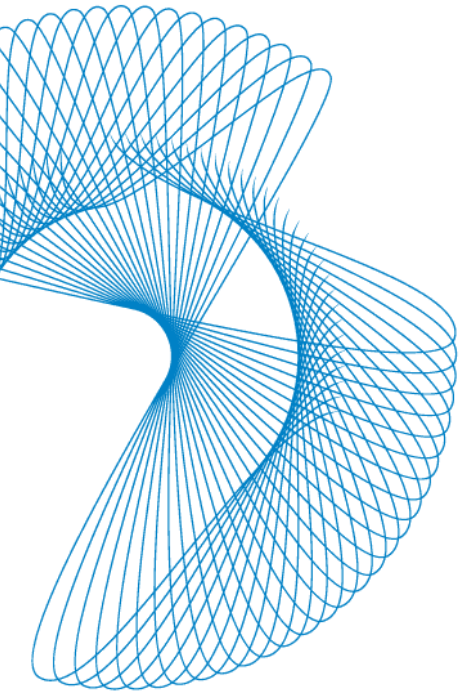
MARITIME NEW ZEALAND



Accident Report

Capella Voyager

Grounding in the Approaches to Whangarei on 16 April 2003

REPORT NO.: 03 3177

VESSEL NAME: *CAPELLA VOYAGER*

Casualty Details:

Date of Casualty:	16 April 2003
Time of Casualty:	1816 hours New Zealand Standard Time (NZST)
Casualty Type:	Grounding
Casualty Location:	Approaches to Port of Whangarei, New Zealand
Weather Forecast Area:	Brett
Investigator:	Michael Roberts

REPORT NO.: 03 3177

VESSEL NAME: *CAPELLA VOYAGER*

Vessel Details:

Vessel Name:	*Capella Voyager*
Date of Build:	1993
Vessel Category:	Crude Oil Tanker
Certified Operating Limit:	International
Overall Length (m):	258.9
Maximum Breadth (m):	48.3
Gross Tonnage:	80 914
Net Tonnage:	39 263
Flag:	Bahamas
Registered Owner:	Chevron Transport Corporation Ltd
Ship Operator:	Chevron Texaco Shipping Co., San Ramon, California, USA
Classification Society:	American Bureau of Shipping (ABS)

SUMMARY

At 1816 hours on 16 April 2003, the tanker ***Capella Voyager***, laden with 107 800 tonnes of crude oil from the Persian Gulf, grounded whilst transiting the main approach channel to her berth at the Marsden Point Oil terminal, Whangarei, New Zealand.

As a result of the grounding, the vessel's shell plating, in way of her forepeak tank and bulbous bow was ruptured and damaged. The forepeak tank flooded but there was no loss of the oil cargo, which was discharged ashore without further incident.

Following the completion of temporary repairs, the vessel sailed in ballast to Singapore where permanent repairs were effected.

GLOSSARY

TERM	DESCRIPTION
AB	Able (Bodied) Seaman
Aft	(Towards) the stern of a vessel
Bathymetry	Measurement of depth
BRM	Bridge Resource Management
Cable	One tenth of a nautical mile
Con (conned)	Conduct of the vessel's navigation
Data Logger	Electronic recording device of main engine movements
DGPS	Differential Global Positioning System
Doppler Log	Device measuring ship speed through the water
Draft (draught)	Depth in water at which a ship floats
DUKC	Dynamic Under Keel Clearance; the distance between the lowest part of a vessel in motion and the seabed beneath. This term is used in this report in its generic sense and does not relate to any product or device
ECDIS	Electronic Chart Display and Information System
(G)	Gyro
Heave	A vessel's oscillatory motion in a vertical plane (up and down) caused by wave action
HW	High Water
IHO	International Hydrographic Organisation
IMO	International Maritime Organisation
ISM	International Safety Management (System)
Knot	One nautical mile per hour
kW	Kilowatt
Leading Lights	Light(s) that signify the safest course along a channel
LINZ	Land Information New Zealand
LOA	Length Overall
m.	Metres

Mile	Nautical mile
MetService	New Zealand Meteorological Service
MSA	Maritime Safety Authority
NIWA	National Institute of Water & Atmospheric Research (New Zealand)
NZRC	New Zealand Refining Company (Ltd)
NZST	New Zealand Standard Time
Pitching	The rising and falling of a vessel's bow and stern
POAL	Ports of Auckland Ltd
POB	Pilot on Board
Port	A vessel's left hand side when looking forwards (towards the bow)
RPM	Revolutions per Minute
Satphone	Satellite Telephone
Squat	The overall decrease of a vessel's under keel clearance when in motion
Starboard	A vessel's right hand side when looking forwards (towards the bow)
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
Suezmax	The maximum size of vessel (defined by her beam or width) that can transit the Suez Canal
(T)	True
UKC	Under Keel Clearance between the lowest part of a vessel and the seabed
VHF	Very High Frequency (radio)
VRM	Variable Range Marker (radar)
Wave Period	The time taken for two successive wave crests to pass a fixed point
Yawing	A horizontal arc described by a vessel's bow as it moves ahead through the water

KEY EVENTS

1.1 Evidence of the Master and Crew of *Capella Voyager*

1.1.1 On 20 March 2003, ***Capella Voyager***, loaded 107 800 tonnes of light crude oil in Fujairah, United Arab Emirates, for delivery under voyage charter to Whangarei, New Zealand. Cargo was distributed throughout all cargo tanks. The vessel was instructed by her charterers, Caltex New Zealand Ltd, to arrive upright on an even keel, at a static draft of 14.42m.

1.1.2 On 14 April 2003, at 0643 hours ship's time (0743 NZST), prior to ***Capella Voyager's*** arrival, the Master sent an e-mail to the vessel's New Zealand agent, in which he asked if the Pilot had any limitations on swell height that might preclude the ship from entering harbour. The Master stated in this e-mail that he had received a forecast for a position off Whangarei that indicated there would be a 4.5m swell on the following day.

1.1.3 On 14 April at 0951 hours ship's time (1051 NZST), the agent replied that the maximum wind speed for berthing was 40 knots. He said that he was awaiting further weather information from the Pilot and would respond when he had received details. He added that if it was agreed between the Pilot and the Master that the rolling of the vessel on her approach to the port was dangerously increasing her draft, the approach would be aborted. He stated this situation has never occurred previously.

1.1.4 On 14 April at 1211 hours ship's time (1311 NZST), approximately 40 hours before the planned pilot boarding time of 0530 hours on 16 April, the vessel received a further e-mail (incorrectly dated AM when it should have been PM) from the agent who stated that he had received information from the Marine Manager of North Tugz Ltd (the service provider at Whangarei for pilots and tugs) that the forecast sea conditions were well within acceptable limits for the vessel. The latest weather forecast that the Marine Manager had at the time was for easterly winds at Cape Brett rising to 35 knots in the morning. Elsewhere, easterly 20 knots rising to 30 knots in the morning, sea becoming rough throughout. Easterly swell rising to 2 metres.

1.1.5 On 14 April, the Master and deck officers undertook a safety evaluation of the port and its approaches. Hazards that were identified at this meeting included shallow patches, fishing boats and swell conditions.

1.1.6 There was no further e-mail exchange on 15 April, as the vessel continued on passage to Whangarei.

1.1.7 On 16 April at 0300 hours, ***Capella Voyager*** arrived off Whangarei, when end of sea passage was rung.

1.1.8 The vessel then drifted off Whangarei, to the north of the Hen and Chicken Islands. At 0530 hours, the ship proceeded to the pilot boarding station, as previously arranged with the vessel's agent.

1.1.9 On arrival, the Master remained concerned about the swell conditions, as he had received a further weather forecast issued by MetService at 0018 hours on 16 April, which gave an easterly swell rising to 4m for coastal sea areas Brett and Colville. After holding a meeting at about 0400 hours with his bridge team, the Master ordered a "dry run" towards the port's approaches.

1.1.10 At approximately 0415 hours, ***Capella Voyager*** was aligned on the occulting white sector of the directional sectored light situated at Marsden Point, heading towards the Fairway buoy, on a course of 321°(T). She was about 5 miles to seaward of the Fairway buoy at that time.

1.1.11 The Master observed from the ship's clinometer that the vessel was rolling about 5º to port and starboard. She was also estimated to be pitching about 2.5m. When the vessel was 2.3 miles from the Fairway buoy, as determined by radar, the swell conditions deteriorated further and the vessel's rolling increased.

1.1.12 Because of the deterioration in the weather conditions and increased vessel motion, the Master ordered *Capella Voyager* to be turned to starboard, and aborted the approach to the pilot station. He called the Pilot on VHF radio Channel 19 and informed him of his decision, and the reasons for not continuing the approach.

1.1.13 In response, the Pilot told the Master that he was already en route to the vessel and would prefer to board *Capella Voyager* to discuss the pilotage. Subsequently, it was agreed between the Master and Pilot that the vessel would commence her approach towards Whangarei at about 1600 hours, to re-evaluate the sea conditions with a view to possible entry into the port.

1.1.14 *Capella Voyager* then resumed drifting off the port, approximately 3 to 6 miles north east of Bream Head, before making another attempt at entry on that evening's tide.

1.1.15 Once the vessel had regained deep water, the Master went to his cabin to sleep for approximately two hours. Whilst the Master was asleep, the Chief Officer received a telephone call from the Marine Manager of North Tugz Ltd, who informed him that the vessel should not have broken off the approach but should have entered the port. The Marine Manager disputes this and recollects that he said he was disappointed that the Pilot had not boarded in the morning to enable discussion of the situation, and hoped the Pilot could at least come aboard that evening, even if the berthing was again cancelled.

1.1.16 At 1115 hours, when the Master returned to the navigation bridge (the bridge), the Chief Officer reported his conversation with the Marine Manager. The Master then called the Marine Manager who told him that once inbound vessels had passed the 20m sounding contour line, situated approximately one cable to seaward of the Fairway buoy, swell conditions always diminished. It was his view that the Master had made a wrong decision not to enter the port. The Master responded by saying that in his professional judgement it would have been unsafe to enter. A trainee tugmaster, a witness to the radio conversation, made a notarised statement to the effect that the Marine Manager had said that he would like the Master to allow the Pilot on board to discuss the situation with him. The Marine Manager felt that the Master should have allowed the Pilot to board the ship in the morning before making the decision to cancel its berthing. A second witness, a pilot, made a similar statement in which, among other things, he said that he did not hear the Marine Manager state that the vessel should have entered port.

1.1.17 At about 1600 hours, in accordance with the earlier agreement, *Capella Voyager* commenced her approach to Whangarei to evaluate sea conditions for entry to the port.

1.1.18 When in a position about 5 miles to seaward of the Fairway buoy, and aligned on the approach to the main navigable channel, the Master found the height of the swell had reduced and the vessel was rolling about 2° to port and to starboard.

1.1.19 At 1728 hours, *Capella Voyager* reached the agreed pilot boarding point, about 2 miles to seaward of the Fairway buoy. Two pilots boarded the vessel via a 'combination' ladder and proceeded to the bridge. After introducing themselves to the Master, they explained that they would like to attempt a dry run (an assessment of the vessel's motion in the approach to the port). This was in recognition of the Master's earlier concern about the swell conditions. It was agreed that the break-off point for entering the port would be about 1 mile to seaward of the Fairway buoy. This was to allow sufficient time and room for the vessel to turn to starboard, and return to deep water.

1.1.20 After proceeding to a point about 1 mile to seaward of the Fairway buoy on a course of 320°(T), *Capella Voyager* commenced a slow turn to starboard. As the vessel continued to turn, the Master and Pilot discussed the motion of the vessel, and agreed that entry to the port could proceed. This was followed by a full Master/Pilot Exchange, including the exchange of a Pilot Card and details of the vessel's particulars.

1.1.21 The weather at the time was recorded in the deck log book as a south west by west wind at 14 knots with 12 miles visibility. Sunset was due at 1759 hours. All navigational marks and light leads were stated to be clearly visible. The swell was observed to be less than in the morning.

1.1.22 After completing a 360° turn to starboard, and when about two miles to seaward of the Fairway buoy, the Pilot ordered a course of 320°(T) to be steered along the axis of the leading beacons line of the main navigable channel. The Chief Officer was at the port radar employing parallel indexing techniques. Positions he derived from the radar were plotted on the chart and entered in *Capella Voyager's* deck log. The Second Officer plotted additional positions obtained from the DGPS.

1.1.23 At about 1813 hours, *Capella Voyager* passed the Fairway buoy abeam to starboard. She was still steering a course of 320°(T) and proceeding at a speed of between 5 and 6 knots in the alternating occulting white/green sector of the sectored light at Marsden Point.

1.1.24 Very shortly after passing the Fairway buoy, *Capella Voyager* started yawing some 6° to starboard and 9° to port. The Helmsman stated the vessel was answering to her helm when this occurred. At the same time, the bow of the vessel started pitching about 1.5m. The Master and Pilot agreed that the swell height was generally about 3m, and 'occasionally' up to a maximum of 4m at this time. According to the Master and crew, *Capella Voyager* also started rolling about 5° to port and to starboard. *In commenting on the report, the Pilot said the vessel was not rolling or heaving but yawing and in his opinion this would not have led to a loss of UKC.*

1.1.25 At about 1816 hours, *Capella Voyager* shuddered as she pitched bow down, rolled and came into contact with the seabed in a position approximately midway between the Fairway buoy and No's 1 and 2 buoys. It was the evidence of the Chief Officer that when this happened he saw the vessel's weather deck flexing. There was also a momentary decrease in the vessel's speed at this time to about 3 knots. The vessel was still on a course of 320°(T). There was a loss of steering for a few seconds when the grounding occurred.

1.1.26 About five seconds after grounding, the vessel touched bottom again as she pitched bow down. When this occurred, the Pilot suggested to the Master that the speed of the vessel be reduced. However, the check Pilot recommended that speed be increased to regain steering control that was lost temporarily when the second grounding occurred. There were no further groundings after this time. *In commenting on the report, the Pilot said there was no loss of steering but speed was increased after the second grounding to ensure the ship arrived at the berth within the tidal window.*

1.1.27 At about 1836 hours, when the vessel was in the vicinity of No. 8 buoy, two tugs were made fast to *Capella Voyager*. As the vessel completed her passage of the approach channel, the Master ordered the Second Officer to sound all double bottom/ballast tanks. It was determined that the forepeak tank was making water rapidly but that none of the oil cargo had leaked into this compartment or any of the double bottom tanks. The relevant Authorities were notified of the grounding at about this time.

1.1.28 At 2036 hours, *Capella Voyager* made fast port side to her berth at Marsden Point.

1.2 Evidence of *Capella Voyager's* Pilot and Check Pilot

1.2.1 At about 0400 hours on 16 April 2003, the Pilot went to the pilots' office in Whangarei to check real time wind speed, direction and barometric pressure from stations situated at Marsden Point, Tamaterau and Port Whangarei. He also checked the actual tidal height against prediction, which was available via electronic telemetry from the tide gauge located at Marsden Point. When he was interviewed by the MSA, he could not remember if the tide was meeting prediction.

1.2.2 The Pilot noted that the wind was south easterly at 16-18 knots. This was below the 40 knots wind speed cut-off criterion for berthing as delineated in the NZRC Terminal Handbook. There was no documented cut off criterion for swell height.

1.2.3 Before leaving home, the Pilot had checked the MetService website and noted that a low pressure system was lying to the north east of New Zealand. An easterly swell forecast of 3-4 metres was in force for sea areas Brett and Colville.

1.2.4 At about 0410 hours, the Pilot contacted ***Capella Voyager's*** Master on VHF Channel 19 to discuss the swell conditions. It was agreed that he would join the vessel at the pre-arranged time of 0530 hours, at a point about 1.5 miles south east of the Fairway buoy. The Pilot recalled the Master's comment at this time that the vessel was rolling, and the weather conditions were not very favourable.

1.2.5 At about 0415 hours, the pilot boat left the berth for ***Capella Voyager.*** Before the pilot boat cleared the inner harbour, the Master informed the Pilot over the VHF that ***Capella Voyager*** was rolling about 5° each way, and he was not prepared to attempt to berth his vessel in those conditions.

1.2.6 In view of the above, it was arranged between the Pilot and the Master that the vessel would return to the same point off the Fairway buoy in the evening, to reassess the swell conditions and determine whether it was safe to enter port.

1.2.7 In the afternoon, the Pilot had a discussion with the other rostered North Tugz Pilot, who told him that based on two pilotages he had conducted earlier that day, he considered the swell conditions to have been 'marginal'. For this reason, it was agreed that he would accompany the Pilot, in a 'check Pilot' capacity, on board ***Capella Voyager***.

1.2.8 At about 1600 hours, when the Pilot returned to his office, he found that the wind speed had decreased to about five knots. He did not check the actual tidal height against the predicted height as he felt the latter to be sufficiently accurate.

1.2.9 The Pilot completed the Pilot Card and met with the check Pilot. At about 1630 hours, after boarding the pilot boat, the Pilot called ***Capella Voyager*** on VHF radio to advise that the pilot boat was *en route* to the vessel.

1.2.10 As the pilot boat passed Frenchman Island ('the Frenchman'), the Pilot estimated the height of the swell to be about three metres. The visibility was excellent.

1.2.11 At about 1730 hours, after boarding ***Capella Voyager***, there was a discussion between the Pilots and Master about the swell. It was agreed that they would conduct a dry run along the axis of the approach to the port and thereafter turn the vessel through an arc of 360° to seaward of the Fairway buoy. If the sea and swell conditions proved to be significantly less that those experienced by the Master in the morning, they would proceed to the vessel's berth. The delay caused by making a round turn would also enable ***Capella Voyager*** to berth at the optimum time, at (or near) slack High Water.

1.2.12 As the vessel turned and started to circle to starboard, the Master/Pilot exchange took place. There was a discussion about the vessel's drafts, under keel clearance (UKC), and the availability and power of tugs. A sketch plan was shown to the Master describing the berth layout. This discussion did not include actions that could be taken in the event of an emergency, such as a grounding, although the Master and his officers had considered this in their pre-arrival checklist.

1.2.13 At about 1813 hours, ***Capella Voyager*** passed the Fairway buoy abeam to starboard. At this point the Pilot called Whangarei Harbour Radio, to alert them to the vessel's imminent transit of the channel. At about the time of passing the Fairway buoy, the vessel started to yaw. Whilst the Pilot could not express the exact degree of yaw he did not consider it to be unusual or excessive. In an attempt to lessen the yaw and improve ***Capella Voyager's*** helm responsiveness, the Pilot ordered an increase in speed from three knots to between five and six knots. It was recognised by the Pilot that any increase in speed would also increase the amount of squat, and thereby result in an overall decrease of under keel clearance.

1.2.14 ***Capella Voyager*** continued to be conned by the Pilot along the main navigable channel in the alternating occulting white/green sector of the directional sectored light, where the depth of water below chart datum was considered by the pilots at Whangarei to be the greatest.

1.2.15 Shortly after increasing speed, ***Capella Voyager*** grounded. At this time, her course was 320°(T) and she was about midway between the Fairway buoy and No's 1 and 2 buoys, still within the white/green sector of the sectored light at Marsden Point. The Pilot stated that immediately before grounding he saw the bow 'fall away', followed by the vessel shuddering and then lots of bubbles rising to the surface. A few seconds later the Pilot saw another swell rolling in from an easterly direction, and the vessel's bow 'fell away' again and grounded for a second time. He estimated the height of the swell at the time of each grounding to have been about 3-4 metres. The check Pilot stated that he did not know for certain whether the vessel had grounded until the Master subsequently ordered an officer to go forward and sound tanks and void spaces.

1.2.16 The remainder of the passage passed without further incident.

1.2.17 The Northland Regional Council Harbourmaster was informed of the grounding by the check pilot at 2000 hours on 16 April. His attendance at the vessel was requested.

1.3 Events following *Capella Voyager's* Arrival at Whangarei

1.3.1 Following ***Capella Voyager's*** arrival at Marsden Point, the MSA Maritime Safety Inspector at Whangarei, attended the vessel and, in accordance with Section 55 of the Maritime Transport Act 1994, issued a Detention Notice on behalf of the Director of Maritime Safety. This was on the basis that in her damaged condition she was a real or potential danger to property or persons and to the marine environment.

1.3.2 The vessel's release from detention was conditional on her being sufficiently and adequately repaired to render her safe, to the satisfaction of both her appointed Classification Society Surveyor and the MSA's Director of Maritime Safety, for a single voyage to a repair yard.

1.3.3 On 18 April 2003, temporary repairs were completed to the required standard and ***Capella Voyager's*** Detention Notice was lifted. This allowed her to sail to Singapore for permanent repairs to be effected.

1.3.4 Following ***Capella Voyager's*** grounding, the Harbourmaster imposed a static draft restriction of 11.8m for vessels entering the port, pending the outcome of a hydrographic survey by POAL. This draft restriction was subsequently lifted on 25 April 2003, after completing a hydrographic survey of the approach channel.

KEY CONDITIONS

2.1 Particulars and Ownership of *Capella Voyager*

2.1.1 *Capella Voyager* is a purpose built Suezmax oil tanker, built in Brazil in 1993. She is a double hull vessel as defined by Marpol Regulation 13F/G. Her bridge, engine room and accommodation are situated at the after end of the vessel. The manoeuvring speeds of *Capella Voyager* are as follows:

		Speed	
	Shaft rpm	LOADED	BALLAST
Full Ahead	57	9.9 knots	11.3 knots
Half Ahead	46	7.9 knots	9.1 knots
Slow Ahead	35	6.0 knots	6.8 knots
Dead Slow Ahead	27	4.6 knots	5.2 knots

2.1.2 *Capella Voyager* is owned by Chevron Transport Corporation Ltd., and operated by Chevron Texaco Shipping Co., California, USA. She is registered in Nassau, Bahamas, and is Classed with the American Bureau of Shipping (ABS).

2.1.3 *Capella Voyager* has a total of 14 cargo tanks, (port and starboard) with 16 double bottom water ballast tanks and 16 wing water ballast tanks. Her forepeak and afterpeak tanks are used for water ballast. She has three fuel oil bunker tanks situated forward of the accommodation block, together with single tanks for diesel oil and slops. Two freshwater tanks are located at the after end of the accommodation block.

2.1.4 *Capella Voyager* is powered by a Sulzer 6RTA72 slow speed diesel engine developing 15 437kW at 89 RPM, through a single, fixed pitch, five-bladed propeller. The vessel is fitted with a single semi-balanced rudder which can be moved through an angle up to 45° to port and to starboard, at speeds below 8 knots. The rudder angle is governed to 30° to port and to starboard at speeds in excess of 8 knots.

2.1.5 All the vessel's Certificates, including her ISM Certificate were found to be valid. The ISM controlled documents relating to passage planning had been completed satisfactorily by the Chief Officer.

2.1.6 *Capella Voyager* is fitted with the following navigational equipment:

- 2 x ARPA radars
- 2 x DGPS receivers
- 2 x Echo Sounders
- Doppler Log
- 3 x VHF radios
- 2 x ECDIS systems

All of the above equipment was working satisfactorily at the time of grounding.

2.2 Damage Sustained by *Capella Voyager*

2.2.1 An underwater inspection of the area of suspected damage around ***Capella Voyager's*** bow was undertaken alongside the vessel's berth at Marsden Point. This showed that the damaged area extended 21m aft from the tip of the bulbous bow to a point just forward of the collision bulkhead and the No.1 cargo tanks which contained 12 268 tonnes of crude oil. The damage consisted of the shell plating being set up, with the heaviest damage noted on the port side of the bulbous bow. The hull plating was found to have been holed just forward of the collision bulkhead. Significant creasing of the shell plating was found in way of the bulbous bow and further aft.

2.3 Crew of *Capella Voyager*

2.3.1 The vessel had a crew complement of 27. These were mainly Swedish, Filipino and Indian nationalities. The Master, a Swedish national, obtained his Master's Foreign Going Certificate of Competency in 1972, and was first appointed to command of a vessel in December 1979. At the time of this accident, he had been Master of ***Capella Voyager*** for three years. He re-joined the vessel at Sri Lanka on 27 March 2003. His Certificate, and those held by the deck officers, were found to be in order with the requisite STCW95 revalidation. ChevronTexaco indicated that the Master and Chief Officer had received training in basic principles and techniques of ship hydrodynamics. They had not been trained in the more advanced techniques required to predict accurately vessel squat in transient rather than steady water depths.

2.3.2 The Chief Officer, a British national, obtained his Chief Mate's Foreign Going Certificate of Competency in 2000. He joined the vessel on 1 February 2003.

2.3.3 The Helmsman (Quartermaster), an Indian national, had been rated A/B since 1997.

2.3.4 None of the crew who was interviewed had previously been involved in a maritime accident.

2.4 *Capella Voyager* - Passage Planning

2.4.1 The MSA Accident Investigator examined the vessel's navigational planning for entry to the port, and found it to be detailed and accurate. Notations had been made on the appropriate chart (NZ5213), with separate slips appended giving such information as notable danger areas, tidal information, least depths, including the charted 14.6m sounding (where it is believed ***Capella Voyager*** grounded), and courses to steer. This documentation was sighted by the Pilot and check Pilot on boarding the vessel.

2.5 The Port of Whangarei

2.5.1 Whangarei Harbour lies at the northern end of Bream Bay, North Island, New Zealand. There are three ports at Whangarei. Firstly, the two oil jetties and refinery at Marsden Point which serve the New Zealand Refining Company; secondly, the cement works wharf, and thirdly the port of Whangarei. The port of Whangarei is a major port, handling significant timber exports. Marsden Point is an oil refinery and terminal. The New Zealand Pilot (NP51) makes reference to the risk of the port being affected by tsunamis. However, neither this document nor the 'Guide to Port Entry' includes any reference to the risk of swell conditions affecting deep drafted vessels in the approaches to the port. Under the sub heading of 'Sea and Swell' for New Zealand waters generally, the New Zealand Pilot advises that swell conditions around New Zealand prevail throughout the year, but are heaviest in autumn and winter.

2.6 Entry to Whangarei Harbour

2.6.1 Access to Marsden Point, by a buoyed approach channel, is limited by draft to a least charted depth of 14.6m between the Fairway buoy and No.'s 1 and 2 buoys. This is confirmed by the New Zealand Pilot, which gives directions that the outer approach channel has a least reported depth of 14.6m at the seaward end. The buoyed channel has a least width of 190m at a point between No.'s 3 and 6 buoys. The overall length of the channel from the Fairway buoy to Marsden Point is about six miles. The deepest and longest berth is at Marsden Point, which can accommodate vessels up to 145 000 tonnes displacement, a maximum draft at HW of 15.2m, and a maximum length of 304m.

2.7 Pilotage at Whangarei

2.7.1 Pilotage is compulsory for all vessels in excess of 100 gross tonnage. The Pilot boarding ground is in a position just over 0.5 miles to seaward of the Fairway buoy, and just under 1 mile from the minimum sounding of 14.6m in the main navigable channel. Pilotage and tug services for Marsden Point are provided by North Tugz Ltd, and are operated on a 24 hour basis.

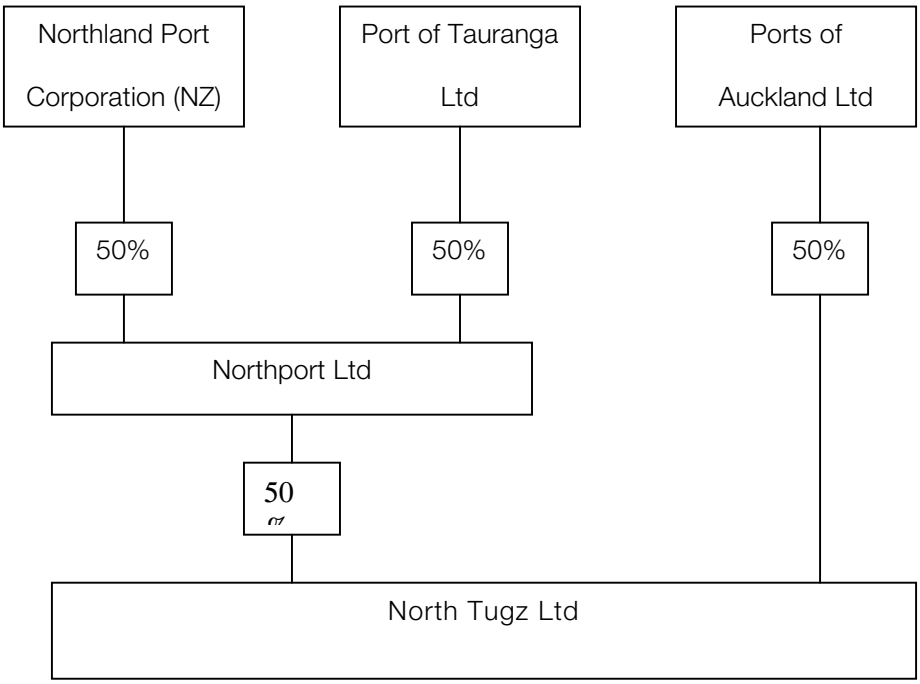
2.7.2 Berthing at Marsden Point is conducted with the assistance of two tugs. Vessels proceeding to Marsden Point are met by these tugs at either the No. 3 or No. 7 buoys depending on their size. The inward movement of vessels is timed so that they berth shortly before HW.

2.7.3 The approach to the port (in terms of courses to be steered) is relatively straightforward, and is well marked with beacons, buoys and daymarks. Tidal streams attain a maximum rate of about three knots on a mid-ebb spring tide in the vicinity of No. 7 buoy. No appreciable tidal cross-set is experienced in the port's approaches when deep drafted vessels enter, as this is conducted close to High Water.

2.7.4 Inbound deep-draft vessels, and vessels approaching the maximum length for the port are committed to entry once they have passed the Fairway buoy, due to the limited turning room in the buoyed channel and the limited depth of water outside this area.

2.8 Port Management

2.8.1 According to Silver Fern Shipping, which holds the contract for the provision of towage and pilotage services for all tankers calling at Marsden Point, Ports of Auckland Ltd previously provided pilotage and towage services at Marsden Point from October 1999 to March 2003. North Tugz Ltd was created on 1 April 2003, and is owned by a consortium of two companies; namely Ports of Auckland (50%) and Northport Ltd (50%). Northport Ltd is the port operating company for the ports of Whangarei and Marsden Point. It is owned jointly by Port of Tauranga (50%) and Northland Port Corporation (50%), and began trading in July 2002, as the port operating company, when it took over the marine activities of the Northland Port Corporation at both Marsden Point and Whangarei. The structure of controlling interests within Northport is represented as follows:



2.8.2 North Tugz Ltd was created to provide pilotage services and tugs throughout the port of Whangarei, and employed two pilots and a Senior Pilot/General Manager. A fourth pilot, who was employed directly by Northport Ltd, was contracted as a pilot to North Tugz Ltd on a regular rostered basis.

2.8.3 All the pilots employed by North Tugz Ltd and Northport Ltd were experienced in the pilotage of deep drafted vessels into Marsden Point. There is no specific requirement by the Maritime Safety Authority of New Zealand (MSA) for pilot training documentation submitted to it, to include appropriate allowance for items such as heave, roll and pitch in determining a vessel's UKC. The MSA uses the IMO Assembly Resolution A.960(23) – Recommendation on Training and Certification and Operational Procedures for Maritime Pilots, as the basis for assessing the submission of pilotage training documentation. The syllabus for pilotage certification or licensing, which is included in the Assembly Resolution, limits factors that might affect ship performance in restricted waters to channel configuration, water depth, bottom, bank and ship interaction, including squat. The Assembly Resolution is contained in the Advisory Circular to Maritime Rule Part 90 – Pilotage. The pilot's training at Whangarei did not include topics directly relating to heave and pitch.

2.8.4 North Tugz Ltd had not provided any standing orders with clearly defined limits of ship operation for varying sea conditions. The North Tugz Ltd passage plan was considered inadequate by the MSA Accident Investigator as it did not contain matters such as target speed in way of the least depths and there was a lack of contingency planning. These are both significant issues when considering the passage of laden oil tankers in restricted waters. Further, the North Tugz passage plan was not in conformance with IMO Resolution A.893[21] – 'Guidelines for Passage Planning'.

2.9 Personnel

The Harbourmaster

2.9.1 The Harbourmaster attained his Master Foreign Going Certificate of Competency in 1988. He worked in the port of Tauranga (NZ) between 1988 and 1995 as a pilot and relieving tug master. He worked as the National Operations Manager in the then Marine Environment Protection Division of the Maritime Safety Authority between 1995 and 2000. In 2000, he became Harbourmaster for Northland Regional Council, which included the port of Whangarei.

2.9.2 *In commenting on the draft report, the Harbourmaster stated, that in February 2000, he met the Northland Regional Council General Manager, and the previous Harbourmaster to discuss navigation safety issues and risks for Whangarei Harbour to gain a better understanding of safety issues and to clarify the criteria set by the previous Harbourmaster for the licensing of North Tugz pilots. He also met the POAL representative, to ascertain the criteria for deep draft vessels crossing the shallows at the harbour entrance. The Harbourmaster stated that he learned the maximum draft for this port had been set at 15.24m and that a limit of 10% of a vessel's maximum draft was to be allowed for under keel clearance. He questioned the validity of the 10% limit and stated he was told the POAL representative that it had been in place since 1963. (POAL representative disputes that the maximum draft for the port was discussed and remembers the meeting as an informal discussion on the procedures North Tugz adopted for berthing large tankers with more powerful tugs than those used prior to 1999). The Harbourmaster was informed that the effects of squat and increase in draft due to roll were managed by North Tugz operating procedures and that increase in draft due to pitch was not a large issue and that the pilots limit the effects of squat by keeping speed to no more than 6 knots. He was told that if swell was present, the Master and the Pilot were to calculate the increase in draft due to rolling and agree if a safe passage could be accomplished. In May 2000 he suggested to the POAL representative that ongoing training for pilots should include the effects of squat, shallow water effect, bank rejection and increase in draft due to rolling.*

2.9.3 After the accident, the Harbourmaster was advised that the Master of ***Capella Voyager*** had aborted the vessel's approach to the port in the early morning of 16 April. The Harbourmaster was aware that laden tankers needed to time their arrival off the Refinery jetties at slack high water and that in consequence they would cross the shallows somewhat earlier than high water.

North Tugz Ltd Marine Manager

2.9.4 The North Tugz Ltd Marine Manager attained his Master Foreign Going Certificate of Competency in 1965. He had worked in Whangarei since 1974, being variously employed as a tug master, pilot, marine superintendent and port manager. At the time of this accident he was employed as Marine Manager for North Tugz Ltd. This appointment was effective from 1 April 2003, with the creation of this new company. As a part of his role, he was responsible for rostering pilots for their duties, and managing other ancillary staff.

Capella Voyager's Pilot

2.9.5 The Pilot attained his Master Foreign Going (NZ) Certificate of Competency in 1982. He began training as a Pilot at Whangarei in 1995, and was passed as a 'Restricted Pilot' in July 1996. He acquired 'Unrestricted' pilot status in April 1998 which enabled him to pilot deep draft tankers to the Marsden Point terminal. He had attended Bridge Resource Management (BRM) and Advanced Marine Pilot training courses prior to the creation of North Tugz Ltd.

2.9.6 He stated that he was well rested on the day of *Capella Voyager's* grounding, and did not feel fatigued. His workload in the preceding days had been light. He had had three days leave in the week preceding the accident. He had not been drinking any alcohol either the night before, or on the day of, the grounding. He was not taking any medication and was in good health.

Capella Voyager's Check Pilot

2.9.7 The Check Pilot attained his Master Foreign Going Certificate of Competency in 1972. He had been a Pilot at Whangarei for 15 years prior to the accident. He obtained his Unrestricted Pilot's Licence in 1988, and had completed a BRM course and an Advanced Marine Pilot training course in Auckland.

2.10 Meteorological Conditions

2.10.1 The port and approaches to Whangarei lie close to the boundary between the coastal marine weather forecast areas of Brett and Colville. MetService issue coastal weather forecasts four times daily and these were the sole determinant of weather forecast data used by North Tugz for vessel movements at Whangarei. This was despite their limitations for application in harbours and approaches, as highlighted in the meteorological section of the New Zealand Nautical Almanac and in the MSA report into the grounding of *Jody F Millennium (JFM)* in February 2002. One matter that was referred to in the *JFM* report, was the absence of wave period information in MetService forecasts, and the significance this can have for port operations. Since the accident, Silver Fern Shipping have contracted MetService to supply dedicated weather data for the port of Whangarei, to include sea state and swell forecasts, together with their direction, height and period. This information is then distributed daily to interested parties, including North Tugz Ltd.

2.10.2 Relevant extracts from the MetService forecasts preceding the accident were as follows:

- Marine Weather at 1224 hours 13 April 2003 - Valid Until Midday 14 April 2003

  COLVILLE
  Easterly 20 knots, rising to 30 knots in the morning. Sea becoming rough. Easterly swell 1 metre.

  BRETT
  GALE WARNING IN FORCE
  North of Cape Brett: Easterly rising to 35 knots in the morning. Elsewhere: Easterly 20 knots rising to 30 knots in the morning. Sea becoming rough throughout. Easterly swell rising to 2 metres.

- Marine Weather at 1227 hours 14 April 2003 - Valid Until Midday 15 April 2003

  COLVILLE
  GALE WARNING IN FORCE
  Southeast 35 knots. Sea very rough. Easterly swell rising to 3 metres.

  BRETT
  GALE WARNING IN FORCE
  Southeast 35 knots. Sea very rough. Easterly swell rising to 3 metres.

- Marine Weather at 1223 hours 15 April 2003 - Valid Until Midday 16 April 2003

  COLVILLE/BRETT
  GALE WARNING IN FORCE
  Southeast 35 knots. Sea very rough. Easterly swell rising to 5 metres.

- Marine Weather at 0018 hours 16 April 2003 - Valid Until Midnight 16 April 2003

  COLVILLE/BRETT
  Southeast 30 knots easing to 20 knots in the evening. Rough sea easing. Easterly swell rising to 4 metres.

- Marine Weather at 0416 hours 16 April 2003 - Valid Until Midnight on 16 April 2003

  COLVILLE/BRETT
  Southeast 30 knots, easing to 20 knots. Rough sea easing. Easterly swell rising to 4 metres.

- Marine Weather at 0901 hours 16 April 2003 - Valid Until Midnight 16 April 2003

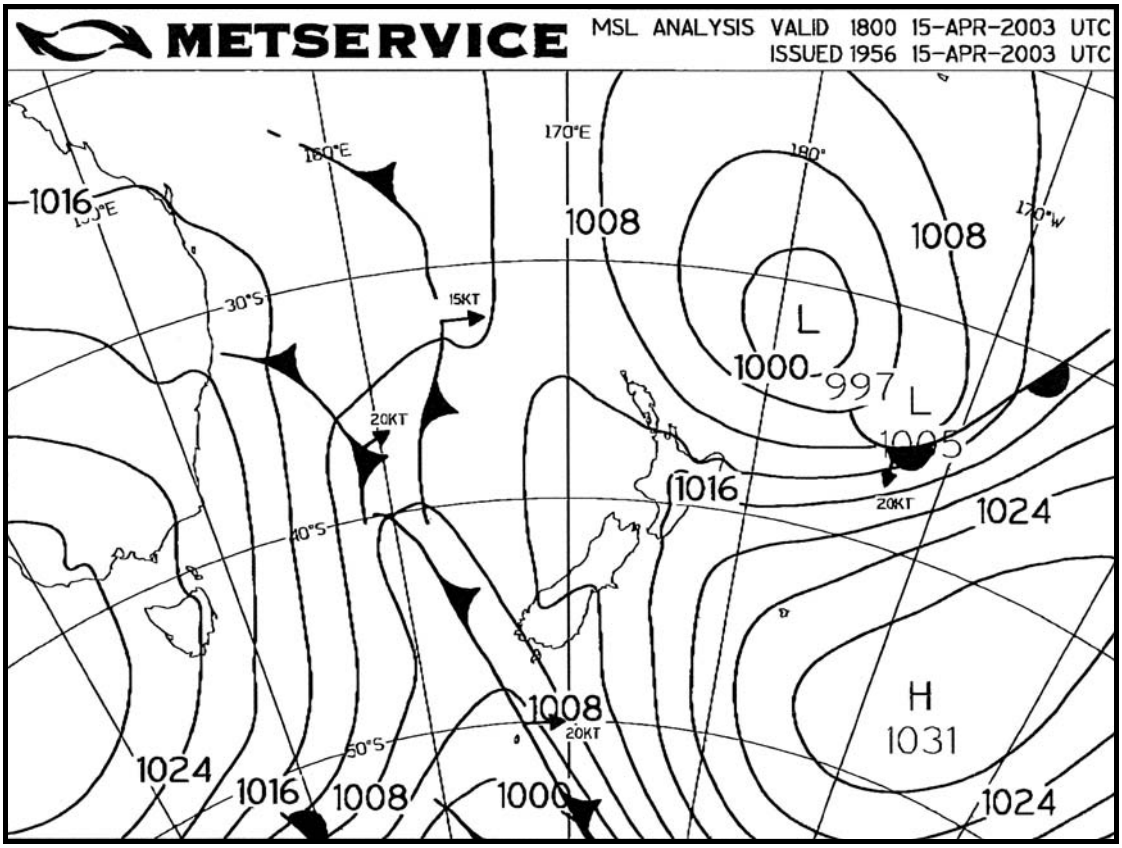
  COLVILLE
  Southeast 25 knots. Sea rough. Easterly swell four metres, easing.

  BRETT
  Southeast 20 knots. Moderate sea easing. Easterly swell 4 metres easing.

2.10.3 Between 15 and 16 April 2003, an anticyclone moved away from New Zealand's South Island, and a complex depression developed north east of the North Island and moved slowly south eastwards. Between these systems, an easterly flow covered the North Island and was strongest at about 0600 hours on 15 April, the day before the grounding occurred. This is reflected in the aforementioned extracts of weather forecasts from MetService.

2.10.4 On 16 April, a depression developed in the Tasman Sea on a trough that was moving east across the South Island. Also, the depression that had developed to the north east of New Zealand continued to move south towards the Chatham Islands. A weather ship situated in a position 210 miles to the north east of Bream Head reported an 8m south easterly swell during the morning of 16 April.

2.10.5 The last MetService weather-fax that was issued before the grounding was at 0756 hours NZST (1956 hours Co-ordinated Universal Time (UTC)), on 16 April. A copy of this weather fax is set out below:



2.10.6 The last weather forecast issued by MetService before the grounding was at 1627 hours on 16 April and was valid until midday 17 April 2003. It stated:

COLVILLE/BRETT
South east 20 knots, tending south west 15 knots overnight. Moderate sea easing. Easterly swell 4m easing.

2.10.7 The forecast that was issued at 1627 hours was not sighted by the Pilot before he boarded *Capella Voyager*. The last MetService forecast he had seen was issued at 0018 hours on 16 April, which gave an easterly swell rising to 4 metres.

2.11 Hydrographic Considerations at Whangarei

2.11.1 Since the early 1990's, POAL personnel have undertaken hydrographic surveys for the port of Whangarei on a contractual basis. These included annual surveys of the port approaches from the Fairway buoy, together with biannual large scale surveys of the area near the Marsden Point terminal. The most recent survey, prior to *Capella Voyager's* grounding, was conducted in July 2002, when the minimum depth of water was reported to be 14.8m. Notwithstanding this figure, a minimum charted depth of 14.6m has always been used as the determinant for the calculation of under keel clearance. Chart symbols on Chart NZ5213 - Whangarei Harbour/Approaches to Marsden Point, show the bottom in way of this depth to be fine sand and broken shell. However, the current Northport Ltd website describes this area as 'foul ground', with a rocky bottom.

2.11.2 Annual hydrographic surveys of the approaches to the port were a condition of North Tugz Ltd being awarded their contract as a provider of pilotage services.

2.11.3 During the MSA investigation, POAL stated that their survey practices were based on the Land Information New Zealand (LINZ) HYSPEC V3.0 standard, which sets out standards applicable for hydrographic surveys in New Zealand.

2.11.4 Prior to the 2002 hydrographic survey of the main navigable channel, determinations of depth were made without motion sensing (heave compensation) equipment. This situation was rectified in 2002 with the acquisition of a motion sensor. The stated survey aim was to seek to achieve IHO special order accuracy for critical depth areas.

2.11.5 POAL had taken lines of soundings at intervals of 20m. According to the HYSPEC V3.0 standard, these should have been 10m apart. LINZ stated that the survey sheets produced by POAL were not to the LINZ HYSPEC V3.0 standard, in that data (such as levels of survey accuracy achieved) had been omitted. It should be noted, however, that paragraph 4.1 of the Guidelines of Good Practice for Hydrographic Surveys in New Zealand Ports and Harbours states, in summary, that the varied nature of ports and harbours dictate that hydrographic operations should be determined by a risk assessment rather than a set of rigid criteria. LINZ Chief Topographic Hydrographer stated that the methodology used by POAL did provide sufficiently accurate soundings for the determination of depths in the approach channel and wharf areas.

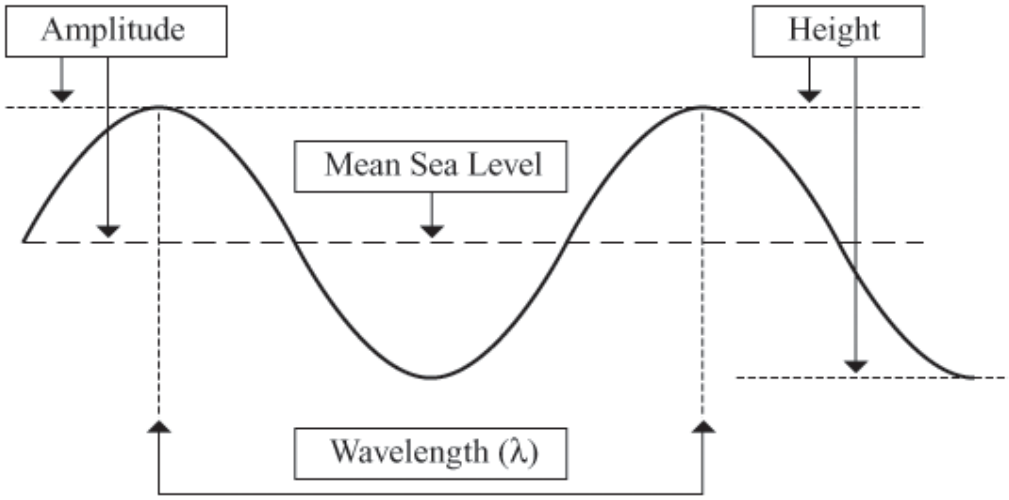
2.11.6 After the survey sheets had been prepared by POAL they were supplied to the pilots at Whangarei. They were then compared by the pilots with earlier survey records to determine significant changes. A summary sheet was also attached by POAL containing such information as the dates and times of the survey, and highlighting any significant changes. Both POAL and the Whangarei pilots stated that there had been no significant changes in depth in the approach channel in at least the last five years.

2.11.7 The pilots stated that the deepest water was to be found along a theoretical line bisecting the arc of the white and green sectored light. This is not borne out by the hydrographic survey that was conducted in June 2002, which shows the depth of water to be broadly uniform across the width of the approach channel.

2.12 Swell and Sea State

2.12.1 It is well established that the east coast of New Zealand can be vulnerable to significant swell conditions, when there are low pressure weather systems to the east of the country. At the time of *Capella Voyager's* grounding, a low pressure system was lying to the north east of New Zealand, with a large area of high pressure to the south *(see paragraph 2.10.5)*. This created a steep pressure gradient between the two systems, which resulted in easterly swells up to a maximum height of about 5 metres for sea areas Brett, Colville and Plenty during 15 and 16 April 2003.

2.12.2 Swell is a type of wave which has been propagated outside its generating fetch - it is no longer under active generation. It can be generated by a weather system that can be some distance from where swell conditions may first develop. Other waves that are generated locally are often referred to as 'wind waves'. They can be superimposed onto swells thereby increasing the overall height of the wave, or the vertical distance between the wave's peak and its trough. Other significant measurements of any wave are its wavelength or the horizontal distance between wave peaks, and period (the time between peaks passing a fixed point). In Northern Europe, according to NIWA, a period of more than 10 seconds is the threshold beyond which a wave is defined as being swell. Locally generated waves have a shorter period, and generally do not greatly influence ship motions on large vessels. Swells which have the longer period cause the most significant vessel motions.



2.12.3 When any wave encounters a shoaling seabed, its wavelength will decrease, its period will remain the same and its height will increase.

2.12.4 There is also a change in velocity which produces a refraction effect, so that waves 'bend' from their initial direction towards the direction in which the shoaling occurs. In this instance, the shoaling was broadly to the north east of the general swell direction, so the waves would have tended to refract slightly in that direction.

2.12.5 In the absence of a wave rider buoy in the approaches to Whangarei, there was no recorded data of the exact wave height and period at the time the accident occurred. Visual observations from those on board *Capella Voyager* indicated a sea and swell wave height of about 2-4m at the time of the accident. There was, however, an indication of combined wind wave and swell height and period from a wave recording buoy situated off the Mokohinau Islands, about 25 miles due east of Whangarei. This showed that at about the time of the accident, the significant wave height was approximately 3.5 metres and the wave period about 12 seconds. Whilst *(for the reasons expressed in paragraph 2.12.3)*, these conditions would not have been replicated at the position of grounding, they nevertheless provide a guide to the conditions that were likely to have been experienced closer inshore.

2.12.6 With an easterly swell and the effects of refraction as the vessel closed with the land, *Capella Voyager* would have been subject to a quartering sea on her starboard side. This is well established as the most significant direction, relative to a vessel, in the generation of heave amplitude. A wave height of 2-4m, with an amplitude of 1-2m, would be expected to produce heave amplitudes at the longitudinal centre of gravity (LCG) of *Capella Voyager* of around 1-2m, provided that the wave period was of sufficient length to encompass the natural heave period of the vessel. Based on wave period information from the buoy at Mokohinau it is considered by the MSA Accident Investigator that such a heave amplitude could have occurred, notwithstanding the decrease in wavelength as they neared the coast.

2.12.7 Further, given that the waves were on the starboard quarter of the vessel, pitching motions would have occurred in addition to the LCG heave.

2.12.8 The magnitude of pitch-induced vertical motion on a vessel is subject to wave characteristics, hull shape and ship speed. The MSA Accident Investigator considers that a pitch-induced vertical motion of 1m at the bow in the conditions prevailing at the time of the accident would have been feasible. This is supported by the evidence of the Master, who estimated that the pitching motion of the vessel was about 1.5m, shortly before the grounding occurred.

2.13 Ship Squat

2.13.1 The vessel's ISM controlled documents contained a matrix of squat data supplied by the vessel's builders, for the calculation of squat for varying speeds of the vessel in both shallow and deep water. Based on this matrix and using an estimated speed of five knots for the vessel's approach, the Chief Officer determined that ***Capella Voyager*** would experience maximum squat in shallow water of 0.39m at her bow.

2.13.2 The Pilot did not undertake any specific calculation of squat for ***Capella Voyager***, but included a notional factor for this in his overall calculation for underkeel clearance.

2.13.3 On the basis of the initial findings of the MSA Accident Investigator into the grounding of ***Capella Voyager***, the MSA commissioned Dr. Tim Gourlay of Curtin University of Technology, Australia, to determine what effect squat would have had on the grounding of the vessel. His findings are summarised as follows:

'Local Bathymetry with regard to Squat - Transverse Depth Variations'

2.13.4 At the point where the grounding occurred the channel is still in 'open water', and there is no significant charted depth variation that lies perpendicular to the channel. The maximum transverse depth variation to the channel, and vessel's track, is in the order of 1.5m over a distance of half a nautical mile. Dr Gourlay did not consider this to be sufficient to affect ***Capella Voyager's*** squat when compared to having a constant depth.

'Local Bathymetry with regard to Squat - Longitudinal Depth Variations'

2.13.5 Depth variations in the direction of the ship's track (longitudinally) have more effect on squat than transverse variations. Near the point where the vessel grounded, the charted depth shoaled from 18.5m to 14.6m over a distance of around 0.2 miles, a bottom slope of about 1:100.

2.13.6 The depth variations in the approach channel and in the direction of the track of ***Capella Voyager*** were significant, and would have affected the vessel's squat as compared to having a purely constant depth, as detailed below:

a) The 'steady state' squat, for a vessel moving in open water of constant depth, is greater in shallower water than in deeper water. If depth variations occur slowly, then a vessel will tend to have a 'steady state' squat. This means that the squat can be calculated by just using the depth a vessel is located in at the time, using the constant water depth. This is known as the 'steady state' formula.

b) When a vessel is passing over a relatively sudden depth change, the flow of water beneath her hull does not have time to disperse so as to give 'steady state' squat. Instead, a 'transient' squat occurs, which is complex and can be quite different to the steady state squat.

2.14 Predicted Squat Table

2.14.1 The predicted maximum squat values for ***Capella Voyager's*** steady and transient squat were found by Dr Gourlay to be as follows:

A. Steady State Bow Squat

Ship Speed (KNOTS)	BOW SQUAT (METRES)
3	0.11
4	0.19
5	0.30
6	0.44
7	0.60
8	0.80
9	1.03
10	1.29
11	1.60
12	1.96
13	2.37
14	2.84
15	3.40

B. Bow Squat, Including Transient Correction:

Ship Speed (KNOTS)	BOW SQUAT (METRES)
3	0.12
4	0.21
5	0.33
6	0.48
7	0.66
8	0.88
9	1.13
10	1.42
11	1.76
12	2.15
13	2.60
14	3.12
15	3.73

Therefore, at a speed of 6 knots (the maximum speed reported at the time of the grounding), the predicted maximum transient bow squat would have been 0.48m.

2.15 Calculation of UKC

2.15.1 The predicted heights and times of tide at Marsden Point on 16 April 2003 were as follows:

TIME (NZST)	HEIGHT (M)
0025 hours	0.4
0644 hours	2.7
1258 hours	0.3
1915 hours	2.6

2.15.2 The MSA Investigator calculated that at the time of grounding the height of tide would have been 2.40m above chart datum at Marsden Point. On the basis of this calculation, and in the absence of accurate tidal data for the location of the grounding, it is estimated that the static under keel clearance of ***Capella Voyager***, at the time of the grounding, would have been as follows:

Time of Grounding	MSA Investigator Estimate of the Height of Tide at 1816	Shallowest Depth	Total Depth at 'Shallow Patch'	*Capella Voyager's* Maximum Draft (taken from Pilot Card)	Static UKC
1816	2.40m	14.60m	17.00m (14.60m + 2.40m)	14.42m	2.58m (17.00m – 14.42m)

2.15.3 The Pilot's calculation for the static UKC of ***Capella Voyager*** at the time of grounding is represented as follows:

Time of Grounding *(Pilot's estimate of when the vessel would pass the 'shallow patch')*	Pilot's Estimate of Height of Tide at 1815	Shallowest Depth *(based on NZ Chart)*	Total Depth at 'Shallow Patch' *(rounded down by the Pilot)*	*Capella Voyager's* Maximum Draft *(rounded down by the Pilot)*	Static UKC (17.10m – 14.40m)
1815	2.52m	14.60m	17.10m (14.60m + 2.50m)	14.40m	2.70m

On the basis of the above two tables, the Pilot's calculation of static UKC was 0.12 metres greater than that of the MSA Investigator, because they each used different figures for the height of tide.

The Pilot's assessment of whether it was safe to enter the port was determined by his adding 10% to the vessel's maximum draft of 14.40m, giving an overall figure of 15.84m. As this figure was 1.26m less than the calculated total depth (see table above) of 17.10m, the Pilot answered in the affirmative to the entry 'manoeuvring clearance', when completing the Pilot's passage plan. This indicated to the Pilot that there was sufficient water for the vessel to enter the port, without making appropriate reference to the prevailing swell conditions or any tidal height difference between Marsden Point and the grounding position.

2.15.4 The Chief Officer calculated ***Capella Voyager's*** minimum under keel clearance as follows:

Capella Voyager's Maximum Draft	Allowance for Squat *(rounded up from 0.39m)*	Total Displacement	Minimum Depth	Chief Officer's Estimate of tidal height	Total Depth 14.60m + 2.40m	Minimum UKC (17.00m – 14.82m)
14.42m	0.40m	14.82m	14.60m	2.40m	17.00m	2.18m

A figure of "2.1m" was written on the vessel's Pilot Card as representing the minimum under keel clearance.

2.15.5 The Investigator's calculation using Dr Gourlay's allowance for squat gave a minimum under keel clearance of 2.10m.

2.15.6 The Pilot's calculation, using a standard figure of 10% of draft gave a minimum under keel clearance of 1.26m *(See paragraph **2.15.3**).*

2.15.7 The Chief Officer's calculation, using a figure of 0.40m for squat, gave a minimum under keel clearance of 2.18m.

2.15.8 A figure of 2.1m (rounded down from 2.18m) was written on the vessel's Pilot Card as representing the minimum under keel clearance.

2.15.9 The Master was aware that the Chief Officer's UKC calculation was based on calm water conditions with no allowance for her motion in swell conditions. Prior to the vessel's arrival, the Master had been advised by the ship's agent that if the vessel was rolling on the approaches to the main channel, 'dangerously increasing draft, as ascertained by the Pilot and yourself', the berthing would be aborted.

2.15.10 On the basis of the evidence of the Master and Pilot regarding the motion of ***Capella Voyager*** after she passed the Fairway buoy, it is considered by the MSA Investigator, having regard to the vessel's minimum UKC (as set out above), that a grounding was almost inevitable. As an example, it should be noted that, over and above the surging effect of a swell, a 2° transverse heel in still water would increase the draft of this ship by 0.83m

2.16 Tanker Grounding Risk Assessment

2.16.1 Following the grounding of ***Capella Voyager***, (and the subsequent grounding of the tanker ***Eastern Honor*** at Whangarei in July 2003**),** an assessment of tanker transits and the possibility of their grounding was conducted by Caltex New Zealand Ltd and the New Zealand Refining Company. The appended graph represents a relative 'risk rating' of crude oil tankers that have visited Marsden Point between January 2002 and August 2003. Factors which were incorporated in this graph included:

- Minimum charted depth
- Tidal height at the time the vessel passed the minimum depth area (14.6m)
- Actual arrival draft
- Static UKC
- Squat
- Swell direction
- Significant swell height, as measured by the Mokohinau wave rider buoy
- Wave period
- Estimated maximum UKC reduction due to wave action *(based on wave height and period).*

In commenting on this graph to the MSA Accident Investigator, it was stressed by the author of the graph that these risk ratings were relative, and that it had not been possible to base them on absolute figures because of the absence of real time data at or near the grounding site.

2.16.2 The two vessels with the highest 'risk' rating were those depicted at the bottom right hand

corner of the graph. These were identified as *Capella Voyager* and *Eastern Honor*. Of particular note was the fact that the wave height and period recorded by the Mokohinau wave rider buoy were both greater when these two vessels grounded as compared to any of the other 65 tanker transits that were analysed for this graph.

2.17 MSA, Port Users & Management Forum, 28 May 2003

2.17.1 Following the release of Dr. Gourlay's report, the MSA initiated an industry working group to consider his findings, and to discuss implementing actions, both short and long term, to prevent another grounding. The working group consisted of MSA, Silver Fern Shipping Ltd, North Tugz Ltd, Northport Ltd, Ports of Auckland Ltd, Oil Company Supply Managers Group and Northland Regional Council. MSA had further discussions and correspondence with North Tugz Ltd management to help the pilots at Whangarei better understand UKC issues. In support of this, North Tugz Ltd agreed to make a detailed assessment of issues relating to under keel clearance and risk management.

2.17.2 Short term strategies agreed by the working group were as follows:

- Deep draft vessels cannot enter Marsden Point if the heel angle is judged to be greater than one degree in each direction
- Significant wave height must not exceed 1m.
- A new hydrographic survey to be conducted by POAL to determine minimum depths in the approaches to Whangarei, and, as an interim measure, a minimum depth of 14.6m should be used as the UKC calculation datum
- Pilots should use a new form to undertake a more rigorous calculation of UKC that is specific to each vessel transit
- A safety ‘manoeuvring margin' should be applied to each UKC calculation of 0.9m

A communication strategy was devised to monitor progress towards longer-term (strategic) technological solutions

Following detailed discussions, the working group was unanimous in adopting the agreed strategies, and these were put into immediate effect.

2.17.3 It was further agreed that long-term strategies would consider in depth the provision of real-time swell monitoring telemetry. This was agreed to be an essential tool for pilots at Whangarei and investigating such a system was put in hand immediately. Significant assistance in identifying the port's needs was rendered by Westgate, the port of New Plymouth, who already operated such a system.

CONTRIBUTING FACTORS

N.B. These are not listed in order of importance

3.1 The lack of sufficient technical knowledge and the appropriate training of pilots relating to the allowances to be applied when determining a safe UKC. Further, the lack of structured and documented guidelines from the management of North Tugz Ltd, as to how and when these should be applied to deep draft vessels. The system used by North Tugz Ltd and the pilots at the time of the accident contained inadequate recognition of all the factors affecting hydrodynamic interaction between a vessel and the seabed when entering Whangarei. *In commenting on the report, North Tugz Ltd stated that all pilots at Whangarei had attended an Advanced Pilot Training Course when papers on squat were presented and discussed. Further, a vessel's increase in draft due to rolling was well known to all pilots and was always considered, after checking the ship's clinometer, to determine whether it was safe to enter the port. It was pointed out that there was no instrumentation on board vessels to determine the effects of pitch and heave on a vessel's draft.*

In respect of the appropriate training of pilots, the MSA Accident Investigator notes that the IMO Assembly Resolution A.960(23), against which MSA assesses pilotage training documents submitted to it, makes no reference to the effects such as roll, pitch, yawing and heaving on the draft of a vessel and consequently the UKC. This oversight should be addressed by MSA in a recommendation to IMO at the earliest opportunity.

3.2 There was a collective oversight on the part of the management of North Tugz Ltd, Northland Regional Council, Northport Ltd and Ports of Auckland Ltd who did not undertake formal risk and safety assessments relating to port entry and departure. No systematic, on-going review of safety issues had been conducted with regard to pilotage. Moreover, no adequate CPD (Continuous Professional Development) programme was in place to keep the pilots abreast of developments in matters relating to maritime safety and other ancillary issues which could enhance their performance. An example of this was the failure to circulate information about UKC issues associated with vessel groundings that have been promulgated widely within the maritime industry. This includes the findings of reports relating to several groundings of large tankers worldwide, including the *Sea Empress* grounding off Milford Haven, Wales in 1996. *In commenting on this report, the Chief Executive of North Tugz Ltd emphasized that some systems, procedures and controls that existed under POAL management had had no time to become fully operational because North Tugz Ltd had only commenced full operations having employed new staff only 16 days before the accident. Pilots previously employed by Northland Port Corporation had attended courses for advanced pilot training within the last 3 years. He actively encouraged CPD*.

3.3 The Pilot's assessment of swell in the port's approach was restricted to a purely visual appreciation. No adequate link was made between swell height and period, and their combined effect on a vessel and its UKC.

3.4 No real time information about the height of the tide at the shallow 14.6m patch. Subsequent to the release of the draft report for comment, North Tugz Ltd Marine Manager, obtained information from the Pilot who said that the actual tidal height at Marsden Point was about 0.1m higher than prediction. The predicted height of the tide at Marsden Point at the time of grounding was 2.4m. The Pilot assumed that the tidal height at Marsden Point was the same as that at the 14.6m shallow patch i.e. 2.4m +0.1m. This is reflected in his entry to that effect in the pilot's passage and berthing guide. It is interesting to note that the tidal height at Whangarei at the time of grounding was predicted as 2.7m. That tends to suggest that, in the absence of any real time data and solely on a topographical basis, the predicted height further down the estuary, at the 14.6m patch, was likely to have been somewhat less than 2.4m. Information from a tidal gauge adjacent to the shallow patch would confirm this.

3.5 The absence of real time data that would have been provided by a wave rider buoy, such as those employed at the New Zealand ports of Napier and New Plymouth. The informed use of the data such a system generates, would probably have prevented this accident. In accordance with the long term strategic objective agreed by the working group *(see section 2.17)*, a wave rider buoy has recently been installed in the approaches to the port of Whangarei at a point adjacent to the shallow patch of 14.6m

3.6 The absence of any warnings on local navigation charts, the New Zealand Pilot and Guide to Port Entry that swell conditions might affect the safe entry of deep draft vessels.

3.7 The lack of specific weather data for the port of Whangarei and its approaches in relation to sea/swell height, direction and period. This has been rectified since this accident occurred.

CAUSE

Human Factor

❑ Failure to comply with regulations	❑ Drugs & Alcohol	❑ Overloading
❑ Failure to obtain ships position or course	❑ Fatigue	❑ Physiological
❑ Improper watchkeeping or lookout	✗ Error of judgement	❑ Ship Handling
❑ Misconduct/Negligence	✗ Lack of knowledge	❑ Other . . .

Environmental Factor

❑ Adverse weather	❑ Debris	❑ Ice	❑ Navigation hazard
❑ Adverse current	❑ Submerged object	❑ Lightning	✗ Other . . .

Technical Factor

❑ Structural failure	❑ Wear & tear	❑ Steering failure
❑ Mechanical failure	❑ Improper welding	❑ Inadequate firefighting/lifesaving
❑ Electrical failure	❑ Inadequate maintenance	❑ Insufficient fuel
❑ Corrosion	❑ Inadequate stability	❑ Other . . .

Environmental Factor Other = Adverse swell conditions in port approach.

4.1 Shortly after passing the Fairway buoy, at the entrance to the approach channel, ***Capella Voyager*** grounded in charted shoaling water, due to a lack of adequate under keel clearance for the prevailing conditions.

OPINIONS & RECOMMENDATIONS

N.B. These are not listed in order of importance.

5.1 That North Tugz Ltd fully implement, train and document a formal DUKC assessment system for the port of Whangarei and its approaches. Specifically, that they provide appropriate training for their pilots in respect of vessel motions in restricted waters to include squat, interaction and the operation of electronic dynamic under keel clearance systems and the correct interpretation of data provided. In the meantime, North Tugz Ltd to continue to impose the restrictions placed upon deep drafted vessels entering the port as set out in paragraph 2.17.2.

5.2 That North Tugz Ltd implement a structured, documented and systematic assessment for the control and monitoring of risks represented by vessels under pilotage, and other matters pertinent to its duties as the provider of services to all port facilities within the Whangarei Harbour.

5.3 That the Harbourmaster actively participate in the above risk assessment and development of control mechanisms in conjunction with North Tugz Ltd. Thereafter, to periodically revisit these matters in regard to safe port operations at Whangarei. Further, that this process be fully documented and be subject to periodic external audit.

5.4 That North Tugz Ltd implement structured and documented operational plans and systems to address pilotage procedures, passage planning and the timely dissemination of information to and from the maritime community on all factors affecting the safe navigation of vessels in restricted waters. This to form part of the continuous professional development of pilots and management. These plans and systems should then be subject to periodic external audits, to ensure that they remain aligned with industry best practice.

5.5 That the hydrographic survey practices of POAL continue to follow the relevant hydrographic standards and procedures contained in the "Guidelines of Good Practice for Hydrographic Surveys in New Zealand Ports and Harbours" for surveys of the Port of Whangarei and its approaches.

5.6 ChevronTexaco Shipping Company LLC holds annual seminars that include the topics of squat and dynamic under keel clearance for its Masters. The Master completed this training in 1990 and again in 2002. The analysis of waveforms and their effects on surge and longitudinal and transverse changes of draft are complex. A scientific understanding of such hydrodynamics on the part of ship's masters may be unnecessary for them to carry our their functions safely. However, the findings of this report might usefully be included in any future courses that the company undertakes for the benefit of its masters. Further, a copy of this report to be passed to INTERTANKO for dissemination to their members as appropriate.

5.7 That North Tugz Ltd liase with the United Kingdom Hydrographic Office to produce appropriate wording for promulgation in the New Zealand Pilot (NP51) and elsewhere, to warn mariners of the significance of swell in the approaches to Whangarei.

5.8 That having regard to the comments set out in 3.1 of this report, a technical committee comprising representatives of MSA and New Zealand pilots be convened to review critically pilotage training documentation submitted to the MSA.

5.9 That copies of this report be forwarded to all New Zealand port companies and Harbourmasters.

5.10 *In commenting on the report, North Tugz Ltd, in discussions with the MSA, stated it was their intention to erect a tidal gauge at the front leading mark in the approach channel to determine more accurately water depth closer to the shallow patch.*