Australian Government
Australian Transport Safety Bureau

Safe Transport

MARINE SAFETY INVESTIGATION
No. 192

Independent investigation into the grounding of
the Liberian registered bulk carrier

Pactrader

in the port of Thevenard, South Australia
1 March 2003

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Released under the provisions of the *Navigation (Marine Casualty) Regulations* under the *Navigation Act 1912.*

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CONTENTS

1 SUMMARY

On the morning of 26 February 2003, the Liberian flag bulk carrier, *Pactrader*, arrived at Thevenard from Lumut in Malaysia and embarked a pilot for berthing at Thevenard wharf. The ship entered the port and made fast, without incident, port-side-to the northern side of the wharf to load a cargo of gypsum for Auckland, New Zealand. The cargo was loaded as planned and completed during the early hours of 28 February. *Pactrader* remained alongside the wharf after completion of cargo operations waiting to sail on the high tide predicted for early the next morning, 1 March.

The pilot boarded *Pactrader* again at midnight, 28 February for the departure. The pilot and master discussed the outward pilotage and, at 0006 on 1 March, the ship commenced singling up the mooring lines as per the departure plan. A single tug was pushing up on the ship's starboard side at about midships. The wind was from about the south-south-west at 20 knots.[1] The tide was setting to the north (the last of the flood) at up to 0.5 knots.

At 0012 the last mooring line was let go and the ship started moving from the berth. As the ship moved ahead it was set to starboard by the tide and wind and, a short time later, it ran aground along its starboard side when its stern was just clear of the end of the wharf. It had only moved about one ship length ahead.

At 0224 on 4 March, the ship was refloated with the assistance of a salvage tug despatched from Adelaide, and returned alongside the wharf. Divers and a classification society surveyor inspected the ship and, when they indicated that there was no significant damage and that the ship was seaworthy, *Pactrader* was released by AMSA[2] to continue its voyage to New Zealand.

The report's conclusions include:

- The pilot did not make sufficient allowance for the significant forces acting on the beam of the ship at sailing time.
- The tug was not used to best advantage given the prevailing circumstances.
- The planning of the sailing operation was inadequate in that neither the master nor the pilot reviewed alternative strategies for unberthing, such as tug utilisation, engine movements and rudder usage.
- The 'soft nose' at the end of the wharf discouraged the pilot from remaining close to the wharf during his outward movement.

The report makes a recommendation that:

Flinders Ports should undertake a risk assessment of the Port of Thevenard, taking into account the variable environmental factors, together with infrastructure and pilotage ongoing training experience issues.

[1] 1 knot = 1 nautical mile (1852 metres) per hour.

[2] AMSA is the Australian Maritime Safety Authority.

2 SOURCES OF INFORMATION

The master, officers and crew of *Pactrader* and ship's records.

The pilot

The master of tug *Wiabuna*

Transport South Australia

Flinders Ports South Australia

The Hydrographer, RAN

Acknowledgment

The ATSB acknowledges the advice and assistance of Austow Pty Ltd in assessing issues relevant to tug operation.

3 NARRATIVE

Pactrader

Pactrader is a Liberian flagged, geared bulk carrier of 28 426 tonnes deadweight at a summer draught of 9.760 m. The ship has a gross tonnage of 16 794. It has an overall length of 169.03 m and a moulded breadth of 27.20 m. The main engine is a Hitachi B&W 5S50MC, 2 stroke diesel producing 5 816 kW which drives a single, right hand turning propeller giving the ship a service speed of 14.0 knots. The ship is not fitted with a bow thruster. *Pactrader* was built in 1996 by the Imabari Shipbuilding Company, Japan and delivered in early 1997. It is owned by Trans-Pacific Shipping Company and managed and operated by Lasco Shipping Company, USA. The ship is currently classed by the American Bureau of Shipping (ABS).

Pactrader is a standard 'handysized' bulk carrier with its five cargo holds forward of the accommodation block. To service the cargo holds there are four cranes along the main deck, each with a safe working load of 25 tonnes. The distance from the bow to the bridge is 143.7 m and from the bridge to the stern is 25.3 m. The ship was also equipped with the required navigational aids, including two radars, one a JMA 9000 and one JMA 7000. The ship was not equipped with a course recorder. All bridge and engine room equipment was operating normally.

At the time of the incident, *Pactrader* had a total crew of 20. All were Filipino nationals. All the watchkeeping officers were appropriately qualified. The master had been on the ship for about three months on his current contract and had served four previous contracts with this company. He had been at sea since 1977 and had held his Filipino master's qualification since 1998.

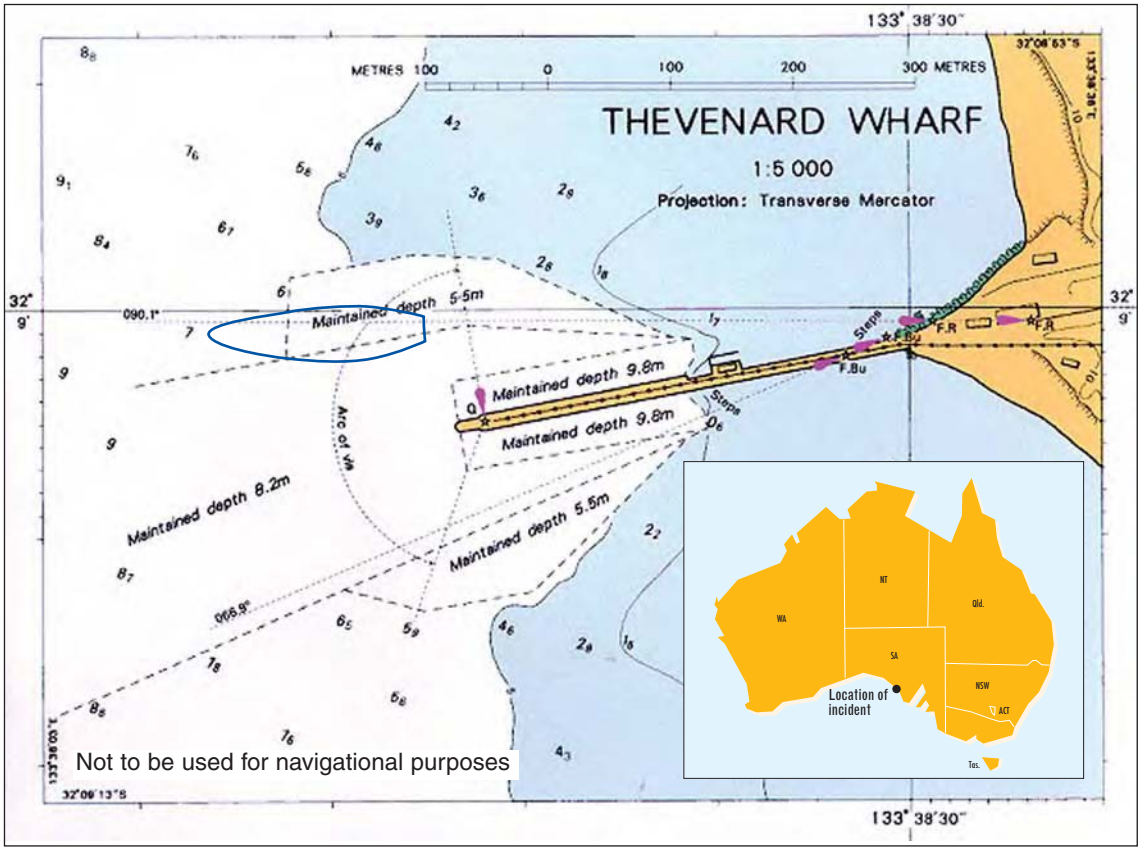
Both the forecastle and the poop were equipped with self-stowing mooring winches. The poop was equipped with four ropes housed on self-tensioning drums. At mooring stations three deckhands were under the direction of a deck officer aft.

Thevenard Port

Thevenard port is located at the entrance to Murat Bay, South Australia at about 32°09S 133°39E. It is on the eastern side of, and near the head of, the Great Australian Bight. It is primarily a bulk export port and a total of 1 355 918 tonnes of gypsum was exported through this port in 2002. Other bulk exports included wheat, salt, barley and oats. Bulk fertiliser is the main import. In that same year, 2002, a total of 107 ship calls were made at Thevenard. These comprised 99 bulk carriers, five general cargo ships and three others. The maximum permitted size of ship for this port is 180 m length overall or 28 m beam.

Two Australian charts are published for this port. Chart Aus 341 is a smaller scale metric chart (1: 300 000) for use in the approach to the port. Aus 120 is the larger scale metric chart at a scale of 1: 75 000, with inserts on the approach channel and the berth at scales of 1: 25 000 and 1: 5 000 respectively. Both charts are published by the Australian Hydrographic Service.

FIGURE 1:
Insert from Chart Aus 120 showing approximate grounding position of *Pactrader*



From the pilot boarding ground, an inbound ship follows the multi-legged Yatala Channel, marked by beacons, for a distance of approximately 6.5 nautical miles. The channel skirts the south and eastern edges of a large shoal area before joining the manoeuvring area between the end of the channel and the wharf at Thevenard. Ships usually swing in this area so as to berth 'head out'. The main channel has a maintained minimum depth of 8.2 metres at chart datum. The manoeuvring area is also dredged as required to maintain a minimum charted depth of 8.2 m in the main channel area (See figure 1). Adjacent to this deeper area, near the end of the wharf, is an area of shoal water the minimum depth of which is maintained to 5.5 m.

FIGURE 2:
Aerial photo of Thevenard

The commercial wharf at Thevenard consists of a single, very closely piled and faced, concrete jetty approximately 392 metres in length extending westward from Cape Thevenard (see figure 3). The wharf extends about 380 m from Point Thevenard and is aligned 080°T/260°T. Ships can berth on either the northern or southern side of this wharf but, in either case, usually berth heading outward (westward). Both berths are at the seaward end of the jetty and are 198 m long and 30 m wide. The maintained depth alongside in both berths is 9.80 m. There is a set of berthing leading marks established for both sides of the wharf. These leads mark the edge of the deep water and are used as clearing marks. The wharf is provided with a 'soft nose' fendering system on the outer, seaward end.

There is one tug, *Wiabuna*, available in the port of Thevenard. The tug was built in 1987 and is of a standard twin-screw design and has Kort nozzles. Its two engines develop 1044 kW and it has a quoted bollard pull of 20 tonnes. It is not equipped with its own lines or recovery winch aft.

Pilotage

Pilotage is compulsory for the port of Thevenard. The pilotage service is provided by Flinders Ports of South Australia. There is one pilot employed for this port who therefore does all the larger commercial shipping movements except those with exempt masters in command.

Vessels are normally only permitted to berth in daylight hours but may sail at any time depending on the height of tide and UKC (under keel clearance) restrictions. There is a minimum UKC requirement of 0.8 m (or 0.9 m if the ship's maximum draught is over 8.2 m).

The flood tides in the port of Thevenard normally flow to the north in the vicinity of the main wharf. This is nearly perpendicular to the wharf itself. At the time of the

FIGURE 3:
Thevenard wharf

incident the tidal range was 1.2 m and the tidal rate was about 0.5 knots. On 28 February the last low water was predicted for 1950 (summer time) at 0.6 m and then the next predicted high water was at 0120, 1 March (1.8 m).

Real-time and historical data on both the wind direction and strength and the actual height of the tide is available in the local harbour master's office, located at the shore end of the wharf. This is used by the pilot to compare actual conditions with predictions.

The pilot

The pilot assigned to *Pactrader* had been at sea, from deck cadet to master, since 1984. Most of his seagoing career had been on bulk carriers and all his marine qualifications, up to and including master Class 1, were obtained through the Australian Maritime College (AMC) in Launceston, Tasmania. During his time in command on the Australian coast he obtained a pilotage exemption for the port of Adelaide,

The pilot started his pilotage career with Flinders Ports early in 2002. He holds pilotage licences from Flinders Ports for Port Adelaide, Thevenard and Port Lincoln. At the time of the incident he had completed about 100 ship movements in and out of the port of Thevenard.

The incident

On 15 February 2003 *Pactrader* completed the discharge of its previous grain cargo in the port of Lumut, Malaysia. The ship then sailed for Australia to load a cargo of bulk gypsum for export to Auckland, New Zealand. Prior to the ship's arrival at Thevenard, the master had requested a copy of the Australian charts Aus 341 and Aus 120 from his managers. A copy of chart Aus 341 was subsequently supplied in sections, via the ship's fax machine, and assembled using adhesive tape on board. The managers sent

a request for Aus 120 to Kelvin Hughes, chart suppliers in the United Kingdom, but they were advised by the chart agent that chart Aus 120 was permanently withdrawn and hence unavailable. The ship managers forwarded this information to the ship.

On the morning of 26 February 2003, the ship arrived at Thevenard in ballast. A pilot was embarked on arrival for the inward passage and berthing at the wharf. The same pilot was to conduct the vessel on its departure.

The master advised the pilot about the characteristics of his ship and provided him with a pilot card detailing the ship's arrival condition. The pilot, in turn, supplied the master with the standard chartlet of the port as part of his normal procedure and they then discussed the inward passage plan. After this information exchange, the ship continued inward and made fast port-side-to the northern side of the wharf, without incident. The wind (as recorded in the ship's log book) was from the south at force five (17-21 knots).

The cargo of 24 188 tonnes of bulk gypsum was loaded as planned, with cargo operations completed at 0324 on 28 February. The sailing draughts were 9.00 m forward and aft and 8.998 m midships giving the ship a displacement of 31 182 tonnes. After completion of loading *Pactrader* remained alongside the wharf waiting for the high tide predicted for 0120 the next morning, 1 March, at 1.80 metres above datum.

At about 2330, the pilot arrived at the harbour master's office, about half an hour before the scheduled sailing time of midnight, as was his usual practice. He checked the tidal heights on his computer readout which are transmitted from the local tide gauges. These were about 10 centimetres higher than the official predictions for that time – a high water of 1.914 m would occur at 0126. He also checked the wind information (from S to SSW at about 20 knots, gusting to 25 knots) and, satisfied with these conditions, he continued down the wharf to the ship.

The pilot boarded *Pactrader* again at about midnight, 28 February/1 March 2003, for the departure. The ship's officers had checked the bridge equipment about one hour earlier. The main engine was also tested and the master informed that all was satisfactory for the departure. The pilot was presented with the departure pilot card and informed that all equipment and machinery were operating correctly. The pilot and master discussed the outward pilotage.

The master made enquiries during these discussions about the strength and direction and effects of the wind. The pilot told him that the wind had persisted for the last week and that he had sailed other vessels in the same conditions. He pointed out that with the wind off the jetty, the wind direction would assist the un-berthing.

At 0006, the engines were put on standby and the crew commenced singling up the mooring lines to one headline, one sternline and an aft breastline as agreed in the departure plan. The third mate and a helmsman were 'on standby' on the bridge for the departure. Hand steering was engaged with two steering pumps running. The twin-screw tug *Wiabuna* had also arrived at midnight. It was not made fast but was pushing up on the ship's starboard side at about midships. The pilot established communications with the tug via his handheld VHF radio.

The ship now let go the last headline and sternline but held on to the aft breastline. The tug was instructed to move aft to push up at a position adjacent to number five

hold, just forward of the bridge. The pilot's intention was to allow the ship's head to open away from the wharf using the effect of the wind but to hold the accommodation and aft end away from the shallow water close to starboard while this happened.

At 0012, the aft breast line was let go and, at 0015.5, after the line was clear of the water, the engine was put ahead, firstly to 'dead slow', then two minutes later to 'slow ahead'. The tug master heard over his VHF radio that the mooring lines were clear so he reduced to minimum power. As the ship started to move ahead, the tug proceeded to the starboard bow of the ship where the tug master expected his next task would be.

The first, and only, rudder order by the pilot was for 'Port 20 degrees'. This was ordered when the ship had about half of its length clear of the end of the wharf. Slowly the ship cleared the end of the wharf and was exposed to the unhampered force of the wind and tide. During this time, the pilot was mostly on the port bridge wing observing the berthing leads over the port quarter as well as the distance off the wharf. Both the last of the flood tide, which sets to the north, and the wind on the port beam as well as the effect of the rudder continuously set the ship over to starboard. At 0018, *Pactrader* ran aground, along its starboard side, on the 5.5 metre shoal area adjacent to the manoeuvring area. By this time the ship's stern was just ahead (about 30 metres) of the seaward end of the wharf and about 70 metres off to starboard. The ship's head settled on 276°T. The line of the leads ran up the length of the ship but well over to starboard of the centre line.

The pilot realised that something was amiss when the ship did not respond as he expected. At the same time, the team on the bridge observed that the speed, as indicated on the GPS[3], had dropped to zero and the echo sounder indicated zero UKC.

The pilot, knowing that there was still a little time left with the tide increasing in height, tried several different manoeuvres using various tug positions and actions, and the ship's engine, rudder and mooring line in an attempt to free the ship. These were all unsuccessful and, after a few hours, when the tide was falling, these attempts were aborted.

On 4 March, at 0224, the ship was refloated and returned alongside the wharf with the assistance of a salvage tug brought from Adelaide. The ship was detained by AMSA and then inspected by divers and a classification society surveyor. When they indicated that there was no significant damage and that the ship was seaworthy, *Pactrader* was released by AMSA to continue its voyage to New Zealand.

[3] GPS is the Global Positioning System

4 COMMENT AND ANALYSIS

Evidence

Interviews were conducted with the master, officers and relevant crew members on board *Pactrader* . The pilot, tug master and other observers were interviewed ashore.

Copies of various ship's documents and official statements from the relevant people were also reviewed. The ship's main engine movement logger was checked and a copy made of its printout. The ship was not equipped with a course recorder but the recollections of rudder commands varied little. There were no engine room alarms recorded.

Records from ashore relating to the pilot, procedures, weather and tidal conditions were collected and reviewed. VHF conversations are not recorded. There was no evidence of any mechanical problems with either the ship or tug prior to the incident. The issue of fatigue was examined but was not considered to be a contributing factor.

The evidence from all persons involved is consistent and the accounts of all parties, in general, are not subject to any dispute. It appears that no one on the bridge was unduly concerned about the ship's progress until the ship was observed to be no longer moving.

The grounding occurred within eight minutes of the last line being released and four and a half minutes of the first engine movement of 'dead slow ahead'.

According to the ship's records the last line, the stern line, was released at 0012. The first engine movement was not made until 0015.5. How accurately the clocks were synchronised at the time is not known, but it is apparent there was a period between the release of the last line and the start of forward impulsion. It was during this time that the tug held the stern against the jetty and the bow was allowed to lift off.

Port/wharf design

The maintained depths around the jetty area (see figure 1) allow vessels in ballast a guaranteed safe area to manoeuvre when berthing. For loaded ships, sailing at draughts greater than 5.5 m, the available water north and south of the jetty is more restricted. To the north the width of unrestricted water is about 70 m.

The pilot's options for sailing were also limited, to a degree, by the design of the wharf fenders. The outer end of the wharf consisted of a 'soft nose' designed to protect the end of the wharf as a ship berths. The fendering is proud of the line of the jetty. The 'soft nose' fender is seen as being vulnerable if contacted by a ship leaving the jetty (see figure 3). An incident involving previous damage to the outer end of the wharf was a factor the pilot took into account. The tendency was to ensure that ships sailing from the berth did not contact this fendering. The pilot, therefore, did not consider the option of warping the ship along the jetty, or staying very close to the jetty on departure. His main concerns in conning the ship, as he perceived it, were on his port side. The pilot remained on the port bridge wing as *Pactrader* cleared the berth.

Both the northern and southern berths of the jetty have sets of 'berthing leads' (leading beacons indicating the limits of deep water). The line of the northern set of

leads is aligned over the 5.5 m dredged area north of the berth. These leads are designed and installed specifically for use during berthing manoeuvres, particularly for ships drawing less than 5.5 m, typically handy size bulk carriers in ballast. On sailing the leads had to be maintained in an open aspect (front lead appearing well north of the rear lead) to ensure the ship remained in clear water.

The un-berthing operation

The pilot had been a licensed pilot for Thevenard for some two years. He had conducted in the region of 100 inward or outward passages at the port.

The pilot's assessment of the conditions was that the wind would assist in lifting *Pactrader* clear of the jetty and he confirmed this with the master during the master/pilot exchange. His main concern was that the wind acting on the accommodation block would make the stern difficult to control. He did not, apparently, give sufficient consideration to the overall effect of the tidal set acting on the hull, the reduced under keel clearance, or of the wind on the bow and the ship's hull as the ship cleared the lee of the jetty.

The pilot was well aware of the shoal water close to the north of the berth and that the 'berthing leads' were not 'leading marks'[4] in the accepted sense. The last of the flood tide and the wind direction and strength, meant that *Pactrader* would experience significant set and drift towards the shoal water. *Pactrader* 's beam of 27 m meant that the ship had about 40 m of clear water to the north. The pilot relied on a visual assessment of the ship's distance off the jetty.

To compensate for the wind effect on the accommodation block, the pilot positioned the tug at the after end of the main deck. In all other respects he treated the departure from the berth as a routine departure. The pilot stated that he had on one occasion used the tug *Wiabuna* towing from forward, but on that occasion he had had difficulty in controlling the stern. He was quite confident that the routine of having the tug holding up the stern while the bow lifted off the jetty was a safe option for un-berthing.

The circumstances were, therefore, that all the control was at the ship's stern, - the tug and the ship's propeller and rudder. The bow was uncontrolled until steerage-way could be achieved. The priority was to achieve steerage-way as soon as possible.

The pilot, on the port bridge wing, was observing the berthing leads as well as estimating the distance off the face of the wharf. He did not, however, make sufficient allowance for the beam of the ship. It is well known that darkness can affect the perception of depth and distance and on the port side of the ship the leads were open to the south indicating that the pilot was inside the line of deep water. But, on the starboard bridge wing the leads were in transit indicating that that side of the ship was in shallow water.

[4] 'Leading marks' – a set of marks that when in line will lead a vessel clear of local danger.

The environmental conditions were acting to push the ship away from the jetty and the fenders. Under these circumstances, it is difficult to understand why the pilot delayed increasing the engine revolutions from dead slow to slow ahead for two minutes. According to the ship's records the last line, the stern line, was released at 0012. The first engine movement was not made until 0015.5.

> In submission the pilot stated that in his recollection there was no time lag between the last line being cast off and the first engine movement being requested.

In these conditions, it was important to gain steerage-way as soon as possible once the mooring ropes aft could not foul the propeller. Given sensible planning, with four men at the after station and ropes recovered on mooring winch drums, there should have been no delay in retrieving the last after breast line and no reason why the breast line should have been in the water for any length of time. The mooring ropes were stowed on drums and the after breast line was the final rope to be released; the engine should have been available for use at a very early stage. Once making headway at which the ship could steer (4 to 4½ knots) the ship would have pivoted about a point about one third its length from the stem. The desired manoeuvre would have been facilitated by having the tug forward on a line to control the bow. The danger would then be any excessive rudder angle that may swing the stern into the shoal area.

The pilot conducted the ship's sailing, using the standard procedure, suited to more benign conditions.

The pilot did not plan the departure with sufficient regard to the dynamic effects that tidal flow and the weather conditions would have on the ship. Both the tidal flow and the wind would have set the ship to the north, towards the shoal water. The priority should have been to achieve steerage way as quickly as possible and to have a means of minimising the effect of any set towards the shoal water. In the event the pilot effectively followed a normal routine departure procedure without making sufficient allowance for the circumstances of the day, or how the tug may best be used.

Bridge resource management

The pilot briefed the master in accordance with the Flinders Ports procedures. The master and his officers were restricted in their input into the planning or monitoring of the ship's arrival or departure from Thevenard. The ship was not supplied chart Aus 120 (approaches to Thevenard) although the ship manager had provided the ship, en route, with a copy in pieces over the ships fax machine, of chart Aus 341(Head of the Great Australian Bight to Streaky Bay). The crew had reassembled these chart portions as best they could on board, using adhesive tape, for use on the approach to the port. The managers also forwarded a message from their British based chart agents to the ship stating that chart Aus 120 was withdrawn and hence unavailable. The pilot however informed the master that chart Aus 120 was available during their inward pilotage.

Chart Aus 120 shows the Yatala Channel on a scale of 1:25 000 and includes an inset of Thevenard Wharf on a scale of 1:5000. Planning of the pilotage section of the passage was limited in as much as these charts were required. Monitoring of the ships progress was also severely limited by the absence of the correct charts.

When the pilot boarded his 'Pilot Passage Plan' included small, black and white chartlets of the Yatala Channel and the port of Thevenard. Although neither chart was

suitable for navigation they illustrated the approaches to Thevenard and the layout of the jetty and available water. However, these charts lacked the colour contrasts of the approved navigation charts and the extent of the shoal water and the limit of the fairway may not have been obvious. They were also at an inappropriate scale for use in voyage monitoring or planning.

On departure the master and pilot discussed the probable effect of the wind. The pilot apparently reassured the master that the effect of the wind would be to assist the ship in lifting clear of the berth. It was agreed that the after breastline should be the last mooring rope let go. However, although the proximity of the shoal water was discussed, alternative positions or uses for the tug were not.

The difference in the width of the fairway north of the berth from arriving in a light condition to that of a deep draught vessel was significant. The fairway was effectively halved from 140 m to 70 m. Also, when sailing the pilot and bridge team had to ensure that the berthing leads, which led over the 5.5 m dredged area, remained open with the 'back' lead open to the south by a reasonable margin. This was essentially a 'back' lead, which could best be seen from the starboard bridge wing. While the number of persons on the bridge is limited on a merchant ship, some way of monitoring the 'berthing leads' could have been considered.

In submission:

> The ship management company pointed out that it was the master and bridge team that first realised that the ship had taken the ground.
>
> The pilot claimed that the reason the master and bridge team realised the ship was aground was because he asked for them to provide a speed check to confirm his own suspicions.

Flinders Ports procedures provide that:

The marine pilot is required to ….. conduct the pilotage in an efficient and responsible manner having due regard to the weather conditions, port limitations and other port users and local regulations.

The decision whether to sail or to remain alongside in adverse or marginal weather conditions is the master's in conjunction with the pilot and port authority. There are necessarily commercial factors to be taken into account both by the ship interests and the port authority. No ships were due in the port in the following few days and it would have been possible to delay sailing. However, the pilot was not unduly concerned and after letting go, the operation was proceeding normally.

Tug operations

Before letting go the sternline the pilot ordered the tug to push up at the after end of the main deck to hold the ship's stern against the jetty. The tug was not made fast to the ship in any way. While the ship was stopped in the water the tug could exert its maximum pushing power. But as the ship starts to move ahead, the ability of the tug to remain square onto the ship and push would rapidly decline. Without being made

fast it would have been more difficult to remain square on and there was also no option of the tug providing braking power.

In the event, the pilot used the tug to hold the stern against the wharf until the first engine movement. Thereafter, until after the grounding the tug played no part in the unberthing manoeuvre. The tug master, anticipating that the next order would be to move forward, started to move to the bow area on his own initiative. He did not advise the pilot of his actions. There was minimum communication between the pilot and the tug master. This was probably because the pilot and master treated the departure as a 'routine' manoeuvre, without allowance for the conditions or how the tug may best be used to counter any set and drift towards the shoal water. The tug master, with no indication to the contrary, also treated this departure as routine.

Had the tug been positioned to control the bow, it may have been better able to assist by holding the ship's bow up to windward. Also, with a degree of control over the bow, the pilot could have conned the ship closer to the jetty and the 'soft nose' fendering. Control over the stern could have been achieved by the use of engine and rudder.

Tug power

There are a number of 'rule-of-thumb' methods of estimating the tug power required in port. Much depends on the nature of the port itself, its exposure to wind and tide, the number of tugs available and the type and size of vessels using the port. There is a significant variation in the calculation of the desirable tug power and tug numbers. The assessment must be made on a port by port basis.

The formula often referred to for bulk carriers and other larger displacement ships, and quoted by Hensen (1997)[5] and used in some Japanese ports gives a bollard pull towards the higher end of the scale. A Swedish formula[6], based on windage area and wind speed is suitable for high sided vessels. Other formulae such as that used in Europoort produce lower figures. None of these formulae are suitable for single tug operations. These formulae are more appropriate to multiple tug use. Guidance as to the adequacy of tug power at remote, single tug ports is determined by experience and the environmental constraints.

Tug power, as a general rule, is critical when berthing, bringing a ship to a stop and manoeuvring alongside without damage to the ship or infrastructure. When sailing in a relatively unconfined port, tug power is normally not be so critical. When operating with one tug the issue is, 'where to put the tug'?

Tugs are used at the pilot's direction, ideally in informed discussion with the master. Where a single tug is used the decision on positioning may be more critical than when using multiple tugs. The pilot, based on one past experience, was discouraged from using the tug towing at the bow, a decision into which the tug master had no input.

Although the wind was gusting to over 25 knots at times, the Inspector considers that the wind was not so strong that the ship could not have been successfully unberthed. The main consideration would have been the UKC in the Yatala Channel given any swell conditions.

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5 Tug Use in Port' by Captain Henk Hensen, FNI published by The Nautical Institute

6 Force Technology (2003)

Training

The pilot had experience in ship handling as a pilot-exempt master. His appointment to Flinders Ports was his first post as a port authority pilot. When the pilot joined Flinders Ports, he initially received general pilotage and port specific training for Port Adelaide under the guidance of a number of qualified pilots. In addition to on-the-job training, he also attended simulator training and undertook familiarisation trips on board tugs there. As part of his continuing education he undertook Bridge Resource Management training in July 2002.

In June 2002, soon after obtaining his licence, the pilot was assessed as competent under the Flinders Ports check pilots program. Ongoing professional development would, in time, include the Advanced Marine Pilots Course followed, at some time, by a Competency Audit as developed by the Australian Marine Pilots Association. The training was documented, monitored and overseen by the General Manager, Marine Operations, at Flinders Ports.

Having acquired his Port Adelaide licence he undertook the necessary qualifying trips into and out of Thevenard. The pilot did not have an opportunity to observe the operations from the tug, for either berthing or unberthing at Port Lincoln or Thevenard since gaining his licences for these ports.

Flinders Ports procedures regarding training state that:

> Further, efforts will be made for the new pilot to observe other pilots licensed for that port.

The aim is to give a new pilot access to a full breadth of experience involving different pilots. However, all the qualifying trips the pilot undertook to gain the Thevenard licence were overseen by only one pilot, who had been the pilot in Thevenard for the previous six months. At Thevenard, therefore, the pilot did not benefit from the experience of a variety of pilots.

At each berthing and unberthing, pilots must make a number of decisions. When conditions are within the bounds of those normally experienced the degree of decision making is minimal. When conditions fall outside the normal parameters and/or other factors fall outside the norm (location of berth, type of ship, and the like) planning and decision making test the skill and experience of the pilot.

Decision making is an acquired skill and can be thought of as occurring on a continuum between 'analytical' and 'intuitive'[7]. Analytical decision making is associated with the novice, where a person is dependent upon knowledge based actions, which is time consuming, has a high workload and needs serial evaluation. Intuitive decision making is associated with the expert, who has a large fund of experience on which to base decisions, which are made rapidly and evaluated concurrently. Somewhere near the midpoint of the continuum is the competent operator, not yet expert, but not a novice. Such people base their decisions on rule-based considerations, but do not have the intuitive confidence to adapt fully to conditions that do not fit the norm.

Given the pilot's level of experience and his usage of the tug, the probability is that he fell within the 'competent', but not yet intuitive, decision making area.

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[7] Wiggins, M., & O'Hara, D. (1993). A skill based approach to training aeronautical decision making. In R Telfer (Ed), *Aviation Instruction and Training*, England: Aldershot. See also: Simpson, P., (2001), *Naturalistic Decision Making in Aviation Environments*, Defence Science & Technology Organisation.

Charts

Pactrader was not provided with the correct navigational charts for either the arrival at the port or the berthing operations. Under SOLAS Chapter 5 (Regulation 20), all ships are required to carry adequate and up-to-date charts to assist in navigation. Two Australian charts, Chart Aus 341(Head of the Great Australian Bight to Streaky Bay on a scale of 1:300 000) or Chart Aus 120 (approaches to Thevenard) are current and available for this port and approaches. Chart Aus 120 shows the Yatala Channel on a scale of 1:25 000 and includes an inset of Thevenard Wharf on a scale of 1:5000. The master was not provided with either of these publications prior to arrival in the port although he had requested them from his managers. Neither the ship nor its manager requested either chart from the local Australian agent prior to arrival or whilst the ship was alongside in Thevenard (for the departure).

The ship manager had provided the ship, en route, with a copy in pieces over the ships fax machine, of chart Aus 341. The crew had reassembled these chart portions as best they could on board, using adhesive tape, for use on the approach to the port. The managers also forwarded a message from their British based chart agents to the ship stating that chart Aus 120 was withdrawn and hence unavailable.

This information is not correct and this chart is available from any Australian chart agent. Chart Aus120 was not reprinted by the United Kingdom Hydrographic Office under the current bilateral agreement so has never been withdrawn from the Admiralty portfolio. It is not available from all chart suppliers but should have been available from this supplier, who is also an agent for the supply of Australian charts. The pilot informed the master that these charts were still current during the inward passage.

In two previous reports (*Sea Crane*, Incidents at Sea No. 87 and *Western Winner,* Incidents at Sea No. 118) the lack of charts have been identified as significant causal factors in groundings. In this case the lack of the charts was not directly causative in terms of navigational error, however, it did restrict the ship's ability to plan or monitor the voyage from berth to berth in accordance with Reg 34 of SOLAS Ch 5 and the recommendations contained in Resolution A.893 (21).

Safety actions

Flinders Ports have, since this incident, made some alterations to the soft nose at Thevenard wharf. These alterations – the addition of rollers at the wharf face end of the system - will allow pilots to stay closer to the wharf without fear of damage during berthing/un-berthing operations. See photo below.

FIGURE 4:
Rollers at 'soft nose'

The pilot boat is now used in this port to stand at the limits of the deeper water near the berth for departing loaded ships as a visual aid to the pilot.

As a result of this investigation the Australian Hydrographic Office will discuss the manner of listing of Australian charts in the Admiralty catalogue (NP131) and suitable notices in publications and websites about supply of these charts.

Drugs and alcohol

The Inspector is satisfied that neither alcohol nor drugs, prescribed or illicit, were taken by any of those involved in the grounding.

5 CONCLUSIONS

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular individual or organisation.

The ship machinery and equipment were all in working order and operated as required.

Based on the evidence available, the following factors are considered to have contributed to the incident:

1. The planning was deficient in that insufficient allowance was made by the pilot and master for the significant forces, due to tidal flow and wind strength, acting on *Pactrader* 's port beam.

2. The lack of planning resulted in:

    - the tug not being positioned to best advantage given the prevailing conditions;

    - a delay of up to three minutes between the letting go the last mooring line and the first engine movement of 'dead slow ahead' and;

    - a delay of a further two minutes between the first engine movement of 'dead slow ahead' and the second movement of 'slow ahead' thereby reducing the ship's ability to gain steerage way.

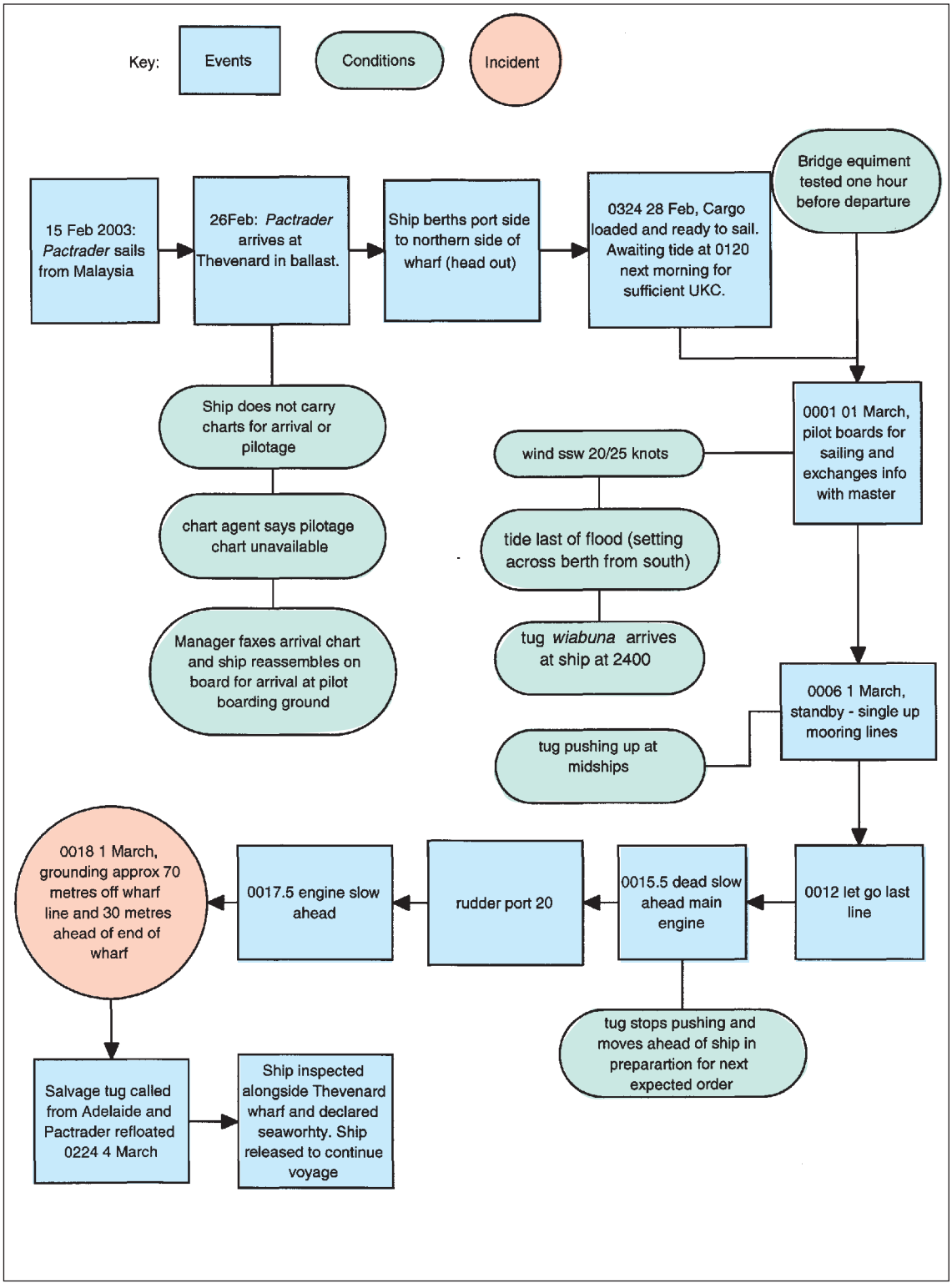
3. The pilot relied on visual assessment to judge the ship's distance from the jetty; the berthing leads were not monitored from the starboard side to ensure *Pactrader* remained in the fairway.

4. The allowance made by the pilot for the 'soft nose' fenders was excessive.

5. Alternative un-berthing strategies were not properly considered.

6. The lack of Chart 120 and Chart 341 limited the ship's staff in their ability to plan or monitor the inward and outward passages. The absence of the charts, however, can only be considered as marginal in terms of causal factors.

FIGURE 5:
***Pactrader*: Events and causal factor chart**



6 RECOMMENDATIONS

MR20040020

Flinders Ports should undertake a risk assessment of the Port of Thevenard, taking into account the variable environmental factors, together with infrastructure and pilotage ongoing training experience issues.

7 SUBMISSIONS

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

The final draft of the report, or relevant parts thereof, was sent to the master and managers of the ship, Flinders Ports and the pilot and Australian Maritime Safety Authority.

Where appropriate the text has been change to correct the draft or reflect the submissions where appropriate.

8 *PACTRADER*

IMO Number	9157363
Flag	Liberia
Port of Registry	Monrovia
Classification Society	American Bureau of Shipping (ABS)
Ship Type	Geared Bulk Carrier
Builder	Imabari Shipbuilding Company, Japan
Year Built	1996 - delivered 1997
Owners	Trans-Pacific Shipping Company
Ship Managers	Lasco Shipping USA
Gross Tonnage	16 794
Net Tonnage	10 492
Deadweight (summer)	28 426 tonnes
Summer draught	9.760 m
Length overall	169.03 m
Breadth	27.20 m
Moulded depth	13.60 m
Engine	1 x Hitachi B&W 5S50MC(mark III)
Total power	5 816 kW
Crew	20 (Filipino)

Independent investigation into the grounding of the Liberian registered bulk carrier *Pactrader* in the port of Thevenard, South Australia on 1 March 2003

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