ATSB
Australian Transport Safety Bureau

AUSTRALIAN TRANSPORT SAFETY BUREAU

MARINE SAFETY INVESTIGATION
REPORT 181

Independent investigation into the grounding of
the Liberian registered container ship

ANL Excellence

in Moreton Bay, Queensland
19 July 2002

COMMONWEALTH DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES

Department of Transport and Regional Services
Australian Transport Safety Bureau

Navigation (Marine Casualty) Regulations investigation into the grounding of the Liberian registered container ship *ANL Excellence* in Moreton Bay, Queensland 19 July 2002

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Investigations into marine casualties occurring within the Commonwealth's jurisdiction are conducted under the provisions of the Navigation (Marine Casualty) Regulations, made pursuant to subsections 425 (1) (ea) and 425 (1AAA) of the *Navigation Act 1912*. The Regulations provide discretionary powers to the Inspector to investigate incidents as defined by the Regulations. Where an investigation is undertaken, the Inspector must submit a report to the Executive Director of the Australian Transport Safety Bureau (ATSB).

It is ATSB policy to publish such reports in full as an educational tool to increase awareness of the causes of marine incidents so as to improve safety at sea and enhance the protection of the marine environment.

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Contents

Figures

Figure 1:
***ANL Excellence* aground in Moreton Bay**

Summary

At 0318 on 19 July 2002, the Liberian flag container ship *ANL Excellence* embarked a pilot off Point Cartwright, Queensland, for the passage to Fisherman Islands container terminal in the Port of Brisbane. After arriving on the bridge, the pilot set up a portable electronic chart display equipped with a differential global positioning system, to allow him to independently monitor the passage to the berth.

The pilotage proceeded routinely. There were no other movements within the port or the approach channels during this time. The weather was reasonable, though visibility was reduced at times by passing rain showers.

At 0518, *ANL Excellence* passed beacon E1 and entered the East Channel. Rain was falling at this time and the bridge window wipers were operating. Ahead, the starboard lateral beacon E3 and the port lateral beacons E2 and E4 could be seen. A temporary, starboard lateral buoy was marking the position of the cardinal beacon E5 which had been destroyed by a ship some 15 months previously. This temporary buoy was not seen by anyone on the bridge.

As the vessel passed starboard lateral beacon E3, the pilot ordered starboard rudder to bring the ship to a heading of 240° and then called Brisbane Port Control to advise that the ship would be at the entrance channel at 0600.

The master, sitting in front of one of the two radars, realised that the relative bearings of beacons E4 and E2 were changing and went to the helmsman to see what was happening. The pilot went to his electronic chart system, which had reverted to a blank screen stand-by mode. He tapped a key and when the chart was restored he suddenly realised that he had ordered the course alteration too soon.

The main engine was stopped and put astern, but *ANL Excellence* grounded before the ship had begun to slow.

The ship was refloated on the high tide of the afternoon of 19 July 2002, using its main engine and with the aid of tugs. Following an inspection of the hull, both internally and externally on 20 July, the vessel was cleared by the Australian Maritime Safety Authority, and its classification society to continue in service.

The report conclusions include:

- The pilot did not follow his normal procedure of checking the position of the course alteration using his portable electronic chart system.
- The temporary buoy marking the original position of the original east cardinal beacon E5 (the turning mark) was obscured by rain.
- The green light on the temporary buoy was not as conspicuous as a white light, which would normally be associated with a cardinal navigation mark.
- Although not suffering from chronic fatigue, the pilot's performance was probably affected by the trough in his circadian rhythm associated with the hours between 0400 and 0600.
- The pilot's electronic chart system was placed at a significant distance from where he was standing, with its display in power saving mode at a critical moment.
- The bridge team did not detect the erroneous helm order and failed to challenge the pilot.

The report recommends that:

- Where port authorities use a buoy or other temporary aid to replace an established navigation aid, the shape and the light characteristics of the temporary aid should be consistent with those of the aid it replaces.
- Brisbane Marine Pilots should review the power management settings and placement of a pilot's portable electronic chart system to ensure that the information displayed remains easily visible from the pilot's conning position at all times during a pilotage.

Sources of information

The pilot

The master, mate and helmsman of *ANL Excellence*

Brisbane Marine Pilots

Brisbane Port Authority

Queensland Transport

References

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1995 (STCW), the International Maritime Organization (IMO).

The Mariner's Handbook, seventh edition, The Hydrographer of the Navy, U.K.

Bridge Instructions, Swedish Club.

Acknowledgments

Photographs of *ANL Excellence* in Moreton Bay supplied by the Courier Mail newspaper, Brisbane.

Narrative

The Liberian flag, cellular container ship *ANL Excellence*, (figure 1), is owned by Hansa Africa Corporation of Liberia and managed by Leonhardt and Blumberg of Hamburg. It was delivered from its builders, Samsung Heavy Industries, in June 1997, as *Ibn Zaidoun* under the German flag. In May 2000 the name of the vessel was changed to *Ville de Venus* and, in June 2001, the vessel changed flag to Liberia. In January 2002 it was renamed *ANL Excellence*. The ship was built under Germanischer Lloyd (GL) class and has remained in GL class since.

The ship is 242.82 m in length with a beam of 32.2 m, a moulded depth of 14.78 m and a summer draught of 11.717 m at a deadweight of 42 953.6 tonnes. The vessel has the capacity to carry 3 424 TEU[1].

The ship is powered by a Samsung-Sulzer 7RTA84C two-stroke, single-acting, direct reversing main engine of 28 371 kW which drives a single propeller to give a service speed of 23.3 knots.

ANL Excellence's wheelhouse is combined with the chart room and communications area. The latter areas are partitioned off by curtains at night. The steering position is on the centre line of the wheelhouse behind an integrated control console. The control console has alarm panels, engine and bow thruster controls, and three CRT displays. The centre display is a 'ship status display', which may be used to display critical engine room information or an electronic navigation chart. Either side of the ship status display are two radar screens. Chairs for the master and officer of the watch are sited immediately behind the radar displays. The bridge front is 178.7 m from the stem and 64.1 m from the stern of the ship.

At the time of the incident, *ANL Excellence* had a crew of 20 comprising the master and three deck officers, the chief and three engineers, a boatswain and five seamen, three engine room ratings, two catering staff and a trainee. The master and mate were Russian nationals and the other officers were European. All of the ratings were from Kirabati.

The master had been in command of *ANL Excellence* for about six weeks and had visited Brisbane in June 2002. He graduated from the Leningrad High Marine Engineering College in 1989 and had worked for a number of shipping companies on general cargo, multipurpose, roll on/roll off and container ships. He gained his master's certificate in 1997 and was promoted to master in 1998. As part of his training, the master had undertaken a course in Canada, which included elements of Bridge Resource Management, consistent with the requirements of STCW 95[2].

The mate qualified as a deck officer in 1985. She had experience on refrigerated cargo ships and container ships and held a chief mate's certificate of competency. She had joined *ANL Excellence* as second mate in January 2002 and was promoted to chief mate in May.

At the time of the incident, *ANL Excellence* was operating on a scheduled container service between Port Klang in Malaysia, Singapore, Brisbane, Sydney, Melbourne, Adelaide and Fremantle. The ship had completed four voyages, each of four weeks duration, since March 2002.

Brisbane Marine Pilots

Brisbane Marine Pilots (BMP) is the company which provides pilot services for the Port of Brisbane. The company operates an 'on demand' pilot service under contract to Queensland Transport.

1 TEU Twenty foot container equivalent unit.

2 International Convention on the Standards of Training, Certification and Watchkeeping for Seafarers 1995.

BMP pilots work a cycling duty roster of sixteen days with ten days duty followed by six days leave. The number of pilots on the duty roster is dictated by normal traffic patterns in conjunction with the company's fatigue management policy. To minimise the risk of pilots being affected by fatigue, BMP operate a risk monitoring system based on a fatigue modelling computer program. This system is supplemented by 'Pilot Job Allocation' guidelines, which are used by the pilot operations coordinators when assigning pilots to ships. These guidelines suggest a minimum period of eight hours between ships (including an hour each way for travel plus a six hour break).

BMP's Fatigue Audit InterDyne (FAID) fatigue modelling program, was developed by Interdynamics in collaborative partnership with the Centre for Sleep Research at the University of South Australia. The FAID program quantifies an individual's level of fatigue based on hours of work for the previous seven days. Pilot's duty hours, including travel, are entered into the computer program which returns a 'fatigue index score' for each pilot at any given time. BMP have set an index score of 80 as the benchmark to indicate that a pilot's performance could be adversely affected by the rostered duty and the pattern of work hours. Should pilots exceed this score they are considered to be entering a risk zone for fatigue.

As a part of their normal shipboard operating procedures, BMP pilots carry a portable electronic charting system (ECS) on a lap top computer, which utilises a differential global positioning system (DGPS) receiver for position information. The ship's real time position is plotted automatically every ten seconds, and, together with the course made good and the ship's speed, is stored in a memory file. The system is independent of the ship's navigation equipment and allows the pilot to monitor the ship's position in relation to the passage plan at any time. The portable ECS units carried by the pilots are not intended to replace ship's navigation equipment, rather they are to be used in conjunction with conventional aids such as radar and properly corrected navigation charts.

The pilot

The pilot assigned to *ANL Excellence* on 19 July 2002 joined BMP in June 1999. He gained a restricted pilot's license for the port on 5 August 1999. In January 2002 he gained an unlimited license and, as such, was appropriately qualified to have the conduct of *ANL Excellence* in the Brisbane pilotage district. He had piloted more than 400 ships in his time with BMP.

At the time of the incident the pilot also held a master class 1 certificate of competency issued by the Australian Maritime Safety Authority. He had extensive experience as a seagoing deck officer and master and had pilotage experience in south pacific and other Australian ports.

On 18 July the pilot had just completed a seven day period of leave, as part of his normal duty cycle. His normal routine on days off was to get up at about 0600 and go to bed between 2230 and 2300. It was not his habit to sleep in the afternoon on his days off.

The pilot started his first day back at 0600 on 18 July. At 0900 he telephoned the BMP office and was told that he had been assigned to *ANL Excellence* with an anticipated boarding time of 0300 on 19 July. He then busied himself with jobs at home for the day. His assignment to *ANL Excellence* was confirmed at 1600. At about 1800 he drove, in company with another pilot, to the pilot station at Point Cartwright, arriving at 1930.

After his colleague had left the pilot house, at about 2030, the pilot went to bed at about 2100. He found it difficult to sleep, but did eventually sleep, waking for a brief period at about midnight. He was woken, as requested, at 0230 on 19 July to join *ANL Excellence*.

The incident

ANL Excellence sailed from Port Klang on 10 July 2002 and completed its sea passage off Point Cartwright at 0248 on 19 July 2002.

At 0318, the pilot from BMP boarded the vessel off Caloundra Head. The master and pilot exchanged information regarding the ship, the inward passage and the berthing manoeuvre.

The pilot confirmed that the ship was to enter Moreton Bay by the deep-water route, through North West Channel, Spitfire Channel, Main Channel and East Channel. With the ship's maximum arrival draught of 11.7 m, this route would provide a minimum under keel clearance of 3 m for the passage to the berth. As part of the initial exchange of information the pilot invited the ship's staff to challenge any order he gave, if they were unsure of his plan of action. The master, in turn, told the pilot of an apparent steering problem the ship had experienced while en route through the Great Barrier Reef. He indicated that he was not sure if the problem had been the result of the ship's limited under keel clearance or poor steering by the helmsmen.

During this time the pilot set up his portable electronic chart system on a table on the starboard side of the wheelhouse, adjacent to the only convenient power outlet.

At 0338 the pilot called Brisbane Harbour Control, confirming the ship's draughts and arrival time.

At 0345, after the pilot assumed the conduct of the vessel, *ANL Excellence* passed the fairway buoy inward. Two ratings where acting as helmsmen, alternating every hour on the wheel. Two steering motors were in operation for the pilotage and the pilot felt that there was no difficulty steering the ship. He felt that the response to the rudder was normal for the type of ship.

At 0400 the mate relieved the second mate as officer of the watch. The tide was just past high water and was virtually slack. The wind was south-easterly at 10 knots. The visibility entered in the log book was described as 'good, moderate in intermittent rain, vessel rolling moderately'.

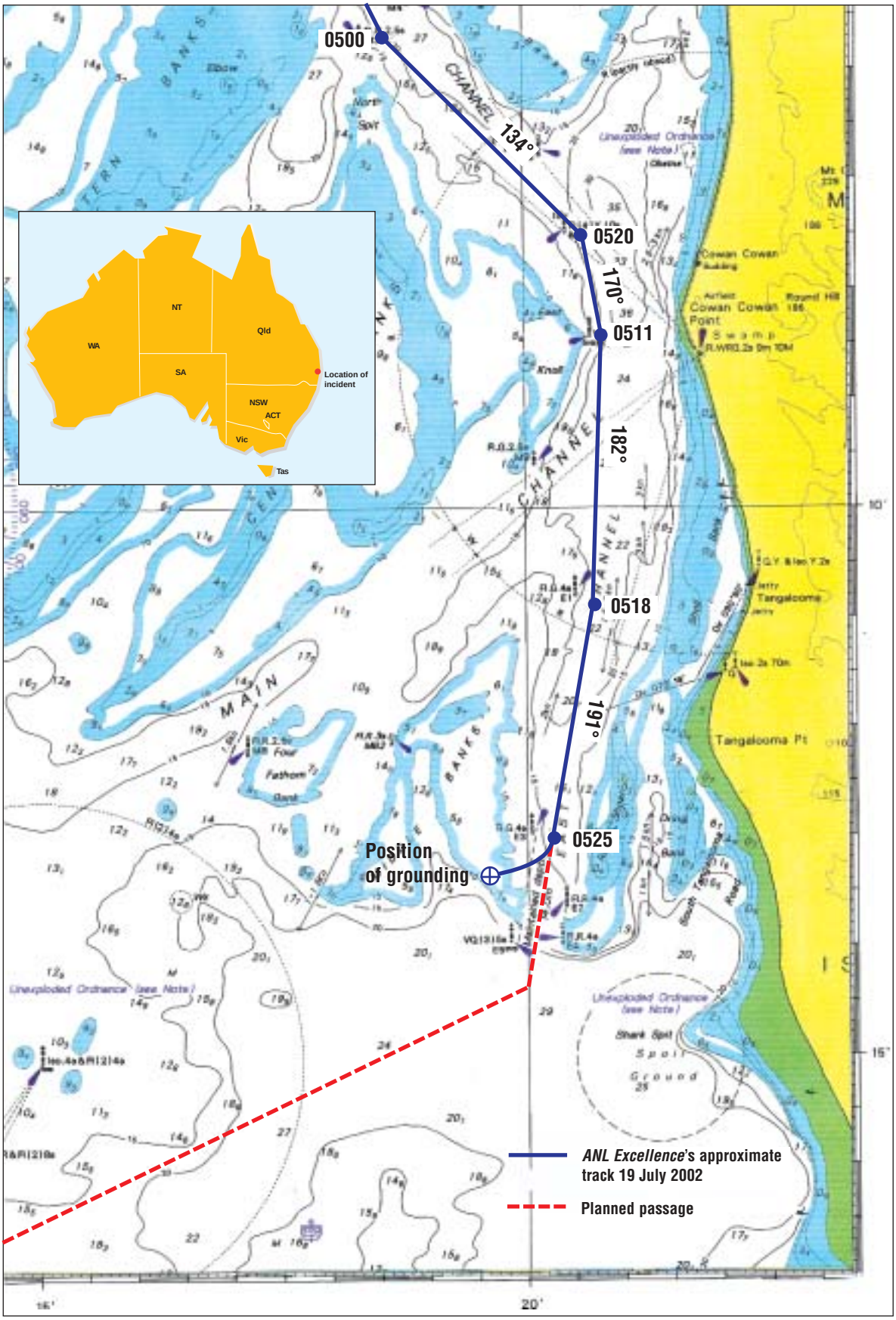
The passage proceeded routinely. After passing the number three beacon in the North West channel (NW3), the main engine revolutions were increased to full sea speed (85 rpm) to ensure arrival at the Entrance Beacons by 0600. The mate recorded the time of passing each buoy on the chart and in the bell book. The vessel rounded NW12 beacon into Spitfire Channel at 0442. In Spitfire Channel the pilot remarked to the master that the computer generated positions of the beacons, displayed on the ship's electronic chart system, were inaccurate.

At 0451 the ship entered the Main Channel. At this time the ship encountered intermittent light rain necessitating the use of the bridge window wipers.

ANL Excellence entered East Channel on a heading of 190° (T) at 0518. The ship's speed shown on the GPS was varying between 18 and 19 knots. The master crossed to the table where the pilot's electronic chart system was showing the ship's passage and briefly discussed the display and its effectiveness with the pilot. Up to this time during the passage, the pilot had checked the electronic chart system before ordering each alteration of course.

At around this time, beacon E3, showing a green light flashing every 4 seconds, could be seen to starboard and the port hand beacons, E2 and E4, could be seen on the port bow both showing red lights. A temporary lateral starboard-hand buoy marking the south-east extremity of Middle Bank could not be seen visually, as it was obscured by a passing rain shower.

Figure 2:
***ANL Excellence's* position of grounding**



The master resumed his seat in the chair in front of the port radar display. The pilot was standing to the starboard side, between the control console and the table on which his electronic chart system was located. On the ship's console, the central 'ship status screen' was showing engine operating parameters. During this time the mate spent much of her time in the chart table area, only coming to the forward part of the bridge to check the time of passing each buoy or beacon.

At about 0525, the pilot ordered 10° of starboard rudder, then an easing of the rudder angle to 5°. Standing close to the helmsman's right hand side, he ordered the helmsman to steer a course of 240°, his normal course from number five East Channel beacon to the Entrance Channel beacons for the Port of Brisbane. The pilot then made radio contact with Brisbane Port Control tower. The exchange took 15 seconds:

> Pilot: Brisbane Harbour – *ANL Excellence* – that's 30 minutes to the Entrance Beacon.
>
> VTS: *ANL Excellence* – Brisbane Harbour – Romeo – Captain they don't want you alongside before seven.
>
> Pilot: There's no danger of that.
>
> VTS: Brisbane Harbour - Romeo

During this time the master was watching the port radar display while the mate was using the starboard radar to check the time of passing the beacons. Both radars were set on the three-mile range. At 0525 the mate looked at the starboard radar and went to the chart table to enter the time of passing E3 beacon to starboard in the movement book. She did not hear the pilot order any course alteration.

The master, watching the port radar, heard the pilot give a series of orders to the helmsman:

> Starboard ten; starboard five, steer 240°

About 20 seconds later he realised that the relative bearings of E2 and E4 beacons were changing rapidly. He saw that the ship's heading was 210° and that the ship was swinging to starboard with the speed reducing to 17.5 knots due to the turn. The master left his chair and went to the helmsman, thinking that he had made some error. At the steering position he saw the course was now 244°, but the pilot said words to the effect that the ship would settle on course.

The pilot moved towards his electronic chart system. The screen was blank as it had reverted to energy saving mode. He tapped a key on the keyboard and the display was restored. He immediately realised that he had ordered the alteration of course at the wrong position.

The master recalled that the pilot said:

> Oh captain! Oh my God, I missed the buoy

At this time the captain said:

> OK lets go to starboard

To which the pilot replied:

> No, stop engine…

the pilot explained that there was shoal water to starboard. The engine telegraph was put to stop.

At 0528 all way came off the ship in position 27° 13.28'S 153° 19.65'E, with the ship heading 246°. The ship was aground on Middle Banks, 1.2 miles north-north-west of the temporary buoy marking the position of the E5 channel beacon (see fig. 2). The master and helmsman felt that the ship seemed to surge as it decelerated from 17.5 knots. It was one hour after high water at Tangalooma Point with a tide height of 1.6 m above datum.

At about 0528, the engine was put astern, initially on slow astern revolutions and progressively to full astern over a period of 2½ minutes. At about 0531 the engine was put to full astern. There was some initial movement astern, but the ship seemed to became fast again. Worried that the propeller wash would build up sand around the midships section, the pilot ordered 'stop engine'. The engine was stopped at about 0535.

At 0541, the pilot reported the grounding to the Port Control Tower and requested the assistance of two tugs. He also contacted the duty director of Brisbane Marine Pilots.

The master instructed the mate to sound all of the ship's tanks to establish whether the integrity of the hull had been compromised. The second mate was woken and was charged with sounding the water depth around the ship.

The soundings revealed that the ship was afloat forward and aft, but aground amidships with no sign that the hull had been breached.

At 0722 two tugs arrived at the ship and were made fast. An attempt was made to refloat the vessel at this time and there was some movement initially. At 0845 the attempt was abandoned due to the falling tide.

At 0857 a relief pilot arrived on board followed by the Queensland Water Police, who breathalysed the master and the pilot. The pilot then returned to shore.

ANL Excellence was refloated on the rising tide at 1436 that afternoon, 19 July. The vessel went to anchor and was examined both internally and externally for any damage. The vessel remained at anchor until the afternoon of 20 July when it berthed at Fisherman Islands container terminal to resume its service.

Comment and analysis

Evidence

The pilot was interviewed ashore on 19 July by ATSB investigators. He provided the investigators with a copy of his electronic chart system file for the pilotage on 19 July. This provided an accurate real-time track and course made good by *ANL Excellence* from the pilot embarkation point to the grounding. (A pilot is unable to alter or access the files recording the vessel's track.)

Investigators interviewed the master, mate and helmsman on board *ANL Excellence* and inspected the ship on 20 July. The accounts provided by the master and pilot relating to the inward passage are consistent throughout, except for some minor differences at the time of the grounding.

The ship's engine telegraph movements were automatically recorded. The automatic recorder was about 14 minutes fast compared with the local time displayed on the ship's GPS receiver. The ship was equipped with a course recorder, but it was not in operation during the inward pilotage passage.

Port Control audio tapes were obtained and provided time-stamped records of the actual VHF radio traffic to and from Port Control. The clock used in recording the times of these recordings was apparently between three and four minutes fast.

The grounding

On 19 July 2002, *ANL Excellence* grounded on Middle Banks in Moreton Bay as a result of a simple error of judgement on the part of the pilot. The pilot stated that he had ordered the alteration at E3 beacon, a starboard hand lateral mark, by mistake.

At the time of the grounding it was still more than an hour before sunrise with nautical twilight at 0541. The sky was overcast and so in the absence of any natural light, the pilot was reliant on the lights of the navigational aids marking the channel to visually indicate the ship's position in the East Channel. For some reason the E3 beacon (green, flashing at 4 second intervals) provided an incorrect cue to the pilot that the ship had reached the temporary buoy (green, continuously flashing very quickly) marking the position of the original E5 east cardinal beacon (white, three very quick flashes every 5 seconds).

The distance between E1 and E5 beacons is about 6050 m (3.23 miles) and between E1 and E3 beacons the distance is about 4100 m (2.22 miles). At 19 knots *ANL Excellence* would have covered the distance between E1 and E5 beacons in 10 minutes and 21 seconds. The pilot, however, ordered the alteration of course about seven minutes after passing E1 beacon.

At, or approaching E3 beacon, the pilot apparently missed several visual and time cues and adopted his usual routine as though the ship was passing E5 beacon. The pilot said that, although he could not see the temporary buoy marking the position of E5 Beacon, he could see the lateral beacons E2 and E4 on the port side ahead of the ship. Despite this, he still ordered the course alteration and called port control to give them the ship's estimated time of arrival at the Entrance Beacons. He did not, however, check the ship's position using the ship's navigation aids or the portable electronic chart system, which was his usual practice, prior to ordering a course change. In the time leading up to the course alteration, the pilot was engaged in conversation with the master and it appears that when he ordered starboard rudder, for whatever reason, the pilot had lost his awareness of the ship's actual situation.

The channel marking

On 21 April 2001, the container ship *Maksim Mikhaylov* (ATSB report number 168) made heavy contact with the east cardinal light beacon E5, effectively destroying the beacon. Queensland Transport (the State government department responsible for the operation of the port) established a starboard lateral light buoy in its place. This was promulgated by Queensland Transport notice 179(T)/2001 of 16 May 2001, which was superseded by 198(T)/2001 of 18 May 2001. The Australian Hydrographic Office promulgated the change in Edition 12 of the Australian Notice to Mariners of 8 June 2001, notice 333(T)/2001.

In July 2001, a second navigation light in Moreton Bay was destroyed by an unidentified vessel. This light was the rear leading light (rear reciprocal) of the Entrance Channel leads.

During the year Brisbane Marine Pilots raised the issue and timing of the reinstatement of beacon E5, and the withdrawal of the temporary lateral buoy, with the harbour master. The issue was raised formally and minuted at three meetings between the regional harbour master and the directors of BMP. At a meeting on 4 December 2001 it was anticipated that beacon E5 would be replaced early in 2002. In late 2001, Queensland Transport decided that a single contract should be drawn up covering the replacement of both navigation aids as a single project, as this would be the most economical course.

At a meeting between the parties on 21 February, the harbour master expected the replacement of both beacons to be completed in June or July 2002. At a later meeting on 10 May, the anticipated date of completion for replacing the two navigation aids was further amended to October 2002.

The green lateral buoy in place of the original E5 beacon had a major disadvantage in that green lights are not as visible or conspicuous as white lights and the green light did not indicate a cardinal mark. The temporary light buoy exhibited the same colour light as E3 beacon, however its interval was markedly different (VQG). In addition, the buoy was not equipped with a radar reflector.

The ship's staff were not aware of the temporary change to the navigation mark at the south-east extremity of Middle Banks. *ANL Excellence* received its chart corrections through the UK Hydrographic Office. The charts in use were corrected to the latest edition of the Admiralty Notice to Mariners received on board. The information concerning the temporary replacement of beacon E5 was contained in Admiralty Notice to Mariners Weekly Edition 25 of 21 June 2001, as a correction to Volume K of the Admiralty List of Lights and Fog Signals. There was no temporary notice promulgated for chart AUS 236 through the British notices.

The Mariner's Handbook, published by the United Kingdom Hydrographic Office details in Chapter 1 issues of chart correction and safety critical information. The chapter notes the proliferation of temporary changes to navigation aids and notes:

> 1.55
>
> … Information that does not warrant a Notice may have to await the next edition. Admiralty Sailing Directions, Admiralty List of Lights, and Admiralty List of Radio Signals can be corrected more frequently than major corrections can be made to charts, and should be carefully examined in conjunction with the chart.
>
> 1.66
>
> … Note A (T)NM will not normally be initiated where the information will be valid for less than 3-6 months. In such cases this information may be available as an RNW (1.56) or a local Notice to Mariners.

The chart in use aboard *ANL Excellence* at the time of the incident indicated that beacon E5 was still in situ.

A pilot is engaged for his/her local knowledge, including temporary changes in the port environment. The pilot on board *ANL Excellence* was fully aware of the temporary change to the navigational aids marking the East Channel, specifically the temporary buoy which had been marking the position of the E5 beacon for the previous 15 months. He was also fully aware that the light characteristics of E3 beacon were different in colour and characteristic from the original cardinal beacon. During the initial information exchange the pilot made no check to ensure the ship's chart had been corrected nor did he inform the crew of the temporary change to the navigation aid.

On the inward passage all beacons were showing good target returns on the ship's radar. The temporary buoy was not displayed on the radar or was not obvious. Beacons E2 and E4 were visible to port but the buoy marking the position of beacon E5 was obscured by rain. The passing rain shower temporarily removed a potentially important visual prompt that may have alerted the pilot, master or mate to the correct alteration point, or immediately alerted the master that the ship was leaving the channel.

The probability is that had beacon E5 been in place, or a temporary buoy with a conspicuous white light been used as a temporary mark, it would have provided a dominant cue and the pilot would not have altered course at beacon E3.

The pilot's electronic chart system

In their submission, Queensland Transport noted that the electronic chart system carried by the pilot has no official endorsement as a navigational tool and, while recognising the system's utility, considers that it should not be accepted as an alternative to the conventional approved methods of navigation in confined waters.

Pilots do not usually navigate in the sense of fixing a ship's position on a chart and then setting a new course, generally time does not allow for this. Using their local knowledge, a pilot conducts the ship by monitoring its position within the fairway to keep it within safe water. A pilot should recognise his/her surroundings without reference to the chart, either by recognising navigation marks, or landmarks, or, when circumstances require, being familiar with radar pictures.

While accepting, where appropriate, pilots may use radar to confirm the ship's position, the ECS carried by the BMP pilots is a very accurate system. Both are aids to assist the pilot. A properly set up ECS provides the pilot with instant confirmation of his visual assessment of the ship's position. The ECS also provides an accurate forecast of the ship's position if a certain course and speed is maintained. The ECS has the advantage of being the pilot's equipment and thus provides information, which he knows is of consistent quality.

The pilot did not use his ECS to confirm the ship's position before altering course, although he stated that it was his normal practice to do so, was a factor which contributed to the grounding. He assumed that the ship was in a position off the E5 Beacon and in his mind had no need to check any of the ship's navigational equipment including the radars or chart. When he went to his lap top computer, after he had ordered the course alteration, it had reverted to a blank screen.

A pilot's main tool remains his/her visual acuity, detailed knowledge of the pilotage area and ship handling skills. While radar and ECS are useful tools they should be used to support a pilot's decision making process, not as a substitute.

The pilot's lap top computer was placed in the starboard corner of the wheelhouse, about seven metres from the centre line and about five metres from where the pilot was standing. Where he placed the unit was dictated by the position of a convenient power outlet. Had the lap top been closer to the pilot's normal conning position he would probably have been more inclined to refer to the ECS. This grounding is

the second accident in Moreton Bay in which the ECS was placed away from the pilot's normal conning position.

In submission BMP stated:

> BMP does not endorse or require pilots to place their ECS in any nominated position whilst conning the vessel. The position of the ECS does not necessarily contribute or detract from the overall performance of the pilot's duties. There is no normal position per se; in most cases, the position for the ECS will be determined by power socket location, safe position, glare from the sun, etc. In other words, the position of the ECS should not adversely impact on a pilot's ability to reference this equipment.

In addition, the fact that the system can revert to a power saving mode at a potentially critical moment is a weakness in the system. The screen saver is programmed by the user, as is the hard disk sleep function. The pilot had the screen saver set at 15 minutes and the hard disk power down at 30 minutes. Such settings may be necessary to save power when operating on batteries. When operating on mains power there is no reason to have any limitation on the display time. Appropriate use of the computer's power management system would allow the pilot to select different settings for the when the lap top is using mains or battery power.

Preventative measures

The act of a ship entering the confines of a port involves interaction between the ship's crew and port services often with specialist navigation assistance provided by a pilot. The way in which the parties interact is defined by various conventions and rules whose purpose, among other things, is to effect the safe passage of the ship to the berth. In any such 'system', there should be sufficient safeguards or defences to prevent an oversight or error on the part of any individual leading to catastrophic consequences.

On the morning of 19 July 2002, there were defences which may have prevented *ANL Excellence* from grounding as a result of the pilot's order to alter course prematurely.

Effective passage monitoring by the master and/or mate would have allowed the pilot's order for the premature course alteration to be challenged or countermanded. In addition, with VTS radar coverage of the area, there was also the possibility of a warning from Brisbane port control when the ship deviated from the standard track. Given the speed of the ship and the proximity of shoal water west of beacon E3, any such action would need to have been virtually immediate.

Bridge Resource Management during the pilotage

On the morning of 19 July, the pilot was able to order an erroneous course alteration although the intended passage and alteration off the position of E5 Beacon was understood by the master and mate and was programmed into the ship's radar. The pilot's order off E3 Beacon was executed without any crosscheck or challenge. Neither the master nor mate checked the ship's position at the time. The grounding became inevitable before the pilot's error was detected by either member of the ship's bridge team.

During the initial pilot/master information exchange the pilot provided the master with a full plan of the inward passage. He also invited the master and mate to 'challenge' him if there was any order that he gave, or aspect of the conduct of the vessel, about which they were concerned. This part of the interchange between the pilot and the bridge team was consistent with the ship's own procedures.

The shipping company's standing orders covering bridge procedures referred to 'Bridge Instructions' published by the Swedish Club. These general instructions introduce the concept of ship's deck officers adopting an aviation pilot/co-pilot approach when working as a navigation team in conditions of intense or restricted navigation. This section of the instructions does not refer specifically to times when a port pilot is on board but rather to

situations requiring a high degree of attention over a prolonged period.

In the section on ‘Navigation with a Pilot On Board’, the Swedish Club’s ‘Bridge Instructions’ stress that the duties and obligations of the master and officer of the watch are in no way diminished by the presence of a harbour or sea pilot. The guidelines require close cooperation between the officer of the watch and the pilot and emphasise the idea of ‘challenge’ when the limits of the passage plan are exceeded or there are doubts about the pilot’s actions. They also require that the officer of the watch ensures that the steering and engine orders are executed according to the pilot’s orders.

The evidence is that the mate habitually spent prolonged periods in the chart room. Other than entering the ship’s position and engine orders in the bell book she took no part in monitoring the conduct of the ship or monitoring the pilot’s actions. She was newly promoted and it was apparent that the relationship between the master and mate was strained. The impression gained from the interviews was that she was anxious to minimise direct contact between herself and the master.

This interpersonal tension effectively nullified the active participation of one qualified navigator in the bridge team.

During the initial information exchange the master provided the pilot with details of the ship and brought to his attention a possible steering problem. The ship had also prepared a ‘Brisbane Pilot to Brisbane Port’ passage plan via the East Channel, based on GPS waypoints, for the passage to the berth. Waypoint 10, at 27°10.9’S 153° 20.7’E, corresponds with a position 450 m east-south-east of beacon E1. The course from this point was noted as being 191°(T) with a distance to the next waypoint of 3.3 miles. Waypoint 11 was 450 m south-east of beacon E5, at 27° 14.1’S 153° 20.0’E.

The two radars were set to the three mile range, giving a radar scan of 7 minutes and 50 seconds ahead of the bow. The waypoints and the courses between the waypoints were generated on the radar screens. The proposed route was shown as a fixed red line.

Passing beacon E3 the visibility was moderate, with some restriction due to rain. The mate was at the forward part of the bridge as the vessel approached E3 beacon, close to the starboard radar. She returned to the chart table to enter the time of passing the beacon in the bell book. She stated that she did not hear the pilot’s order to the helmsman for starboard rudder.

The master was aware of the pilot’s order for starboard 10° rudder and then starboard 5° rudder. The ship was making headway at about 18.5 knots (571 m/min, 9.52 m/sec). The master was not using a parallel index technique on the radar to monitor the ship’s position in the channel although the projected course was displayed on the radar as a red line. When he heard the pilot give the order to the helmsman at about 0525 (based on the pilot’s portable electronic chart system the actual time was probably 0524:40), the master did not immediately associate the order with the alteration of course. He was not anticipating the alteration, although he could not see any beacon or navigation mark ahead to starboard.

When the master became aware that the relative bearings of beacons E2 and E4 were changing unexpectedly his first thought was that the helmsman had made an error. He recalled that the course was about 210° by gyro when he realised the ship was in the process of a substantial course alteration. Between 30 and 40 seconds had elapsed since the alteration of course had been ordered and between 20 and 30 seconds after the ship responded to the order.

By this time the ship was turning rapidly to starboard at about 36°/min under a small angle of rudder.

Given the master's relatively slow reaction to the pilot's order for the course change, it is doubtful that he had full situational awareness of the ship's navigation in the period leading up to the order. Given this situation and that fact that the mate was apparently not actively participating in the pilotage, the ship's members of the bridge team were ineffective in preventing the grounding.

Vessel Traffic Service Centre

The Brisbane Port Vessel Traffic Service Centre has radar coverage of the whole of the compulsory pilotage area. Pilots of inward bound vessels routinely provide their ship's estimated time of arrival (ETA) at the Entrance Beacons after clearing East Channel and while, or just after, altering course to about 240°.

ANL Excellence was the only pilotage movement between 0300 and 0600. When the pilot called at 0525 the ship would have been the only sizeable movement on the radar coverage. Had the port control VTS operator realised that the pilot was reporting his ETA earlier than normal and/or detected the alteration of course he would have been in a position to warn the pilot that the ship was standing into danger.

The pilot's evidence is that he made the call to port control after ordering the alteration. The master's account of the incident supports the pilot's account. Unfortunately the time of the VHF radio call is not accurately known as the time stamps on the voice recordings were in error by some minutes. When it was reset by a port officer the time difference between the computer time and UTC was not accurately noted.

It is not possible to assess whether or not the alteration of course was apparent on the VTS radar display at the time of the call. There would have been some delay before the VTS operator could have recognised that the ship had departed from the usual track. Nor is it clear, with the turn established, whether a warning by the VTS operator would have been in time to prevent the grounding.

At present the role fulfilled by VTS in Queensland ports is an information service. It is not the job of the VTS operators to attempt to remotely pilot vessels. Their task is to advise pilots of other traffic and to act as a communications hub. This does not, however, preclude the provision of warnings to pilots (in exceptional circumstances) by the VTS operators who routinely monitor the passage of ships using their navigation channels.

Historically there has been some reluctance by pilots to accept advice from persons not qualified in pilotage. VTS operators have been reluctant to warn pilots in case the pilot is fully in command of the situation and is dismissive of intervention from ashore. An unnecessary call might also be a distraction to a pilot and the ship's bridge team during a critical time in a manoeuvre. Often ships are operating in restricted waters and the opportunity for effective intervention is very limited.

When exchanging radio messages a simple radio protocol could help reduce the risk of an accident. In future, when calling or called by a ship, the VTS operator could identify the ship's position within the channel. In this case a reference to beacon E3 may have been a warning to the pilot that he was altering at the wrong beacon.

Queensland Transport indicated that they were currently reviewing vessel traffic management with a view to enhancing the role of VTS to make it more pro-active and interactive. Such a role may include the provision of advice to ships under pilotage, however the responsibility to act on any such advice will remain with the master and/or pilot on the vessel.

In submission Queensland Transport stated with regard to the issue of VTS:

> As the report correctly observes, the VTS is an information system only and is not equipped to

provide instant off course alarms. And the VTSOs are not trained to carry out a higher level function. The level of service being provided is under review. However, any increase in the level of service has considerable implications for equipment and training needs.

Fatigue

The grounding occurred at a time of day coinciding in a 'trough' in the human 'circadian rhythm', which has a negative affect on alertness; the hour before dawn is a time associated with a marked reduction in human performance.

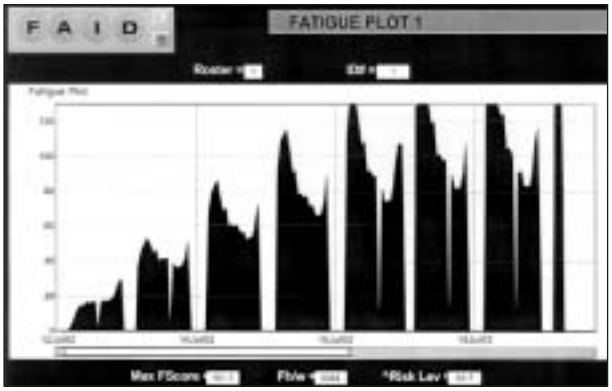
The pilot had returned from a period of leave on 18 July. *ANL Excellence* was his first ship on roster for a period of 8 days. He should have been refreshed and his performance unaffected by any considerations of fatigue through prolonged duty hours. With an early morning start, initially 0200, he could have anticipated the need for rest. He did have an opportunity to rest in the afternoon, however, if he was not inclined to sleep then he could not force it. He did sleep from about 2100 to midnight and again after midnight but he would also have been affected to some degree by the 'early morning effect'.

As the pilot's duty roster developed, his hours of work would have been subject to the BMP fatigue management system. However, given that the pilot had only been on roster for one day, it would be difficult to extract a meaningful score from the FAID system for the purposes of this investigation.

In the case of the master and mate of *ANL Excellence* the FAID program is easier to apply. *ANL Excellence* had been on passage from Singapore, through the Great Barrier Reef. The ship had been maintaining normal sea watches since Singapore, but the master had been on duty for extended and irregular hours as a result of the demands of the pilotage through the Great Barrier Reef and the arrival time off Brisbane. On 16, 17 and 18 July, particularly, he had had less than six hours broken sleep each day (see fig. 3). The mate, although maintaining watches, had also worked extended hours particularly on 14 and 15 July (see fig. 4).

FIGURE 3:
Master's fatigue index plot

FIGURE 4:
Mate's fatigue index plot



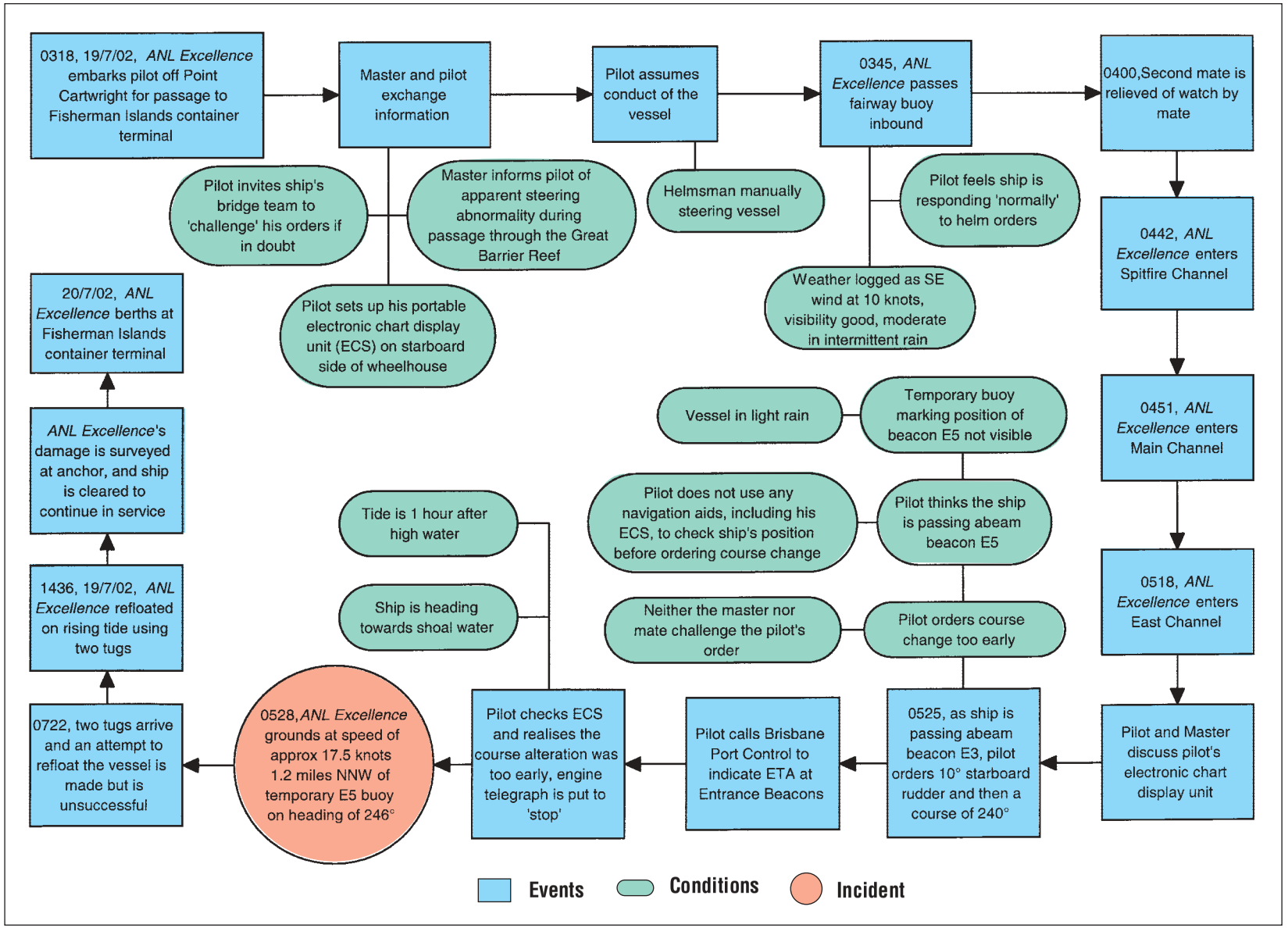
A score in excess of 80 indicates that fatigue may start to affect performance. Both the master's and mate's scores at 171 and 158 respectively, were very high around the time of the incident with their pre-existing level of fatigue compounded by the time of the day.

Fatigue degrades performance. The fact that the master heard the pilot give an order to the helmsman but was slow to realise the implications of the alteration and that he first checked the helmsman, rather than query the pilot, is a sign of probable fatigue.

Drugs and Alcohol

Neither prescribed, 'over-the-counter', or illicit drugs, nor alcohol were a factor in the grounding.

FIGURE 5:
***ANL Excellence*: Events and causal factors chart**



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.

Based on the evidence available, *ANL Excellence* grounded on Middle Banks on 19 July 2002 as a result of the pilot erroneously ordering an alteration of course at the starboard lateral beacon E3 instead of at the temporary starboard lateral buoy marking the position of the original east cardinal beacon E5. The following are considered to be factors in the incident:

1. The pilot did not follow his normal procedure of checking the position of the course alteration using his portable electronic chart system.

2. The temporary buoy marking the original position of the original east cardinal beacon E5 (the turning mark) was obscured by rain.

3. The green light on the temporary buoy was not as conspicuous as a white light, which would normally be associated with a cardinal navigation mark.

4. Although not suffering from chronic fatigue, the pilot's performance was probably affected by the trough in his circadian rhythm associated with the hours between 0400 and 0600.

5. The pilot's electronic chart system was placed at a significant distance from where he was standing, with its display in power saving mode at a critical moment.

6. The bridge team did not detect the erroneous helm order as a result of:

    1. Both the master and mate were probably fatigued as a result of their hours of work during the passage through the Great Barrier Reef, which was exacerbated by the 'time of day' effect.

    2. Neither the master nor the mate were sufficiently aware of the ship's situation, at the time, to challenge the pilot's premature order for the course alteration.

    3. Insufficient attention was paid to the ship's radar display.

    4. The navigation chart in use by the ship did not show the temporary replacement of E5 cardinal beacon with a temporary starboard lateral buoy marking the south-east extremity of Middle Bank.

    5. The interpersonal tension between the master and mate effectively nullified the active participation of one qualified navigator in the bridge team.

Safety actions already initiated

Queensland Transport are in the process of reviewing VTS management with a view to making the system more interactive and proactive.

Recommendations

MR20030022

Where port authorities use a buoy or other temporary aid to replace an established navigation aid, the shape and the light characteristics of the temporary aid should be consistent with those of the aid it replaces.

MR20030023

Brisbane Marine Pilots should review the power management settings and placement of a pilot's portable electronic chart system to ensure that the information displayed remains easily visible from the pilot's conning position at all times during a pilotage.

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, mate, pilot, the ship's management company, Queensland Transport, Brisbane Marine Pilots and the Australian Maritime Safety Authority.

Submissions were received from Brisbane Marine Pilots and Queensland Transport and where appropriate, the report text has been amended and portions of the submissions included.

ANL Excellence

Former Names	*Ibn Zaidoun* – 1997, *Ville de Venus* – 2000
IMO Number	9134517
Flag	Liberia
Port of Registry	Monrovia
Classification Society	Germanischer Lloyd (GL)
Ship Type	Cellular container ship
Builder	Samsung Heavy Industries, Korea
Year Built	1997
Owners	Hansa Africa Corporation
Ship Managers	Leonhardt and Blumberg
Gross Tonnage	37 394
Net Tonnage	20 334
Deadweight (summer)	42 953.6 tonnes
Summer draught	11.717 m
Length overall	227.93 m
Breadth	32.20 m
Moulded depth	14.78 m
Engine	Samsung-Sulzer 7RTA84C, two-stroke, single acting, direct reversing.
Total power	28 350 kW
Crew	20 (Russia, Ukraine, Kirabati, German)

Independent investigation into the grounding of the Liberian registered container ship ANL Excellence in Morton Bay, Queensland 19 July 2002

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