Australian Government
Australian Transport Safety Bureau

Grounding of *Bow Singapore*

Port Phillip, Victoria | 19 August 2016

Investigation

ATSB Transport Safety Report
Marine Occurrence Investigation
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Addendum

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Safety summary

What happened

On 19 August 2016 at 1458, a Port Phillip Sea Pilot boarded *Bow Singapore* outside Port Phillip, Victoria. The pilot was to conduct the ship through The Rip and the South Channel to an anchorage in the northern part of Port Phillip.

At 1614, as the ship neared the eastern end of the South Channel, the rudder ceased responding to helm inputs and remained at 5° to port. The ship started swinging towards the edge of the channel. Steering was regained a short time later but, despite the efforts of the pilot, the ship grounded at 1617.

On 20 August at 0040, *Bow Singapore* was re-floated, with the assistance of the rising tide and a tug. The ship proceeded to anchor and, later, to the discharge berth in Geelong. After discharging cargo the hull was inspected by divers and no damage was found.

What the ATSB found

The ATSB found *Bow Singapore*'s steering gear ceased working and the rudder remained at 5° to port. A telemotor solenoid, controlling the rudder's movement to starboard, had stopped responding to electrical signals. This initiated an uncontrolled turn towards the edge of the channel and shallow water.

The company's procedures for a steering gear failure required a change in operation from the bridge to local emergency operation from the steering gear room. However, the procedures did not include the steps to be taken on the bridge prior to that change, such as using non follow-up mode and changing to alternate telemotor and/or pump systems.

The planned maintenance system for the steering gear did not include or contain any schedules for any detailed inspections or scheduled parts replacement. In addition, the hydraulic system port and starboard solenoids were painted green and red respectively, to match the side of the ship that each is on when mounted on the shuttle valve. However, this was opposite to the direction the rudder would move when they were operated.

What's been done as a result

Odfjell Management, the ship's managers, arranged for a manufacturer's representative of the steering gear to attend the ship when it arrived in Singapore. The solenoids and shuttle valves for both steering systems were replaced, the relief valves were opened and examined and the oil was changed. No faults that could cause the failure were found.

The ship managers have now included a 6-monthly job entry into their planned maintenance system for the opening and inspection of the steering gear's solenoids. In addition, the telemotor solenoids have been repainted so that the colours now match the direction of rudder movement, rather than the side of the ship on which they are mounted.

Further, the fleet wide safety management system procedure for 'steering gear failure' has been amended to include reference to ship specific emergency change over procedures.

Safety message

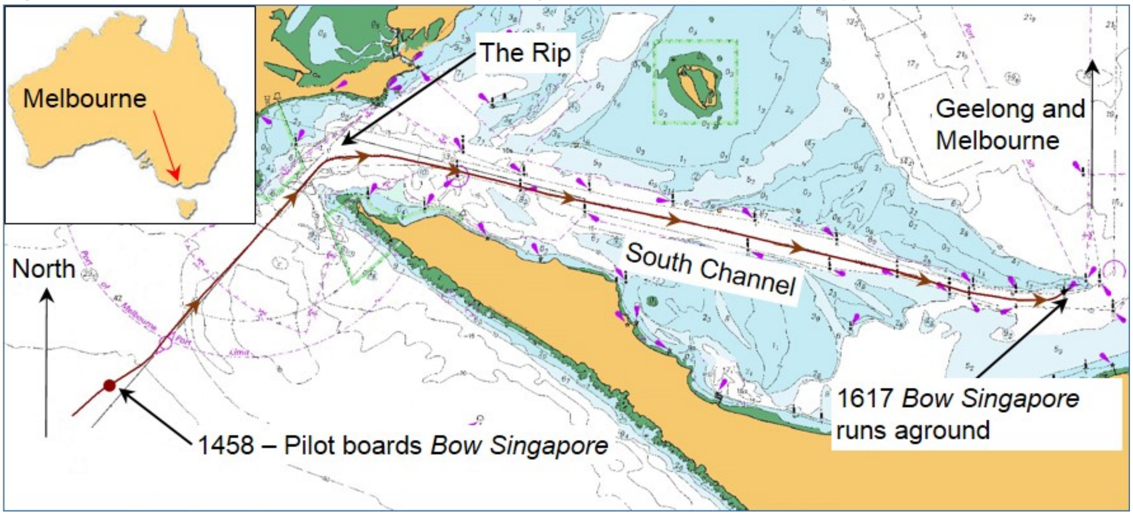
For equipment, particularly that which is critical to the safe operation of a ship, it is important that there is a well-formulated maintenance plan that includes inspection, testing and planned maintenance.

The occurrence

On 19 August 2016 at 1450,[1] the 105 m chemical and products tanker *Bow Singapore*, approached the Port Phillip pilot boarding ground. The ship was bound for the port of Geelong, Victoria. The bridge team consisted of the master, second mate as the officer of the watch (OOW) and a seaman as the helmsman.

At 1458, a Port Phillip Sea Pilot boarded the ship for the inbound transit (Figure 1), through The Rip and South Channel to an anchorage off the Port of Geelong. The master and pilot exchanged information regarding the ship and the inward passage and the pilot then took the conduct.[2]

Figure 1: Section of chart AUS 158 showing the track of *Bow Singapore*



Source: Australian Hydrographic Service with annotation by the ATSB

At 1505:13, the pilot instructed the helmsman to steer a heading[3] of 042°. Shortly after, the ship entered The Rip and was turned into the South Channel on an east by south course. The transit through the channel continued as intended by the pilot.

At 1600, the ship was approaching the eastern end of the South Channel at a speed of 13.5 knots.[4] At that time the third mate took over the navigational watch from the second mate as OOW and another seaman took over as helmsman.

At 1611:43, the pilot ordered a heading of 093° (Figure 2, point 1), an alteration of about 7° to port. The order was repeated back by the helmsman, and at 1612:32 he advised the pilot that the ship's heading was 093° (Figure 2, point 2). The helmsman then used the rudder, as needed, to maintain that heading.

At 1613:38, the helmsman applied 5° of port rudder and then went back to midships. A few seconds later, he checked the rudder indicator and saw that the rudder had remained at 5° to port (Figure 2, point 3). He gave a series of starboard rudder movements in quick succession, however the rudder remained at 5° to port and he then informed the ship's bridge team of the problem.

At about 1614, the OOW took the helm from the helmsman. He changed to the non follow-up (NFU) mode[5] and made a series of starboard rudder movements. Again, the rudder did not respond and remained at 5° to port.

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

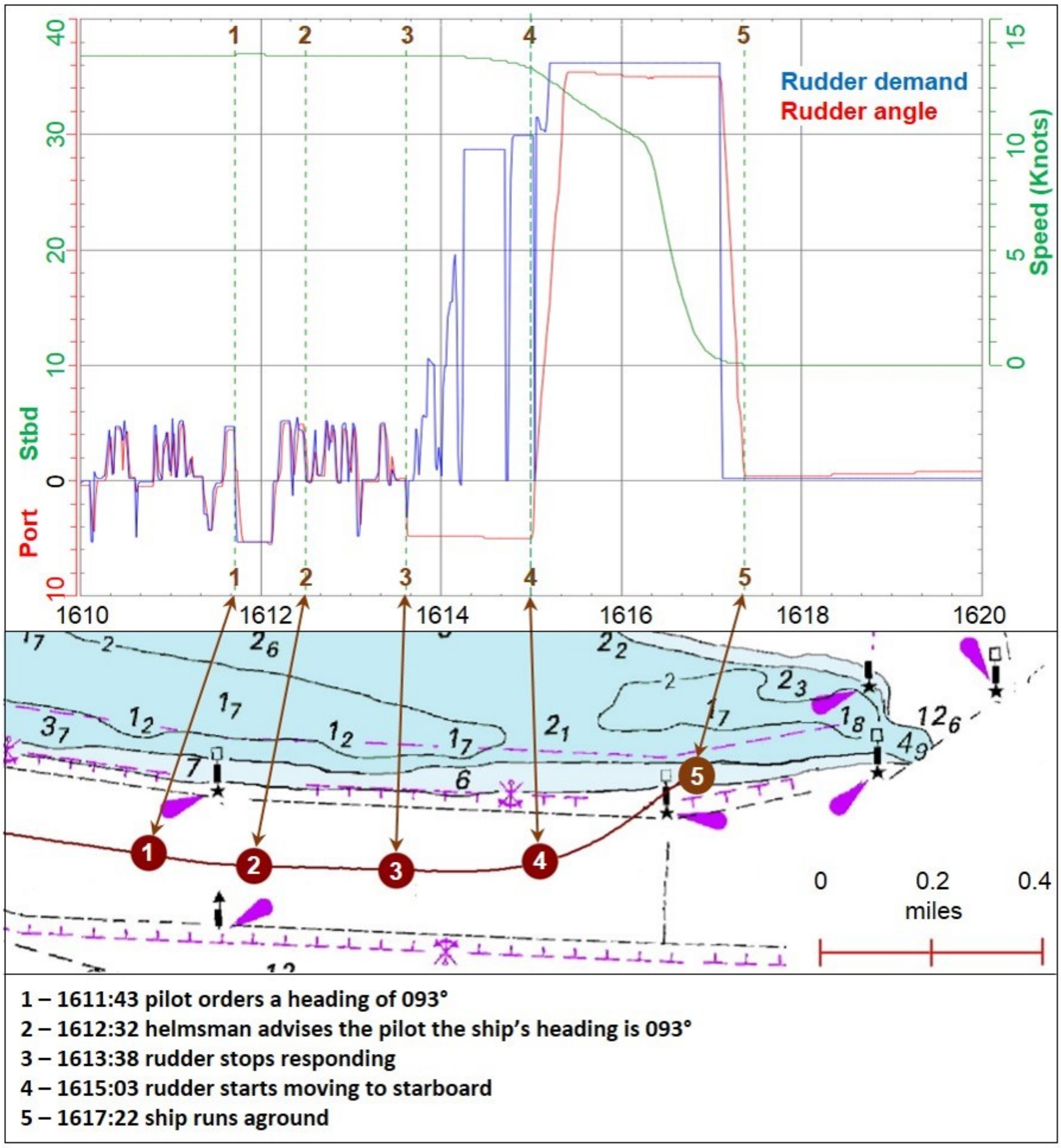
2 Conduct of the ship's passage determines the outcome by controlling (con) how the outcome is achieved.

3 All ship's headings in this report are in degrees by gyro compass with negligible error.

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

5 In non follow-up (NFU) mode, the movement of rudder to port or starboard is controlled through the use of a lever. The lever is released when the rudder has reached the required angle.

Figure 2: *Bow Singapore*'s rudder movements, speed and position prior to grounding



Source: ATSB

By 1614:10, the pilot became aware that there was a problem with the steering gear and ordered 'hard to starboard'. He then asked the master about changing the steering system to NFU mode. In response to the pilot's order, the OOW put the NFU lever to starboard again. A few seconds later, the pilot then asked the master to change over the steering pumps.

At 1614:35, the pilot ordered 'stop engine', which was acknowledged by the ship's bridge team and 7 seconds later the engine telegraph was moved to stop.

At 1614:52, the pilot asked for 'full astern'.

By 1615:03, the master had changed the main steering pumps from number one to number two as requested by the pilot and the OOW had changed the steering (telemotor) system[6] from number one to number two. The rudder then started to respond to the NFU starboard demand. A few seconds later the pilot observed that the rudder was moving to starboard (Figure 2, point 4).

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[6] The telemotor comprises a transmitter on the bridge and a receiver connected to a variable delivery pump through the hunting gear.

By 1615:14, the pilot again ordered 'full astern' and 10 seconds later the ship's engine was full astern.

At 1615:32, the pilot made VHF radio contact with the Port of Melbourne[7] and advised the duty Lonsdale vessel traffic service officer (VTSO) that *Bow Singapore* was about to run aground.

Shortly after, at 1615:58, the pilot observed that the rudder was now hard to starboard and the ship had slowed to 10 knots and he ordered 'stop engine'. He then considered the options that may prevent the ship from running aground.

At 1616:07, the main engine had stopped and shortly after the ship's bridge team mentioned the rudder was still hard to starboard. The pilot then ordered 'slow ahead' to increase the water flow over the rudder and assist the manoeuvre away from the shallow water.

However, by 1616:38, the ship had slowed considerably and in the limited time available, going slow ahead on the main engine had little effect. About 6 seconds later, the pilot ordered 'stop engine' and then 'slow astern'. He then informed the master the ship had run aground and asked for the ship's crewmembers to stand by the anchors.

At 1617:22, the pilot contacted Lonsdale VTS and reported the ship had grounded on the sandbank (Figure 2, point 5).

Over the next 7 minutes the pilot attempted to manoeuvre the ship off the sandbank by increasing astern power and using the bow thruster. Although the ship did move, the pilot's efforts to re-float the ship were ultimately unsuccessful.

The crew then started taking soundings of empty ballast tanks, the full cargo tanks and the water depth around the ship. No ingress or egress was found and the ship's crewmembers continued to monitor until the ship was re-floated.

On 20 August at 0040, with the assistance of a tug and the rising tide, *Bow Singapore* was re-floated. It then proceeded to the anchorage off the Port of Geelong. Subsequent underwater hull inspections/survey did not indicate any damage to the ship.

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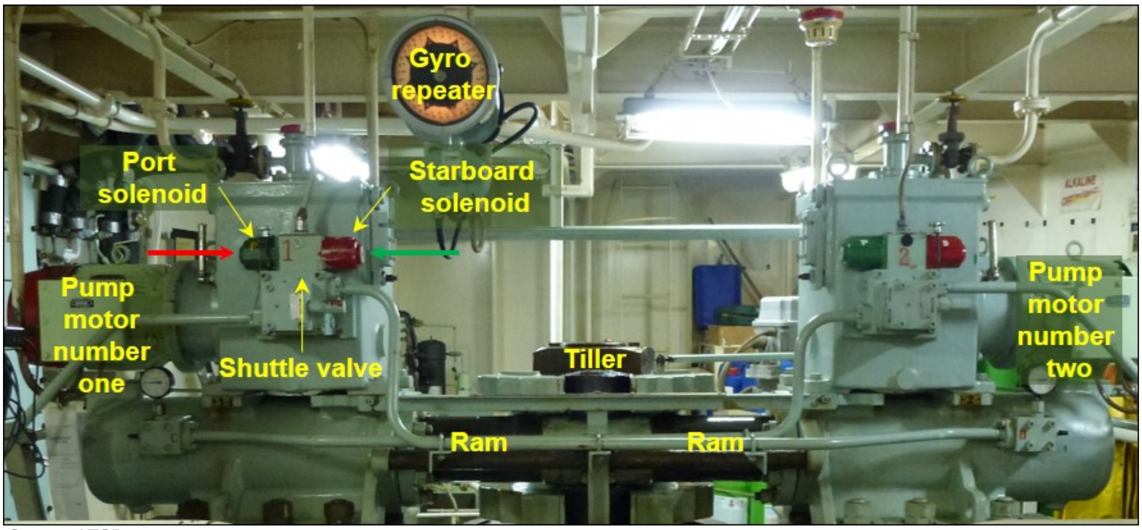
[7] The Port of Melbourne operates a 24 hour Vessel Traffic Service (VTS), which is divided into two sectors: Lonsdale VTS (LVTS) for traffic south of 38°05'S and Melbourne VTS (MVTS) for traffic north of 38°05'S.

Safety analysis

Steering gear

Bow Singapore was fitted with a Kawasaki Precision Machinery RV21-022 steering gear (Figure 3). It was a two (simplex) ram Rapson slide system with two identical hydraulic systems. Each system included a hydraulic pump, directional control (shuttle) valve and electrical control systems.

Figure 3: Bow Singapore's steering gear

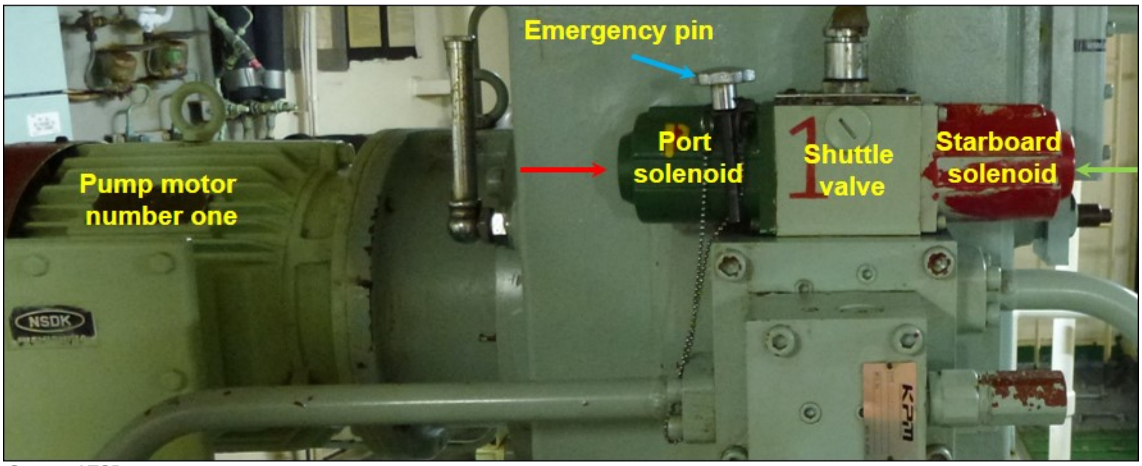


Source: ATSB

The rudder was moved by the hydraulic shuttle valve directing high pressure oil from the pump to one of the two rams. The valve consisted of a spring-centred shuttle operated by two opposing solenoids. When electrical power[8] was applied to a solenoid, it moved the shuttle directing the flow of oil to a ram and the rudder moved. When the signal was removed, the valve's internal springs returned the shuttle to a neutral position and the rudder stopped moving.

Manual (emergency) operation can be performed locally by inserting a pin (Figure 4, blue arrow) into the back of the required solenoid and pushing the shuttle valve across (red arrow – rudder to port, green arrow – rudder to starboard).

Figure 4: Steering system one solenoid valve arrangement



Source: ATSB

[8] The telemotor's electrical signal is generated by moving the wheel or NFU lever on the bridge.

The solenoid's electrical connection consisted of two hard-mounted pins that protrude from the mounting face of the solenoid. They made contact with spring-loaded receivers when the solenoid was mounted on the body of the shuttle valve.

Prior to departure from the last port, both steering gear systems were tested from the bridge and the steering gear room, as part of the normal departure routines. No faults were recorded. The ship departed on steering system number one, as was the normal practice, and operated without fault for the voyage to Port Phillip.

While the ship was aground in Port Phillip, the steering gear was inspected and tested by the ship's engineers and an electrician. They first confirmed that the telemotor signal had reached the number one starboard solenoid.[9] However, the solenoid did not respond to the starboard telemotor signals. Next, the port and starboard solenoids were manually operated and the rudder responded in both directions. The telemotor test was repeated and the rudder, again, did not respond to starboard telemotor signals.

The manual testing showed that the solenoid, shuttle valve and pump were operating as expected. Therefore, the fault was unlikely to be mechanical and more likely to be an electrical fault associated with the starboard solenoid. The engineers then changed the solenoid and the steering gear resumed normal operation.

When the solenoid that had been replaced was bench tested on board *Bow Singapore* it operated as designed. The solenoid was further tested in the ATSB laboratory and it also worked as designed and the coil's current flow and resistance were as per the specification. It was then disassembled and visually inspected and no abnormal conditions were evident.

As no fault could be found with the solenoid, the ATSB identified two other possible reasons for the failure:

- An intermittent fault. Although an intermittent fault is possible, it is unlikely as this condition has not reoccurred and there is no history of this fault having previously occurred.
- A high-resistance contact. The solenoid's electrical pins were clean and showed no signs of mechanical damage. There was also no sign of arcing and/or heat discoloration that can sometimes be found with a poor electrical connection. However, this does not rule out the possibility of a high-resistance (dry) joint having developed. As the steering gear returned to normal operation, after fitting another solenoid, it is possible that if there was a poor connection, it was restored during the solenoid changeover.

Further inspection of the steering gear in Singapore, by the manufacturer's representative, also found nothing to explain why the steering gear had stopped responding.

In summary, from the evidence provided by the ship, the manufacturer's representative and the ATSB laboratory, no mechanical or electrical fault could be found to establish why the steering gear failed to respond to starboard telemotor signals.

Emergency procedures

The International Safety Management (ISM) Code[10] requirements are mandatory for *Bow Singapore* and its management company to comply with. Part A (Implementation), Section 8.1 (Emergency preparedness) states:

> The Company should identify potential emergency shipboard situations, and establish procedures to respond to them.

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9 The telemotor signal was confirmed by using a non-contact test pen. The test pen will indicate that voltage is present but does not differentiate between circuits in which there is or isn't current flow.

10 The International Management Code for the Safe Operation of Ships and for Pollution Prevention ISM Code adopted by the International Maritime Organization's Resolution A.741 (18) as amended.

Therefore, a procedure should contain all steps, in a logical order, so the operators can respond to a problem expediently and enable the best possible outcome.

However, the management company’s (Odfjell Management) procedure for ‘steering gear failure’ stated:

1. Inform the Master and Engineer on duty
2. Engage the emergency steering
3. Call up an additional look-out if necessary
4. …
5. …
6. Reduce speed or stop engines, if necessary

Hence, an immediate change in operation from the bridge to local emergency operation from the steering gear room. The procedure did not include steps to be taken on the bridge, such as the use of the NFU mode or changing over pumps and/or telemotors.

However, the crewmembers had made an on board procedure stating the above (Figure 5) and affixed it to the bridge steering console. The ship’s bridge team followed the steps in the on board procedure after the helmsman reported the issue with the steering gear.

Figure 5: Bridge steering console emergency procedure for steering gear failure

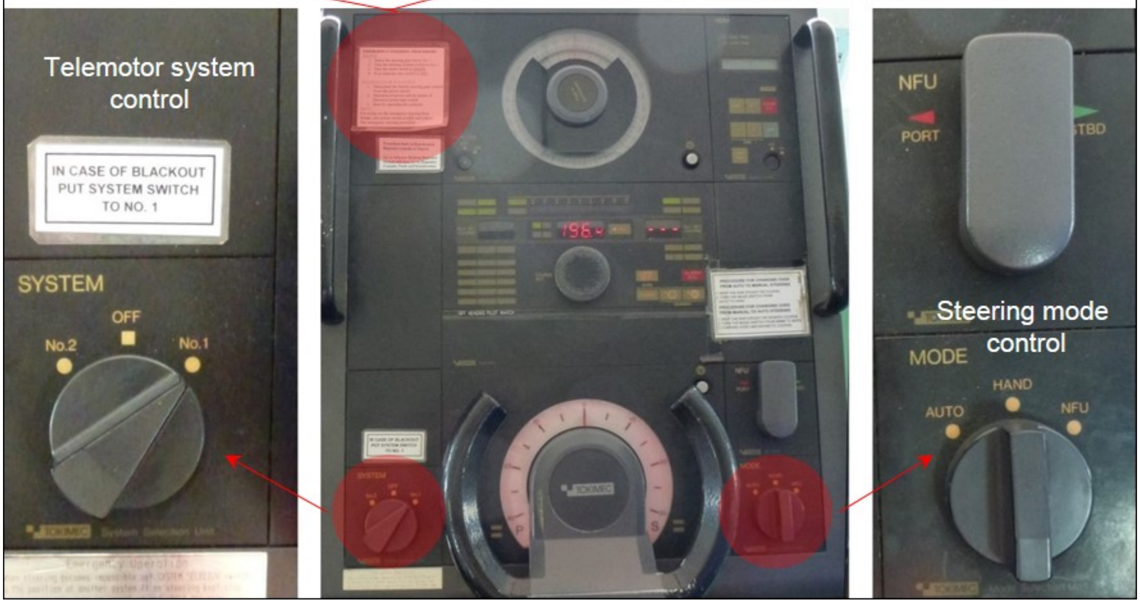
Emergency Steering Procedure

Bridge

1. Select the steering motor No.1
2. Turn the steering System switch to No. 1
3. Turn the mode switch to HAND
4. If not response turn switch to NFU

Steering Gear Platform

1. Disconnect the remote steering gear control from the power circuit
2. Operation of power unit by means of Electrical motor start switch
3. Steer by operating the solenoid



Source: ATSB

Therefore, there was an inconsistency between the company-controlled documented procedure and the procedure affixed to the steering console. The company procedure would have resolved a loss of steering control from the bridge but required local operation to work. However, during pilotage in restricted waters, there is a limited time available to respond. Hence, the time required for crewmembers to proceed to the steering gear room and operate locally would not be the most expedient way to respond to a steering failure.

Equipment knowledge

Guidance regarding equipment knowledge is contained in Section 3.2, Regulation 26, Chapter V, SOLAS[11] (Safety of Navigation), which specifically states:

> All ships' officers concerned with the operation and/or maintenance of steering gear shall be familiar with the operation of the steering systems fitted on the ship and with procedures for changing from one system to another.

The ship's bridge team initially responded to the steering failure by changing over to NFU mode. When the rudder did not respond, they changed over from steering pump number one to two and steering (telemotor) system number one to two, the reverse order of the procedure affixed to the steering console (Figure 5).

Their actions of changing both the pump and telemotor over to the other system was due to their understanding that cross operation of systems one and two was not possible (for example, number one telemotor could not control number two steering system), however, it was. Notwithstanding, the actions of the ship's bridge team were appropriate, timely and in excess of what had been documented in the company's emergency procedure.

As stated in the SOLAS requirements, the management company's procedures need to document how to change over from one system to another and that the crew are adequately trained to ensure system knowledge is accurate. However, the company's emergency procedure did not provide these directions and in lieu of this the ship's crew had made their own ship-specific procedure.

Maintenance procedures

The ISM Code, Part A (Implementation), Section 10.3 (Maintenance of the ship and equipment) states:

> The Company should identify equipment and technical systems the sudden operational failure of which may result in hazardous situations. The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems.

The management company's planned maintenance system (PMS) schedule contained monthly and three-monthly checks for the steering gear. It required the crewmembers to test the alarms, check for leaks and to check the auto start of the standby pump in case of any alarm. Prior to each dry-docking (twice in a 5 year period), Odfjell Management had the steering gear inspected by the manufacturer's representative. A repair specification was then compiled based on the results of the inspection report.

The PMS also required checks of the steering gear's hydraulic oil, which were sampled three times a year, and sent ashore for analysis.[12] Although oil analysis is a useful tool, it has limitations. It cannot identify all age and wear related problems, such as the hardening/flattening of O-rings, a change in a spring's characteristics or leakage past a valve.

Similarly, electrical systems would benefit from planned maintenance inspections, such as electrical insulation testing, checking terminations for tightness and checking that relays and timers are properly seated in their bases.

Further, the PMS schedule for the steering gear did not include the manufacturer's recommendations for a monthly check[13] of the solenoid valves. In addition, detailed inspections or scheduled parts replacement were not included. Therefore, the continued safe operation of the steering gear was reliant, for the most part, on breakdown maintenance when components failed.

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

12 The most recent oil samples (17 June) for both steering gear systems showed that the oil's viscosity was as expected, the contaminant levels were low and that they had not risen from those in the previous four sample results.

13 Monthly check that the solenoid valve is correctly operated from the steering console on the bridge.

Planned maintenance systems that include regular and thorough maintenance and visual inspections, as well as operational tests, better reduce the risk of machinery failure than operational tests alone. This is particularly important for systems that are critical to the safe operation of the ship.

Equipment labelling and visual cues

Each hydraulic system had two solenoids that moved a shuttle valve which directed the flow of oil to a ram which moved the rudder. Manual (emergency) operation of the solenoids required a pin to be inserted into the back of the required solenoid to push the shuttle valve across. That action would then move the rudder in that direction.

System number one's solenoids were each painted and stencilled for identification. The port solenoid had a ‘P’ stencilled on it and likewise the starboard solenoid had an ‘S’. However, the dominant information was the colour that they had been painted. The solenoid bodies were painted a colour that was opposite to the direction the rudder would move. The red solenoid was painted green (starboard) but when operated moved the rudder to port. Likewise, the green solenoid was painted red (port) but when operated moved the rudder to starboard.

Therefore, this could create confusion when crewmembers operating the solenoids locally receive a rudder order from the bridge. For example, receiving an order for port 5 could be interpreted as either operating the port solenoid or the red starboard solenoid. Although the colouring of the solenoids did not contribute to this occurrence, in an emergency situation, the risk of a helm order being incorrectly applied would increase. The added complexity of steering a ship from the steering gear room and the likelihood of an error occurring would be further increased due to the colouring found on the solenoids.

Similar past incidents

Flag States with the responsibility to investigate safety occurrences have investigated similar incidents regarding steering gear failures and the crew's limited understanding of steering gear systems and shipboard maintenance procedures.

Flag Gangos

On 12 August 2014, the outbound bulk carrier *Flag Gangos* collided with the berthed oil tanker *Pamisos* on the Mississippi River at Gretna, Louisiana. The *Flag Gangos* subsequently collided with a pier at the facility where the *Pamisos* was berthed, and the pier struck and damaged a fuel barge, berthed behind the *Pamisos*.

The US National Transportation Safety Board (NSTB) investigated the collision. Its final investigation report (NTSB/MAB-15/25, accident number DCA14FM015), stated that the ‘probable cause’ was a delay in completing a mandatory upgrade to the vessel's steering system and a ‘failure to routinely test the steering gear's hydraulic fluid for debris as required by the manufacturer’.

Halit Bey

On 22 April 2014, the chemical and products tanker *Halit Bey* was proceeding up the St. Lawrence River, under the conduct of a pilot, when steering control was lost. The vessel veered to port and exited the navigational channel, running aground on the south side of the river off Grondines, Quebec. The vessel was later re-floated with the assistance of two tugs.

The Transportation Safety Board (TSB) of Canada investigated the grounding (report M14C0045). The findings with potential relevance to the current investigation included:

- The bridge crew was not adequately familiarized with the characteristics of the *Halit Bey*'s steering control system and did not know how to regain steering control after the autopilot override alarm activated.

- After steering control was lost, the vessel veered to port, towards the shore.
- The crew's attempt to reduce speed and anchor the vessel were unsuccessful, in the limited time available, to prevent the vessel from exiting the navigational channel and running aground.
- If crew members are not familiarized with all aspects of the operation of safety critical equipment, such as a vessel's steering control system, there is a risk that they will not have the knowledge required to operate the system proficiently or regain control in the event that it is lost.

Orsula

On 15 December 2011, the bulk carrier *Orsula* departed Contrecœur, Quebec, in ballast for Baie-Comeau, Quebec. While proceeding down the St. Lawrence River under the conduct of a pilot, the vessel lost steering control and ran aground at 1329 on the Battures de Gentilly, 1.25 miles northeast of Bécancour wharf, Quebec. About 48 hours later, it was re-floated on the first attempt using tugs.

The Canadian TSB investigated the grounding (report M11L0160). The findings with potential relevance to the current investigation included:

- Steering control was lost when the port steering system potentiometer failed while the rudder angle was at 10º to starboard, causing the vessel to veer to starboard and leave the dredged channel.
- The bridge crew members were not familiar with the use of the non-follow-up mode or with switching the steering system selector switch from port to starboard to regain steering control.
- The master switched the steering system selector switch from port to starboard, which restored steering control, but it was too late to prevent the vessel from running aground.

Arcadia

On 22 October 1996, the oil tanker *Arcadia* was under the conduct of a pilot inbound for a refinery at Anacortes, Washington. The loss of steering occurred due to a loose electrical connection on the steering gear's number one hydraulic control solenoid. The connection was overlooked during a regular maintenance check.

The Washington State Department of Ecology published an investigation report (publication # 98-253). The lessons learnt and recommendations with potential relevance to the current investigation included:

- Steering gear is a critical vessel safety system. As such, steering gear systems must be properly maintained. However tedious, inspections of the electrical connections of the system must be part of the maintenance program. The maintenance program should be structured to minimize the opportunity for human errors.
- Ensure that steering gear is properly maintained under a comprehensive planned maintenance program that minimizes the likelihood of human error and conforms with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code), especially Section 10. All electrical connections should be regularly checked for integrity as part of such a steering gear maintenance program.

Findings

From the evidence available, the following findings are made regarding the grounding of *Bow Singapore*, under pilotage, in Port Philip on 19 August 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (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 operating environment at a specific point in time.

Contributing factors

- *Bow Singapore*'s steering gear stopped responding to helm inputs and the rudder remained at 5° to port. This initiated an uncontrolled turn towards the edge of the channel and shallow water.

Other factors that increased risk

- The company's procedures for a steering gear failure required a change in operation from the bridge to local emergency operation from the steering gear room. However, the procedures did not include the steps to be taken on the bridge prior to that change, such as using non follow-up mode and changing to alternate telemotor and/or pump systems.
- The number one steering system telemotor solenoid stopped responding to helm inputs. However, when examined and tested, the solenoid functioned as designed and no faults were found.
- ***Bow Singapore*'s planned maintenance system for the steering gear did not include or contain any schedules for any detailed inspections or parts replacement. [Safety issue]**
- The hydraulic system solenoids were painted red or green to match the side of the ship that each were mounted on, but that was opposite to the direction the rudder would move.

Other findings

- The actions of the bridge team were both timely and appropriate as well as being in excess of the requirements of the procedure that was in place at the time of the incident.

Safety issues and actions

The safety issue identified during this investigation is listed in the Findings and Safety issues and 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 organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) 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.

The initial public version of these safety issues and actions are repeated separately on the ATSB website to facilitate monitoring by interested parties. Where relevant the safety issues and actions will be updated on the ATSB website as information comes to hand.

Steering gear planned maintenance instructions

Number:	MO-2016-007-SI-01
Issue owner:	Odfjell Management
Operation affected:	Shipboard operations
Who it affects:	All workers on ships managed by Odfjell Management

Safety issue description:

Bow Singapore's planned maintenance system for the steering gear did not include or contain any schedules for detailed inspections or parts replacement.

Proactive safety action taken by Odfjell Management

Action number: MO-2016-005-NSA-006

Following the incident, Odfjell Management introduced 3 and 6 month job entries into their planned maintenance system for the inspection and testing of the steering gear unit. The 6-monthly schedule included specific requirements relating to preventative maintenance of the steering gear solenoid valve.

Current status of the safety issue

Issue status: Adequately addressed

Justification: The action taken by Odfjell Management will significantly reduce the likelihood of an unexpected steering gear component failure.

Additional safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

The telemotor solenoids have now been painted a colour that reflects the direction of rudder movement (that is, red solenoid moves the rudder to port). The system number and rudder direction have also been clearly stencilled on the steering gear.

The management company had also undertaken a risk analysis for the operation of the steering gear in confined waters.

Further, the fleet wide safety management system procedure for ‘steering gear failure’ had been amended to include requirements to:

- inform the Master and Engineer on duty
- engage the emergency steering (reference should be made to ship specific emergency change over procedure as stipulated in steering gear manual or as posted at the conning position and steering gear room)
- call up an additional look-out if necessary
- reduce speed or stop engines, if necessary.

General details

Occurrence details

Date and time:	19 August 2016 – 1617 (UTC +10)	
Occurrence category:	Incident	
Primary occurrence type:	Grounding	
Location:	South Channel, Port Phillip	
	Latitude: 38° 19.76’ S	Longitude: 144° 53.52’ E

Ship details

Name:	*Bow Singapore*
IMO number:	9288590
Call sign:	9VAA9
Flag:	Singapore
Classification society:	DNV-GL
Ship type:	Chemical/Products tanker
Builder:	Fukuoka Ship Building Company
Year built:	2004
Owner(s):	Mount Pleasant Shipping Company
Manager:	Odfjell Management
Gross tonnage:	6,219 t
Deadweight (summer):	9,888 t
Summer draught:	8.2 m
Length overall:	114.8 m
Moulded breadth:	19.4 m
Moulded depth:	10.7 m
Main engine(s):	MAN-B&W 6L35MC
Total power:	3,900 kW
Speed:	13.5 knots
Damage:	Nil damage

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- interviews of the directly involved crew of *Bow Singapore*
- interview of the pilot
- automatic identification systems and voyage data recorder data
- documents provided by Odfjell Management
- Kawasaki Heavy Industries (S) Pty. Ltd.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (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 and directly involved crew of *Bow Singapore*, the pilot, Odfjell Management, the regional harbour master, Transport Safety Investigation Bureau, Singapore and the Australian Maritime Safety Authority.

Submissions were received from the pilot, Odfjell Management, Transport Safety Investigation Bureau, Singapore 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

The ATSB is an independent Commonwealth Government statutory agency. The ATSB 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 operations involving the travelling public.

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 factors related to the transport safety matter being investigated.

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.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Grounding of Bow Singapore, Port Phillip, Victoria, on 19 August 2016

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