Report 08-206: passenger ferry *Monte Stello,* collisions with wharves, Picton and Wellington, 8 and 9 August 2008

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

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

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passenger ferry
Monte Stello

collisions with wharves

Picton and Wellington

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The *Monte Stello* in Picton

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Abbreviations

CPP	controllable pitch propeller
E/P	electro-pneumatic
GPS	gobal positioning system
IMO	International Maritime Organization
ISM Code	International Management Code for the Safe Operation of Ships and for Pollution Prevention
m	metre(s)
Maritime NZ	Maritime New Zealand
ro-ro	roll-on/roll-off
SOLAS	International Convention for the Safety of Life at Sea, 1974
Strait Shipping	Strait Shipping Limited
UTC	co-ordinated universal time
VDR	voyage data recorder

Glossary

bridge mark	a sign on a berth that indicates where the bridge front of a particular ship is located when it is secure at a particular berth. Used by the master or pilot to estimate the distance of the ship from the end of the berth during manoeuvring
bus-bar(s)	a thick strip(s) of copper that conducts electricity within a switchboard
controllable pitch propeller	a propeller on which the blades can be rotated around their long axis to alter the blade pitch angle
lane metre	a lane is a strip of deck 2 metres (m) wide. A lane metre is an area of deck one lane wide and one metre long
link-span	a hinged bridge on the quay at a port or ferry terminal that can be connected with a ramp on a vessel to allow loading or unloading
pitch angle (propeller blade)	the angle made by a propeller blade with the plane in which the propeller is turning
restricted limits	means; enclosed water limits; and inshore limits as defined in New Zealand Maritime Rules Part 20 2004.
stern tube	the bearing that supports the propeller shaft where it emerges from the ship
tail shaft	the part of the propeller shaft that passes through the stern tube and is fitted to take the attachment of the propeller

Data Summary

Ship particulars:

Name:	*Monte Stello*
Type:	passenger ferry
Class:	New Zealand passenger ship
Limits:	New Zealand coastal
Classification:	Lloyds Register
Length:	126.96 m
Breadth:	21.0 m
Gross tonnage:	11 630
Built:	1979
Propulsion:	twin Pielstick PC 2.5 V12. 5700 kilowatts each driving a controllable pitch propeller
Service speed:	19.5 knots
Owner/operator:	Strait Shipping Limited (Strait Shipping)
Port of registry:	Wellington
Crew:	New Zealand
Dates and times:	8 and 9 August 2008[1]
Locations:	Picton and Wellington Harbours
Persons on board:	crew: 27 passengers: Picton: 52 Wellington: 42
Injuries:	crew: nil passengers: nil
Damage:	port stern hull plating damaged above water line
Investigator-in-charge:	Paul Bird

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

Executive Summary

On 8 and 9 August 2008, the roll-on/roll-off passenger and freight ferry *Monte Stello* was involved in 2 berthing occurrences: the first a collision with the floating pontoon at its berth in Picton, and the second a collision with the end of Glasgow Wharf where it was to berth in Wellington.

The Picton occurrence resulted in damage to the steelwork securing the pontoon to the link-span and minor damage to the ship. The Wellington occurrence resulted in substantial damage to the wharf and the ship's hull being penetrated at the stern, resulting in about 8 days out of service while repairs were made.

The Picton accident was mainly the result of a ship handling error when the officer conducting the berthing was under training. The Wellington occurrence was caused by a combination of the effect the wind was having on the ship as it backed towards its berth and the ship's progress not being adequately monitored. The speed of the propeller pitch response did not meet the handling master's expectations for aborting the approach. It could not be established if the reported delays in the propeller pitch response were due to an undetermined one-off fault in the manoeuvring system, or if the delays were symptomatic of what had become accepted peculiarities in the way the controllable pitch propeller system performed.

Safety issues identified included the unsatisfactory condition of the control systems for the controllable pitch propellers, and flaws in the planned maintenance system designed to ensure such critical systems were maintained in good order.

Although not causal to either occurrence, the Rules governing the requirement to fit voyage data recorders on Cook Strait passenger and freight ferries were examined.

Recommendations were made to the Director of Maritime New Zealand to address the safety issues identified, including the issue of voyage data recorders.

(Note: this executive summary condenses content to highlight key points to readers and does so in simpler English and with less technical precision than the remainder of the report to ensure its accessibility to a non-expert reader. Expert readers should refer to and rely on the body of the full report.)

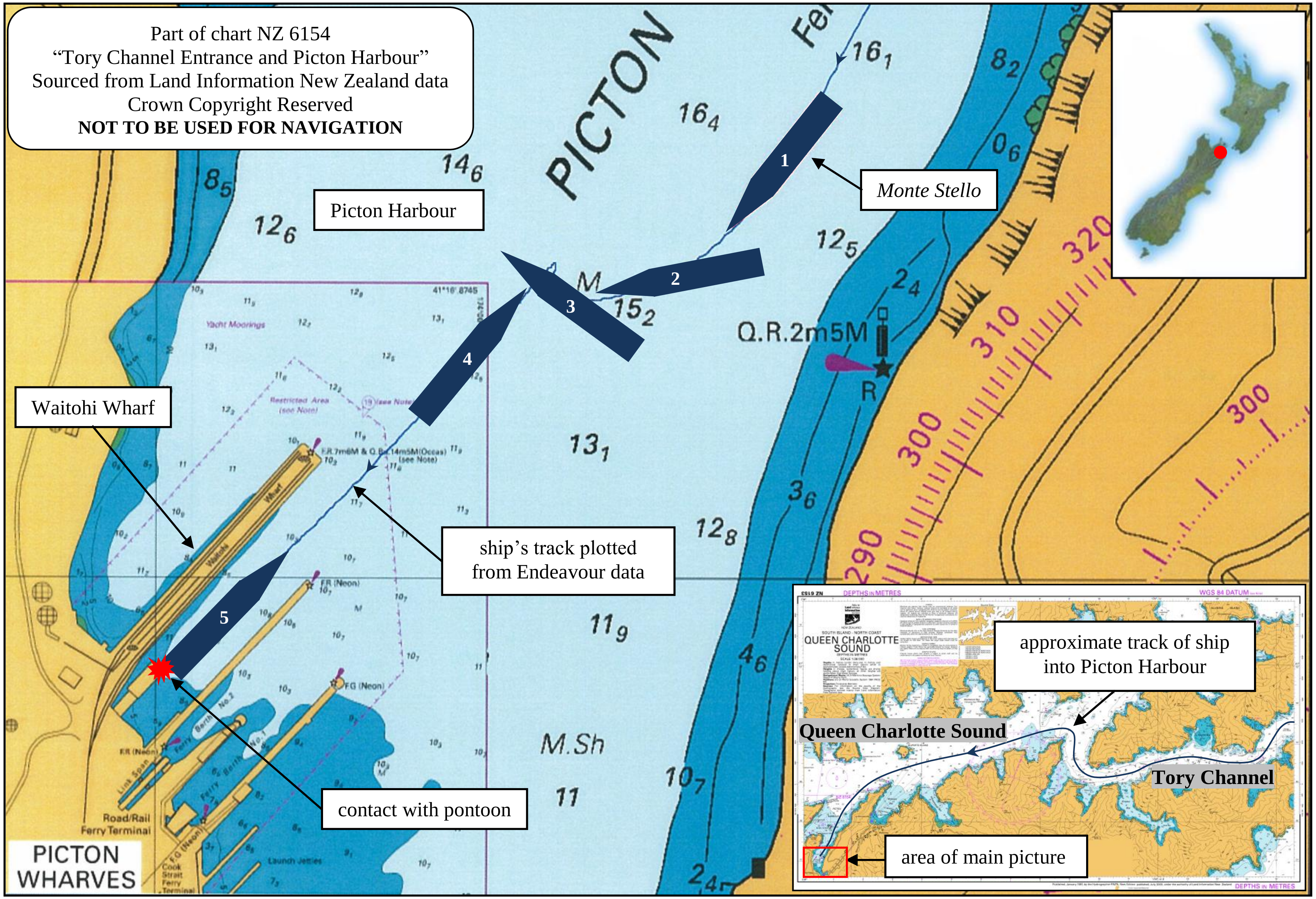

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Figure 1
General area of Picton collision

1 Factual Information

1.1 Narrative

Picton collision, 8 August 2008

1.1.1 At about 2300 on 7 August 2008, the passenger and freight ferry *Monte Stello* had crossed Cook Strait and was about 20 minutes from the entrance to Tory Channel. A master, who was additional to the ship's usual crew who was conning the ship handed over to the second officer for training purposes. The second officer was to con the ship under the supervision of the additional master for the remainder of the voyage through Tory Channel and Queen Charlotte Sound to Picton (Figure 1 inset). A lookout and helmsman were also present on the bridge.

1.1.2 At about 2320, the ship entered Tory Channel and continued without incident on its intended track into Queen Charlotte Sound. At about 0015 the ship approached Picton Harbour and it's speed was reduced. The second officer went to the port bridge wing, taking over the steering control from the helmsman using a controller mounted on a wandering lead. The engine and bow thruster controls were switched from the bridge centre console to the port bridge wing console. The helmsman and lookout were then dismissed to go to their mooring stations and the additional master joined the second officer on the port bridge wing.

1.1.3 The weather at the time was cold with a slight drizzle and light winds about 5 knots varying southeast to southwest.

1.1.4 The second officer operated the steering and bow thruster controls and was verbally giving propeller pitch orders to the additional master, who was operating the engine pitch controls. The ship was turned to starboard through 180 degrees by using astern thrust on the starboard engine, ahead thrust on the port engine and the bow thruster until it was parallel to Waitohi Wharf (Figure 1).

1.1.5 Astern pitch was then applied to both propellers and the ship began to move astern parallel to the wharf, and towards the floating pontoon onto which the stern ramp was to be lowered

1.1.6 As the ship moved along the wharf, the assistant bosun who was on the aft mooring deck advised the bridge by radio when the stern of the ship was in line with the bridge mark on the wharf. At this point both propellers were put to zero pitch, then ahead pitch (+2) was applied for a short period. The second officer felt the ship slow down, so he ordered zero pitch again.

1.1.7 When the bridge was about 50 m from the bridge mark on Waitohi Wharf, ahead pitch (+3) was applied to both propellers to slow the ship down. When the bridge was estimated to be about 20 m from the bridge mark, the pitch was increased (+5).

1.1.8 The assistant bosun was working with the other crewmen on the mooring deck and they had put one line ashore when he noticed the ship's stern was about 10 m from the ramp and became concerned the ship was going to collide with the pontoon. He used the radio to advise the bridge when the ship was about 10 m, 5 m, 2 m and one metre off the pontoon.

1.1.9 The ship's stern hit the floating pontoon at a speed estimated by the additional master to be about 2 knots.

1.1.10 The second officer had not looked at the pitch indicators located on the bridge wing console as the ship backed into the berth. He was instead looking for the propeller wash from the stern of the ship. The additional master was not looking at the pitch indicators either and just applied the pitch settings ordered. He was unable from his position on the bridge wing inboard of the second officer to see any wash from the propeller.

1.1.11 After the ship hit the pontoon, it began to move forward. The ship was then manoeuvred back into position and secured alongside without further incident.

1.1.12 Port Marlborough engineers made an assessment of the pontoon and advised that it was unfit for use, having sustained structural damage. The ship sustained buckling of the hull plating around the stern, with a crack that allowed a small quantity of water through on the return journey to Wellington.

1.1.13 Unable to discharge passengers and freight using the ramp, the ship waited for an adjacent berth to become available. The additional master at the time of the accident did not report any faults with the engines to the chief engineer and told him they assumed the collision had been caused by a ship handling error.

1.1.14 The ship's engines and steering gear were tested before the ship was moved to the adjacent berth, and no faults were reported.

Wellington collision, 9 August 2009

1.1.15 After the collision in Picton the ship made 3 more crossings of Cook Strait without incident and on the last crossing arrived in Picton at about 0300 on Saturday 9 August 2009.

1.1.16 The ship was loaded and made ready for departure for the return voyage to Wellington. The master was on the bridge and accepted the transfer of pitch controls from the engine control room to the bridge. The master said that when the pitch controls were transferred the port propeller pitch went astern by about 50%. This fault had happened before and the master, as he had on previous occasions, used the emergency override to return the pitch to zero before changing back to bridge control. The ship departed Picton at about 0440 for Wellington with the master conning the ship into Cook Strait, whereupon the second officer took over the watch.

1.1.17 At about 0650 the master returned to the bridge to take the con and by about 0730 the ship was off the entrance to Wellington Harbour. With the master on the bridge were a helmsman, a lookout, the second officer and a prospective mate/master.

1.1.18 By about 0756, the ship had transited Wellington Harbour and was making a standard approach to Glasgow Wharf with some allowance being made for a south-southwest wind blowing at about 25 knots, gusting 30 knots. The ship was making about 13.9 knots (position 1 in Figure 2).

1.1.19 The master went to the starboard bridge wing with the remote steering control and swung the ship through a port turn, assisted by the second officer positioned at the centre console ready to operate the engine pitch and bow thruster controls to the master's orders. The turn was executed using rudder, zero pitch on the port propeller and keeping ahead pitch (+3) on the starboard propeller (position 2 in Figure 2).

1.1.20 When the port turn was complete, both propeller pitch controls were put to astern (-5). The master returned to the bridge centre console and the pitch and bow thruster controls were then transferred from the centre console to the port bridge wing where the second officer was then stationed. The master and the prospective master then joined the second officer on the port bridge wing.

1.1.21 As the ship tracked back towards the berth, the port propeller pitch was reduced to astern (-3). This was intended to create an asymmetric thrust to keep the stern from falling down onto the wharf, while starboard thrust was applied to the bow thruster to prevent the bow falling away owing to the south-southwest wind. The bosun on the aft mooring deck radioed the master when he estimated that the stern was about 150 m off the wharf to advise the berth was "open" (the stern of the ship was outside the line of the berth).

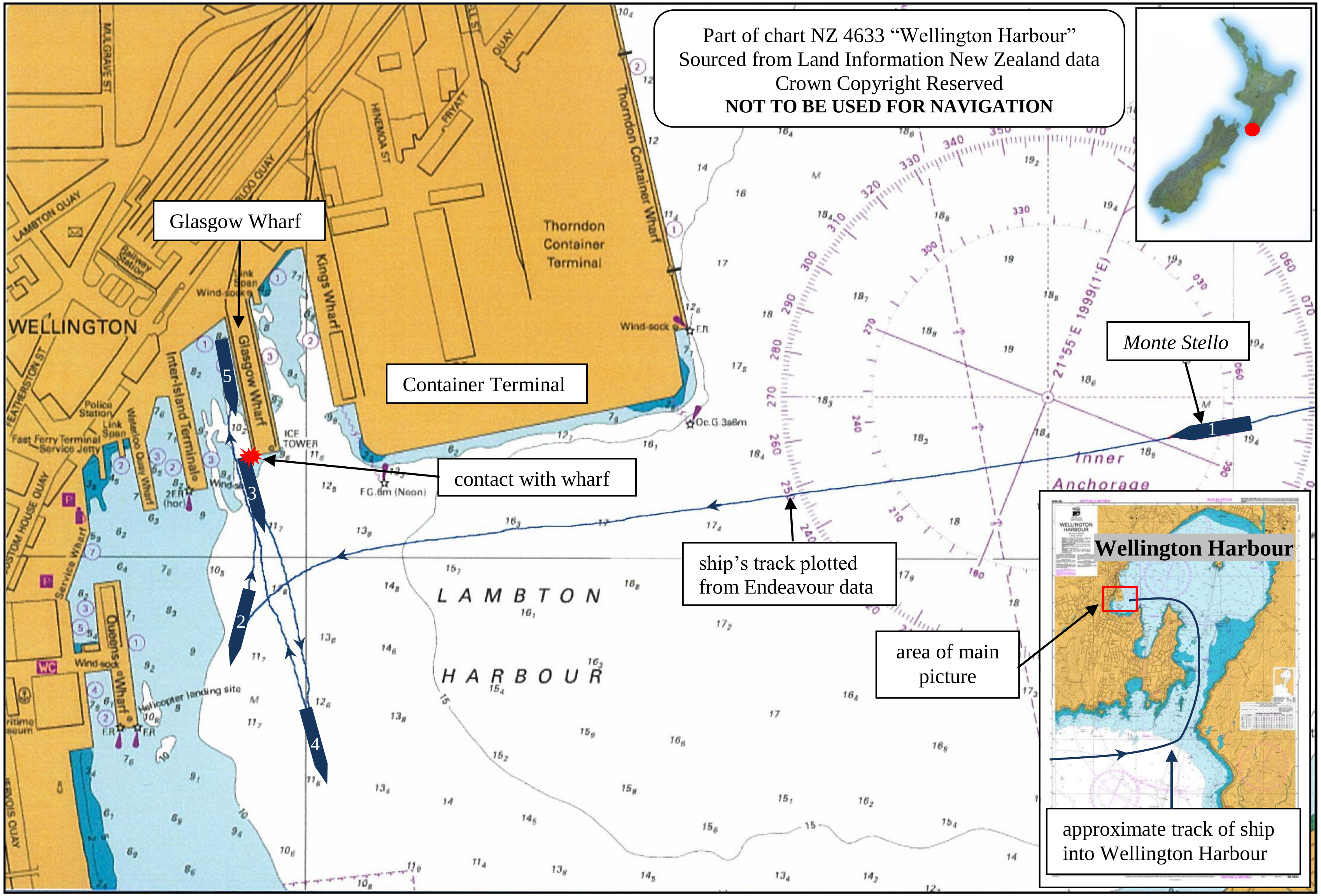

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Figure 2
General area of Wellington collision

1.1.22 At about this time the second officer advised the master that he did not think the bow thruster was working correctly, because the ammeter was not showing its normal reading for the pitch applied (he thought it was reading too high) and he thought the ship's head was not responding as he expected. At about that time the master ordered both port and starboard propeller pitch to be put to zero. The master later said he could not discern whether the bow thruster was operating correctly and at that stage he was satisfied he could still adjust the ship's course using the ship's engines and rudder if necessary.

1.1.23 The bosun said that when he estimated the stern was about 120 m off the end of Glasgow Wharf he advised the master by radio that the ship was close on Glasgow (the stern of the ship inside the line of the berth), and he repeated this at 100 m. The master recalled that he heard the bosun counting down the distance between the stern and the wharf over the radio from about 100 m, and at 80 m that the berth was closing. At that point the master said he ordered ahead pitch (+3) on both engines but felt the ship was not responding to the pitch order, which was confirmed verbally by the second officer. The master said he ordered ahead pitch (+5) on both propellers around about the time the bosun radioed that the stern was 60 m off the berth. The master said he then looked at the pitch indicators, something he normally did not do, and noticed that both were still reading zero.

1.1.24 The master then ordered full ahead pitch to both propellers, at which point he estimated the stern was about 40 m off the berth. The ship continued moving astern and its stern collided with the knuckle of the wharf, at a speed estimated by the second officer to be about 3 knots. The prospective mate/master said that he estimated the ship collided with the wharf about 30 seconds after the full ahead order was given. The second officer said that he did not recall the interval between ahead pitch being applied and the collision.

1.1.25 The second officer said he observed the pitch indicators move as the full ahead order was given and the prospective mate/master said he observed ahead pitch coming on both propellers as the ship struck the wharf. The master thought pitch came on shortly after. As more ahead pitch came on the propellers, the ship moved off the wharf, increasing speed towards the centre of the harbour.

1.1.26 The master went to the centre bridge console. He contacted the engine room and told the chief engineer that he did not have pitch control, then added it had just returned. The engine room advised that there appeared nothing wrong at their end and asked if the master wanted the pitch and engine control transferred back to the engine room. The master asked the chief engineer to stand by, then reduced the pitch on both engines.

1.1.27 In the engine control room the ship's engineers had been handing over the watch. If the ship had kept to its usual schedule and not been delayed owing to the earlier collision in Picton, the ship would have been moored alongside when the handover was made.

1.1.28 The second engineer and third engineer who had been on duty were due to be relieved by the chief engineer and another third engineer. The chief engineer had arrived in the control room at about 0750 and was talking to the other engineers and organising the work schedule for the day. None of the engineers was paying particular attention to how the stand-by was progressing, and they were first alerted to the occurrence when they felt the bump as the ship collided with the wharf.

1.1.29 The chief engineer said that, after feeling the collision, he looked at the pitch indicators and observed that they were both showing ahead pitch. The next thing he observed was the port shaft alternator breaker tripping, then main engine exhaust temperature deviation alarms and high exhaust temperature alarms sounded. He also heard the turbocharger on the port main engine surging ("making a barking noise").

1.1.30 It was at that point that the master called the chief engineer on the intercom and said he'd lost control of the pitch. The chief engineer said that he looked at the pitch indicators on the control room console and saw that the port pitch indicator was showing 94% ahead and "plenty" on the starboard pitch indicator. That was when he asked the master if he wanted the engine room to take over the pitch control, but the master requested that he stand by. Shortly after this, both engines returned to zero pitch. The second engineer, who could see the pitch indicators on the console, said that when he felt the bump the port pitch indicator was at 65% and rising, eventually reaching about 90%.

1.1.31 The chief engineer then reset the shaft alternator and advised the master that the bow thruster that was being supplied by the shaft alternator could be restarted.

1.1.32 The master brought the ship to rest towards the middle of the harbour (position 4 in Figure 2) and changed the pitch controls back to the bridge centre control station. The master then tested the pitch controls of both engines ahead and astern. Both were observed to operate but with different speeds of response.

1.1.33 The prospective mate/master observed the tests conducted by the master and remained stationed at the centre bridge console in case of further pitch problems; he would be in a position to change over to the emergency pitch controls. He also noted the response times of the pitch controls to the pitch orders as being constant during the tests and subsequent berthing; 5 seconds for the port and 13 seconds for the starboard pitch systems.

1.1.34 Once satisfied that the controls were operating albeit with a delay, the master berthed the ship without further incident.

1.1.35 An assessment of the damage was made by the ship's personnel and a classification society surveyor who was attending the ship because of the earlier collision in Picton. An investigation then began into the occurrence.

1.2 Damage

1.2.1 Waitohi Wharf in Picton utilised a link-span to facilitate the loading and unloading of Strait Shipping's 2 passenger ferries. The link-span was hinged at both ends, one of which was connected to the shore and the other to a floating pontoon onto which a ship's stern door was lowered (Figure3).

1.2.2 When the M*onte Stello* hit the floating pontoon, 5 hinges that linked the floating pontoon to the link-span sheared off and 2 of the brackets that secured the floating pontoon to the adjacent piles also sheared (Figure 4). There was also superficial damage to the pontoon plating. The pontoon was out of commission for about 2 days while repairs were made.

1.2.3 The stern of the ship was damaged slightly by the impact and required some remedial welding repairs when the ship arrived back in Wellington.

1.2.4 The port aft quarter of the *Monte Stello* contacted the knuckle of Glasgow Wharf, and in the impact the wooden fenders and the wharf were damaged (Figure 5). The damaged piles and fenders that had fallen into the water were removed by a diving contractor and the wharf repaired.

1.2.5 The collision punctured a hole in the shell plating of the ship above the water line (Figure 6).

1.2.6 The *Monte Stello* returned to service 8 days later after repairs had been made to the ship's hull plating.

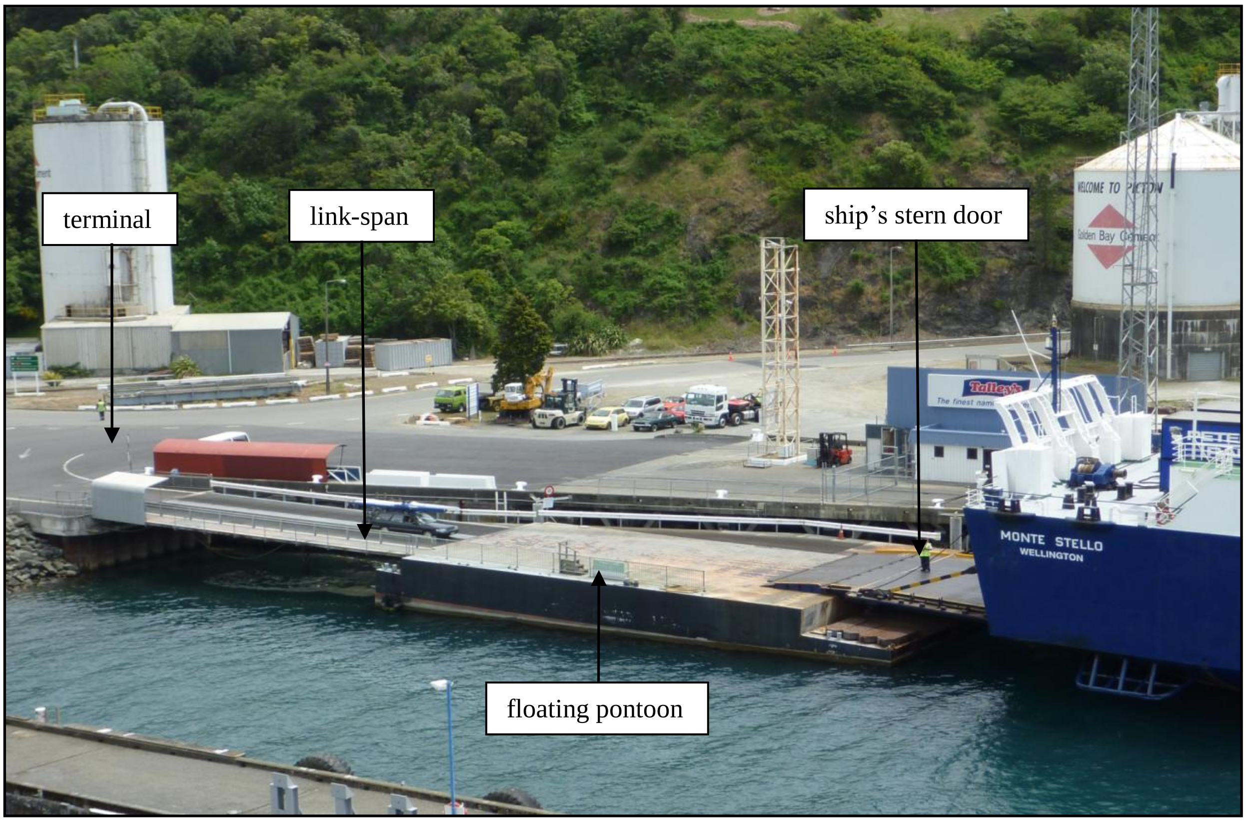

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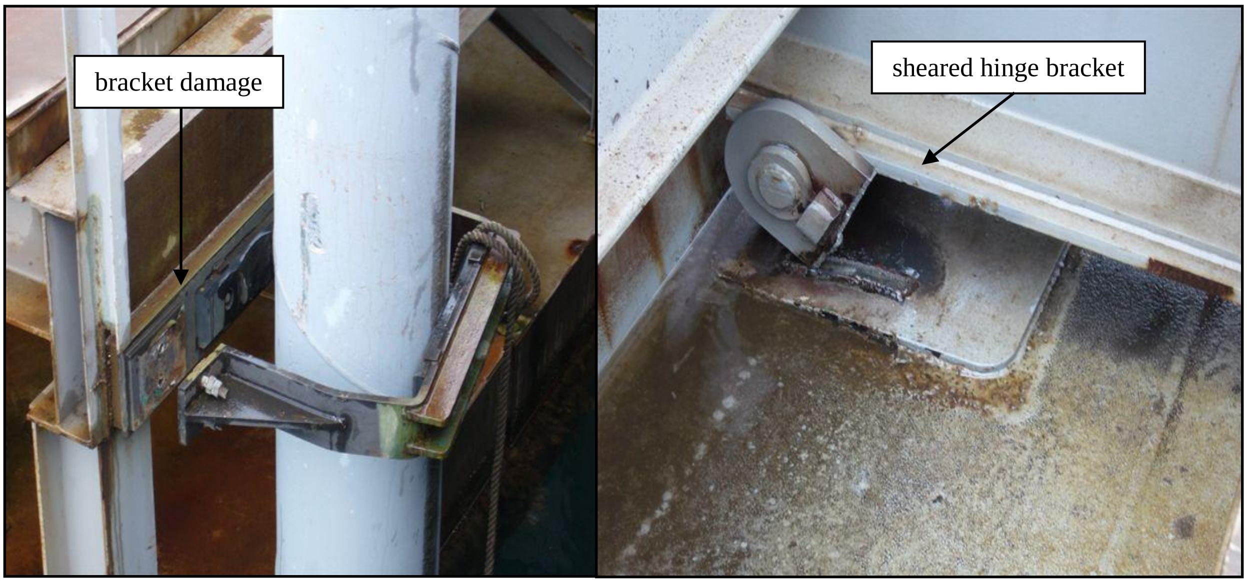
Figure 3
Picton link-span and floating pontoon



Photographs courtesy of Marlborough District Harbourmaster

Figure 4
Damage to hinges and brackets on link-span

Figure 5
Damage to end of Glasgow Wharf

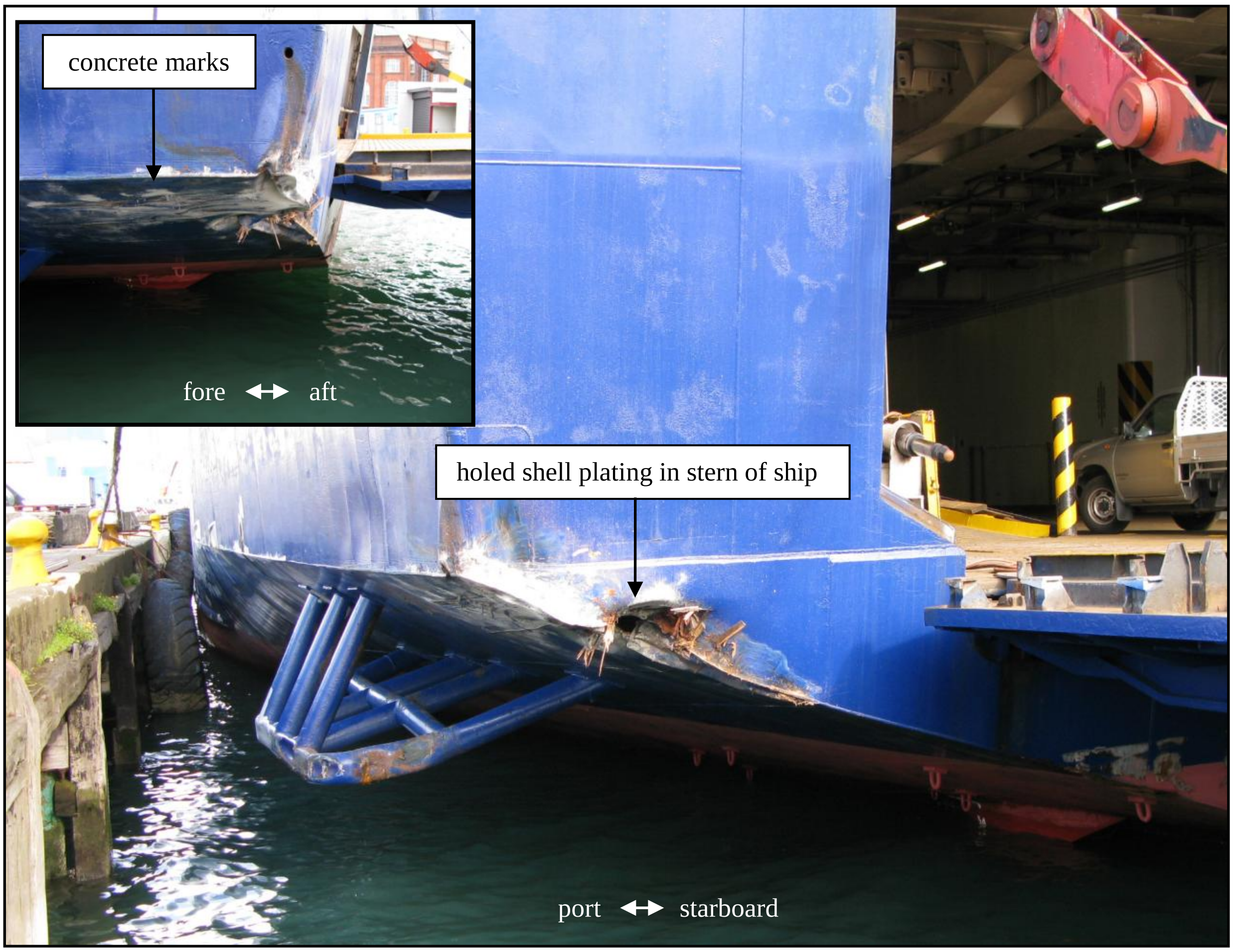


Figure 6
Damage to *Monte Stello* stern after Wellington collision

1.3 Ship and company information

1.3.1 The *Monte Stello* was built in 1979 by Société Nouvelle Des Ateliers et Chantiers in Le Harve, France. The ship was originally built for Société Nationale Maritime Corse Méditerranée, which operated freight and passenger services between Marseilles and Corsica.

1.3.2 On 1 January 1994, the *Monte Stello* was on a voyage from Marseilles to Porto Vecchio, Corsica when it grounded on rocks off Sardinia. Although the ship was declared a constructive total loss, it was eventually re-floated on 2 May and taken for repair.

1.3.3 In 1996 the ship was sold to the Lithuanian Shipping Company, Kaleida. The ship was renamed the *Palanga* and entered service between Klapeida and Keil and later Stockholm and Karlshamn.

1.3.4 In 2001 Lisco Baltic became the registered owner and the *Palanga* was transferred to DFDS Tor Line services between Esbjerg and Harwich then Lubeck and Ventspils. This was followed by a brief charter to Transmediterranea, which engaged the ship on a service between Las Palmas and Tenerife.

1.3.5 In January 2006 the *Palanga* was sold to Strait Shipping, New Zealand and reverted to its original name, *Monte Stello*. Prior to purchase the ship was inspected by representatives of Strait Shipping at Las Palmas dry dock.

1.3.6 The *Monte Stello* arrived in New Zealand during March 2006, and was refitted in the VT Fitzroy dry dock in Auckland before entering service in August 2006, operating between Wellington and Picton.

1.3.7 The *Monte Stello* had a freight capacity of 970 lane metres and was certified to carry 369 passengers.

1.3.8 Strait Shipping started operating Cook Strait freight ferry services in 1992. In 2003 the company began the Bluebridge passenger service across Cook Strait, and at the time of the occurrences the company operated 2 passenger ferries, the *Monte Stello* and *Santa Regina*, sailing between Wellington and Picton. The company also operated a freight-only vessel the *Kent*, which serviced various ports on the New Zealand coast.

1.3.9 The *Monte Stello* was registered in New Zealand and operated under New Zealand Maritime Rules, designated as a passenger ship over 45m in length and operating outside restricted limits.

1.4 Personnel information

Picton

1.4.1 The additional master had started his sea-going career in 1977 with the Union Steam Ship Company and had sailed on a variety of ships that included tankers, bulk carriers and roll-on/roll-off (ro-ro) ferries. In 1999 he sailed as first mate on the fast ferry *Top Cat* on the Cook Strait service. In 2001 he joined Strait Shipping and sailed as mate/master on the passenger ferry *Suilven*, then served on the *Kent* as master in 2004. After about 3 years serving on the *Kent* he served as relief master on the passenger ferry *Santa Regina*, and he had just started his second tour of duty on the *Monte Stello*, having completed a 2 week voyage about 6 weeks earlier. During that voyage he had received training and berthed the ship under the supervision of the master and mate/master. On the occurrence voyage he was an extra hand, so was working 8 hours on and 16 hours off with the rostered master and mate/master. He held a pilot's exemption licence for Picton, which had been issued in 2000.

1.4.2 The second officer had begun his sea-going career in 1993 and held a master's class one certificate of competency. He had sailed on a variety of ships, including oil carriers and bulk carriers, and had command experience on a bulk carrier. In December 2007 he had started employment with Strait Shipping as a second officer sailing on the other Bluebridge passenger ferry, the *Santa Regina*, until March 2008. Since March he had been working on the *Monte Stello* on a 2-week-on and 2-week-off roster, and with the other second officer was working 4 hours on and 4 hours off followed by 8 hours on and 8 hours off. He had berthed the *Monte Stello* under the supervision of the master about 4 times on his previous voyage and on occasions before that, but had not kept an exact record.

1.4.3 The assistant bosun held an offshore watch keeper certificate and had had about 23 years' experience on small vessels prior to his employment with Strait Shipping, where he had been for about 2½ years. He was normally employed as a seaman but on the occurrence voyage had been promoted to assistant bosun because the regular assistant bosun was not on board.

Wellington

1.4.4 The master had started his sea-going career in 1963. Between 1979 and 2000 he had been employed as pilot, port operations manager, harbour master and chief pilot. In 2001 he joined *Strait Shipping*, serving for 3 months as a second officer before serving on the *Suilven* as mate/master for about 2 years. He then served as mate/master and master of the *Kent* before moving to the passenger ferry *Santa* Regina, on which he spent more than 4 years as master. At the time of the occurrence he had been on the *Monte Stello* for about 5 months, working 2 weeks on and 2 weeks off. He held a master mariner's certificate of competency and retained his licences to operate as a pilot.

1.4.5 The second officer had had about 12 years' previous experience as a deck officer, including as a first mate and master on foreign-going cargo ships. After 3 years' employment ashore he joined Interisland Line as a mate/master, before serving as mate with a number of companies, including Strait Shipping, until he began permanent employment in 2000 as a third then later as a second officer. He had spent considerable time on the *Santa Regina* but had only been on the *Monte Stello* for 3 days, sailing on the ship to Auckland for dry-docking, and had been on board about 2 days on the Cook Strait operation before the occurrence.

1.4.6 The prospective mate/master had 17 years' command experience on general cargo, bulk carrier and square rig sailing ships and experience in anchor handling, supply and tow offshore vessels.

1.5 Propulsion system

1.5.1 The main propulsive power on the *Monte Stello* was provided by 2 Pielstick V12 diesel engines. Each main engine was operated at constant speed and drove a controllable pitch propeller (CPP) for propulsion and a shaft generator for electrical power generation. The *Monte Stello* had 2 independent port and starboard CPP systems. The general arrangement for a single system is shown in Figure 7. The port and starboard propellers were counter-rotating inwards (port rotating clockwise and starboard anticlockwise when viewed from the stern).

1.5.2 On a CPP, each of the propeller blades on the propeller hub could be rotated simultaneously about its vertical axis to change the pitch angle to produce ahead or astern thrust, without changing the direction of the propeller. In the neutral pitch position the propeller blades generated zero thrust even when the propeller hub was turning.

1.5.3 The original CPP system had been installed by LIPS BV when the ship was built. In 1995 when the ship was reinstated after it grounded, the CPP control system had been modified. The system was originally capable of 2 modes of operation: "constant speed" and "combinator". Strait Shipping only operated in the constant speed mode, where the engine revolutions remained constant at all times and only the pitch was adjusted. The combinator mode was not used because the main engine-driven shaft generators required a constant speed and the system had not been tested. In the combinator mode adjustments would have been made to engine revolutions and pitch together through the manoeuvring range. The original control functions for an automatic pitch reduction in the event of an overload of an engine also did not function, so pitch adjustments were made manually on the bridge, usually on advice from the engine room.

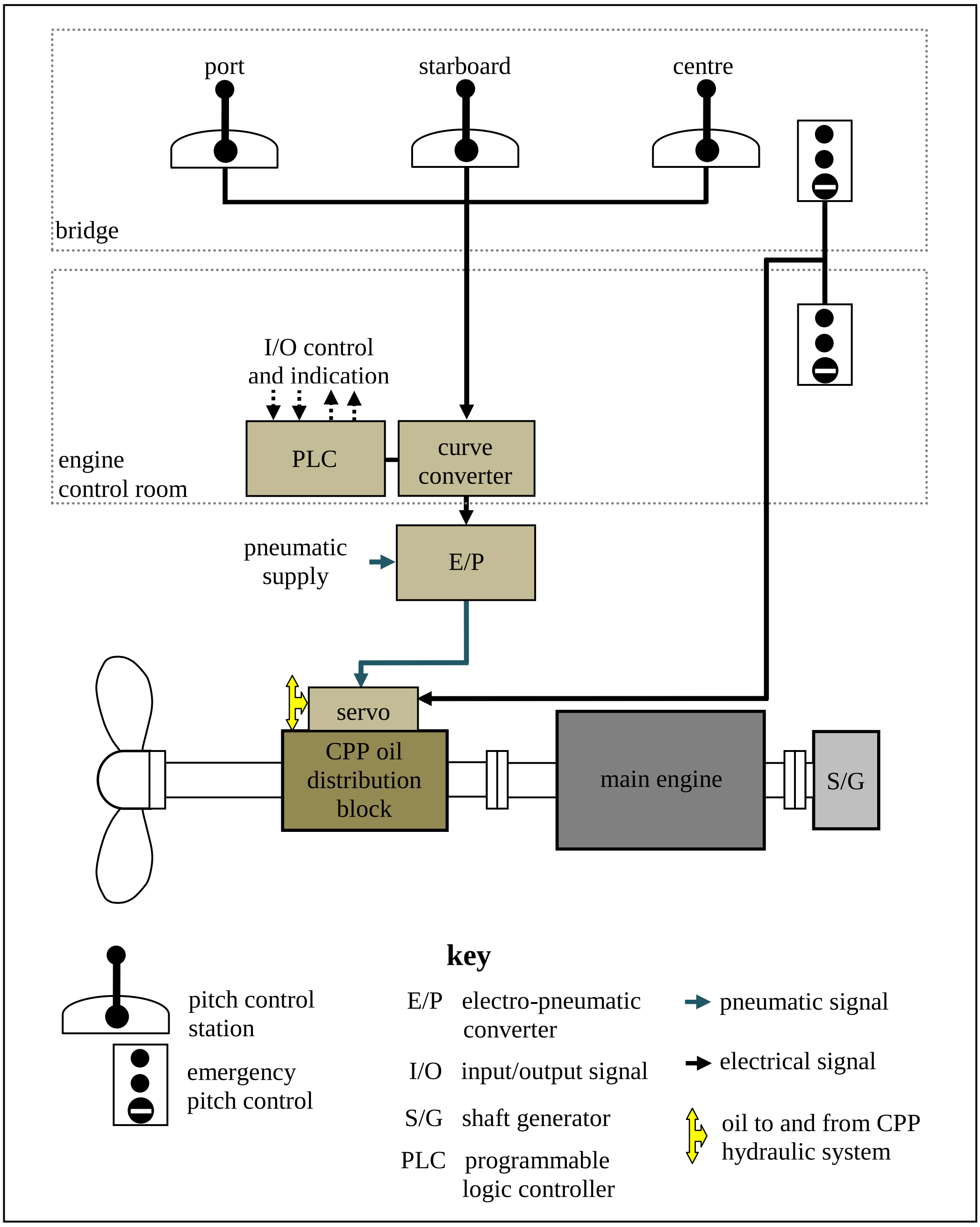


Figure 7
Simplified CCP system

1.5.4 On the *Monte Stello* the pitch on the propellers was normally controlled from one of the 3 bridge control stations, one located at the centre console inside the bridge and one located on each bridge wing. Each control station had pitch levers for both propellers, but only one station could be used at any time. When the ship was secure alongside and the engines not required, control was transferred to the engine control room station.

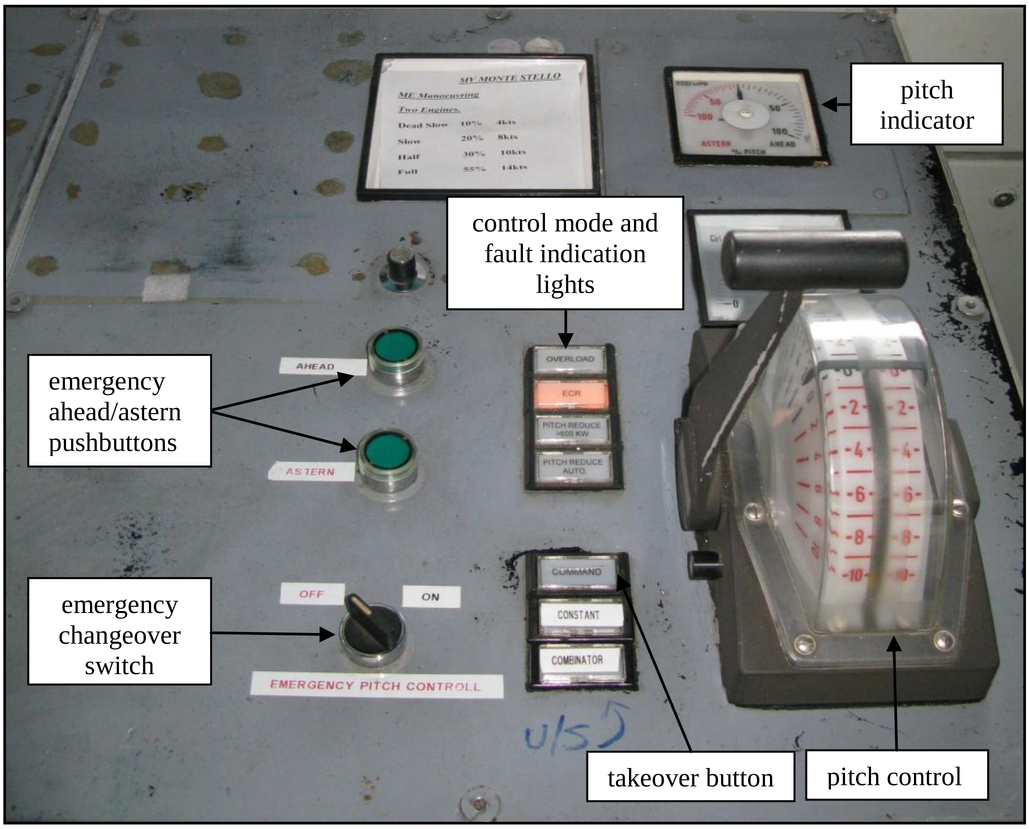


Figure 8
Port pitch control on bridge centre console

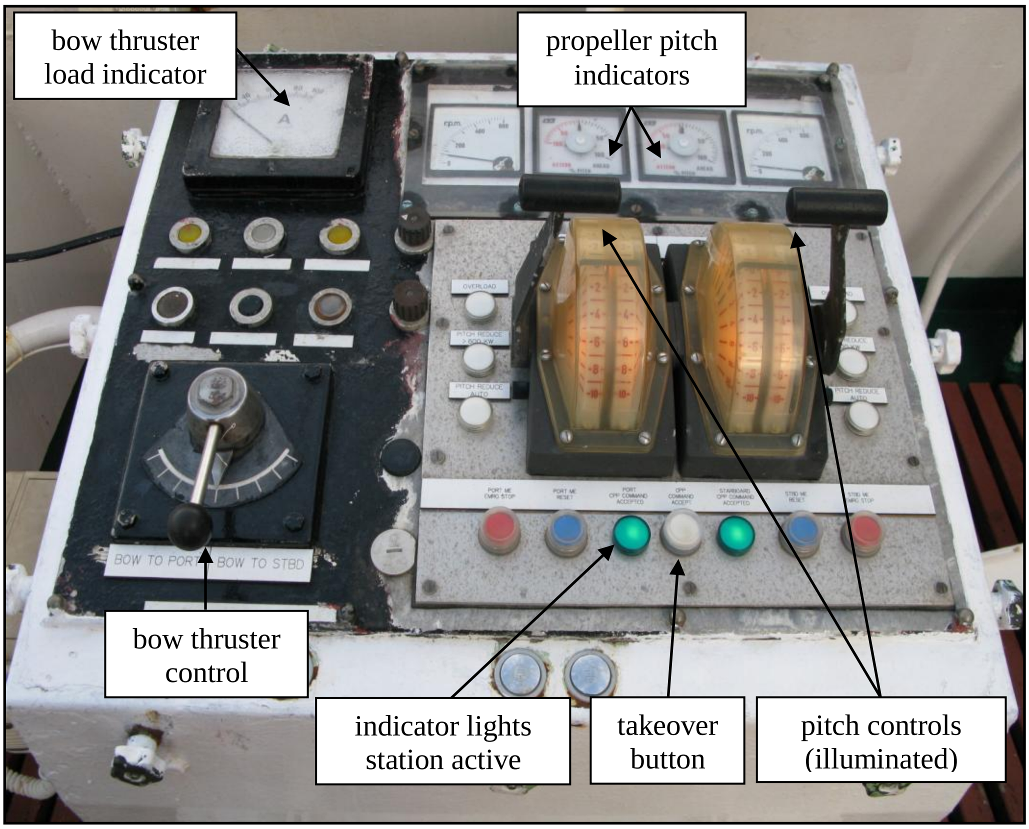


Figure 9
Both pitch controls port bridge wing

1.5.5 When a pitch lever was moved to a new position, a corresponding electrical signal was sent to a curve converter, which then sent an electrical signal to the electro-pneumatic (E/P) converter. This signal was selected by a programmable logic controller from a number of different output characteristics available inside the curve converter for different operating modes. For each different characteristic stored in the curve converter, a different output response could be given for a given pitch order, thereby controlling the amount and rate at which pitch was applied. The programmable logic controller selected the required curve in the curve converter dependent on the control mode selected by the bridge or engine room, and also managed the alarm and control indication functions associated with the CPP systems.

1.5.6 The electrical signal from the curve converter was then converted into a pneumatic signal by an electro-pneumatic (E/P) converter, which was used to operate a servo, which in turn operated an oil distribution valve that controlled the flow of hydraulic oil to adjust the pitch of the blades on the propeller hub. The operation of the CPP hydraulic system is explained in more detail later in this section.

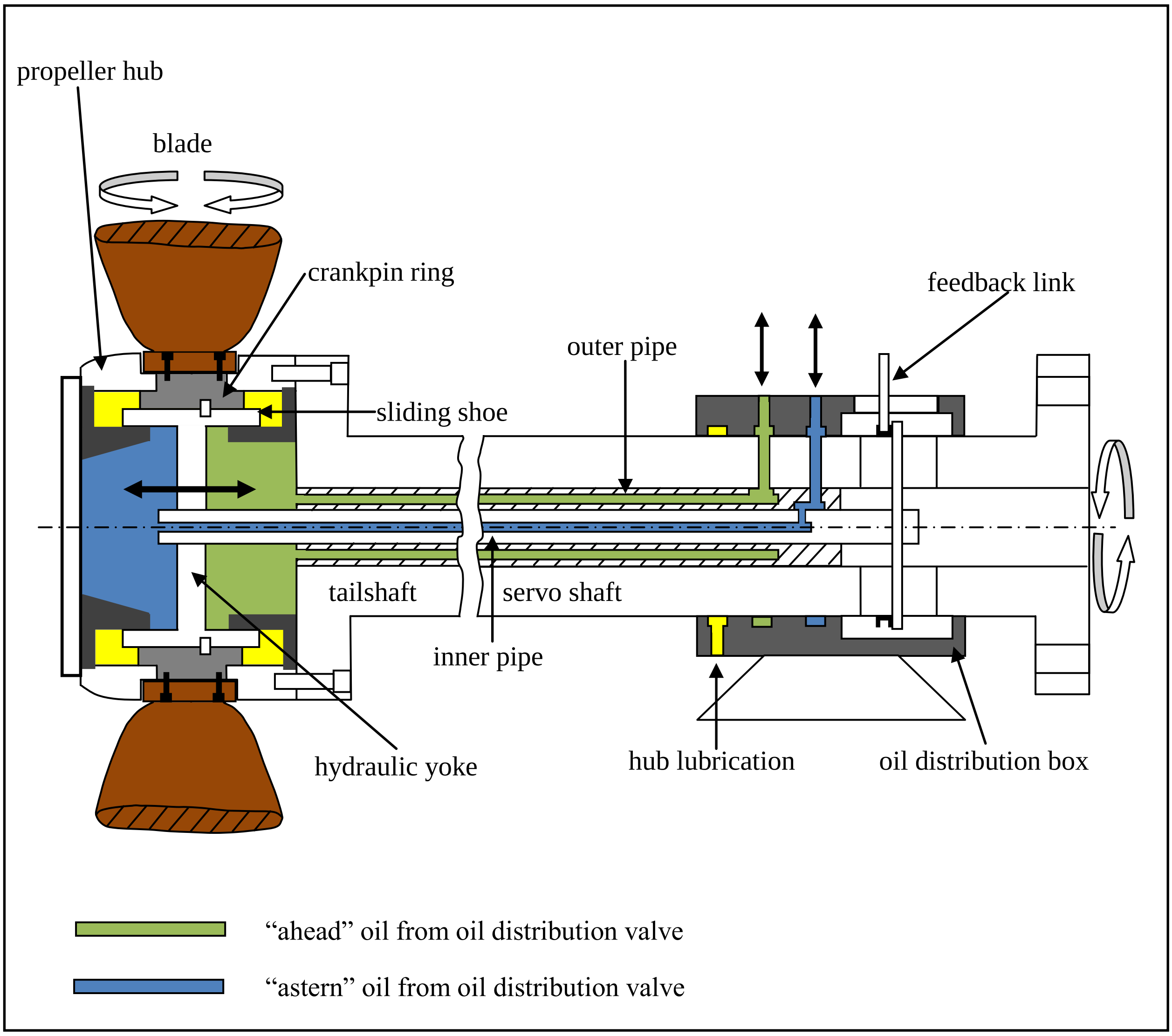


Figure 10
Simplified drawing of CPP operation

1.5.7 In bridge control mode, the pitch levers at the non-active bridge stations followed the lever (or pitch order) on the active bridge station. A transfer of control from one station to another was made by pressing the corresponding takeover button at the station where control was to be taken. When a control station was active, the pitch control lever scale and take-over buttons were illuminated (Figures 8 and 9). Pitch indicators at each control station displayed the amount of pitch on each propeller.

1.5.8 Emergency push-button controls (one button for ahead and one for astern) were also fitted on the bridge centre console and were initiated by a switch. By pushing the appropriate button pitch in the required direction was applied, the amount of pitch dependent on the length of time a button was pressed for the operator observing the pitch meter to see how much pitch was applied. Once the button was released no more pitch was applied. More pitch could be applied by pressing the same button again, while to reduce pitch the opposite button was pressed until the required pitch was reached.

1.5.9 Figure 10 shows a simplified diagram of the general principle of operation for the CPP propellers on the *Monte Stello*. A cast propeller hub was bolted to each tail shaft, and inside the hub a hydraulic yoke was connected to the moveable propeller blades via a sliding shoe and crankpin ring. This arrangement converted an axial movement of the yoke to rotate the blades about their own axis.

1.5.10 The tail shaft was connected by a coupling to the servo shaft, which was part of the intermediate shafting and driven by the main engine. The shafting was hollow bored and contained 2 coaxial pipes that formed supply and return passages to each side of the hydraulic yoke. The inner pipe about which the shaft rotated also operated the pitch mechanical feedback mechanism for the hydraulic system.

1.5.11 The inner pipe also conveyed low-pressure oil to the aft side of the hydraulic yoke for astern pitch adjustment. The outer pipe fixed inside the shafting conveyed-high pressure oil for ahead pitch adjustments.

1.5.12 The rotating servo shaft was supplied with oil through a stationary oil distribution block, which was fitted with seals to prevent oil leakage. The hydraulic oil for pitch control was supplied through an oil distribution valve that was also connected to the feedback link. The feedback link activated a feedback sensor, which relayed the actual pitch angle to the control system and also formed part of the mechanical linkage for local operation at the oil distribution box in the event of an emergency.

1.5.13 Figure 11 shows the principle of operation of the oil distribution valve.

1.5.14 In the event of a failure of the bridge controls, the first available option was to use the emergency pitch control (buttons) on the bridge. If this failed, the engine room could control the pitch in the same way using an identical set of emergency pitch controls in the engine control room. In the event of a total failure of the remote control systems, pitch could be controlled locally in the engine room at the oil distribution box by using a lever to operate the servo manually. A telegraph system and telephone were provided at these local stations to facilitate helm orders from the bridge.

1.5.15 In the hydraulic system, 2 supply pumps fed filtered hydraulic oil under pressure to the oil distribution block and servo. The system also contained an oil cooler, feed and header tanks, and alarms and automatic pump changeover in the event of a malfunction.

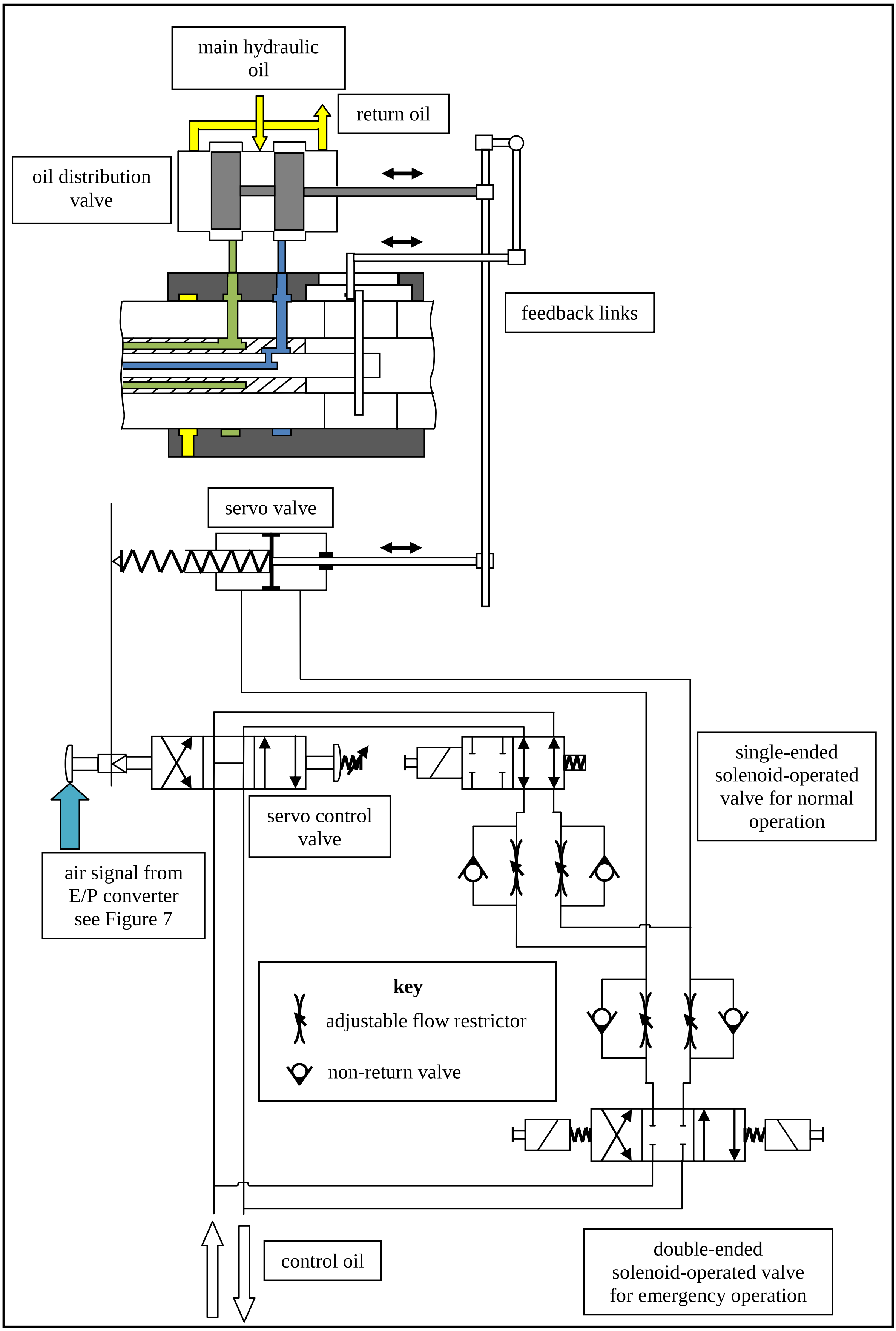


Figure 11
CPP control system

1.5.16 Figure 11 has been developed from the manufacturer's drawing and shows in more detail the pneumatic/hydraulic control system for a single CPP system (Lips B.V Drunen- Holland, 1995). The air signal from the E/P converter operated a 3-position hydraulic valve (servo control valve) that was supplied with control oil from the main hydraulic system. In normal operation, oil from the servo control valve passed through the single solenoid valve to a servo valve. The position of the servo control valve determined the oil flow to and from the servo valve, which was mechanically linked to the oil distribution valve. The movement of the link operated the oil distribution valve, which applied main hydraulic oil to the oil distribution block to move the propeller blades in the required direction. In an emergency the servo valve could be disconnected and a lever on the link used to control the pitch at the oil distribution box in the event of a total control failure.

1.5.17 In emergency operation the single ended-solenoid valve blocked the flow from the servo control valve, and operation of the solenoid valves on the double-ended valve moved the servo valve in the required direction.

1.5.18 Adjustable flow restrictors allowed some coarse adjustment of the oil flow to limit the maximum operating speed of the servo.

1.6 International Safety Management Code and maintenance

1.6.1 The *Monte Stello* was a New Zealand-registered passenger ship operating in the coastal limit and so subject to New Zealand Maritime Rules.

1.6.2 Under New Zealand Maritime Rules, Strait Shipping was required to operate the *Monte Stello* within a safe management system. The safe management system in use on the ship was the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code) as adopted by the International Maritime Organization (IMO) in SOLAS, (International Maritime Organization, 2002). This Code was a requirement for SOLAS ships, ships that traded internationally and under New Zealand Maritime Rules Part 21 Safe Management Systems (New Zealand Government, 1997), the ISM Code was applied to passenger ships of 45 m or more in length that proceeded beyond restricted limits. Compliance with the ISM Code was verified by Maritime New Zealand (Maritime NZ), which was also responsible for Port State inspections of the ship.

1.6.3 ISM Code section 10, (ibid) set out the requirements for maintenance of a ship and its equipment:

> 10 Maintenance of the ship and equipment:
>
> 10.1 The Company should establish procedures to ensure that the ship is maintained in conformity with the provisions of the relevant rules and regulations and with any additional requirements which may be established by the Company.
>
> 10.2 In meeting these requirements the Company should ensure that:
> .1 inspections are held at appropriate intervals;
> .2 any non-conformity is reported with its possible cause, if known;
> .3 appropriate corrective action is taken; and
> .4 records of these activities are maintained.
>
> 10.3 The Company should establish procedures in SMS [safe management system] to identify equipment and technical systems the sudden operational failure of which may result in hazardous situations. The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems. These measures should include the regular testing of stand-by arrangements and equipment or technical systems that are not in continuous use.
>
> 10.4 The inspections mentioned in 10.2 as well as the measures referred to 10.3 should be integrated in the ship's operational maintenance routine.

1.6.4 When the *Monte Stello* was purchased by Strait Shipping, the maintenance records for the ship's machinery were sparse. After the delivery voyage was completed, a sample inspection of the main engine-running machinery proved its poor condition and resulted in a major overhaul of both engines. The poor condition of the main engines raised questions about the accuracy of the maintenance records that came with the ship.

1.6.5 Strait Shipping established a computerised planned maintenance system on the *Monte Stello*, which set out the maintenance requirements for the ship's equipment and machinery. The system was a copy of that used on the company's other Cook Strait ferry, the *Santa Regina*, so was familiar to technical staff. The system was approved by the classification society Det Norske Veritas.

1.6.6 Although the *Monte Stello* was similar to the *Santa Regina*, not all of the job descriptions and maintenance intervals were applicable to the machinery of the *Monte Stello* because of the differences between the 2 ships. Strait Shipping considered its approach as the best option for a starting point and that the system would be refined with time and experience.

1.7 Security camera footage

1.7.1 At the time of the occurrence, a Picton port security video camera directed at Waitohi Wharf recorded the *Monte Stello* berthing and contacting the floating pontoon.

1.7.2 The recording showed that as the ship was backing towards the pontoon propeller wash appeared from the stern of the ship when the stern of the ship was about 40 to 45 m from the floating pontoon, about 57 seconds before the collision.

1.7.3 The security camera footage was not clear enough to determine when wash appeared earlier during the berthing.

1.7.4 Although security cameras were used in Port Wellington, none of the cameras in the vicinity of Glasgow Wharf recorded the collision on 9 August 2008.

1.8 Electronic chart data

1.8.1 The *Monte Stello* was fitted with an "Endeavour" electronic chart system. The system display showed the ship's position overlaid on an electronic version of a navigational chart of the area. The real-time display gave information such as the ship's position, heading, course and speed.

1.8.2 The Transport Accident Investigation Commission's (the Commission's) investigators downloaded the pertinent electronic data files stored in the Endeavour system (Endeavour, 2008). These were used by the Australian Transport Safety Bureau to display the information in a simulation program called "Insight" developed by "Flightscape" (ATSB(1), 2009) (ATSB(2), 2009). The simulation program superimposed an outline of the ship onto the navigation chart showing the ship,s track on berthing and information recorded by the Endeavour program. The simulation and the original data files were used during the investigation.

1.8.3 The program gave real-time readings for the ship's position and its speed over the ground, heading, course over the ground and rate of turn.

1.9 Voyage data recorders

1.9.1 The *Monte Stello* had been fitted with a voyage data recorder (VDR), but at the time of the occurrences the VDR had a fault. Strait Shipping said that the VDR had been in that condition when the ship was purchased and had remained switched off, which meant that it contained no data to assist with these investigations.

1.9.2 Ships' VDRs enable accident investigators to review information recorded before and after an occurrence to help identify the causes that led to it. Performance standards for VDRs, adopted by IMO in 1997, stated that a VDR should continuously maintain sequential records of pre-selected data items relating to the status and output of a ship's equipment and command and control of the ship.

1.9.3 The IMO International Convention for the Safety of Life at Sea Convention (SOLAS) chapter V (safety of navigation) regulation 20 set out the requirements for VDRs on SOLAS ships and was adopted by IMO in December 2000 (International Maritime Organization IMO, 2010). The regulation stated in part:

> 1 To assist in casualty investigations, ships, when engaged on international voyages, subject to the provisions of 1.4, shall be fitted with a voyage data recorder (VDR) as follows:
>
> .1 passenger ships constructed on or after 1 July 2002;
>
> .2 ro-ro passenger ships constructed before 1 July 2002, not later than the first survey on or after 1 July 2002;
>
> .3 passenger ships, other than ro-ro passenger ships, constructed before 1 July 2002, not later than 1 January 2004; and
>
> .4 ships, other than passenger ships of 3,000 gross tonnage and upwards constructed on or after 1 July 2002.

1.9.4 Under Maritime Rules Part 46 Surveys Certification and Maintenance (New Zealand Government, 1997), passenger ship safety certificates in New Zealand were issued by Maritime NZ or on behalf of Maritime NZ by a recognised organisation, usually a classification society. Under Maritime Rules Part 46 the *Monte Stello* could have been certified as a SOLAS ship, in which case a SOLAS passenger safety certificate would have been issued. Because the ship did not trade internationally it could have been certified as a ship over 45 m in length that proceeded beyond restricted limits and issued with a New Zealand ship safety certificate, which after the occurrences Strait Shipping chose to do.

1.9.5 Under Maritime Rules Part 46 (ibid), SOLAS ships were certified under the requirements of SOLAS 1974, International Convention on Load Lines and International Convention for the Prevention of Pollution from Ships (MARPOL) conventions. The same survey regime was applied to ships more than 45 m in length that proceeded beyond restricted limits. The Rules explained that this was consistent with the intent generally to apply SOLAS construction and safety equipment requirements to such ships in other Maritime Rules.

1.9.6 Maritime Rules Part 40B Design Construction and Equipment SOLAS Ships (New Zealand Government, 2004), required foreign-going passenger ships and non-foreign-going passenger ships of 500 gross tonnage or more to comply with the design, construction and equipment requirements of SOLAS. It also required ships of more than 45 m in length that operated beyond restricted limits to comply with SOLAS. The Rule applied only the SOLAS requirements at the time of build and only those SOLAS regulations that had been gazetted into Maritime Rules.

1.9.7 At the time of the occurrences, the *Monte Stello* had been issued with a passenger ship safety certificate by the classification society Lloyds Register Asia. The certificate was issued under the provisions of SOLAS under the authority of the New Zealand government. Although the ship did not comply fully with SOLAS, a SOLAS certificate was issued. Maritime NZ advised the Commission that there was tacit agreement with this, and if an international voyage needed to be untaken without passengers for dry docking for example, an exemption could be issued from the requirement to have a VDR for that voyage.

1.9.8 Maritime Rules Part 45 Navigation Equipment (New Zealand Government, 2000), incorporated SOLAS Chapter V into New Zealand legislation. Under Maritime Rules Part 45 (ibid) ships of over 45 m in length that proceeded beyond the restricted limit were included as ships to which the SOLAS requirements for navigation equipment applied. Cook Strait ferries such as the *Monte Stello* fell into this category.

1.9.9 Maritime Rules Part 45 (ibid), came into force in February 1998 and incorporated the requirements of SOLAS Chapter V at that time. The Rule was amended in May 2004 and in September 2008 but did not include the SOLAS requirements under Chapter V of SOLAS (ibid) for VDRs. There was no requirement under Maritime Rules for any New Zealand-registered ship, SOLAS or otherwise, to carry a VDR.

1.9.10 Of the 5 Cook Strait passenger ferries operating at the time of the occurrences, 4 were registered in New Zealand, with 3 of those 4 having been issued with passenger ship safety certificates under SOLAS by their respective classification societies and the fourth being issued a New Zealand passenger ship safety certificate by Maritime NZ. The remaining ferry operated under the United Kingdom registry and was required to be fully SOLAS compliant as it was technically always trading internationally.

1.9.11 In October 2007 Strait Shipping asked Maritime NZ for clarification regarding the requirement to have a VDR on board its other Cook Strait passenger ferry, the *Santa Regina* which was due to dry dock in 2008. Strait Shipping asked about the possibility of an exemption being issued from the requirement to have a VDR so that the passenger ship safety certificate for the ship could be renewed.

1.9.12 Maritime NZ advised Strait Shipping by letter that at that time there was no legal requirement for a New Zealand ship that was certificated for international voyages to be fitted with a VDR, because the SOLAS resolutions requiring them to be fitted had not been incorporated into New Zealand's national legislation, namely Maritime Rules Part 45 (ibid). This meant that Maritime NZ was unable to issue an exemption to a requirement from a rule that did not exist. At that time Maritime NZ viewed Cook Strait passenger ferries as being SOLAS ships.

1.9.13 Maritime NZ said that at that time it was undertaking a review of all SOLAS amendments made since the introduction of Maritime Rules to ensure that the amendments were reflected in the Rules – a process that was expected to take about 2 years. It went on to advise that this should be borne in mind if the opportunity arose to fit a VDR to the *Santa Regina* in accordance with SOLAS.

1.9.14 Maritime NZ said that since it was not the intention of Strait Shipping to undertake international voyages while carrying cargo or passengers on the *Santa Regina*, Maritime NZ had no objections to the ship being issued with a passenger ship safety certificate for a further year by the classification society.

1.10 Previous occurrences

1.10.1 On 30 November 2006, Maritime NZ was notified of an occurrence on the *Monte Stello* in Wellington Harbour. The port propeller had stuck at full astern pitch and the port main engine had been shut down by the emergency stop button and the bow thruster tripped. The engine was restarted and the ship berthed with the assistance of a tug.

1.10.2 On 4 December 2006, Maritime NZ was notified of an occurrence on the *Monte Stello* while the ship was alongside in Picton, in which the ship had backed into the floating pontoon onto which its stern ramp had been lowered. The port propeller pitch had gone astern while on engine room control owing to a hydraulic pump failing and the stand-by pump not starting. Electrical connections on the hydraulic pumps and starters were checked and some loose connections found, and the system was subsequently tested ok.

1.10.3 On 7 December 2006, Maritime NZ was notified of an occurrence on the *Monte Stello* while the ship was berthing at Glasgow Wharf in Wellington. There had been a loss of control of the port pitch astern. The port main engine was stopped and the ship anchored until a tug was able to attend and assist the ship to berth with the engines being operated in the engine room control mode.

1.10.4 The Commission was also advised of the above occurrences and made some initial enquiries into the occurrence of 7 December 2006. It had been raining during the berthing operation and the cause at the time was thought by Strait Shipping to be electrical tracking across control circuits from water ingress of non-water-tight pitch indicators during wet weather. Strait Shipping undertook to replace the indicators and make the mounting of them watertight. The fault was subsequently traced to a faulty hydraulic valve.

1.10.5 In June 2007 the *Monte Stello* made heavy contact with Glasgow Wharf when preparing to leave the berth. The ship's starboard quarter and bow were damaged, resulting in sailings being cancelled while repairs were made. The cause of the collision was the port propeller going to astern pitch after the pitch controls had been transferred from the engine room to the bridge.

1.10.6 The occurrence was noted by the ship's master in his fortnightly end-of-voyage report. The subsequent end-of-voyage report 2 weeks later noted that remedial work had been under-taken by the ship's electricians and technical staff, but while there had not been a reoccurrence of the fault, further work was required to give confidence in the system.

1.10.7 Subsequent end-of-voyage reports made by masters on board the ship warned of the need to be vigilant, noting continued occurrences where the port engine pitch had gone astern when control was transferred to the bridge. Reports also noted a previous pitch failure in February 2008 and further attempts by the ship's technical staff to remedy the problem associated with it.

1.10.8 Masters' end-of-voyage reports in July noted that a change of engine room procedures had stopped the pitch going astern on transfer of control to the bridge, but full vigilance was required as the fault had not been fixed. Isolated cases of the port pitch going astern were reported and this remained the situation at the time of the occurrences under investigation.

1.10.9 The chief engineer said that about 12 months before the occurrences under investigation, a new solenoid valve block had been fitted to the port CPP oil distribution box; this had not been recorded in the maintenance records provided to the Commission by Strait Shipping. Since that time the port pitch control had been known to apply the pitch at twice the speed of the starboard one. This situation remained despite attempts to adjust the flow restriction valves in the hydraulic lines to the servo valve to reduce the speed of response (Figure 11). Manipulation of these valves reduced the operating speed but also had the effect of preventing ahead pitch being attained, so the valves were returned to their original settings. Theories were aired that the curve converter setting might have been adjusted by previous owners, but there was reluctance to attempt to adjust the converter because of lack of information about the parameters used.

1.10.10 The effect of the port pitch being faster was not deemed a problem when manoeuvring the ship under normal circumstances. It had been noted that in the event of a crash manoeuvre on the port CPP where full pitch was ordered, the rate at which pitch was applied caused the port main diesel engine to be temporarily overloaded. This overload, if accompanied by a drop in the engine speed, was sufficient to operate protective devices on the port shaft generator if it was in use and trip the circuit breaker. The result was a loss of power to the bow thruster if it was running.

1.10.11 On 16 July 2008 at about 2335, the *Monte Stello* was on its normal approach to Tory Channel entrance when the ship struck an unknown submerged object, damaging the starboard propeller. The ship was sent to Auckland and entered dry dock on 22 July to have the starboard propeller blades straightened; the opportunity was also taken to clean the hull of the ship. The ship returned to its regular service between Picton and Wellington on 1 August 2008, one week before the occurrences under investigation occurred.

2 Analysis

2.1 General comment

2.1.1 There is a reduced margin for error when ships are operating in the close confines of a harbour or restricted waters. The *Monte Stello* made on average 4 return crossings in a day; 4 departures and 4 arrivals. These arrivals and departures were usually completed without the assistance of tugs and with the master undertaking the pilotage, so it was imperative that the machinery and control systems were reliable for the safe operation of the ship.

2.1.2 Pilotage and berthing a ship the size of the *Monte Stello* is a period of high work load for the bridge team, particularly when the weather conditions are challenging. It is important therefore that the bridge team assists the master by closely monitoring what is happening and bringing to their attention any deviations from the norm in respect of ship handling or machinery operation so that they can be quickly corrected before the situation becomes unrecoverable.

2.1.3 There were a number of examples of good challenge and response exhibited within the bridge teams involved in these 2 occurrences, but there were also a number of missed opportunities where the effective monitoring of equipment following the requested setting, challenges and more importantly responses to those challenges were not conducted efficiently. These are discussed further in the following sections.

2.1.4 The bridge team needs to have confidence in the equipment they are operating, or at least understand its limitations. There had been a number of previous occurrences on the *Monte Stello* where the CCP system had malfunctioned, and although diagnoses and repairs had been made, the root causes had not always been found and not always rectified. It was apparent from the masters' reports that confidence in the propeller pitch control was guarded, and it is possible that that lack of confidence affected the bridge team's response to the occurrences' sequence, or even later resulted in false diagnoses of the actual causes of each collision.

2.1.5 The Commission was not able to establish conclusively whether a fault occurred with the propeller pitch control while berthing the ship in Wellington, or whether any delays in the propellers responding to the pitch commands were simply the usual delays that had been experienced previously. The answer could possibly lie somewhere between. This too is discussed in more detail in the following sections.

2.1.6 It should be noted that the ship had just completed a dry docking where its hull had been cleaned and repainted. With a clean hull a ship will gather stern way more quickly and carry its speed for longer once propulsion has stopped. This could have been a factor that caught both crews by surprise in these occurrences.

2.2 Picton collision

2.2.1 The additional master and second officer who made up the bridge team when the ship struck the wharf in Picton did not attribute the collision to a technical failure but thought it was probably the result of an error in judgement under training. The bridge log recorded that the pitch controls had been tested satisfactorily after the collision and before the ship moved to another berth.

2.2.2 Both officers were on the bridge wing, but neither the second officer who was giving the pitch orders nor the additional master who was operating the pitch controls were monitoring whether the propeller pitch response matched what was being set on the pitch control levers. This was because the second officer was looking over the ship's side monitoring the berthing and the additional master, who was positioned inboard of the second officer, was also trying to monitor the ship's position and oversee the second officer's training.

2.2.3 A critical outcome of crew resource management is for every aspect of the ship's progress to be monitored, including the status of machinery and equipment. When orders are passed from one person to the next, the order should be confirmed, the action implemented and the result of that action monitored. For a change in propeller pitch for example, the order is given and a repeat-back confirmation received, then someone must follow the pitch indicators to ensure they are responding correctly.

2.2.4 The on-the-job training of the second officer in ship handling under supervision was accepted good practice. The supervision of the second officer did, however, put additional workload on the master, who in this case was captive to operating the pitch controls while overseeing the berthing from a less-than-optimal location, to monitor the second officer's performance at the same time. It would be more accepted practice in such situations to provide an additional person to operate the pitch controls, leaving the master free from distraction and able to position themselves to observe the berthing and supervise as necessary. This process should be followed until the trainee is assessed or formally type-rated into the role being assessed.

2.2.5 The assistant bosun was on the mooring deck and had no concerns about the berthing until the ship was a short distance from the pontoon. He was new to the role but had observed berthing before, and the cues he gave to the bridge were consistent with the expectations of the bridge team and the practice he had previously observed. To him, stationed down aft, the berthing would have looked entirely routine, with the approach speed about normal and the wash from the propellers (as could be seen on the port security video) in accord with expectation.

2.2.6 The assistant bosun did become concerned at the speed, or more the ship's failure to slow down as expected, but only when the stern was 10 m from striking the floating pontoon. Even though the bridge team had a number of markers along the wharf to help judge the ship's position, a steady countdown of the distance between stern and shore structure helps to maintain the bridge team's awareness, particularly should they become distracted by other events. A verbal countdown would also on this occasion have assisted the master captive at the controls to monitor the berthing.

2.2.7 The security camera footage showed ahead propeller wash appearing at the stern of the ship about 57 seconds before the ship hit the pontoon, which corresponded with about when the master said he applied it. The data downloaded from the ship's bridge navigation systems (Endeavour, 2008) and simulation (ATSB(1), 2009) shows that the ship was on course and approached the berth in a controlled manner, but simply did not stop in time. Although a delay in pitch coming on the propellers could not be ruled out, the evidence suggests that in this case the collision could more likely be put down to misjudgement and insufficient monitoring of performance while the handler was under training.

2.3 Wellington collision

2.3.1 When the ship berthed in Wellington, the master was conning the ship with the assistance of the second officer watched by the prospective mate/master, all of whom reported a delay in the ahead pitch response as the ship was backing towards the berth. Until that point nobody had reported anything unusual with the way the pitch control was performing as the vessel approached the swinging basin, made its turn and began moving astern towards the berth.

2.3.2 The master was not particularly concerned about the strength of the wind, having berthed there many times and in stronger winds. The master said he made allowance for the wind and used the bow thruster to keep the ship's head to the wind and asymmetric thrust to prevent the stern falling away from the wind as the ship tracked back towards the berth. Up until this point, as the ship picked up speed astern towards the berth, the bridge team's recollection of events was consistent.

2.3.3 The data downloaded from the bridge navigation systems was based on the global positioning positing system (GPS) gyro and rate of turn indicator. Speed information was derived from the GPS positions plotted every 2 seconds. The GPS had an accuracy in the order of 10 m, so the information derived from it was reasonable. A study of the data showed that there was a slight positional error as shown by the ship not quite making contact with the knuckle of Glasgow Wharf. There was also a timing error depending on which set of data was used; that derived through the radar or that directly through the Endeavour electronic chart system. Errors in time can be attributable to the various items of navigation equipment, such as the automatic identification system, the GPS and the computer driving the Endeavour system having different time stamps. The slight error in position can be attributable to natural inaccuracies with the GPS, different chart datums in use, an incorrect off-set position for the position of the GPS antenna, or a combination of all these factors.

2.3.4 Nevertheless, an analysis of the data (Endeavour, 2008), including the animation provided by the Australian Transport Safety Bureau (ATSB(2), 2009) showed a steady progress of the ship's heading, speed and position as it tracked back towards the berth. In other words there was no outlying position, speed or rate-of-turn data indicating erratic performance of the navigation systems.

2.3.5 The navigation data showed the ship moving back towards the berth, starting with the line of the berth showing open to anyone standing near the stern of the ship, which was confirmed by the bosun. The ship picked up speed astern and was still doing so until the stern was 50 to 55 m off the knuckle of the wharf, reaching a maximum of 4.7 to 4.8 knots, quite a high speed for being so close to the end of the wharf.

2.3.6 It should be realised that at this point the master was aiming for a position (the ship's berth) that was 200 m further along the wharf. The bow of the ship steadily but slowly fell away from the wind as the ship made leeway (was blown) down onto the wharf by the wind that was blowing across the starboard bow. The bow thruster was not strong enough to hold the bow up into the wind.

2.3.7 The asymmetric thrust created by having the port propeller with less astern pitch than the starboard would have worked with the wind to accentuate the stern falling down towards the wharf. To achieve the intended effect of using asymmetric thrust to hold the stern into the wind, propeller pitch should have been reduced on the starboard propeller rather than the port. It is unclear why the port rather than starboard pitch was reduced.

2.3.8 The bosun began commenting as far out as about 120 m that the ship (the stern where he was standing) was closing with the line of the wharf. His repeated information to the master at 120, 100 and 80 m off the knuckle was acknowledged by the master, but the master felt comfortable that he could recover the situation using the engines and rudders if necessary.

2.3.9 From about when the bosun reported 80 m off the knuckle, the accounts of events from those involved differed. It is not unusual for witnesses to give different accounts of events. Each person is recalling from a different perspective according to their role, and no-one is particularly noting times and distances because the occurrence has not yet happened. This is why the recording of data is so important for event reconstruction. The Commission has taken each witness account and cross-referenced it with other available data such as that from the navigation systems.

2.3.10 At about 150 m off the knuckle, the second officer questioned whether the bow thruster was working properly. He made the comment because the bow thruster meter on the control panel seemed to be reading high, not because it wasn't registering. His perception was that the bow was not behaving as he thought it should for such a high load; that is, the bow was still falling away to port. The bow falling away to port would not be surprising under the conditions. With the ship gathering speed astern, the pivot point around which the ship turns moves from around amidships when stationary closer to the stern. The total force of the wind acting on the starboard side vertical surfaces creates a turning couple around the pivot point that pushes the bow away from the wind and causes the stern to come up into the wind, a phenomenon referred to as "stern boring".

2.3.11 The master said he ordered the pitch brought back to zero at which point he investigated the second officer's claim. No-one could really say how long this distraction lasted, but the recorded data shows that the speed of the ship over the ground continued to increase from about 3.4 knots to a maximum of 4.8 knots in the next 40 seconds. This could be explained by the time taken for the pitch to come back to zero, which in post-occurrence testing was seen to be about 8 seconds for the port propeller and 14 seconds for the starboard; other factors were the wind continuing to push the ship towards the berth, a slight time lag in the GPS registering a change in speed, and the distances estimated for when pitch was applied, which were based on recalled estimates by those involved at the time.

2.3.12 The master said he ordered ahead pitch (+3) when the bosun made his 80 m call, then an increase to ahead pitch (+5) at the 60 m call because the master felt the ship was not responding, confirmed to him by the second officer saying so. The speed of the ship was at that point in the region of 4.5 knots, which would equate to about 8 seconds between these successive propeller pitch orders. The tests following the occurrence showed that the starboard propeller pitch would have been unlikely to be registering and the port pitch possibly had started to register. This was because both had still been returning to zero when the master ordered them to stop. Even if the propeller pitch response had been instant it would not be expected that the master would feel the ship responding to the pitch (+3) setting. It is more likely that within that 8 seconds the master realised, prompted by the bosun's 60 m call, that the ship was heading for the knuckle at about 4.5 knots.

2.3.13 The ship had by that time been allowed to drift into a position with few options for escape. The bow thruster was not strong enough to hold the bow into the wind and the ship had drifted down inside the line of the wharf under the influence of the wind. The only option for the master was to use the engines to escape back out into the swinging basin and position his ship for another attempt. This now leads to the question, did the propeller pitch respond to the various commands asked of it in an acceptable manner? The answer would seem to be "no", based on observations at the time and post-occurrence testing.

2.3.14 Most of the evidence showed that ahead pitch was being achieved by the time the master ordered full ahead on both propellers, which was when the ship's stern was about 40 m off the knuckle of the wharf and about 23 seconds before impact. The second mate said pitch was coming on about when he put the pitch levers to full ahead. The prospective mate/master saw pitch coming on just before collision. The engineers in the engine control room felt the ship strike the wharf and noticed that a lot of pitch was already on and climbing.

2.3.15 The question is, was there some other fault that delayed the propeller pitch response, or was the response in keeping with the delays known to be present in the system and the difference in response speeds between the port and starboard propeller? An analysis of the data, as shown in Appendix 1, shows that allowing for the errors in people's perceptions of time and distance, it is feasible that the propeller pitch responses were consistent with those known characteristics and that the ship had been allowed to press on with an approach that was going to be difficult to achieve from an early stage. Post-occurrence testing was not able to find any other fault in the system.

2.4 Was there a bow thruster fault?

2.4.1 It is clear from the evidence that the bow thruster was operating normally as the ship moved astern toward its berth in Wellington. The second officer's perception was more that it was not having the desired effect on the ship's progress. The additional master thought it was working normally.

2.4.2 During the investigation, the possibility that the bow thruster had been applied in the wrong direction was considered. The Commission concluded that this was unlikely because if it had, the effect on the ship's progress would have been dramatic. The bow thruster would have been working with the wind rather than against it, which would have resulted in the bow swinging dramatically to port and the ship being totally misaligned with the berth, which did not happen.

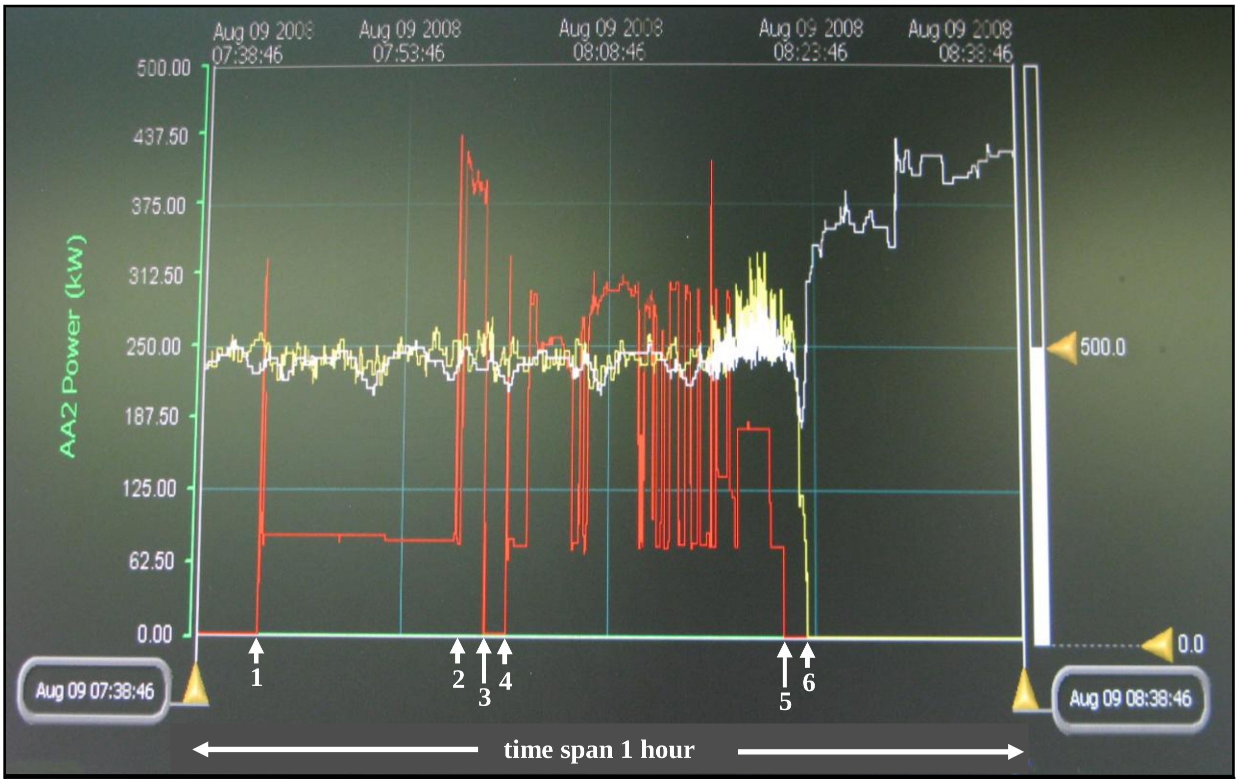
2.4.3 The master thought that the bow thruster had tripped before the ship struck the wharf, but the engineers in the control room reported that the shaft generator and bow thruster tripped as the port engine loaded up when full ahead pitch was achieved on the port propeller as the ship hit the wharf. The second officer was unsure of when it tripped and the prospective mate/master said he thought it was operating satisfactorily. The electrical power trend data showed that immediately before the bow thruster tripped it was on load drawing about 375 kilowatts, near its full load but within the rated capacity of the shaft generator.

2.4.4 The *Monte Stello* had a system that monitored the electrical system, including the individual characteristic trends of the ship's generators. This was displayed on a computer in the engine room and data could be recalled to display frequency and load information in a specific period. Figure 12 shows the load data in a period of about one hour when the ship was in Wellington berthing on 9 August 2008, and has been annotated to highlight specific events.

2.4.5 The times on the trend display were not synchronised with the Endeavour data or control room alarm printer. Although the times on the various displays were logged after the occurrence, they did not exactly match.

2.4.6 Figure 12 shows that the ship's 2 diesel generators were on load when the ship arrived at the entrance to Wellington Harbour. The bow thruster was the only load on the port shaft generator, so the load on the generator reflects the load on the bow thruster. The bow thruster was switched on and tested (spike in power at point 1). The bow thruster was not used on load until about 15 minutes later. The bow thruster was then on load (in use) for just under 2 minutes until it tripped at point 2. This supports the master's recollection that he was using the bow thruster as the ship backed towards the wharf after the turn was complete. The length of time that the bow thruster was in use coincided with the time taken for the ship to move astern and collide with the wharf.

2.4.7 A comparison with frequency trend data in the same time period showed that on the bus-bars supplied by the port shaft generator, the frequency fell to zero about 7 seconds after the load on them fell to zero. This shows that the bow thruster's circuit breaker tripped about 7 seconds before the port shaft generator circuit breaker tripped. The port shaft generator was reset in about 30 seconds and the bow thruster reset and on load again about 60 seconds after that, meaning the bow thruster was off for about 90 seconds in total. This supports the chief engineer's recollection of resetting the circuit breaker for the port shaft generator and advising the bridge that the bow thruster could be switched on again. Neither the second officer nor the additional master saw the bow thruster trip.



Event log power trend graph		Key	
1	bow thruster switched on and tested	(red line)	port shaft generator load
2	bow thruster on load as ship berthing	(yellow line)	no. 3 diesel generator load
3	bow thruster off load-circuit breaker tripped	(white line)	no. 4 diesel generator load
4	bow thruster on load- circuit breaker reset	s	time in seconds
5	bow thruster switched off ship alongside	m	time in minutes
6	no.3 diesel generator switched off		

Figure 12
Electrical load data during berthing in Wellington

2.5 Maintenance of CPP systems

2.5.1 The planned maintenance system on the *Monte Stello* was generic in nature, having been taken from a similar ship in Strait Shipping's fleet, the *Santa Regina*. This was reasonable at the time as the ship had very little in the way of maintenance records when it was brought to New Zealand. The maintenance system should then have been adapted as required, as the ISM system was developed and operational experience gained.

2.5.2 There were a number of failures with the CPP systems prior to the occurrences and remedial work was carried out by the ship's crew, although the cause was not always identified. The maintenance and ISM systems were not updated in response to these occurrences, possibly because no cause was found. Trying to locate intermittent faults can be particularly challenging; it is possible during the course of such work that something as simple as a loose connection is tightened or a component is disturbed that may cause the fault to disappear. An example was the previous reported pitch failure, where water ingress to the port bridge wing control was thought to be the cause but this was later traced to a hydraulic valve in the system.

2.5.3 The above is particularly true for operators using older systems, however these challenges still need to be addressed and the maintenance regime adapted as required. In some cases reliability can only be assured by renewing components or putting additional checks in place. The maintenance system for the CPPs on the *Monte Stello* had not been significantly developed since the ship began operation, despite the previous failures.

2.5.4 The planned maintenance records in the maintenance system had not recorded all the occurrences and adjustments made in the system. It is possible that some of these were noted elsewhere, but the maintenance system is the first point of reference under ISM. In Strait Shipping and on the *Monte Stello*, the retention of the engineers and electricians had been high so they were familiar with the operation of the ship and its history since its arrival in New Zealand. If circumstances change and new personnel are on board they will not carry the same knowledge as previous personnel, and unless previous history is recorded such knowledge can be lost.

2.5.5 On the *Monte Stello* there was insufficient information on board detailing the characteristics of the various program curves in the CPP system curve converter. There was no standard available for the ship crew to compare the actual CPP performance over the full load range, or sufficient instructions on the interaction between the various components of the system to give confidence to make the adjustments.

2.5.6 There was a difference between the port and starboard systems in the rate at which pitch was applied in response to a pitch order. This situation had been allowed to continue for about 12 months despite attempts to fix it by making adjustments in the hydraulic part of the system. The difference in speed meant that if the port shaft generator was in use and a large increase in pitch was ordered during manoeuvring, there was a high probability that the port main engine would be overloaded. This was undesirable in itself but also the bow thruster could be tripped, as happened during this occurrence and on previous occasions. Losing the bow thruster during manoeuvring is not helpful to the bridge team, particularly for an operation where tugs are rarely used and time spent manoeuvring is proportionally high. Resetting circuit breakers and re-starting equipment increase the workload on personnel at what may be a critical time.

2.5.7 A requirement of the ship's planned maintenance schedule for the CPP system was a monthly test to operate each CPP locally at the oil distribution box control and record the response time taken for full propeller pitch to be achieved. Although these tests were logged as being completed, the operating response times for each CPP were not recorded, despite this being set out in the job description. There were no recorded operating response times in the planned maintenance system, including when the ship left dry dock after repairs 7 days before these occurrences. The job description did not say what an acceptable response time was.

2.5.8 Routine tests such as those above can in some cases identify early deterioration in performance of plant before it becomes an issue. On the *Monte Stello* these tests were not recorded, and there is no evidence to suggest that if they had been then the occurrences would have been avoided. However the fact that they were not gives an indication that the company's approach to the identification and maintenance of critical systems was in need of further development.

2.5.9 Previous operational problems in June 2007, with the port CPP system putting astern pitch on when the control mode was changed over, had led to a collision and damage to the ship. At the time of the occurrence the root cause had not been found. The ship's crew had under the instruction of the owner adopted strategies when changing over control to prevent a reoccurrence, but these had not been adopted formally into the ship's ISM system operating instructions. It is always preferable to engineer a fix to a system where possible, rather than rely on a work around. This statement is validated by the fact that after these procedures had been put in place, there were still reported occurrences of the port CPP pitch moving astern when control was changed over to the bridge.

2.5.10 An un-commanded application of propeller pitch can have serious consequences. The changeover is generally made while the ship is at the wharf with mooring lines attached, and mooring gangs standing by to release the ship. As shown in previous occurrences, damage to the ship and wharf can occur. The risk to persons on the wharf and on the mooring decks is high.

2.5.11 An investigation by an independent expert contracted by Strait Shipping following the occurrences in this report led to the cause of the un-commanded application of astern pitch being found. The fitting of timers in the CPP control system by the previous owners was not recorded or known to the present owner. It was not known when this had been done or why, other than it worked around the problem being experienced when control was transferred to the bridge. One of these timers fitted in the port CPP system had been set at 6 seconds, whereas the starboard timer was set at 30 seconds. It was not known when this adjustment had been made or by whom, but this was attributed as the cause for the potential for the port pitch system to go astern un-commanded when control was transferred to the bridge. This raises the safety issue already identified regarding the continuity of ship maintenance records and system diagrams when ships change ownership in the Commission's report 08-203, *Monte Stello* Loss of Power in Tory Channel.

2.5.12 The characteristics of the curve converter identified in the investigation of the independent expert meant that a loss of power to the curve converter during normal operation had the potential to create the same fault if a timer was faulty or if not faulty, then create a delay as the timer, set at 30 seconds, timed out before an output signal was restored from the curve converter. This was unknown prior to the occurrences under investigation and would have been problematic had an emergency situation arose.

2.5.13 When the CPP systems were modified the changes made to the CPP system pneumatic control boxes in the engine room were not identical, although they achieved the same result. The original solenoid-operated pneumatic valves were left in one system, although electrically disconnected (Figure 12). The components of the system then no longer matched what was in the drawings and description of the system. This might cause confusion when personnel are trying to fault find or understand the system in future.

2.5.14 In general, leaving redundant pneumatic components in a system is not good practice; under normal circumstances it would be reasonable to assume such components were overhauled or inspected periodically. Since these obsolete components were not considered part of the new system, it was possible for the degradation of internal components over time to go undetected and contamination of the pneumatic system to result with potential to affect performance.

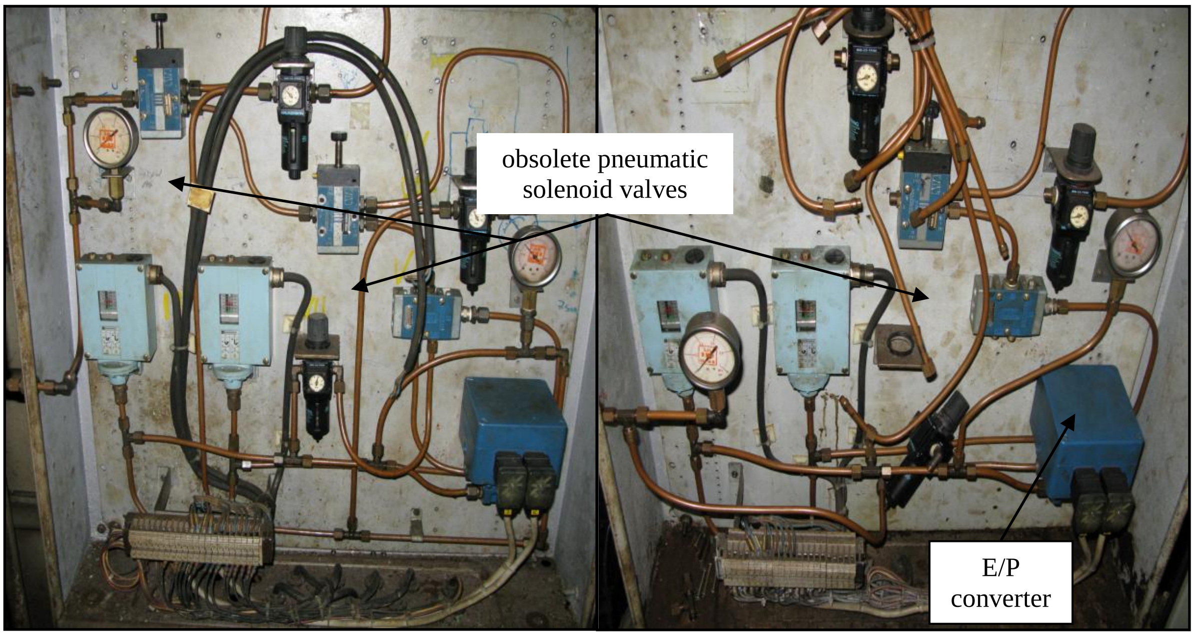


Figure 13
Modifications to electro/pneumatic control boxes

2.5.15 On the *Monte Stello* the indication instruments for the CPP and bow thruster systems were not calibrated correctly and did not accurately reflect the output of these systems. In normal circumstances this situation, although not ideal, might not present a problem and could be compensated for by the crew. When a problem does occur the crew can lose valuable time before they realise there is a real fault or can be distracted while trying to reconcile instrument readings with what is actually happening. The same can be said for berthing and un-berthing the ship up to 8 times each day with CPP systems for each propeller performing differently.

2.5.16 The difficulties of maintaining equipment on ships when information on maintenance and modifications has not been passed on from previous owner, equipment and system drawings do not match the installation has already been identified in the Commission's report 08-203 *Monte Stello* Loss of Power in Tory Channel.

2.5.17 The maintenance of the CPP systems on the *Monte Stello* posed the same challenges identified in the above report to the owners and crew on board. In this case the previous occurrences and the occurrences under investigation were indicators that all was not well with the systems.

2.5.18 The oversight and maintenance of the CPP systems were not robust enough to give those operating the ship confidence that the causes of the previous failures had been identified and that they would not happen again. The problem of manufacturers' support being unavailable, particularly on older systems that have been modified and in some cases considered obsolete, was also identified in the Commission's report 08-203.

2.5.19 Since the occurrences there have been no more reported failures of the CPP systems.

2.6 Bridge resource management

2.6.1 The concept of crew resource management is that the whole operating crew, not just the bridge team share the same mental picture of how the voyage or manoeuvre will proceed. That way anyone can challenge if events are not going as planned.

2.6.2 As mentioned earlier, there were good and bad examples of crew resource management. The bosun during the Wellington occurrence was giving very good feedback to the bridge team, whereas the assistant bosun for the Picton occurrence was of less help.

2.6.3 It was apparent fairly early on in the Wellington occurrence that the progress of the ship towards the berth was not optimal. Any one of the bridge team could have challenged that and a decision taken earlier to abort the approach and start again rather than press on. The second officer did question the effectiveness of the bow thruster, although this was done in a cryptic sort of way.

2.6.4 At the time of the Wellington occurrence the engine room personnel were changing over the watch in the engine control room. Normally the handover took place when the ship was alongside but the ship was running later than normal because of the disruption to the service caused by the damage to the pontoon in Picton. The engine room personnel were busy organising the day's work and watch handover, so did not pay particular attention to the CPP until they felt the ship strike the wharf.

2.6.5 In this case it is debatable whether the engine room personnel would have noticed any pitch delay under normal circumstances. It is essential that not only critical systems in the control room are monitored, but also any correlation to what is happening outside the control room, particularly during times of high workload such as berthing. This clearly was not happening in the control room on this occasion.

2.6.6 Strait Shipping would benefit from building on a whole-of-ship approach to crew resource management to ensure all crew are focused on achieving a common goal of achieving the passage plan with the minimum of risk.

2.7 Voyage data recorders

2.7.1 Had the VDR on the *Monte Stello* been operational the occurrences under investigation would not have been prevented but information from the recorder would have been useful to the investigations (including the company investigations and fault finding) in determining the causes of the 2 occurrences in this report. The same might also have been said of the Commission's investigation 08-203 *Monte Stello* Loss of Power in Tory Channel.

2.7.2 New Zealand as a member state of IMO had adopted the SOLAS Convention. The mechanisms for incorporating the requirements of the Convention were New Zealand Maritime Rules. Rather than the Rules simply adopting the various amendments to SOLAS, the individual requirements of the Convention were written into the Rules, a process that could take several years.

2.7.3 New Zealand Maritime Rules Part 40B section 40B.3 (1) (c) (ibid), applied the requirements of SOLAS to New Zealand-registered ships over 45m in length trading outside restricted limits as if they were SOLAS ships. As SOLAS is continuously being updated, Part 40B applied only the SOLAS requirements in force at the time the ship was built, plus any subsequent amendments incorporated into New Zealand Maritime Rules (gazetted). Because New Zealand Maritime Rules have not kept pace with the changes to the SOLAS Convention, the requirement for ships to be fitted with VDRs has not been written into the Rules.

2.7.4 An added complication is that SOLAS requires VDRs to be fitted to only those ships trading internationally. This means that of those ships providing the Cook Strait service only those registered in other countries (meaning they are trading internationally) or those New Zealand-registered ships whose owners have elected to have SOLAS applied to their ships are required to have VDRs fitted.

2.7.5 Strait Shipping had elected for its ships not to hold SOLAS certificates, so even if New Zealand had written the SOLAS requirements for the carriage of VDRs into its Maritime Rules, the *Monte Stello* still would not have been required to have a VDR fitted.

2.7.6 Maritime NZ could not issue an exemption from having a VDR on the *Santa Regina* because the Maritime Rules did not require it. Maritime NZ indicated at the time that it was likely it would write the requirement into the Rules in the future, although it had not done so in the previous 2 amendments to the relevant Rule. Strait Shipping, having been told that there was no requirement for its ships to have VDRs fitted, then applied this to the *Monte Stello* as well, so did not bother to repair the faulty VDR.

2.7.7 Retrofitting VDRs on existing ships can be expensive or impracticable but provision is made in the SOLAS requirements for exemptions in certain cases (cargo ships). However, IMO has highlighted ro-ro passenger ferries being given extra consideration when adopting the requirement for VDRs into SOLAS, whereby these types of ship have to have VDRs fitted 2 years before dedicated passenger-only ships. All of the current Cook Strait ferries are ro-ro passenger ships operating in a challenging environment, including enclosed waters for most of the operation.

2.7.8 The case that it would be expensive to retrofit a VDR could not have been applied to the *Monte Stello*, because it had already had one fitted when the ship was purchased. Although there was no legal requirement to have a VDR fitted, the question must be asked why a responsible ship owner would not have it operating all of the time in a good state of repair. Not only does a VDR provide valuable information following an accident or incident, it can provide a valuable diagnostic tool, as well as be used to enhance training programmes.

2.7.9 There is a discrepancy in the application of SOLAS regulations, which are based on tonnage for ships trading internationally, and New Zealand Maritime Rules, which in this case make the requirement to apply SOLAS regulations to ships operating outside a restricted area based on the length of the vessels. This presents a possible area of concern within the present framework where the application of the SOLAS requirement to carry VDRs to all ships over 45m in length operating beyond the restricted limit may not be appropriate.

2.7.10 In practice ships that trade internationally have to comply with all the current SOLAS regulations or risk detention by other Flag State Authorities when in their ports. The present system is less than transparent, where only some SOLAS requirements are being applied to domestic ships, and then only those requirements that have been written into New Zealand Maritime Rules. The result is that the 5 current Cook Strait ferries all have different requirements depending on the countries of registry, their ages and the owners' preference for the survey regime with which their ships will comply.

2.7.11 One objective of the SOLAS Convention is to achieve consistency of standards among ships trading internationally. The objective of the New Zealand Maritime Rules should be the same, yet the way the New Zealand Maritime Rules have been structured and the Rules lagging behind the requirements of SOLAS have created an anomalous situation with the requirements for VDRs as one example.

3 Findings

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

Picton

3.1 While berthing in Picton, the *Monte Stello* collided with the floating pontoon attached to its cargo link-span mainly due to an error in judgement by the officer handling the ship while undertaking on-the-job training.

3.2 The master in command was not able to oversee the berthing effectively because he was captive to the control console on the bridge wing, where he was operating the propeller pitch controls in response to the handling officer's instructions.

3.3 There were insufficient resources on the bridge at the time of berthing to operate and monitor the progress of the ship while an officer was under training.

Wellington

3.4 While moving astern into its berth in Wellington the *Monte Stello* was allowed to be driven by the weather into a position that offered limited escape options to prevent striking the end of Glasgow Wharf.

3.5 The *Monte Stello* struck the end of Glasgow Wharf when the speed of the propeller pitch response did not meet the handling master's expectations for aborting the approach.

3.6 It could not be established if the delays in the propeller pitch response were due to an undetermined one-off fault in the manoeuvring system, or if the delays were symptomatic of what had become accepted peculiarities in the way the controllable pitch propeller system performed.

3.7 The performance of the controllable pitch propeller system, as described during the occurrence and observed during post-occurrence testing was not suitable for a ship manoeuvring in and out of berths several times each day without the use of tugs.

3.8 The bow thruster was operating as normal and only tripped off after the collision with the wharf, when the excessive load on the port engine caused the shaft generator from which it was drawing to disconnect.

General

3.9 The company system for planned maintenance and repair did not accurately record the history of inspection and repair, nor did it ensure appropriate functioning of the controllable pitch propellers and their control systems, which were critical to the safe operation of the ship.

3.10 The components of the controllable pitch propeller system did not match the original drawings and insufficient information was available on board about the system to conduct effective diagnosis and repair.

3.11 The VDR fitted to the *Monte Stello* could have saved considerable time and investigative expense, as well as provided a diagnostic tool for fault finding, but had not been repaired and maintained operational because New Zealand Maritime Rules did not require it to be.

3.12 Maritime Rules not requiring Cook Strait ro-ro passenger vessels to be fitted with voyage data recorders, in spite of their not being engaged on international voyages, does not comply with the spirit of SOLAS Chapter V that envisages voyage data recorders being fitted on ships of this size and type operating in high-risk areas.

4 Safety Actions

4.1 The Commission classifies safety actions by 2 types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission that would otherwise have resulted 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 have resulted in the Commission issuing a safety recommendation.

4.2 The following safety actions are not listed in any order of priority.

Safety actions addressing other issues

(a) Following the occurrences and before the ship was returned to service the controllable pitch propeller systems were tested to the satisfaction of the attending classification society surveyor and Maritime New Zealand port state inspector.

5 Safety Recommendations

General

5.1 The Transport Accident Investigation Commission Act 1990 requires the Commission to issue its recommendations to the appropriate regulator even though another person or organisation may appear to be the more appropriate recipient. This is because the regulator will be better placed to ensure that these recommendations are, if appropriate, implemented across the industry rather than just by a single operator.

5.2 Previous safety recommendation from the Commission's Report 08-203 *Monte Stello* Loss of Power in Tory Channel:

On 25 February 2010, it was recommended to the Director of Maritime New Zealand that she:

> Forward this report to the International Maritime Organization bringing to its attention the safety issue where there is no mandatory requirement for continuity of ships' maintenance records and system diagrams when ships change ownership, and inviting it to refer this report on to the appropriate committee for its consideration (005/10).

On 22 December 2009, the Director of Maritime New Zealand replied in response to the preliminary safety recommendation in the draft preliminary report, worded as above. That reply, in part, was:

> MNZ [Maritime New Zealand] supports the recommendation to forward this report to IMO once published.
>
> In light of the information provided in the report, with particular emphasis of the safety risks associated with the lack of available records relating to ships' components, MNZ intends to:
>
> 1. Undertake a Flag State inspection of the ***Monte Stello*** to satisfy itself that the safety actions mentioned in paragraph 4 of the draft report have in fact been undertaken.
>
> 2. Write to all Classification Societies drawing attention to ISM Code section 10 – with a view to pointing out that a safety bulletin will be issued identifying the risks associated with the lack of proper documentation for components such as the wiring diagrams and the need to address such matters.
>
> 3. Issue a safety bulletin drawing attention to the risks identified in this report to owners and operators.

Recommendations

5.3 The following recommendations are not listed in any order of priority:

On 22nd July 2010 it was recommended that the Director of Maritime New Zealand address the following safety issues:

5.3.1 During the Picton berthing occurrence the master was captive to the propeller pitch controls and could not totally oversee the second officer who was under training, nor could he totally monitor the progress of the ship as it backed into the berth. The Commission is of the opinion that Cook Strait ferry operators should identify in their training system for pilotage and ship-handling, masters or other appropriately qualified officers who have been selected and appropriately schooled as training masters, and while ship-handling or pilotage training is in progress, the bridge team should be resourced to allow the training master freedom to totally and effectively monitor the trainee and the progress of the ship. (026/10)

5.3.2 The operator's system for planned maintenance and repair neither accurately record the history of inspection and repair, nor ensured the proper functioning of the controllable pitch propellers and their control systems, which were critical to the safe operation of the ship. The operator's planned maintenance and repair system should be comprehensively audited to ensure it meets the outcomes required by the ISM Code. (027/10)

On 17th August 2010, the Director of Maritime New Zealand replied in response to the safety recommendation, worded as above. That reply, in part, was:

TAIC Recommendation No: 026/10

MNZ will require the Cook Strait ferry operators to ensure their training plans and procedures sufficiently address operational issues during training and familiarisation activities in relation to pilotage and ship handling. MNZ will verify that the training plans and procedures are implemented and complied with by 30 November 2010.

TAIC Recommendation No: 027/10

MNZ will require the operator to undertake a comprehensive review of their Planned Maintenance System (PMS) to ensure it meets the requirements and principles of the ISM Code. MNZ will liaise with the operator to determine an appropriate completion date. Upon completion, MNZ will conduct a targeted verification of the operator's PMS within two months to ensure that the PMS is in compliance with the ISM code.

On 25th July 2010 it was recommended that the Chief Executive of Ministry of Transport address the following safety issue:

5.3.3 The *Monte Stello* was fitted with a voyage data recorder (VDR), but it had not been maintained in working order because New Zealand Maritime Rules do not require one to be fitted. Even New Zealand-registered ships to which SOLAS has been applied are currently not required to be fitted with a VDR because New Zealand Maritime Rules have not been updated to incorporate changes made to SOLAS that came into effect in July 2002. Even if SOLAS requirements for VDRs had been incorporated into New Zealand Maritime Rules, the *Monte Stello* would not have been required to have one fitted because it was not trading internationally. The Wellington/Picton Cook Strait ferry operation combines roll-on-roll-off ships operating in challenging enclosed water pilotage and a stretch of open water renowned for challenging sea conditions.

The contribution to improving maritime safety world-wide by requiring certain classes of ships to be fitted with VDRs has been recognized by the IMO for many years, particularly for roll-on-roll-off ships such as the *Monte Stello* and the other current Cook Strait ferries. Until New Zealand-registered ships of the type trading across Cook Strait are fitted with VDRs or equivalent means of recording data, New Zealand and the greater maritime community are losing the potential safety benefits these devices provide.

Changes should be made to relevant New Zealand legislation that will result in all Cook Strait roll-on/roll-off ferries being required to have a fully SOLAS compliant VDR, or where not practicable to fit such equipment, other means to record as many operating parameters as practicable. (028/10)

On 24 August 2010, the Chief Executive of Ministry of Transport replied in response to the safety recommendation, worded as above. That reply, in part, was:

The Ministry of Transport will include consideration of the recommendation as part of the implementation of SOLAS requirements when advancing the Maritime Rules Development Programme. The Maritime Rules Development Programme for the 2011/2012 financial year is expected to be finalised in June 2011.

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Approved on 21 July 2010 for Publication

Mr John Marshall QC
Chief Commissioner

Appendix 1: Simulation of *Monte Stello* Wellington occurrence

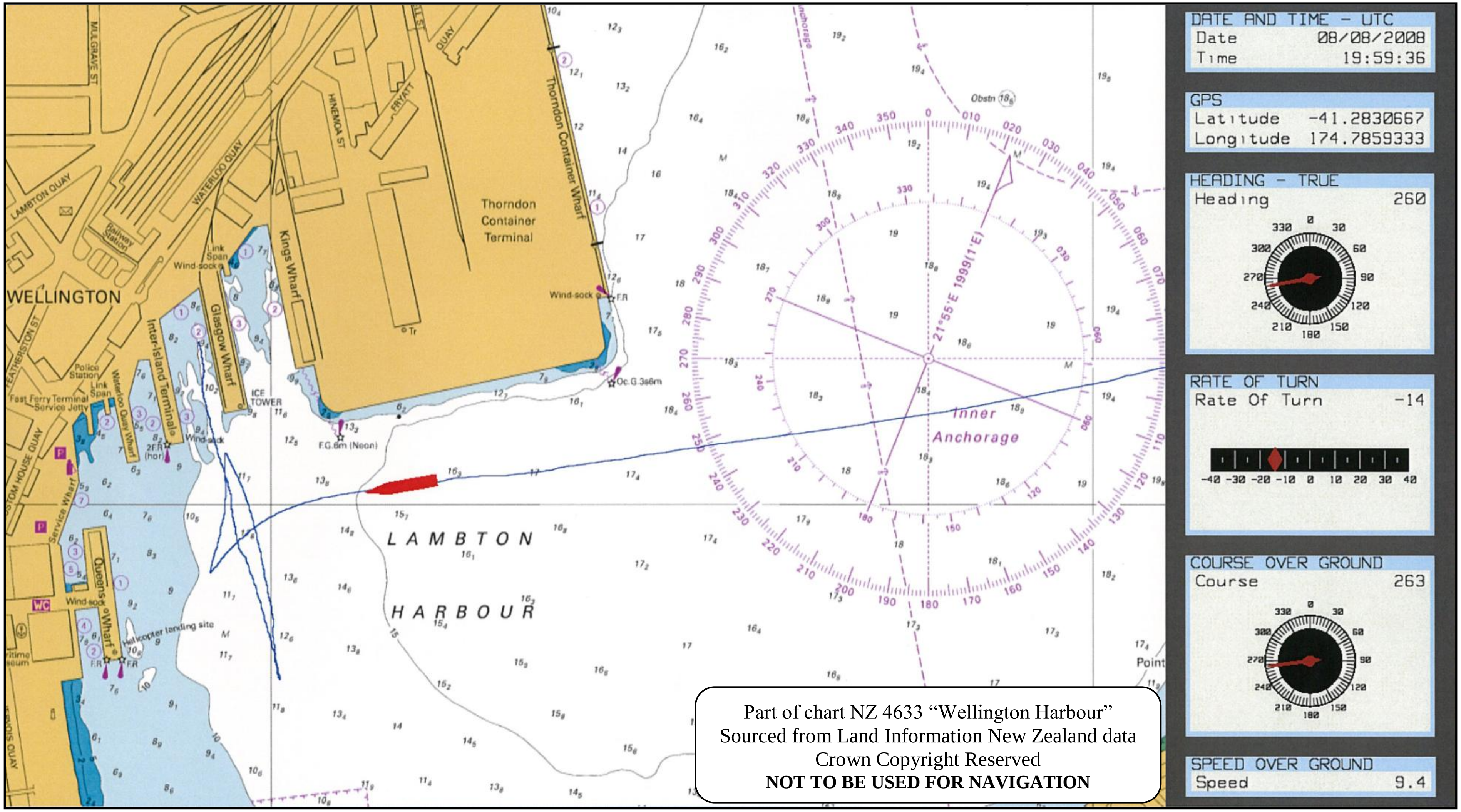
The following table shows the relevant data from the Endeavour data (Endeavour, 2008) and simulation (ATSB(2), 2009):

Flightscape/Endeavour simulation data						True heading	Rate of turn degrees per minute	Course over ground
Time (UTC)	Seconds before contact	Distance stern to knuckle	Speed (knots)	Speed (metres per second)	Comments			
20:01:57	123	210 m	0.4		Turn complete	196°	+13	257°
20:01:58	122	210 m	0.4		Ship moving astern	196°	+10	256°
20:02:55	75	150 m	3.4	1.75		190°	-21	14°
20:03:08	62	127 m	4.0	2.06	Bosun at about 120 m "close on Glasgow"	186°	-21	10°
20:03:21	49	100 m	4.3	2.21	Bosun "not looking good you're close on Glasgow"	182°	-21	7°
20:03:30	40	80 m	4.6	2.37	Bosun countdown "80 m"	179°	-21	4°
20:03:38	32	60 m	4.7	2.4	Bosun countdown "60 m"	177°	-22	3°
20:03:40	30	55 m	4.7	2.4		177°	-22	3°
20:03:44	26	46 m	4.8	2.5		173°	-22	1°
20:03:47	23	42 m	4.7	2.4	Bosun "going to hit the wharf full ahead"	173°	-22	2°
20:03:51	19	28 m	4.4	2.3		171°	-22	1°
20:03:54	16	21 m	4.0	2.06		170°	-21	0°
20:03:58	12	14 m	3.7	1.9		169°	-19	0°
20:04:02	8	10 m	3.2	1.65		168°	-18	1°
20:04:06	4	5 m	2.4	1.23		168°	-18	1°
20:04:10	0	0	0.4			166°	-20	13°

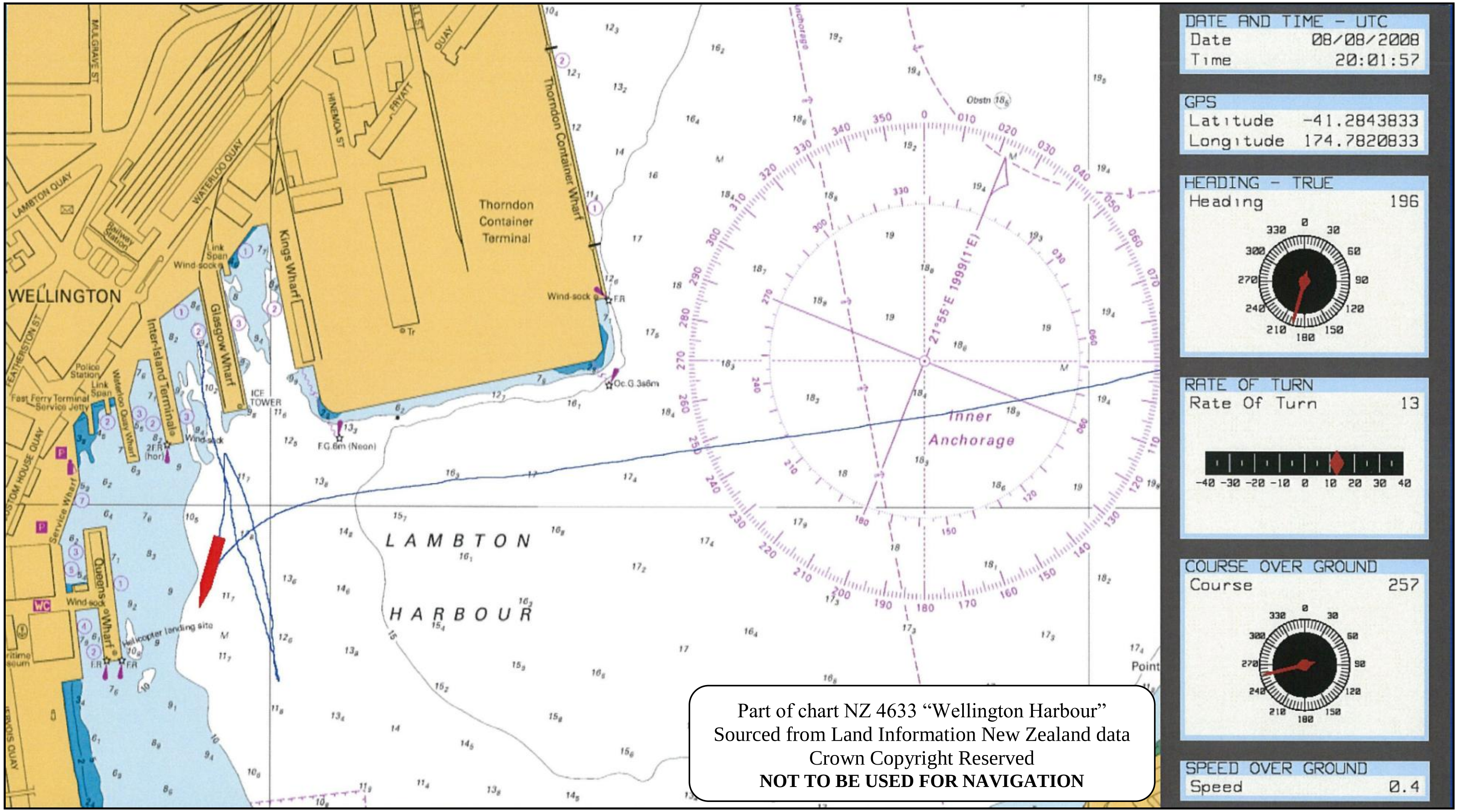
The following images show the recorded Endeavour data overlaid onto a chart of the Port of Wellington to show the ships position and relevant data using a Flightscape simulation program at prescribed points during the berthing.

Relevant data is displayed to the right of each picture as explained below:

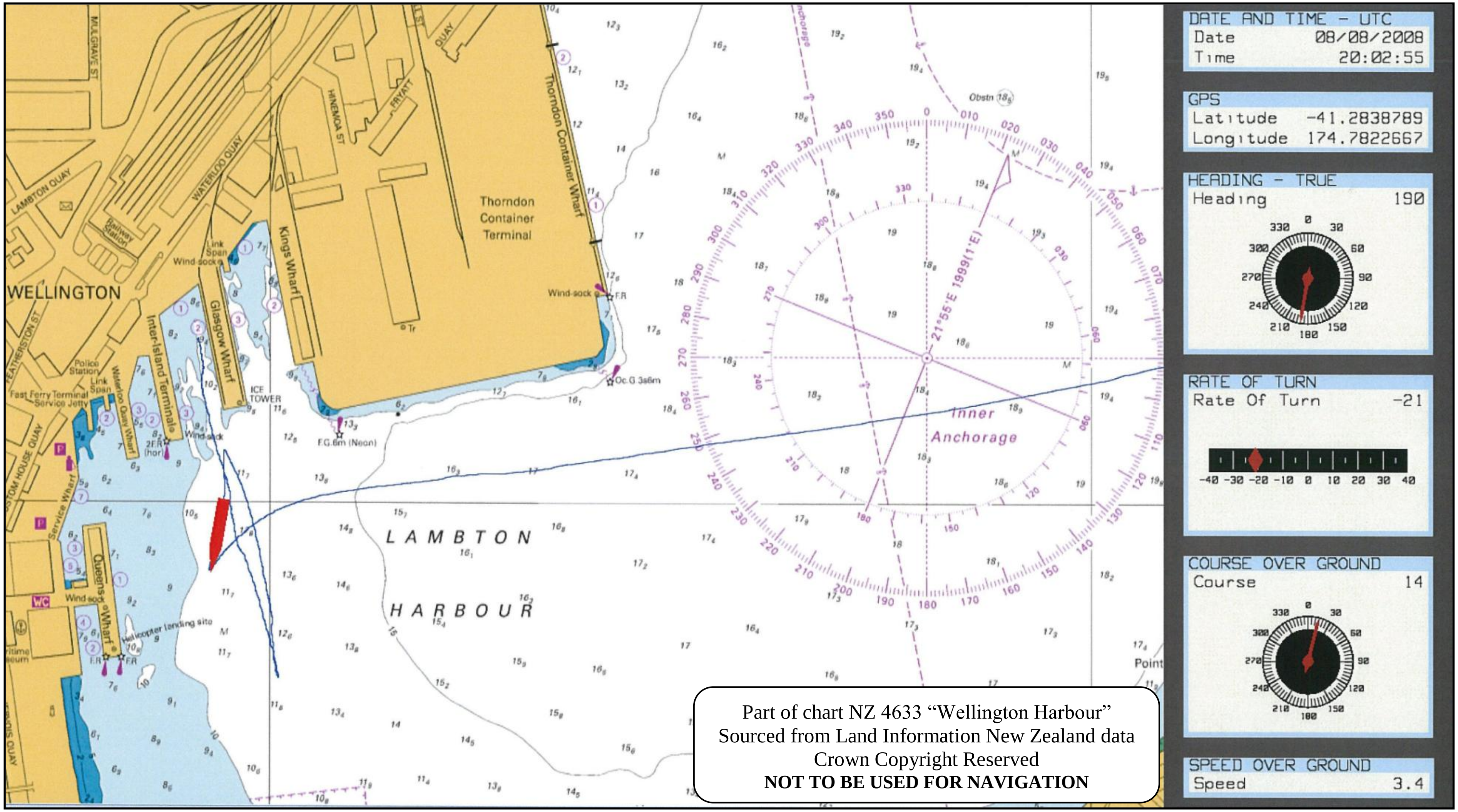
Date and time- UTC:	co-ordinated universal time is used (New Zealand local time – 12 hours) and is expressed in the 24 hour mode
GPS:	global positioning system data giving ships position in degrees of latitude and longitude
Heading true:	the direction in which the ship head (bow) is pointing expressed in degrees
Rate of turn:	the rate at which the ship is turning expressed in degrees per minute (- sign indicates the bow turning to port)
Course over ground:	the direction in which the ship is actually moving expressed in degrees
Speed over ground:	the ship's speed, expressed in knots



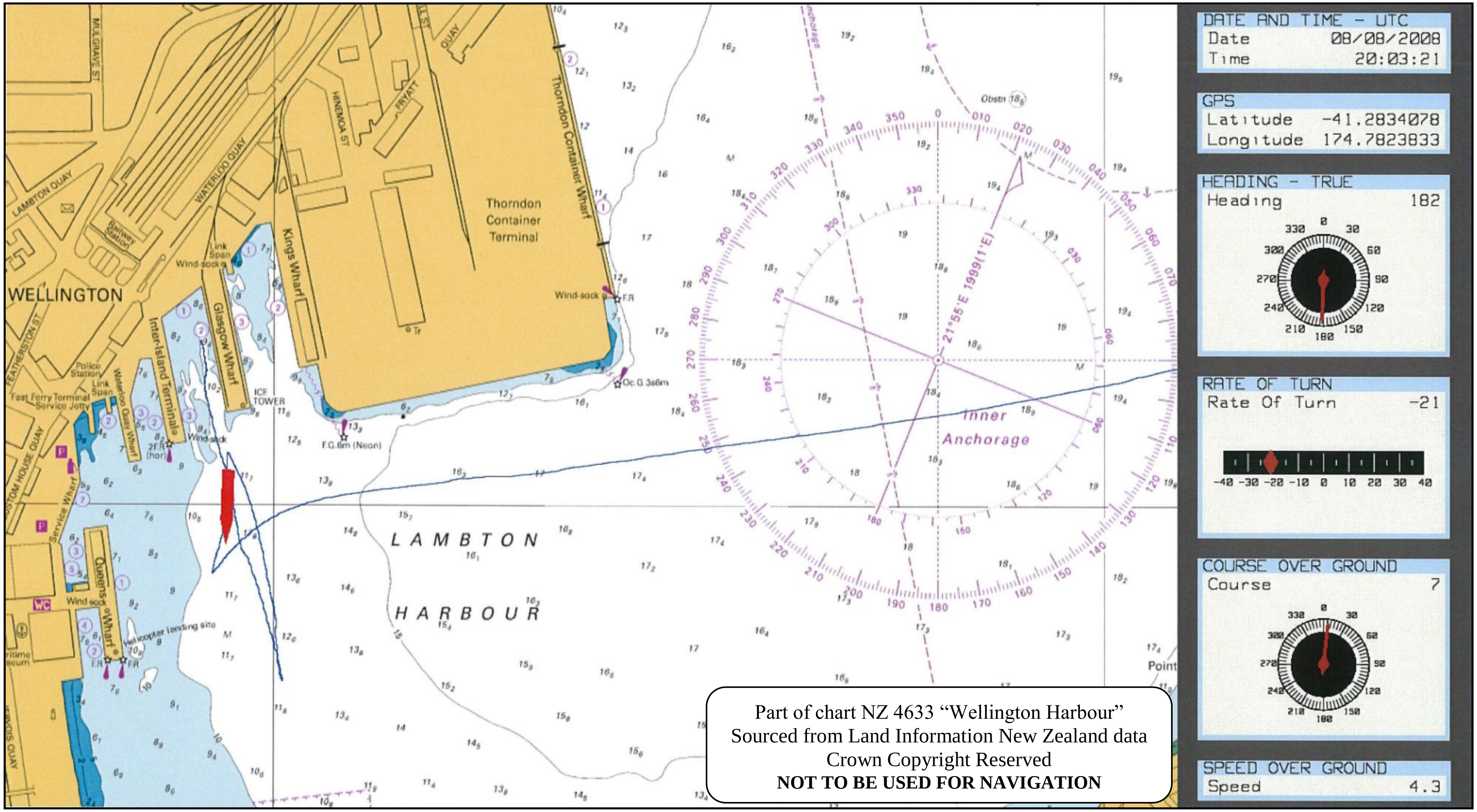
***Monte Stello* on approach about to turn to port**



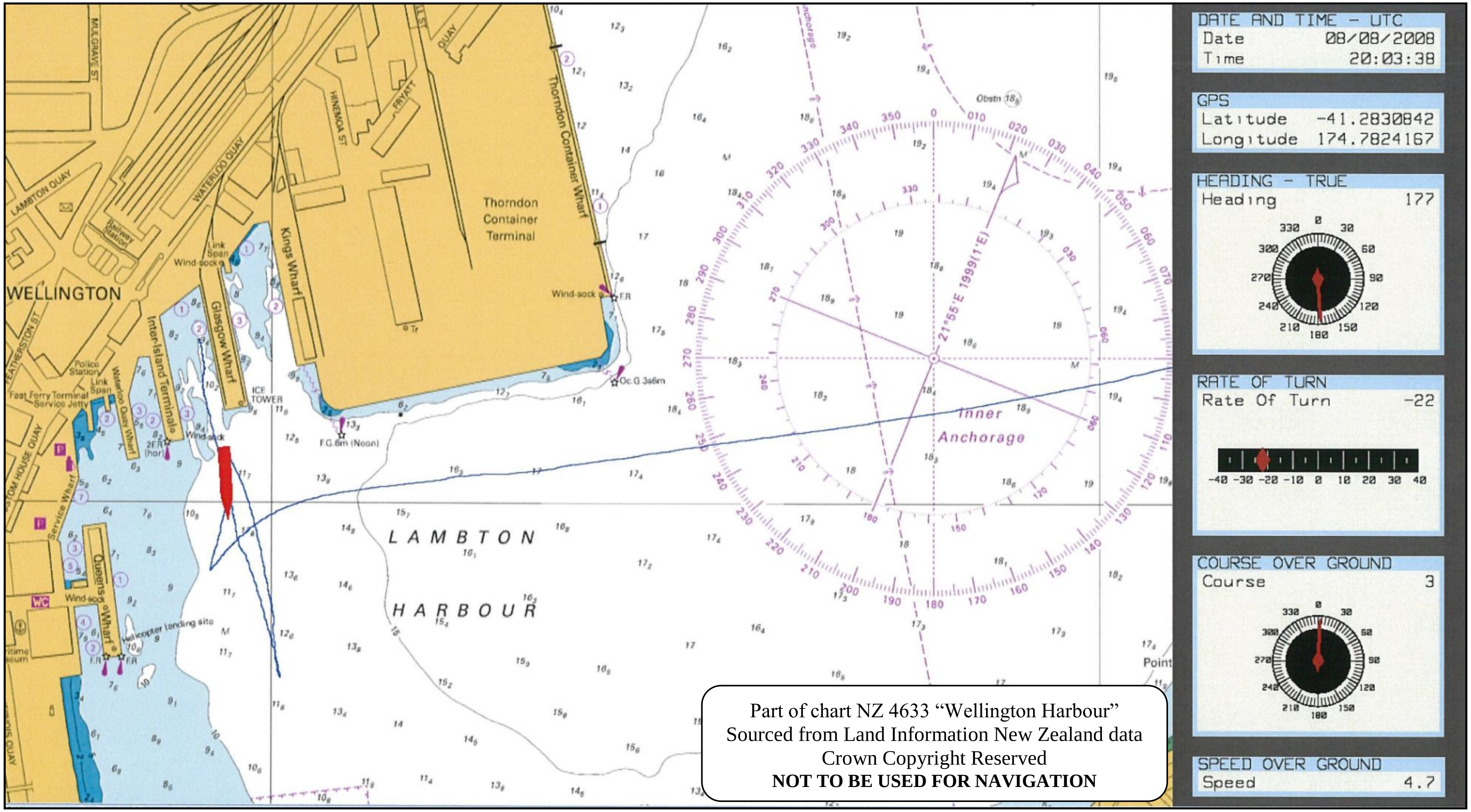
Monte Stello **turn complete (about 210 m from knuckle of wharf)**



Monte Stello **backing towards wharf (about 150 m from knuckle of wharf)**



***Monte Stello* backing towards wharf (about 100 m from knuckle of wharf)**



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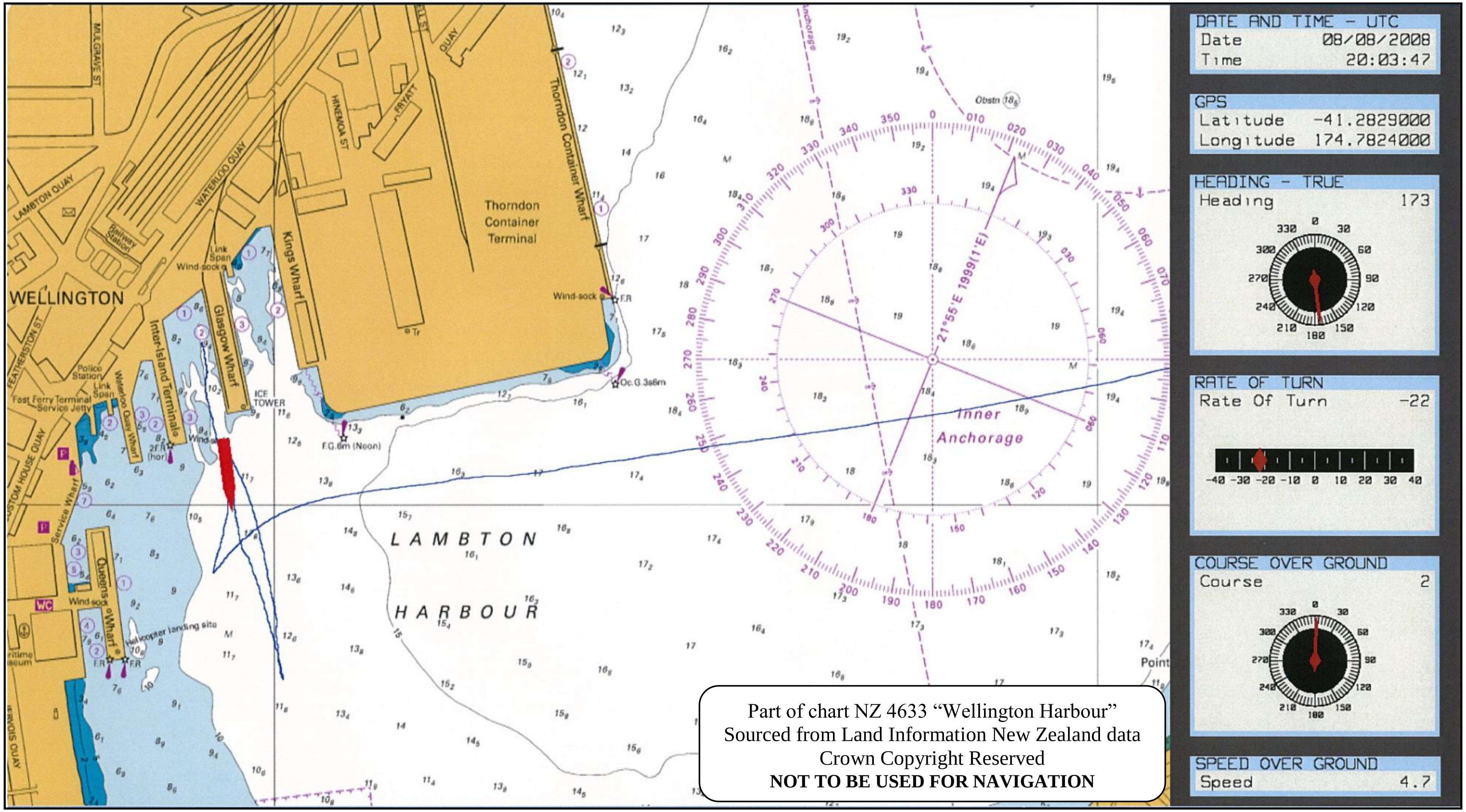
Monte Stello **backing towards wharf (about 60 m from knuckle of wharf)**



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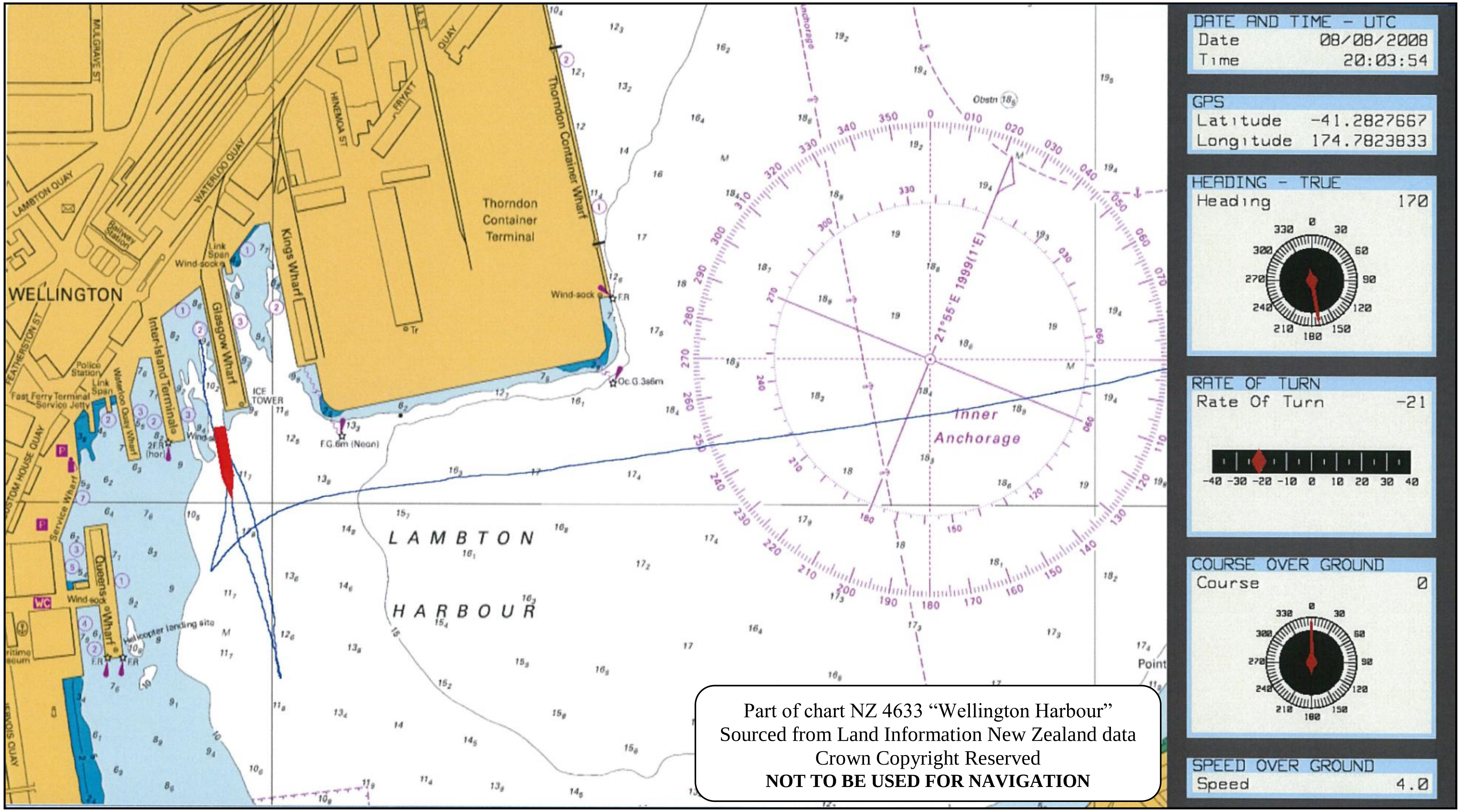
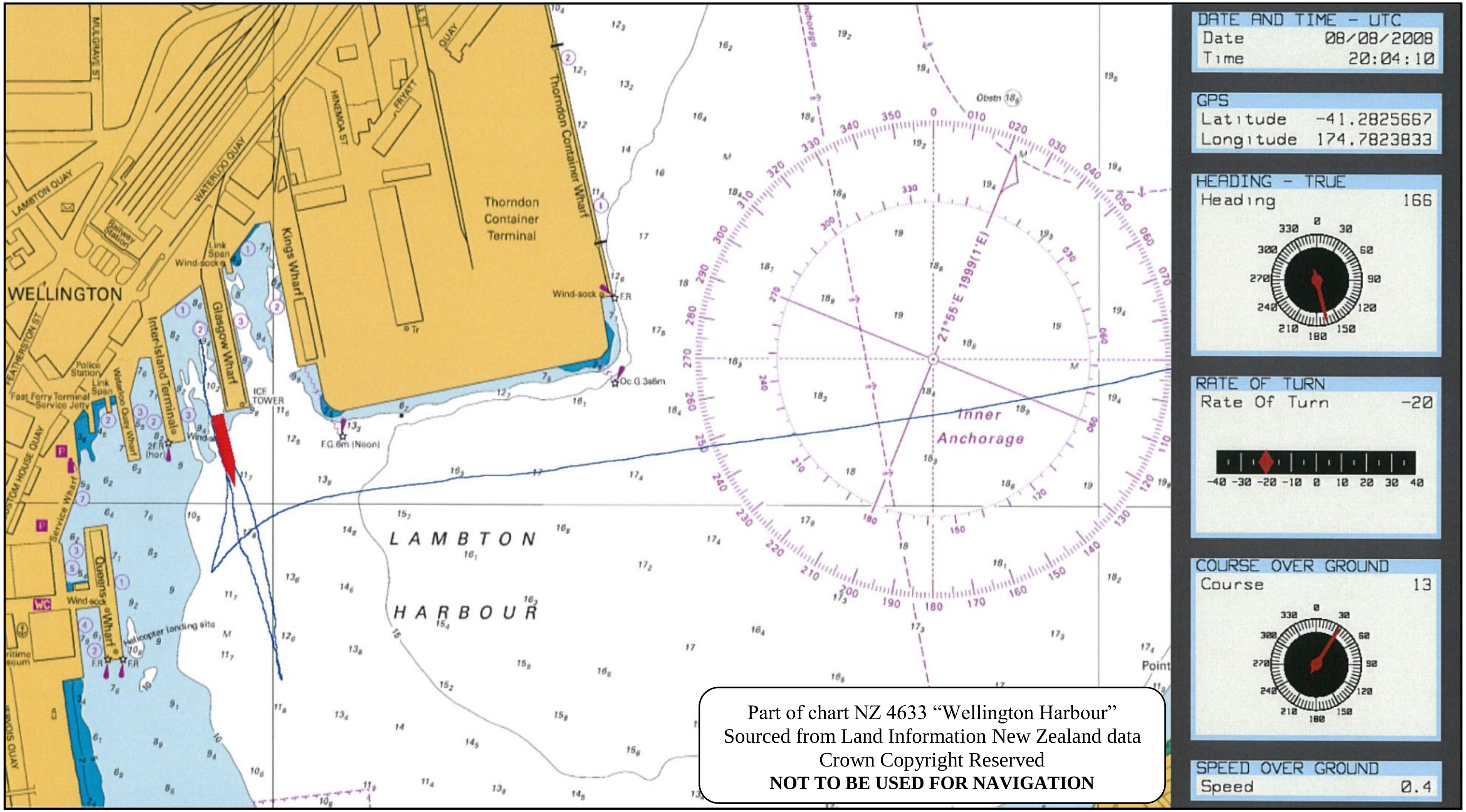
Monte Stello **backing towards wharf (about 40 m from knuckle of wharf)**



***Monte Stello* backing towards wharf (about 20 m from wharf knuckle)**



***Monte Stello* contacts knuckle of wharf**

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