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Australian Transport Safety Bureau

Foundering of the general cargo ship *Tycoon*

Christmas Island | 8 January 2012

Investigation

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Safety summary

What happened

On the morning of 8 January 2012, one of the permanent mooring lines holding the general cargo ship *Tycoon* in position in the inner moorings at Flying Fish Cove, Christmas Island, came free from its anchor. As a result, the ship moved forward and closer to the nearby terminal rock face, eventually making contact with the rock face as the weather and sea conditions deteriorated.

Despite attempts to move it away, *Tycoon* continued to pound against the rock face. Eventually, the ship's engine room began to flood through a tear in the hull. Shortly afterwards, the crew safely abandoned the ship.

At about 1100 on 9 January, *Tycoon* suffered a catastrophic failure of its hull and the contents of the ship's number two cargo hold, about 260 tonnes of bagged phosphate, were exposed to the sea. The ship continued to be pounded by the sea and swell and, over the following months, it broke up under the action of the waves. On 14 May, salvors were appointed and by 26 July the wreck had been removed from Flying Fish Cove.

What the ATSB found

The ATSB found that the shackle connecting the port's cantilever mooring line to its anchor chain failed and that *Tycoon*'s master did not advise shore authorities of his concern regarding the deteriorating conditions or that the cantilever mooring line had come free. He also did not make proper use of the ship's main engine or mooring lines to attempt to keep the ship in position after the mooring line came free.

In addition, it was found that there had been no risk assessment undertaken by successive port managers with regard to the use of the inner moorings and that there was little guidance provided to the masters of ships intending to moor in Flying Fish Cove. Furthermore, the managers of the port had not implemented an effective inspection and maintenance program and therefore were not aware of the deteriorated condition of the aft mooring line shackle.

What's been done as a result

The port operator has started to fly diving contractors into Christmas Island to complete the annual dive inspection and has commenced replacing and upgrading the mooring equipment. They are also developing a Port Handbook which will be provided to the master of each ship and are facilitating safety training workshops that will be a forum through which the risks posed to the port and its operations can be assessed.

Safety message

Those responsible for the management and operation of a port should consider all the risks associated with the operations carried out within the port. As a result, there should be appropriate procedures and contingency plans in place to deal with foreseeable emergencies and effective maintenance and inspection regimes that ensure the good order of equipment and facilities.

Contents

The occurrence

On the morning of 6 January 2012, the 85 m general cargo ship *Tycoon* (Figure 1) arrived off Christmas Island following a voyage from Singapore. The ship was carrying general cargo and containers and, after cargo discharge, was due to load 3,700 tonnes of bagged phosphate for export to Malaysia.

Figure 1: *Tycoon* moored at the inner moorings at Christmas Island in August 2011

Source: Christmas Island Port

At 0645[1], the Christmas Island pilot boarded *Tycoon* and at 0715, the first of the ship's stern lines was run to the south breast buoy (line 1 in Figure 2). Ship's lines were then connected to the lamgar buoy[2] (2), the pickup buoy (3) and the cantilever line[3] (4). A forward ship's line was run to the south cliff bollards (5). A ship's line was then connected to the north cliff bollard (6), followed by another stern line to the south breast buoy (7). One of the stern lines to the south breast buoy was made fast to the ship's bits and one was held on an aft winch. Similarly, one of the seaward head lines was made fast to the ship's bits and one was held on a forward winch.

By 0730, the ship was all fast at the inner moorings and positioned about 25 m forward of the bulk phosphate cantilever loader and about 20 m off the rock face on its port side.

At 0800, cargo discharge began and it continued throughout the day. At 1645, cargo operations were completed for the day and the stevedores left the ship by barge. The barge was lifted from the water and stowed ashore, as was normal practice overnight. In preparation for *Tycoon*'s overnight stay, an additional forward port breast line (8) was run ashore to the south cliff bollards.

At about 2100, the pilot visited the terminal to check on *Tycoon*. The ship was rolling at its moorings but not sufficiently to cause the pilot any concern. The master had previously been told to contact the pilot if he needed to for any reason.

At 0630 on 7 January, the stevedores were transferred to *Tycoon* by barge and at 0700, discharge operations started. By 1030, discharge was completed and at 1100, loading of the bagged phosphate began.

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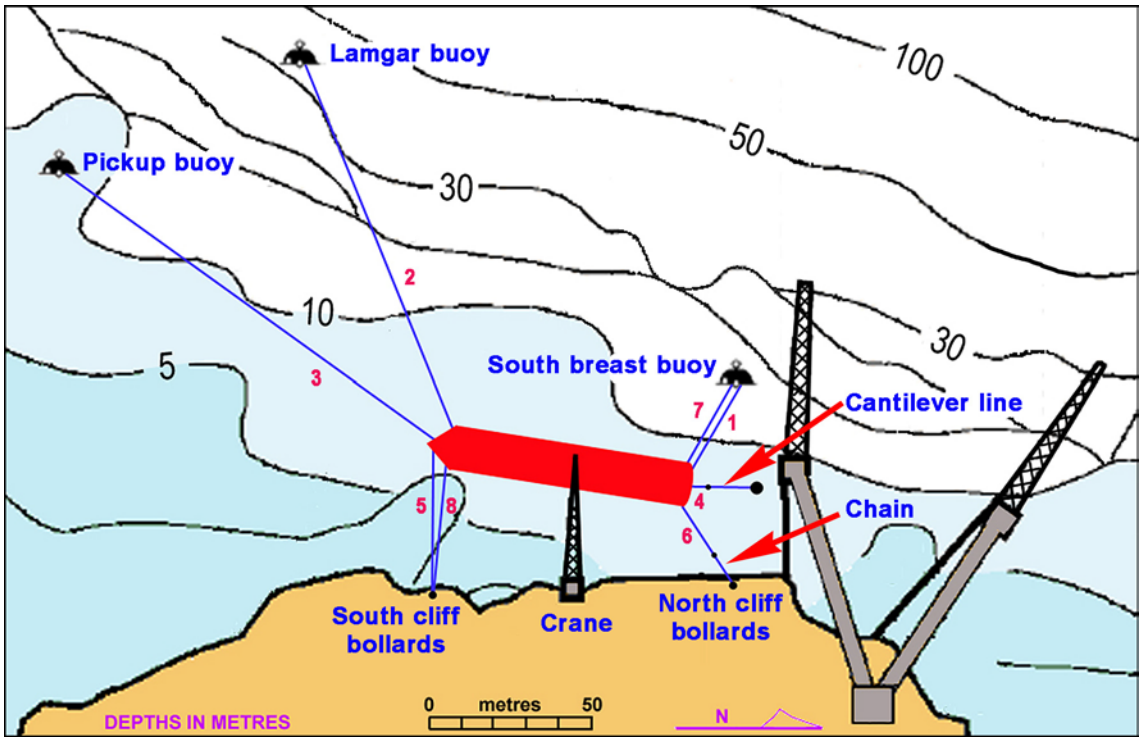
1 All times referred to in this report are local time, Coordinated Universal Time (UTC) + 7 hours.

2 A large mooring buoy, usually secured to the seabed by two anchors.

3 The cantilever line was a floating line that was permanently shackled to a chain that was anchored to the sea bed beneath the bulk phosphate cantilever loaders.

Figure 2: *Tycoon*'s mooring arrangement at the inner moorings



Source: ATSB

By 1645, when the stevedores finished work for the day, 260 tonnes of bagged phosphate had been loaded. The stevedores then left the ship by barge and the barge was again recovered from the water and taken ashore. At this time, there was a 2 m sea on a north-westerly swell of about 0.5 m and the wind was north-north-easterly at about 13 knots.[4,5]

The pilot assessed the available weather forecasts and considered that the conditions were suitable to allow *Tycoon* to remain moored in position. However, the forecasts indicated to him that the weather would deteriorate late the next day and he thought that he may have to sail the ship the following afternoon, after cargo work had finished for the day.

At 1600 and again at 2000, the weather was recorded in *Tycoon*'s log by the master as north-easterly wind at 11 to 15 knots with a north-easterly sea of 2 to 3 m.

Shortly before 2200, the pilot visited the terminal to check on *Tycoon*. Weather conditions had not changed from the afternoon. While the ship was rolling at the moorings, there was no chafing of the mooring lines and they appeared secure. Seeing no reason for concern, he waved to some of the ship's crew members who were fishing on the after deck and left the terminal.

Sometime between 2300 and midnight, the stevedore manager also visited the terminal. He turned on the terminal lights and saw that the swell had picked up a little and that the ship's inner mooring lines were slack. He too saw that the crew were fishing and they appeared to show little concern about the condition of the ship. He turned off the lights and left the terminal.

At midnight, *Tycoon*'s master was relieved on the bridge by the second mate. After a handover, the master went below to his cabin to sleep. At this time, the sea was 3 m on a north-north-westerly swell of 0.8 m and the wind had backed to north-westerly at 8 knots.

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4 One knot, or one nautical mile per hour equals 1.852 kilometres per hour.

5 Unless otherwise stated, all weather observations are taken from the log of HMAS *Leeuwin*, a Royal Australian Navy ship which was standing off the port.

Sometime between 0200 and 0300 on 8 January, concerned that the weather was deteriorating, the second mate called the master. When the master arrived on the bridge, he saw that the weather had worsened since he had left. He sent the second mate to the after deck to check on the condition of the mooring lines.

At 0300, the wind was 20 knots from the west-southwest. The sea was 3 m on a swell of 1 m from the northwest.

At about 0400, because of his increasing concern, the master placed the engine room staff on stand-by and the main engine was readied for immediate use. The wind was now westerly at 21 knots and the sea was 3 m on a west-north-westerly swell of 1.5 m.

At about 0420, the pin in the shackle between the cantilever line (line 4 in Figure 2) and its anchor chain worked free, disconnecting the line from its anchor. The master was advised that the line had gone slack and the crew recovered the ship's mooring line and the cantilever line onto the aft centre mooring winch.

With the cantilever line gone, the ship moved forward and began to roll more violently. The sea was pushing the ship towards the rock face and crane pylon and, as the waves rebounded off the rock face, the ship was pushed back out to sea.

At about 0510, the stevedore manager arrived at the terminal. While he was there, he saw that the sea conditions were rough, the cantilever line was no longer connected to its anchor chain and the ship's crew had recovered the line onto the after deck. He could see that *Tycoon* had moved about 5 m forward and that the starboard breast lines (lines 1 and 7 in Figure 2) to the south breast buoy were very tight. He went forward, to the shore crane, and saw the ship's master on the bridge. The master used hand signals to indicate to the stevedore manager that the cantilever line had let go.

At 0543, the sun rose at Flying Fish Cove. High tide that day was predicted to be 1.0 m at 0758 with a low tide of 0.7 m at 1230.

At about 0600, the stevedore manager tried to telephone the pilot to advise him of *Tycoon*'s situation. However, he could not get through because the pilot was on another telephone call. He then left the terminal to go to the stevedoring office, which was located near the jetty where the barges were launched.

At about 0615, one of *Tycoon*'s aft starboard breast lines connected to the south breast buoy parted. As a result, the one remaining aft starboard breast line began to take the increased strain and the ship started to move further ahead and in towards the rock face and crane pylon. The wind was now west-south-westerly at 13 knots and the sea was 4 m on a 1.9 m west-north-westerly swell.

Shortly thereafter, *Tycoon* moved forward about 35 m until its port bow collided with the rock face. In the confused sea and swell close inshore, the ship began to pound continually against the rock face and crane pylon.

At 0620, the pilot returned the stevedore manager's telephone call. The stevedore manager told him that the weather was getting up and that he thought *Tycoon*'s master wanted to leave the moorings.

Just after 0620, the stevedore manager heard *Tycoon*'s master calling the pilot on VHF channel 16. He answered the call and told the master that the pilot was on his way.

At 0623, the stevedore manager telephoned the harbour master and advised him of the situation. The stevedore manager then went outside to the jetty at the southern end of Flying Fish Cove. From there, he could see the ship's bow leaning against the rock face (Figure 3).

At about 0630, the pilot and some stevedores joined the stevedore manager on the jetty. They decided that they could not launch the barges in the prevailing weather conditions. The pilot then contacted *Tycoon*'s master on VHF channel 16 and told him to heave in on the lamgar buoy line (line 2 in Figure 2) in an attempt to move the ship's bow out to seaward. He also told the master to heave in on the remaining after starboard breast line to the south breast buoy in an attempt to stop the ship from impacting the rock face and crane pylon.

Figure 3: *Tycoon* as seen from the jetty at about 0630

Source: Phosphate Resources, Christmas Island

The pilot and the stevedores went to the terminal where they joined the harbour master, who had just arrived.

The ship's crew tried to heave in on the lamgar buoy line but the windlass was not powerful enough to pull the ship's bow away from the rock face in the prevailing weather and sea conditions. The master passed this information to the pilot.

At about 0647, while the sea was pounding the ship against the rock face and crane pylon, the crew on the after deck, thinking that the master would be trying to take the ship to sea, cut through the remaining two stern lines.

At 0700, the wind was from the west at 10 knots and the sea was 4 m on a 2 m swell from the northwest.

At about 0710, *Tycoon*'s master informed the pilot that the ship's main engine was 'ready'. In an attempt to get the ship's stern away from the crane pylon, the pilot asked the master to run the main engine at full astern and when the ship was moving astern, to put it to full ahead and the rudder hard over to starboard.

The master ran the main engine astern twice for a total of about 1½ minutes but the ship did not move. He made no further attempt to use the main engine.

The stevedores were asked to get two lengths of 32 mm mooring line, which were in the terminal, with a view to running a starboard breast line from the ship's after deck to the 'B' buoy, located about 300 m to seaward of the south breast buoy.

At 0723, the pilot called the Royal Australian Navy ship HMAS *Leeuwin*, which was in the vicinity of Flying Fish Cove, and asked the ship's commanding officer to launch his ship's rigid hull inflatable boat (RHIB) to assist with running a mooring line from *Tycoon* to the 'B' buoy. At 0803, the RHIB was launched.

A heaving line was thrown to the crew working on *Tycoon*'s after deck and they secured it to the cantilever line that was still connected to the ship's aft centre line mooring line. This line was then brought ashore and connected to the two lengths of shore line. The free end of this line was passed down to the crew of the RHIB, who then took it to the seaward 'B' buoy.

By this time, the ship had suffered severe damage to the port side of the accommodation. The port lifeboat had been smashed and was hanging from its davits (Figure 4).

Figure 4: Impact damage to *Tycoon*'s port side

Source: Phosphate Resources, Christmas Island

At 0814, two of HMAS *Leeuwin*'s RHIB's crew climbed onto the 'B' buoy and put the eye of the line over the buoy's hook. The RHIB was then manoeuvred clear of the buoy and stood off *Tycoon* in case it was required to assist again.

While the line was being run, the ship was continually pounded against the rock face and crane pylon and, at about 0830, a 1 m vertical tear could be seen in the port side of the ship's hull in way of the engine room.

The ship's crew started to heave in on the line running to the 'B' buoy. However, the centre-line winch drum soon filled up with line, so the crew stoppered the line while they moved it onto the outer starboard winch drum. Once this was done, the crew again attempted to heave the line in.

At about 0843, the tear in the ship's hull in way of the engine room had grown to about 2 m in length and had opened up to about 0.5 m in width (Figure 5).

At about 0900, torrential rain began to fall as a squall passed through Flying Fish Cove.

The rain and seawater started to enter the engine room through the tear in the hull and when the master was advised of this, he told the engine room staff to evacuate the engine room and come to the bridge. He also told the crew on the after deck to stop what they were doing and also come to the bridge.

Figure 5: Tear in the hull in way of the engine room

Source: Phosphate Resources, Christmas Island

At 0933, the master told the pilot and harbour master on VHF channel 16 that he wanted to abandon the ship.

By this time, there were various emergency response personnel in the terminal and a number of options were put forward to facilitate getting the crew safely off the ship. Following a suggestion from the coxswain of HMAS *Leeuwin*'s RHIB, it was decided that the master should lower the ship's starboard accommodation ladder so the crew could climb down it and jump into the sea. They would then be pulled into the RHIB.

At about 0935, HMAS *Leeuwin*'s commanding officer contacted HMAS *Maryborough*, which was also in the area at the time, and requested that its two RHIBs be launched to assist in the rescue.

By 0943, the rain had started to ease.

At 0944, HMAS *Maryborough*'s RHIBs were launched and they arrived on scene a short time later.

Tycoon's crew lowered the starboard accommodation ladder and then gathered together in lifejackets on the deck adjacent to it. At 1031, the first crew member climbed down the ladder and jumped into the sea (Figure 6). He was quickly pulled on board the RHIB which had come in close to the ship's side.

At about this time, HMAS *Leeuwin*'s commanding officer estimated that the wind was gusting 'up to 40 knots, average sea height was 2 metres offshore with 3 plus metre surf zones close inshore and on the exposed northwest rock faces'.

By 1037, five of *Tycoon*'s crew members had been pulled from the sea by HMAS *Leeuwin*'s RHIB crew. As that RHIB backed away from the ship, one of HMAS *Maryborough*'s RHIBs came in to continue to pick up *Tycoon*'s crew members.

By 1052, all 15 crew had been rescued. *Tycoon*'s master was the last crew member to leave the stricken ship, taking with him a number of ship's documents.

Figure 6: Crew member jumping from the ship

Source: Australian Federal Police, Christmas Island

The conditions prevented the ship's crew from being landed in Flying Fish Cove, so the RHIBs took them to the boat ramp at Ethel Beach, on the east coast of the island, where they were landed and provided medical attention. The master and chief mate were the only crew members who required significant medical attention. The master had injured his back while on board the RHIB and the chief mate's blood pressure was high. They were both admitted to the island's hospital for observation and released the next day.

For the remainder of 8 January and into 9 January, *Tycoon* remained wedged against the crane pylon. During that time, winds of up to 30 knots, seas of up to 5 m and swell up to 3.5 m continued to pound the ship against the rock face and crane pylon.

At about 1100 on 9 January, the ship suffered a catastrophic hull failure in way of number two hold. The starboard side of the hold collapsed inward exposing the contents of the hold to the sea (Figures 7 and 8). Damage to the hull in way of the engine room allowed oil and other pollutants to be washed into the sea.

On 9 January, an Australian Maritime Safety Authority (AMSA) casualty coordinator and a representative from the Western Australian Department of Transport arrived on Christmas Island to coordinate the response to the incident.

The released phosphate washed into the sea and dissipated under the action of the waves, so the clean-up centred around collecting and removing oil and related products from the nearby beach.

On 10 January, additional oil spill responders arrived on the island to manage the ongoing response and clean-up of Flying Fish Cove. Many local residents also volunteered their time to assist with the clean-up operations.

Despite repeated attempts by AMSA over the next several months to negotiate with *Tycoon*'s owners to remove the wreck from Flying Fish Cove, it remained in situ with no salvors appointed. The ship continued to be pounded by the sea and swell and it broke up under the action of the waves (Figure 9).

Figure 7: Failure of the ship's hull at number 2 hold

Source: Phosphate Resources, Christmas Island

Figure 8: Tycoon awaiting salvage/removal

Source: ATSB

Figure 9: The wreck of *Tycoon* on 7 March 2012

Source: Christmas Island Port

On 13 March, AMSA, acting on behalf of the Commonwealth of Australia, served an official wreck removal notice on *Tycoon*'s owner, requiring the removal of the wreck. The ship's owner did not act on the notice. Consequently, on 11 May, AMSA signed a wreck removal contract with Titan Salvage, with the intent of recovering all removal costs from *Tycoon*'s owner. On 14 June, work to remove the wreck began.

Titan Salvage completed the removal of the wreck on 26 July (Figure 10). Demobilisation of personnel and equipment was completed by the week ending 3 August and the first ship to be moored in the inner moorings was brought in on 9 August 2012, 7 months after *Tycoon* foundered.

Figure 10: The removal of the wreck of *Tycoon* on 22 July 2012

Source: Christmas Island Port

Context

Tycoon's crew

Tycoon had a crew of 15 Myanmar nationals, all of whom were appropriately qualified to hold their positions on board the ship.

The master had 33 years of seagoing experience. He held a Panamanian master's certificate of competency that was first issued in 1993. He had been sailing as master since that time and had been *Tycoon*'s master for about 10 years. He had visited Christmas Island on 10 occasions in the past on board *Tycoon*. On three of those occasions, the ship had moored at the inner moorings of Flying Fish Cove.

Christmas Island

Christmas Island is an external territory of Australia. It is located in the Indian Ocean, about 1,400 miles northwest of Perth, Western Australia, and 700 miles south of Singapore (Figure 11). Its closest neighbour is Java, Indonesia, which is about 200 miles to the north.

Figure 11: The location of Christmas Island

Source: Google Earth

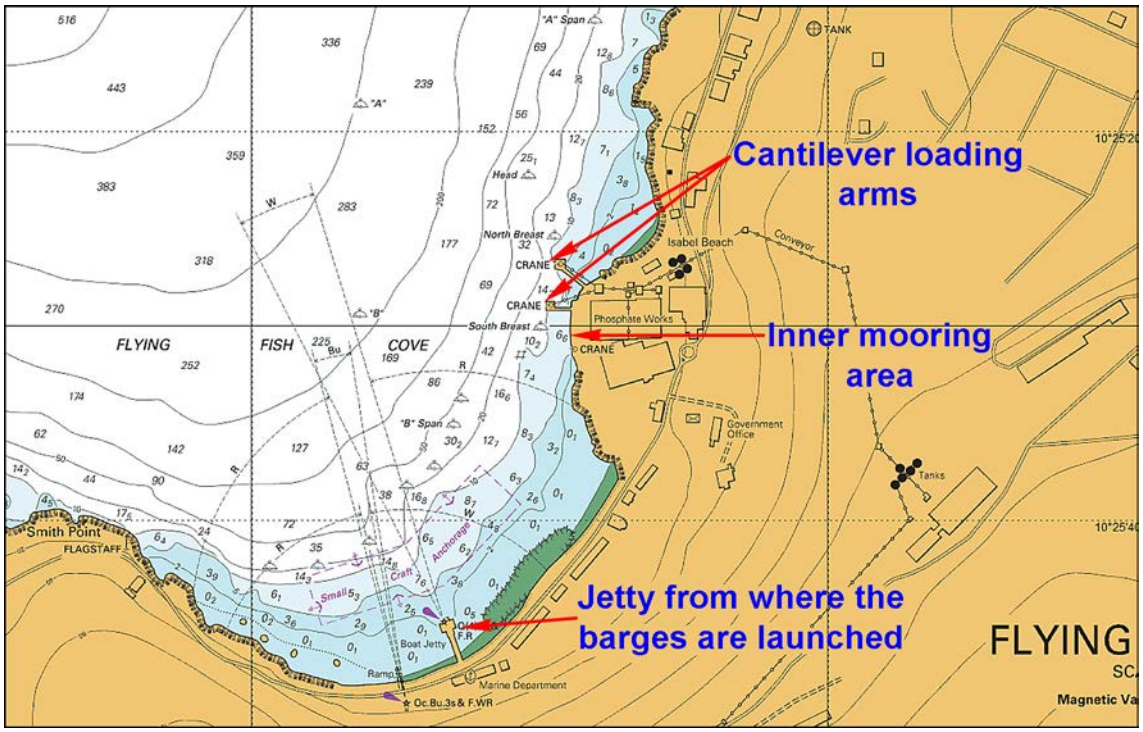
The Christmas Island economy is based on phosphate mining/export, the support of an immigration detention centre and tourism. The island has high conservation value due to the large number of bird, crab and plant species, some of which are unique, that inhabit the island. As a result, about 63 per cent of the island is gazetted as a national park.

Christmas Island is about 135 km^2 in size and is the summit of a submarine mountain, rising steeply to a central plateau dominated by stands of rainforest. The plateau reaches heights of up to 361 m above sea level and consists mainly of limestone and layers of volcanic rock. A narrow coral reef surrounds the island and there is virtually no coastal shelf. The sea plummets to a depth of about 500 m within 200 m of the shore. The island's coastline is an almost continuous sea cliff, up to 20 m in height. In a few places, the cliff gives way to shallow bays with small sand and coral

shingle beaches. The largest of these bays forms the island's only port, Flying Fish Cove, located on the island's northern side (Figure 12).

The months of December to March are known on Christmas Island as the 'swell season', with the north-western side of the island, including Flying Fish Cove, being subjected to seasonal rough north-westerly seas and large swells.

Figure 12: Section of navigational chart Aus 920 showing Flying Fish Cove



Source: Australian Hydrographic Service

The inner mooring system

The depth of the seabed and the wind and sea conditions which can be experienced in Flying Fish Cove, mean that there are no conventional wharf facilities suitable for ships. Ships are either moored to buoys which position them under the two cantilever bulk phosphate loaders or at the inner moorings, in close proximity to the port's single cargo crane. In the latter case, ships are held in position by lines attached to three mooring buoys, two chains that were permanently connected to bollards ashore and a floating 'cantilever' stern line (which is permanently shackled to an anchored chain).

According to the port operator, the cantilever line was not part of the inner mooring system, but was an additional line that was used to stabilise the ship while the stevedores were working cargo. Conversely, *Tycoon*'s master considered the cantilever line to be one of the mooring lines used to hold the ship in position.

While the cantilever line may not have 'technically' been part of the inner mooring system, it was made fast to *Tycoon* on the ship's arrival in the port when the other mooring lines were made fast and it was not let go at any time during the ship's stay in port. To all intents and purposes, the cantilever line was one of a system of mooring lines that were being used to hold *Tycoon* in position on the morning of 8 January 2012.

The moorings were laid more than 25 years before *Tycoon* foundered, when the port was under the management of the British Phosphate Commission, and had been in use since 1994, when ships began using the inner moorings after the installation of the first shore crane.

The drawings of the mooring system that were provided to the ATSB showed the layout of the buoys and their moorings. However, they did not show the range of the anchor chains, the size of the anchors or define any operational or weather limitations for the mooring system.

Given that the port is open to the sea and ships moored at the inner moorings were positioned only 20 m off the cliff face, the moorings are not suitable to hold a ship in position in some of the wind and sea conditions that can be expected at Flying Fish Cove.

There are no tugs available in Flying Fish Cove to assist ships. Barges are used to run ships' mooring lines to the mooring buoys and to ferry the stevedores to and from ships. The barges are launched from a gantry on the jetty located at the southern end of Flying Fish Cove. If the swell/sea conditions are greater than about 1.2 m, the barges cannot be launched.

Port management

At the time of *Tycoon*'s foundering, Christmas Island Port was managed on behalf of the Commonwealth Department of Regional Australia, Local Government, Arts and Sport (the Department) by Patrick Ports (Patrick), under a contract arrangement which had been in place since 2006.

The senior Patrick employee on Christmas Island was the harbour master. He had been in the role since 20 September 2007 when he was appointed by the then Minister for Local Government, Territories and Roads in accordance with the Section 4 of the *Shipping and Pilotage Act 1967 (WA) (CI)*[6] (the Act). According to Section 5 (1) of the Act, the harbour master may:

(a) control the entry and departure of vessels into and from the port;

(b) control the berthing, mooring and moving of vessels within the port;

(c) exercise such other powers relating to the control and the direction of vessels and persons within the port and the maintaining of good order within the port, as are prescribed;

(d) remove any wreckage that is within, or in or about the approaches to, the waters of the port and is obstructing or likely to obstruct the safe movement of vessels therein; and

(e) control the movement of vessels in a prescribed control area outside the port.

Before taking on the role of harbour master, he had spent the previous 11 years on Christmas Island working in the construction industry. Prior to that, he had a 20 year career with the Royal Australian Navy, primarily as a logistics specialist dealing with issues associated with stores, victualing, clothing and quality assurance. He left the navy as a chief petty officer in 1996.

Under the terms of the contract between the Department and Patrick, Patrick was required to manage the day to day operations of the port, including planned and unscheduled maintenance of the port's assets and the development of annual capital works plans, which were submitted to the Department for approval.

As part of the ongoing maintenance obligations, Patrick was required to revise its scheduled maintenance plans annually and submit these to the Department, along with a schedule for general maintenance and repair of the port's assets during the next financial year. Patrick was required to regularly report (at least monthly) to the Department with respect to the condition of the port's assets and monthly meetings were held between the two parties to discuss matters including compliance with the maintenance plan.

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[6] The *Territories Law Reform Act 1992* amended the *Christmas Island Act 1958* to replace the previous laws of the territory which were largely based on the laws of colonial Singapore. The *Territories Law Reform Act 1992* applied certain Commonwealth Acts and laws of the state of Western Australia. These actions introduced a modern body of Australian law and were a major step in extending to the residents of the territory the same rights responsibilities and obligations as those enjoyed by their fellow Australians.

Pilotage

Pilotage at Flying Fish Cove was compulsory for ships with a gross tonnage in excess of 150.

At the time of the incident, pilotage services in the port were provided by a single marine pilot employed by Indian Ocean Stevedores, a wholly owned subsidiary of Phosphate Resources, the operator of the island's phosphate mine. Ocean Stevedores also provided agency services to ships using the port.

The pilot first went to sea in 1962 and spent the next 20 years in the maritime industry on a range of ship types. He obtained his Australian master class one certificate of competency in 1972 and first sailed as master in 1980. Between 1982 and 1986, he was the assistant harbour master, and then harbour master, on Christmas Island. In 1986, following the closure of the phosphate mine on the island, he returned to sea and the stevedoring industry. In 2008, he returned to Christmas Island and, after a period of training, was appointed as the port pilot on 13 October 2008 by the then Minister for Home Affairs in accordance with Section 4 (b) of the Act.

While neither the Act nor the pilot's letter of appointment defined his role or responsibilities, both he and the harbour master understood that his responsibilities included mooring, positioning, re-positioning and moving vessels in the port and monitoring and advising on weather conditions.

Weather forecasts for 7 and 8 January 2012

The only weather monitoring/observing facility at Christmas Island is located at the island's airport, inland from the coast and at an elevation of 279 m above mean sea level. Therefore, there is no ability to accurately forecast or observe sea/wave/swell or wind conditions in Flying Fish Cove or off the island's northwest coast, the area where the prevailing weather comes from during the swell season.

While *Tycoon*'s master, the harbour master and the pilot collectively had a responsibility to monitor the weather and consider the effects any changes may have on the ship and its moorings, it was the norm on the island for the pilot to actively monitor the weather and report to the others as necessary. The guidance provided to the masters of ships loading bulk phosphate at Christmas Island stated that:

> The Marine Pilot monitors weather conditions throughout the year throughout the year and will keep the Master informed of any possible adverse conditions.

In order to get an appreciation of the forecast weather and how it might impact on ships moored in the cove, the pilot used a number of online weather services, principally the Australian Bureau of Meteorology (BoM), Weather Underground, Buoy Weather and Willy Weather. These services all provide marine specific observations and forecasts to differing degrees.

The weather on Friday 6 January was such that containers were discharged from *Tycoon*, an operation which could only be done when the sea was calm.

The weather forecasting websites the pilot looked at to get an idea of what could be expected for 7 and 8 January did not cause him any concern. However, Buoy Weather was forecasting heavy rain with the wind moving around to the west by 2000 on 8 January. According to the pilot, January 9 'was looking like it might be a mess'.

The BoM Indian Ocean Islands forecast issued at 1545 on 7 January stated:

> Christmas Island
> A few showers and thunderstorms. Light winds becoming fresh [17 to 21 knots] W/NW during the day.

In anticipation of this, the pilot sent an email late on the afternoon of 7 January to *Tycoon*'s operator, and the island's mine operator, stating that the forecast was not good for the night of 8/9 January. He stated that he might need to take the ship to sea on the evening of 8 January and that he would keep them updated.

The pilot did not advise *Tycoon*'s master that he thought the weather was going to deteriorate. However, he spoke to him and asked that the ship's crew be made available to assist with cargo loading on 8 January so that as much phosphate as possible could be loaded in case the ship had to sail on the evening of 8 January.

The events of January 2012 show that the forecast weather change did eventuate, but occurred much earlier than the pilot predicted. The BoM daily weather observations which were recorded at the Christmas Island airport (Table 1) clearly show the change in the weather conditions during the period 7 to 10 January.

Table 1

Day	Rain (mm)	Max wind direction	Max wind speed (km/h)	Wind direction at 9am	Wind speed at 9am (km/h)	Wind direction at 3 pm	Wind speed at 3pm (km/h)
7	16.8	N	26	E	7	NNE	17
8	61.8	WNW	48	WSW	9	W	19
9	139.6	NW	52	NW	20	WNW	20
10	22.6	WNW	33	W	9	SW	11

Given the forecast weather data available to the pilot, and the subsequent recorded weather observations, it is evident that the change in weather came through Christmas Island about 18 hours earlier than he expected, early on the morning of 8 January and not during the night of 8/9 January as he anticipated. As a result, both those ashore and on board *Tycoon* were caught off-guard and unprepared.

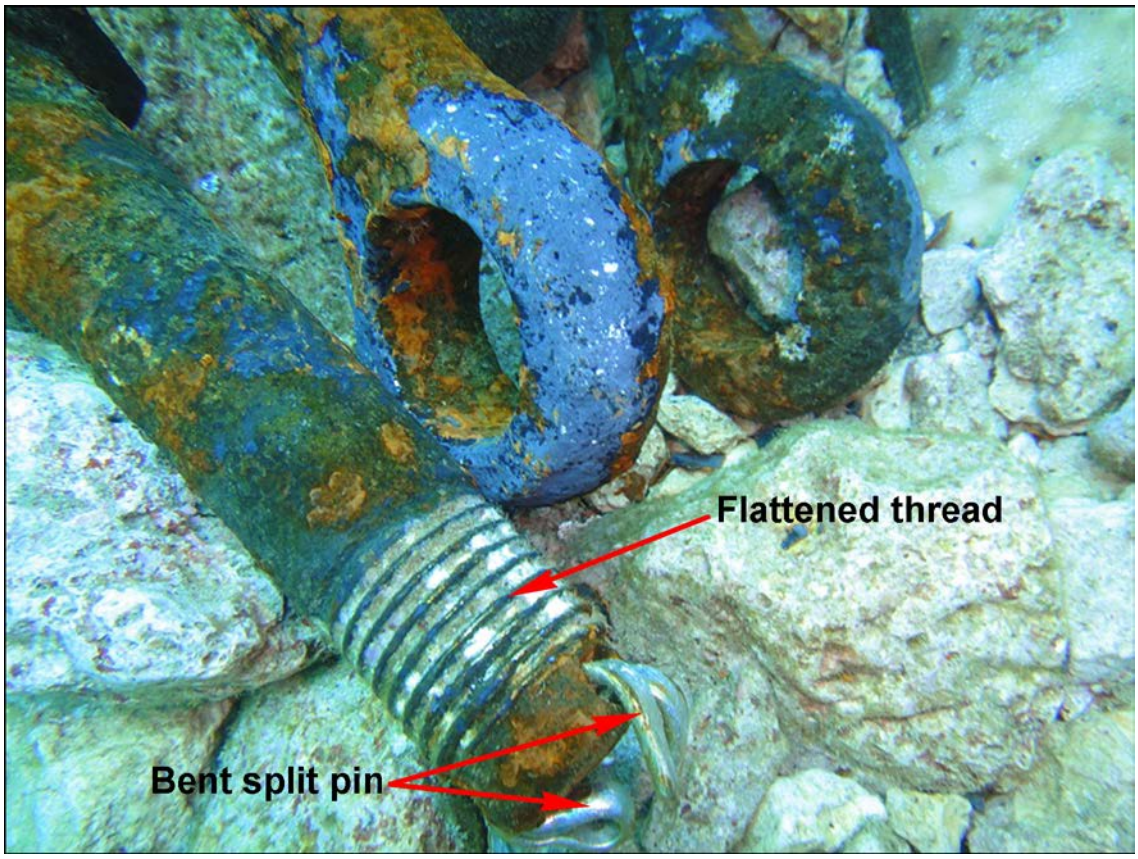
Cantilever mooring line shackle

On 16 January, when the weather and sea conditions had abated, the harbour master arranged for a diver to inspect and video the cantilever line underwater securing arrangements (anchor and cable).

The diver followed the cable from the anchor to the shackle that had secured the cable to the floating cantilever line and identified that the shackle pin retaining nut was missing and that the pin had worked its way out of the shackle (Figure 13).

Since the retaining nut could not be found, it was not possible to definitively conclude how it came off. However, it is likely that over time the nut loosened, allowing the pin to move laterally in the shackle. The shackle pin moving back and forth would have caused the nut to loosen further and would have slowly worn the shackle pin/nut threads. Eventually, the nut would have become completely unscrewed and it would have been sitting hard against the retaining split pin. Then, the lateral movement of the shackle pin would have started to exert a force on the split pin, eventually bending it. When the split pin was bent sufficiently to allow the retaining nut to come off, the shackle pin was free to work its way out of the shackle.

Figure 13: The cantilever line's underwater shackle and pin



Source: Christmas Island Port

Effectiveness of *Tycoon*'s winches

A ship's mooring winches are primarily designed to maintain tension on mooring lines to hold a ship alongside a wharf. Therefore, the power of the winches is associated with the size of the ship, with a larger ship having more powerful winches. The winches are also used to moor a ship to buoys when required, such as in some offshore tanker berths and in the case of Christmas Island where there are no conventional wharf facilities. However, they are not designed to heave against the snatch loads that are created by a ship's movement in a heavy seaway.

The weather and sea conditions experienced in an open sea situation, like those experienced in Flying Fish Cove on 7/8 January 2012, can be more powerful than the capacity of a ship's winches. While every effort can be made by the crew of the ship to heave on the mooring lines to keep the ship in position, the winches may simply not be powerful enough to overcome the forces of nature. It is for this reason that a very close watch should be maintained on the weather and sea conditions when a ship is moored to buoys and, if necessary, the moorings should be slipped and the ship taken to sea sooner rather than later.

This was the situation faced by *Tycoon*'s crew when they tried to heave on the ship's starboard headlines to pull the bow away from the rock face. *Tycoon* was not a large ship and its winches were of a commensurate size. Furthermore, they were not powerful enough to overcome the forces of the sea and swell being experienced at the time. As a result, the ship's bow could not be pulled out to seaward.

Actions of *Tycoon*'s crew

Master not advising those ashore of his concerns

When *Tycoon*'s master was interviewed by the ATSB investigators, he made no mention of contacting, or trying to contact, the pilot or any other person ashore about any concerns he may

have had regarding the deteriorating weather conditions, his decision to put the engine room on standby or that the cantilever line had come free from its anchor chain at about 0420. This was despite the fact that the ship subsequently moved closer to the rock face and into a position of greater danger.

The master's statement was corroborated by the statements provided by the pilot, the harbour master and the stevedore manager. All of whom were unaware of any communication from the master until 0510 when the stevedore manager arrived at the terminal.

However, in submission, *Tycoon*'s Protection and Indemnity (P&I) representative made the following statement.

> …the Master tried desperately to contact the shore authorities to advise of his concerns. He made numerous attempts to contact the Pilot from 0400 onwards. Repeated calls on the VHF remained unanswered until 0630 hours when the Pilot finally responded. The first contact with anyone ashore was at 0510 hours when the stevedore manager appeared at the top of the rock face above the vessel.

The ATSB re-considered all the available evidence, including that provided in submission by *Tycoon*'s P&I representative, the master and other crew members and determined that, on balance, the evidence indicates that the master did not attempt to contact the authorities ashore until the stevedore manager arrived at the terminal at 0510 on 8 January 2012.

It was still dark at 0420 on 8 January 2012 and the sea/swell was already in excess of 1.2 m, the limit at which a barge could be launched. However, had the master advised the pilot, or anyone else ashore, at the time that the cantilever line had come free, it might have been possible for those ashore to provide some assistance. For example, assistance could have been sought from HMAS *Leeuwin*, which was standing off the port.

However, it was not until about 0510 when the stevedore manager arrived at the terminal, during which time the situation had worsened, that anyone ashore became aware of the situation regarding the ship's moorings. By that time, the weather and sea conditions were such that a barge could not be launched and the options available to let the ship proceed to sea, or for additional moorings to be run, were extremely limited.

Cutting the stern lines

With the loss of the cantilever line, more weight came on the starboard after breast lines that had been run to the south breast buoy. About 2 hours later, one of these lines parted. This meant that all the weight then came on the remaining starboard after breast line and it was only this line that was keeping the ship safely in the moorings. However, the forces as a result of the wind and sea pushed the ship forward and towards the rock face and the crane pylon.

When the crew on the poop deck thought that the ship was about to leave for sea, they decided to assist by cutting through the remaining port and starboard breast lines (one of each) (Figure 14). However, their actions made the situation worse and meant that there were no lines out aft and there was nothing to hold the ship's stern off the rock face. It also meant that there was no means for the crew to heave the ship off the pylon and rock face.

The actions of the crew on the after deck might have been with the best intent, given the situation they were facing at the time. However, they did not consider the implications for the ship that cutting the lines would have. They did not ask *Tycoon*'s master for permission to cut the lines, nor did they tell him that the lines had been cut. When the master saw that the lines were no longer connected to the ship, he thought that the lines had parted under the strain of the wave action.

Use of the ship's main engine

At about 0400 on 8 January, *Tycoon*'s master was sufficiently concerned about the deteriorating weather and sea conditions that he put the ship's engine room staff on stand-by and had the ship's main engine readied for use. However, he did not make any attempt to use the engine, in conjunction with the ship's mooring lines, to keep the ship in position. In the weather conditions at

that time, before they deteriorated further as the morning progressed, it might have been possible to proceed to sea or at least limit the amount of damage the ship sustained later that day after the mooring lines were lost.

It was not until after 0700, when the pilot instructed the master to run the main engine full astern and then full ahead, that the engine was used at any time. By that time, the weather and sea conditions had deteriorated further and, considering that the engine was only run for a total of 1½ minutes, its use was ineffective.

The master did not make proper use of the ship's main engine and mooring lines to try and keep the ship at the inner moorings during the early hours of 8 January, relying instead on the pilot for directions. However, by the time the pilot was aware of the situation surrounding *Tycoon*, the weather and sea conditions prevented an effective response to keep the ship from foundering.

Figure 14: The stern lines being cut in anticipation of *Tycoon* proceeding to sea

Source: Phosphate Resources, Christmas Island

Abandoning ship

While video evidence provided to the ATSB suggests that the crew on the after deck were starting to have some success in moving *Tycoon*'s stern away from the rock face, this was only one of a number of factors that the master had to consider when deciding whether or not to abandon ship.

The weather was deteriorating and *Tycoon* was being continually pounded against the rock face. The ship had been extensively damaged and a tear in its side had opened up in way of the engine room. The tear quickly grew in size and the engine room began taking on water.

From the master's vantage point, it appeared inconceivable that the ship could be saved, so he decided to abandon ship. He made the reasonable decision of putting the safety of the crew before that of the ship in a situation that he considered to be hopeless.

Actions of the Royal Australian Navy RHIB crews

While on Christmas Island, the ATSB investigators obtained smartphone video footage from the numerous people who witnessed the rescue of *Tycoon*'s crew members.

The footage clearly shows that the crews of the three naval RHIBs were able to bring their skills and training in the handling of the RHIBs to the fore when they rescued the crew from the rough seas and in close proximity to the ship's starboard gangway (Figure 15).

Figure 15: The three Navy RHIBs during the rescue operation

Source: Phosphate Resources, Christmas Island

Without the presence of the navy personnel and their skill, the rescue of the 15 crew members would have been much more problematic and dangerous.

Two videos of this event are included in this report and can be found of the ATSB website at: www.atsb.gov.au/publications/investigation_reports/2012/mair/292-mo-2012-001.aspx

Safety analysis

Condition of the cantilever line underwater components

While there are a number of underlying local conditions that contributed to the foundering of *Tycoon*, it was the failure of the cantilever line that initiated the events that followed.

The only record available in the port's maintenance/inspection system that related to the cantilever line and its underwater components was a June 2010 work order. [7] The work order indicated that the cantilever line (known in the system as the FFC alongside stern line) and its underwater components had been inspected. However, the work order did not provide any detail on the condition of any of the components at the time of the inspection. Furthermore, it did not state whether any of the components, including the connecting shackle joining the chain and the cantilever line, were replaced at that time.

While there was no record of what was done at the time of the inspection, the port's engineering manager recalled replacing the cantilever line and its connecting shackle when the mooring system was inspected in June 2010.

According to the port operator's staff, adverse, prolonged swell conditions in the middle part of 2011 prevented the inspection of the cantilever line's underwater components at that time. Then, the unavailability of a diver later in the year meant that the line and its components did not get inspected at all in 2011.

Therefore, on 8 January 2012, when the cantilever line shackle failed, it had been 18 months since the underwater components of the cantilever line had been inspected.

Cantilever line planned maintenance

While the port operator had intended to inspect the underwater components of the moorings (the anchors, cables and joining shackles) at least once a year, the planned maintenance system did not detail when these inspections were due. The inspection regime in place at the time was therefore somewhat ad hoc. At the very least, it was very much dependent on the availability of an appropriately skilled diver and the weather and sea conditions. If an inspection of a particular component or part of the mooring system couldn't be undertaken because of the lack of a diver or adverse weather or sea conditions, that particular component did not get inspected until the following year, or possibly later.

While the seasonal weather conditions experienced on Christmas Island could be an impediment to carrying out maintenance of the underwater components of the mooring system, the conditions should not have been a determining factor in deciding whether or not to inspect the various components. An effective planned maintenance programme should have taken into account these variables and scheduled critical maintenance for the most opportune times with appropriate contingency plans in place to ensure that critical inspections were always carried out.

Effectiveness of the shackle pin securing arrangement

The port operator's staff had identified that, in the prevailing conditions, simply putting a split pin through the shackle pin was not an effective way to prevent the nut from coming free. As a result, it was their practice during maintenance activities to replace these types of shackles with newer shackles which employed a much more robust locking arrangement to reduce the risk of the nut coming free (Figure 16).

[7] Number 500006351, Job plan ASFFC12MS, dated 10/05/2010.

At the time of the *Tycoon*'s foundering, the port operator held a certificate which was supplied with the cantilever line itself and was in the process of compiling other records. However, the operator did not possess any records in relation to the underwater components of the cantilever line. They held no records in relation to the anchor, the chain or the shackles.

Figure 16: A new joining shackle with the improved 'locking pin' arrangement

Source: ATSB

While the port operator staff thought that they had replaced the cantilever joining shackle with one of the newer upgraded design, they had no record that confirmed this and the underwater video footage taken on 16 January 2012 revealed that this was not the case.

In summary, the port operator did not have a complete set of records relating to the various components of the inner mooring system. Furthermore, having identified an issue with shackle pins coming loose, the port operator and its staff had not implemented a program of systematic replacement of all joining shackles with the newer more robust locking arrangement.

Risks of using the inner moorings

The weather conditions each year at Christmas Island during the months of December to March (the swell season) are known to be unpredictable and, because of the exposed nature of Flying Fish Cove, ship operations are impacted by what can be rough seas and swell.

Despite this known fact, the port operator, in consultation with the pilot, had not undertaken any documented risk assessment for the practice of leaving a ship at the inner moorings overnight during the swell season. Furthermore, no contingency plans had been developed which could have been implemented if the weather conditions in the port unexpectedly deteriorated while a ship was berthed at the inner moorings. Therefore, the safety of any ship using the inner moorings was almost completely dependent on the experience and judgement of the pilot and the ship's master.

The pilot generally told ships masters that once cargo work was finished for the day, they could heave on the ship's seaward headlines to cant the bow of the ship to seaward if they were concerned about being too close to the cliff-face overnight. However, the pilot did not advise masters when they should follow this practice. The only plan he enacted was to consider whether or not to put a ship to sea if the weather forecasts indicated to him that the conditions might deteriorate on a certain day.

In submission, the port operator stated that:

> The standard practice used on Christmas Island to prepare for difficult weather conditions is to move the lines from the drums to the raised bollards. In addition, the vessel would have been 'warped out' the previous night once the stevedoring had been finished for the day. This involves pulling up the outside lines and loosening the inside lines, moving the vessel as far from the cliff face as possible and moving the bow of the vessel to a westerly direction heading out to sea (Warping Procedure). This ensures that the vessel is in position and can 'cut and sail' quickly if required as a result of a change in weather conditions.

Tycoon was not 'warped out' on the evening of 7 January 2012 and, while doing so may have been prudent, there was no documented procedure that described the process. Warping out was a practice that was followed by the masters of some ships that berthed at Christmas Island. While it was the pilot's practice to generally advise ships masters that they could 'warp the ship out' at the end of each days cargo work, the masters were not told under what circumstances they should do so, or that it was a requirement of the port that they do it.

While it is appropriate for the pilot and master to assess the risks associated with the mooring of each and every ship, such assessments should be carried out within the context of the port and its operations. The port's formalised risk assessment processes should form the framework in which such case by case assessments can be made and should be the basis on which local rules and procedures are developed and implemented by the port operator, the entity responsible for the overall operation of the port.

Given the severe consequences of a ship becoming stranded at the inner moorings, it was of great importance that the port operator properly considered the risks associated with a ship remaining at the inner moorings overnight. An appropriate risk assessment should have considered the prevailing weather conditions, the open nature of the port, the adequacy of a mooring system that was reliant on the ability to launch barges to allow ships crews to let go their mooring lines and whether it was safe for ships to remain moored overnight without effective monitoring.

Guidance for ships' masters

The port operator did not issue masters of ships using either the inner or outer moorings with any guidance or directions, such as harbour master directions or a port information guide.

However, the pilot, acting as the ship's agent,[8] provided general port information[9] to masters of ships loading bulk phosphate from the cantilever loading arms. This document covered topics associated with preparation for loading, pilot boarding, loading bulk phosphate, documentation required for port entry, marine crew visas, ballast water requirements and pilotage and mooring arrangements. However, it did not include any information in relation to emergency or contingency arrangements.

With regard to mooring arrangements, this guidance document only covered those arrangements for ships which were to be moored to buoys under the cantilever loading arms and included minimum mooring line requirements (and a sketch of the mooring arrangement), specifications for minimum mooring line dimensions and numbers and main engine availability requirements.

Despite being berthed significantly closer to the shore and the more dangerous rock face and crane pylon, there was no relevant guidance for ships' masters berthing at the inner moorings.

However, it was the pilot's usual practice to provide verbal advice to masters of ships berthed at the inner moorings after the ship had been made fast to the buoys. He told them that they could contact him at any time if they had any concerns. He also told them that once cargo work was finished for the day, they could heave on their ship's outboard headlines if they wanted to cant the bow of the ship a little more seaward if they were concerned. This would allow them to let their lines go and manoeuvre the ship away from the close confines of the rock face. However, if the

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[8] A person or firm who transacts all business in a port on behalf of the master, shipowner or charterer.

[9] Guidance for masters of vessels calling at Christmas Island - bulk phosphate vessels.

barges could not be launched, then the ship's crew would have to cut the mooring lines in order to proceed to sea.

In the main, masters of ships moored at the inner moorings were left to their own resources. While the pilot provided them with a simple overview and verbal briefing, the port operator provided them with no guidance or direction.

Findings

On the morning of 8 January 2012, one of the permanent mooring lines holding the general cargo ship *Tycoon* in position in the inner moorings at Flying Fish Cove, Christmas Island, came free from its anchor. As a result, the ship moved forward and closer to the nearby terminal rock face, eventually making contact with the rock face as the weather and sea conditions deteriorated.

Despite the attempts to move it away, *Tycoon* continued to pound against the rock face. Eventually, the ship's engine room began to flood through a tear in the hull. Shortly afterwards, the crew safely abandoned the ship.

At about 1100 on 9 January, *Tycoon* suffered a catastrophic failure of its hull and the contents of the ship's number two cargo hold, about 260 tonnes of bagged phosphate, was exposed to the sea.

From the evidence available, the following findings are made with respect to the foundering of *Tycoon* and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The pilot considered that the forecast deterioration in the weather and sea conditions would occur during the evening of 8 January. Consequently, when the change occurred in the early hours of 8 January, both the shore authorities and the ship's crew were caught unprepared.
- The pin in the shackle joining the cantilever line to its anchor cable worked its way out and the line subsequently came free. As a result, the ship moved forward in the inner moorings and more weight came onto the two starboard stern lines, resulting in one of them parting and all the ship's weight being carried by the other.
- The available evidence indicates that the ship's master did not tell anyone ashore of his concerns about the safety of the ship when the weather started to deteriorate and the cantilever line came free. He also did not effectively attempt to use the ship's main engine or mooring lines to keep the ship in position at the inner moorings.
- The ship's crew cut the two remaining stern lines. However, they did not ask for the master's permission to do so nor did they inform him that they had cut the lines.
- The port operator had not implemented an effective planned inspection and maintenance program for the mooring system in Flying Fish Cove. Consequently, it had been 18 months since the underwater components of the cantilever line had been inspected. *[Significant safety issue]*
- The port operator was aware that the type of locking pin arrangement on the cantilever line joining shackle was not effective in preventing the shackle's pin from working its way free. However, the operator had not implemented a program of replacing the shackles in the entire mooring system in Flying Fish Cove with new shackles that had a more robust locking pin arrangement. *[Significant safety issue]*
- A risk assessment for mooring a ship at the inner moorings had never been undertaken. As a result, the risks associated with leaving a ship at the inner moorings overnight during the swell season were not properly identified and strategies to minimise those risks were not implemented. *[Significant safety issue]*
- While the pilot provided limited advice to masters of ships visiting Christmas Island, the port operator did not provide the master of ships intending to berth using the buoys in Flying Fish Cove with any written or verbal guidance regarding berthing and unberthing arrangements and emergency contingencies. *[Minor safety issue]*

Other key findings

- The professionalism and skill of the Royal Australian Navy rigid hull inflatable boat crews was clearly demonstrated by their actions on 8 January 2012 when they assisted with the abandonment of the crew from *Tycoon*.

Safety issues and actions

The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation. In addressing those issues, the ATSB prefers to encourage relevant organisation to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Inspection of the mooring system in Flying Fish Cove

Number:	MO-2012-001-SI-01
Issue owner:	Patrick
Operation type:	Inspection of inner moorings underwater components
Who it affects:	Ships berthed at the inner moorings at Christmas Island
Risk at time of occurrence:	Significant

Safety issue description:

The port operator had not implemented an effective planned inspection and maintenance program for the mooring system in Flying Fish Cove. Consequently, it had been 18 months since the underwater components of the cantilever line had been inspected.

Proactive safety action taken by: Christmas Island Port

By way of enhancing its existing maintenance system, the port operator has introduced a system to fly in diving contractors to Christmas Island to complete the annual dive inspection and has commenced works to further enhance the mooring system, which include:

a) Introducing new mooring components to enhance the safety of the mooring arrangements, including adding 'Jew's Harps' to the floating stern line, the Makaan cliff chain and the Kampong Cliff Chain. This will allow the ship's mooring lines to be passed through the 'Jew's Harp' and then back to the vessel to be secured and ultimately allows the ship's crew to manage the lines better and to slip the lines themselves in the event of an emergency.

b) Replacing all four buoys (head buoy, stern buoy, south breast and north breast) including new anchors, dumpers, chains and shackles. The buoys all come complete with double quick release couplings (QRC) with the exception of the north breast which is single QRC only.

These works are scheduled to be completed in May 2013.

Action number:	MO-2012-001-NSA-001
Action status:	Closed
ATSB response:	The ATSB is satisfied that the action taken adequately addresses this safety issue.

Current status:

Residual risk:	Minor
Issue status:	Closed
Justification:	Safety action taken

Joining shackle locking pin effectiveness

Number:	MO-2012-001-SI-02
Issue owner:	Patrick
Operation type:	Inspection of equipment
Who it affects:	Ships berthed at the inner moorings at Christmas Island
Risk at time of occurrence:	Significant

Safety issue description:

The port operator was aware that the type of locking pin arrangement on the cantilever line joining shackle was not effective in preventing the shackle's pin from working its way free. However, the operator had not implemented a program of replacing the shackles in the entire mooring system in Flying Fish Cove with new shackles that had a more robust locking pin arrangement.

Proactive safety action taken by: Christmas Island Port

The port operator is in the process of replacing the mooring equipment including the anchors, dumpers, chains and shackles. These works are scheduled to be completed in May 2013.

Action number:	MO-2012-001-NSA-002
Action status:	Closed
ATSB response:	The ATSB is satisfied that the action taken adequately addresses this safety issue.

Current status:

Residual risk:	Minor
Issue status:	Closed
Justification:	Safety action taken

Risk assessment for the inner moorings

Number:	MO-2012-001-SI-03
Issue owner:	Patrick
Operation type:	Risk of using the inner moorings
Who it affects:	Ships berthed at the inner moorings at Christmas Island
Risk at time of occurrence:	Significant

Safety issue description:

A risk assessment for mooring a ship at the inner moorings had never been undertaken. As a result, the risks associated with leaving a ship at the inner moorings overnight during the swell season were not properly identified and strategies to minimise those risks were not implemented.

Proactive safety action taken by: Christmas Island Port

Patrick, as the port operator, recognises that there is scope to enhance the coordination of information and processes to better manage safety within the port. As part of this enhancement,

Patrick, arranged for a safety training workshop to be held on Christmas Island in June 2012 and invited all users of the port who are located on the island, including stevedores and pilots.

Following on from this workshop, Patrick has put in place a procedure to facilitate regular meetings of users for the purpose of identifying and managing as a group safety issues arising from the operation and use of the port. These meetings will include an assessment of the mooring system and the overall risks posed to the port and its operations. Patrick will take all appropriate steps to ensure that the risks associated with mooring are properly assessed in consultation with relevant stakeholders.

Action number: MO-2012-001-NSA-003

Action status: Monitor

ATSB response: The ATSB considers that further action should be taken to address this safety issue.

ATSB safety recommendation to: Patrick

Action number: MO-2012-001-SR-01

Action status: Released

The ATSB recognises that the actions taken by Patrick are a step in the process of effectively assessing the risks posed to the port and its operations. However, the ATSB recommends that Patrick takes further action to carry through with its intent to address this safety issue.

Current status:

Residual risk: Significant

Issue status: Monitor

Justification: The ATSB considers that further action should be taken to address this safety issue.

Guidance for masters of ships berthed at the inner moorings

Number:	MO-2012-001-SI-04
Issue owner:	Patrick
Operation type:	Directions while secured in the inner moorings
Who it affects:	Ships berthed at the inner moorings at Christmas Island
Risk at time of occurrence:	Minor

Safety issue description:

While the pilot provided limited advice to masters of ships visiting Christmas Island, the port operator did not provide the master of ships intending to berth using the buoys in Flying Fish Cove with any written or verbal guidance regarding berthing and unberthing arrangements and emergency contingencies.

Proactive safety action taken by: Christmas Island port

Patrick, as port operator, is in the process of enhancing the information made available to the pilot by preparing a Port Handbook. The handbook will be provided to the pilot to distribute to the master of each ship.

The draft version of the handbook will be provided to port users, including the stevedores and pilot, for review by the end of March 2013.

Action number: MO-2012-001-NSA-004

Action status: Closed

ATSB response: The ATSB is satisfied that the action taken adequately addresses this safety issue.

Current status:

Residual risk: Minor
Issue status: Closed
Justification: Safety action taken

General details

Occurrence details

Date and time:	1031 on 8 January 2012 (UTC + 7 hours)	
Occurrence category:	Incident	
Primary occurrence type:	Foundering	
Type of operation:	Mooring	
Location:	Flying Fish Cove, Christmas Island	
	Latitude: 10° 25.5’ South	Longitude: 105° 40.2’ East

Ship details

Name	*Tycoon*
IMO number	8304220
Call sign	3EVV2
Flag	Panama
Classification society	Panama Bureau of Shipping
Ship type	General cargo
Builder	Sanyo Zosen, Japan
Year built	1983
Owner(s)	Tycoon Navigation, Panama
Operator	Ocean Grow International Ship Management, Chinese Taipei
Manager	Ocean Grow International Ship Management, Chinese Taipei
Gross tonnage	2638
Deadweight (summer)	4129 tonnes
Summer draught	6.246 m
Length overall	84.66 m
Moulded breadth	14.51 m
Moulded depth	8.60 m
Main engine(s)	Akasaka 6DM38AK, four stroke single acting diesel engine
Total power	1471 kW
Speed	10.5 knots

Sources and submissions

Sources of information

On 10 January 2012, two investigators from the ATSB travelled to Christmas Island to investigate the events surrounding the foundering of *Tycoon*. While on Christmas Island, the investigators interviewed relevant members of the ship's crew, the harbour master, the port's maintenance manager, the pilot, a number of stevedores, Customs officers, Australian Federal Police officers, staff of Phosphate Resources, relevant crew members from HMAS *Leeuwin* and other witnesses.

The investigators also gathered information, including relevant documentation and records. Through the course of the investigation, further information was provided by the Department for Regional Australia, Local Government, Arts and Sport, and the Australian Maritime Safety Authority (AMSA).

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Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the master, chief mate, second mate and chief engineer of *Tycoon*, Ocean Grow International Ship Management, the Christmas Island Port harbour master and maintenance manager, Patrick Ports, the pilot, Phosphate Resources, the master and relevant crew member of HMAS *Leeuwin*, the Royal Australian Navy, the then officer in charge of the Australian Federal Police on Christmas and Cocos (Keeling) Islands, the Director of Complete Stevedoring and Freight Services (Christmas Island), the Panama Maritime Authority, the Department of Regional Australia, Local Government, Arts and Sport, and AMSA.

Submissions were received from the master, chief mate and chief engineer of *Tycoon*, *Tycoon*'s P&I representative, the Christmas Island Port harbour master and maintenance manager, Patrick Ports, Phosphate Resources, the then officer in charge of the Australian Federal Police on Christmas and Cocos (Keeling) Islands, the Panama Maritime Authority, the Department of Regional Australia, Local Government, Arts and Sport and AMSA. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Terminology used in this report

***Occurrence*:** accident or incident.

***Safety factor*:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (for example engine failure, signal passed at danger, grounding), individual actions (for example errors and violations), local conditions, current risk controls and organisational influences.

***Contributing safety factor*:** a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

***Other safety factor*:** a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

***Other key finding*:** any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

***Safety issue*:** a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

***Risk level*:** The ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety action taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical safety issue:** associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant safety issue:** associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor safety issue:** associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

***Safety action*:** the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Marine Occurrence Investigation

Foundering of the general cargo ship *Tycoon*, Christmas Island, 8 January 2012

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