

Departmental investigation  
into the  
grounding of the Panamanian flag  
refrigerated cargo vessel  
**PEACOCK**  
on Piper Reef, in the Great Barrier Reef,  
on 18 July 1996



**Report 95**



**Transport and  
Regional Development**

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**Navigation Act 1912**  
**Navigation (Marine Casualty) Regulations**  
**into the grounding of the Panamanian flag**  
**refrigerated cargo vessel**  
**PEACOCK**  
**on Piper Reef, in the Great Barrier Reef,**  
**on 18 July 1996**

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# Summary

The Panamanian flag refrigerated cargo vessel Peacock, on a ballast passage from Singapore to New Plymouth, New Zealand, embarked a licensed pilot off Goods Island at 1630 AEST on 17 July 1996 for the passage through the Torres Strait and the Inner Two Way Route of the Great Barrier Reef.

At about 0155 on 18 July 1996, the vessel grounded on Piper Reef at full speed, in a position 100 metres eastward of the light beacon. Initial attempts to refloat the vessel by going astern on the engine were unsuccessful.

Peacock remained stranded on Piper Reef until the late afternoon of 26 July 1996, when salvors successfully refloated the vessel after having transferred some of the fuel oil bunkers to a barge.

The vessel's hull was not breached and no pollution occurred. However, machinery tests showed that only one steering motor was fully functional, therefore Peacock was towed to Cairns for necessary repairs.

# Sources of Information

Master, Second Mate and Helmsman

Pilot

Queensland Coastal Pilot Service Pty Ltd

Australian Reef Pilots Pty Ltd

Australian Maritime Safety Authority

## **Acknowledgement**

Professional opinion on fatigue was provided by:

Director of Aviation Medicine, Civil Aviation Safety Authority

Circadian Technologies Inc

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

# Narrative

The Panamanian registered, four hold, refrigerated cargo vessel Peacock has an overall length of 124.7 m, a beam of 17.8 m and a moulded depth of 9.85 m. The vessel has a gross tonnage of 4964 and a summer deadweight of 6541 tonnes at a mean draught of 7.317 m. Built in 1986 at the Kochi Jyuko K K shipyard in Japan, the vessel is powered by a six cylinder, 5149 kW Mitsubishi diesel engine, driving a single fixed propeller and providing a service speed of 16½ knots.

Owned by Libero Panama SA and operated by Shunko Shipping Corporation of Tokyo, Peacock is engaged in world-wide trading. The vessel has a Korean Master, a mixture of Korean and Indonesian officers, and Indonesian ratings. The three Deck Officers maintain the traditional “4 on, 8 off” bridge watchkeeping routine, each bridge watch being comprised of one deck officer and one helmsman/lookout.

In common with a number of small Japanese owned/operated vessels engaged in world-wide trading, Peacock carries extra fuel oil and diesel oil bunkers. This additional fuel oil is carried in the double bottom tanks and the only ballast tanks in the vessel are the fore peak and aft peak tanks.

Peacock sailed from Singapore in a light condition, at 0220 local time (UTC + 8) on Wednesday 10 July 1996, having discharged the second consignment of a full cargo of apples loaded in Chile. The vessel was bound for New Plymouth, New Zealand, its route being via the southern China Sea, the Flores Sea and the Torres Strait and Inner Two Way Route of the Great Barrier Reef to the South Pacific Ocean. As part of the passage plan for the voyage, the Second Mate had laid



**Portion of chart Aus835 showing course of Peacock**

off the courses in the delineated two-way route of the Torres Strait and the inner route of the Great Barrier Reef.

A licensed pilot of the Queensland Coastal Pilot Service Pty Ltd boarded the vessel to the west of Goods Island, at the western end of the Prince of Wales Channel, Torres Strait, at 1630 AEST on Wednesday 17 July. Another eastbound vessel was approaching about three or four miles astern of Peacock, so the Pilot immediately called for full harbour speed. After being advised of the vessel's draught (3.3 m forward and 5.1 m aft) and full sea speed (16 knots) the Pilot ordered full sea speed.

Harrison Rock buoy was passed abeam to port at 1650 and the Pilot then concentrated on conning the vessel clear of Mecca Reef,

Hammond Rock and Nardana Patches. Once Peacock was lined up on the East Strait leads, and before the vessel reached Ince Point, the Pilot laid off his intended courses on the chart to take the vessel clear of Alpha Rock. While on the East Strait leads, the Pilot ascertained that there was an error on the gyro compass of between  $\frac{1}{2}^{\circ}$  and  $1^{\circ}$  high.

After clearing the Alert Patches the Pilot, watched by the Master, laid off his courses down to Cairncross, rubbing off the Second Mate's courses as he did so. While engaged in this, he noticed that apart from a position off Hammond Rock, no positions had been marked on the chart by the Watch Officer. He brought this to the Master's attention and placed on the chart table a copy of his "Standing Procedures for Pilotage in the Reef", detailing position fixing requirements. These "Standing Procedures" stipulated that the vessel's position was to be plotted every 15 minutes when the Pilot was absent from the bridge. The Master discussed this with the Mate, the Watch Officer, and thereafter the vessel's position was plotted on the chart at regular intervals.

With just the one helmsman to the Watch, the practice was for the ship to proceed in automatic steering, with the helmsman taking the wheel for course alterations. Once the vessel was steadied on the next course, the steering would be changed back to automatic mode, the change-over being achieved by the helmsman using a single, positive, two-way switch located on the steering console.

Wyburn Reef was rounded at 1945 and, when the vessel was steadied on the new course of  $167^{\circ}$ , the Pilot, satisfied that it was safe for him to do so and with the Master's agreement, left the bridge to take a rest in the pilot's cabin, two decks below. Before leaving the bridge, he gave instructions that he should be called at any time considered necessary and when the vessel arrived at the position he had marked on the chart, just northward of Cairncross Islets, 25 miles to the south.

The Pilot was called at about 2110 and returned to the bridge, having spent the time in the cabin resting, mainly awake. On his return to the bridge, the Master was still there and the Third Mate had taken over from the Mate as Watch Officer. The Pilot checked the chart and noted that the vessel's position had been plotted on the chart at 15 minute intervals, as required by his "Standing Procedures".

After the vessel had altered course off Hannibal Island, at 2220, the Pilot left the bridge for another rest period, leaving instructions that he be called at a position off Sunday Island, about 23 miles distant, which he calculated would be at about 0020. On this occasion he slept, and was asleep when called at 0010. When he arrived on the bridge, he found that he had been called slightly early, with still seven miles to run to the course alteration point off Clerke Island (off Cape Grenville). The reason for his being called early was that the Master had had a plate of noodles prepared for him. He noted that the Third Mate had been relieved by the Second Mate as Watch Officer and that the steering was still in automatic.

Rounding Clerke Island, the Pilot followed his normal procedure, waiting until Moody Reef light was in transit with Clerke Island light and altering to 180°, bringing the eastern edge of Haggerstone Island right ahead. Just before Clerke Island light was abeam to starboard, course was altered to 212° (on this occasion 213°). The pilot noted the time of Clerke Island light being abeam as 0050. Once steadied on this new course, the Master, who had been on the bridge since before the Pilot had boarded off Goods Island, asked the Pilot if it would be all right if he went down to his cabin to get some sleep. The Pilot assured the Master that that would be all right and the Master left the bridge at about 0100, having first instructed the Second Mate to follow the Pilot's instructions and to ensure the safety of the navigation.

After rounding Clerke Island, the Pilot felt that the wheelhouse was becoming rather stuffy. He checked the air conditioning vents and, as the issuing air was warm, thought the air conditioning unit had either been turned down or off.

Haggerstone Island was passed at a distance (by radar) of two miles, about two cables greater than his normal passing distance, so the pilot adjusted the course to 208°, in order to pass between 1.2 and 1.3 miles off Moody Reef light when it was abeam to port. The radar distance off Moody Reef light, when abeam, was 1.3 miles, so the pilot let the vessel run on for about two cables before altering course to 175°. With Peacock steady on the 175° course and Moody Reef light abeam at 1.3 miles, Piper Island light lay between ½° and 1° on the starboard bow, rather than the normal right ahead, this to make allowance for any drift effect of the 15 to 20 knots south-easterly wind on the ship in light condition.

With a little over seven miles to run to the next alteration point, 1¾ miles north of Piper Reef light, the Pilot went to the chartroom and did some paperwork. After a few minutes, he went into the wheelhouse to check that all was well, then, returning to the chartroom, he saw that the Second Mate had plotted the vessel's position on the chart for 0125. Satisfied that the position was correct, the pilot returned to the wheelhouse, where he walked up and down for a while, watching Piper Reef light, very fine to starboard, and Inset Reef light, broader on the port bow.

After plotting the position on the chart at 0125, the Second Mate checked the radar and visually checked through the wheelhouse windows to see that everything was all right. He then returned to the chart table and got out the next chart to check the courses laid off by the Pilot.

At about 0135, the Pilot glanced at the radar and saw that there was about 3 to 3½ miles to run to the point where he normally starts to alter course off Piper Reef. He calculated that after another seven or eight minutes there would be ¾ mile or so to run to the position and therefore sat in the pilot chair, chin cupped in the palm of his left hand, to await that moment. He watched the lights, Piper Reef light still very fine to starboard and occasionally becoming concealed from his view by the forward starboard Samson post and Inset Reef light broadening out to port. He also kept an eye on the clock, located on the forward bulkhead, as the time moved towards 0140.

Suddenly, the ship vibrated, described by the Pilot as being similar to that caused by a ship moving from a calm to a choppy sea, or feeling a few waves. The Pilot moved out of the pilot chair, ordered “hard a port” and as the vibration increased, called “stop engines”, realising the vessel had run aground. As he moved to the starboard wheelhouse door, which he had some difficulty in opening, he was aware of someone behind him moving to the engine telegraph and putting the telegraph to stop. The time of the grounding, although not recorded, was considered to have been about 0155. Peacock had come to rest on a heading of 166°.

After leaving the bridge at about 0100, the Master, instead of going to bed, had started to write a report to the Company. When Peacock started to shake, he looked out of the window and saw a light beacon very close on the starboard side. He went up to the bridge, where he found the engine had been stopped, the Second Mate was looking out through the wheelhouse starboard window and the Pilot was out on the starboard bridgewing. He ordered all the deck lights to be switched on, so as to be better able to assess the situation. Peacock was listed four degrees to port and appeared to be hard aground. The engine was put to full astern, but there was no movement and the engine was stopped again after about four minutes, at 0203.

The Mate had arrived on the bridge shortly after the Master, and after the engine had been stopped again he joined the Master and the Pilot in discussing the best course of action. The Pilot suggested going ahead on the engine with the rudder hard over to starboard, in an attempt to pivot the vessel to starboard before going astern on the engine again. The Mate agreed with the Pilot, but the Master preferred to go astern and the telegraph was put to full astern at 0208. Again there was no movement and the engine was stopped at 0219.

The Master discussed the situation with the Chief Engineer, who was concerned about the fact that heavy fuel oil was still in the system, which would cause problems if the engine was to remain stopped for any appreciable length of time. It was therefore decided to run the engine astern and change over to diesel oil and the engine was put to full astern at 0225.

The Master issued instructions for the crew to sound around the vessel, also for the Chief Engineer to sound all of the tanks. These soundings showed that although Peacock was well aground, there had been no penetration of the hull.

Assisted by the Pilot, the Master prepared messages to be telexed to the Maritime Rescue Coordination Centre (MRCC) Canberra and to the Queensland Coastal Pilot Service Pty Ltd in Brisbane. The message to MRCC Canberra was transmitted at 0319.

The change over to diesel oil took until 0332, after which an attempt was made to pivot the vessel to starboard, the engine being worked up to half ahead. However, this was aborted at 0340, the Pilot advising the Master that it would be better to wait for the next high tide, at about 1030, before making further attempts to refloat the vessel.

The engine was again put on full astern at 1016 and run until 1038. As this had no effect, the Master and Pilot concluded that Peacock could not be refloated without assistance. On instructions from the

owner, the Master signed a salvage agreement, using Lloyd's Standard Form, with salvors who flew to the vessel by helicopter that same morning.

In compliance with 6.5.12<sup>1</sup> of Marine Orders Part 54, the Pilot was relieved from the vessel on 19 July.

After the failed attempt on the morning high tide, the Australian Maritime Safety Authority issued an Intervention Order, under the MARPOL Convention, stipulating that no further attempts were to be made to refloat Peacock until such time as oil pollution prevention equipment was in place. Floating boom equipment was shipped from Cairns aboard the tug Hamilton, which arrived at Piper Reef early on 20 July, and further equipment was flown to Lockhart River by DC4 aircraft.

The tides were such that there was insufficient water for refloating the vessel for another week. On Friday 26 July, 450 tonnes of bunker fuel were transferred to Pacific Explorer, a landing barge operated by Endeavour Shipping and normally used for transporting aviation fuel and general cargo to Thursday Island. Late that afternoon Peacock was pulled off the reef by the tug Pacific Salvor (brought down from Papua New Guinea for the salvage operation) and was moved to an anchorage position approximately one mile northward of Piper Reef.

No pollution had occurred, either as a result of the grounding, or the salvage operation.

An underwater inspection of the vessel's hull was carried out by divers on Saturday 27 July, and as the various double bottom tanks were

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<sup>1</sup> If a ship under pilotage grounds ... the Manager must as soon as practical after being advised of the grounding ... suspend the licence of the pilot having conduct of the vessel for a period not exceeding seven days.

cleared as being sound, the bunker fuel was transferred back from Pacific Explorer. The underwater inspection revealed that Peacock had suffered very little damage, the maximum indentation of plating being about 50 mm.

Inspection by a classification society surveyor of the main engine and other machinery revealed a problem with one of the vessel's steering motors, which though operable, was not fully functional. As it is a requirement that vessels transiting the Inner Two Way Route have two steering motors operating during the transit, AMSA issued another Intervention Order, requiring Peacock to be towed to Cairns. The salvage company and the owner extended the salvage agreement to cover the tow, Pacific Salvor commencing the towage operation on Sunday 28 July.

# Comment and Analysis

Peacock grounded on Piper Reef while the navigation was under the conduct of a pilot with 26 years experience in the Great Barrier Reef and when an alteration of course was not made about six minutes before the grounding. No machinery or equipment failure contributed to the grounding.

It is therefore necessary to examine why the Pilot did not make the necessary course alteration, why this was not detected by the vessel's Bridge Watch and what the circumstances were which led to the situation.

The Pilot had sat in the pilot chair at about 0135 and his last recollection of time, before being startled by the ship vibrating on grounding, was at about 0137 or 0138. From that point, or shortly thereafter, he lost situational awareness and it seems probable that he fell asleep about 15 minutes before the grounding.

The Second Mate absented himself from the wheelhouse for a considerable length of time, taking no part in the navigation of the vessel, with the result that the alertness of not only the Pilot but also that of the Second Mate was impaired to such a degree that the vessel was placed at hazard.

## Alertness

Research has shown that nine internal or external factors and stimuli are relevant to the level of alertness in an individual<sup>2</sup>. They are:

1. Environmental light.

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<sup>2</sup> Moore-Ede, M., The Twenty-Four Hour Society, Random House Australia, 1993

2. Environmental temperature.
3. Environmental sound.
4. Environmental aroma.
5. Time of day on circadian clock.
6. Muscular activity.
7. Ingested nutrients and chemicals.
8. Interest, opportunity or sense of danger
9. Sleep bank balance.

These factors can be seen as switches that may be in the “on” position, “off” position or in “neutral”. Whereas just one individual switch in the closed position may not be sufficient to cause a dangerous loss of alertness or induce sleep, the greater the number of closed switches, the greater the hazard.

## **Environmental factors**

Bright light, cool temperature, irregular sound and certain aromas all act as stimulants, which help keep a person alert. Dim lighting and darkness, warm sultry heat and regular rhythmic noise can all have the opposite effect.

The conditions on any ship’s bridge at night, particularly in the tropics, with the darkness, warmth, rhythmic sound of the engines and steady background noise of electrical machinery, are such that the environmental switches are all in the “off” position. However, there is normally sufficient activity to maintain the alertness of those on duty.

There is some dispute with respect to the claimed stuffiness of the atmosphere in the wheelhouse and whether or not the wheelhouse doors were open. Any stuffiness would have decreased the alertness of those in the wheelhouse and made them more susceptible to drowsiness.

## **Time of day**

The natural period of sleep is during the hours of darkness, between 2200 to 0600, the brain automatically regulating the body into the sleep mode. People working regular shift work, where the periods of work are not changed, can adapt to the different sleeping period without too much ill effect, their biological clock adjusting to the changed conditions. Thus mariners are able to adjust to their watch regime, the time of day switch being in the “on” position at the required times.

The pilots serving the Great Barrier Reef, however, work a routine where the natural sleep period is seriously disrupted, although generally for periods not exceeding 48 hours at one time. During the natural sleep period, 2200 to 0600, the time of day switch will be in the “off” position.

Depending on the speed of the ship, pilots have conduct of the ship in the Inner Two Way Route for between 34 and 50 hours. However, there are five recognised areas within the Inner Two Way Route where pilots can leave the bridge to take a rest, provided circumstances permit. Also, their schedule is so programmed that after each pilotage they are usually able to get at least one full night’s sleep before their next assignment. The pilots are apparently able to adjust to this routine, without ill effect.

## **Muscular activity**

All types of muscular activity, even chewing, act as a stimulant to alertness, the muscular activity switch moving to the “off” position when the body is at rest.

The inner route pilotage requires the pilot to be on the bridge for very long periods at a stretch and it is not unusual for a pilot to sit in the chair specifically provided for his use.

However, in sitting in the pilot chair at 0135 and particularly in cupping his chin in his hand, the pilot caused the muscular activity switch to move to the “off” position, making himself more susceptible to sleep. Also, by supporting his head in his hand, his head could not fall forward as he relaxed and a basic warning mechanism was lost.



**Photograph of interior of Peacock wheelhouse showing position of pilot chair**

## **Ingested nutrients and chemicals**

Caffeine and amphetamines are stimulants, whereas alcohol and some medications are sleep inducing. Although the Pilot had drunk an occasional cup of coffee whilst on the bridge, he had not consumed large quantities.

The Pilot stated that he had consumed two glasses of wine during dinner the previous evening, or some 21 hours before he boarded Peacock. He stated that he had consumed no other alcohol whilst

awaiting the vessel at Thursday Island, and the Master confirmed that he had had no alcohol whilst on board.

The Pilot also stated that he was not under any long term medication, and had not taken any short term medication for relief of a cold, influenza or pain.

In the early hours of 18 July 1996, the Pilot's nutrients and chemicals alertness switch would have been in the "neutral" position.

## **Interest, opportunity, sense of danger**

These are all stimulants to alertness - the Pilot was jolted into full alertness by the vibration as the ship ran aground.

As the Pilot was sitting in the pilot chair everything was going smoothly - the vessel was on course, the weather was fine and the passage through the reef presented no special challenge to the Pilot, for whom it was purely routine. The Pilot's sense of risk was therefore reduced. With still some minutes to run to the next course alteration he was relaxed and, whereas it would not have been in the "off" position, this alertness switch would have been in "neutral".

## **Sleep bank balance**

Sleep periods are considered as making deposits in the individual's "sleep bank" and periods of wakefulness make withdrawals. As a general and approximate rule, sleep deprivation occurs, and the alertness switch goes to the "off" position, when an individual expends the total "sleep credits". Sleep credits are considered to accumulate at a rate of two for every hour of sleep and to expend at the rate of one for every hour awake. Hence, after eight hours sleep an individual

can be considered to have 16 credits, which are expended over the next sixteen hours.

## **Summary of alertness switches**

From the time the pilot sat in the pilot chair, at 0135, six alertness switches were in the “off” position and two were in the “neutral” position. However, the situation was not remarkably different from any other inner route pilotage situation and could be considered as being normal.

The fact that an experienced pilot succumbed to sleep while having the conduct of the vessel suggests a prima facie case of sleep deprivation, or fatigue, on the part of the pilot.

## **Fatigue**

The Pilot stated that he had had a good night’s sleep, between eight and nine hours, in the hotel on Thursday Island, the night before joining Peacock. He also stated that he had also spent the early part of the afternoon sitting down, resting, while waiting to go out to the vessel. Although he had not slept, other than a possible short nap, during his first spell away from the bridge, between 1945 and 2110 on 17 July, he did sleep during his second spell away, between 2225 on 17 July and 0010 on 18 July. The period between returning to the bridge at 0010 and sitting in the chair at 0135 was 85 minutes. Theoretically, with his period of sleep immediately before 0010, the Pilot would not have expended all his sleep credits, although they would have been low, therefore, it is considered unlikely that the Pilot would have been suffering from acute fatigue during the early hours of 18 July.

Chronic fatigue is reached when a ‘normal’ period of sleep proves insufficient to restore the individuals’ working performance to its

usual level.<sup>3</sup> It is brought about by sleep disturbance, due to various factors, and or sleep deprivation over a prolonged period.

In 1993, new regulations came into force, administered by AMSA which also licences the pilots, governing pilotage within the compulsory pilotage areas within the Great Barrier Reef Marine Park. The introduction of the new regulations and the opening up of the pilotage to competition, resulted in the formation of two pilotage services, with separate managing companies.

The managing company with the smaller number of pilots was able to secure the larger share of the available business, resulting in those pilots having to take on a greater workload. In the twelve months prior to the split, the Pilot conducted 59 pilotages, whereas in the same 12-month period prior to the incident he had conducted 69 pilotages, an increase of 17%, with a decrease in recreational time of about 7%.

Prior to the introduction of compulsory pilotage under the Great Barrier Marine Park Act, in October 1991, the workload was distributed fairly equally by the secretariat amongst all the Queensland Coast and Torres Strait pilots, although senior pilots had the option of reducing their workload. During the 12 months period July 1990 to June 1991, the Pilot conducted 47 pilotages. Therefore, over the intervening five-year period, as a result of pilotage being made compulsory and the restructuring, the number of pilotages conducted by the pilot has increased by 47%. Much of this increase has been in pilotage of ships through Hydrographers Passage, a pilotage of about 9½ hours duration. However, of importance is the number of nights worked in any period and whether rest periods between pilotages are disrupted by relocation travel.

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<sup>3</sup> Executive Summary of the Proceedings of a Research Workshop on fatigue in the Maritime Industry, Seafarers International Research Centre, University of Wales, Cardiff, 1996

From	time/date	To	time/date
Blossom Bank	0800, 22 June	Hay Pt	1620, 22 June
Hay Point	0900, 24 June	Booby Island	2310, 26 June
Booby Island	1600, 28 June	Stephen Island	0400, 29 June
Stephen Island	1800, 30 June	Goods Island	0300, 1 July
Booby Is	0940, 2 July	Cape Flattery	1930, 3 July
Cape Flattery	1000, 6 July	Booby Island	2000, 7 July
Goods Island	0130, 9 July	Townsville	0700, 11 July
Goods Island	1900, 14 July	Cairns	2359, 15 July
Goods Island	1630, 17 July		

**Table1 - Pilots Schedule**

A pilot's tour of duty is generally of between 14 and 21 days duration. However, of the six tours of duty the Pilot had undertaken since 1 January 1996, one had been of 26 days duration and that particular tour was into its 27th day.

The Pilot had started that particular tour of duty on 22 June 1996, after a period of 12 days at home and after travelling to Hamilton Island on 21 June. The Pilot was involved in pilotage, with either little sleep or disrupted sleep patterns, during the nights of 25, 26, 28 and 30 June, 2, 6, 8, 9, 10, 14, 15 and 17 July. That is 12 nights out of a total of 26 for the tour and 6 nights out of the last 10.

Tables 1 and 2 show the Pilot's schedule over the period.

The major contributing factor to possible chronic fatigue would seem to be irregular hours of work over a prolonged period. However, in addition to the actual hours of work, a number of other factors, such as sleep apnoea, diet and, domestic and occupational concerns, can affect the quality of sleep and an individual's susceptibility to fatigue.

HOURS OF WORK

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0
22																									
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Table 2 - Pilot's Hours of Work

At 64 years of age and heavily built, the Pilot is a prime subject to suffer sleep apnoea. Prior to his weight loss in 1993, the Pilot reportedly was a heavy snorer, an indication of sleep apnoea.

Although he reportedly now snores less, it is possible the Pilot suffers some degree of sleep apnoea, with the resultant effect on the quality of his sleep.

Although not under medication, the Pilot had been diagnosed as being a type 2 diabetic in January 1993 and was under a dietary regime. After an initial weight loss of approximately 26 kg over a two month period, the Pilot's weight had since remained stable at 106 kg.

In the 24 hours prior to the incident, the Pilot had eaten breakfast, consisting of Swiss Muesli with milk and coffee; lunch, consisting of a bread roll with ham and tuna, but with no butter or spread, an apple

and a coffee; dinner, consisting of a small amount of a rather fatty and unappetising meat dish and; supper, consisting of a bowl of noodles.

Although the Pilot was obviously well adjusted to his diet, dieting and food intake of insufficient calorific value can reduce both energy and stamina and so make an individual more prone to fatigue, particularly under increased workload.

The formation of competing pilotage services has resulted in changed conditions of service, including a reduction in income for individual pilots and a number of pilots have reported experiencing concern and anxiety as a result of these changes. Such anxieties are acknowledged to cause stress, which can affect an individual's sleep and concentration.

Despite the pilot stating that he had not felt tired, only a little leg weary, taking all the above into account, it is considered that the Pilot, at the time of having the conduct of Peacock, was suffering to some degree from chronic fatigue.

Details of the Pilot's schedule were submitted to Circadian Technologies Inc, of Cambridge, Massachusetts, an institution that is widely consulted on investigating the effects of disruption to the body's natural sleep pattern. Based on an initial appraisal of the information provided, the Institution considered pilot fatigue to be a major factor in the incident.

At the behest of AMSA, the Pilot was examined by specialists at the Airport Health Centre, an accredited rehabilitation provider, and was also referred to a neurologist. The report by the Centre included the comment "All the investigations and reports indicate that there was no underlying medical reason, other than fatigue, to explain the short absence of conscious awareness during which the incident of 18 July 1996, occurred. Certainly there is no underlying medical illness or condition of any significance".

## **Pilot's roster**

Although the regulations allow for pilots performing up to 28-day tours of duty, in that they stipulate that after 28 days a pilot should have a minimum of 10 days rest, generally tours are of between 10 and 21 days duration. However, it is not uncommon for their tours to be longer than 21 days, particularly for those living in the Brisbane and Sydney areas.

The pilots are organised by their managing companies, based in Brisbane, and their work is governed by the shipping demand. However, the length of a particular tour, or tours, can be tailored to an individual's needs. Also, any pilot is at liberty at any time (and it is his responsibility) to request relief if he considers himself for any reason unable to perform his duties to acceptable standards.

In this instance, the Pilot was in a suitable location to terminate the tour in Townsville on 11 July and in Cairns on 16 July, by which time he had completed 20 days and 25 days on duty respectively. However, on both of these occasions he was relocated to Thursday Island to pick up another vessel at the request of the managing company.

Before commencing that tour of duty, the Pilot had advised his managing company that he had a dental appointment in Sydney on 23 July, enabling the managing company to program his movements to suit both the company and himself.

On completing a pilotage at Townsville on 11 July, the Pilot initially received instructions to proceed home, but this was quickly followed by a series of instructions, to remain in Townsville to pick up a north bound vessel, to proceed to Cairns and, to proceed to Thursday Island. Finally, his instructions were to proceed to Thursday Island after overnighting in Cairns, as the managing company was short of pilots at Thursday Island.

After completing the next pilotage at Cairns on 16 July, the Pilot was again requested by the managing company to take one more vessel from Thursday Island. He reminded the company about his dental appointment, but was assured he would be home in time to keep it.

Although the regulatory rest periods between vessels were being maintained, the three consecutive inner route pilotages resulted in a high proportion of nights worked in the latter part of a long tour.

An examination was made of the work schedules of 22 pilots of the Queensland Coastal Pilot Service for the period 1 January 1996 to 21 July 1996. Sixteen pilots had performed at least one tour of duty in excess of 21 days; six pilots had performed two tours of duty in excess of 21 days; one pilot had performed three tours of duty in excess of 21 days and; five pilots had performed a tour of duty in excess of 30 days.

In all cases, the pilots appeared to have had good rest periods between pilotages, usually well in excess of the minimum 24 hours. However, only dates were provided, not times, which could be misleading, as nights with interrupted sleep could be hidden. Early embarkation times and late disembarkation times both impinge on natural sleep patterns. Also, a 24-hour rest period from disembarkation at midnight one day to embarkation at midnight the following day does not provide the same recuperative sleep as midday to midday.

Although the companies monitor the rest periods pilots have between ships and the number of days they work, the number of nights worked do not appear to be taken into account, nor allowance made for the reduced quality of rest. To avoid a pilot becoming over tired, it is imperative that a person does not work an excessive number of nights in any given period.

## **Bridge procedures and organisation**

Pilots are aware that the length of the passage (the longest single pilotage in the world), their irregular hours and disrupted sleep patterns expose them to fatigue. Without counter-measures, strategies and management of their bridge routine the risk of an accident through reduced performance as a result of fatigue is significantly increased.

The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, requires officers to check the courses steered, the ship's position and speed at frequent intervals to ensure that the ship follows the intended course. Also, on taking over the watch an officer must satisfy himself of the ship's position, course and speed, take note of any dangers that may be encountered and also maintain a proper record of the ship's movements. The STCW Convention also makes specific provision that the presence of a pilot does not relieve the officer of the watch from their duties and obligations for the safety of the ship. (See Annex 1)

These provisions are also recommended in the International Chamber of Shipping's Bridge Procedures Guide, which recommends that officers of the watch should cooperate closely with pilots and maintain an accurate check on the ship's position and movements. It also recommends that, where an officer becomes unsure of the pilot's actions he should if necessary call the master and take action before the master arrives on the bridge. (See Annex 1)

Such cooperation is a two-way street, although it is not easy to implement a standard procedure when piloting vessels of different nationalities and with crews who may have little or no English. However, it should be possible to ensure that every officer of the watch is involved, is told or shown each alteration of course position and encouraged to take an active role in supporting the pilot.

In the case of the Peacock, the Pilot did call the Master's attention to the fact that positions were not being entered on the chart, but it was confined to this basic task. However, as the Second Mate's command of the English language was limited the Pilot had no dialogue with him at all, nor did he indicate the alter course position to him. It is probable the Second Mate felt ignored and irrelevant, rather than an important element in the bridge organisation, which removed the defences against pilot error.

## **Bridge watchkeeping**

When the Pilot started to lay off his courses on the charts, once Peacock was steadied on the East Strait leads, he noted that only one position had been marked on the chart, off Hammond Rock, in the western straits of the Prince of Wales Channel. From this it seems that it was not normal for the vessel's progress to be monitored by the officer of the watch when under pilotage.

After the Pilot had brought this lack of monitoring to the attention of the Master, who in turn brought it to the attention of the Mate, the vessel's position was plotted on the chart at 15 minute intervals until midnight.

At midnight the Second Mate relieved the Third Mate as officer of the watch. The Second Mate had maintained a regular sleep pattern for some days, did not drink alcohol and was not on any medication, therefore, his level of alertness could be expected to have been normal. However, it is apparent the Second Mate took the view that the Pilot was responsible for navigation, that he had little or no role to play and as a result his alertness was seriously affected.

The Second Mate, a Korean, and the Third Mate, an Indonesian, had difficulty in communicating and the hand over consisted mostly of

gestures. After midnight, the vessel's position was plotted on the chart at 0010, the time the Pilot was called as the vessel approached the Home Islands, and at 25 minute intervals at 0035, 0100 and 0125.

Based on the above, the Second Mate should have plotted the position at 0150, at which time Peacock should have been on the next course. Had he maintained his 25-minute regime and plotted the position at 0150, he should have realised that the vessel had passed the alter course position. With more than one mile to run before Piper Reef light, there would have been time to avert the grounding. It is evident that, having plotted the position at 0125, the Second Mate did not check the vessel's speed and estimate the time the vessel would be at the next alteration of course position.

As it was, after the Second Mate had plotted the position at 0125, he busied himself behind the curtains closing off the chart table. He stated that he had been checking the courses laid off by the pilot on the next chart. In doing this he was following the Master's instructions, however, such a task should not take very many minutes. The length of time he spent at the chart table, more than twenty five minutes, was excessive and not satisfactorily explained and resulted in him not monitoring the navigation of the vessel and the actions of the pilot, which were his prime responsibilities.

The helmsman said that he had been able to see the light and had realised it would be passed very close, but because the pilot was present, he felt that it must be all right. However, the helmsman was aware that the Second Mate had been absent from the wheelhouse for some considerable time and it would have been prudent, therefore, for him to summon the Second Mate to the wheelhouse as the light beacon was approached.

There is differing evidence as to whether the steering was in manual or in automatic at the time of the grounding. The Pilot thought the helmsman had moved away from the wheel, to the port side of the wheelhouse, after the alteration of course off Moody Reef, and had moved back to the wheel when he ordered “hard a port”. According to the helmsman, however, he was at the wheel, steering the vessel manually. Although this had no bearing on the grounding, it is considered probable that the helmsman had changed over to automatic steering and had moved away from the wheel, as this would have been in line with the normal procedure on board.

# Conclusions

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

Peacock grounded on Piper Reef as a result of the vessel's course not being altered, from 175° to 149°, as it approached from the north with the reef right ahead.

The following factors are considered to have contributed to the grounding:

1. The Pilot's loss of situational awareness, the balance of probability being that he fell asleep.
2. The Pilot's sitting with his chin cupped in his left hand, making him more susceptible to falling sleep.
3. The warm, stuffiness of the wheelhouse atmosphere, in association with the sleep inducing factors of time of day and background environmental noises.
4. Chronic fatigue as a result of the Pilot's recent work schedule, particularly the high proportion of nights of disrupted sleep.
5. The lack of a strategy on the part of the Pilot to counter the effects of foreseeable fatigue during periods of reduced activity.
6. The lack of proper bridge management and lack of interaction between the Pilot and the Watch Officer.
7. The lack of proper monitoring of the vessel's progress by the Watch Officer.

8. The attitude of the Watch Officer in assuming the Pilot was solely responsible for the navigation and his prolonged absence from the wheelhouse.
9. The absence of a formal control framework, to monitor a coastal pilot's nights of disrupted sleep, to prevent the development of chronic fatigue.

# 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 following:

The Pilot

The Master, Second Mate and Helmsman, m.v. Peacock.

The Australian Maritime Safety Authority

A written submission was received from the Pilot, a joint acknowledgement from the Master and Second Mate, and written comment from AMSA. The text of the report has been amended where it was considered appropriate.

The Pilot's submission also contained the following comments:

*"I am not aware of having suffered from the symptoms of sleep apnoea apart from snoring. I have had no sudden waking in the middle of the night for no apparent reason and have never discussed such a condition with any medical practitioner whom I have consulted.*

*"I question the suggestion that my diet should be considered to be inadequate, given that I have had a regular pattern of eating reduced*

*sugars and fats for three years. There has been no reduction in my energy or stamina levels during this period.*

*“I was not aware of any actual fatigue or its symptoms nor did I foresee that I would suffer fatigue (Conclusion no.5) despite the fact that I had experienced a high proportion of working nights during which I had a disrupted sleep.*

*“Prior to June 1993 pilots had no distractions from their pilotage duties apart from those associated with normal living. However, it is now a different matter as there are continuous concerns felt by pilots with respect to competition currently existing between the pilotage services and the general uncertainty that ensues from this circumstance. Both income and sufficient recreational time are matters of concern noting that the pressure of work is stressful enough without adding these other factors. Pilots today have these distractions to cope with in addition to their pilotage duties. In my view it all adds up to the placement of extra stress on pilots. It is my view that some responsibility for this situation rests with the authorities, in particular noting their obligations in respect of the maintenance of an efficient and safe pilotage system and the integral factor in achieving this, namely the conditions and environment under which pilots are required to earn their livelihood.”*

# Details of Peacock

<b>Former name</b>	Southern Cross
<b>IMO No.</b>	8518819
<b>Flag</b>	Panama
<b>Classification Society</b>	Nippon Kaiji Kyokai
<b>Ship type</b>	Refrigerated cargo/vehicles
<b>Owner</b>	Libero Panama S.A.
<b>Operator</b>	Shunko Shipping Corp, Tokyo
<b>Year of build</b>	1986
<b>Builder</b>	Kochi Jyuko K K, Japan
<b>Gross tonnage</b>	4964
<b>Net tonnage</b>	3036
<b>Summer deadweight</b>	6541 tonnes
<b>Length overall</b>	124.70 m
<b>Breadth, extreme</b>	17.80 m
<b>Draught (summer)</b>	7.317 m
<b>Engine</b>	Mitsubishi 6 cylinder diesel
<b>Engine power</b>	5149 kW
<b>Crew</b>	19 Korean and Indonesian

# Annex 1

## **Bridge Watchkeeping**

Regulation II/1.6(b) of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978:

“During the watch the course steered, position and speed shall be checked at sufficiently frequent intervals, ... to ensure that the ship follows the planned course.”

Regulation II/1.8(b):

“On taking over the watch the relieving officer shall satisfy himself as to the ship’s estimated or true position and confirm its intended track, course and speed and shall note any dangers to navigation expected to be encountered during his watch.”

Regulation II/1.8(c):

“A proper record shall be kept of the movements and activities during the watch relating to the navigation of the ship.”

Regulation II/1.10:

“Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer in charge of the watch from their duties and obligations for the safety of the ship. ... The master and officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship’s position and movement.”

Paragraph 3.10.3 of the International Chamber of Shipping's Bridge Procedures Guide:

“The officer of the watch should co-operate closely with the pilot to assist him where possible and to maintain an accurate check on the ship's position and movements. If the officer of the watch becomes unsure of the pilot's actions or intentions, he should seek clarification and, if still in doubt, should inform the master immediately and take the necessary action before the master arrives on the bridge.”