



Departmental investigation into
the grounding of the Panama flag
general cargo ship
NEW REACH
on Heath Reef,
Great Barrier Reef
on 17 May 1999



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Navigation Act 1912 Navigation (Marine Casualty) Regulations investigation into the grounding of the Panama flag general cargo ship NEW REACH

On Heath Reef, Great Barrier Reef on 17 may 1999

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Summary

The Panama flag general cargo ship *New Reach* sailed from Cairns, Queensland, at 0654 on 16 May 1999 bound for Penang, Malaysia, with a full cargo of sugar. A licensed pilot was embarked to take charge of the navigation through the inner route of the Great Barrier Reef.

At about 1020 on 16 May, *New Reach* passed Low Isles, the southern limit of the compulsory pilotage area.

The pilotage proceeded routinely until about 0311 on 17 May, when, after making a routine mandatory report to the Reef Reporting Centre, the pilot realised that the light on Heath Reef was in the wrong position relative to the ship's heading. He altered course to port to bring *New Reach* to the west of Heath Reef. At about 0320, the ship grounded in shallow waters about 220 m south of the reef edge on a heading of 327°, about one hour before low water.

Nobody was hurt as a result of the grounding and no oil or other pollutant escaped from the ship.

At about 0920 on 17 May, *New Reach* was refloated under its own power and, after reporting to the Reef Centre, went to anchor south of Night Island, 17 nautical miles to the north. The Australian authorities issued detention orders. At 1314 the vessel was given permission to move to Lloyd Bay, close to the Lockhart River Settlement and its airstrip.

On 18 May, divers, surveyors and other officials boarded the vessel. A new pilot also joined *New Reach* to relieve the pilot on board.

After an underwater inspection by the divers and an examination of the fore peak tank by the class society surveyor, the ship was cleared to resume its voyage. The vessel cleared Booby Island at 0530 on 19 May.

Sources of Information

Master and crew of *New Reach*

The pilot

The skipper of f/v *Shanendale*

The Great Barrier Reef Marine Park Authority

AMI Sales, O'Connor, WA (agents for Kelvin Hughes)

Acknowledgment

Portion of chart Aus 834 and 835 reproduced by permission of the Hydrographic Office, RAN

New Reach

New Reach is a Panama flag general cargo ship. It is owned by Genial Marine SA and managed by Hsin Chien Marine of Taiwan.

New Reach was built in Kochi, Japan and launched in 1979 as *Seahawk*. The ship had two subsequent changes of name before becoming *New Reach* in 1997. Since building it had been maintained in class with Nippon Kaiji Kyokai.

The ship is 151 m in length overall (140.4 m between perpendiculars), has a moulded depth of 13.5 m and a beam of 26.0 m. All accommodation and the machinery space are aft of the forward engine room bulkhead at frame 32. Forward of the engine room are four cargo holds extending for 107.2 m to the collision bulkhead at frame 166. The distance between the collision bulkhead and the fore foot at frame 181 is 8.9 m. *New Reach* has a summer deadweight of 22,829 tonnes at a summer draught of 10.02 m.

New Reach is powered by a Mitsubishi 6 cylinder diesel engine developing 5884 kW driving a single shaft and a fixed pitch propeller. The ship has a service speed of 13.75 knots. The engine is fuelled by marine diesel oil when manoeuvring and by heavy fuel oil when on passage. The main, heavy fuel storage tanks outside the engine room are arranged as centreline double bottoms beneath cargo holds 2, 3 and 4. The engine room is manned at all times.

The ship is equipped with the normal range of navigation equipment including global positioning system (GPS) receivers, a track plotter, and two radars—a Kelvin Hughes 5000 R, and a JCR NCD 326B. The bridge and chart room are combined.

The ship has three 'goal posts' and four derricks, one derrick for each hatch. The very forward goal posts, on the after end of the forecastle head, are about 12 m apart and about 110 m from the bridge.

The ship had a crew of 22: the master and chief engineer are Taiwanese nationals and the remainder of the crew are from the Peoples Republic of China. The master had held command for 17 years. The 2nd mate had been 3rd mate on the ship for about one year, before being promoted on the recommendation of the master.

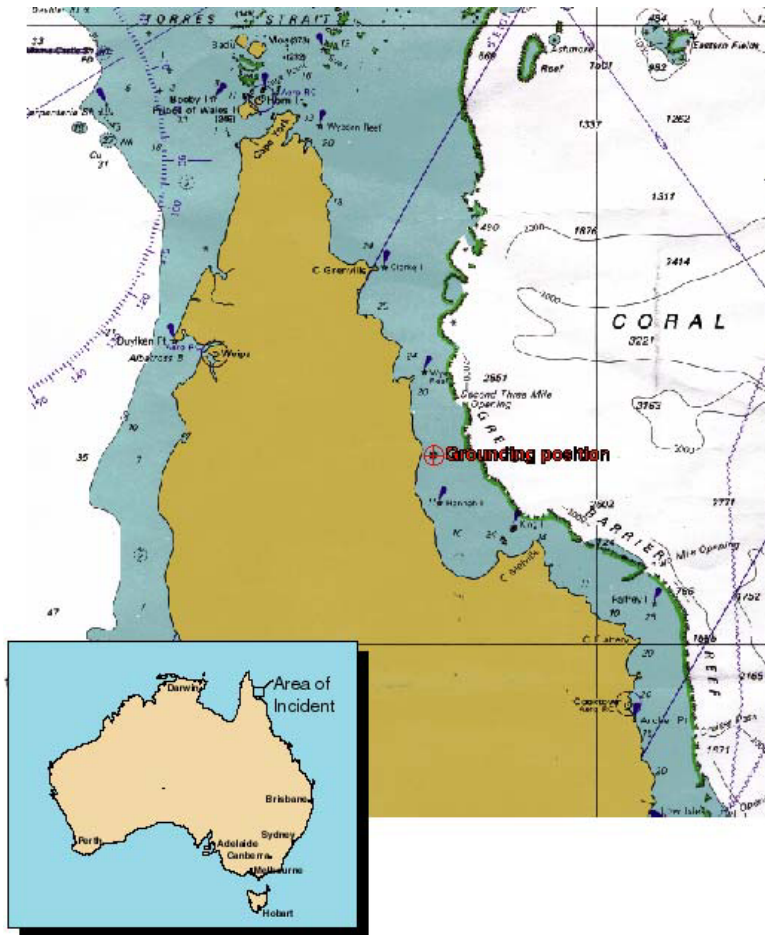
New Reach holds an International Safety Management Certificate, issued by Nippon Kaiji Kyokai in December 1997.

The inner route of the Great Barrier Reef

The southern extreme of the Great Barrier Reef compulsory pilotage area is designated as 16° 40' S. The inner route, between this southern limit and Goods Island in the Torres Strait, is about 480 nautical miles (nm) in length. The area contains stretches of relatively narrow fairway and areas of intense seasonal fishing activity. The route offers a safe passage, sheltered from the sea conditions experienced outside the reef.

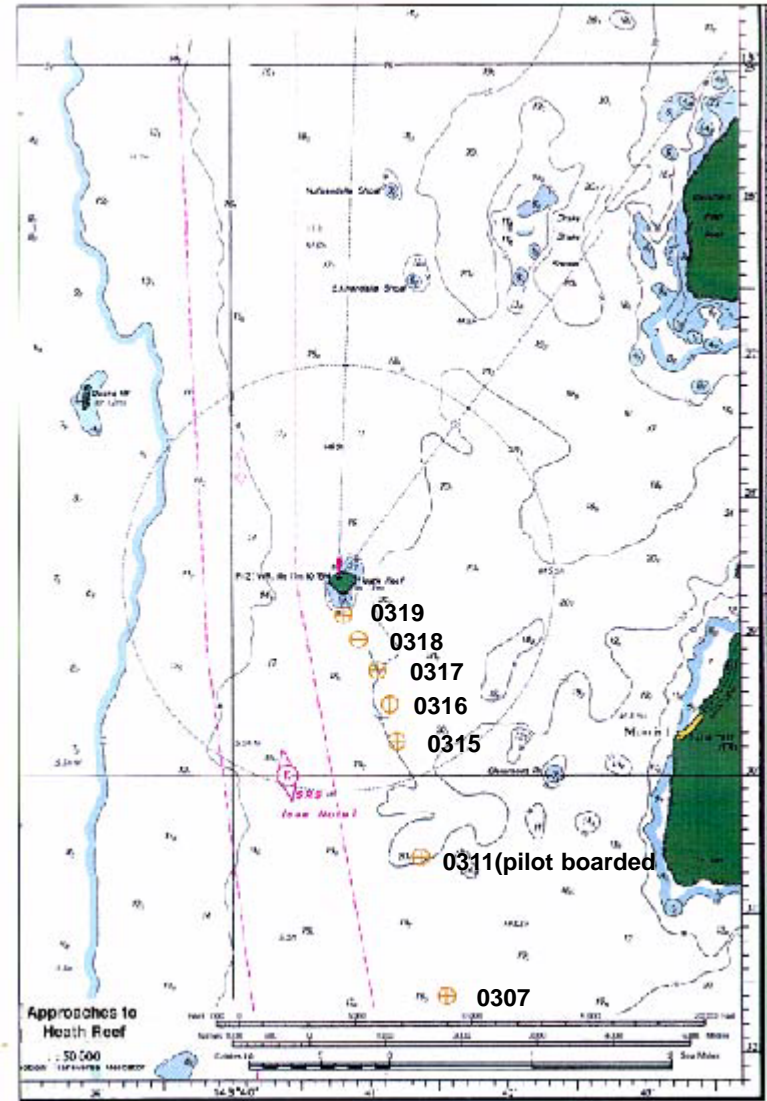
Before 1 October 1991, pilotage was offered on a voluntary basis. However, following recognition by the International Maritime Organization of the Great Barrier Reef as a 'particularly sensitive area', the Australian Government introduced legislation making pilotage through the inner route (and also Hydrographers Passage) compulsory for ships over 70 m in length.

To further enhance safety in the Great Barrier Reef, a mandatory system of ship reporting, at predesignated positions between Cape Townsend and the Torres Strait, was introduced on 1 January 1997. A ship transiting the inner route between Cairns and Torres Strait is required to make some 10 reports to Reef Centre. The system of radio monitoring is enhanced by remote radar coverage of Torres Strait, the vicinity of Cairns and part of Hydrographers Passage. Both radio and radar are monitored from Reef Centre, at Hay Point near Mackay.



Portion of chart Aus 835 showing grounding position

Portion of chart Aus 834 showing track of New Reach



Narrative

New Reach berthed at the Queensland port of Cairns at 1234 on 14 May, to load a cargo of sugar for the Malaysian port of Penang. The ship completed loading at 0530 on 16 May and prepared for departure. The bridge and steering equipment was tested together with the engine, and found to be in good working order. At 0636 the harbour pilot and the coastal pilot boarded the vessel.

The ship sailed at 0654 drawing 8.08 m forward, 8.39 m aft, with about 15,600 tonnes of cargo, 857.5 tonnes of heavy oil, 143.4 tonnes of marine diesel, and fresh water.

The ship cleared the Cairns fairway buoy at 0754 and the harbour pilot disembarked. The fuel was changed from diesel oil to heavy oil.

Once clear and on course for Low Isles at the southern end of the compulsory pilotage area, the pilot briefed the master on the northbound passage. The pilot erased the courses laid off by the ship's 2nd mate and substituted his own course lines, based on a suitable route for *New Reach*, given its draught. The pilot showed the master the changes. The master was also comfortable with the fact that, given the length of the pilotage, pilots would take rest periods, if conditions permitted, in stretches of the Reef where navigation was not demanding.

At about 1019 *New Reach* passed Low Isles. The ship's gyrocompass had an observed error of two to three degrees high, and the courses were set accordingly. Once established on course, the pilot was able to leave the bridge for about 2½ hours until approaching Gubbins Reef. After negotiating the dog's-leg stretch at Gubbins Reef, the pilot was able to leave the bridge again for about 1½ hours to Three Isles. Three Isles was passed at about 1542. As an aid, the pilot used the variable range ring, the bearing cursor and the parallel indexing features of the Kelvin Hughes radar to ensure safe passing distances from hazards.

The watchkeeping officers maintained their normal watches, periodically plotting the ship's position. A rating was also on the bridge at all times acting as a helmsman, when required, and as a lookout. The normal procedure was for the ship to be steered manually when approaching a course alteration and while establishing the ship on the next course. Once the ship was settled on course the steering was switched to automatic.

When the pilot was not on the bridge, the master stood the watch with the navigating officer. The passage proceeded normally, the officers of the watch seemed efficient and the ratings appeared competent in steering.

After passing Three Isles, and until clear of Clack Reef in Princess Charlotte Bay the pilot remained on the bridge in charge of the navigation. The ship passed Clack Reef at 2258, after which the pilot left the bridge for 50 minutes to an hour. At Wharton Reef the pilot went back to the bridge. The tide was on the ebb with the tidal stream running to the north-east, through the 'gutters' between the reefs.

From Wharton Reef to Magpie Reef the Pilot's planned route was to the east of Eden Reef, in the relatively narrow channel that passes close to Stainer Island and east of Burkitt Island and Hannah Island. The route involved some four alterations of course and, on that night, a concentration of 12 to 18 fishing vessels. *New Reach* passed Magpie Reef at about 0155 averaging about 13.5 knots. The 2nd mate plotted the ship's positions from time to time and the pilot continued to use the Kelvin Hughes radar, mostly on the six mile range.

From Magpie Reef the pilot had planned a direct course of 350° to a position 0.4 nm to the west of Heath Reef, some 20 nm to the north. He had intended to leave the bridge for a rest at Magpie Reef, but given the presence of two fishing vessels operating in or close to the route between, he remained on the bridge.

At about 0232, *New Reach* had cleared the fishing vessels and passed between Fife Island and Hay Island. The ship was making good about 13.8 knots on a gyro heading of 354°. Heath Reef light, the next close hazard and course alteration point, could be seen ahead, close to the bow at about 11 nm. With less than 8 nm to run to the position at which he would be called if he was not on the bridge, the pilot decided that it was not worthwhile leaving the bridge for 35 minutes. He did not set up the parallel index lines for passing Heath Reef at that time. He sat in the pilot chair adjacent to the Kelvin Hughes radar, on the port side of the wheelhouse.

The ship continued on a gyro heading of 354° to make good a course of 350° at a speed of about 13.8 knots. The state of tide was about two hours before low water and what tidal stream there was tended to set the ship to the east. The 2nd mate fixed the ship's position at 0249 and again at 0307, when about 3 nm from Heath Reef. Both positions put the ship to the east of the intended course line.

The weather was fine with some cloud, the wind was from the south-east at 18 - 20 knots. There was only one vessel—a fishing vessel—in the vicinity of Heath Reef, which was showing a 'broad' red side light.

At about 0311, the 2nd mate touched the pilot on the shoulder to remind him to make the scheduled mandatory report to Reef Centre. The pilot got down from the chair and picked up the VHF radio and duly reported the ship's position and speed. As he looked forward at Heath Reef, he realised that *New Reach* was in the wrong relative position. He ordered an alteration of course to 350°.

The pilot could also see the fishing vessel, but it was well clear of *New Reach*. However, the skipper of the fishing vessel used channel 16 VHF to contact *New Reach* and inquired whether the pilot wanted him to pass *New Reach* to starboard (green to green). The pilot replied that it was not necessary and that he was 'just dodging' around Heath Reef.

After watching the light on the Reef the pilot ordered a series of alterations to port in quick succession. The rating at the helm followed the pilot's orders and tried to steady the ship on a course of 344°. However, the ship kept turning to port, despite the rudder being put hard to starboard. Although no impact or deceleration was felt, at about 0320 the vessel was stopped in the water. The engine was also stopped.

The 2nd mate called the master and when he arrived on the bridge the engine was put astern, including full astern for about six minutes. However, the ship did not move. The ship was aground about 220 m from the reef edge (400 m due south of Heath Reef light) on a heading of 327° in a position logged as 13° 28.72' S 143° 40.82' E.

At 0336, the pilot made an initial report to Reef Centre:

'I'm stopped on Heath Reef at the moment – once we get a bit more water I'll see if we can get her off.'

Reef Centre informed the Australian Search and Rescue Centre in Canberra of the grounding.

The master contacted the ship management company and the Protection and Indemnity Club correspondent in Cairns, also reporting the grounding. The master ordered that soundings be taken of the internal tanks and around the ship. The port anchor was dropped. At a draught of 8.08 m forward and 8.39 m aft, the soundings around the ship established that the ship was aground from the stem to number 3 hold. The rudder and propeller were in about 18 m of water.

The Queensland and Commonwealth authorities maintained contact with *New Reach* through Reef Centre. The master passed information on the bunker oil carried on board and other relevant information to the Australian authorities. Although no breach of the hull was reported, initial steps were taken to respond to any possible oil pollution. Detention orders were placed on the ship by both the Queensland and Commonwealth authorities.

High water at Heath Reef on the morning of 17 May was predicted at 1000, with a height above datum of 2.2 m. At about 0830, ballast was pumped to number 4 tank, increasing the trim by the stern. At 0916, the anchor was weighed and at 0920 the engine run, initially at slow astern, then at half speed and finally full speed astern. The vessel refloated at a time logged at 0925, and cleared the shoal water. An inspection around the hull indicated that there were no leaks. Reef Centre was advised that the vessel had been refloated and that there was no apparent damage.

Initially the vessel was ordered to go to anchor about 15 nm to the north, south of Night Island. The vessel anchored at 1118. Later, at about 1316, permission was given to move a further 35 nm north to Lloyd Bay, off Lockhart River, which was a more convenient position to undertake an underwater and internal inspection of the ship.

At 1642, *New Reach* anchored in position 12° 42.3'South 143° 27.9'East, in Lloyd Bay.

Starting at about 1030 on 18 May, a team consisting of divers, surveyors, a relief pilot and other officials was transferred by helicopter from Lockhart River. Inspection of the hull revealed that paint had been cleaned from the ship's bottom and that the ship had been aground as far aft as the midpoint of number 3 hold (about frame 83). There was no obvious deformation of the hull. An internal inspection of the forepeak also revealed no obvious damage. The vessel's class society imposed a condition of class on *New Reach* and the vessel was cleared to sail. By 1715 the pilot, the divers and other officials, with the exception of the new pilot and an investigator, had left the ship by helicopter. At 1730 on 18 May, all detention orders were lifted and the ship resumed passage, with a replacement pilot.

New Reach disembarked the replacement pilot and the investigator off Goods Island at 0530 on 19 May.

Comment and analysis

Evidence

This report draws upon interviews with the pilot, master and crew of *New Reach*, as well as data from the ship's logbook, charts and other documents, including the course recorder. The time shown on the course recorder trace was accurate to within one minute of the time shown on the GPS receiver and other bridge timepieces. The course recorder trace showed the gyrocompass heading at any time, between 2° and 3° high of the true course. The indication is that the times given by the ship were accurate.

A record of the pilot's program since entering the pilot service was supplied by the Queensland Coastal pilot Service Pty Ltd.

Audiotape copies of the radio messages between *New Reach* and Reef Centre for 16 and 17 May were supplied by Reef Centre, through the Australian Maritime Safety Authority. For 17 May, there is a time differential of about six minutes between the times recorded by the ship and those recorded by Reef Centre. Reef Centre confirmed that the operators experienced some technical problem with their timing equipment and that their times were between four and six minutes slow.

Information as to the positions and courses of the fishing vessel *Shanendale* was provided by the vessel's skipper. He also provided information regarding VHF radio contact between the two vessels.

Examination of the site of the grounding by officers of the Great Barrier Reef Marine Park Authority gave an uncorrected GPS position for the centreline of the grounding site as 13°28.72' S 143° 40.73' E. *New Reach* scoured an area of over 2000 m² of coral pushing the coral into two mounds, the larger being on the west side of the grounding site. The area of this site is consistent with the ship being aground from the stem to about 70 m from the stern.

Both the position and alignment of the grounding site as surveyed by the Authority are consistent with those reported by the pilot and recorded in the ship's records.

The passage – 0232 to 0310, approaching Heath Reef

At interview, the pilot stated that he had no recollection of events from shortly after passing Fife Reef until the 2nd mate touched him on the shoulder. This was a little before 0310. It is certain that the pilot had been in an advanced stage of drowsiness, probably in the first or even second stages of sleep for a period of about 50 minutes.

The weather was clear and there was a moderate wind and sea from the south-east. Since before passing Fife Reef, Heath Reef Light could be seen ahead between the forward derrick goalposts. The field of view between the forward goalposts, about 12 m apart and 110 m forward of the bridge, is about 5°.

The master was not on the bridge at the time of the incident. Navigation of the ship was in the charge of a licensed pilot and there was no reason why the master should be on the bridge.

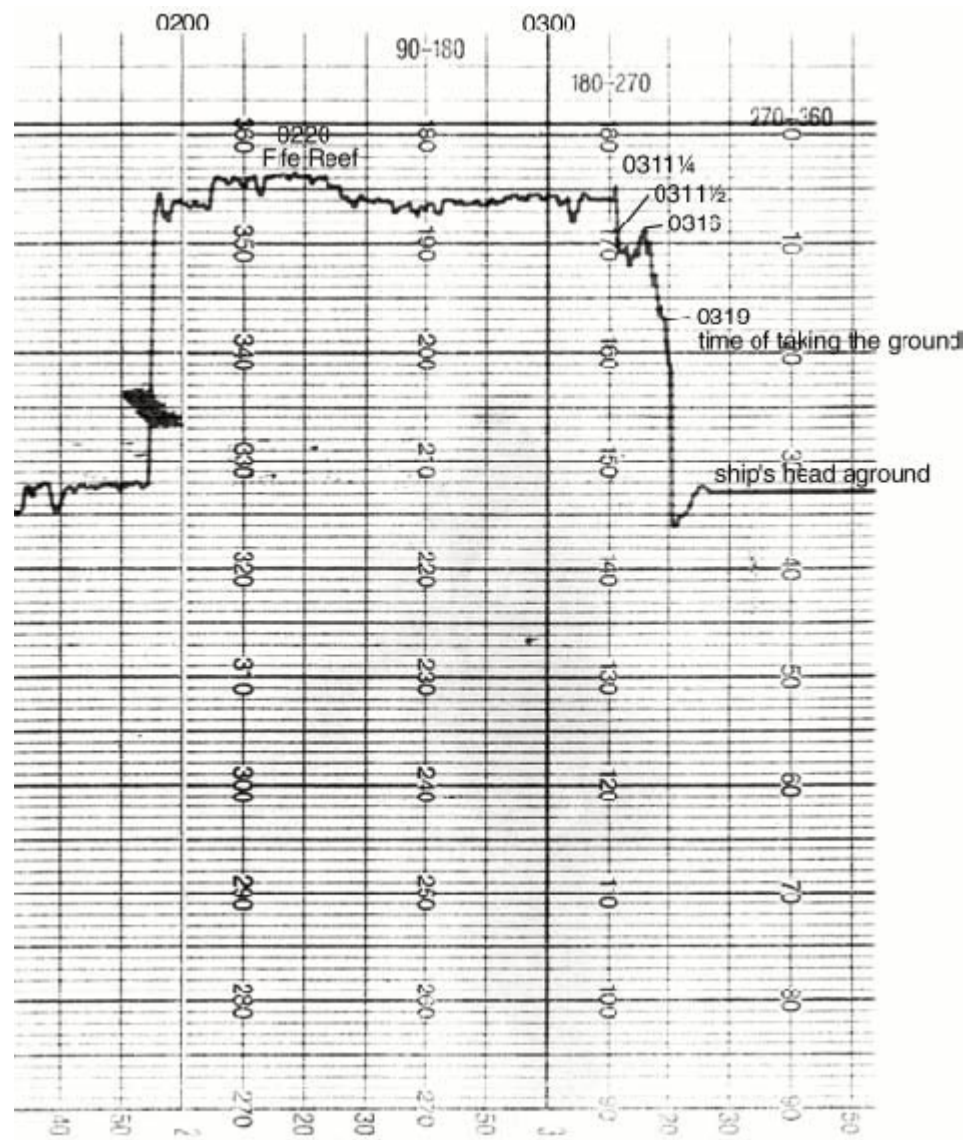
The rating on watch stated that the 2nd mate alternated between the radar and the forward end of the bridge. The rating could see the pilot sitting in the pilot chair just outboard of the Kelvin Hughes radar. Some time before the grounding, he saw the pilot's chin resting on his chest. The pilot's head did move from time to time but he believed the pilot was asleep on occasions. He did not say anything to the 2nd mate or, after the incident, to the master or any officer.

After passing Fife Reef, the 2nd mate fixed the ship's position on two occasions. At 0249, the position plot put the ship 0.45 nm east of the course line. At 0307, the position was 0.55 nm to the east of the course line. The course made good between the two positions was about 350½°. On neither occasion did the 2nd mate draw the position of the ship to the pilot's attention.

The 2nd mate, who, for the most part, maintained his watch forward of the two radars, stated that he did not see the pilot asleep. As far as the 2nd mate was concerned, the pilot had charge of the navigation. Heath Reef light could be clearly seen ahead and the pilot had made no adjustment to the course since passing Fife Reef. Everything appeared to be proceeding routinely.

The grounding – 0310-0320

Heath Reef can be passed on either side, and the eastern side is a recognised alternative route if two vessels are expected to pass off Heath Reef. The marked two-way route to the west is preferred, as South and North



Section of course recorder Fife Reef to grounding

Khandalla shoals lie 2 nm north of Heath Reef.

When the pilot realised the ship was out of position he altered course to port to pass on the west side of Heath Reef as originally planned. The course recorder showed an alteration of course at 0311¼ of 4° to port to a gyro heading of 350° (347°T). The duration of the conversation between the pilot and Reef Centre was one minute and 24 seconds. This would suggest that the 2nd mate touched the pilot's shoulder to alert him to Reef Centre between 0309½ and 0310, when the ship was 2.24 nm (about 4200 m) from the shoal water to the south of Heath Reef.

The Unit's investigators, and psychologists from the Bureau of Air Safety Investigation, listened to the tape recording of the pilot's routine report made approaching Heath Reef. Nothing could be detected in the pilot's tone of voice to suggest that he became stressed or alarmed during the recording.

From the time the pilot initiated the call to Reef Centre, he had about eight minutes in which to avoid grounding. He neither consulted the chart, nor plotted the ship's position himself, nor ordered the 2nd mate to fix the ship's position. After ordering the alteration to 350°, the pilot went to the Kelvin Hughes radar and tried to set up the parallel index lines to give him a clearance off Heath Reef.

It was during this time that the pilot was in VHF radio contact with the fishing vessel *Shanendale*.

At 0310 the ship was travelling 426 m/min (13.8 knots or 7.09 m/sec) and was about nine minutes from grounding. Having been steady on a course for 4½ minutes, from 0311½ to 0316 the pilot ordered alterations of course, initially to 346° and then 343°. As the vessel reached a heading of 343° at 0319 the vessel took the ground. The *New Reach* had been turning at a rate of 2.6°/min.

According to the ship's manoeuvring diagram based on a speed of 10.2 knots, with the rudder hard to port, *New Reach* would advance 0.16 nm (296 m) in 1 minute 40 seconds and would transfer 0.093 nm (172 m) in altering through 90°. At 13.8 knots, the advance, transfer and the times would be greater, but there would have been minimal shallow water effect as the reef shoal is steep-to and the general depth was more than twice the ship's draught. However, from the time of realising *New Reach* was not in the intended position to the grounding, there was time to take adequate avoiding action. A full rudder movement as late as 0317½ would have ensured the ship cleared Heath Reef and the shoal water.

However, the pilot did not believe *New Reach* would ground. And, as far as the 2nd mate was concerned, the ship had passed other reefs close-to and he was not alarmed.

The situation the pilot found himself in was compounded by his limited experience of less than one year. He had not been in such a situation before off Heath Reef or any other part of the Reef. As a result, he had a limited skill base on which to draw to take instinctive action to con the ship to safety. Nor did he have any learnt or stored rules or procedures for the situation in which he found himself. In a state of fatigue, he had to adapt to a novel situation, drawing from his general seagoing knowledge for a solution.

Although the pilot had been using the parallel index feature since Low Isles, he was unable to set up the index lines or a clearing bearing to pass Heath Reef. At that time, the radar was on the three mile range. It is probable that a combination of having just woken in a fatigued state and finding himself under an immediate exigency to act made manipulation of the ball difficult for him, given his limited use of the set.

The Nucleus 5000 is a modern radar. A roller ball and three buttons with a screen 'menu' control all functions. The roller ball operates an electronic marker; outside the radar picture or plan position indicator (PPI) a computer-generated arrow can be used to select on screen buttons. When within the radar PPI, the roller ball manipulates the range and bearing functions and the parallel index lines. The set is very versatile, but the roller ball takes a little practice to use.

By the time *New Reach* had reached a heading of 344°, looking at the radar screen and the signal return from the reef-edge, it probably seemed to the pilot that the ship would just clear the reef. Also, by 0318, Heath Reef light was to starboard of the forward derrick post and the bearing would have been opening. However, the shoal water to the south of Heath Reef extends 200 m below the surface and it was on this that the ship grounded.

Fatigue

The pilot's actions or omissions strongly suggest that his performance was affected by fatigue. He had unintentionally fallen asleep after Fife Reef (at a time of reduced circadian activity). Although he had been woken in ample time to take action to avoid the grounding and despite the fact that the pilot knew *New Reach* was out of position, he did not establish the ship's position. Also, he was unable to manipulate the radar controls to display parallel index lines, although he had been using the controls regularly since boarding the

ship.

Fatigue is an ever-present factor and problem with pilotage in the inner route of the Great Barrier Reef. Ultimately, the only way to offset or overcome fatigue is to actually sleep

Definitions of fatigue

The International Maritime Organization defines fatigue as *'a reduction in physical and/or mental capability as a result of physical, mental or emotional exertion which may impair nearly all physical abilities including: strength; speed; reaction time; coordination; decision making or balance.'*¹

Seafarers International Research Centre describe fatigue as:

'An acute or chronic and encompassing tiredness, depression, sleepiness, stress, sleep quality, disturbed circadian rhythms and boredom. It can be experienced even when the fatigued individual appears to be performing normally.'

'Acute fatigue can occur in a matter of hours and is usually the result of excessive mental or physical activity.'

*'Chronic fatigue is reached when the 'normal' period of sleep proves insufficient to restore the individual's working performance to its usual level. It is insidious and usually happens over a period of time. Persons suffering chronic fatigue always perform below their personal best.'*²

The Great Barrier Reef Pilotage

The distance between Low Isles and Booby Island is about 464 nm*. A ship travelling at 13.5 knots can be expected to take a little more than 34 hours to complete the pilotage. Such a period of duty leads naturally to fatigue and pilots must have a regime to reduce the effect of any decrement in performance by managing the hours of the pilotage.

One of these strategies is to involve to the greatest extent possible the master and officers and ratings who form the watch in the passage.

Another strategy is to leave the bridge at certain points, under the right conditions of visibility and traffic, to take a brief sleep. However, it is important that this is not the only means of offsetting fatigue, as pilots cannot be

certain that conditions will permit their absence from the bridge.

For vessels on a northward passage, recognised areas for rest include the passages between Low Isles and a position south of Gubbins Reef, normally for about two hours. After clearing Gubbins Reef, there is another stretch of about 1¾ hours between Archer Point and a position south of Two Isles. After Two Isles, the pilot remains on the bridge for about 98 nm (nearly 8 hours) until a break of just less than one hour across Princess Charlotte Bay. Thereafter, there may be two or three opportunities to rest in stretches between Heath Reef and Torres Strait.

The pilot

The pilot on board *New Reach* lives in Cairns. Between 19 and 24 April, he had a period of five nights at home. From 24 April to 14 May, he had piloted five ships through the inner route of the Great Barrier Reef and two through the Great North East Channel. The night of 16-17 April was his fourteenth night of duty in a 23 day period.

At 1400 on 14 May, he disembarked from a southbound ship off Cairns and spent the nights of 14 and 15 May at home. He is a man conditioned by his sea career to wake naturally at about 0600.

On the afternoon of 15 May, he slept for about one hour in the afternoon. That evening, he was at home and went to bed at about midnight, after collecting a family member at about 2300. He got up at about 0545 on 16 May to join *New Reach* at the Cairns Sugar berth at about 0635. After the ship cleared Cairns fairway and en route to Low Isles he briefed the master and prepared the charts for the passage through the reef.

After passing Low Isles at 1019, the pilot went below to rest in a cabin set aside for him. However, he was not sleepy at that time of the morning and did not sleep. After passing Gubbins Reef he was also unable to sleep. It was early afternoon and again he did not feel particularly tired. He found that the noise of the ship and particularly the vibration prevented him from relaxing.

The pilot was then on the bridge for about seven hours from Two Isles to Princess Charlotte Bay. He went below again at Princess Charlotte Bay for about 50 minutes. Again, he found it difficult to relax, putting this down to the ship's vibration and noise. He stated that he did not sleep. He went back to the bridge at Wharton Reef, intending to leave the bridge at Magpie Reef for a break of about 1 hour 10 minutes to try and sleep.

After passing Magpie Reef, the pilot decided, based on the activities of fishing vessels, that he should stay on the bridge controlling the navigation.

The pilot had been without sleep from 0545 on 16 May to about 0220 on 17 May, when the ship passed Fife Reef then—a period of more than 20½ hours.

Most people require between 7½ and 8½ hours sleep in any 24-hour period. In attempting to make some objective assessment of fatigue, the term ‘sleep deficit’ is used. This sleep deficit is compared with sleep credits. Sleep credits are accumulated at the rate of two points for every hour asleep and expended at the rate of one point for every hour awake. It does not take into account physical exertion, environmental factors that may be sleep inducing, or other external factors that affect alertness.

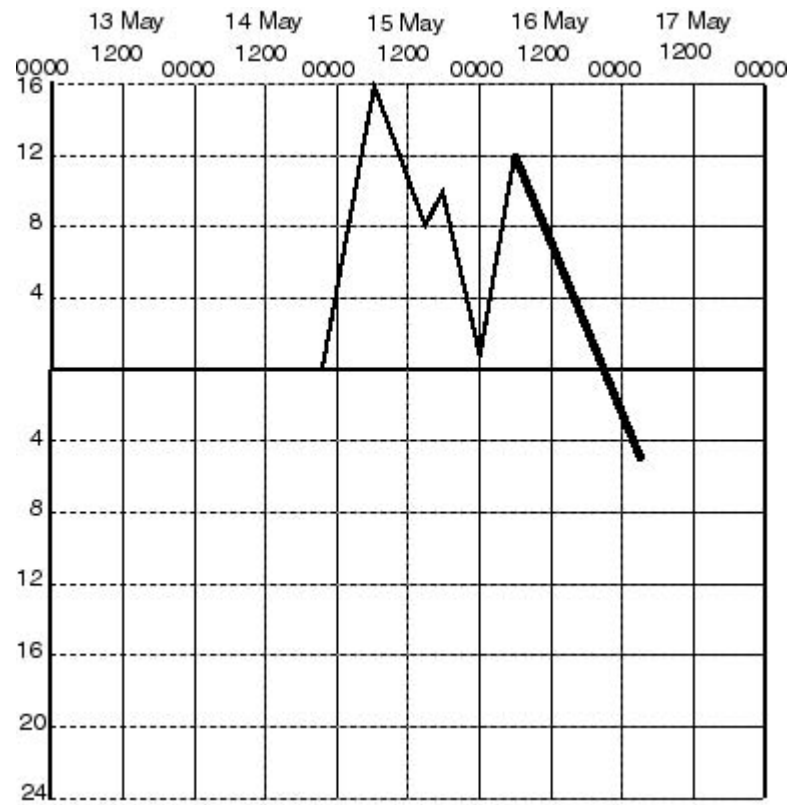
The United States Coast Guard Research and Development Center has developed a ‘fatigue index score’ which, according to the Center accurately identifies fatigue in 80 per cent of US casualties. On the basis of the index, the pilot would have had a score somewhere between 130 and 170, substantially above the 50 score threshold.

Although the index has come in for some criticism, the score, taken with the sleep credit-deficit chart and the general evidence, satisfies the Inspector that the pilot was suffering a degree of fatigue.

Passage plan

Under company procedures, the 2nd mate of *New Reach* was responsible for formulating a passage plan and entering it in a special book/folder kept on the chart table. The procedures required details of the projected courses, times and alteration positions for all stages of the passage and, in addition, a column detailing the position-fixing frequency. In the open sea this was hourly; in coastal waters it was every 30 minutes; and in relatively confined waters, every 15 minutes.

Had the procedures relating to position fixing been followed through the inner route, the ship’s position would have been plotted every 15 minutes. In the event, the position fixing was a little erratic, but plots were made about every 30 minutes. The frequency of plotting reflects on the bridge organisation generally but, in itself, did not directly contribute to the grounding.



Pilot's sleep credit-deficit chart (assuming nil deficit 2200 on 14 May)

The passage plan entered into the folder by the 2nd mate started from Booby Island and did not include the passage through the Great Barrier Reef. However, the 2nd mate had drawn course lines through the inner route. But these courses were erased and new courses entered by the pilot. The 2nd mate was not involved with the pilot in redrawing the ship's courses.

The pilot had, and carried with him, a clear and comprehensive folder showing the passage through the Reef, detailing the alteration positions and dangers within the pilotage area to Booby Island. He drew the course lines and marked the courses on the chart. He also clearly marked those positions at which he was to be called, should he be absent from the bridge.

Bridge organisation

The master spoke good English and had been through the inner route a number of times before. Communications between the pilot and the master were good. The pilot assessed that the mates on watch did not have a good grasp of English. Over the first 12 hours of the passage, he realised that the ratings (helmsmen) on the bridge had a reasonable understanding of English, particularly the rating on the 12-4 watch.

The pilot did not brief the watchkeeping officers on checking the ship's position or the passing distances off the various reefs. Neither did he tell the master that he expected the ship's officers to plot the ship's position and report to him should any fix be off the intended course line. The pilot had not explained that the tidal stream could be expected to set the ship to the east and the 2nd mate was not instructed to alert the pilot if the plotted position was not on the course line.

From Fife Reef, the 2nd mate had plotted the ship as being 0.45 nm and then, about 30 minutes later, 0.55 nm to the east of the intended track. He did not report this to the pilot and, critically, did not warn him when the pilot started to make alterations of course to port at 0311.

The pilot, in submission, agreed that he did not verbally brief the master or officers, but that his 'Instruction for Watchkeepers' covered these points. While the pilot's instructions may have covered these points, it would have arguably been more effective had he told the master and officers of his requirements and invited a response to ensure the instruction was understood.

The master gave specific instructions to the officers to 'provide every assistance' to the pilot and, if they were in any doubt, to call the master. Such instructions are routine and did not deal with the specifics of the inner route.

Regardless of any instruction issued to the officers of the watch, the presence of a pilot did not relieve them from their duties and obligations for the safety of the ship. Apart from any considerations of the 'ordinary practice', the obligations of a watchkeeping officer are laid down in the Convention on Standard of Training, Certification and Watchkeeping for Seafarers (Section A-VIII/2.49) and are codified in subsection 3.3.3.1 of the Bridge Procedure Guide issued by the International Chamber of Shipping (third edition, 1998).

In submission, the master stated that the positions plotted at 0220, 0249 and 0307 clearly show that the vessel was making good a course which would take it clear to the east of Heath Reef. The ship's track was clearly drawn on chart Aus 834 to the west of Heath Reef and the pilot had given no indication that he was departing from the planned course. The 2nd mate had a clear duty to continue checking the ship's position while taking appropriate action to maintain the ship on the planned course. The appropriate action, in the first instance, was to report the ship's position to the pilot.

The 2nd mate did not question the pilot or check the pilot's actions. He adopted a passive role. This may be, in part, due to the 2nd mate's acceptance of a rigid hierarchical system, attributable to his limited experience and cultural attitude towards senior officers and pilots.

During the earlier part of the watch they had passed close to reefs and lights. At 0311, the pilot was active and shortly after the report to Reef Centre, was issuing helm orders. It probably did not occur to the 2nd mate that the pilot was not fully in control of the navigation.

The 2nd mate was not utilised by the pilot to plot the ship's position, although there was time to do so. After the grounding, when the pilot instructed the 2nd mate to call the master, there was a degree of misunderstanding. Initially, the 2nd mate seemed to understand the pilot to mean the rating or 'quartermaster', who was already on the bridge. However, the Inspector does not believe that the pilot neglected to utilise the officer of the watch because of language difficulties, but only that he did not consider doing so.

There were two sets of people monitoring the ship, neither communicating effectively. The pilot's passage plan in terms of charts and paperwork was more than adequate. However, the pilot had no plan to involve the officers of the watch in the pilotage. If he felt that there was a language difficulty, he could have arranged for the master to brief the three watchkeeping mates. It is also a strategy to manage the long hours of wakefulness required of the coastal pilots.

There was little recognition of the principles of bridge resource management. There was very limited interaction between the officers on watch and the pilot. The potential for a single person error was very high.

Pilot training

The pilot started in the pilot service on 21 August 1998 and undertook the Australian Maritime Safety Authority Training schedule for coastal pilots. By early October, he had completed the requisite passages as an observer and qualified for a pilot's licence for the inner route on 8 October 1998. Between 12 October and 10 December he completed 12 passages on vessels at draughts of 10 m and under. By 23 April he had completed the requisite number of passages in the four draught categories and had qualified for an unrestricted license for the inner route. In the period between 12 October 1998 and 18 April 1999, he piloted 30 ships through the inner route (ten through the Great North East Channel) and had embarked as an observer on five transits through Hydrographers Passage.

The pilot had not undertaken any course in bridge resource management.

Shanendale

At 0310 on 17 May, the fishing vessel *Shanendale* was about 4.6 nm north of *New Reach* in the two-way route. The pilot had no concerns that *Shanendale* would impede *New Reach*. Radio communication was established between the two vessels and a clear understanding was reached.

The 2nd mate and the rating could see the fishing vessel and heard, but could not follow, the conversation between the pilot and the fishing skipper. They were effectively spectators and believed that *New Reach* was being forced to pass close to the reef because of the fishing vessel.

The pilot could also see *Shanendale* in the two-way route to the north and west of Heath Reef. He realised that *New Reach* was not in anyway constrained by the fishing vessel. The skipper asked whether he should take *Shanendale* further to the west, but the pilot replied in the negative and added 'I'm just trying to dodge my way round', or words to that effect.

Although the inspector is totally satisfied that *Shanendale* acted appropriately and did not impede *New Reach*, the mere presence of the fishing vessel added to the hazards that the pilot had to consider in a condition of impaired performance.

Drugs and alcohol

The master stated that he had not provided the pilot with any beer or other alcoholic beverage. There was no evidence that the pilot had consumed, or had any access to, alcohol.

The pilot was not taking any medication.

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

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:

- When the pilot realised that the ship was out of position, he did not establish the ship's true position to allow him to take appropriate action based on full and correct information.
- The pilot's navigation of the ship in proximity to Heath Reef was based on insufficient information, faulty analysis and inexperience.
- The pilot made an error of judgement and his overall performance was affected by fatigue.
- The pilot did not have any effective strategy to manage or counteract inevitable fatigue levels.
- Neither the master nor pilot briefed the watchkeeping officers on the passage through the inner route. Communications regarding navigation between the pilot and the officers on watch was minimal.
- The 2nd mate did not fulfil his duties and obligations to maintain the ship on course by bringing the pilot's attention to the plotted position of 0249 or the plotted position of 0307.
- Approaching Heath Reef, the 2nd mate established that the ship was to the east of the intended course line but did not alert the pilot to the ship's position.
- With the pilot on the bridge for the passage from Fife Reef, the 2nd mate was unconcerned at the relative position of Heath Reef light.
- There was a marked lack of bridge resource management, which led to *New Reach* grounding through over- reliance on a single person.
- The fishing vessel *Shanendale* was well clear of *New Reach* and did not in any way restrict the cargo ship's sea room.

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, were sent to the pilot, the Australian Maritime Safety Authority, the master and 2nd mate of *New Reach*. Where appropriate the text has been change to correct the draft or reflect the submission.

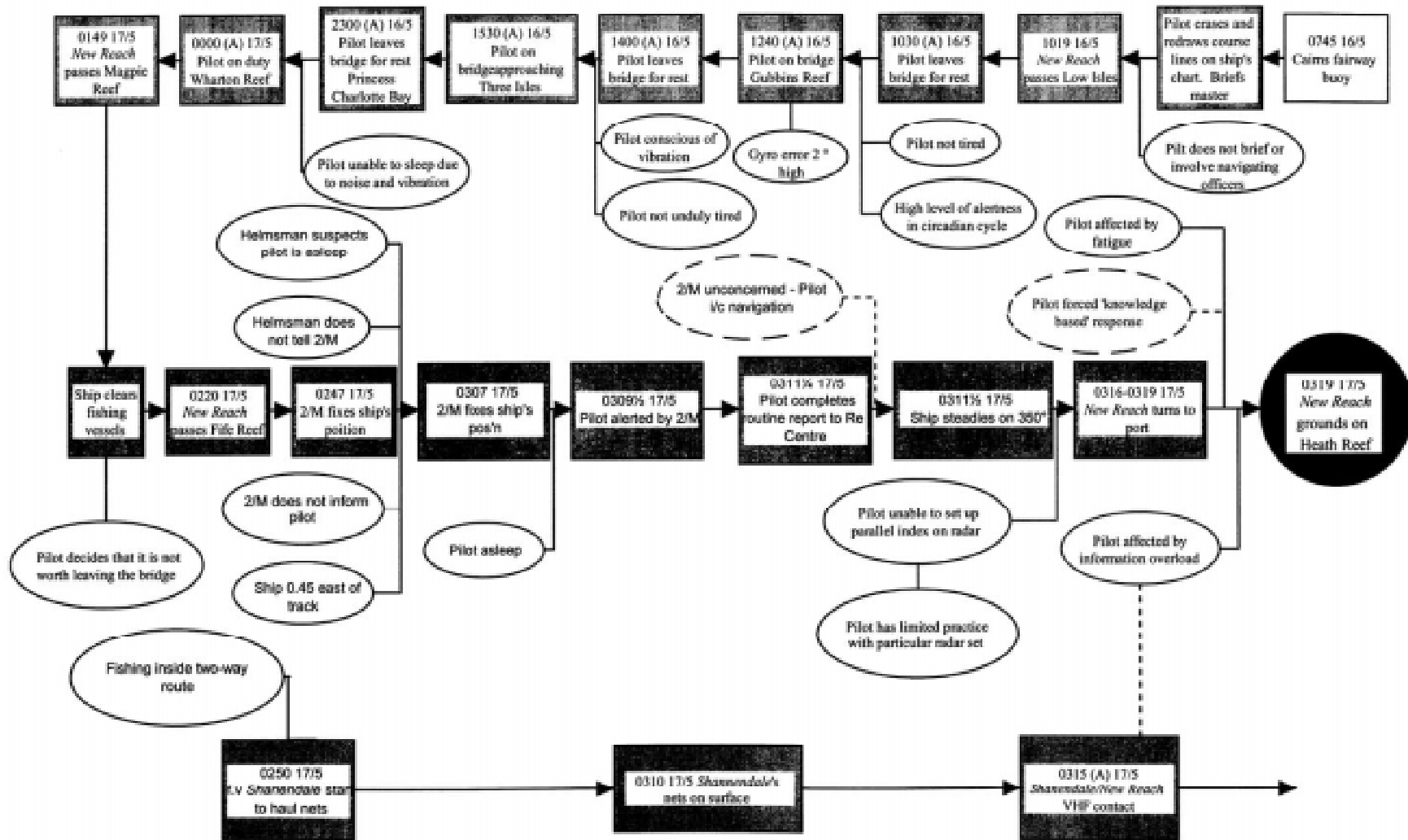
The master made the following submission:

Thank you for your letter of 6 July 1999 with the enclosed draft report which I have carefully considered, I have to tell you that I disagree with some of your conclusions. In particular, I do not agree that the Second mate of this vessel failed to fulfill his duties and obligations as the Officer of the watch. There is not doubt in my mind that the grounding at Heath Reef was due solely to an error of judgement on the part of the pilot. The 3 positions plotted on working chart AUS834 by the Second mate (at 0220 Hrs, 0249 Hrs and 0307 Hrs) clearly show that the vessel was making good a course which would take it clear to the East of Heath Reef and which would also take the vessel safely between Heath Reef and South Khandalla Shoal. It was the Pilot's decision to make a series of small course alterations to port shortly after 0311 Hours which led directly to the grounding. The pilot ordered these course alterations at the same time as he was making his scheduled mandatory report to reef centre and also when he was communicating by VHF with a fishing vessel in the vicinity. It is quite apparent that the pilot ordered these course alterations without making any proper assessment of the vessel's position and without consulting the Second mate. I am shocked that the pilot should have made such a basic error of judgement in a compulsory pilotage area.

I also do not accept the criticism that I failed to brief the watchkeeping officers on the passage through the inner route. I gave instructions to the watchkeeping officers to provide every assistance to the pilot and to call me if any time they were in any doubt. The watchkeeping officers should also not be criticised if communications between the pilot and these officers was minimal. Some Pilots are talkative. Others are not.

Event and factor chart

A simplified version of the flowchart used in the analysis of the casualty, identifying events and causal factors.



New Reach - simplified event and factor chart

It has to be remembered that the pilot was in charge of the navigation of the ship. As is stated in the draft report, there was a concentration of 12 to 18 fishing vessels in the vicinity which entailed several alterations of course before the vessel passed between Fife Island and Hay Island at about 0232 Hrs on 17 May. The vessel was then only some 10.8 miles from Heath Reef Light which could be clearly seen ahead. As is also stated in the report, there were at least 2 fishing vessels ahead and operating in or in close proximity to the track. For all the Second mate knew, the pilot was deliberately navigating the vessel to leave Heath Reef to port. The pilot did not at any time indicate his intentions to the Second mate. The Second mate for example did not know that the pilot had intended to leave the bridge for a rest at magpie Reef. As far as the Second mate was concerned, the pilot was deliberately allowing the vessel to remain to the east of track and the positions were plotted by the Second mate on the working chart and were available for the pilot to check whenever he wished to do so.

I am indeed conscious of the need for good Bridge Resource Management. This is a subject which I emphasise to my watchkeeping officers. However, one cannot force a pilot to communicate with the watchkeeping officer if he chooses not to do so.

Finally, the pilot had been making regular use of the pilot chair adjacent to the Kelvin Hughes Radar throughout the passage north from Cairns. The pilot was not talkative and the Second mate had no reason to believe that he had fallen asleep or otherwise lost situational awareness.

I trust that these comments may be of some assistance to you and I would ask that they be included in your final report for publication.

Details of *New Reach*

Previous names	<i>Seahawk –89;Handy Gaul –90; Ken Gale – 96.</i>
IMO number	7908720
Flag	Panama
Classification society	Nippon Kaiji Kyokai
Ship type	General Cargo
Builder	Kochi Jyuko K.K. - Kochi
Year built	1979
Owner	Genial Marine S.A
Ship managers	Hsin Chien Marine Co. Ltd, Taiwan
Gross tonnage	13,519
Net tonnage	8264
Summer deadweight	22,829 tonnes
Summer draught	10.02 m
Length overall	151.0 m
Breadth	26.0 m
Moulded depth	13.5 m
Engine	Mitsubishi 6 cy
Power	5884 kW
Crew	22