Report 98-219

cargo vessel *Gao Cheng*

near grounding and collision between 2 tugs and a beacon

Nelson

28 December 1998

Abstract

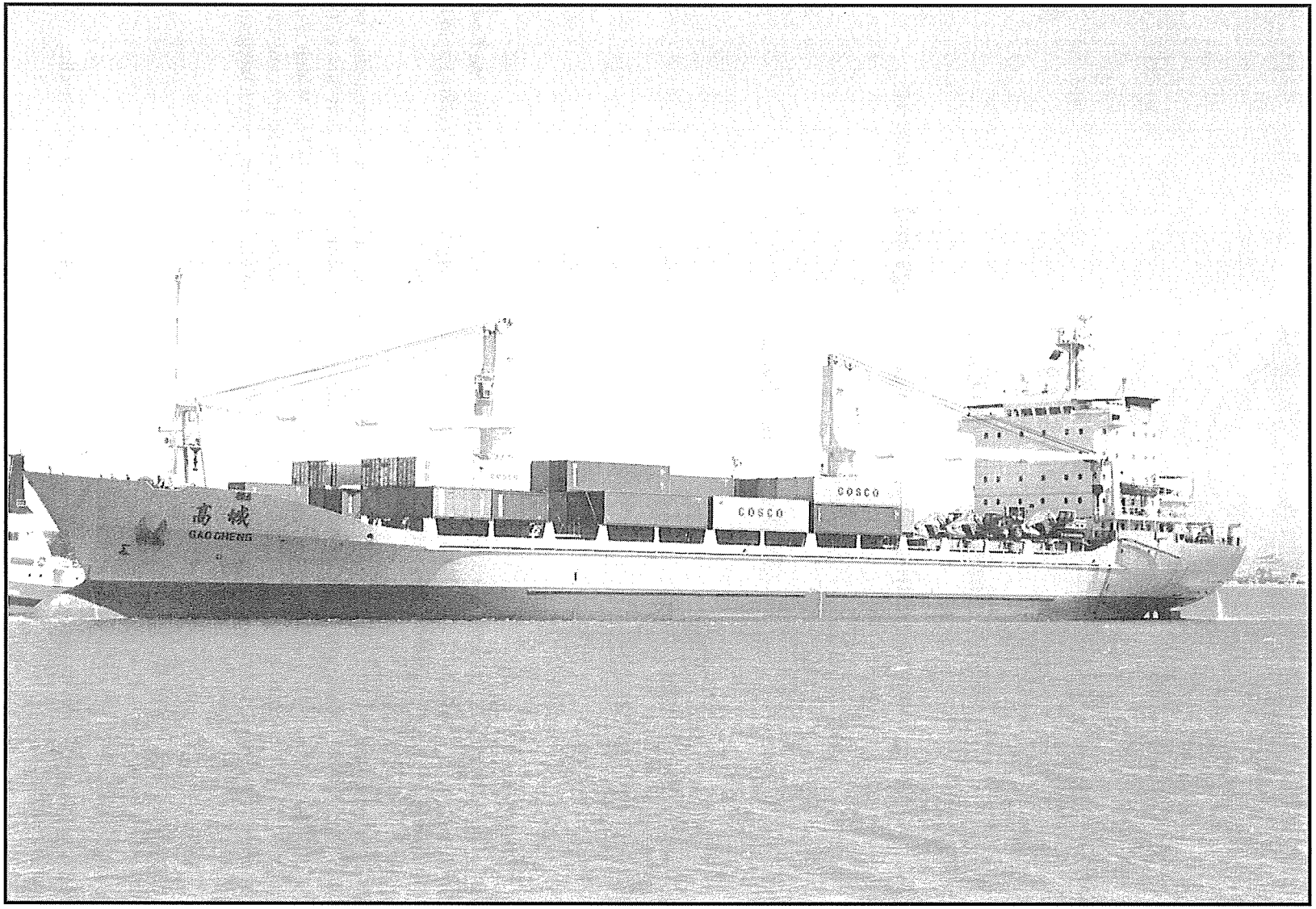
At about 0100 on Monday, 28 December 1998, the container vessel *Gao Cheng* was entering the Port of Nelson with a pilot on board and 2 tugs in attendance. As the vessel was approaching the entrance to the harbour the pilot reportedly suffered a sudden loss of vision in his right eye.

The pilot became distracted, lost situational awareness and the *Gao Cheng* came close to grounding on the port side of the channel. While one of the tugs was attempting to take up position on the port bow of the *Gao Cheng,* the tug grounded. As the *Gao Cheng* passed the grounded tug, the second tug, which was standing by on the port side of the *Gao Cheng* did not have sufficient room in which to manoeuvre clear and collided with the grounded tug. The grounded tug was then pushed in the collision, over a navigational beacon.

Safety issues identified included:

- the requirement for pilots to undergo regular medical examinations
- the requirement for pilots to report any change in medical fitness that may affect their ability to perform their duties
- the standard of bridge resource management practiced on the *Gao Cheng* leading up to the incident.

Safety recommendations were made to Port Nelson Limited, the operator of the *Gao Cheng* and the Director of the Maritime Safety Authority to address the safety issues.



Gao Cheng
(photograph courtesy of Iain Lovie)

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List of Abbreviations

ASD	azimuth stern drive
GPS	global positioning system
kW	kilowatt
m	metres
MSA	Maritime Safety Authority
NZDT	New Zealand Daylight Time (UTC + 13 hours)
NZST	New Zealand Standard Time (UTC + 12 hours)
rpm	revolutions per minute
SOLAS	International Convention for Safety of Life At Sea
STCW	International Convention on Standards of Training, Certification and Watchkeeping
t	tonnes
TEU	twenty-foot equivalent unit (containers)
UTC	universal time (co-ordinated)
VHF	very high frequency

Glossary

abeam	direction at right angles to the length of a ship
aft	rear of the vessel
amidships	helm order, when the rudder is in the fore and aft line of the vessel
aweigh	when an anchor is broken out of the ground and the cable is vertical
beam	width of a vessel
bollard pull	measure of the static pull a vessel can exert
bridge	structure from where a vessel is navigated and directed
bulkhead	nautical term for wall
by the head	said of a ship when its draught forward is greater than its draught aft
by the stern	said of a ship when its draught aft is greater than its draught forward
cable	0.1 of a nautical mile
chart datum	zero height referred to on a marine chart
class	category in classification register
conning	directing the course and speed of a ship
counter	curved side of a ship around the stern
deadweight	total weight of cargo, stores, fuel and ballast carried by a ship
deckhead	nautical term for ceiling
draught	depth in water at which a ship floats
ebb tide	falling tide
even keel	draught forward equals the draught aft
flood tide	rising tide
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
knot	one nautical mile per hour
kort nozzle	solid shroud around the propeller of a vessel
leading lights	two or more lights that when in transit identify the safest track
neap tide	tidal undulation that has the highest low water, and lowest high water, in a lunar cycle
nett tonnage	derived from gross tonnage by deducting spaces allowed for crew and propelling equipment
port	left hand side when facing forward
pivot point	imaginary point around which a vessel turns under helm
quarter	that part of a ship between the beam and the stern
range of tide	difference in height between successive high and low waters
restricted limits	operating limits as defined in Maritime Rules part 20
set	allowance applied to the course steered to counteract the effect of tide or current
shoulder	the part of a ship on each side of the bow where the straight sides begin
skeg	projection from the after part of the keel

spring tide	period of highest and lowest tides in a lunar cycle
starboard	right hand side when facing forward
telegraph	device used to relay engine commands from bridge to engine room
trim	difference between the forward and aft draughts of a floating vessel
wheel-over position	the point at which the helm order is given to make a turn

Marine Incident Report 98- 219

Data Summary

Vessel particulars:

Name:	*Gao Cheng*
Type:	container/general cargo
Class:	VII, foreign going cargo vessel (SOLAS)
Construction:	steel
Built:	Dalian Shipyard, China in 1984
Owner:	Cosco Containers Line Ltd.
Registered:	Shanghai, China
Tonnage (gross):	9683 t
Tonnage (deadweight):	12 739 t
Cargo capacity:	724 TEU[1]
Length (overall):	147 m
Length (bridge to stem):	119 m
Length (bridge to stern):	28 m
Breadth:	22.2 m
Draught (actual):	7.1 m even keel
Service speed:	14 knots
Propulsion:	one 5500 kW, B & W 5L55GB, 2-stroke diesel engine, driving a single 4-bladed fixed-pitch propeller

Location: Nelson

Date and time: Monday, 28 December 1999 at 0100[2]

Injuries: nil

Nature of damage: minimal to ship and tugs, beacon destroyed

Investigator-in-Charge: Captain Billy Lyons

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[1] Twenty foot container or equivalent unit

[2] All times in this report are in NZDT (UTC + 13 hours) and are expressed in the 24 hours mode

1. Factual Information

The incident occurred at about 0100 hours on 28 December 1998, the *Gao Cheng* departed Nelson at 1200 the same day, bound for Japan. As a result there was no opportunity to interview the master and crew or inspect the vessel. The *Gao Cheng* has since ceased trading to New Zealand.

Some vessel information was later obtained through the operator's New Zealand office. The account of events described in this report are based only on information gathered from the pilot, tug skippers and various employees of Port Nelson Limited.

1.1 History of the voyage

1.1.1 The *Gao Cheng* was a 724-TEU container vessel manned by a mainland Chinese crew. It was on a liner trade between New Zealand and Asia, calling at Nelson about every 6 weeks.

1.1.2 The *Gao Cheng* arrived off Nelson at 2030 on Sunday, 27 December 1998, and anchored about 2 miles to the north east of the harbour entrance. The local agent had ordered a Port Nelson Limited (the company) pilot for 0030 on Monday, 28 December.

1.1.3 The company duty pilot piloted an outbound vessel and transferred by pilot launch to the *Gao Cheng*, boarding at 0002 on Monday, 28 December.

1.1.4 When the pilot boarded the *Gao Cheng* the crew had just started weighing the anchor. The pilot discussed his passage plan and relevant tidal information with the master. He also ascertained that the bridge equipment had been tested and was all functioning properly.

1.1.5 The pilot's passage plan consisted of a chartlet of the harbour indicating the relevant information for a vessel arriving or departing Port Nelson, and a table indicating the tidal and underkeel clearance figures. The *Gao Cheng* was to berth starboard side to Brunt Quay.

1.1.6 The pilot had previously piloted the *Gao Cheng* with the same master. He later stated that although the master's knowledge of the English language was limited, he felt the master had understood the passage plan. The bridge of the *Gao Cheng* was manned by the pilot, master, officer-of-the-watch and the helmsman.

1.1.7 The pilot was giving orders directly to the helmsman, and to the officer-of-the-watch who was operating the bridge control for the engine.

1.1.8 The anchor was aweigh at 0022. The pilot ordered half ahead on the engine and turned the vessel to starboard to approach the entrance to the port. When about 1.5 miles from the line of the leading lights he slowed the vessel to dead slow ahead to attain a speed of about 4 knots.

1.1.9 As the *Gao Cheng* approached the line of the outer leading lights the pilot turned the vessel to port. When the leading lights were in line he ordered the helmsman to steady on a course of 165 degrees true. At this stage he checked the error on the master gyrocompass which appeared to be nil. The pilot recalled the global positioning system (GPS) indicating a speed of 4 knots at that time.

1.1.10 The two company tugs *Huria Matenga* and *W H Parr* were standing by to assist with the berthing of the *Gao Cheng*. The *Huria Matenga* was about 2 miles off the harbour entrance having assisted with the departure of the outward bound vessel. The *W H Parr* was waiting at the harbour entrance. The pilot called both tugs skippers on very high frequency (VHF) radio and explained his intentions and requirements.

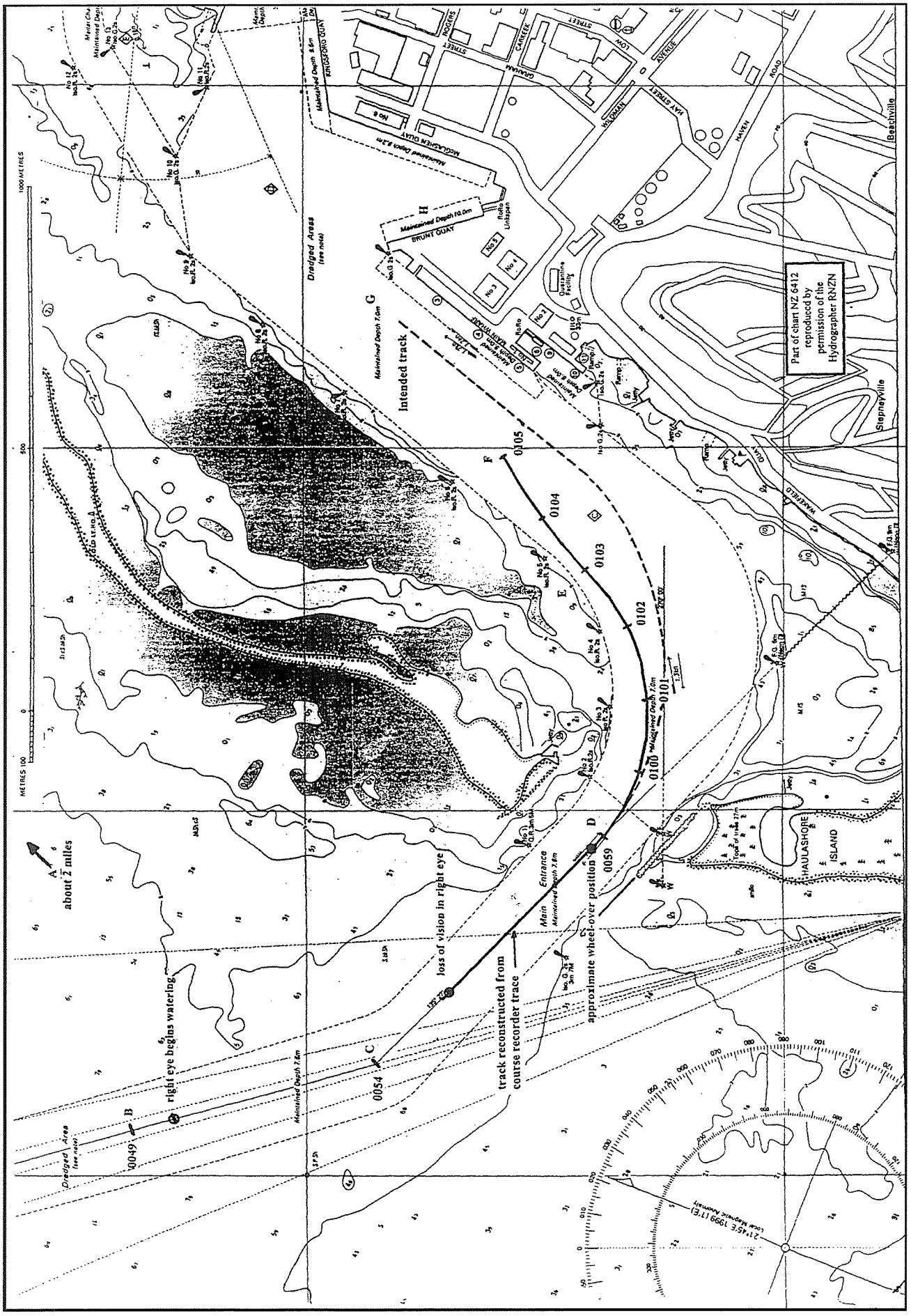

Figure 1

Part of Chart NZ 6412 showing relevant information

1.1.11 The *Huria Matenga* moved in and stood by on the starboard shoulder and as the *Gao Cheng* approached the harbour entrance the *W H Parr* moved in and stood by on the port side, abreast of the bridge front. The tugs did not make fast but were positioned to assist the *Gao Cheng* with the turn into the harbour, if required.

1.1.12 The pilot later stated that when the *Gao Cheng* was about 400 metres from the turn onto the inner leading lights his right eye began to water profusely. He was not overly concerned as he had experienced this problem on previous occasions. He continued with the pilotage and turned the vessel onto the inner leading lights, steadying on a course of 135 degrees true.
(See Figure 1.)

1.1.13 When the vessel was about 200 metres from number one beacon the pilot reportedly lost vision in his right eye.

1.1.14 The pilot could not recall being under any undue stress or anxiety during the approach to the channel; however, he did say that he was worried and be came distracted when he lost vision in his right eye. In spite of this, he elected to continue with the pilotage without informing the master of the *Gao Cheng* or the tug skippers of his vision problem. He moved around the bridge more than usual to maintain his visual references and compensate for his partial loss of vision.

1.1.15 When the *Gao Cheng* reached the wheel over position the pilot ordered the wheel hard to port to make the turn into the harbour. The pilot thought the vessel was initially slow to turn but it came around without requiring the assistance of the tugs.

1.1.16 The *Gao Cheng* continued through the turn with the wheel hard to port and the engines on dead slow ahead until it was abeam of number 4 beacon, where the pilot noticed that the rate of turn was greater than he had expected. He initially ordered the helm to amidships, and then hard to starboard to compensate for the excessive swing. At the same time he called the *Huria Matenga* on VHF radio and requested it cross to the port bow of the *Gao Cheng* to stand by in case it was needed to check the swing.

1.1.17 The skipper of the *Huria Matenga* asked the pilot if he was to go around the bow or the stern of the *Gao Cheng*. The pilot requested the tug cross ahead of the *Gao Cheng*.

1.1.18 From his position on the starboard bow of the *Gao Cheng* the skipper of the *Huria Matenga* had difficulty estimating in the dark how close to the port side of the channel the ship was. He was aware that it was closer than usual but assumed the pilot had judged that there would be sufficient room for the tug to manoeuvre.

1.1.19 The skipper of the *Huria Matenga* manoeuvred the tug ahead and across the bow of the *Gao Cheng*. His intention was to turn the tug full circle, keeping the bow of the tug facing the ship and come in with the tugs bow angled into the side of, and in the same direction as the ship.

1.1.20 Once across the bow of the *Gao Cheng,* the skipper of the *Huria Matenga* could see from the line of the beacons and the distance from them to the *W H Parr* that there would not be much room in which to manoeuvre, but as he was then committed to the turn he continued to swing the tug ahead of the *Gao Cheng*.

1.1.21 When the *Huria Matenga* was about three quarters through the turn its stern swung outside the channel midway between numbers 4 and 5 beacons and grounded. The skipper assumed that only the skeg of the tug had touched bottom, as the drive units appeared to be still functioning normally.

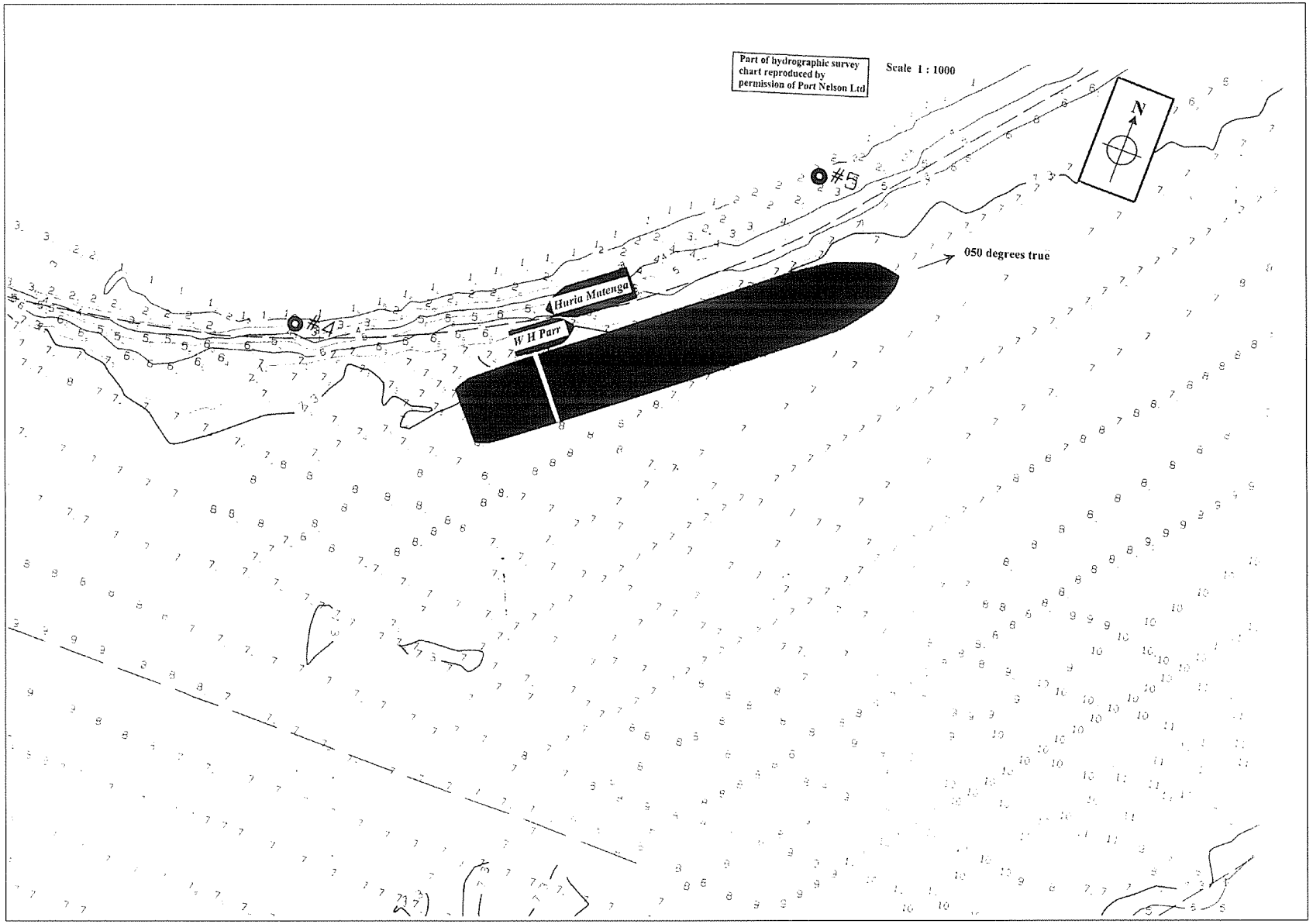

Figure 2
Chartlet showing position of vessels at time of incident

1.1.22 The skipper of the *Huria Matenga* decided not to attempt to refloat his tug immediately because the *Gao Cheng* was approaching at 4 knots, and if the tug had come free it could have got in the path of the ship. Instead, he swung the bow of the tug to starboard, to lie parallel with the channel giving the *Gao Cheng* and *W H Parr* as much room as possible in which to pass. He then de-clutched the engines (see Figure 2).

1.1.23 The skipper of the *Huria Matenga* called the pilot and the skipper of the *W H Parr* on VHF radio and alerted them to his situation. He also briefly discussed with the skipper of the *W H Parr* the distance available for the tugs to pass. They decided it would be close, but the tugs should pass clear of each other.

1.1.24 The skipper of the *W H Parr* felt that he could not drop his tug astern and manoeuvre clear of the *Gao Cheng,* as the tug may have been drawn under the counter at the stern of the ship. He also judged that there was insufficient room between the ship and the edge of the channel to manoeuvre the tug around the stern of the *Gao Cheng*.

1.1.25 Meanwhile, the starboard helm the pilot had ordered on the *Gao Cheng* had arrested the turn to port and the vessel had begun to turn to starboard. Consequently, the distance between the port quarter of the *Gao Cheng* and the port side of the channel began to decrease.

1.1.26 The skippers of both tugs soon realised that there was insufficient room for their tugs to pass clear of each other, so the skipper of the *Huria Matenga* clutched in the engines and attempted to refloat the vessel so he could run alongside the *Gao Cheng,* ahead of the *W H Parr*. The *Huria Matenga* however, remained aground and slewed around to starboard, pushing the port quarter of the tug onto the ships side at about 45 degrees.

1.1.27 The pilot overheard the discussion between the two tug skippers on VHF radio. In order to steady the *Gao Cheng* on its course and stop the distance between the side of the channel and the port quarter of the vessel closing he ordered the helm to amidships and gave a kick of half ahead on the engine for about 15 seconds. The pilot estimated that the heading of the *Gao Cheng* was about 065 degrees true at that point.

1.1.28 At about 0100 the *W H Parr* collided with the *Huria Matenga*, and the *Huria Matenga* was pushed sideways for about 100 m and over the top of number 5 spar light beacon. The skipper of the *Huria Matenga* again de-clutched the engines.

1.1.29 As the distance between the edge of the channel and the *Gao Cheng* began to increase the 2 tugs separated and the *Huria Matenga* was left astern, but afloat again. The tug skippers assessed the damage to their respective tugs and both determined that they were able to continue with the berthing of the *Gao Cheng*.

1.1.30 They both reported their situation to the pilot on VHF radio. In order to complete the berthing of the *Gao Cheng* the pilot requested the *W H Parr* make fast on the port shoulder and the *Huria Matenga* make fast on the port quarter, abreast of the bridge front. The pilot also called the pilot launch on VHF radio and requested it stand by in case it was needed to assist .

1.1.31 According to the pilot, the master of the *Gao Cheng* asked him what had happened. The pilot informed him that the *Huria Matenga* had broken down, but everything was under control. He did not tell the master that the tug had run aground. The master appeared to the pilot to accept this explanation and according to the pilot at no time did the master or the officers question him with regard to the navigation of the *Gao Cheng*.

1.1.32 The *Gao Cheng* berthed starboard side to Brunt Quay without any further problems. The first line was ashore at 0125.

1.1.33 At about 0150 the pilot disembarked from the *Gao Cheng* and boarded the tugs to discuss the incident with the tug skippers and assess whether the tugs would be able to assist with the next shipping movement, which was scheduled at 0500. He elected to still not inform the tug skippers of the problem with his vision.

1.1.34 The pilot returned to the pilot office at about 0220 and telephoned the second-call pilot to request that he take over the next shipping movement. While awaiting the arrival of the second call pilot he made brief notes about the incident.

1.1.35 When the second call pilot arrived at the office the two pilots had a brief discussion about the incident. They also discussed the arrangements for the tugs to be inspected later in the day. At about 0400 the pilot went to the hospital to seek medical attention. He had by then regained partial vision to his right eye.

1.1.36 The tug skippers later stated that at the time of the incident they had no idea the pilot was experiencing problems with his vision. They recalled they may have detected a level of anxiety in the pilot's voice over the VHF radio, and that his orders were more abrupt than usual. They did not become aware of the pilot's vision problem until the next day.

1.2 Damage

1.2.1 After the incident all vessels were checked for damage. The *Gao Cheng* had minor scraping and loss of paint on the port side aft. Both tugs had minor denting to the bulwarks and slight damage to the tyre fendering.

1.2.2 The *Huria Matenga* was inspected by divers the next day but the only underwater damage found was loss of paint on the skeg. (See Figure 3.)

1.2.3 Number 5 navigational beacon was sheered off below the waterline.

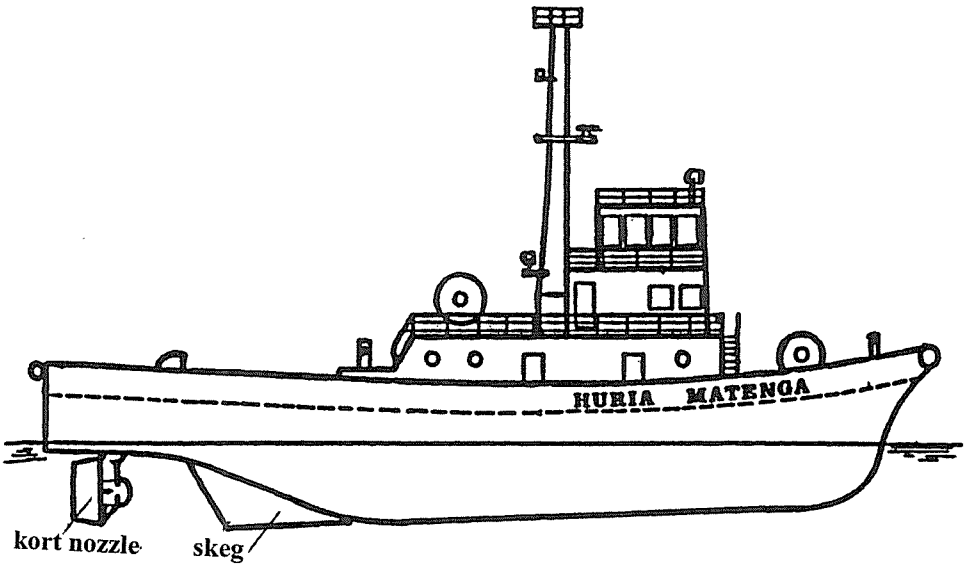

Figure 3
Huria Matenga

1.3 Vessel information: (*Gao Cheng*)

1.3.1 The manoeuvring characteristics obtained for the *Gao Cheng* gave the following harbour manoeuvring speeds:

- dead slow ahead 4 knots
- slow ahead 6 knots
- half ahead 8 knots
- full ahead 12 knots

1.3.2 The turning circle information provided by the owner's representative for the *Gao Cheng* was incomplete and of little use to the investigation.

1.3.3 The various pilots spoken to all felt that the *Gao Cheng* was a relatively straightforward vessel to handle and none had encountered any problems piloting it in the past.

1.3.4 The *Gao Cheng* was fitted with a course recorder, the trace from which was removed after the incident for analysis. It was established that the course recorder was set up about 5 minutes slow of UTC and reading about 4 degrees high of the true course steered. The results were plotted (See Figure 1) and are discussed in the analysis section of this report.

1.3.5 The *Gao Cheng* underwent a Maritime Safety Authority (MSA) port state inspection in Auckland on 23 December 1998. There were no deficiencies noted with regard to crew qualifications or the statutory certificates pertaining to the vessel. Little other information is known about the master and crew of the *Gao Cheng*.

1.4 Tug Information: (*Huria Matenga)*

1.4.1 The *Huria Matenga* was a 30.5 m azimuth stern drive (ASD) harbour tug (sometimes referred to as a reverse tractor tug). Propulsion was by two 1120 kW Niigata diesel engines, each driving an omni directional, fixed-pitch propeller shrouded by a kort nozzle. The design name for these drive units is "Z-pellers". The two Z-pellers were located near the stern of the tug. (See Figure 3)

1.4.2 Each Z-peller could be rotated through 360 degrees, either independently, using separate ahead/astern controls, or together in parallel, by using an azimuth wheel. The rpm of the propellers could be adjusted from zero (unclutched) to a maximum of 750, using separate speed control levers. The configuration of the Z-pellers made the *Huria Matenga* a highly manoeuvrable tug, being able to turn within its own length, steer astern and move sideways. The tug had a rated maximum bollard pull of 36 t ahead, and 33 t astern, and a maximum speed of about 13.5 knots.

1.4.3 The *Huria Matenga* was fitted with a hydraulic towing winch located on the foredeck for towing over the bow in the reverse tractor mode.

1.4.4 Navigation aids included a radar, a magnetic compass and a fixed VHF radio with a recording facility. The recorder was voice activated and recorded the radio transmissions between the pilot and tug skipper. The recording was not time referenced.

1.4.5 The Huria Matenga had a valid safe ship management certificate at the time of the incident.

1.5 Tug information: (*W.H. Parr*)

1.5.1 The *W.H. Parr* was a smaller (20 m long), older and less powerful version of the *Huria Matenga*. Propulsion was by two 520 kW Paxman diesel engines, each driving a Schottel omni directional, fixed-pitch propeller shrouded by a Kort nozzle. Although the operating controls were different, each nozzle could be operated in much the same way as the Z -pellers on the *Huria Matenga*. The Z-pellers were located near the stern.

1.5.2 The rated bollard pull of the *W.H. Parr* was about 20 t ahead, and 18 t astern, and the maximum speed when new was about 10.5 knots at 1250 rpm.

1.5.3 The *W.H. Parr* was not fitted with a towing winch, but instead the towline was handled by the crew using a capstan. Like the *Huria Matenga*, the *W.H. Parr* was used in the reverse tractor mode, towing over the bow.

1.5.4 The *W.H. Parr* was fitted with a horizontal rotating bow fender to assist the tug in moving along the hull of the assisted vessel when in the pushing mode. The fender could be locked by a pneumatic brake controlled from the wheelhouse.

1.5.5 Navigation aids included, a radar, magnetic compass and a fixed VHF radio. The VHF radio had a voice-activated recording facility, but this was inoperable at the time of the incident.

1.5.6 The W H Parr had a valid safe ship management certificate at the time of the incident.

1.6 Port Nelson, information

1.6.1 Port Nelson is contained between a boulder bank and the mainland at the head of Tasman Bay. The only entrance used by commercial traffic lay between the end of the boulder bank and Haulashore Island. Tidal flow generally follows the main channel, although some set can be experienced in the main channel from the tide passing through the old entrance, to the south and from the shallows on the northern side of the channel.

1.6.2 Vessels entering or departing Nelson had to negotiate a tight 94 ° turn in the channel, which had an approximate radius of 2.6 cables. On an inward passage, if a turn was commenced abeam of number one beacon, the available advance for a vessel to make the turn and end up in the middle of the channel was about 3.15 cables. The main channel was maintained at a minimum depth of 7 m below chart datum.

1.6.3 The company required that vessels over 130 m long have 2 tugs in attendance when inward bound.

1.7 Weather and tidal information

1.7.1 The weather at the time of the incident was reported as south-east wind 7 to 10 knots, with a slight sea, and a northerly swell of 1 to 1.5 m at the harbour entrance. It was a fine and clear night. The moon was waxing to a full moon on 2 January 1999 and the visibility was good.

1.7.2 Low water was predicted for 2336 on 27 December 1998, at a height of 1.1 m above chart datum. The following high tide was predicted for 0600 on 28 December 1998 at a heigh t of 3.5 m above chart datum. The incident occurred about 90 minutes after low water during a period of neap tides.

1.7.3 The under keel clearance of the *Gao Cheng* was calculated as follows:

minimum depth in harbour	7.0 m
height of low tide above chart datum	1.1 m +
minimum depth of water at low tide	8.1 m
draught of *Gao Cheng*	7.1 m -
minimum underkeel clearance	1.0 m

1.7.4 The tabulated tidal stream data provided on the Nelson harbour chart for tidal diamond C, off number 5 beacon, predicted the tide to be setting approximately 050 degrees true at a rate of 0.3 knots at the time of the incident.

1.8 Interaction

1.8.1 When a vessel is travelling in calm, open, deep water the vessel and the water pressure system around the hull reaches equilibrium. If the vessel moves into shallow or confined water this equilibrium can become upset as the pressure system around the hull interacts with the seabed or sides of a channel.

1.8.2 Squat is the term given to the increase in draught and/or trim a vessel can experience due to its movement through shallow water. The water accelerates as it flows past the hull to fill the hole the vessel has left in its wake. This increase in velocity causes a decrease in water pressure under the vessel and a resultant loss of buoyancy. The effect of squat on loaded vessels with an even keel, like the *Gao Cheng* entering Nelson, often causes the vessel to trim by the head. A vessel squatting by the head can experience an over-steering phenomenon caused by the pivot point shifting aft, together with an increase in lateral resistance forward.

1.8.3 In much the same way as a vessel squats towards the seabed, a vessel travelling close to the side of a channel can experience bank effect: An increase in water pressure at the bow forms a cushion between the bow and the bank, deflecting the bow towards the centre of the channel. At the same time, aft of the pivot point the flow of water accelerates between the bank and the side of the vessel, drawing the stern of the vessel towards the bank. The resultant forces may cause the vessel to sheer across the channel if not compensated for.

1.8.4 The influence that squat and bank effect have on a vessel varies with the square of the speed of the vessel. Therefore, a small reduction in speed will dramatically reduce the effects of squat and bank effect.

1.9 Relevant personnel information

1.9.1 The pilot held the following maritime qualifications:

- United Kingdom Certificate of Competency Class 1 (Master Mariner)
- United Kingdom Certificate of Competency as Foreign Master Square Rig (Unlimited)
- British Technical Education Certificate of Achievement in Nautical Science (UK)
- Higher National Diploma in Nautical Science (UK)
- Authorisation of Pilot: Port of London
- Maritime Pilot Licence: Port Nelson

1.9.2 At the time of this incident the pilot was 36 years old. His sea-going career spanned some 13 years, beginning as deck officer cadet, and finishing with 5 voyages as master, having sailed in various ranks on a variety of vessel types.

1.9.3 In 1992, the pilot moved into a shore based job with the Port of London Authority, assisting the harbourmaster in a number of duties including vessel traffic management. He commenced his pilot training with the Port of London Authority in 1994.

1.9.4 After training with authorised pilots for six months, and attending numerous ship handling and pilot training schemes, He became an Authorised London Pilot and subsequently conducted some 320 pilotage acts, eventually handling vessels up to 280 000 t deadweight and 340 m in length.

1.9.5 In 1996, the pilot was employed by Port Nelson Limited. His first 8 weeks consisted of training with Port Nelson pilots to become familiar with local geography, conditions and port practices.

1.9.6 The pilot's tug handling experience commenced while piloting for the Port of London Authority, where pilots had to become familiar with the handling characteristics and limitations of the various types of tugs in use. During this period, the pilot made several observational trips on Z-peller tugs similar to the *Huria Matenga* and the *W.H. Parr*.

1.9.7 When the pilot started with Port Nelson Limited, he began training as a relief tug skipper on the *Huria Matenga*, in addition to his port familiarisation. All of this training was conducted as an understudy to the full time tug skippers.

1.9.8 The skipper of the *Huria Matenga* started his maritime career in 1979 as deck hand on the Port Nelson tugs and pilot launch. In 1980, he obtained his Local Launchman Licence and skippered the port pilot launch until 1983, when he obtained his Master of Rivership Licence and became skipper of the then new, *Huria Matenga*. Although the skipper alternated between the two tugs, the majority of the ensuing 15½years was spent operating the *Huria Matenga*.

1.9.9 The skipper of the *W.H. Parr* held a Commercial Launch Master Certificate. He had some 26 years experience in the maritime industry and had spent a number of those years as skipper of the port suction dredge, deckhand on the tugs, skipper of the pilot launch, and for the last 7 years, skipper of the tugs.

1.9.10 Both tug skippers had passed the Nelson City Council pilot exemption examination, as part of the port company's training regime for tug skippers.

1.9.11 The normal roster for pilots was 2 days on-2 days off, but as it was a holiday period the roster had been changed. The pilot was rostered on duty from 0800 on 25 December until 0800 on 28 December, being only required to work when there were shipping movements. He had shipping movements in the early hours of the morning on 26 and 27 December and piloted a vessel out before boarding the *Gao Cheng* early on 28 December.

1.9.12 The tug skippers were also only required to work when there were shipping movements, this was also dependant on the number of tugs required for each movement.

1.9.13 The pilot and tug skippers all stated later that they did not feel fatigued having had sufficient rest periods between shipping movements.

1.10 Requirements for pilots to undergo medical examinations

1.10.1 The General Harbour (Nautical and Miscellaneous) regulations 1968, Part IX, details the minimum requirements for a person to be appointed as a maritime pilot in New Zealand. The various individual port companies may enforce their own additional criteria.

1.10.2 The regulations required every pilot to hold a masters foreign-going certificate of competency. Since those regulations came into force, changes to the International Convention on Standards for Training, Certification and Watchkeeping (STCW) have introduced the sea-going licence. This was issued in conjunction with the certificate of competency and valid for 5 years. As part of the requirement for the renewal of a sea-going licence the applicant must have held a valid medical certificate.

1.10.3 Because New Zealand pilots did not operate outside restricted limits, the MSA did not require them to hold a valid sea-going licence. This meant that pilots did not need to undergo the medical examination required for the renewal of a sea-going licence.

1.10.4 The requirements for employment as a pilot in Nelson were detailed in the Nelson Harbour Board By- Laws and Regulations, which stated:

> Before any person can receive an appointment as a pilot he must fulfil the requirements of General Harbour Regulations with reference to the appointment of pilots.

1.10.5 The General Harbour (Nautical and Miscellaneous) Regulations 1968 stated, with reference to medical and eyesight standards for pilots:

> The candidate must produce up-to-date certificates of good conduct and sobriety, and a medical certificate that he is in good health and not afflicted with any bodily infirmity rendering him unfit for the duties of the position. The candidate must also produce a recent form and colour test certificate as required by the Masters and Mates (Foreign Going and Unrestricted Home Trade) Examination Regulations 1961.

1.10.6 This meant that in Nelson a pilot was required to pass a medical and eyesight examination when initially employed, but there was no requirement for them to hold a valid sea-going licence or undergo any further examinations for the remainder of their term of employment. There was also no requirement for them to report any change in medical fitness that may affect their ability to perform their duties.

1.11 Other information

1.11.1 In January 1998 the same pilot was piloting the *T A Explorer* outbound from Nelson when it grounded on Haulashore Island. This incident was investigated by both the Commission (Report 98-201) and the MSA. The pilot did not agree with some of the findings in both reports and to date there remains unresolved conflict.

1.11.2 In September 1998 the pilot was piloting the *Maersk Taupo* outward bound, using the *Huria Matenga* on the starboard shoulder to assist with the turn. When the *Maersk Taupo* was just clear of number 1 beacon the tug's line parted. Due to their size, poor turning characteristics and the fact that the slowest engine speed, dead slow ahead gave a speed of about 7 knots, this class of vessel was considered by the pilots to be one of the more difficult to pilot in and out of Nelson.

1.11.3 This incident was of some concern to the pilot, he discussed it with an experienced colleague, who was occasionally employed by the company as a relief pilot. The pilot requested that the colleague accompany him the next time a similar vessel visited the port so each could observe the other's technique.

1.11.4 On the 7 October 1998, they boarded an outbound methanol tanker. The pilot took the vessel out, observed by his colleague. They then transferred to the inbound vessel *Maersk Tekapo*, sister ship to the *Maersk Taupo*. The colleague brought the vessel in observed by the pilot.

1.11.5 After this exercise both pilots discussed their respective, but similar techniques. The colleague could find no fault with the pilot's method.

1.11.6 The tug skippers had expressed concern to the company's Shipping Services Manager that since the *T A Explorer* incident the pilot was tending to carry too much speed on the vessels he was piloting, thus reducing the effectiveness of the tugs. They also felt that he was cutting the corner on occasions and not releasing the tugs until abeam of number 1 beacon on outward-bound vessels, which made it difficult for the tug crew if there was any swell at the harbour entrance. The Shipping Services Manager had monitored the situation and discussed it with the pilot on occasions.

1.11.7 The various colleagues of the pilot spoken to after the *Gao Cheng* incident, described him as a highly organised, meticulous person. They all felt that the incident involving the *T A Explorer* together with problems in his personal life had affected his confidence to some degree. They also commented that he had become more withdrawn and appeared to be under some stress.

1.12 Medical information

1.12.1 When the pilot commenced his employment with the company in April 1996 he passed a full medical examination and eyesight test as part of the conditions of employment, as detailed in the Nelson Harbour by-laws. He also held a unrestricted medical certificate issued by the British Department of Transport on 23 May 1994, which was valid for 5 years.

1.12.2 The pilot's eyes were sensitive to bright light, a condition known as photophobia. As a consequence it was not unusual for his eyes to water.

1.12.3 As he wore glasses for reading and long-range vision he had his eyes tested annually by a local eye specialist.

1.12.4 In March 1998 he was investigated for further visual symptoms, including photophobia, and restricted field vision in both eyes. He underwent further tests to monitor the problems. No specific diagnosis was made but glaucoma was excluded as the cause of his symptoms.

1.12.5 The Shipping Services Manager was aware that the pilot was attend ing an eye specialist and asked on several occasions the reason. The pilot told him that the treatment was to improve his vision and had no detrimental effect on his ability to perform his duties.

1.12.6 On 30 November 1998, while not working, the pilot suffered a loss of vision in his right eye for about 15 minutes. He immediately went to see an ophthalmologist in Nelson, who carried out extensive tests.

1.12.7 The pilot said that he discussed with the ophthalmologist whether the symptoms would affect his ability to continue piloting. The specialist told him that he could continue working and driving, but to contact him if it happened again. Acting on this information the pilot felt that it was not necessary to report the situation to the company. However, he did inform the Shipping Services Manager that he was undergoing tests for a possible brain tumour.

1.12.8 On 9 December 1998 the pilot had a magnetic resonance imaging brain scan in Blenheim. This showed no relevant abnormality but it was felt that he should have a more extensive scan in Christchurch.

1.12.9 In the months after the incident the pilot had numerous appointments with a variety of medical practitioners in Nelson and elsewhere. He also underwent many clinical investigations and tests.

1.12.10 On 21 May 1999, at the request of the Commission's medical consultant the pilot was examined by the Professor of Psychological Medicine from the Wellington School of Medicine.

1.12.11 On 29 May 1999 the pilot had a sudden complete recovery of normal vision in both eyes, to the extent that he no longer needed to wear glasses to aid his vision.

1.12.12 An independent report from a clinical psychologist was provided by the pilot to the Commission on 13 October 1999.

2. Analysis

2.1 The incident

2.1.1 The master and crew of the *Gao Cheng* were not interviewed with regard to this incident. The majority of the information pertaining to the sequence of events aboard the *Gao Cheng* was submitted by the pilot.

2.1.2 The pilot and tug skippers had received ample notice of the departure of the outward bound vessel and the arrival of the *Gao Cheng*. The majority of movements in the preceding days had been in the early hours of the morning. However, they were all able to rest for the remainder of the time. They all stated they were fresh and were not fatigued at the time of the incident.

2.1.3 The passage plan the pilot discussed with the master contained ample information for the master of the *Gao Cheng* to be fully aware of the pilot's intentions. The master should have been familiar with the port having visited on numerous previous occasions.

2.1.4 At the point where the pilot said he lost vision in his right eye the *Gao Cheng* was committed to the passage. Discontinuing the approach would, therefore, not have been a prudent option.

2.1.5 The course recorder trace provided a broad representation of the track the *Gao Cheng* followed. The recorder was set to UTC, but for clarity these times were converted to New Zealand Daylight Time (NZDT). (See Figure 4.)

2.1.6 When the anchor was aweigh at 0022, the pilot ordered half ahead on the engines and commenced a turn to starboard. This equates to position A on the trace, timed at 0017. From this, it appeared that the trace was set up 5 minutes slow of NZDT.

2.1.7 Brunt Quay lies in a direction of 344/164 degrees true . When the *Gao Cheng* was alongside Brunt Quay the course recorder trace read 168 degrees true. It was therefore assumed that the trace was set up reading 4 degrees high.

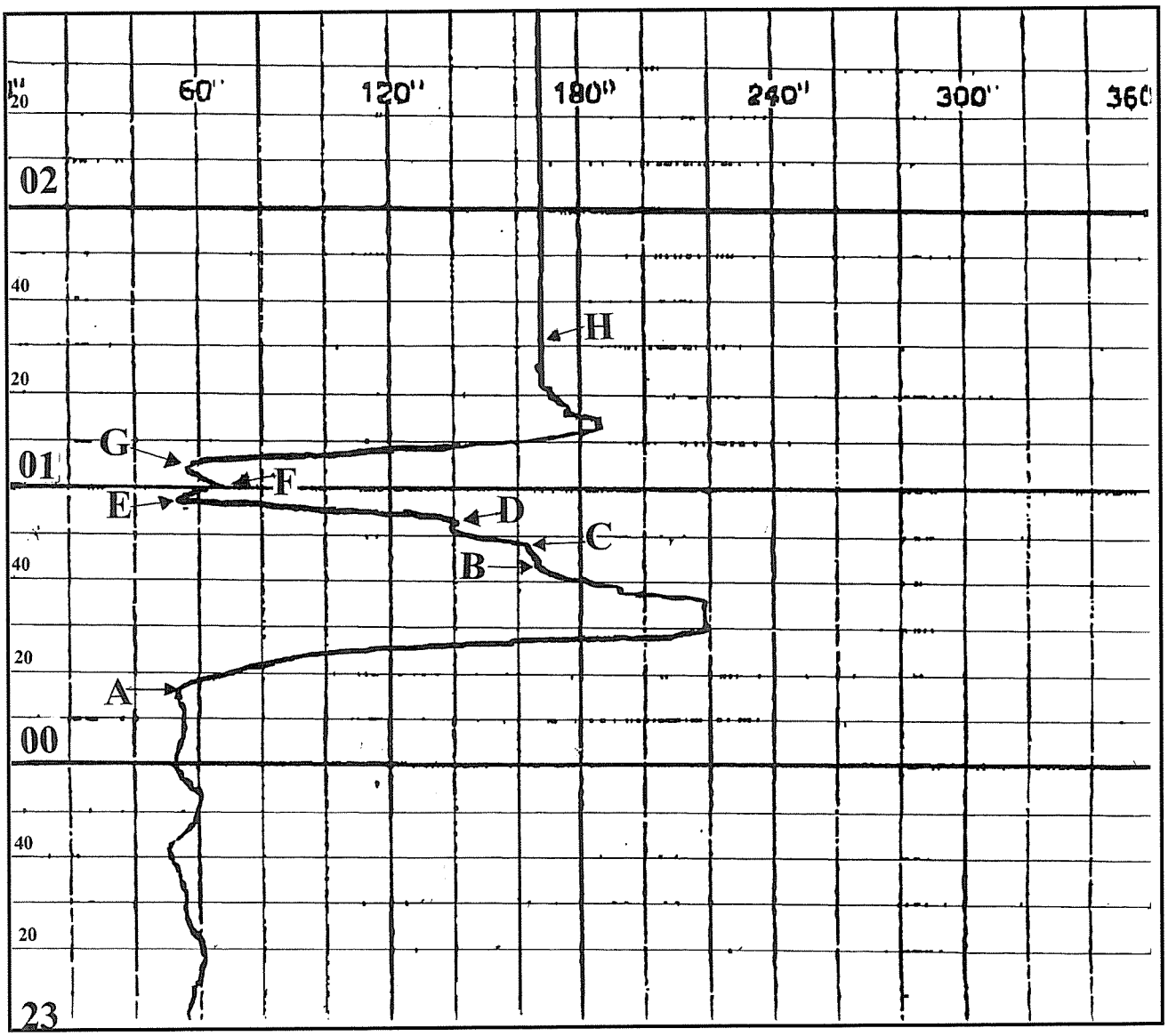

Figure 4
Course recorder trace (times refer to NZDT)

2.1.8 The positions marked on both Figures 1 and 4 represent the following (times and courses have been corrected for the errors mentioned above).

position	time	occurrence
A	0022	anchor aweigh, half ahead, turn to starboard
B	0049	vessel turns on to outer leads (165 degrees true)
C	0054	vessel turns on to inner leads (135 degrees true)
D	0059	vessel commences turn into harbour
E	0103	incident occurs, vessels head at 050 degrees true
F	0105	vessel swings to starboard, to 065 degrees true
G	0109	vessel commences starboard turn in to berth
H	0125	vessel starboard side alongside Brunt Quay

2.1.9 In order to re-construct and plot the approximate track of the *Gao Cheng* it was assumed that the vessel maintained a speed of 4 knots from 0054.

2.1.10 A speed of 4 knots equates to a distance travelled of 124 m per minute. The time between positions C and D was 5 minutes which, at 4 knots represents a distance travelled of 648 m. At position D the vessel commenced the turn into the harbour and at position E it was heading 050 degrees true. This represents a change in heading of 85 degrees in 4 minutes, or 21 degrees per minute. Using 30-second intervals (61 m per 10.5 degrees of heading change) the approximate track of the vessel is shown as in Figure 1.

2.1.11 After the incident the pilot altered the course to starboard, between positions E and F. The heading reached a maximum of 065 degrees true in 2 minutes, or 7.5 degrees per minute.

2.1.12 The reconstructed track, shown in Figure 1, does assume the vessel was travelling at a constant speed of 4 knots, but it was similar to that described by the pilot and tug skippers after the incident.

2.1.13 The statements made by the pilot and tug skippers and the information derived from the course recorder trace indicate that the passage plan discussed with the master of the *Gao Cheng* was broadly followed until just after the wheel-over position, near number one beacon. From all available accounts the vessel was on the line of the leading lights until the port turn was initiated.

2.1.14 The 4-knot speed of the *Gao Cheng* as it approached and entered the harbour channel was appropriate, and slow enough to negate any effect of interaction between the vessel and the seabed. There was no indication that mechanical or equipment failure caused the vessel to deviate close to the port bank of the channel. There was no suggestion that the helmsman was not steering the vessel to the pilots orders.

2.1.15 The weather conditions were good. Any tidal effect on the track of the vessel would have been negligible, and was discussed by the pilot and master as part of the passage plan.

2.1.16 After initiating the turn to port, it appears the pilot became distracted by the re-occurrence of the loss of vision in his right eye and did not realise that the rate of turn was excessive until the *Gao Cheng* was close to the port bank.

2.1.17 It could not be established to what extent the master and officer-of-the-watch were monitoring the progress of the *Gao Cheng* into Nelson harbour. However, if they were unaware that anything was untoward until the master questioned the pilot after the tugs had collided, it would suggest that a less than optimum standard of bridge resource management was being practiced.

2.1.18 The pilot could have informed the master that he was experiencing vision problems, but given that the vessel was at the most critical point of the pilotage, and the master had limited understanding of English, this could have exacerbated the situation. The pilot's decision not to inform the master at that time is therefore understandable, but was not in keeping with the principles of bridge resource management.

2.1.19 The pilot could have advised the tug skippers that he was experiencing problems without going into details. Both tug skippers were experienced in the port and with the intended manoeuvre. Had they been aware that the pilot was experiencing difficulties they could have monitored the situation more closely and passed valuable information back to the pilot.

2.1.20 By not informing the master of the *Gao Cheng* or the tug skippers of his problem the pilot made no provision for the possibility of his condition deteriorating.

2.1.21 Had the skipper of the *Huria Matenga* been aware that there was a problem he might not have taken for granted that the pilot had accurately assessed the room available for his tug to manoeuvre on the port side of the *Gao Cheng*. As a result the *Huria Matenga* might not have grounded.

2.1.22 Once the *Huria Matenga* was committed to the port side of the *Gao Cheng,* there were few options available for the tug skippers. Once the *Huria Matenga* had grounded there were even less. The stern of the *Gao Cheng* would have been only 20 m from grounding on the port bank, leaving the skipper of the *W H Parr* with little option but to run with the ship. To try and turn his tug would have almost certainly resulted in it grounding. To try and reverse out could have resulted in the tug being drawn under the counter at the stern of the *Gao Cheng*.

2.1.23 After the *Gao Cheng* and the tugs cleared number 5 beacon the pilot continued to berth the vessel without incident As it was dark at the time of the incident the master of the *Gao Cheng* could not have observed the pilot and recognised that he was experiencing difficulties.

2.2 Medical

2.2.1 The pilot had passed the medical and eyesight tests required by the company as a pre-requisite to his employment, as detailed in the Port Nelson by-laws. However, there was no requirement for him to have any further medicals or report to the company any changes to his health. If this had been the case the company would have been informed of his problems earlier and could have monitored his condition more closely.

2.2.2 There was no requirement by the MSA or the company for pilots to hold a valid sea-going licence. As a result, after the initial medical and eyesight test required for employment, a pilot was not required to have any further medical examinations for the remainder of his term of employment.

2.2.3 The cause of the incident appears to have been the pilot leaving the helm hard to port for too long. Failure to ease the turn by issuing a further helm order was probably the result of a "slip", which is described in the General Error Modelling System [3] as an attention failure. This failure of attention is likely to have been precipitated by distraction from the loss of vision in the pilot's right eye just before entering the turn.

[3] The General Error Modelling System is a human performance failure taxonomy system to classify different types of error.

2.2.4 Stable monocularity (normal vision restricted to one eye) can achieve almost normal vision, but a sudden loss of vision in one eye is usually more disabling until the affected person can compensate for the change in visual performance. Although he had experienced transient losses of vision in the same eye a month previously, the pilot reported that he was worried and distracted by this recurrence of his symptoms. He denied any stress or undue anxiety prior to the sudden loss of vision on the night of the incident.

2.2.5 The distraction caused by the sudden loss of vision was probably more important than any visual impairment per se. Visual perception in his left eye was unchanged, and even with monocular vision, visual functions such as perception of depth and movement, and detailed imaging in the central visual fields would probably have been largely unaffected. From the pilot's own account, he was able to maintain good visual references by moving around the bridge, and it is unlikely that his visual defect itself caused him problems with appreciating the extent and rate of the turn.

2.2.6 The pilot had been under clinical investigation for a range of visual problems prior to the incident. He was noted in March 1998 to have apparent visual field defects which his eye specialist attributed to anxiety, having excluded glaucoma. At the time of the incident, he was being investigated for a 15 minute episode of loss of vision in his right eye on 30 November 1998; the presumptive diagnosis around that time was atypical migraine or multiple sclerosis.

2.2.7 Assessment of medical fitness to work as a harbour pilot is hampered by a lack of any specific guidelines on medical standards and certification. In general, fitness for work in safety related transport activities where an employee has a medical condition is determined by two factors:

- The level of functional impairment caused by the condition, in this case visual acuity and visual fields.
- The probability of developing any sudden impairment or incapacitation as a result of the condition or its complications.

In this case, the visual fields were considered to be acceptable for harbour pilot duties, despite being difficult to assess. The risk of sudden incapacitation from further visual loss caused by atypical migraine or multiple sclerosis was considered to be low. As a result, the pilot was advised that he was fit to continue working as a harbour pilot until the investigations were complete. This was a reasonable decision in the circumstances, where not all relevant clinical information was available.

2.2.8 Subsequent clinical investigations were normal or inconclusive, and the pilot underwent a psychiatric examination by the Professor of Psychological Medicine at the Wellington School of Medicine on 21 May 1999 at the request of the Commission. Based on his findings at that examination, reports of a number of investigations of his vision and neurological function, and the pilot's sudden and complete recovery of normal vision in both eyes on 29 May 1999, lead him to the conclusion that there was no physical basis for his sudden visual loss on the night of the incident.

2.2.9 In the opinion of the psychiatrist, the pilot was not malingering or presenting a factitious disorder, and was not suffering from any affective or psychotic disorder. In the circumstances, he considered that the most likely diagnosis was that of a conversion disorder, although in his opinion the absence of a clear stressor precludes this as a formal diagnosis. The diagnosis was corroborated by an independent psychologist consulted by the pilot. If the pilot's symptoms were due to a conversion disorder, he would have experienced a functional loss of vision in the same way as loss of vision from a physical cause, and would not have been aware that the symptoms had a psychological rather than physical component.

2.2.10 Although the pilot does not report any anxiety prior to the onset of his visual symptoms on the night of the incident, his colleagues report specific anxieties about the turn in the channel following his previous accident with the *T A Explorer*, and that he had a tendency to cut this corner on some occasions. In addition, the pilot was observed to have been withdrawn and appeared to be stressed after the *T A Explorer* accident, and in relation to other matters. His anxiety was also observed by his medical attendants. It may be that he was subconsciously acutely anxious at the time that his visual symptoms developed, but that he would not have been aware of any increase in his level of anxiety.

2.2.11 Conversion disorder is a recognised but uncommon cause of visual and neurological symptoms mimicking multiple sclerosis, and similar cases have been reported in the scientific literature. The further investigations required to definitively confirm the diagnosis of a conversion disorder were not completed by the time of publication of the report. However, the subsequent full recovery of all visual function in May 1999 following psychiatric assessment, and the consistency of the diagnosis with the events described by the pilot on December 28, suggest that the pilot's visual symptoms and subsequent distraction were probably due to a conversion disorder.

2.2.12 As the doctors involved in the initial assessment of his visual problems, prior to the accident, considered that the most likely physical causes were atypical migraine or multiple sclerosis, it seems reasonable to have allowed the pilot to continue working while further investigations were completed. While a psychological cause for some of the pilot's symptoms had been considered, the rarity of conversion disorder as a cause of visual and neurological symptoms like those observed in the pilot would require all other possible causes to be excluded by exhaustive investigation before making the diagnosis.

2.2.13 More detailed guidance on the medical assessment of seafarers was published in a draft Maritime Rule Part 34 in June 1998, but did not apply to harbour pilots who were specifically excluded from the Rule when it came into force on 1 August 1998. This appears to be based, internationally, on a historical anomaly or an erroneous concept that the safety standard requirements for harbour pilots was less than for seafarers. The MSA has subsequently sought the opinions of the maritime industry about the need for more detailed medical standards for harbour pilots with a view to making the SCTW medical requirements equally applicable to harbour pilots. Pilots are no less susceptible to medical impairment or in capacitation than any other group of seafarers. The consequences of medical incapacitation may be more serious when operating close to shore or in a confined space when there is less time to wait for the affected crewmember to recover or be relieved.

3. Findings

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

3.1 As the master and crew of the *Gao Cheng* were not interviewed or the vessel visited, it could not be established whether the vessel:

- was operated in accordance with legislation
- had valid statutory certificates
- had a master and crew that were appropriately qualified
- had a safety management system in operation.

3.2 The pilot and tug skippers held appropriate qualifications for their positions.

3.3 The passage plan the pilot said that he discussed with the master of the *Gao Cheng* contained ample information for the master to be fully aware of the pilot's intentions.

3.4 When the *Gao Cheng* had reached the position where the pilot stated he had lost vision in his right eye it was too late to turn the vessel around and head back out to sea.

3.5 The pilot was distracted and concerned by the sudden loss of vision in his right eye. This probably caused him to leave the helm hard to port for too long and as a consequence the *Gao Cheng* ended up close to the port side of the channel.

3.6 The pilot's decision not to inform the master of his vision problem when it first occurred, although understandable under the circumstances, was not in keeping with the principles of bridge resource management.

3.7 It would have been prudent for the pilot to have informed the tug skippers that he was experiencing problems, so that they could have assisted by passing information back to the pilot.

3.8 Following the incident, the pilot was able to complete the berthing of the *Gao Cheng* without further incident and without informing anyone of his vision problem.

3.9 From the pilots account of events the master and officer-of-the-watch on the *Gao Cheng* did not appear to have noticed the deviation from the intended track; consequently, they were not following the principles of bridge resource management.

3.10 The skipper of the *Huria Matenga* was not aware of the limited sea–room available on the port side of the *Gao Cheng* until he crossed the bow.

3.11 The skipper of the *W H Parr* had insufficient room to manoeuvre the tug around the stern of the *Gao Cheng*.

3.12 The weather and tidal conditions did not contribute to the incident, neither did the effects of interaction.

3.13 The company did not require pilots to hold a valid sea going licence or undergo regular medical examinations.

3.14 The MSA had no regulations in force with regard to the standard and frequency of medical examinations for pilots.

3.15 Neither the MSA nor the Port company had any requirement in force for a pilot to report any change to his medical fitness that may affect his ability to carry out his duties.

3.16 The pilot should have been required to inform the Shipping Services Manager of his loss of vision on 30 November 1998.

4. Safety Action

4.1 Following the incident the pilot was suspended from piloting while he underwent further medical examinations.

5. Safety Recommendations

5.1 On 25 August 1999 it was recommended to the Director of M aritime Safety that he:

5.1.1 Apply the medical standard of STCW-95 for masters and mates to all pilots within a New Zealand harbour or at a New Zealand offshore installation (062/99)

5.1.2 Amend Maritime Rule Part 34 to:

Ensure that provisions are in p lace that require seafarers and pilots to report to their employer, who should then notify the MSA of any changes in their medical fitness that may affect their ability to perform their duties or would otherwise render their medical certificate invalid (063/99).

5.2 On 20 September 1999 the Director of Maritime Safety responded as follows

5.2.1 **062/99**
The application of the SCTW-95 medical standard for pilots is not contemplated in the IMO convention. However, MSA plans to introduce a maritime rule during 2000 which will prescribe appropriate and similar standards to pilots. In such context, the essence of the recommendation and its underlying rationale is accepted in full.

5.2.2 **063/99**
This is accepted and is also proposed to be included in the above rule. We note, however, that there are general requirements for maritime document holders to report any information that affects their status as a fit and proper person. These are found in sections 406(c) and 41(5). The case of pilots is anomalous as they are not currently required to hold a maritime document to perform pilot duties. They must hold a masters foreign going certificate as a prerequisite for appointment, but need not maintain it as a current document. Once pilots are required to have maritime documents under the new system (the final full version of Part 90 due in 2000 will revise the pilot and pilotage system) this loophole will be closed. This is a case of historical anomaly which is being addressed.

5.3 On 25 August 1999 it was recommended to the operations manager of COSCO Containers Limited, as operator of the *Gao Cheng* that he:

5.3.1 Ensures Bridge Resource Management principles are being practiced within the COSCO fleet (061/99).

5.4 On 28 September 1999 the operations manager of COSCO Containers Limited responded in part as follows:

5.4.1 . . . recommendation [061/99 has been] duly noted and those principals to be practiced as recommended.

Approved for publication 6 October 1999

Hon. W P Jeffries
Chief Commissioner