Australian Government
Australian Transport Safety Bureau

# Grounding of the Australian flag training vessel *Wyuna*

Tamar River, Tasmania | 19 October 2000


Investigation

**ATSB Transport Safety Report**
Marine Occurrence Investigation
161
Final

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Report No 161

# Navigation Act 1912
# Navigation (Marine Casualty) Regulations
# investigation into
# the grounding of the Australian flag training vessel
# *Wyuna*
# in the Tamar River, Tasmania
# on 19 October 2000

Issued by the
Australian Transport Safety Bureau
March 2002

# Sources of information

Master and crew of *Wyuna*

The Australian Maritime College

The Port of Launceston Authority

Australian Maritime Safety Authority


## Acknowledgment

The Australian Transport Safety Bureau is grateful for the assistance provided by the staff at the Australian Maritime College's ship simulator unit in simulating the incident.

The Inspector is grateful to Interdynamics Pty Ltd ( www.interdynamics.com) for the computer program, FAID 330E, which was used in the analysis of the fatigue factors.

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**FIGURE 1:**
***Wyuna***

# Summary

On 19 October 2000, the Australian Maritime College vessel *Wyuna* was being used to train students in night pilotage exercises in the Tamar River.

The exercises had commenced before dawn that morning, resuming at 2000 under the master's supervision. An outward passage and an inward passage were satisfactorily completed and a second outward passage was started.

The tide was ebbing. The sky was overcast with moderate rain, the wind was SSE at force 4/5 and the visibility was moderate to good. During the early stages of the passage out, the master observed that the vessel was overshooting course alteration points. On both occasions he verified *Wyuna's* position and brought the vessel back on track.

After clearing North West Bank beacon, the master became disorientated and confused North West Bank Beacon for Shear Rock Beacon. He instructed the student on the con to set a course to take *Wyuna* clear of the river, but the vessel was set on course for Shear Rock. At 2305, *Wyuna* struck Shear Rock.

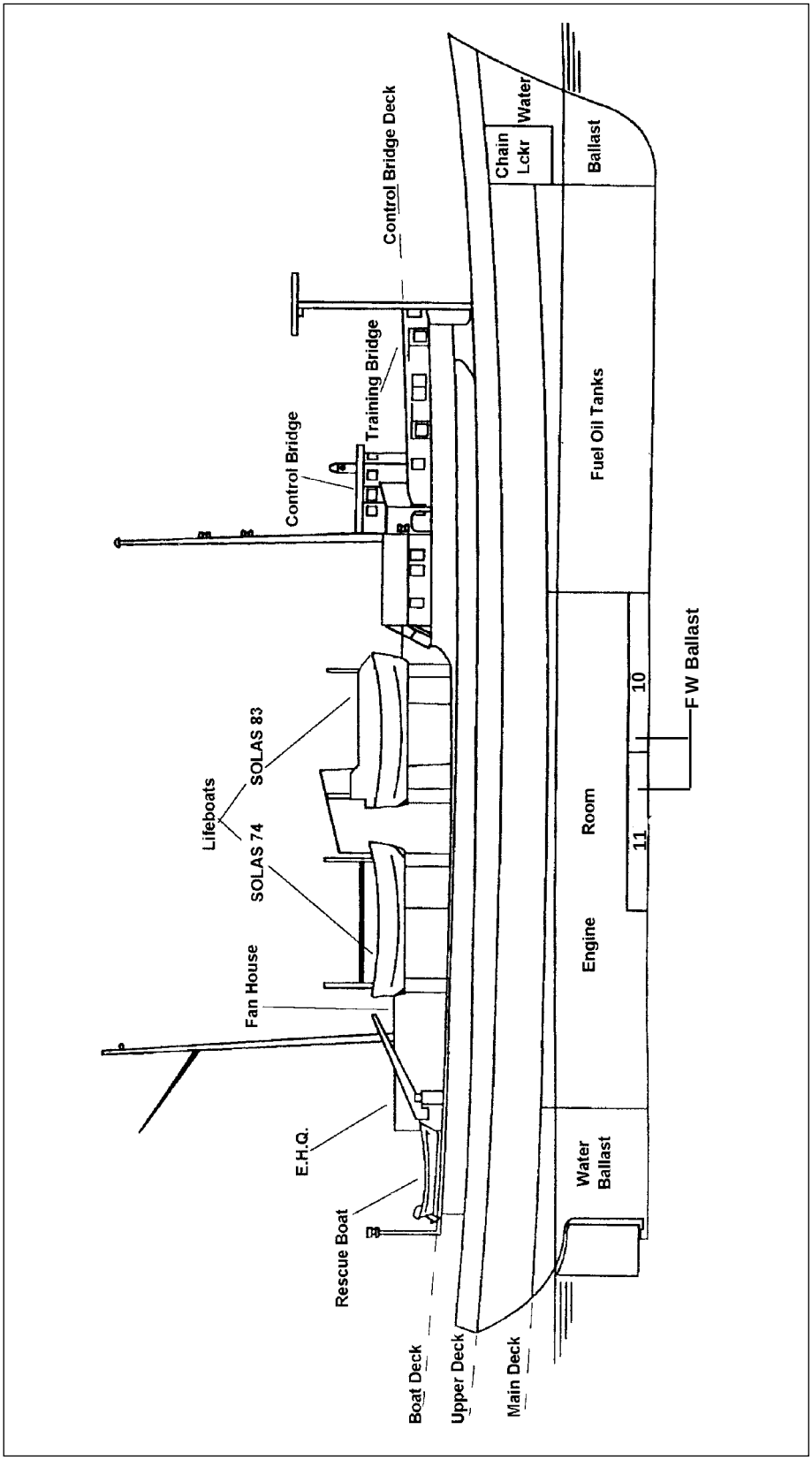
The master stopped the engines and checked the electronic chart display, which showed the vessel on Shear Rock. The tide was setting the ship across the rock but, about 2 minutes later, the ship was afloat once more, being carried northward across the channel.

The master let go the port anchor with a shackle[1] and a half of chain, but this did not arrest the ship's drift and, at 2315, the ship grounded once more, on Middle Bank. The chief engineer reported that there was no apparent damage to machinery, so the master used the engines to prevent the ship from going further aground and, at 2317, *Wyuna* steamed back into the channel.

The master took the ship back to anchor at Bell Bay while continuing to check the vessel for any damage. No oil or water was lost from the ship but numbers 10 and 11 double bottom tanks were making water through sprung seams and rivets.

[1] A shackle is about 27 metres

**FIGURE 2:**
**Plan of *Wyuna***



# Narrative

## *Wyuna*

*Wyuna* is an Australian flag training vessel owned and operated by the Australian Maritime College (AMC) based in Launceston, Tasmania. The vessel's primary function is to provide practical seagoing experience to the nautical and engineering students attending the college.

*Wyuna* was built in Glasgow, Scotland, in 1952 as a pilot vessel for the Port Phillip Sea Pilots, to operate off Port Phillip Heads. The vessel was built under Lloyd's survey and maintained to Lloyd's class until 1981, when it was presented to the newly-created Australian Maritime College. Since then, all surveys of the vessel have been conducted by the Australian Maritime Safety Authority.

*Wyuna* is 63.5 m in length overall and has a beam of 11.9 m. It has a displacement of 1 831 tonnes at its maximum draught of 5.0 m.

The accommodation is situated above the engine room and tank spaces. There are two wheelhouses located at the forward end of the accommodation. The upper or control bridge is located on the control bridge deck and the lower or training bridge is located on the boat deck. The vessel has 45 berths for its crew and students, located on 3 decks, behind the training bridge, on the boat deck, the upper deck and the main deck. The galley and mess are located aft on the upper deck below a fully equipped radio room.

*Wyuna's* propulsive power is provided by two 515 kW electric motors driving twin fixed-pitch propellers. Power for the electric motors is provided by three English Electric, 380 kW, 400 V direct current generators each driven by a 476 kW, 4-stroke, diesel prime mover. Electrical power for ship's services is provided by two 150 kW, three 60 kW and one 50 kW, 220 V direct current generators. The vessel's maximum service speed is 13 knots when all three main diesel generators are supplying the electric propulsion motors.

Below most of the engine room space are double-bottom water ballast tanks. Immediately forward of the engine room are deep tanks, which are used for distillate bunkers and forward of these tanks is more water ballast space in a combination of double bottom and deep tanks.

*Wyuna* is equipped with an extensive array of navigation aids including a sophisticated PC-based electronic chart system (ECS) integrated with a differential global positioning system (DGPS) and 3 radars, one with ARPA. The vessel also has a recording echo sounder, a course recorder, gyro and magnetic compasses and equipment for training students in radio communications.

*Wyuna's* regular complement consists of the master, mate and 2$^{nd}$ mate, chief engineer 1$^{st}$ and 2$^{nd}$ engineers and the bosun, all permanent employees of the AMC. When an overnight trip is planned with students, a cook is engaged. Students then form the rest of the crew, performing the duties of deck and engine room ratings.

The mates and engineers work 4 on, 8 off watches when the vessel is at sea. The regular officers instruct students during their periods on and off watch and these instructions may be supplemented by lectures from other lecturers who may be on board.

*Wyuna's* master had been the vessel's permanent master since 1992. He also had 10 years command experience in the Australian

Merchant Navy and had held an Australian Master Class 1 Certificate of Competency since 1974. In addition to regular duties as master of *Wyuna*, he is the coordinator for the AMC's gas tanker courses. At the time of the incident, the master held a current pilotage exemption certificate for the Tamar River issued by Marine and Safety Tasmania for vessels under 65 m in length.

The mate on board *Wyuna* at the time of the incident had a Chief Mate Class I certificate and also held a pilotage exemption for the Tamar River.

The 2nd mate also had a Chief Mate Class I certificate, but he did not have pilotage exemption for the Tamar.

## The Australian Maritime College

The Australian Maritime College was established by an Act of Federal Parliament in 1978 to service the needs of the Australian maritime industry. In 1980, the AMC accepted its first intake of shipping officer cadet students and has, since then, provided progressively diverse services to the maritime industry. This includes teaching in areas of maritime operations, ocean engineering, marine engineering, naval architecture, fisheries and maritime business. In addition to teaching, the AMC performs research and industry consultation activities in many of its areas of maritime expertise.

The AMC has infrastructure located on two major campuses in Northern Tasmania. The main campus is located at Newnham, a suburb of Launceston, and this is where the faculty of Maritime Transport and Engineering is based. The faculty of Fisheries and Marine Environment is located at Beauty Point, about 50 km north of Launceston, on the west shore of the Tamar estuary.

The faculty of Maritime Transport and Engineering provides a range of courses for deck and engineer officers which are STCW '95 compliant and approved by the Australian Maritime Safety Authority (AMSA). One of the faculty's resources is the training vessel *Wyuna*, which is used to provide (among other things) practical navigation, pilotage, ship handling and survival training for advanced diploma and diploma level nautical science students.

## Management of the vessel

Each of the major physical facilities of the AMC has a manager. In the case of *Wyuna*, the master is the manager, responsible for its operation in compliance with the Navigation Act and associated Regulations and Marine Orders. He is also responsible for the training of students undertaking courses on board and for conducting safety courses.

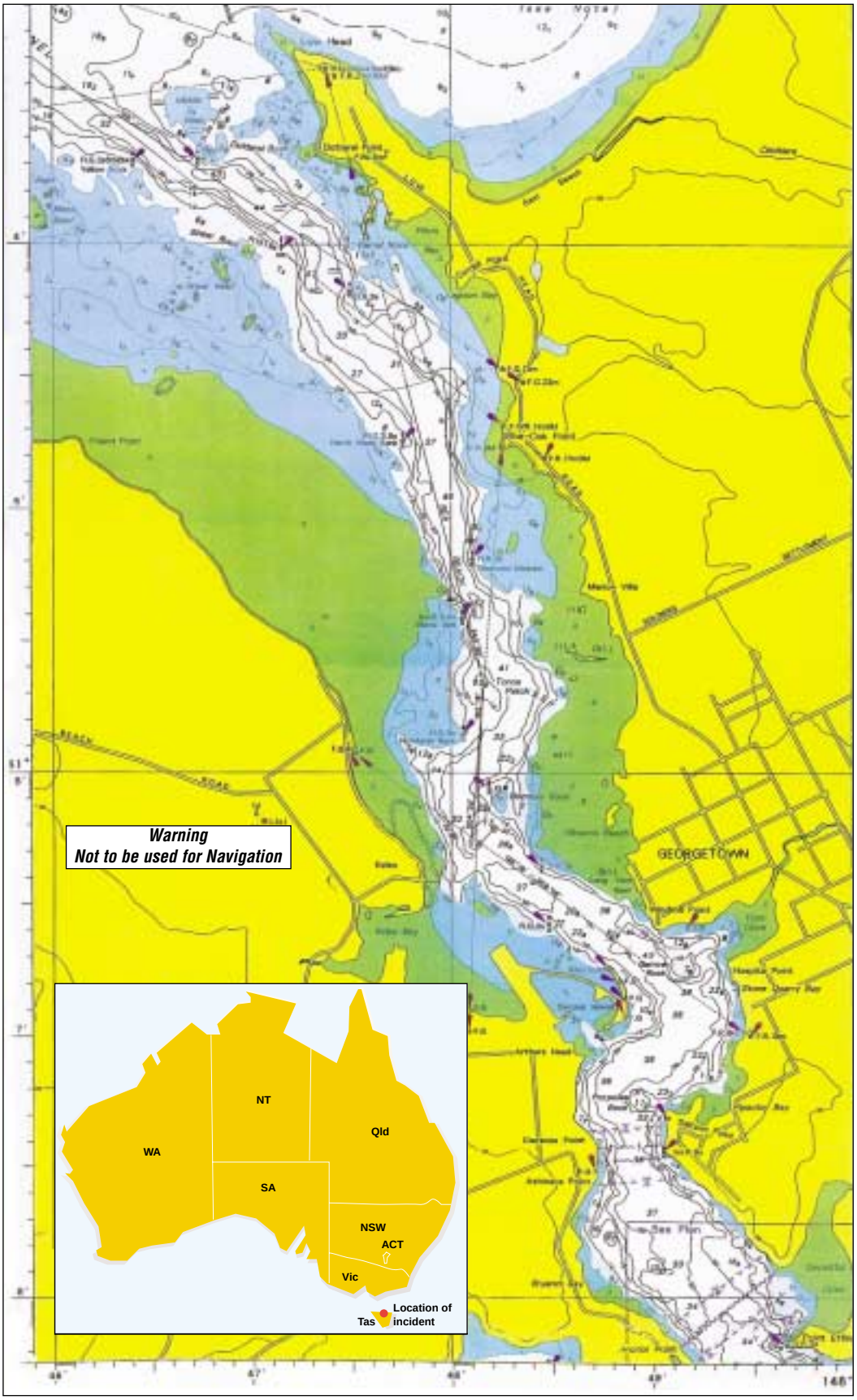
## Tamar River pilotage

The Tamar River is located in northern Tasmania and flows northward from Launceston to its mouth at Low Head. Pilotage is compulsory in the Tamar River for all vessels 35 m or more in length. The pilotage, from the boarding ground off Low Head to Bell Bay (Port Dalrymple), is about 11 miles in length. See chartlet (on page 7) for further detail. The channel is about 280 m wide at the entrance and has a least width of about 210 m.

The pilotage plan used by *Wyuna* consisted of 9 legs between the vessel's berth and a position clear of Middle Reef.

The Port of Launceston Authority confirmed that on the night of 19 October all light beacons in the outer reaches of the Tamar River were operating.

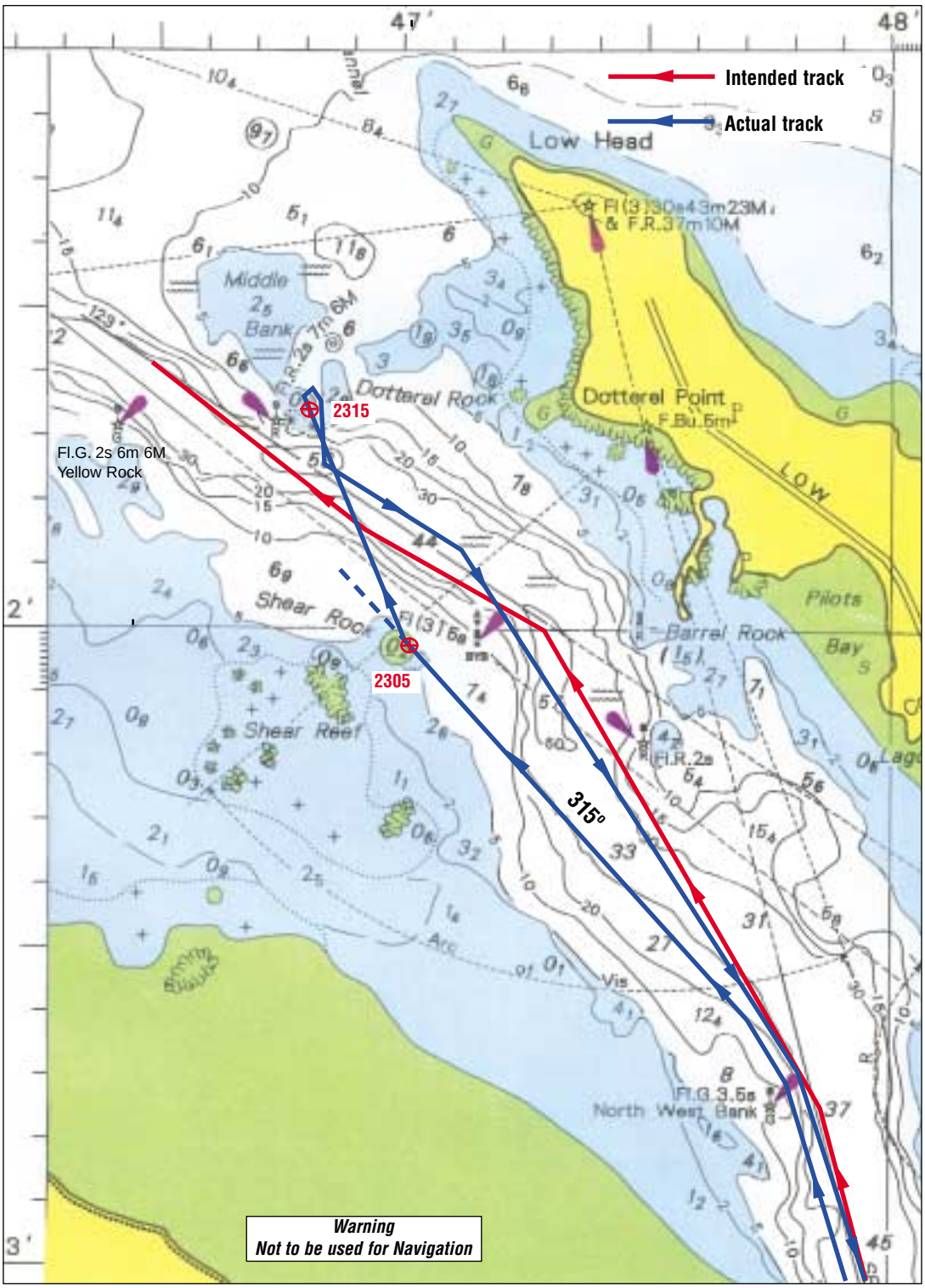
**FIGURE 3:**
**Chartlet of Tamar River**



## Preparation for the exercise

Twenty five nautical students were due to undertake navigation and pilotage training in mid October 2000. Notes for the conduct of the exercise were provided to the students a week in advance to give them time to familiarise themselves with the passage plan and instructions before joining the vessel. The notes, entitled Bridge Resources Management, contained instructions for both visual and blind (zero visibility) pilotage.

**FIGURE 4:**
**Chartlet of area including tracks from ECS**



The notes stated:

**Outline**

The exercise will be conducted in the training bridge of *Wyuna*. Control of the vessel will be by students operating in the training bridge with a lecturer present. A senior officer…will be in the control bridge where direct steering and engine control can be taken in the event it is deemed necessary. …

…Navigation will be by use of Bridgemaster radar, differential GPS and electronic chart. A standard paper chart is used as the basis for navigation, but conventional position fixing techniques will not be used. Instead, radar parallel indexing and direct assessment of cross track error from pre-designated tracks on the electronic systems is to be the means of guiding the ship through the passage. Rate of turn, water referenced speed and underkeel depth are all indicated close by the other equipment in the wheelhouse front.

At the AMC jetty, the ship will be handed over to the students after unberthing, clear of the berth and headed North. From this position, the ship will complete the complete river pilotage until reaching a point on the entrance leads marked as waypoint 10. Here the ship will be turned about and the pilotage re-run back to the AMC jetty.

For zero visibility, all the bridge windows will be blanked….

… Students will operate the vessel in teams of 3, …master, duty officer and helmsman. At pre-determined points, rotation between duties will take place.

**Operational notes**

…This is a very difficult exercise because everything happens so quickly and you must orientate yourself entirely on the instruments. You will have the pilotage courses plotted on a paper chart on a desk in the forepart of the wheelhouse, duplicated on an electronic chart display next to this, and again as a radar map on the Bridgemaster radar next to this. You will not have the time to fix the ship's position on the paper chart. Consequently, you must navigate by sight, radar and electronic chart. …Below are listed some of the commonly experienced problems….

Altering course too late and too little, resulting in heavy overshoot on the turns.

…Making course adjustments too late. You have no time to spare and very little margin for error

…Over correcting...

…You can not afford to ignore your radar. Only the radar can inform you of any traffic in the vicinity. In addition, the value of both the electronic chart and the radar map depends entirely on the accuracy of the DGPS receiver. If the DGPS receiver drops out of DGPS mode, the radar map and the electronic chart are useless. …you should always have a parallel index line set for the next clearing point. Such a setting can be made by the officer of the watch as you are going, and clearing distances from main points are given in the pilotage notes below. …Index lines must be set allowing for the current gyro error.

## The incident

On 16 October 2000, 25 Master Class 1 students joined the training vessel *Wyuna* at Beauty Point to spend five days conducting navigation and pilotage training around northern Tasmania. The training included day and night pilotage exercises in the Tamar River. The students were divided into 7 operational groups of 3 and one group of 4 with each group assigned a letter from 'A' to 'H'.

The vessel, with a draft of 3.8 m forward and 4.25 m aft, was operated around the clock. The students were rotated through the various activities including practical exercises and lectures by the *Wyuna's* master and officers. At the end of the first day, each group had completed a transit of the Tamar River, either inward or outward, during daylight. During these pilotage training runs, each student had performed the role of (a) master with the con, or (b) officer of the watch assisting the master, or (c) helmsman, each operation being supervised by *Wyuna's* master or mate during their respective watches. The pilotage training

utilised a passage plan with all waypoints programmed into the ECS on the training bridge.

The vessel then made a short voyage to conduct navigation exercises off Flinders Island. *Wyuna* returned to the anchorage off the Tamar River late on 18 October, weighing anchor a little before 0400 on 19 October to start night pilotage exercises.

The purpose of the night pilotage exercise was to familiarise students with piloting the vessel visually, using illuminated channel buoys, beacons and leading lights. During the exercise, the master or first mate monitored the vessel's progress using the integrated ECS/DGPS, providing real time position information. As the ECS monitor was located on the forward console in the training bridge, the master dimmed the screen during the exercise to ensure that the students only used visual cues and radar for navigation of the vessel. The students were advised to monitor cross track error using parallel indexing on the ARPA equipped radar.

Night pilotage exercises started at 0400 on 19 October under the supervision of the first mate. Two runs were completed before dawn with student groups A and B. Later in the morning, after completing the exercise the mate informed the master that the vessel was set down heavily onto Barrel Spit beacon by the flood tide during the second pilotage run. He also advised the master that he found it was difficult to get a good visual perspective at night and thus difficult to judge distance.

After a day's training in ship handling, night pilotage resumed at 2000 under the master's supervision. The tide was ebbing. The sky was overcast with moderate rain and the wind was from the south-south-east estimated at force 4-5 (about 16-17 knots). Visibility was moderate to good.

Student group C operated the vessel outward, the ship being turned in clear water and group D made the return run upriver, the ship being turned off Orari Bank beacon. Visibility remained moderate to good but, with the rain, visibility from the training bridge was somewhat reduced as the windscreen wipers were out of order.

At about 2230, student group E, comprising three students, commenced the next outward run. Each student was again allocated a role, with one on the helm, another acting as pilot with the con and the third acting as officer of the watch keeping a lookout and monitoring the radar. During the early stage of this run the master twice observed the vessel had overshot the course alteration points in the 2 knot ebb tide. On both occasions he verified *Wyuna's* position by turning up the brilliance on the ECS, taking control to bring the vessel back on track.

North of Garden Island, at about 2245, the student who had the con took over as helmsman, one of the other students took the con and the third student was the officer of the watch.

The student who had the con (the student 'master') felt that, just after he had altered the course to 005° off Bombay Rock, the master had taken control of the vessel. His recall of events was that the master had taken control after that alteration and that the master made the next alteration of course to 345° as well as the alteration to 315° off North West Bank beacon at about 2259. He also recalled that the master then handed the con back to him as the vessel was coming around to 315°. He checked the course on the chart and, realising that it should have been 327°, he ordered the helmsman to steer 320°, then 325°.

As the ship's head altered to starboard, the master was stated to have advised the student 'master' to keep the ship headed between the

two beacons that could be seen ahead. The student ‘master’ adjusted the course to 320°, but the master said that a course had to be set to steer between the lights. At that point, this student ‘master’ ordered a course of 315° to be steered, after which the master was stated to have expressed his satisfaction, advising him to steady the ship on that course and that they must not let the ship be set to starboard onto Barrel Spit.

The master remained confident that the ship was safe, not feeling the need to verify the ship’s position using the electronic chart. None of the students saw Shear Rock beacon either visually or on the radar and they deferred to the master's instructions, the student ‘master’ feeling that the master had taken over.

At 2305, *Wyuna* struck the bottom with a prolonged scraping and shuddering. The master stopped the main engines immediately and turned up the brilliance of the ECS. The electronic chart showed Shear Rock beacon was bearing 086° at 150 m. After the initial impact, the vessel continued to touch the bottom as it was pushed across Shear Rock by the tide. About 2 minutes later, *Wyuna* floated clear with the tide carrying the vessel rapidly northward across the channel.

The master had contacted the chief engineer by this time to advise him of the situation and the latter started checking the machinery space for signs of damage. The master was concerned that the vessel would ground again on the other side of the channel, on Middle Bank. However, he was unwilling to use the main engines until the chief engineer reported that it was safe to do so and ordered the students on the bridge to the forecastle to let go the port anchor.

By about 2310, the port anchor had been let go with 1½ shackles of chain. However, the anchor failed to hold and could be clearly heard dragging over the seabed. At about this time, the master instructed the vessel’s crew to sound around and assess the damage.

At 2315, *Wyuna* grounded a second time, this time on the southern end of Middle Bank. The chief engineer reported that the engine room was making no water, and that there was no apparent damage to the propulsion machinery. The master felt that the tide was carrying the vessel further aground so rang half ahead on both main engines at 2317, steering clear of Middle Bank, back into the channel.

Once *Wyuna* was back in the channel, the master verified that the steering was operational, that the main engines were running without a problem and both the log and echo sounder were still working. He then returned to the anchorage at Bell Bay, working up speed slowly to check for normal response. In the meantime, the vessel's crew were making a more detailed examination of all water ballast, fresh water and fuel oil tanks.

*Wyuna* dropped anchor northwest of Bell Bay beacon at 0005 on 20 October. By this time it was confirmed that nos. 10 and 11 starboard double bottom water ballast tanks in the engine room were pressurised, indicating that they were open to the sea, but all other spaces appeared intact. These tanks were pumped down and the rate of water ingress was noted as slow, indicating leakage from sprung seams and rivets. Soundings were checked once more and the water around the vessel carefully studied for any signs of oil leakage.

Early in the morning of 20 October, *Wyuna* was moved from the anchorage to be berthed at the AMC jetty at Beauty Point at 1038. The master subsequently notified the Port of Launceston Authority and the Australian Maritime Safety Authority of the incident.

# Comment and analysis

## Evidence

On 24 October, two investigators from the Australian Transport Safety Bureau (ATSB) attended *Wyuna* at Beauty Point. The master of the vessel was interviewed and provided a comprehensive statement of events. The three students on the bridge at the time of the incident and the Director of the Faculty of Engineering and Maritime Transport were also interviewed.

Other evidence, including copies of the ship's documentation, logs, and the passage plan was obtained. Hard copies of the *Wyuna's* ECS real-time passage were provided to the investigation. This record showed a limited number of time positions. The vessel's course recorder was not operating at the time of the incident and the bridge team did not maintain a bridge movement/bell book. Approximate times of passing beacons have been calculated based on a speed of 8.5 knots (262 m/min).

A simulation of the incident using the ECS real-time passage information was conducted for the investigators in the AMC's ship simulator facility. The Tamar River pilotage is a standard simulation used in the college simulator and two runs of the pilotage were conducted. Both simulations were conducted using conditions of visibility as close as possible to those experienced on the night of the incident. The first simulation used *Wyuna's* actual track from the position of the last alteration prior to the grounding, to the position of the first grounding on Shear Rock. The second run was conducted using *Wyuna's* standard passage plan which, starting from the same position as the previous simulation, ran to a point in the channel adjacent to Middle Bank.

The simulations showed that Shear Rock beacon should have been visible from the bridge that night and also clearly showed the relative positions of the shore lights at the time of the grounding.

## Master's report

The master's report on the grounding stated in part:

> At the time of the incident, *Wyuna* was conducting night pilotage training exercises with Master Class 1 students …on their fourth day of training on board…
>
> The primary purpose of the exercise is to familiarise the student with the task of orientating the vessel visually by use of the lighted channel buoys, beacons and leading lights. Position monitoring and vessel tracking is performed by a Differential GPS system loading the position once per second onto an ECDIS/RCDS. The DGPS is configured to apply fairly stringent masks to the satellite signals, ensuring high quality fixes or nothing. The system cannot default to GPS or DR and alarms on losing lock for any reason. This ensures positional fixing of 5 metres or better or no positions at all. For the purposes of night pilotage training, this system is running, but the display turned off by darkening the screen.
>
> …a Bridgemaster radar is in operation for student and supervisor use. Students are encouraged to monitor vessel XTE (cross track error) by using parallel indexing, but not all are able to do this in the river.
>
> Night pilotage runs commenced at 0400 on the 19th, under the supervision of the Chief Officer. 2 runs only were made as by then it was dawn. The Chief Officer reported being set down heavily onto Barrel Spit Beacon by flood tide …. This was our first night time operation in the river this year and we were ourselves out of familiarity with it.
>
> …night pilotage resumed under my supervision at 2000. The sky was overcast with moderate

> rain…. Visibility remained moderate to good, but we experienced some loss of clarity of vision from rain on the wheelhouse windows. The windscreen wipers on *Wyuna* do not work properly.

His report went on to state:

> The students did not see Shear Rock light and deferred to my instructions, presumably out of respect for my years experience with the ship and this pilotage.

## Manning

*Wyuna* was manned by an appropriately qualified master and appropriately qualified mates and engineers. At the time of the grounding, the bridge team consisted of *Wyuna's* master and three students.

The students held certificates of competency and formed the deck crew complement, concerned with navigation safety. They were Master Class 1 candidates with varying seagoing backgrounds.

For the purposes of training in pilotage techniques and operating the ship when under way in pilotage waters, a person holding pilotage qualifications was required to be in charge of the ship. Both the master and mate held the appropriate pilotage exemption qualifications.

The master had frequently entered and exited the port as part of the training regime for the vessel. However, both he and the mate had only made one night passage in the last year, about a year previously, and only 2 or 3 night passages in the last 8 years. They both had limited experience in night pilotage in the river.

The notes provided to the students before the exercise started stated that during the exercise:

> A senior officer…will be in the control bridge where direct steering and engine control can be taken in the event it is deemed necessary.

No such officer occupied the control bridge. The master was fulfilling the dual role of instructor and pilot in the compulsory pilotage area.

The role and responsibility of the trainees as both crew and students was ambiguous. The students were qualified mariners and they had sea-going experience that should have been useful in ensuring a safe passage.

## Bridge Resource Management

The AMSA Marine Notice, no. 7 of 1994, on Bridge Resource Management (BRM) and Navigational Practice reminds seafarers, shipowners and pilots of the importance of sound BRM and watchkeeping techniques to enhance safety and reduce human and systemic errors while navigating ships. The notice points out that BRM should include a clear identification of the bridge team members at all stages of a voyage, their duties and responsibilities and the line of command including the levels of authority in making, challenging or responding to decisions and instructions.

The notice included a list of errors that had resulted in casualties, such as insufficient support to the master, inadequate monitoring and a failure to detect and challenge a deviation from the passage plan or standard operating procedures.

The master's procedure for taking control of the vessel from a student was that the master would advise the student that he had the ship and was taking control. He emphasised that members of the bridge team should question any departure from the set plan. While he had briefed the students verbally on procedures for transferring the conduct of the vessel, no such procedures were contained in the notes distributed to the students.

There was confusion over who had control of the vessel. Off North West Beacon, the student 'master' ordered the correct alteration of course to clear Shear Rock beacon. The master, however, countermanded the alteration

to starboard, expressing satisfaction with a course of 315°. The master considered that he had taken control only for the purposes of getting the vessel back on track after overshooting course alteration points. However, the student 'master' thought that the master had taken the con and had retained control until the vessel was off North West Bank. The student 'master' did not question the master.

The student OOW offered no advice as part of the bridge team. He had not orientated himself in the ten to fifteen minutes since he assumed the role of OOW. The notes for the river passage given to the students had instructed:

> A standard paper chart is used as the basis for navigation, but conventional position fixing techniques will not be used. Instead, radar parallel indexing and direct assessment of cross track error from pre-designated tracks on the electronic systems is to be the means of guiding the ship through the passage

The student OOW had not mastered these techniques. It was the middle of the night and he was not familiar with the ship or the river. He had been monitoring the radar but he was not familiar with the set. He saw all the beacons on radar with the exception of Shear Rock beacon, which he thought might have been lost in clutter or was not visible because it was too close to the ship.

He did not know the ship's position, or which beacons *Wyuna* had passed or which beacon they were due to pass. Times of passing beacons were not marked on the chart and in the absence of a bridge movement book, there was no ready reference for the student 'OOW' to establish the next beacon to be passed.

The student 'helmsman' had been concentrating on maintaining a course when the vessel grounded. With the tide astern, he had found it difficult to steer the courses given to him and was not able to observe or follow the vessel's progress northward in the river.

All the students, however, had been briefed on the exercise and they had completed daylight transits. For the student 'OOW', one of his duties was to monitor the vessel's progress, informing the student 'master' of any problems. The student 'OOW' had not set up parallel indexing lines on the radar and, just before the ship grounded, he was looking out to port where he was apparently able to see Shear Reef, thinking that it was 'a bit close'.

At no stage, during the critical period of the voyage, was the course deviation to the west of Shear Rock beacon, an east cardinal mark, questioned.

There was a lack of oversight of the safe navigation of *Wyuna* through the absence of a suitably qualified person on the control bridge. When *Wyuna's* master ordered an incorrect heading he was not questioned by the student 'master', nor did the student 'OOW' take an active part as a member of the bridge team.

## Conduct of the passage

The three students forming group E started their exercise at about 2230, taking the roles of pilot, OOW and helmsman.

At about 2245, north of Garden Island, the students changed roles, with the next alteration off Bombay Rock due in about three minutes. The student previously acting as OOW took the con as pilot, while the other two interchanged. The tide was ebbing, giving *Wyuna* a speed over the ground of about 8.5 knots.

Off Bombay Rock, *Wyuna* overshot the alteration of course position and the master intervened and ordered the course to steer to the next alteration point. The master had apparently, though not explicitly, taken control and ordered the alterations at the next two course alteration points at Toroa Patch and off North West Bank beacon.

The next two beacons to seaward of North West Bank beacon were Barrel Spit (flashing red every 2 seconds) to be left to starboard and Shear Rock (flashing 3 every 5 seconds) to be left to port. These beacons were about 700 m and 1200 m, respectively, ahead of the ship at this time

The student 'master' understood that the master had handed him the con and he ordered a course to take *Wyuna* to the east of Shear Rock. But the master intervened again, ordering a course of 315°. The master was preoccupied with clearing Barrel Spit as, earlier in the day, the mate had told the master that the flood tide had been setting the vessel onto Barrel Spit.

However, on a heading of 315°, the vessel was now heading between Yellow Rock beacon (flashing green every 2 seconds) about 2300 m fine to port and Middle Bank beacon (flash red every 2 seconds) about 2000 m fine to starboard. Shear Rock beacon was now to starboard, instead of to port. The master's course of 315° was taking *Wyuna* onto Shear Rock.

The navigation beacon lights should have been clearly visible, despite the rain. There were no background lights to obscure Shear Rock light beacon as, from *Wyuna*, the beacon would have been well clear of Low Head and other land-based lights. Neither the master, nor the students noticed that a light that should have been left to port on the outward pilotage was, in fact, to starboard. It seems that no one on the bridge of *Wyuna* saw Shear Rock light.

For some reason, the master had become disorientated and had ordered a heading corresponding with the next leg of the passage, from Barrel Spit to the sea. It was as though he thought that the vessel was further north and that he was altering course off Shear Rock beacon. A contributory factor may have been that the lights on Barrel Spit and Middle Bank beacons have identical characteristics. However, there was an inconsistency in that the master had cautioned the students not to allow the vessel to be set on to Barrel Spit. Such a warning was not consistent with being north of the Barrel Spit light beacon on an ebb tide.

On earlier occasions, the master had used the ECS display to check when *Wyuna* had overshot course alteration points. On this occasion, had he done so, the danger of grounding would have been immediately apparent.

## Echo sounder

The echo sounder could have provided visual and audible indication that *Wyuna* was standing into danger and it was operating throughout the exercise. The channel between Point Effingham and Yellow Rock is deep with steeply shelving boundaries. Any excursion outside the channel would have been immediately obvious on the echo sounder.

The master was in the habit of using the echo sounder at all times. However, in the minutes before the grounding he was confident that the ship was correctly positioned in the channel and did not look at the depth below the keel.

The echo sounder unit included an adjustable setting at which an audible alarm would sound. Had the alarm been set to sound if the vessel left the general depth of the channel, or set at a lesser depth of, say 10 m, it would have provided aural indication that *Wyuna* had left the channel.

At a speed of 8.5 knots, there would have been about 60 seconds for corrective action to be taken.

## SOPEP and tank soundings

The shipboard oil pollution emergency plan, SOPEP, for the vessel requires that a report be made when the vessel has grounded. Though the master stated that he considered it unnecessary at that time, the plan does not permit a delay in submitting this report.

The state of the vessel's tanks had not been recorded regularly. In the event of a grounding or a collision, comparison of soundings gives an indication of where the ship's hull has been breached. Knowledge of the state of the tanks is important for identifying potential sources of pollution and for calculating damage stability.

## Anchors

In the event of an engine breakdown, anchors can be used to stop a vessel and prevent a grounding.

However, aboard *Wyuna*, anchoring in an emergency was not included in the induction procedures. A ship would only use its anchors in the channel between Yellow Rock and Point Effingham in the most dire emergency, given the width of the channel and the rate of tidal flow.

The use of the anchor after the initial grounding to arrest the ship's drift, preventing further grounding, was sound, but the length of chain paid out (about 1½ shackles) was inadequate in that depth of water (30–40 m) and strength of tide.

The International Association of Classification Societies Requirements concerning Mooring and Anchoring (IACS Req. 1994/Corr.95) makes the following statements regarding the design of anchoring equipment:

> A1.1.2
>
> The equipment is therefore not designed to hold a ship off fully exposed coasts in rough weather or to stop a ship which is moving or drifting. In this condition the loads on the anchoring equipment increase to such a degree that its components may be damaged or lost owing to the high energy forces generated particularly in large ships.
>
> A1.1.4
>
> The equipment number formula for anchoring equipment here under is based on the assumed current speed of 2.5 m/sec, wind speed of 25 m/sec and a scope of cable between 6 and 10, the scope being the ratio between the length of chain paid out and the water depth.

## Fatigue

In terms of vessel operations in pilotage waters, the manning levels on *Wyuna* placed high workloads on the master and mate who were performing the functions of instructors as well as pilots.

The master was engaged in some form of activity related to training of the students and the operation of the vessel whenever he was awake. He was overseeing the pilotage operations, monitoring the students and conducting or preparing for training. The program aboard *Wyuna* was scheduled to attempt to ensure that staff received appropriate rest periods, but the hours of work impacted heavily on the master. He was on the 8–12 watch by day and night and he had other tasks outside these hours. Despite this, however, he felt that he was sufficiently rested.

Reviewing the master's operational hours from the start of the program with the Master Class I students, it was determined that he had been working about twelve hours each day for the past 3 days, suggesting that fatigue might have affected his judgement and performance.

Fatigue can have a detrimental effect on an individual's performance. It can affect a person's attention, memory, reaction time and the ability to make decisions without the

person necessarily feeling fatigued. The possibility that fatigue might have been a factor in this incident was assessed using the computer program FAID 330E from Interdynamics Pty Ltd. Two sets of data were analysed using this program.

The master's hours of work and all other activities, other than times when he was asleep, were utilised in the first set of data that was analysed. The results of this analysis were that high to very high fatigue scores were obtained for a number of days preceding the incident. At the time of the incident, his fatigue score was between high and very high, suggesting that fatigue may have been a contributory factor in the incident.

The other set of data used in the analysis was from the master's actual hours of duty only. The result of this analysis was that there were standard to moderate levels of fatigue at the most demanding periods of work. At the time of the incident, the master's fatigue score was between standard and moderate.

The Inspector has taken note of both analyses, but concludes that the master displayed a number of symptoms which suggest that fatigue may have affected his judgement. He had a preoccupation with the tide off Barrel Spit, to the exclusion of other visual cues. Although he could have checked the ship's position using ECS, he did not do so on this occasion. He was confused, thinking that the vessel was north of its actual position.

## Ship management

*Wyuna* was owned and operated by the AMC and it is the College that is ultimately responsible for the safe operation of the vessel. The master was effectively the ship manager and responsible to the AMC.

It would be reasonable to expect a training institution to have a system of management that treated the ship as a ship rather than as just another facility. Such a system is provided by the International Safety Management (ISM) Code.

Although *Wyuna* was not a vessel to which the ISM Code applied, the ISM Code is a safety management tool to:

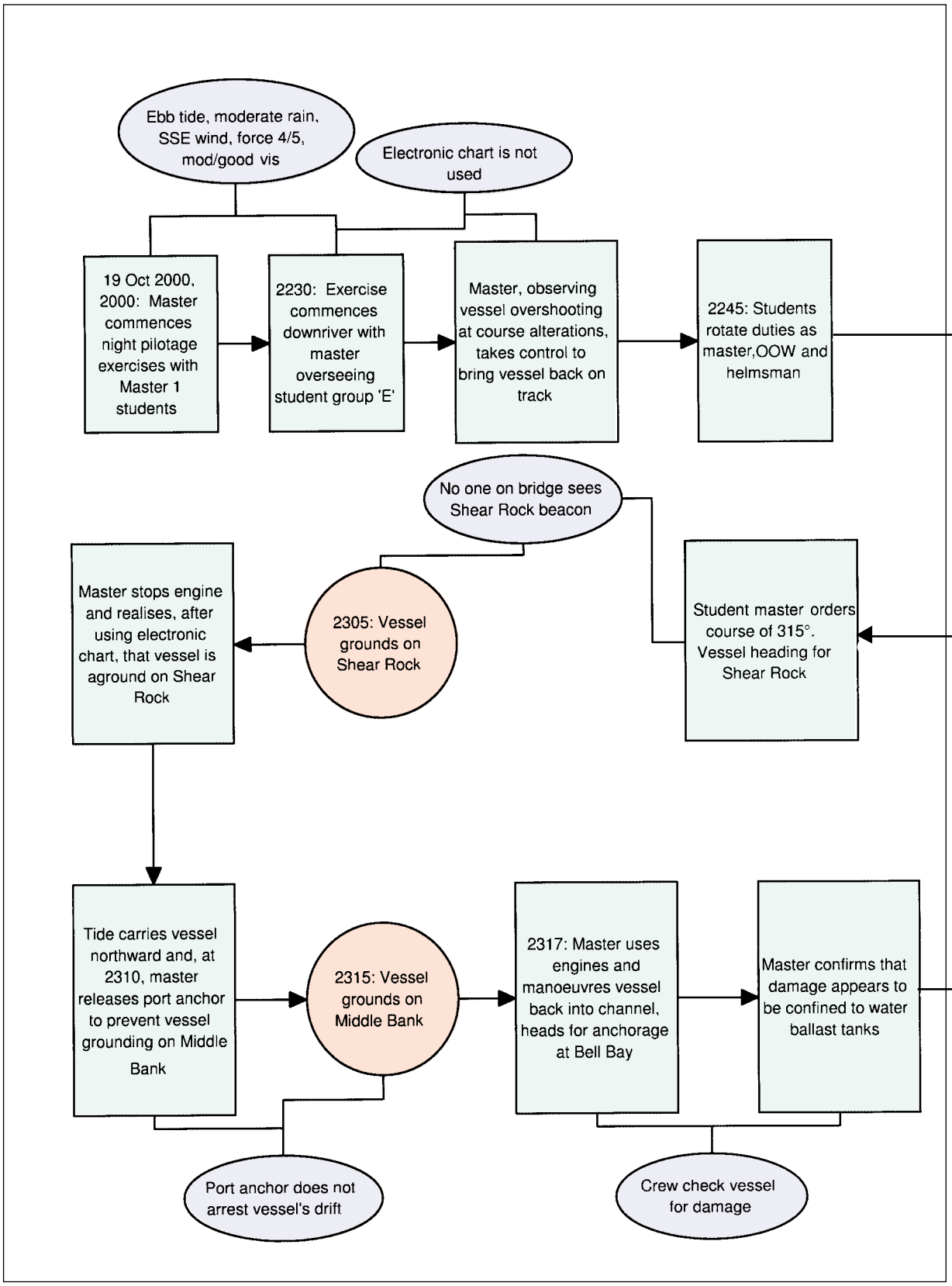
- Provide for safe practices in ship operation and a safe working environment.
- Establish safeguards against all identified risks.
- Continuously improve the safety management skills of personnel ashore and aboard ship, including preparing for emergencies related both to safety and environmental protection.

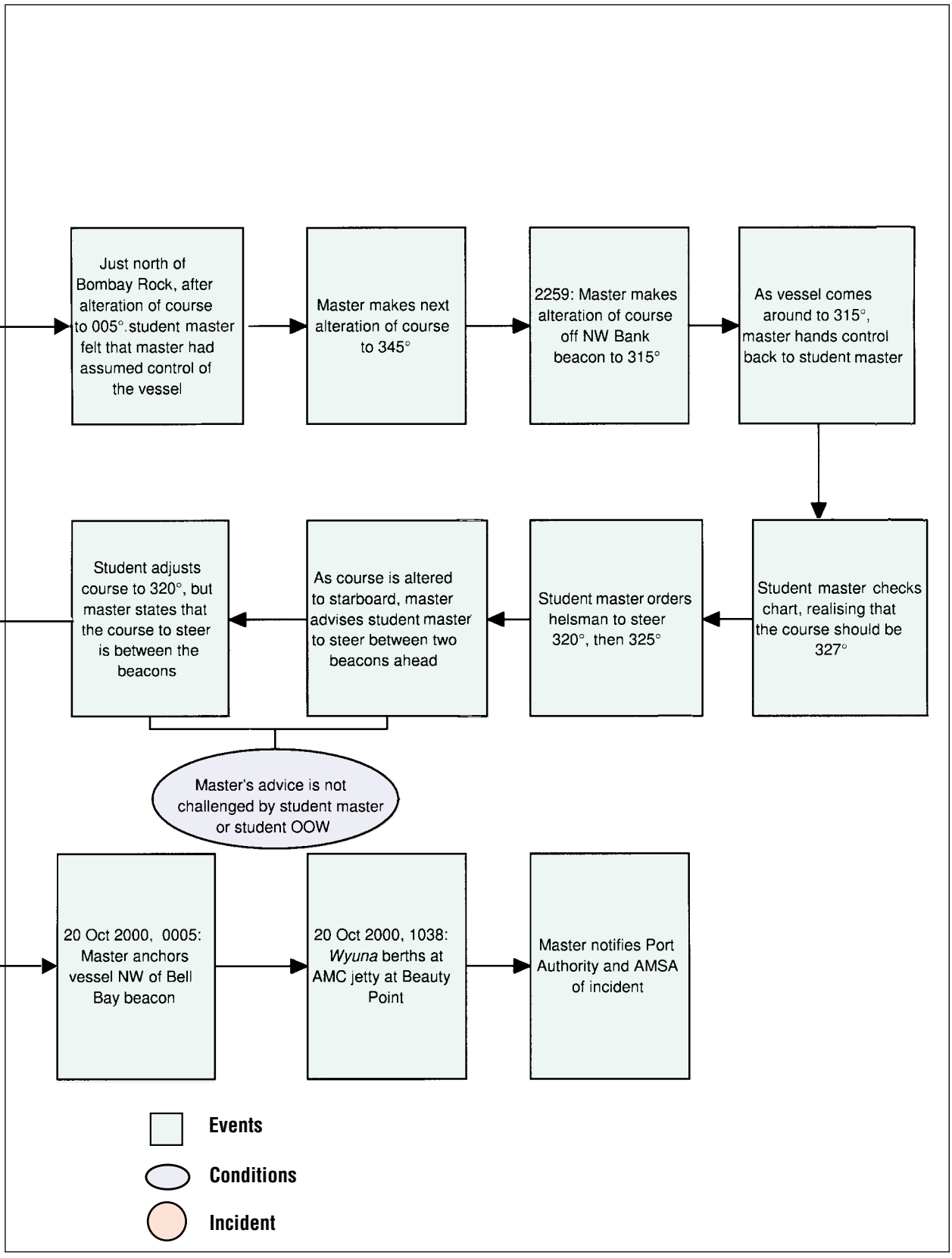
The nautical complement of officers on board was not sufficient to maintain safe 24-hour operations, particularly in pilotage waters. Although the master's instructions to the students contained the provision for a qualified person to be on the control bridge during pilotage exercises, this practice was not followed.

Although the master and mate conducted lectures and courses in addition to their watches and ship-keeping duties, there was no program to monitor possible fatigue.

*Wyuna* was managed in the same manner as other facilities and the AMC seemed to exercise little control over the vessel and its operations. Responsibility for the vessel seemed to have been almost entirely delegated to the master.

**FIGURE 5:**
**Grounding: *Wyuna,* Events and causal factors chart**




Just north of Bombay Rock, after alteration of course to 005°.student master felt that master had assumed control of the vessel
Master makes next alteration of course to 345°
2259: Master makes alteration of course off NW Bank beacon to 315°
As vessel comes around to 315°, master hands control back to student master
Student master checks chart, realising that the course should be 327°
Student master orders helsman to steer 320°, then 325°
As course is altered to starboard, master advises student master to steer between two beacons ahead
Student adjusts course to 320°, but master states that the course to steer is between the beacons
Master's advice is not challenged by student master or student OOW
20 Oct 2000, 0005: Master anchors vessel NW of Bell Bay beacon
20 Oct 2000, 1038: Wyuna berths at AMC jetty at Beauty Point
Master notifies Port Authority and AMSA of incident
Events
Conditions
Incident

# 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, the following factors are considered to have contributed to the incident:

- There was insufficient oversight by the AMC of the operation of the vessel.
- Contrary to the advice in the students' notes, there was no officer on the control bridge ready to assume control of the steering and engines.
- The absence of clear written instructions contributed to misunderstanding with respect to who on the bridge had conduct of the vessel.
- Fatigue may have resulted in the master's preoccupation with the direction of flow of the tide across the channel. Fatigue may also have resulted in his loss of concentration, his inability to identify the vessel's position, the setting of an incorrect course and his insistence that the course be maintained.
- The student 'master' was aware of the correct course required and though he had time, in accordance with the principles of BRM, to alert the master to the vessel's situation, he did not do so.
- The master did not receive adequate support from the student 'OOW'.
- Even though the master had encouraged the students to question any divergence from the set plan, neither of the two students in a position to challenge the master, did so.
- The student 'OOW' did not monitor the vessel's progress as he should have. Had he used the radar as it was intended that he should, he would have realised that the vessel was off course.
- The master dimmed the ECS display so that the students were obliged to monitor the ship's progress visually and by radar, but this led to him also being unable to use the ECS.
- Had the movement book or an equivalent system been maintained, the students would have known of the ship's position with respect to beacons in the river.
- The echo sounder alarm, which was not in use, would have provided an indication of the ship's incursion into shallow water.

# Recommendations

These recommendations are published recognising that corrective action may already have been taken to address the safety issues identified by the investigation.

The Inspector recommends that:

- The AMC document and implement an appropriate safety management system for the operation of *Wyuna*.
- The AMC review manning levels for the vessel.
- A roster of duties for *Wyuna* be maintained as well as a daily record of hours worked by each member of the ship's crew to facilitate the monitoring of fatigue levels of individuals.
- Clear unambiguous written instructions are formulated as part of the safety management system to identify who has conduct of the vessel at any given phase of the voyage.

# 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 of *Wyuna*, the Director of the Faculty of Engineering and Maritime Transport of the AMC and the students on the bridge at the time of the incident.

A submission was received from the Director of the Faculty of Engineering and Maritime Transport of the AMC and the report was amended where necessary.

# *Wyuna*

| | |
|---|---|
| IMO Number | 54393907 |
| Flag | Australian |
| Survey Authority | Australian Maritime Safety Authority |
| Ship Type | Training Vessel |
| Builder | Ferguson Bros. Ltd, Port Glasgow |
| Year Built | 1952 |
| Owner | Australian Maritime College |
| Gross Registered Tonnage | 1 313 |
| Net Tonnage | 312 |
| Displacement | 1 831 tonnes |
| Maximum Draught | 5.0 m |
| Length overall | 63.5 m |
| Breadth | 11.9 m |
| Engines | 2 x 515 kW English Electric 400 V D.C. motors each driving a fixed pitch propeller |
| Generators | 3 x 476 kW English Electric 400 V D.C. main diesel generators, plus 6 aux 220 V D.C. diesel generators |
| Maximum speed | 13 knots with 3 main generators running |
| Crew | 7 regular + 38 training and other berths |

**Australian Transport Safety Bureau**

**24 Hours** 1800 020 616
**Web** www.atsb.gov.au
**Twitter** @ATSBinfo
**Email** atsbinfo@atsb.gov.au

Investigation

**ATSB Transport Safety Report**
Marine Occurrence Investigation

Grounding of the Australian flag training vessel *Wyuna*, 19 October 2000

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