Australian Government

Australian Transport Safety Bureau

Grounding of the Panama registered bulk carrier *Dumun*

Gladstone, Queensland | 29 April 2011

Investigation

ATSB Transport Safety Report

Marine Occurrence Investigation

285-MO-2011-004

Final

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

Marine Occurrence Investigation
MO-2011-004
No. 285
Final

Independent investigation into the grounding of the Panama registered bulk carrier

Dumun

at Gladstone, Queensland

29 April 2011

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SAFETY SUMMARY

What happened

At 1706 on 29 April 2011, the Panama registered bulk carrier *Dumun* grounded while departing the port of Gladstone, Queensland.

Prior to the grounding, the ship's steering appeared to stop responding to bridge commands when the linkage between the tiller and rudder angle transmitter became detached. The steering gear continued to operate normally, but the transmitter lost its input signal and, as a result, the bridge mounted rudder angle indicator stopped working.

The bridge team assumed that the steering had failed, so the pilot ordered the main engine stopped and then started astern. However, these actions were not enough to prevent the ship from grounding.

What the ATSB found

The ATSB determined that the ship's builders did not identify that the rudder angle indicator transmitter and tiller linkage were not installed correctly. More broadly, the ATSB found that the analysis of shipping operations in Gladstone, carried out by the relevant authorities, had not appropriately considered all that could be done to prevent the grounding of a ship as a result of steering gear or main engine failure. In addition, it was found that a comprehensive safety management system had not been implemented in Gladstone with the aim of identifying, evaluating and controlling pilotage related risk.

What has been done as a result

Dumun's shipbuilder has sent a bulletin to the owners of all ships built by the company advising that the rudder angle indicator linkage should be checked to ensure that it is correctly fitted. The company has also modified its procedures to ensure that these checks are carried out during the building of all future ships.

Maritime Safety Queensland (MSQ) and its pilots have worked with Gladstone Port Corporation and terminal operators to improve ships' readiness for departure by implementing rigorous pre-departure checks. MSQ is also in the process of developing a single pilotage safety management system covering all of the ports in which the organisation provides pilotage operations.

Safety message

Safety regulators and port authorities should consider all the risks associated with the passage of deep draught ships within their ports and have appropriate contingency plans in place to deal with foreseeable emergencies.

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THE 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 appropriate, or to raise general awareness of important safety information in the industry. 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 (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. 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 actions 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.

1 FACTUAL INFORMATION

1.1 *Dumun*

Dumun is a geared bulk carrier which was built by Tsuneishi Group (Zhoushan) Shipbuilding, China, in 2010 (Figure 1). The ship has an overall length of 189.99 m, a beam of 32.26 m and a deadweight of 58,107 tonnes at its summer draught of 12.826 m. It has five cargo holds located forward of the accommodation superstructure which are serviced by four centreline mounted 30 tonne capacity cargo cranes.

Propulsive power is provided by a Mitsui MAN B&W 6S50MC-C, two stroke, single acting, slow speed diesel engine that delivers 8,400 kW at 113 rpm. The main engine drives a single fixed pitch propeller, giving the ship a service speed of about 14.5 knots. [1]

Figure 1: ***Dumun***

At the time of the incident, *Dumun* was registered in Panama and classed with Lloyd's Register (LR). It was owned by Dumun Marine and managed by Well Ship Management and Maritime Consultants, both of Taipei, Taiwan.

Dumun's navigation bridge was equipped with navigational equipment consistent with SOLAS[2] requirements. The layout included an integrated control console housing radars, main engine controls, a machinery alarm panel, a steering stand and communications equipment. The console was located on the ship's centreline, just forward of a chart table (Figure 2).

A gyro compass repeater was mounted at the bridge front on the centreline. Instruments including rudder angle indicator, main engine speed and weather information were mounted overhead, above the compass repeater. Other equipment control panels, including those for the steering gear motors and navigation lights, were mounted on the bulkhead immediately aft of the chart table.

The ship had a crew of 21 Chinese nationals, all of whom joined the ship for its delivery from the shipyard about 5 months before the grounding. The master had

1 One knot, or one nautical mile per hour equals 1.852 km/hr.

2 The International Convention for the Safety of Life at Sea, 1974, as amended.

about 34 years of seagoing experience. He held a master's certificate of competency that was first issued in China in 1993. He had been sailing as master since that time and had worked for Well Ship Management since 2009.

Figure 2: *Dumun*'s navigation bridge

The chief mate had about 30 years of seagoing experience and held a chief mate's certificate of competency. He had been sailing as chief mate since 1995 and had worked with Well Ship Management since 2004.

The third mate had about 4 years of seagoing experience, all of which was with Well Ship Management. He had held a watchkeeper's certificate of competency for 18 months and this was his second ship as third mate.

The helmsman had 13 years of seagoing experience, the first nine of which were spent working on board fishing vessels. *Dumun* was the third merchant ship he had sailed on.

The chief engineer had about 21 years of seagoing experience and held a Chinese chief engineer's certificate of competency that was issued in 2007. He had worked with Well Ship Management since 2005 and had been sailing as chief engineer for 3 years.

1.1.1 Steering Gear

Dumun was fitted with a Mitsubishi SFC-80TS electro-hydraulic steering gear, which comprised two, opposed, single-acting hydraulic cylinders attached to the rudder tiller arm. Oil was supplied under pressure to the hydraulic cylinders by two identical and independent hydraulic units (Figures 3 and 4). Each of the hydraulic units consisted of an electric motor, a hydraulic pump mounted in an oil storage tank, control valves and piping. Each hydraulic unit met 100 per cent of the steering gear design requirements. As a result, only one hydraulic unit had to be run at any given time. Furthermore, the control system was designed so that the two hydraulic units could not be operated at the same time.

Figure 3: The steering gear

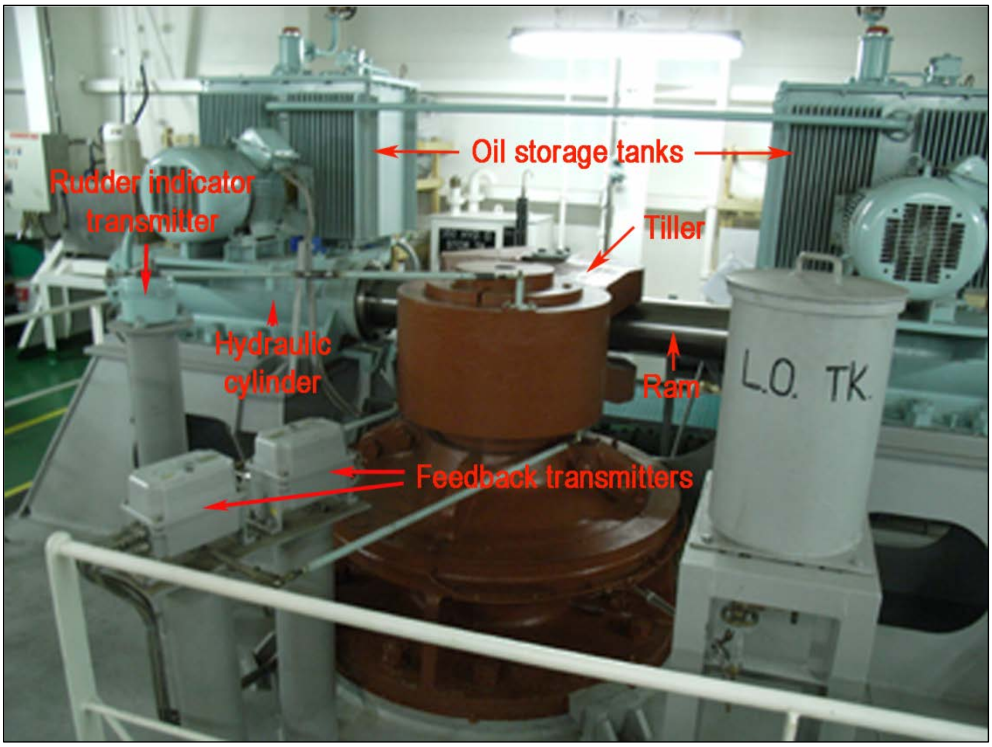
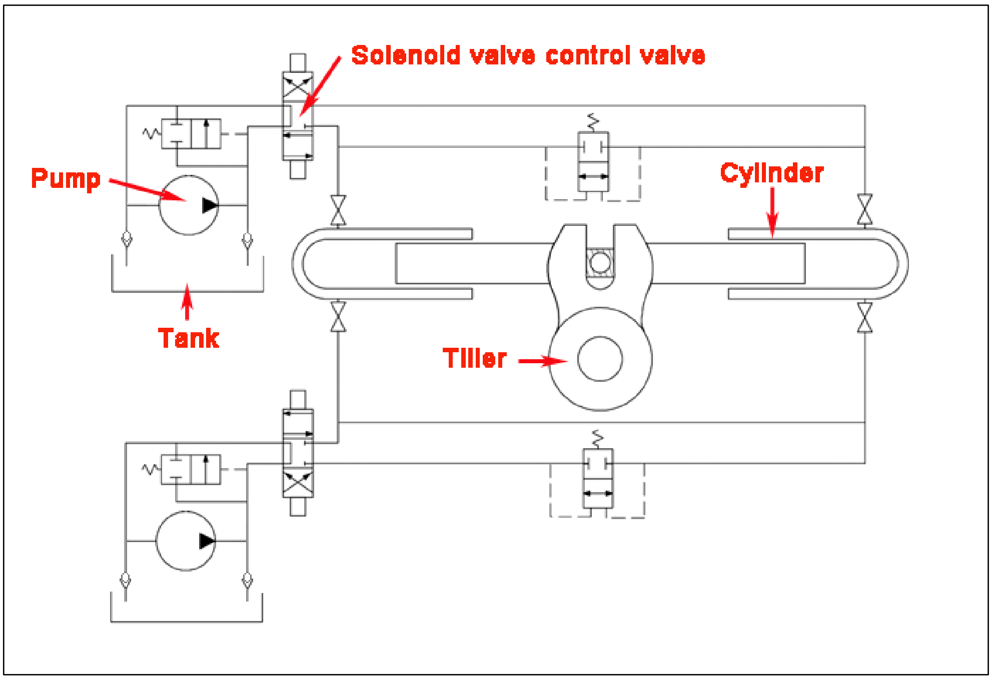


Figure 4: Steering gear schematic

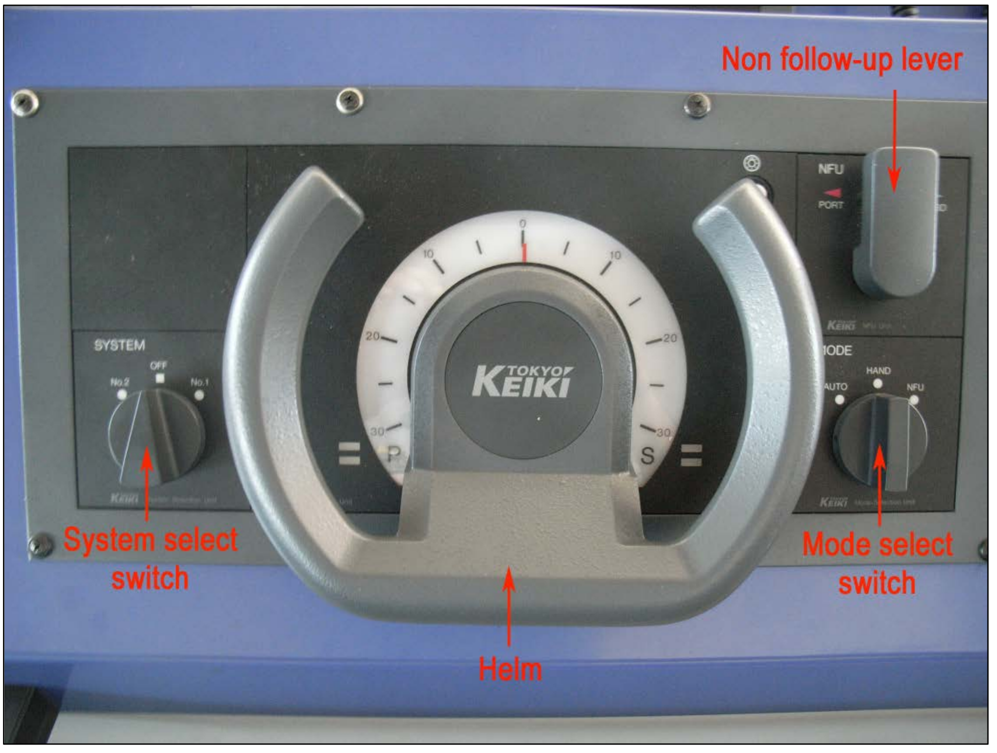


Hydraulic pressure for each of the two constant pressure hydraulic units was provided by a constantly running fixed displacement piston pump. When no change in rudder angle was required, oil circulated through the solenoid control valve and back to the pump suction. When the control system called for a change of rudder angle, the solenoid control valve activated, directing pressurised oil to the desired hydraulic cylinder, while draining oil from the other cylinder to the pump suction. As a result, the rudder moved in the desired direction.

Remote steering control

For remote bridge control purposes, the steering gear was fitted with a Tokyo Keiki PR-6000-E remote steering control system. The system provided remote control of the two hydraulic units from the bridge mounted steering stand (Figure 5).

Figure 5: *S*teering control stand



Either steering system could be selected to operate from the steering stand and either could be set to auto-pilot, hand or non-follow up (NFU) control. If, at any time, the control system in use failed, the operator could change over to one of the standby systems.

When hand steering mode was selected, the operator controlled the ship’s steering by turning the helm to a desired rudder position. The remote control system constantly compared the electronic input signal from the helm with the signal received from a position transmitter mounted on the tiller. If the signals were not the same (i.e. the tiller was in a different position to the helm), the control system applied an output signal that energised the solenoid control valve. As a result, the tiller (and hence the rudder) moved in the desired direction. When the desired helm signal matched the output from the tiller position transmitter, the solenoid control valve de-energised and the rudder stopped moving and remained in the desired position.

The control systems were designed to provide complete redundancy. As a result, each system relied on its own tiller position transmitter for a feedback signal. A third tiller position transmitter (Figure 3) provided an independent signal to the bridge-front mounted rudder angle indicator.

When NFU steering mode was selected, the operator controlled the ship's steering by manipulating a 'lever'. This system operated the solenoid control valves directly, independent of a feedback signal from the tiller position transmitters. When the lever was moved to port, the control system energised the solenoid control valve and the tiller (and hence the rudder) moved to port. When the rudder reached the desired position, the operator released the lever and it returned to its central position. The solenoid control valve then de-energised, the rudder stopped moving and remained in that position. The system operated similarly when the lever was moved to starboard.

1.2 Gladstone

The port of Gladstone is located on the central coast of Queensland (Figure 6). Its natural harbour forms one of the largest ports in Queensland. Gladstone is one of Australia's major coal export ports and is centrally situated to serve the rich mining areas of central Queensland.

In 2011, 451 ships imported products including LPG, containers, caustic soda, sulphuric acid, magnetite, Gypsum and petroleum products into the port. During the same period of time, 889 ships carried export products out of the port, including 608 shipments of coal[3]. While there is a substantial amount of development currently occurring in the port, including the construction of LNG export facilities, coal will continue to be the port's primary commodity in terms of number of shipments per year for the foreseeable future.

The city of Gladstone and all berthing areas are on the south-western side of the harbour. The harbour is entered through South and Gatcombe Channels leading from sea to the outermost berths at South Trees Point. From there, Auckland, Clinton and Targinie Channels together lead 9 miles[4] further west-northwest, giving access to berths at Barney Point, Auckland Point, Clinton and Fishermans Landing.

Auckland Channel is the main shipping channel leading from Gatcombe Channel and the South Trees Point area to the main area of the port. It is approximately 3 miles long, 182 m wide and has a charted depth of 15.8 m. Auckland Channel starts at A1/A2 beacons (northwest of South Trees Point) and runs in a direction of approximately 293° (T). It ends at A7 beacon, just to the north of Auckland Point. To facilitate passing, a smaller by-pass channel, which has a charted depth of 6.8 m, is dredged alongside the Auckland Channel for part of its length.

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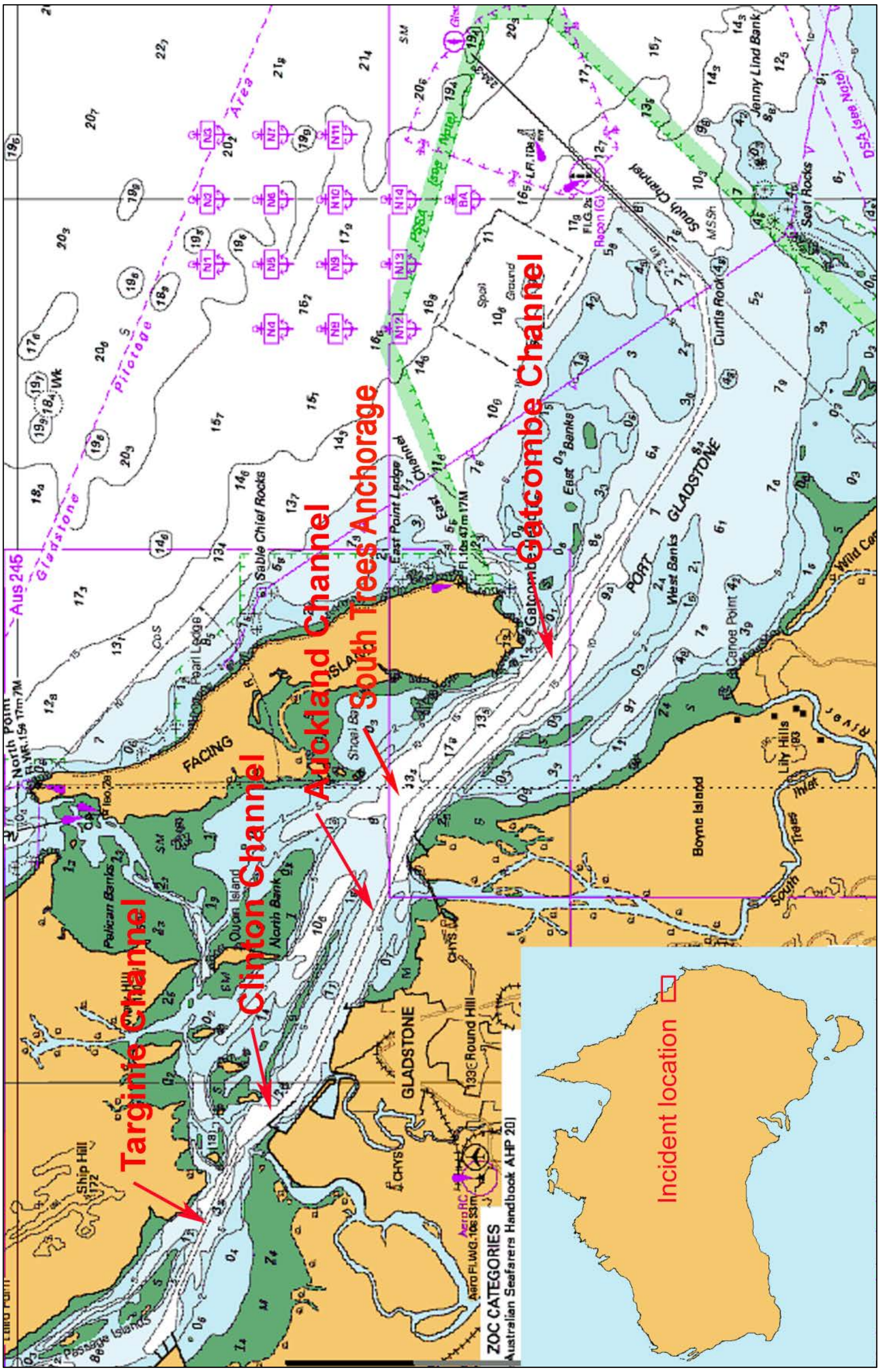
[3] Port of Gladstone Corporation statistics downloaded on 25 June 2012 from: http://www.cqpa.com.au/viewcontent/ShippingStatistics/CargoOriginDestination.aspx?View=G&Durat=C&Key=2011

[4] A nautical mile of 1852 m.

Figure 6: Section of navigational chart Aus 819 showing Gladstone



The Australia Pilot (NP 15) describes tidal streams within the South Channel and harbour as generally turning at the time of high water at Gladstone. The tidal streams generally run southeast on an ebb tide and northwest on a flood tide. Wind can affect these streams which may set very strongly through the channels. Areas within the harbour can experience tidal streams of up to 4 knots. Predicted tidal directions and maximum rates are shown on the charts.

The port of Gladstone is managed by the Gladstone Ports Corporation, a statutory Queensland Government owned corporation, while safety oversight is provided by Maritime Safety Queensland (MSQ), the state Government agency responsible for maritime safety and marine pollution matters in Queensland coastal waters.

1.2.1 Pilotage

A pilot is compulsory in the Port of Gladstone for all vessels 50 m or more in length unless the master holds a pilotage exemption. Pilots are licensed and employed by MSQ.

The pilot on board *Dumun* for its departure on 29 April obtained his master's certificate of competency in Australia in 1988. He sailed in various ranks and then as a master for about 10 years before moving ashore to take up a harbour master's position in Townsville. In 2002, he started working as a pilot in Townsville and, in 2006, transferred to Gladstone. At the time of the grounding, he held an unrestricted Gladstone pilot's licence.

1.3 The incident

On the afternoon of 27 April 2011, *Dumun* arrived off Gladstone and, by 1518[5], was brought up to its anchor in the Gladstone outer anchorage.

At 1300 the next day, a Gladstone pilot boarded the ship for its passage to the Clinton wharves. By 1530, the ship was all fast alongside the Clinton number four wharf. Cargo loading started at 1640 and continued until 1310 on 29 April. In that time, 51,520 tonnes of coal were loaded on board.

When cargo loading was completed, the crew made the necessary preparations for the ship's departure. At 1500, navigation equipment checks were completed and pre-departure checklists and documentation were finalised. The equipment tested included the main engine, bridge/machinery space communications, main engine telegraph and steering gear.

At 1612, a pilot boarded the ship. He was escorted to the bridge where he met the master and discussed the departure passage plan. During their exchange of information, the pilot was informed that all the navigation equipment had been tested and found to be in good working order. He was also told that the ship's departure draughts were 11.91 m forward and 12.25 m aft.

At this time, the tide was flooding and a high tide of 3.8 m was predicted at 1916, well after *Dumun* was expected to be clear of the port.

The bridge team consisted of the pilot, the master, the third mate and a helmsman. The third mate stood by the main engine telegraph, ready to relay engine requests to the engine room and the helmsman took up his position at the steering stand. The helmsman moved the helm to check that he had steering control. The rudder angle indicator responded to the change of helm, confirming that he had steering control.

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5 All times referred to in this report are local time, Coordinated Universal Time (UTC) + 10 hours.

Mooring teams assembled forward and aft with the chief mate in charge forward and the second mate in charge aft. All four engineers assembled in the machinery control room. The main engine was normally controlled from the bridge, but during this departure it would be controlled from the machinery control room because the chief engineer had some concerns over excessive use of starting air during manoeuvring and wished to monitor this closely during the departure. The first engineer was standing by at the control console and was responsible for answering the bridge telegraph orders and operating the main engine. The other engineers were standing by to carry out tasks as directed by the chief engineer.

One tug was made fast forward and one was made fast aft. At about 1620, the crew were directed to begin letting go the mooring lines. At 1630, the last mooring line was let go and the pilot began manoeuvring the ship off the berth with the use of the main engine and the two tugs. He manoeuvred the ship onto a heading of 113° (T), lining it up with the centre of the Auckland Channel.

At 1633, the pilot requested half ahead and at 1635, he directed the crew to let go the tugs. Once the tugs were clear of the ship, they left and steamed towards their base at Auckland Point.

From time to time, the pilot ordered the heading that he wished the helmsman to steer, all the time keeping *Dumun* in the centre of the channel and maintaining a course made good of 113° (T).

At 1652, the pilot requested full ahead. The aft mooring team was then told to stand down and make ready for sea and the chief mate was stood down from the forward mooring team.

Shortly afterwards, the chief mate arrived on the bridge. He went straight to the chart table, noted the GPS position and plotted it on the chart. The ship was now approaching the A3 and A4 beacons (Figure 7). The helmsman was steering 115° and the ship was maintaining a course made good of about 113° (T).

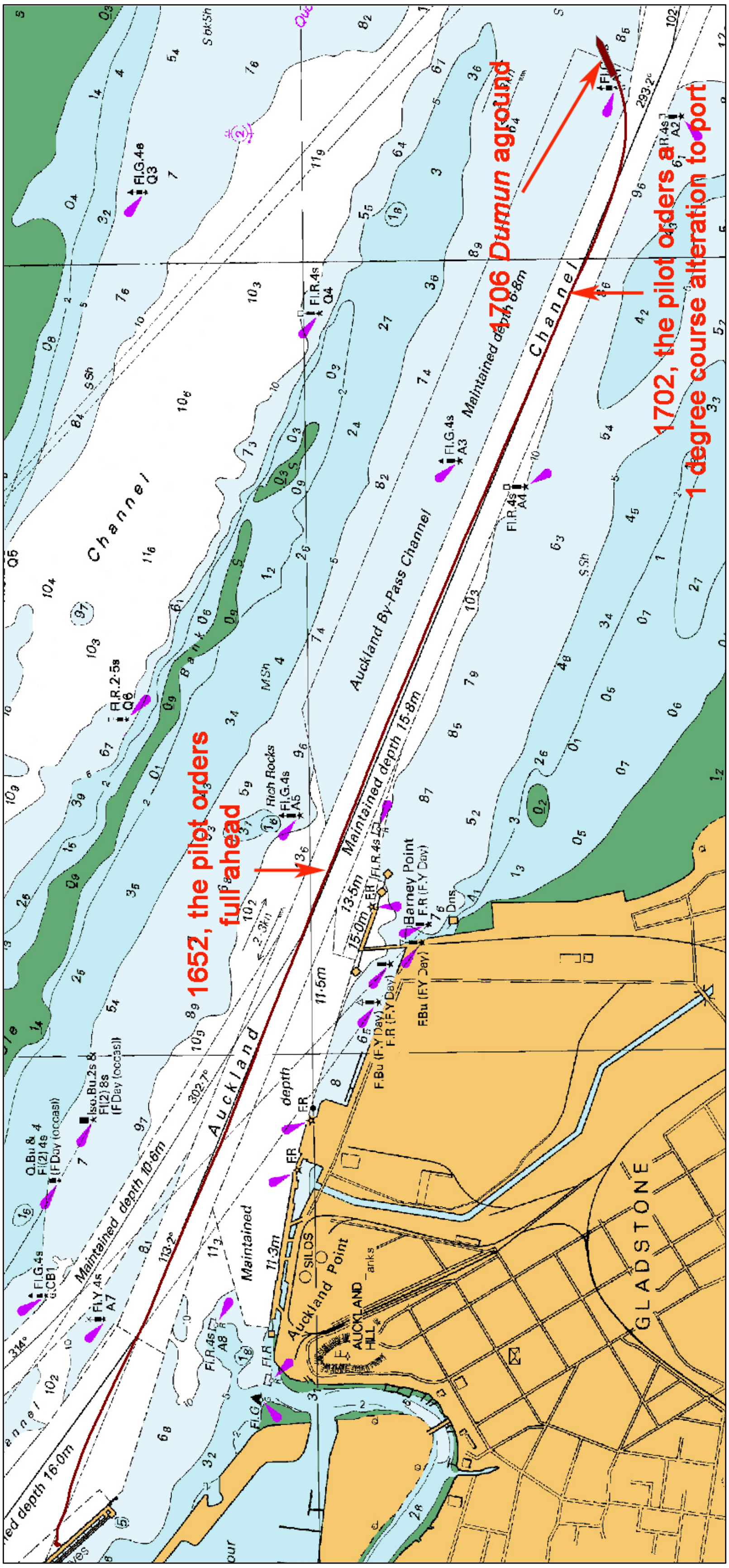
At 1702, *Dumun* was making good 9.6 knots when the pilot directed the helmsman to steer 114°, a course alteration of 1° to port. The helmsman applied port helm to effect the heading change, but the rudder did not appear to respond. The rudder angle indicator continued to show starboard 5°.

The helmsman alerted the chief mate to the situation. The chief mate came to the steering stand and moved the helm. However, the rudder angle indicator continued to show starboard 5°. He then changed over steering control systems and again moved the helm. The rudder still did not respond.

The chief mate called out to the master, informing him of what was happening. The master then telephoned the engine room and advised the chief engineer. At about the same time, the pilot called out ‘what’s happening’ and was told that the ship’s steering was not working.

At 1703¼, the pilot ordered the main engine stopped and, soon afterwards, the ship started to swing to port. At about the same time, the chief mate selected NFU steering control and operated the steering control lever. The rudder angle indicator still did not move. Shortly afterwards, the master changed over steering motors, but still nothing appeared to respond.

Figure 7: Section of navigational chart Aus 366 showing *Dumun*'s track in red



At 1703¾, the pilot ordered full astern and, almost immediately, the ship's rate of turn to port increased markedly. At about the same time, the chief mate left the bridge to go to the steering gear compartment. As he left, other crew members were called and directed to make their way to the steering gear compartment.

At 1704, the pilot contacted Gladstone harbour vessel traffic service (VTS) and reported that *Dumun* was approaching A1 beacon, that it had lost steering control and was about to exit the Auckland Channel. He also requested tug assistance as soon as possible. The VTS operator then called the tug base and directed all available tugs to assist.

Dumun's advance, and its rate of turn to port, started to slow as the ship's hull made contact with the muddy sea bed adjacent to the channel. The master repeatedly ordered the helmsman to apply starboard helm, which he did, but the helmsman also kept shouting out that the steering was not working.

At about 1705, A1 beacon was pushed aside as it ran down the ship's port side. At 1705¼, the pilot ordered the main engine stopped and, then, ordered hard-to-starboard.

At 1706, the ship came to a stop on a heading of 066° (T) in position 23°50.723S 151°18.473E, with A1 beacon about 40 m off the port quarter (Figure 8).

Figure 8: VTS image of *Dumun* aground, with AI beacon astern

Meanwhile, when the chief engineer arrived at the steering compartment, he went directly to the emergency steering platform at the aft end of the steering gear. The second engineer followed, but as he approached the starboard side of the steering gear, he noticed that the link-arm connecting the tiller to the rudder angle indicator transmitter was hanging loose at the tiller end (Figure 9). He called out to the chief engineer and reported what he had found. The chief engineer then came over and immediately started trying to re-locate the link-arm. At about this time, the chief mate arrived in the steering gear compartment.

The chief engineer finished re-fitting the link-arm and then, at 1709, telephoned the bridge to report that the steering had been repaired. However, he was told that the ship had already grounded.

Figure 9: Rudder position transmitter link arm

Back on the bridge, the pilot thought that the flooding tide would push *Dumun* towards A1 beacon, so he ordered slow ahead, followed by dead slow ahead, in an attempt to keep the ship steady in its current position.

The pilot and the master discussed the refloating of the ship. The master told the pilot that the crew had confirmed that the hull had not been breached. Shortly afterwards, the chief engineer came to the bridge and explained to the master that the steering had been repaired, although there was a misalignment of about 6° between the actual rudder position and what the rudder angle indicator was showing. He also explained that before the grounding, the bridge had lost rudder angle indication, but not steering control. The master then passed on this information to the pilot.

Discussions were held between the master, the pilot and the regional harbour master and an agreement was reached to refloat the ship on the rising tide. The pilot also telephoned the Gladstone pilot manager and it was agreed that a second pilot would be sent out to the ship.

By 1754, four tugs had arrived at *Dumun*'s position. They were positioned: one at the centre lead aft, two at the port quarter and one at the port shoulder. At 1757, the pilot directed the tugs to start building up thrust, but the ship did not move.

At 1812, another pilot boarded the ship and was escorted to the bridge. He discussed the situation with the original pilot and it was agreed that the second pilot would provide advice to the original pilot who would remain in control.

The two tugs at the port quarter were moved forward. The pilot then ordered the tugs to start building up thrust and, at 1816½, the ship's bow started swinging to starboard.

At 1820, a fifth tug arrived off *Dumun* and was positioned aft.

By 1828, *Dumun* had been turned through about 220° and was lying adjacent to A1 beacon on the northern toe-line of the Auckland Channel. The ship was aligned with the channel and heading upstream. The pilot steadied the ship and started moving it sternwards towards the South Trees Anchorage (Figure 6).

At 1844, the second pilot took over the conduct of the ship. The ship's sternwards progress continued at a speed of about 1 to 2 knots.

At 1958, *Dumun* was anchored in the South Trees Anchorage. Soon afterwards, four tugs and the original pilot departed the ship. The second pilot remained on board and one tug stood by.

At 0600 the following morning, an Australian Maritime Safety Authority (AMSA) surveyor arrived on board *Dumun*. The surveyor inspected the ship and issued the master with a detention order that prevented it from departing Gladstone until a determination of seaworthiness was provided by Lloyd's Register (LR).

At 1100, divers arrived on board *Dumun* to undertake preliminary underwater hull inspections. They completed their inspection at 1325 and the ship was cleared for a move to the outer anchorage.

At 1500, *Dumun*'s anchor was weighed and the ship commenced the passage to the outer anchorage under the control of a pilot. At 1700, the ship's anchor was let go in outer anchorage position N1.

On 2 May, a complete underwater examination was carried out to the satisfaction of the attending LR surveyor. No structural damage was found but the hull coating was scored and abraded with exposed metal in some areas. The ship's condition was considered suitable to allow it to continue normal operations.

On the morning of 3 May, AMSA was advised of the outcomes of the underwater examination and, as a result, the detention order was lifted. Later that day, *Dumun* departed Gladstone bound for Singapore.

2 ANALYSIS

2.1 Evidence

On 30 April 2011, two investigators from the Australian Transport Safety Bureau (ATSB) arrived in Gladstone, Queensland. The investigators interviewed the pilot who was on board *Dumun* at the time of the grounding and he provided his account of the incident.

On 1 May, the investigators attended *Dumun* while the ship was at anchor off Gladstone. The master and directly involved crew members were interviewed and they provided their accounts of the incident.

Photographs of the ship and copies of relevant documents were obtained, including log books, navigational charts, statutory certificates, reports, manuals and procedures. The investigators also took possession of the hard drive from the ship's voyage data recorder (VDR).

Through the course of the investigation, further information was provided by Maritime Safety Queensland (MSQ) and Mitsubishi Heavy Industries.

2.2 Steering system malfunction

At 1702 on 29 April 2011, when the pilot ordered the helmsman to steer 114°, a course alteration of 1° to port, *Dumun*'s bridge mounted rudder angle indicator did not respond to the change in helm command. As a result, the bridge team assumed that they had lost steering control. However, they had not, and the steering gear machinery continued to operate normally throughout the incident.

2.2.1 Rudder angle indicator

When the engineers arrived at the steering compartment, they saw that the rudder angle indicator transmitter link-arm was not connected to the tiller. The threaded link-arm/rod-end connection (Figure 10) had come loose and the link-arm had fallen out of the rod-end. With this inter-connection lost, the transmitter was not getting an input signal. As a result, the bridge mounted rudder angle indicator was not showing the actual position of the rudder.

All bolted connections, like the link-arm/rod-end connection, work by placing the threaded shaft under tension. The tension creates friction between the male/female threads and the mating surfaces (in this case the lock nut and the rod-end/lock tab). If there is insufficient friction generated, the connection can come loose. Loosening can also be aided by movement between the mating surfaces, wear in the threads and vibration.

Inspections carried out on board *Dumun* after the grounding determined that, when originally fitted, the link-arm was too short for its intended purpose. When it was properly adjusted, so that the rudder angle indicator on the bridge showed midships when the rudder was at midships, there was only about 4 mm of thread in each of the two link-arm rod-ends (Figure 10)). When allowance was made for the taper at the end of the link-arm thread and the taper at the rod-end opening, there was probably only about one or two circumferences of thread holding the link-arm in place in each rod-end. With only this small amount of thread in place, an appropriate amount of tension could not have been applied to the threaded shaft with the lock nut. As a result, insufficient friction would have been generated to ensure that the connection would not come loose.

Figure 10: The link arm/end piece joint as it was fitted on board *Dumun*

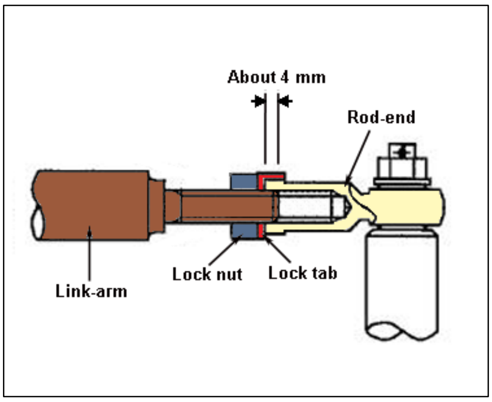
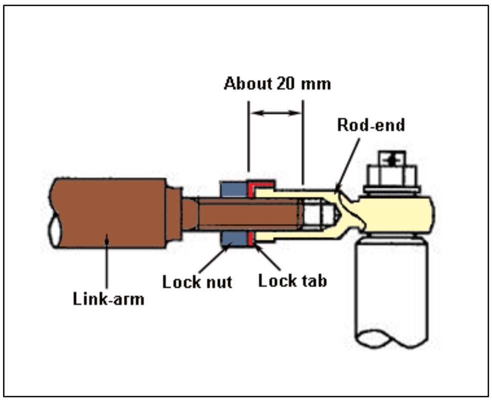


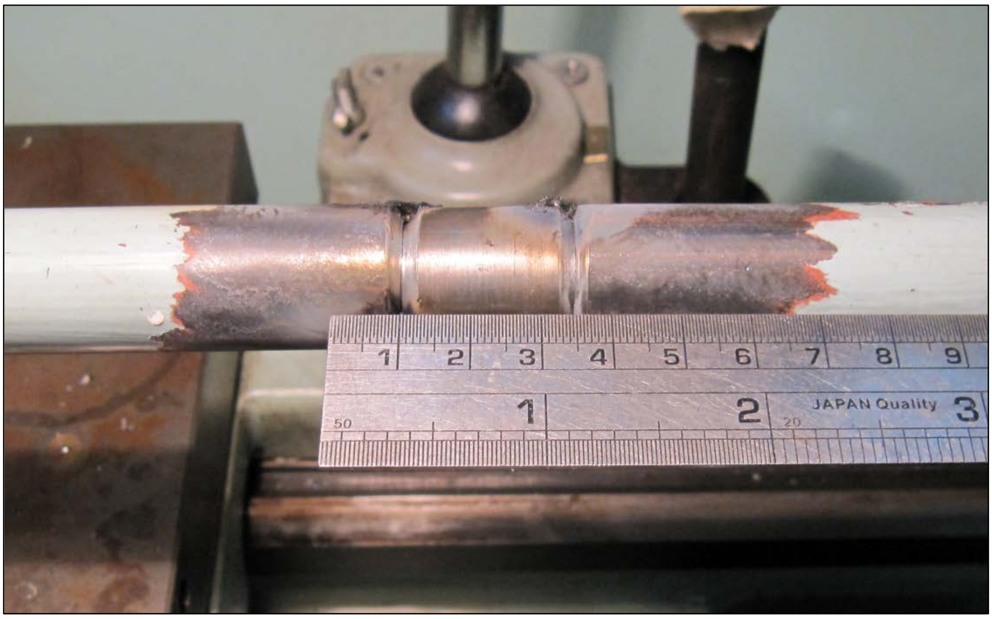
Figure 11: The link arm/end piece joint as it should have been fitted



The connection should have been prevented from coming loose by the fitted lock tabs. However, an inspection of the lock tabs after the incident indicated that they were probably not fastened tightly and, hence, allowed enough play for the lock nuts to slacken off and for the link-arm to 'drop out' of the tiller mounted rod-end.

When correctly fitted, there should have been about 20 mm of thread in each of the two rod-ends (Figure 11). With this amount of thread in place, an appropriate amount of tension could have been applied to the threaded shaft and, as a result, sufficient friction would have been generated to ensure that the connection would not loosen. Furthermore, correctly fitted locking tabs would have provided a further protection against loosening.

Figure 12: Section being added to the centre of the link-arm



Following the grounding, the ship's engineers modified the link arm by increasing its length by 24 mm (Figure 12). Hence, when re-fitted, there was about 16 mm of thread in each rod-end. The engineers also made sure that the locking tabs were correctly fitted.

2.2.2 Maintenance and testing

The crew had been on board *Dumun* since its delivery from the shipyard, a period of about 5 months. They had completed the SOLAS mandated emergency steering drills and tested the operation of the steering gear before every port arrival and departure. They had also carried out routine daily and weekly inspections.

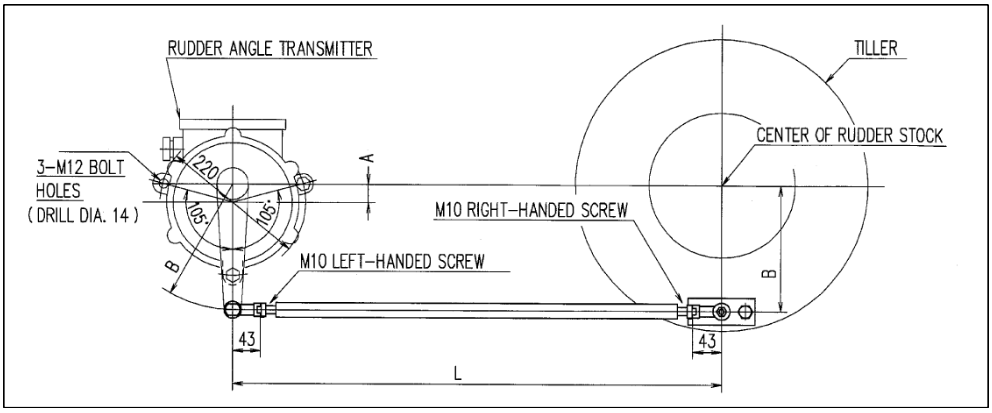
During this time, they had made no adjustments to the steering gear and had carried out no major maintenance on it. Therefore, the link-arm had not been adjusted or altered since the ship's delivery from the shipyard.

2.2.3 Installation and commissioning

The steering gear, all of its components, test certificates, instruction manuals and associated drawings were provided by the manufacturer to the shipyard. All the installation, setup and commissioning works were then carried out by the shipyard.

The manufacturer's installation instructions and drawings provided clear guidance regarding the positioning and installation of the rudder angle indicator transmitter and its associated components. The drawings showed where the mounting post for the transmitter should be located relative to the centre of the rudder stock. They also showed where the mounting bolt holes should be drilled in the mounting post top plate (Figure 13).

Figure 13: Section of the installation drawing for the rudder angle indicator transmitter



The drawings showed that, when fitted correctly, the distance between the pivot point of the transmitter and the centre of the rudder stock should be the same as the adjusted length of the link-arm and rod-ends. The drawing also indicated that this dimension (L in Figure 13) should be 1180 mm.

Inspections carried out on board *Dumun* after the grounding, showed that the distance between the pivot point of the transmitter and the centre of the rudder stock was not the same as the adjusted length of the link-arm and rod-ends. The adjusted length of the link-arm and rod-ends was about 25 mm longer (Figure 14).

Figure 14: Ship's engineers checking the transmitter/rudder stock dimension

The inspections determined that the mounting post was in the correct position, but the transmitter had been mounted slightly out of alignment on the mounting post. As a result, the link arm had to be adjusted to its extreme length so that the rudder angle indicator would display the correct rudder position.

The manufacturer's drawings supplied to the ship clearly showed the correct installation arrangement and the critical dimensions. However, the shipyard did not have a commissioning process in place to ensure that the installation and each of the critical dimensions was checked. As a result, *Dumun* left the shipyard with a defect that would inevitably lead to a steering system malfunction.

2.3 The grounding

For the first half hour, *Dumun*'s departure from Gladstone on 29 April 2011 went as planned. The ship was lifted off the berth and the tugs were then let go. The ship's speed was built up, the helmsman was steering 115° and the ship was maintaining a course made good of 113° (T) down the centre of the Auckland Channel. The aft mooring team was stood down and the main engine speed was set at full ahead.

However, at 1702, when the pilot ordered the helmsman to steer 114°, a course alteration of 1° to port, the plan started to unravel when the bridge mounted rudder angle indicator did not respond to helm commands.

The helmsman immediately alerted the chief mate, who tried changing over steering systems and control modes. However, the rudder angle indicator still did not move. The master was alerted and while the pilot was not told directly, he soon became aware that there was a problem.

2.3.1 Actions taken on the bridge

From the moment that the helmsman determined that the rudder angle indicator did not appear to be responding to helm commands, the bridge team assumed that they had lost steering control. This assumption was reasonable given the fact that they did not have time to see if the ship's head was actually responding to the changes in helm.

After the pilot ordered the main engine stopped, the ship started swinging to port. Then, after he ordered full astern, the rate of turn to port increased markedly as the tide started to push on the ship's starboard bow. The ship turning to port while the rudder angle indicator showed starboard 5° probably helped convince the bridge team members that they had lost steering control.

The bridge team acted appropriately in dealing with what they assumed was a steering gear failure and, given the ship's position in the channel, its speed and the flooding tide, it is unlikely that they could have done more than they did in the time available to them. However, they were limited in the actions they could take because the attending tugs had been let go.

Had the tugs still been tethered to *Dumun*, the pilot could have used them to assist in preventing the ship from grounding. While it cannot be concluded that the tugs alone would not have prevented the ship from grounding, they would have at least lessened its severity.

2.3.2 Actions taken in the steering compartment

When the engineers arrived at the steering gear compartment, they immediately identified the steering gear fault and quickly rectified it. However, it was too late, the ship had already grounded.

Once the chief engineer identified the steering gear fault, he focused solely on repairing it. This was an understandable reaction and one that would probably have been duplicated by other engineers put in the same situation. However, had he delegated that task and telephoned the bridge to report that the steering was operating normally and that it was only the rudder angle indicator that was not working, the bridge team may have had sufficient time to take action to avoid the grounding.

2.4 Port planning and risk management

Emergency situations during pilotage require a swift response to often unique circumstances. However, with careful forethought, consideration and planning, many emergency situations can be predicted and planned for.

When carrying out such contingency planning, those responsible need to consider the risks associated with the foreseeable emergencies, i.e. the likelihood of an incident occurring, and the consequences as a result of it occurring.

In the past 10 years, the ATSB has been advised of eight groundings in the port of Gladstone. Three of these groundings have been investigated by the ATSB, including the 2002 grounding of *La Pampa*[6], which occurred following the failure of the ship's steering gear. During this period of time, the ATSB has also investigated similar incidents involving deep draught bulk carriers in the Western Australia ports of Dampier[7] and Port Hedland[8].

While the most serious of these groundings has only led to the short term closure of the port, a grounding resulting in significant environmental damage due to oil pollution and/or long term closure of the port, resulting in substantial financial losses, is a credible scenario. Therefore, it is reasonable to expect that contingency planning, including consideration of risks like the failure of a ship's steering gear, has been carried out.

At the time of *Dumun*'s grounding, the risk controls in place to prevent a ship grounding in Gladstone included the compulsory use of pilots, a system of aids to navigation, VTS monitoring of shipping movements and inner harbour anchorages. These measures have generally been sufficient to ensure that fully functioning ships safely transit the waters within the port's limits. However, the events surrounding the groundings of *La Pampa* and *Dumun* show that these measures were not enough to prevent a ship from grounding following the failure of its steering gear.

In reference to contingency planning, the ATSB report into the grounding of *La Pampa* stated that:

> One other contingency plan would involve tugs acting as an escort, either as a matter of routine, or, as in this case, where a ship experiences some problem which is not properly resolved. It must be recognised, however, that an escort tug (or tugs) is no guarantee of preventing groundings. Much depends on whether the tug is tethered, the width and alignment of the channel, and environmental factors. In addition, Hensen (1997)[9] comments that the full advantage of escort tugs can only be achieved by proper training of the tug crew and pilot, training which includes, procedures, communications, escort speeds, limitations of tugs, direct and indirect towing and equipment.

Section 9 of the Gladstone port procedures[10] (Tug Procedures) provided guidance to pilots and ship operators relating to the use of tugs in the port. For a ship the size of *Dumun* departing Clinton wharves, the port procedures stated that two tugs should be used when departing. However, the procedures did not detail how long the tugs should be retained to assist with the ship's departure from the port or whether they should escort the ship for all, or part, of the transit. As a result, on 29 April 2011,

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6 ATSB Safety Investigation Report No. 176, *Independent investigation into the grounding of the Panama registered bulk carrier La Pampa at Gladstone, Queensland, on 27 March 2002,* which can be downloaded at www.atsb.gov.au

7 ATSB Safety Investigation Report No. 184, *Independent investigation into the grounding of the Korean flag bulk carrier Hanjin Dampier at Dampier, Western Australia, on 25 August 2002,* which can be downloaded at www.atsb.gov.au

8 ATSB Safety Investigation Report No. 256, *Independent investigation into the grounding of the Isle of Man registered bulk carrier Iron King at Port Hedland, Western Australia, on 31 July 2008,* which can be downloaded at www.atsb.gov.au

9 *Tug Use in Port - A Practical Guide,* Capt H. Hensen, FNI.

10 *Port Procedures and Information for Shipping,* Port of Gladstone, November 2010, Queensland Government Department of Transport and Main Roads.

the tugs were used as they have always been, to assist the ship in un-berthing and were let go once the ship had left the berth.

In contrast, Section 16 of the port procedures (LNG[11] Vessel Operating Parameters) provided detailed guidance relating to the use of tugs in future LNG operations in the port. The subsection titled 'Berthing/Unberthing Operations – Tug usage' stated:

> Four (4) tugs will be utilised for all berthing/unberthing operations. Two (2) tugs will act as escorts from the Fairway and two will join the inbound vessel in the vicinity of G4 and be made fast subject to the discretion of the Pilot in charge in conjunction with the Master. Two tugs will be released on departure in the vicinity of G4. The remaining two tugs will escort the vessel to the Fairway.

Furthermore, another subsection titled 'Tug escorts' stated:

> LNG vessels will transit all channels and cuttings with tug escorts (2 x 80 t bollard pull fully fitted for escort) at speeds up to about 10 knots with tugs made fast. Although the decision as to where to make the tugs fast will be made after consultation between the Pilots and the Master, it is recommended that both escort tugs should be attached on the stern (tandem deployment) for inbound and outbound transits of the port.

The Gladstone port procedures have identified the use of escort tugs as an action to assist in the mitigation of the risks associated with an LNG carrier grounding in the port. However, the port procedures do not apply the same risk control to trading ship[12] operations in the port.

In submission, MSQ stated that:

> Based upon level of risk assessed, combined with the need to provide optimum commercial towage services in the port of Gladstone, escort towage is not recognised as providing an effective risk mitigation measure for bulk carriers. LNG tankers are specifically built to have far more capacity/weight for escort towage (bollards, chocks, fairleads) than bulk carriers. The LNG proponents have insisted upon the use of escort towage for LNG tankers as a safeguard against grounding based upon their own industry standards.

While the image of an LNG carrier grounding in a port is an emotive one, the likely negative outcomes associated with such an event are the same as those that are likely to occur as a result of a bulk carrier grounding. That is, serious environmental damage due to pollution and/or medium to long term closure of the port, resulting in substantial financial losses. However, the likelihood that any such future event will involve a bulk carrier is higher, given the projected greater number of bulk carrier movements within the port.

The grounding of a trading ship in Gladstone rates as one of the highest operational risks posed to MSQ's areas of responsibility[13]. The organisation has carried out a number of risk management workshops and developed treatment plans to deal with the issues of concern. The workshops have identified steering gear and main engine

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11 Liquefied Natural Gas.

12 An MSQ term that is used to describe the types of ships that currently operate in and out of Gladstone.

13 MSQ document *Assessed hazards – 2008/09 Risk Management Cycle*

failure as likely causal factors to the grounding of a trading ship. However, the only action that has been identified to mitigate this risk is the improvement of the flow of information regarding ship history and maintenance issues to the regional harbour master and the pilots.

As a result, pilots routinely check that a ship's navigation systems, propulsion and machinery are operating correctly as part of their pre-sailing checks. However, other active solutions, like the use of escort tugs, that could be in place to assist the pilot in the case of an unanticipated main engine or steering failure have not been thoroughly evaluated.

While the responsible authorities in Gladstone had applied a risk based approach to contingency planning for both current and future shipping operations in the port, the analysis of current shipping operations had not appropriately considered all that could be done to prevent the grounding of a trading ship as a result of steering gear or main engine failure.

2.4.1 Pilotage risk management

The mandated rules contained in the Gladstone port procedures set Maritime Safety Queensland's (MSQ) minimum requirements for operating ships within port limits. However, it was ultimately the pilotage division of MSQ which was responsible for ensuring that all the risks associated with pilotage in the port were appropriately managed.

The Gladstone pilots, including the pilot on board *Dumun* on 29 April 2011, were trained using a package that aimed to standardise their practices. They were also routinely checked by a peer to ensure they continued to follow those practices. However, these were learnt practices that had been passed on from pilot to pilot over time and they were not supported by a set of documented procedures that had been developed through a formalised and documented process of risk analysis.

In many industries, including the shipping industry, contemporary systems used to manage risk are commonly referred to as safety management systems (SMS), a system that can be described as:

> A management system used to manage all aspects of safety throughout an organisation. It provides a systematic way to identify hazards and control risks while maintaining assurance that these risk controls are effective. [14]

An SMS includes the documented policies, procedures and guidelines that an organisation uses to manage operational risks. It includes systems for reporting incidents, near-misses and non-conformities; along with an audit/review process that is used to identify existing or potential risks and to continuously improve the system.

The development of a safety management system involves an organisational approach to identifying operational risk. Once the areas of operational risk have been identified, they can be evaluated and risk mitigation strategies can be developed and implemented.

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[14] Federal Aviation Administration, *System Approach for Safety Oversight (SASO) Outreach, Spring 2009 Edition*, FAA, USA.

With reference to pilotage management systems, the International Standard for Maritime Pilot Organizations (ISPO) code, which was developed in consultation with Dutch pilots, Lloyd's Register (LR) and the European Maritime Pilot's Association (EMPA)[15], provides guidelines for the implementation of a pilotage safety and quality management system. This system combines elements of an SMS with those of a quality management system to achieve the following objectives:

- to ensure safe practice;
- to establish safeguards against all risks identified;
- to continuously improve safety management practices within the maritime pilot organization;
- to provide an organizational structure, procedures, processes and resources needed to administer the activities of the maritime pilot organization;
- to continuously improve quality management practices, by keeping records to verify that the procedures are being followed;
- to continuously improve the quality of the service; and
- to determine and implement effective arrangements for communication with customers.

In Australia, the National Maritime Safety Committee (NMSC) has prepared a set of pilotage guidelines[16] which include the following statement:

> The primary objective of a pilot organisation is to manage the risk to life, vessels, and the environment within the port or pilotage area, during pilotage. A pilot organisation's SMS should address all significant risks identified using a recognised methodology...[17]

The available international and local guidance suggests that pilot organisations should have an SMS, or management system, that includes best practice piloting procedures aimed at minimising identified risk. As a result, many of Australia's pilotage organisations have already adopted a systemised management approach to minimising risk.

While MSQ's pilotage division had developed procedures that could form the core of an SMS, a comprehensive and cohesive pilotage SMS had not been developed and implemented for the port of Gladstone.

As previously discussed, there have been previous similar incidents in the port of Gladstone where a ship grounded following the failure of a critical item of its machinery. Therefore, had the SMS processes of risk identification, evaluation and mitigation been applied to pilotage in Gladstone, it is likely that the organisation would have identified the risks associated with the grounding of a deep draught bulk carrier following the failure of its steering gear. This, in turn, may have resulted in the implementation of risk mitigation strategies, like the use of escort tugs or the development of procedures that could be practiced by pilots during simulation exercises and, hence, could be effectively implemented at a time of emergency.

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15 International Standard for Maritime Pilot Organizations (ISPO), *Part A (Standards-V 08, 2009) and Part B (Guidelines to standards, V 05, 2010)*, Netherlands. <http://www.ispo-code.com/>

16 Australian Transport Council, *National Marine Guidance Manual- Guidelines for Marine Pilotage Standards in Australia, Edition 2*, National Marine Safety Committee, November, 2008.

17 ibid. Chapter 2, Section 6.1.

2.5 Bridge communications

With reference to bridge communications, Chapter V, regulation 14.4 of SOLAS[18] states that:

> On ships to which chapter I applies, English shall be used on the bridge as the working language for bridge-to-bridge and bridge-to-shore safety communications as well as for communications on board between the pilot and bridge watchkeeping personnel, unless those directly involved in the communications speak a common language other than English.

The SOLAS requirements above are clearly supported by the Bridge Procedures Guide[19], which states that:

> Communications within the bridge team needs to be understood. Communications between multilingual team members, and in particular with ratings, should either be in a language that is common to all relevant bridge team members or in English.[20]
>
> When a pilot is on board, the same rules should apply...[21]

While the SOLAS requirements place the burden of mastering a second language on seafarers whose native language is not English, the adherence with these requirements is essential if bridge communications between persons of differing nationalities are to be optimised.

The pilot on board *Dumun* on 29 April 2011 did not speak any dialect of the Chinese language. Therefore, all communications on the bridge during the pilotage should have been in English. However, they were not. The master, chief mate, third mate and helmsman all spoke between themselves in Mandarin. Furthermore, when they spoke on the telephone to the engine room, or on a hand held radio to other crew members, they spoke exclusively in Mandarin.

The use of the Mandarin language on *Dumun*'s bridge did not directly contribute to the ship's grounding. However, it did exclude the pilot from information which, at times, may have affected his decision making.

For example, when the helmsman noticed that the rudder angle indicator was not moving, he notified the chief mate, in Mandarin. The chief mate then advised the master, again in Mandarin. It was not until the pilot asked 'what's happening?', in response to the activity around the steering stand, that the master told him, in English, that the steering was not working.

All operational discussions on *Dumun*'s bridge, and between the master and other crew members, should have been in English, in accordance with the relevant sections of SOLAS, so that at all times, the pilot had an appreciation of what was happening around him.

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18 The International Convention for the Safety of Life at Sea, 1974, as amended.

19 International Chamber of Shipping, *Bridge Procedures Guide 4th edition 2007*

20 ibid, Section 1.2.11 - Use of English.

21 ibid, Section 1.2.12 - The bridge team and the pilot.

3 FINDINGS

3.1 Context

At 1706 on 29 April 2011, the bulk carrier *Dumun* grounded while departing the port of Gladstone, Queensland. Just before the grounding, the ship's steering appeared to stop responding to bridge control. The pilot ordered the engine stopped and started astern, but these actions did not prevent the ship from grounding.

From the evidence available, the following findings are made with respect to the grounding. They should not be read as apportioning blame or liability to any particular organisation or individual.

3.2 Contributing safety factors

- The bridge mounted rudder angle indicator stopped working when the link-arm connecting the tiller to the rudder angle transmitter came free from the tiller. As a result, the bridge team had no way of knowing the position of the rudder or if the steering gear was operational.
- The ship's rudder angle indicator transmitter and tiller link-arm were not fitted correctly at the time of their installation at the shipyard.
- The shipyard commissioning processes did not identify that the ship's rudder angle indicator transmitter and tiller link-arm were not installed correctly. *[Minor Safety Issue]*
- The tugs returned to their base after being let go when the ship cleared its berth at Clinton wharves. As a result, they were not in a position to provide any assistance in preventing *Dumun* from grounding.
- The analysis of trading ship operations in Gladstone that had been carried out by the relevant authorities had not appropriately considered all that could be done to prevent the grounding of a ship as a result of steering gear or main engine failure. *[Significant Safety Issue]*

3.3 Other safety factors

- There had not been a comprehensive safety management system implemented in the port of Gladstone with the aim of identifying, evaluating and controlling pilotage related risk. *[Significant Safety issue]*
- On several occasions, conversations between crew members on the bridge were conducted in Mandarin. As a result, the pilot, who did not speak Mandarin, did not know what was being discussed.

3.4 Other key findings

- Given the ship's position in the channel and the lack of time in which to take action, it is unlikely that the bridge team could have done more than they did to prevent the ship from grounding.

4 SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisations. In addressing those issues, the ATSB prefers to encourage relevant organisations to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given 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.

4.1 Tsuneishi Group (Zhoushan) Shipbuilding

4.1.1 Commissioning processes

Minor safety issue

The shipyard commissioning processes did not identify that the ship's rudder angle indicator transmitter and tiller link-arm were not installed correctly.

Action taken by Tsuneishi Group (Zhoushan) Shipbuilding

Tsuneishi Group (Zhoushan) Shipbuilding has advised that it has sent a bulletin to the owners of all ships built in the shipyard requesting that all steering link-arm connections are appropriately tightened and that their locking tabs are correctly fitted. The shipyard's procedures have also been modified to ensure that, in future, these checks are carried out during the building of all ships.

ATSB assessment of action

The ATSB is satisfied that the action taken by Tsuneishi Group (Zhoushan) Shipbuilding adequately addresses the safety issue.

4.2 Maritime Safety Queensland

4.2.1 Contingency planning

Significant safety issue

The analysis of trading ship operations in Gladstone that had been carried out by the relevant authorities had not appropriately considered all that could be done to prevent the grounding of a ship as a result of steering gear or main engine failure.

Action taken by Maritime Safety Queensland

Maritime Safety Queensland has advised that its pilots have worked with the Gladstone Port Corporation and terminal operators to improve ships' readiness for departure by implementing rigorous pre-departure checks and gaining improved intelligence on ships.

ATSB safety recommendation – MO-2011-004-SR-002

The Australian Transport Safety Bureau recommends that Maritime Safety Queensland takes further action to address the issue of contingency planning for foreseeable events like the grounding of a deep draught ship as a result of steering gear or main engine failure.

4.2.2 Pilotage safety management

Significant safety issue

There had not been a comprehensive safety management system implemented in the port of Gladstone with the aim of identifying, evaluating and controlling pilotage related risk.

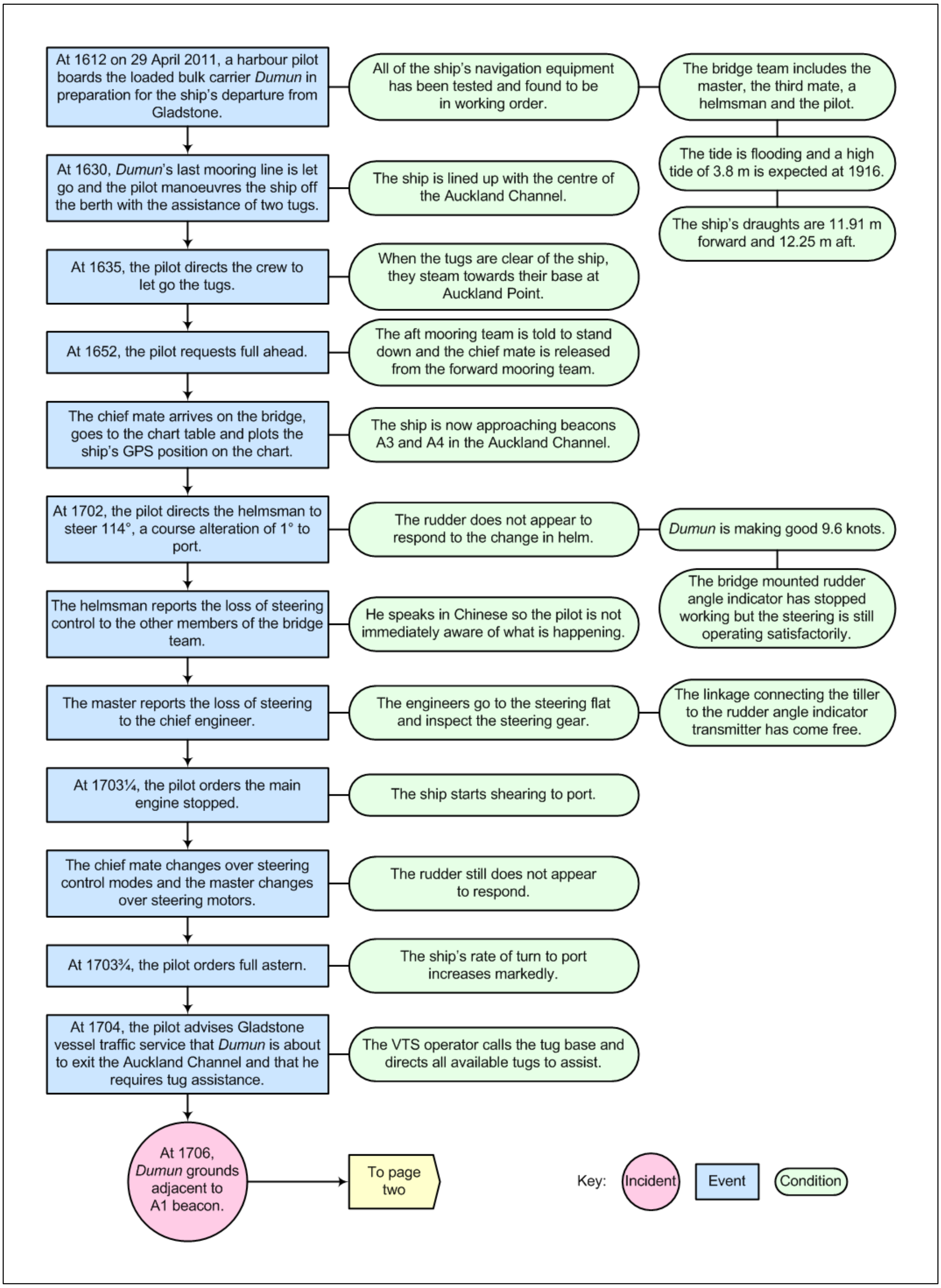
Action taken by Maritime Safety Queensland

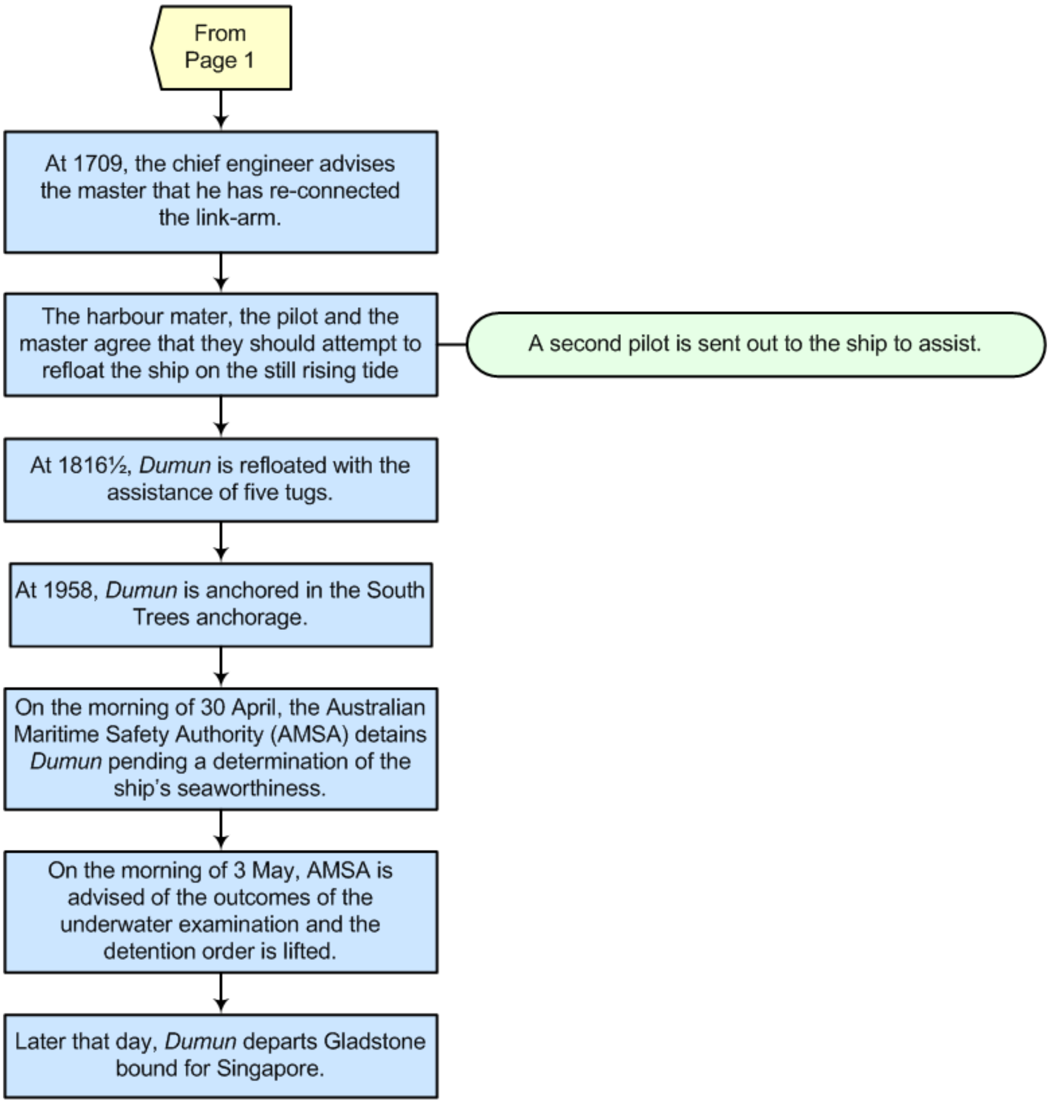
Maritime Safety Queensland has advised that it has pilotage safety management systems in place in Cairns and Townsville and has appointed a consultant to assist with the development and implementation of a single safety management system covering all of its pilotage operations.

ATSB assessment of action

The ATSB is satisfied that the action taken by MSQ will adequately address the safety issue.

APPENDIX A : EVENTS AND CONDITIONS CHART




From Page 1
At 1709, the chief engineer advises the master that he has re-connected the link-arm.
The harbour mater, the pilot and the master agree that they should attempt to refloat the ship on the still rising tide
A second pilot is sent out to the ship to assist.
At 1816½, *Dumun* is refloated with the assistance of five tugs.
At 1958, *Dumun* is anchored in the South Trees anchorage.
On the morning of 30 April, the Australian Maritime Safety Authority (AMSA) detains *Dumun* pending a determination of the ship's seaworthiness.
On the morning of 3 May, AMSA is advised of the outcomes of the underwater examination and the detention order is lifted.
Later that day, *Dumun* departs Gladstone bound for Singapore.

APPENDIX B : SHIP INFORMATION

Dumun

IMO number	9520819
Call sign	HOSJ
Flag	Panama
Port of Registry	Panama City
Classification society	Lloyds Register (LR)
Ship Type	Bulk carrier
Builder	Tsuneishi Group (Zhoushan) Shipbuilding
Year built	2010
Owners	Dumun Marine
Ship managers	Well Ship Management and Maritime Consultants
Gross tonnage	32,315
Net tonnage	19,458
Deadweight (summer)	58,107 t
Summer draught	12.826 m
Length overall	189.99 m
Moulded breadth	32.26 m
Moulded depth	18.00 m
Engine	Mitsui MAN B&W 6S50MC-C
Total power	8,400 kW
Service speed	14.5 knots
Crew	21

APPENDIX C : SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included:

Dumun's master and crew

The Port of Gladstone pilot

Maritime Safety Queensland (MSQ)

Mitsubishi Heavy Industries

References

Australian Transport Safety Bureau, June 2004, *Marine Safety Investigation No. 176 - Independent Investigation into the grounding of the Panama registered bulk carrier La Pampa*

Federal Aviation Administration, USA, spring 2009, *System Approach for Safety Oversight (SASO)*

Gladstone Port Corporation website: http://www.gpcl.com.au/

International Chamber of Shipping, *Bridge Procedures Guide 4th edition 2007*

International Maritime Organization (IMO), 2009, *Safety of Life at Sea Convention (SOLAS)*

International Standard for maritime Pilot Organizations (ISPO), *Part A (Standards-V 08, 2009) and Part B (Guidelines to standards, V 05, 2010)*

National Marine Safety Committee, November 2008, *National Marine Guidance Manual- Guidelines for Marine Pilotage Standards in Australia*

Queensland Government Department of Transport and Main Roads, November 2010, *Port of Gladstone Port Procedures and Information for Shipping*

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 *Dumun*'s master, chief engineer and chief officer, Well Ship Management and Maritime Consultancy, Mitsubishi Heavy Industries, Tsuneishi Group (Zhoushan) Shipbuilding, the regional harbour master, the Gladstone pilot manager, the pilot, Maritime Safety Queensland and the Australian Maritime Safety Authority.

Submissions were received from Mitsubishi Heavy Industries, Tsuneishi Group (Zhoushan) Shipbuilding, Well Ship Management and Maritime Consultancy, the Gladstone pilot manager, Maritime Safety Queensland and the Australian Maritime Safety Authority. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Marine Occurrence Investigation
Grounding of the Panama registered bulk carrier *Dumun*
Gladstone, Queensland, 29 April 2011
285-MO-2011-004
Final