Australian Government
Australian Transport Safety Bureau

Publication Date: September 2009 ISBN 978-1-921602-90-0

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia
1800 020 616
+61 2 6257 4150 from overseas

www.atsb.gov.au

ATSB-23

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

ATSB TRANSPORT SAFETY REPORT
Marine Occurrence Investigation No.257
MO-2008-009
Final

Engine room flooding on board *Great Majesty*

Port Kembla, New South Wales
27 October 2008

Abstract

At about 1745[1] on 27 October 2008, during cargo discharge operations whilst alongside in Port Kembla, New South Wales, the chief mate of *Great Majesty* remotely opened two ballast valves adjacent to the number two water ballast pump (No. 2 WB P/P) to gravitate[2] seawater into the number one water ballast tank (No. 1 WBTK).

About 10 minutes later, the engine room bilge alarm sounded and the duty motorman found seawater flooding into the space through the open casing of No. 2 WB P/P. Repair work had been started on No. 2 WB P/P but the suction line had not been blanked off.

The inflow of water was stopped after the alarm was raised. About 390 m^3 of seawater had entered the engine room and a total of 22 electric motors located on the lower levels of the engine room were damaged by the water ingress.

The investigation found that the ballast operation procedure did not provide sufficient guidance to the crew. The investigation also found that the work permit system onboard had not been effectively implemented. Consequently, most maintenance and repair work being carried out by the ship's crew was without a work permit.

Figure 1: *Great Majesty* in Port Kembla

1 All times referred to in this report are local time, Coordinated Universal Time (UTC) + 11 hours.

2 To allow ballast water to flow into tanks due to the difference in water levels in and outside the ship instead of pumping it.

FACTUAL INFORMATION

Great Majesty

Great Majesty (IMO number 9143477) is a Hong Kong registered, geared bulk carrier. It was built in 1998 by Daedong Shipbuilding, South Korea and is classed with Bureau Veritas (BV).

Great Majesty is owned and operated by Parakou Shipping, Hong Kong, China. It has an overall length of 190.02 m, a beam of 31.0 m and a depth 16.6 m. It has a deadweight of 46,194 tonnes at its summer draught of 11.6 m.

The ship is strengthened for the carriage of heavy cargoes and has five cargo holds serviced by four cranes, all located forward of accommodation superstructure.

The ship's propulsive power is provided by a B&W 6S50MC single acting, direct reversing diesel engine, which produces 7,796 kW at 108 rpm. The engine drives a single fixed pitch propeller which gives the ship a service speed of about 14.5 knots[3].

At the time of the incident, *Great Majesty* had a crew of 23 which comprised 15 Bangladeshi, six Chinese and two Indian nationals. All of the crew held the appropriate qualifications.

The master had 25 years of seagoing experience, mostly on bulk carriers. He held a class one certificate of competency as master, issued in the United Kingdom in 2005. He had been a ship's master since 2007 and he joined *Great Majesty* in September 2008. This was his second trip to Port Kembla.

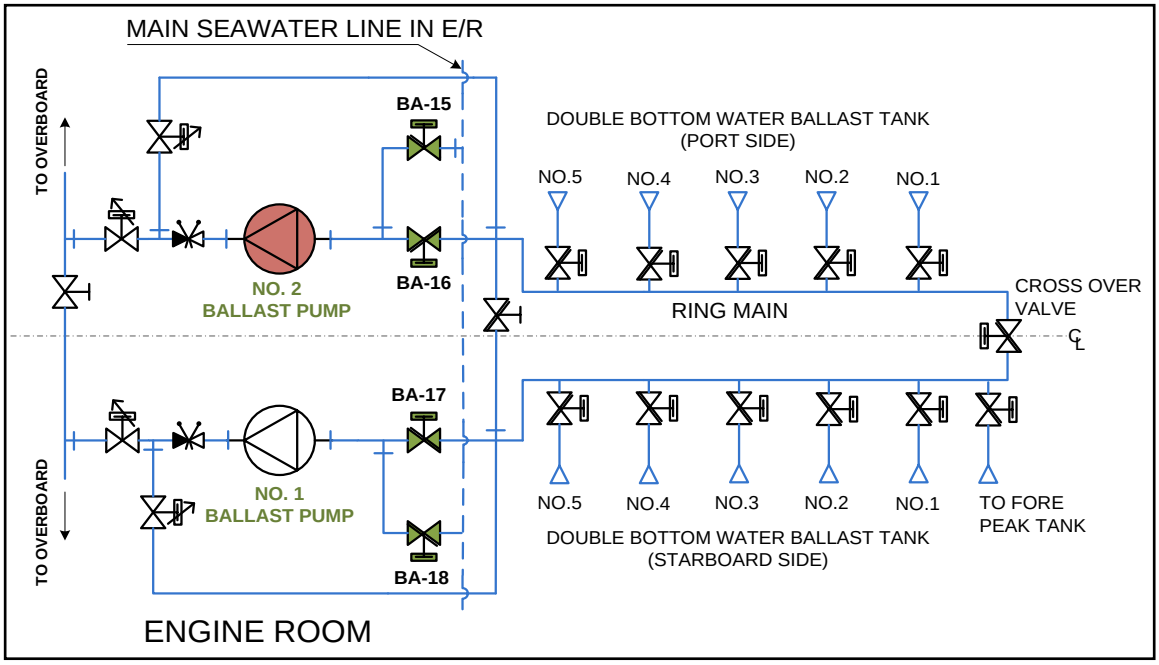
The chief mate had 12 years of seagoing experience. He held a class one certificate of competency as master, issued in Bangladesh 8 months before he joined the ship. He had sailed as chief mate for 5 years and had joined the ship 4 months before the incident.

Great Majesty's chief engineer had 20 years of seagoing experience on many types of ships. He held a Hong Kong class one engineers licence, which was based on a Chinese class one certificate of competency. He joined the ship 3 months before the incident.

Ballast system

Great Majesty has ten double bottom WBTKs, five on each of its port and starboard sides. It also has an after peak and a fore peak WBTK. The total ballast capacity of the tanks is 13,835 m³. Cargo hold number three can also be used as a ballast hold, which gives an additional capacity of 12,500 m³. All WBTKs are connected to a 'ring main' ballast piping system (Figure 2).

Figure 2: Ballast system diagram



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

The ship has two main WB P/Ps, located on the engine room bottom plates, each with a capacity of 1,000 m^3 per hour. Each ballast pump is a vertical centrifugal pump, driven by an electric motor. The suction and discharge pipes have a nominal bore of 350 mm.

The ballast pumps are connected to the engine room seawater main through either of the remotely operated butterfly valves, BA-15 and BA-18 (Figure 2).

Ballast operations are usually conducted by the chief mate from the ballast control room, which is located within the ship's office on the main deck.

The incident

On 3 October 2008, *Great Majesty* arrived at Groote Eylandt, Northern Territory, to load a cargo of manganese ore for discharge at Bell Bay, Tasmania.

During the stay, the crew experienced problems with No. 1 WB P/P which was subsequently taken out of service.

On 16 October, *Great Majesty* arrived in Bell Bay. During ballast operations, the crew found water leaking from a crack in the casing of No. 2 WB P/P. The second engineer temporarily repaired the pump casing using 'Devcon' putty.

After its cargo operations in Bell Bay were completed, the ship departed for Port Latta, Tasmania, to load pelletised iron ore.

At 0400 on 22 October, *Great Majesty* arrived at Port Latta. Later that day, the ship began loading cargo.

On 23 October, as loading was being completed, No. 2 WB P/P's casing began to leak again.

As a result of the recent problems with both ballast pumps, the master asked the chief engineer to ensure that both pumps were fully operational before the ship arrived in Port Kembla, its next port of call. The chief engineer advised the master and the chief mate that No. 2 WB P/P could not be used in Port Kembla because of its cracked casing and that a new pump casing had been ordered for delivery in Port Kembla.

At 0406 on 23 October, *Great Majesty* departed Port Latta. Following departure, the engineers dismantled No. 2 WB P/P and removed the motor, impeller and discharge pipe elbow. They fitted a blank flange on the discharge line. The pump casing remained in situ, connected to the suction pipe.

On 24 October, the second engineer overhauled No. 1 WB P/P and then reassembled it. The chief mate asked the chief engineer to ensure that it was fully operational by pumping from 'sea-to-sea' and the chief engineer confirmed that the pump worked correctly.

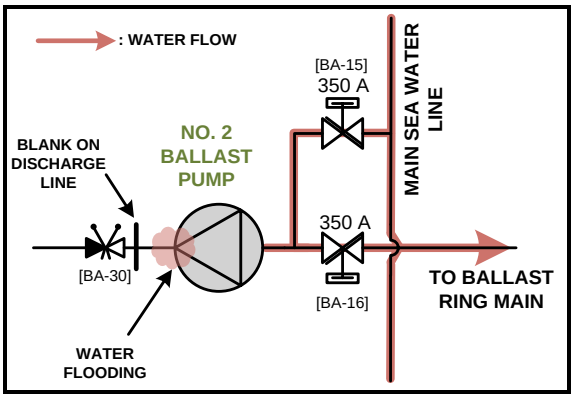
The chief engineer advised the chief mate that the No. 2 WB P/P could not be used because it had been 'stripped and blanked off'.

At 1918, *Great Majesty* anchored off Port Kembla to wait for an available berth.

At 1342 on 27 October, *Great Majesty* departed the anchorage and by 1542, the ship was all fast alongside Berth 112 in Port Kembla. The ship's arrival draughts were 10.5 m forward and 11.9 m aft. At 1610, a shore crane began to discharge cargo from No. 1 cargo hold.

At 1745, the chief mate started to gravitate water ballast into No. 1 WBTK. He opened valves BA-15 and BA-16 (Figure 3) to connect the main sea water line to the ballast main piping.

Figure 3: Flooding line



About 10 minutes later, the motorman who was on duty in the engine room heard the bilge alarm sound. On investigation, he saw seawater flooding into the engine room through the open casing of No. 2 WB P/P. The motorman immediately informed the third engineer who, in turn, called the chief engineer.

The chief engineer immediately went to the ballast control room and told the chief mate to stop ballasting. The chief mate closed all ballast valves and the inflow of sea water stopped.

The chief engineer used the ship's public address system to inform the rest of the crew of the flooding.

The floodwater had damaged the cooling water pump for the main generators and by 1800, the chief engineer stopped the main generators, causing the ship to 'black out'. The emergency generator started automatically. Cargo operations were also stopped.

On inspection, it was found that the water level in the engine room was about 1 m above the bottom plates (Figure 4).

Figure 4: Flooded water level indicated by hand

At 1945, engineers removed the after peak WBTK manhole cover and began to pump the water from the engine room into the after peak tank using a submersible pump and hoses.

By 2045, about 90 m^3 of water had been transferred to the after peak tank. The emergency fire pump was started and used to supply cooling water to the No. 1 main generator.

The crew started to clean the engine room and check the operation of all motors and pumps. A total of 22 electric motors located around the lower levels of the engine room had been damaged by the water ingress. At about this time, the master contacted the ship's local agent and requested technical assistance with the damaged electric motors.

At 2100, the ship's power was restored and cargo operations were resumed.

At 0500 on 28 October, the transfer of about 390 m^3 of water from the engine room to the after peak tank was completed.

At 0825, two technicians from ashore attended the ship to assist with removing, drying and reconditioning the damaged electric motors.

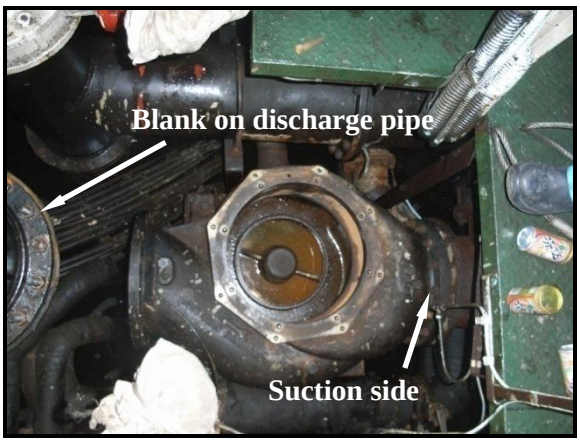
On 30 October, the cargo discharge was completed and at about 2200 on 31 October, *Great Majesty* departed Port Kembla.

ANALYSIS

The flooding

At about 1800 on 27 October 2008, seawater flooded *Great Majesty*'s engine room bottom plates when the chief mate remotely opened valves adjacent to No. 2 WB P/P. The pump had been stripped for repairs and while the discharge line from the pump had been blanked, the pump casing was left open and the suction line to the pump and its casing had not been blanked off (Figure 5).

Figure 5: Disassembled pump casing



The chief mate had opened the valves with the intention of gravitating seawater into No. 1 WBTK. He had been advised by the chief engineer not to run No. 2 WB P/P because it had been 'stripped and blanked off'. The chief mate's understanding of this information was that the pump had been fully blanked on both suction and discharge sides. Therefore, he assumed that he could still use any valve in the ballast system but should not run No. 2 WB P/P. He was not told, and did not inquire about any other restriction on the operation of the ballast system.

Therefore, following the information from the chief engineer regarding to the pump's maintenance, the chief mate thought that valves BA-15 and BA-16 were not restricted in their use. Consequently, he chose to use these valves rather than valves BA-17 and BA-18 (which have an identical purpose) near the operational No. 1 WB P/P, to gravitate water into the ballast tanks.

In addition, valves BA-15 and BA-16 had not been effectively isolated. Consequently, the chief mate was able to remotely open them thus connecting the open pump casing to the main seawater line which subsequently resulted in the flooding.

Equipment isolation

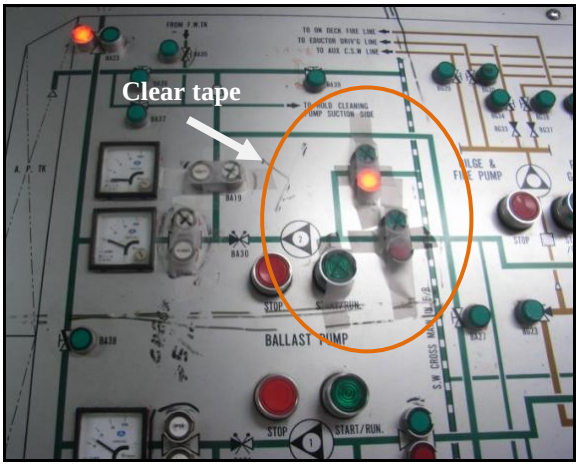
On 23 October, the chief engineer electrically isolated No. 2 WB P/P motor so that he could remove it.

The absence of a blank flange on the suction side of the pump now left the still remotely operated valve, BA-15, as the only separation between the engine room and the sea. This placed the engine room and the ship in a dangerous and undesirable situation.

If a blank had been fitted to the suction line, the act of opening the ballast valves BA-15 and BA-16 would not have resulted in water entering the engine room (Figure 3).

In addition, the chief engineer did not isolate the remotely operated valves on either side of the pump and did not place any warning tags on the ballast control panel (Figure 6). Consequently, these valves could still be operated remotely from the ballast control panel in the ballast control room.

Figure 6: Ballast control panel (clear tape placed over buttons after incident)



No. 2 WB P/P was not properly isolated and blanked off. Consequently, seawater entered the pump and flooded the engine room through the open pump casing.

Shipboard procedures

Ballast operation procedure

The ship's safety management system (SMS) includes a ballast operation procedure which stated that:

> Before any ballast operation, the chief officer should ensure that ballast tanks are in good/normal condition with no leakages; all covers of tank top manholes are well secured and watertight; all air-pipes and sounding pipes are in normal condition, robust and intact.

The procedure did not address the readiness of other ballasting equipment, such as the availability of the pumps or valves in the ballast system, or the ballast control panel.

Had it done so, the chief mate may have been prompted to ensure that the entire ballast system, with the exception of No. 2 WB P/P, was available to be used in Port Kembla. However, even with the procedure as it was at the time, he was not prompted to manually check the readiness of the system. Had he done so, he would have established for himself the situation with No. 2 WB P/P and its associated ballast lines and probably not used valves BA-15 or BA-16.

The ballast operations procedure did not provide a sufficient level of guidance for the chief mate to establish whether the ballast system could be used in the way he intended, given the situation with No. 2 WB P/P.

Work permit system

The ship's SMS included instructions that a work permit should be completed before any maintenance work was started. The latest version of the work permit form was issued in 2007. The form described the work to be done, any system or equipment which needed to be isolated and how it was to be isolated. Before completing the form, the procedures required that a tag stating 'Danger: Do not operate' be attached to the related equipment, thus informing the crew of this work permit before work commenced.

The master and chief mate were aware that No. 2 WB P/P was inoperable and was being overhauled. However, no work permit had been completed by the chief engineer for this work, detailing the isolations in place and tags were not put in place to indicate the system should not be used.

Australian Transport Safety Bureau (ATSB) investigators found that the last occasion a work permit had been used on board the ship was in September 2008, about a month before the incident. This suggests that many maintenance and repair work items were carried out by ship's personnel in the intervening time without the work permits required by the ship's procedures.

The investigators also found that, following the incident, the crew applied clear tape over the ballast control buttons to protect them from being used. Again, no warning tag had been attached to the ballast control panel as the procedure required (Figure 6).

The evidence indicates that the implementation of the ship's work permit system was probably not consistent or effective.

Communication

The company's policy stated that the ship's working language was English. However, difficulties in communication arose between some of the officers because the level of English proficiency on board *Great Majesty* varied significantly.

To help offset this problem, the company's SMS included a checklist for specific tasks to reduce confusion. The ballast operations procedure stated that:

> During ballast operations proper & effective communication between deck & engine departments should be made.

Closed loop communication is a method to improve the effectiveness of a communication. It is a term that refers to the process involving: the initial sending of a message, the receiving, understanding and acknowledging of the meaning of the message; and follow-up confirmation about the accuracy of the information. The closed-loop communication style, either verbal or written, serves to reduce the likelihood of error and to improve safety for any work onboard.

The master and chief mate both had difficulty understanding the chief engineer's English, sometimes requiring him to repeat himself several times, in order to adequately understand what he was saying.

The master, chief mate and chief engineer met following the ship's departure from Port Latta. The master asked the chief engineer to ensure that the pumps were working properly. In reply, the chief engineer stated that No. 2 WB P/P could not be used and was blanked off.

The chief mate did not confirm his understanding of the chief engineer's information and incorrectly assumed that there was no restriction in using any valve in the ballast system. Additionally, the chief engineer did not effectively or accurately communicate the status of No. 2 WB P/P and its associated valves to the chief mate.

The chief engineer should have been aware of his difficulties in verbal communication with other crew members. Therefore, he could have considered using written communications as provided by the ship's SMS in order to be accurately understood.

Before arrival in Port Kembla, the chief engineer came into the ship's office on several occasions but he did not discuss the pump or the condition of the ballast system. It is likely that the chief engineer assumed that the chief mate had understood his explanation of the pump and the condition of the associated piping. Neither the message sender nor the receiver had actively listened or practiced any closed-loop communications.

Had communications between the ship's senior officer been effective, it is likely that the chief mate would have understood that he should not operate the valves BA-15 and BA-16 and the incident would probably not have occurred.

FINDINGS

At about 1800 on 27 October 2008, about 390 m^3 of seawater flooded *Great Majesty's* engine room bottom plates when the suction valves to No. 2 WB P/P were remotely opened from the ballast control room. No. 2 WB P/P had been stripped for repairs with its casing left open at the time.

From the evidence available, the following findings are made with respect to the engine room flooding on board *Great Majesty* and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- When the ballast pump was disassembled for repair, the suction pipe was not blanked off and the suction valves were not isolated. Consequently, the chief mate was able to remotely open the pump's suction valves and connect the open pump casing to the main seawater line, which resulted in the flooding.
- No work permit was completed for the pump maintenance and 'Danger: Do Not Operate' tags were not placed on the ballast valve remote control panel.
- The ballast operations procedure did not provide a sufficient level of guidance for the chief mate to establish whether the ballast system could be used in the way he intended, given the situation with No. 2 WB P/P. *[Safety issue]*
- The work permit system had not been effectively implemented on board the ship. Consequently, most maintenance and repair work was being carried out by ship's personnel without the work permits and 'Danger: Do Not Operate' tags that were required by the ship's procedures. *[Safety issue]*
- The communications between senior officers on board *Great Majesty* were not effective. The chief engineer did not effectively or accurately communicate the status of No. 2 WB P/P and its associated valves to the chief mate. As a result, the chief mate was not aware that he should not open No. 2 WB P/P suction inlet valve.

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 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 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.

Parakou Shipping

Ballast operation procedure

Safety Issue

The ballast operations procedure did not provide a sufficient level of guidance for the chief mate to establish whether the ballast system could be used in the way he intended, given the situation with No. 2 WB P/P.

Action taken by Parakou Shipping MO-2008-009-NSA-033

ATSB has been advised that the following safety action have been taken by Parakou Shipping following the engine room flooding onboard *Great Majesty*:

- Ballast operation procedures have been modified and compliance with these procedures is being monitored.
- The company has developed a ballast operations checklist to ensure that all risks associated with ballast operations are identified.

ATSB assessment of response/action

The ATSB acknowledges the safety action taken by Parakou Shipping to address this safety issue.

Work Permit procedure Implementation

Safety Issue

The work permit system had not been effectively implemented on board the ship. Consequently, most maintenance and repair work was being carried out by ship's personnel without the work permits and 'Danger: Do Not Operate' tags that were required by the ship's procedures.

Action taken by Parakou Shipping MO-2008-009-NSA-021

ATSB has been advised that the following safety action have been taken by Parakou Shipping following the engine room flooding onboard *Great Majesty*:

- Issued company circulars to all company vessels, pertaining to the case of *Great Majesty* engine room flooding.
- Strengthen communication between respective departments.
- Have regular attendances and audits on the vessel to monitor their performance and progress.

ATSB assessment of the response/action

The Australian Transport Safety Bureau believes that the company's response does not adequately address this safety issue.

ATSB safety recommendation MO-2008-009-SR-020

ATSB recommends that the Parakou Shipping undertake further action to address this safety issue.

SOURCES AND SUBMISSIONS

Sources of Information

Master and Crews of *Great Majesty.*

Parakou Shipping, Hong Kong

Submissions

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

A draft of this report was provided to the Australian Maritime Safety Authority, the Marine Department (MARDEP) Hong Kong, Parakou Shipping Company, the master, the chief mate, and the chief engineer of *Great Majesty.*

Submissions were received from the master of the *Great Majesty*, MARDEP Hong Kong, and Parakou Shipping. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.