with the ECDIS equipment fitted, including its backup arrangements, sensors and related peripherals. ECDIS manufacturers are encouraged to provide training resources including type-specific materials. These resources may form part of the ECDIS familiarization training;

STCW Convention regulation I/14, paragraph 1.4, requires companies to maintain evidence of the training and ensures that it is readily accessible. For certificates of competency that have expiry dates beyond 1 January 2017, port State control authorities should accept the certificate issued as *prima* *facie* evidence that the seafarer has met the standard of competence required by the 2010 Amendments in accordance with the control provisions of article X and regulation I/4 of the STCW Convention;

Companies should also maintain evidence of the familiarization training in compliance with STCW Convention regulation I/14, paragraph 1.5;

Administrations should inform their port State control officers of the requirements for ECDIS training as detailed in paragraph 7 above; and

attention is also drawn to STCW.7/Circ.16 – Clarification of transitional provisions relating to the 2010 Manila Amendments to the STCW Convention and Code and STCW.7/Circ.17 – Advice for port State control officers on transitional arrangements leading up to the full implementation of the requirements of the 2010 Manila Amendments to the STCW Convention and Code on 1 January 2017.

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