

MA2010-5

**MARINE ACCIDENT
INVESTIGATION REPORT**

May 28, 2010

Japan Transport Safety Board

The objective of the investigation conducted by the Japan Transport Safety Board in accordance with the Act for Establishment of the Japan Transport Safety Board is to determine the causes of an accident and damage incidental to such an accident, thereby preventing future accidents and reducing damage. It is not the purpose of the investigation to apportion blame or liability.

Norihiro Goto
Chairman,
Japan Transport Safety Board

Note:

This report is a translation of the Japanese original investigation report. The text in Japanese shall prevail in the interpretation of the report.

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name: Cargo ship "NORD POWER"

IMO number: 9271626

Gross tonnage: 88,594 tons

Vessel type and name: Cargo ship "HAI YING"

IMO number: 8410873

Gross tonnage: 1,312 tons

Accident type: Collision

Date and time: 0742:30 , July 22, 2008 (local time, UTC + 9 hours)

Location: Kanmon Passage, Kanmon Port
185° true, around 1,630meters from Daibahana Lighthouse
(approximately 33° 56. 09'N 130° 52.33'E)

April 22, 2010

Adopted by the Japan Transport Safety Board

Chairman Norihiro Goto

Member Tetsuo Yokoyama

Member Tetsuya Yamamoto

Member Toshiyuki Ishikawa

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1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

Cargo ship "NORD POWER" was sailed from Seitetsu-Tobata Hakuchi in Wakamatsu Section 5 in Kanmon Port, with a master and 19 crew members aboard by 2 pilots of the Kanmon Pilotage Area, and while underway from Tobata Passage toward the east of Mutsure Shima Island in Kanmon Passage, at about 0742:30 (local time, UTC + 9 hours), July 22, 2008, the vessel collided in Kanmon Passage with cargo ship "HAI YING", which was proceeding toward Sakaigawa Harbor in Wakamatsu Section 5 in Kanmon Port, with a master and 9 crew aboard after having weighed her anchor up from an anchorage eastward of Mutsure Shima Island, Shimonoseki City, Yamaguchi Prefecture.

NORD POWER sustained damage to the bow in the form of a dent, while HAI YING sustained damage in the form of a crack to the starboard side shell plating, which caused flooding in the cargo hold, and listing to starboard. But there were no casualties on either vessel.

1.2 Outline of the Accident investigation

1.2.1 Designation of Investigators

On October 1, 2008, the Japan Transport Safety Board (JTSB) took over the investigation into this accident from Moji Marine Accident Investigators' Office, and designated a investigator-in-charge and four other investigators to investigate this accident.

1.2.2 Collection of Evidence

July 24 and August 6, 2008

—on-site investigations

July 24, July 30, July 31, August 4, August 6, August 7, October 20, October 21, October 29, 2008, and February 26, April 14, April 15, August 21, August 24, August 25, 2009

—interviews

July 24, September 5, October 30, 2008, and June 15, September 2, 2009

—collection of the questionnaires

1.2.3 Interim Report

On October 30, 2009, the JTSB submitted an interim report to the Minister of Land, Infrastructure, Transport and Tourism based on the facts found up to that date and made it available to the public.

1.2.4 Comments from Parties Concerned

Comments were invited from parties relevant to the cause of the accident.

1.2.5 Comments from Flag States

Comments were invited from the flag States.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 Voyage conditions according to the Automatic Identification System

According to the records from the Automatic Identification System¹ (hereinafter referred to as “AIS records”) of NORD POWER (hereinafter referred to as “Vessel A”) and HAI YING (hereinafter referred to as “Vessel B”) which were received by Japan Coast Guard Kanmon-Kaikyo Traffic Advisory Service Center (hereinafter referred to as “Kanmon MARTIS”), the voyage conditions of both vessels were as follows.

(1) Vessel A

- 1) At 0732:04: Latitude 33°55'13.6"N, Longitude 130°51'33.8"E, with a course over the ground of 081° (true bearing, hereinafter indicates the same), bow bearing of 054°, and speed (over the ground, hereinafter indicates the same) of 1.3 kn (Turning to port and accelerating).
- 2) At 0736:08: Latitude 33°55'20.2"N, Longitude 130°51'44.2"E, with a course over the ground of 051°, bow bearing of 037°, and speed of 4.3 kn (Turning to port and accelerating).
- 3) At 0738:08: Latitude 33°55'28.9"N, Longitude 130°51'51.8"E, with a course over the ground of 033°, bow bearing of 033°, and speed of 6.2 kn (Direction fixed at 033° and accelerating).
- 4) At 0740:08: Latitude 33°55'41.1"N, Longitude 130°52'01.8"E, with a course over the ground of 035°, bow bearing of 033°, and speed of 7.9 kn (Accelerating).
- 5) At 0741:08: Latitude 33°55'47.8"N, Longitude 130°52'08.0"E, with a course over the ground of 038°, bow bearing of 029°, and speed of 8.5 kn (Turning to port).
- 6) At 0742:07: Latitude 33°55'54.5"N, Longitude 130°52'13.9"E, with a course over the ground of 035°, bow bearing of 021°, and speed of 8.0 kn (Turning to port and decelerating).
- 7) At 0742:27: Latitude 33°55'56.6"N, Longitude 130°52'15.5"E, with a course over the ground of 032°, bow bearing of 019°, and speed of 7.6 kn (Stopped turning to port and decelerating).
- 8) At 0742:37: Latitude 33°55'57.6"N, Longitude 130°52'16.2"E, with a course over the ground of 030°, bow bearing of 019°, and speed of 7.2 kn (No change in her bow bearing or deceleration).
- 9) At 0743:08: Latitude 33°56'00.3"N, Longitude 130°52'18.0"E, with a course over the ground of 029°, bow bearing of 020°, and speed of 6.0 kn (Turning to starboard and decelerating).

(See Table 1 AIS Record of Vessel A.)

¹ “Automatic Identification System (AIS)” is a system through which such pieces of information as a vessel's identification, type, name, position, course, speed, destination, and voyage condition are exchanged mutually between vessels or between vessels and land stations, such as navigational support facilities and other facilities.

(2) Vessel B

- 1) At 0701:45: Latitude 33°58'02.5"N, Longitude 130°53'35.9"E, with a course over the ground of 358.9°, bow bearing of 353°, and speed of 1.8 kn (Turning to port and accelerating).
- 2) At 0705:03: Latitude 33°58'11.3"N, Longitude 130°53'30.2"E, with a course over the ground of 315.4°, bow bearing of 316°, and speed of 4.1 kn (Turning to port and accelerating).
- 3) At 0715:05: Latitude 33°58'04.9"N, Longitude 130°52'34.1"E, with a course over the ground of 234.4°, bow bearing of 246°, and speed of 5.9 kn (Turning to port and accelerating).
- 4) At 0720:04: Latitude 33°57'45.9"N, Longitude 130°52'07.3"E, with a course over the ground of 224.6°, bow bearing of 229°, and speed of 5.4 kn (Turning to port).
- 5) At 0732:05: Latitude 33°56'54.1"N, Longitude 130°51'53.3"E, with a course over the ground of 172.8°, bow bearing of 180°, and speed of 4.8 kn.
- 6) At 0735:05: Latitude 33°56'39.2"N, Longitude 130°51'56.6"E, with a course over the ground of 165.4°, bow bearing of 171°, and speed of 5.1 kn (Turning to port).
- 7) At 0740:05: Latitude 33°56'14.9"N, Longitude 130°52'09.4"E, with a course over the ground of 154.9°, bow bearing of 159°, and speed of 5.4 kn (No speed change).
- 8) At 0741:05: Latitude 33°56'10.1"N, Longitude 130°52'12.4"E, with a course over the ground of 149.6°, bow bearing of 150°, and speed of 5.3 kn (Turning to port and no speed change).
- 9) At 0742:01: Latitude 33°56'06.1"N, Longitude 130°52'15.7"E, with a course over the ground of 135.2°, bow bearing of 118°, and speed of 5.0 kn (Turning to port and slightly decelerating).
- 10) At 0742:28: Latitude 33°56'04.9"N, Longitude 130°52'17.9"E, with a course over the ground of 114.3°, bow bearing of 093°, and speed of 4.7 kn (Turning to port and slightly decelerating).
- 11) At 0742:34: Latitude 33°56'05.1"N, Longitude 130°52'18.4"E, with a course over the ground of 028.7°, bow bearing of 084°, and speed of 6.2 kn (Course over the ground changing suddenly and accelerating sharply).
- 12) At 0743:01: Latitude 33°56'07.4"N, Longitude 130°52'20.2"E, with a course over the ground of 036.6°, bow bearing of 076°, and speed of 5.7 kn (Course over the ground turning further to port).

(See Table 2 AIS Record of Vessel B.)

2.1.2 Engine motion of Vessel A

- (1) According to the record of the Engine Telegraph Logger², the engine motion of Vessel A was as follows.

² "Engine Telegraph Logger" is an instrument which records the status of Engine Telegraph manipulation (utilizing the main engine).

Recorded time on the Engine Telegraph Logger	Status of the Engine Telegraph
0730:30, July 22	Dead Slow Ahead
0731:30, July 22	Slow Ahead
0733:00, July 22	Half Ahead
0734:30, July 22	Harbor Full Ahead
0740:30, July 22	Slow Ahead
0741:00, July 22	Stop Engine
0741:30, July 22	Full Astern

According to the statement of the pilot³ who was on board Vessel A at the time of the collision, the recorded time on the Engine Telegraph Logger of Vessel A was 30 seconds ahead of the time shown on the clock of Vessel A (Japan Standard Time).

(2) According to the logbook of Vessel A, the engine motion of Vessel A was as follows.

Time	Engine motion
0730, July 22	Dead Slow Ahead
0735, July 22	Harbor Full Ahead
0739, July 22	Stop Engine
0741, July 22	Full Astern

2.1.3 The operations of the vessels stated by the crew

(1) Vessel A

According to the statements from the chief officer (hereinafter referred to as “Chief Officer A”), third officer (hereinafter referred to as “Third Officer A”), an ordinary seaman (hereinafter referred to as “Ordinary Seaman A”), the pilot who was directing the vessel when leaving the berth (hereinafter referred to as “Pilot A1”), the pilot who was directing the vessel at the time of collision (hereinafter referred to as “Pilot A2”), the response to the questionnaire by the second officer (hereinafter referred to as “Second Officer A”), the pilot log written by the two pilots, and the collision report written by the master of the tugboat Sanpomaru, the process until the occurrence of the accident of Vessel A was as follows.

Vessel A was berthed head-in on her starboard side at No. 4 berth of Seitetsu-Tobata Hakuchi in Wakamatsu Section 5 in Kanmon Port (hereinafter referred to as “Tobata No.4 Berth”). Early in the morning on July 22, 2008, the master of Vessel A (hereinafter referred to as “Master A”) positioned the crew, began to operate two radars fitted with Automatic Radar Plotting Aids⁴

³ “Pilotage” refers to the act of a pilot boarding a vessel and directing it in a pilotage area. (Article 2 of the Pilotage Law)

⁴ “Automatic Radar Plotting Aids (ARPA)” is an instrument which automatically processes the position change of other vessels detected by radar and shown on the display; indicating the course, speed, the closest point of approach (CPA) and time to the closest point of approach (TCPA); indicates the estimated position of other vessels; and warns the risk of collision with other vessels.

(hereinafter referred to as “ARPA”) and other instruments, finished the preparation for leaving port, and waited for the pilots to board the vessel.

Pilot A1 and Pilot A2 boarded Vessel A at about 0705 in order to leave port at slack water⁵ in the vicinity of Tobata Passage in Kanmon Port. Master A handed over the pilot card⁶ of Vessel A to both pilots at the time of boarding and both pilots handed over the pilot information card⁷ to Master A. They exchanged the information. At this moment the pilots explained to Master A that Pilot A1 would direct the vessel first, and also explained where they would rotate shifts, the positioning of tugboats, the turning spots, and the outline of the steering schedule. They confirmed that the preparation had been completed.

At about 0715-0716, Pilot A2 reported to Kanmon MARTIS by VHF radio telephone (hereinafter referred to as “VHF”) that Vessel A was soon to leave the berth. Then he received information from Kanmon MARTIS about a vehicle carrier (boarded by a pilot) (hereinafter referred to as “Vessel C”), which was navigating westward through Kanmon Passage. He confirmed that Tobata Signal Station showed a flashing red-light departure signal⁸ every 2 seconds as a control signal of Tobata Passage.

Vessel A, with the master and 19 crew members on board, raised the International signal flags on the mast above the bridge, displaying 1st Substitute, W and M flags⁹ vertically, indicating a Traffic Route Signal¹⁰ to follow, and H flag separately, showing pilots on board. At about 0718, Vessel A let go all mooring lines and left Tobata No.4 Berth for Gladstone Port in Australia under the

⁵ “Slack water” refers to the state of the tide when the tidal current gradually weakens and stops (The speed is 0).

⁶ “Pilot Card” is a card that the master hands to pilots on board and that shows the particulars, draft, speed and other matters.

⁷ “Pilot Information Card” is a card that the pilots on board hand to the master and that shows the situation of the port, scheduled navigation areas, tidal currents and others.

⁸ The meaning of “departure signal in Tobata Passage” is as follows.

Vessels leaving port may leave the port. Vessels entering port with a gross tonnage of no less than 500 tons must wait outside the passage avoiding the course of vessels leaving port. Vessels entering port with a gross tonnage of less than 500 tons may enter the port. (Article 20.2 of the Ordinance for Enforcement of Act on Port Regulations, attached Table No. 4)

⁹ “1st Substitute Flag, W Flag, and M Flag” are one of the Traffic Route Signals used in Kanmon Port and vessels setting up these flags are supposed to leave/pass for western entrance of Kanmon Passage, and proceed to the east of Mutsure Shima Island. (Article 20.2 of the Ordinance for Enforcement of Act on Port Regulations, attached Table No. 4)

¹⁰ “Traffic Route Signal” is a signal which indicates the route to follow in the port stipulated by each port under the notice of Japan Coast Guard, based on Article 11 of the Ordinance for Enforcement of Act on Port Regulations. Vessels display International Signal Flags to indicate to other vessels their route to the destination in port.

con of Master A, directed by Pilot A1¹¹, in ballast condition.

Master A conned the vessel at the starboard side of the steering gear located at the center of the bridge, deployed Third Officer A on the engine control panel and Ordinary Seaman A at the manual steering gear.

Pilot A1, whose turn within Kanmon Straits & Harbour Pilot Association (hereinafter referred to as “Kanmon Straits and Harbour Association”) on that day, was ahead of Pilot A2 and assumed piloting first at the starboard wing of the bridge supported by Pilot A2. He positioned four supporting tugboats, Yahata-maru No.1, Chikuho-maru, Sanpo-maru and Happo-maru (hereinafter referred to as “Vessel No.1-Vessel No.4” respectively). As Vessel A was berthed head-in on her starboard side at the berth, Pilot A1 secured Vessel No. 1’s line on her port bow, Vessel No. 4’s line on her port quarter, and ordered Vessel No.2 and No.3 to push her starboard bow. Vessel A began to turn to port in front of the berth heading toward Tobata Passage.

At about 0730, Pilot A2 sighted Vessel B on her port bow at about 30°, 1.8 nautical miles (hereinafter referred to as “M”) off. He tried to confirm the destination indication signal of Vessel B through binoculars, but could not identify the International signal flags, so he thought she had stopped or was proceeding at a very slow speed. Pilot A1 was notified by Pilot A2 about the presence of Vessel B, and recognized her near Kanmon Passage No.9 Light buoy, (hereinafter “Kanmon Passage” is omitted from the name of Light buoys). He thought she would cross ahead of Vessel A and saw no risk of collision. Pilot A2 blew two short blasts¹² at this time.

As the bow headed toward Tobata Passage at about 0730, Pilot A1 ordered the engine to be set at dead slow ahead and released the tug lines of Vessel No.1 and Vessel No.4. Then he positioned Vessel No.2 to watch out for the towing vessel (ahead of the starboard side of Vessel A), which was proceeding westward out of the fairway off Sakaigawa Channel, and Vessel No.3 near Light buoy No.12 to watch out for the vessel (ahead of the port side of Vessel A) proceeding eastward through Kanmon Passage.

At about 0731, Pilot A1 ordered the direction to be set to 045°, keeping the engine set to slow ahead. He directed Vessel No.1 and Vessel No.4 to accompany Vessel A on the port side of her bow and quarter.

On the other hand, Pilot A2 directed Vessel No.3, which was heading for Light buoy No.12, to confirm the movement of Vessel B. Vessel No.3, when she was near Light buoy No.12, watched Vessel B in the vicinity of Light buoy No.10 and reported to Pilot A2 that Vessel B looked like she was nearly stopping and that her destination was not clear.

Pilot A2 reported to Kanmon MARTIS with VHF that Vessel A would enter into Tobata Passage. At this moment he received the information that Vessel C and the succeeding three vessels

¹¹ “under the con of Master A, directed by Pilot A1” means that the master is the commander of maneuvering the vessel but the pilot is entrusted the control of the vessel by the master, and he gives instructions about the course, speed, signals, utilization of tugboats, and other matters on behalf of the master and he takes the actual con of steering the vessel.

¹² “2 short blasts on the whistle” is one of the manoeuvring signals stipulated in Paragraph 1, Article 34 of the Act on Preventing Collision at Sea and, when vessels are in sight of one another, it indicates that a power-driven vessel is altering her course to port.

were proceeding westward. Pilot A2 communicated with Vessel C, which was directed by a pilot by walkie-talkie, and they agreed that Vessel A should go ahead of Vessel C. Therefore Vessel C slowed down so that Vessel A could precede.

At about 0732, as Vessel A settled course on Tobata Passage, Pilot A2 took over from Pilot A1 under the approval of Master A. Then Pilot A2 began to direct the vessel at the front central part of the bridge and Pilot A1 was positioned on the starboard front of the bridge to support Pilot A1.

At about 0733, Pilot A2 ordered the course to be set on 033°.

At about 0733, Pilot A2 ordered that the engine be set to harbor-full speed ahead taking into account anticipated drift to starboard side due to the side current from the port side in Tobata Passage. Then Vessel A proceeded, steering slightly to the west of the central line of Tobata Passage toward Kanmon Passage.

At about 0735, Vessel No.3 reported to Pilot A2 that Vessel B was making her way toward Sakaigawa at slow speed. Pilot A2 thought that Vessel B would cross astern of Vessel A after Vessel A crossed Kanmon Passage because small vessels navigating eastward in Kanmon Passage normally proceed southward close to Light buoy No.10 and then set course on Oseto No.1 Leading Lights. But later he recognized that Vessel B was proceeding southward near the center of the passage, and ordered Vessel No.3 to ask Vessel B to accelerate and pass ahead of Vessel A swiftly as he saw the risk of collision with Vessel B in Kanmon Passage.

On receipt of the order, Vessel No.3 approached Vessel B from her port quarter and requested three or four times in English via the loudspeaker (Vessel No.3 made requests to Vessel B in the same way from this time on) to accelerate to full ahead, then confirmed that the crew of Vessel B gave a sign of consent by a hand signal at around 0735. But Vessel B did not accelerate, so Vessel No.3 reported to Pilot A2 that although the master of Vessel B consented to accelerate the vessel, the speed had not actually changed.

Vessels have usually complied with requests from large-sized vessels via tugboats in his experience. Therefore, Pilot A2 supposed Vessel B would also comply with this request to accelerate and pass ahead of Vessel A as usual.

Pilot A2 was keeping look-out for the movement of Vessel B and noticed that there was a risk of collision. At about 0736, he gave five short and rapid blasts on the whistle¹³ to urge Vessel B to accelerate. At about 0737, he repeated the same sound signal on the whistle, but did not slow down his own vessel immediately, as Vessel A was supposed to go ahead of Vessel C.

At about 0738, Pilot A2 ordered Vessel No.3 to request Vessel B to pass Vessel A on the starboard side of the other, but later he changed the direction to port side of the other.

Vessel No.3 requested Vessel B to pass port side of the other, but Vessel B did not change her course and speed. Therefore, at about 0739, it reported to Pilot A2 that Vessel B had not accelerated.

Pilot A1, who was supporting Pilot A2, ordered Vessel No.3 to request Vessel B to stop or set her engine to full astern if she would not accelerate.

Pilot A2 set the engine to dead slow ahead.

¹³ “five short and rapid blasts on the whistle” is a warning signal stipulated in Paragraph 5, Article 34 of the Act on Preventing Collision at Sea and it indicates doubt when vessels in sight of one another are approaching each other and either vessel fails to understand the intension or actions of the other or is in doubt as to whether sufficient action is being taken by the other to avoid collision.

Vessel No.3 requested Vessel B to set the engine to full astern with hard starboard.

As Pilot A2 did not observe any change in the action of Vessel B, he felt the risk of collision. At about 0740, he issued an order to stop the engine and hard starboard (35°). But Vessel B looked like she was turning to port, so when the rudder angle indicator showed about 20° starboard, he ordered the rudder to midship, followed by to hard port (35°).

At this moment, Pilot A1 asked Pilot A2 if it was necessary to put the engine to full astern, but Pilot A2 did not order immediately because the bow bearing of Vessel B was gradually turning to starboard.

At about 0741, Master A and Pilot A2 almost simultaneously issued orders to set the engine to full astern.

At about 0742:30, the bow of Vessel A, heading 018°, collided with Vessel B in the starboard center of the hull, while Vessel A's engine was at full astern.

(2) Vessel B

According to the statements from the Master of Vessel B (hereinafter referred to as "Master B") and an ordinary seaman (hereinafter referred to as "Ordinary Seaman B"), the process until the occurrence of the accident of Vessel B was as follows.

Vessel B left Ningbo Port in the People's Republic of China for Kanmon Port at about 2245 (local time, UTC + 8 hours), July 16, 2008, with Master B and 9 crew members on board. At about 1545, July 19, she dropped anchor at the position 042°, 2,690 meters off Daibahana Lighthouse in quarantine anchorage, east of Mutsure Shima Island in Shimonoseki-City, Yamaguchi Prefecture in order to adjust berthing time at the destination.

At about 0700, July 22, Master B coned Vessel B and weighed anchor. He deployed Ordinary Seaman B at the manual steering gear, directed the vessel toward Sakaigawa Berth in Wakamatsu Section 5 in Kanmon Port, raising 2nd Substitute Flag No.2, R Flag, and S Flag¹⁴, all of which are international signal flags, as a Traffic Route Signal.

Master B started 2 radars, set one of them at 1M range and the other 0.75M range. Then he set the engine at 290rpm, adjusted the blade angle to 16°, and directed the vessel to enter Kanmon Passage from the northern side of Light buoy No.5. He indicated Light buoy No.10 as a steering mark to Ordinary Seaman B and directed the vessel to proceed southward through this passage at 5 kn.

Master B identified Vessel A and 4 tugboats almost on dead ahead for the first time when Vessel B was gradually altering her course to port toward Light buoy No.12, proceeding southward to the west of Daibahana Tidal Stream Signal Station.

Master B determined the situation as Vessel A was proceeding toward Kanmon Passage at slow speed so as to enable her to avoid Vessel B, which was proceeding through the passage.

At about 0736, when Vessel B approached Light buoy No.10, Master B ordered the vessel to

¹⁴ "Representative Flag No. 2, R Flag, and S Flag" is one of the Traffic Route Signals used in Kanmon Port and vessels displaying these flags are indicating to proceed toward the mooring facilities located between Sakaigawa Nippon Steel Chemical Pier or Wakamatsu No. 5 Ward Nippon Steel Chemical Products Shipping Wharf and Sakaigawa Public Wharf. (Notice of Japan Coast Guard based on Article 11 of the Ordinance for Enforcement of Act on Port Regulations)

alter her course to port and ride on the course line (141°) to Oseto No.1 Leading Light¹⁵.

As Vessel B was approached by Vessel No.3 which requested Master B to accelerate, he expressed his consent by swinging his hands up and down at the port wing. As Vessel A appeared to be accelerating, he raised the blade angle rapidly from ahead 16° to 20° at about 0737.

Later the chief officer at the bow reported to Master B that he had heard the whistle of Vessel A. Master B felt that there was a risk of collision with Vessel A as he had learned she was accelerating.

Vessel No.3 requested Master B to put engine full astern and take a hard starboard. He tried to avoid collision by turning the rudder to port 30° because there was a Light buoy on the starboard side of Vessel B and the water was not deep enough outside the passage. But he did not slow down Vessel B because he was increasing her speed owing to the request from Vessel No.3.

At about 0739, while Vessel B was turning to port, the starboard center hull of Vessel B collided with the bow of Vessel A.

At about 0740, immediately after the collision, Master B adjusted the blade angle to 0°.

A few days later, Master B confirmed the collision time recorded by AIS was about 0742.

The date and time when this accident occurred were at about 0742:30, July 22, 2008. The position of the occurrence was in the vicinity of 185° and 1,630 meters from Daibahana Lighthouse.

(See Figure 1 Assumed Navigation Route, Figure 2 Assumed Navigation Route (Magnified), Figure 3 Situation of the Collision, Table 3 AIS Record of Vessel A, and Table 4 AIS Record of Vessel B.)

2.1.4 Rotation and handover of pilots' shifts

According to the statements from Pilot A1 and A2, the details were as follows.

(1) On the day of the accident, the turn of Pilot A1 was before that of Pilot A2, and they talked about it in advance and decided not to change the rotation. Therefore Pilot A1 assumed the maneuvering of the vessel during the leaving from the berth.

(2) The Kanmon Straits and Harbour Association does not impose any rules about the handover point of pilots. But it was customary to handover before the vessel entered Kanmon Passage after leaved the berth when the vessel set sail from Seitetsu-Tobata Hakuchi toward the west entrance of Kanmon Port. They discussed this and decided on the rotation spot. They rotated the shift at about 0732 when the bow of Vessel A turned toward Tobata Passage.

(3) When they rotated the shift, they notified Master A and got his approval. They also notified Third Officer A and Ordinary Seaman A to make sure they were aware of the situation.

¹⁵ A "leading lights" are a pair of lights consisting of a front and rear light that flash, each on a conspicuous construction installed on shore. When these are in line from a waterway difficult to navigate or a narrow entrance of a bay, the extending line of the pair (the leading line) indicates the course line of the passage shown on nautical charts.

2.1.5 The directions from Master A, the advice of pilots, and sharing and utilization of information on the bridge.

(1) According to the statements from Pilot A1 and A2, the details were as follows.

1) Pilot A1 and Pilot A2 accepted the pilot cards from Master A, handed over the pilot information card to him and explained to him the outline of the steering methods. There were no questions or directions from Master A. After this moment Master A did not give them any directions about steering the vessel until he and Pilot A2 almost simultaneously ordered to set the engine to full astern before the collision.

2) When Pilot A2 stopped the engine, Pilot A1 asked Pilot A2 if it was necessary to put the engine to full astern. Pilot A2 did not order to do so immediately because the bow bearing of Vessel B appeared to be turning rightward and he supposed Vessel B could cross ahead of Vessel A.

3) Pilot A1 did not advise Pilot A2 to slow down or stop the engine without delay because Pilot A2 was more experienced as a pilot.

4) Neither pilot gave Master A advice or notification except the report of their shift. They did not confirm the information about Vessel B through ARPA or AIS because visibility was quite clear at the time and they could identify Vessel B with their own eyes.

5) When a pilot is on board, a master does not steer the vessel himself but entrusts the pilot to do it. However, the pilot gave the master an explanation on maneuvering the vessel in a situation involving other vessels, on the timing of deceleration, etc. to enable the master to command the vessel properly in congested waters such as Hayatomo Seto or other spots.

(2) According to the statement from the executive of Kanmon Straits and Harbour Association, the details were as follows.

1) Kanmon Straits and Harbour Association always instructs pilots that when two pilots are onboard a vessel, the pilot who directs the vessel (hereinafter referred to as “chief pilot”) and the other one, who supports the chief pilot (hereinafter referred to as “assistant pilot”), should not just do their own jobs but they should also support each other and keep the vessel under double check. The assistant pilot should actively support the chief pilot.

2) Pilots ask masters to direct the vessel as pilots cannot directly issue orders or directions to the individual crew members. Pilots try to collect necessary information from officers because they often embark on vessels for the first time and there are many types of navigational equipments. But actually pilots just ask officers to confirm the speed of other vessels by AIS or ARPA, or to keep watch outside when there are a lot of fishing boats around the vessel. In most cases pilots try to collect information and steer the vessel themselves.

(3) According to the statements from Third Officer A and Ordinary Seaman A, Third Officer A was positioned on the engine control panel until the collision, and Ordinary Seaman A was on the manual steering gear. They could communicate well with the pilots because they issued orders in English.

2.1.6 Steering methods

According to the statements from Pilot A1 and A2, the details were as follows.

(1) Ordinary steering methods to leave ports

When Vessel A proceeds through Tobata Passage and thence enters Kanmon Passage, the vessel sometimes encounters a sidewise tidal current and drifts downstream, and therefore in order to cross Kanmon Passage swiftly it is necessary to enter at a considerable speed. At the time of the accident, all of the following are decided and implemented in accordance with the normal practice of sailing procedures from Seitetsu-Tobata Hakuchi : the maneuvering of the vessel to leave the berth; the use of tugboats; the use of the engine, including the place where she is put at full ahead, the location of pilots' shift rotation, the course setting in Tobata Passage.

(2) Evasive action of large-sized vessels and maneuvering support of tugboats

It is very difficult for large-sized vessels like Vessel A to avoid other vessels in Kanmon Passage by her own maneuvering when leaving Seitetsu-Tobata Hakuchi . Therefore, Vessel A used 4 tugboats to leave the berth, and after having turned around, released two of the tugboats and positioned them to lookout for other vessels in Kanmon Passage, and then accompanied the other two tugboats that were standing by Vessel A to assist at anytime. When meeting with transiting vessels in Kanmon Passage, it is normal practice to request their cooperation regarding adjusting their speed or which side to clear and to confirm mutual safe navigation via the tugboats. Most vessels in that passage have complied with such requests from tugboats. Some vessels have avoided large-sized vessels like Vessel A depending on the information provided by Kanmon MARTIS. When the speed of Vessel A was over 4 kn, the support from the tugboats was not effective, but they were scheduled to accompany Vessel A to the west of Daibahana Lighthouse as a precautionary measure.

2.1.7 VHF Communication

(1) Information from Kanmon MARTIS

According to the questionnaires answered by Kanmon MARTIS and others, the details were as follows.

- 1) The VHF communication (report) about the accident between 0715-0745, July 22 and the contents (outline) of the information are shown in the table below.

Communication (report) time Sender→Receiver	Contents (outline) of the information
About 0717 Pilot A2→Kanmon MARTIS Kanmon MARTIS→Pilot of Vessel A	Reported they began to leave the berth for MN Line ¹⁶ via Tobata Passage. Informed that Vessel C was navigating westward near Lighted Buoy No.29.
About 0732 Pilot A2→Kanmon MARTIS Kanmon MARTIS→Pilot of Vessel A	Reported that the Vessel A would navigate into Tobata Passage toward MN Line. Confirmed the position of Vessel A. Informed that there were many vessels navigating westward near Lighted Buoy No.19. (No information about Vessel B)
Kanmon MARTIS→Each Vessel	General broadcasted ¹⁷ (in Japanese) that Vessel A would navigate into Tobata Passage toward MN Line.
About 0735 Kanmon MARTIS→Each Vessel	General broadcasted (in English) that Vessel A would navigate from Tobata Passage toward MN Line and the eastern side of Mutsure Shima Island.
About 0744 Pilot of Vessel A→Kanmon MARTIS	Reported that Vessel A had collided near Lighted Buoy No.11
About 0745 Kanmon MARTIS→Each Vessel	Broadcasted the accident information in English and Japanese. Called for the attention of each vessel in Kanmon Passage.

- 2) There was no communication with VHF between Kanmon MARTIS and Vessel B
- 3) After the accident, Kanmon MARTIS broadcasted the information about Vessel B with VHF while Vessel B was in Kanmon Passage. After Vessel B anchored, it informed the vessels entering into Nishiyama Ku in Kanmon Port about Vessel B. It offered AIS information to vessels equipped with AIS.

¹⁶ The “MN Line” is one of the position reporting lines defined in the north of Mutsure Shima Island for Kanmon Martis to receive position reports from vessels. In case a vessel requiring an advance notice reports her position when passing the MN line to Kanmon Martis with VHF or other instruments, Kanmon Martis confirms the echo of the vessel on the MN Line shown on the radarscope to identify the vessel reported and keeps tracking of the echo for subsequent observation.

¹⁷ The “general broadcasted” means Kanmon Martis provides information with VHF without limiting its receiving sections (vessels) in a form of broadcasting so that every vessel can listen to it.

(2) Communication between Vessel A and other vessels

According to the statement from Pilot A1, Kanmon MARTIS informed him about Vessel C and other westbound vessels. Therefore, he communicated with walkie-talkie with Vessel C, which was being directed by a pilot. Kanmon MARTIS did not inform him about Vessel B. He did not communicate with Vessel B with VHF until the accident occurred.

(3) According to the statements of Pilot A2 and Master B, Vessel A and Vessel B were listening to VHF channel 16.

2.2 Data on mitigation of damage

According to the statements of Pilot A1, Pilot A2 and Master B, information from Japan Coast Guard, and the Salvage Report, the details were as follows.

(1) Vessel A

After the collision, the engine order of Vessel A were put full astern, but Vessel A kept moving forward slowly northeast by inertia and pushing Vessel B by her bow. Five minutes after the collision, at about 0748, Vessel B moved away from the bow. As the hull of Vessel B listed to the starboard side, the pilots directed Vessels No.2 and No.3 to rescue the crew of Vessel B. At about 0758, they rescued the eight crew members of Vessel B.

Later, Vessel A secured the tug lines at her starboard bow and port side quarter. She stopped near the center of Kanmon Passage, holding her hull almost in parallel with the Passage and heading approximately southeast. After other vessels passed through, Vessel A turned around clockwise with Vessel No.1 pushing her port bow and Vessels No.2 and No.4 pulling the tug line. At about 0821, Vessel A completed turning her around and commenced proceeding toward the anchorage at the northern side of Mutsure Shima Island. At about 0910, she cast anchors at nearly 2.4 M off Mutsure Shima Island Lighthouse in the direction of 000°.

(2) Vessel B

Vessel B was pushed northeast slowly by Vessel A after the collision. She was separated from Vessel A at about 0748. Vessel B was flooded in the cargo hold but not in the engine room. At about 0755, Vessel B cast starboard anchor in the north of Kanmon Passage nearly halfway between Lighted Buoy No.11 and No.13 and stopped, the flooding causing her to list about 20° to the starboard side.

At the anchorage at about 0758, eight crew members of Vessel B were rescued by the tugboats. The other two crew members lowered and got in the lifeboat stowed on the starboard poop deck of Vessel B. They were rescued by a patrol boat near the Refinery Berth at Hikoshima, Shimonoseki City at about 0820.

The salvage company waterproofed the vessel B temporarily, drained the water out, and confirmed that there was no other flooding in the vessel. After that, Vessel B was towed by a tugboat and arrived at the berth in Nishiyama Ward in Kanmon Port at about 1055, July 23.

(3) Japan Coast Guard

1) Inspection of damage to Vessel B and the request for the owner

From 0900 to 1030, July 22, Japan Coast Guard divers inspected Vessel B and confirmed that there was damage in the form of three cracks running in the vertical direction from the center starboard side of the hull to the bottom, and water was leaking in from the cracks. He closed nine air vents of fuel tanks and other instruments.

Japan Coast Guard asked the People's Republic of China Maritime Search and Rescue Center to direct the owner of Vessel B to salvage the vessel promptly.

2) Mobilization and activities

On July 22, five patrol boats and two airplanes were mobilized, and on July 23, two guard boats were mobilized. They took part in the rescue of the crew, oil spill investigations, and traffic control for transiting vessels.

There is no restriction or prohibition on marine traffic based on Article 37 of Act on Port Regulations.

(4) Salvage Company

At about 1255, July 22, the insurance company (registered in Hong Kong) that insured Vessel B made a contract with a salvage company to salvage Vessel B.

The salvage company immediately took part in the operation, but it stopped the operation at about 1300, because the body of Vessel B listed further to the starboard side to about 24°. From about 1335, three salvage company divers started the diving operation. They closed the cracks with wooden stoppers and water cement as emergency waterproofing during the slack water period at around 1430. They finished the operation at about 1445.

Later, at about 1533, they began to use a pump (drainage capability: 60t/h) to drain the water from the flooded cargo hold and Ballast Tank No.1 and No.3 on the starboard side of the double bottom. They completed the drainage before 1637. As a result, the hull floated up about 10 cm on average but she still remained listed about 24° to the starboard side.

At about 1740, Vessel B was pushed by the current toward the east, dragging anchor and shifting her position. So the tugboats towed Vessel B and she cast her anchor again at about 230 meters from the former anchorage, toward the east-southeast. After that, one of the tugboats secured the tug line from the bow of Vessel B and other one moored alongside Vessel B so that she could not drift away by a current. The lookout boats took precautions around her.

From about 0814, July 23, the divers of the salvage company investigated the bottom hull of Vessel B to confirm the emergency waterproofing repairs made and other matters. As they did not find any other leakage, they began to tow Vessel B by tugboat at about 1025 and Vessel B berthed in the Nishiyama Wharf, Nishiyama Ku in Kanmon Port at about 1055.

2.3 Injuries to Persons

There were no casualties on either vessel.

2.4 Damage to Vessel

(1) Vessel A

Vessel A had a dented bow and a scratch from the bow to the port center part of the hull.

(2) Vessel B

According to investigations conducted at the site, the statement from Master B, information from Japan Coast Guard, and the salvage report, the details were as follows.

Vessel B had a dent near the upper deck on the hull, 10 meters wide at the widest point, from the upper deck near the middle part of the starboard side to the bottom. There was another vertical wedge-shaped dent from the upper dent to the bottom, about 0.7 meters deep at the deepest point. The cargo hold was flooded with seawater from the crack on the hull below sea level. The cargo of packaged graphite became wet and the hull listed 24° to the starboard side, but the vessel did not capsize. The hatch cover and hatch coaming on the upper deck were bent in the collision.

(See Photo 3 Vessel B and Photo 4 Starboard of Vessel B).

2.5 Information on Crew and others

(1) Gender, Age, and Certificate of Competency

1) Master A male, 52 years old

Documentary proof of application for a recognition endorsement under STCW regulation I/10
-First Grade Navigation Officer (Issued by the Republic of Panama)

2) Third Officer A male, 34 years old

3) Ordinary Seaman A male, 52 years old

4) Pilot A1 male, 55 years old

Kanmon Pilotage Area Chief Pilot License

Date of Issue: March 18, 2008

Date of Revalidation: March 18, 2008

Date of Expiry: March 17, 2013

5) Pilot A2 male, 64 years old

Kanmon Pilotage Area Chief Pilot License

Date of Issue: January 7, 1998

Date of Revalidation: December 7, 2007

Date of Expiry: January 6, 2012

6) Master B male, 34 years old

Documentary proof of application for a recognition endorsement under STCW regulation I/10
-Master (Master of vessels larger than 3,000 gross tons, issued by the Kingdom of Cambodia)

Date of Expiry: December 28, 2012

Licensed Master

(Issued by Shandong Maritime Safety Administration, the People's Republic of China)

Date of Issue: December 28, 2007

7) Ordinary Seaman B male, 37 years old

(2) Major Seagoing Experiences and Others

1) Master A

Major seagoing experiences on vessels of Master A are unidentified.

2) Third Officer A

According to the statement of Third Officer A, he embarked on a cargo vessel for the first time in 1997. He embarked on Vessel A on May 26, 2008. He had previously navigated through Kanmon Strait 5 times.

3) Ordinary Seaman A

According to the statement of Ordinary Seaman A, he embarked on Vessel A on February 14, 2008.

4) Pilot A1

According to the statement of Pilot A1, the details were as follows.

a) Major seagoing experiences

He joined a shipping company in 1974 as an officer. He was promoted to master in about 1997 for the first time. He resigned from the shipping company in September 2007 and became a pilot in Kanmon Pilotage Area in March 2008.

b) Number of piloted vessels

In the 4 months between his becoming a pilot and the accident, he had directed 115 vessels, including 6 large vessels coming to Tobata No.3 and No.4 Berth, but this was his first time to embark on Vessel A as a pilot.

5) Pilot A2

According to the statement of Pilot A2, the details were as follows.

a) Major seagoing experiences

He joined a shipping company in 1967 as an officer. He was promoted to master in about 1991 for the first time. He resigned from the shipping company and became a pilot in Kanmon Pilotage area in January 1998.

b) Number of piloted vessels

He directed large ore and coal carriers, LNG carriers and other vessels about 5 times a month and had directed more than 600 vessels navigating through Tobata Passage in the period of about 10 years between his becoming a pilot and the accident. But this was his first time to embark on Vessel A as a pilot.

6) Master B

According to the statement of Master B, the details were as follows.

a) Major seagoing experiences

He embarked on a ferry as a ordinary seaman for the first time in March 1997 and became a ordinary seaman on a large cargo vessel in August of the same year. In September 1998 he became a third officer and embarked on container vessels and cargo vessels. Later he was promoted to second officer of ocean-going vessels and became Chief Officer in May 2005. In April 2008 he became a master for the first time and embarked on Vessel B, a tramp vessel between Japan and China.

b) Navigation Experience through Kanmon Strait

When he was an officer of a container liner between Japan and Korea, he navigated through the Kanmon Strait about once a week, so he had experienced round-trip navigation about 30 times. On Vessel B, he had navigated through the strait twice as a master, but this was his first time to enter Kanmon Port. He had not let pilots get on board before when navigating through Kanmon Strait.

7) Ordinary Seaman B

According to the statement of Ordinary Seaman B, he embarked on a coastwise cargo vessel in the People's Republic of China as an ordinary seaman for the first time when he was 24 or 25 years old. Later he embarked on a maximum 36,000-gross-ton, ocean-going vessel. He embarked on vessel B in February 2008.

2.6 Vessel Information

2.6.1 Particulars of Vessels

(1) Vessel A

IMO Number:	9271626
Port of registry:	Panama (Republic of Panama)
Owner:	Stiringaster Line Inc. (Republic of Panama)
Management company:	Hukujin Steamer Co., Ltd. (hereinafter referred to as "Company A")
Gross tonnage:	88,594 tons
L×B×D:	289.00m×45.00m×24.10m
Hull material:	Steel
Engine:	One diesel engine
Output:	14,330 kW (continuous maximum)
Propulsion:	One fixed pitch propeller
Year of construction:	2005
Navigation area:	Pelagic area (international navigation)
Use:	Cargo vessel
Number of crew:	20 crew members (4 Koreans, including the master, and 16 Filipinos)

(2) Vessel B

IMO Number:	8410873
Port of registry:	Phnom Penh (Kingdom of Cambodia)

Owner:	Hong Kong Jieda Shipping Co., Limited (People's Republic of China)
Management company:	Yantai Xiangrui Int'l Vessel Management Co., Ltd. (People's Republic of China) (hereinafter referred to as "Company B")
Gross tonnage:	1,312 tons
L×B×D:	73.00m×11.50m×7.00m
Hull material:	Steel
Engine:	One diesel engine
Output:	742 kW (continuous maximum)
Propulsion:	One controllable pitch propeller
Year of construction:	1985
Navigation area:	Pelagic area (international navigation)
Use:	Cargo vessel
Number of crew:	10 crew members (all Chinese)

2.6.2 Loading condition

(1) Vessel A

According to the statement of Third Officer A, the questionnaire replied by Second Officer A, and the pilot card, the details were as follows.

Vessel A was loaded with iron ore at Port Hedland, Australia. Half of the ore was unloaded at Kisarazu Port, Chiba Prefecture. On July 18, 2008, she entered Kanmon Port and arrived at Tobata No.4 Berth, where the approximately 92,959 tons of remaining ore was unloaded. Then Vessel A, with an empty cargo hold, was filled with 65,500 tons of ballast water. Her bow draft and aft draft leaving the port were 8.20 meters and 9.28 meters respectively.

(2) Vessel B

According to the statement of Master B, Vessel B was loaded with 1,594 tons of graphite (non-dangerous goods) and her bow draft and aft draft leaving Shanghai Port were 3.7 meters and 5.3 meters respectively.

2.6.3 Data on equipment of the vessels

(1) Vessel A

The general arrangement of the equipment on the hull and the bridge was as follows.

Vessel A was an aft-bridge type bulk cargo vessel with 9 cargo holds with hatch openings about 15.2 m long and 21.0 m wide. The superstructure, which had an 11-meter-wide bridge on the uppermost deck, was on above the upper deck on the quarter. The engine room was placed below the upper deck. There were 5 wide windows on the front wall of the bridge and visibility was good.

On the bridge, Radar No.1 with ARPA attached and Radar No.2 were installed on the starboard side, a gyrocompass repeater and steering gear were in the center, and an engine remote control board with an engine telegraph was on the port side. On the starboard side of the bridge front, the push button of the whistle, the VHF and the AIS were installed. On the starboard side of the bridge back was a chart table equipped with 2 GPS receivers on the upper side. On the port side of

her, there were telecommunications consoles equipped with a NAVTEX receiver¹⁸. There was a Voyage Data Recorder¹⁹ (VDR) which could record the navigation of Vessel A for 12 hours.

On the upper bridge deck, GPS antenna No.1 and AIS antenna were on the port side front and GPS antenna No.2 on the starboard side rear. The distance between GPS antenna No.1 and the top of the bow was about 250 m. At the time of the accident, the AIS was sending out the position received by GPS antenna No.1.

According to the statements from Pilot A1, Pilot A2, Third Officer A, Ordinary Seaman A, and the questionnaire answered by Second Officer A, there was no trouble with or breakdown of the hull, engine or instruments when the accident happened. The vessel was equipped with English versions of JP135 (Kanmon Strait) and Marine Traffic Information Chart H-301BW (Kanmon Strait).

(See Photo 1 Vessel A and Photo 2 Outlook from Bridge of Vessel A)

(2) Vessel B

The general arrangement and equipment on the hull and the bridge were as follows.

Vessel B was an aft-bridge cargo vessel with a long cargo hold whose hatch opening was about 37.8 m long and 9.0 m wide. The superstructure, which had a 6-meter-wide bridge on the uppermost deck, was on above the upper deck on the quarter. The engine room was placed below the upper deck. There were 7 windows on the front wall of the bridge and visibility was good. The distance between the jack staff on the bow and the bridge front was about 56 meters.

On the starboard side of the bridge were Radar No.1 and the engine remote controller, equipped with angle buttons for the controllable pitch propeller and an engine revolution indicator. On the center of the bridge was a navigation console box, equipped with a gyrocompass repeater and steering gear in her center. An engine telegraph, push button for the whistle, and the AIS were on the right side of the steering gear. On the left side of her, Radar No. 2 and Radar No. 3 with a hood attached were installed. VHF's were installed on the ceiling on the upper-left side of the steering gear and near the chart table on the port side rear of the bridge. A GPS receiver and a NAVTEX receiver were also installed near the chart table.

A GPS antenna was installed at the port side rear on the upper side of the bridge deck. The distance between the antenna and the top of the bow was about 62 m.

According to the statement of Master B, at the time of the accident, crewmembers of the Vessel B controlled the pitch of the propellers with angle buttons due to the failure of the pitch control dial. The switch for the automatic load control system always remained "off". Other than those above, there was no trouble with or breakdown of the hull, engine, or instruments when the accident happened. The vessel was equipped with the charts of Japanese versions of W135 (Kanmon

¹⁸ "Navtex receiver" is an instrument which receives marine safety information, including navigation warnings, weather warnings, and other matters automatically and prints it out. The information is mainly offered to vessels proceeding within about 300 M from the coast.

¹⁹ "Voyage Data Recorder (VDR)" is an instrument that is able to record the position, course, speed, radar information and other information about navigation, communication by VHF radio telephone, and voices in the bridge within capsules which can be removed later.

Strait), W1263 (Central Part of Kanmon Port), and W1264 (Northern Part of Kanmon Port).

According to the Register of Ships (issued by the Japan Shipping Exchange, Inc.), the Vessel was built at a dockyard in Japan. At that time, she was operated as a coastal vessel powered by a 882kW main engine, and her gross tonnage and deadweight tonnage were 498 tons and 1,598 tons respectively.

2.6.4 Data on maneuverability characteristics of the vessels

(1) Vessel A

According to the maneuverability table of Vessel A, the speed and maneuverability in light conditions were as follows.

1) The maximum rudder angle was 35° and the minimum effective steering speed was 1.5 kn.

2) Speed

Engine order	Revolutions (rpm)	Speed (kn)
Navigation full speed	86.2	16.7
Harbor full speed	64	12.9
Half speed	52	10.7
Slow speed	38	8.1
Dead slow speed	28	6.3

3) The shortest stopping time and distance

Engine order	Time (m)	Distance
Navigation Full speed	10.3	1.34 M (2,480 meters)
Harbor full speed	8.3	0.84 M (1,560 meters)
Half speed	7.3	0.63 M (1,170 meters)
Slow speed	5.9	0.39 M (720 meters)

4) Turning ability (No remarkable difference between port and starboard)

Speed	Starboard rudder angle	Advance	Transfer	Time to turn 90° starboard
8.1 kn	35°	0.48M (890 meters)	0.50M (930 meters)	5.8 minutes

(2) Vessel B

1) Speed (Engine revolution 290~300 rpm, light condition)

According to the statement from Master B and the turning ability table, the performances were as follows.

Engine order	Blade angle (°)	Speed (kn)
Navigation full speed	20	11.0
Harbor full speed	16	8.0
Half speed	12	6.0
Slow speed	7~8	5.0
Dead slow speed	3	4.0

2) Turning ability (Speed, rudder angle, etc. unknown, light condition)

Turning direction	Advance	Transfer
Starboard	about 250 meters	330 meters
Port	about 250 meters	330 meters

3) The shortest stopping time and distance

Vessel B navigated at normal navigation full speed with the blade angle at 16°. When fully loaded with the engine running at 290 rpm and the blade angle at 16° ahead, the shortest stopping time and distance were about 6 minutes and 1,500 meters respectively.

2.6.5 Safety management of the vessels

According to the Safety Management Certificates of Company A and Company B, the Documents of Compliance for Vessel A and Vessel B, and the Safety Management Manual of Vessel A, the details were as follows.

Company A and Company B built up safety management systems which were based on the International Safety Management Code²⁰ (ISM Code), so Safety Management Certificates were issued to them, and Documents of Compliance were issued to Vessel A and Vessel B.

(1) Vessel A

1) Safety Management Certificate

Number: 5HO-1935SMC
 Type of Vessel: Bulk carrier
 Issuing Authority: Class NK (Nippon Kaiji Kyokai)

2) Document of Compliance

Number: ST-6IB-0339PNMDOC
 Management Company: Company A
 Type of Vessel: Bulk carrier or other cargo vessel

²⁰ The “International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code)” was adopted on November 4, 1993, as an IMO Assembly Resolution on the purpose of ensuring the safe operation of vessels and preserving marine environments. It was introduced in the Annex of International Convention for the Safety of Life at Sea (SOLAS), 1974, and came into effect on July 1, 1998, after the amendment of the convention in 1994. It is applied to all passenger vessels and vessels with gross tonnage of no less than 500 tons engaged on international voyages.

Issuing Authority: Class NK

3) Manning and Charter

According to the information from Company A, the Vessel A's crew was manned by a manning company located in Busan, Republic of Korea. The owner of the vessel had a time charter contract with a Japanese shipping company.

(2) Vessel B

1) Safety Management Certificate

Number: SMC-0785721

Type of Vessel: Other cargo vessel

Issuing Authority: Union Bureau of Shipping (Marshall Islands)

2) Document of Compliance

Number: 000217

Management Company: Company B

Type of Vessel: Bulk carrier or other cargo vessel

Issuing Authority: Global Maridom Bureau Inc. (Republic of Korea)

(3) Safety Management Manual of Vessel A

The outline about the authority of the master in the Safety Management Manual of Vessel A was as follows.

1) *The Master*

a) Supervisor of Safety and Environmental Management System in Vessel

The Master is the supervisor of the System on the vessel and has the following responsibility and authority for management and implementation of the System in addition to establishment of the shipboard administration rules:

- Responsibility of disseminating management policy to crew for observance and striving for implementation and management of the policy*
- Responsibility for motivating crew to comply with the legal and other requirements, and verifying that the legal and other requirements are observed*
- Responsibility for giving appropriate orders and directions through a clear and simple method*
- Responsibility for periodically checking the operations of the System and reporting the results to the Designated Person through the General Manager of the Operation Department*

(The following descriptions were omitted.)

b) Chief Executive Onboard Vessel (Overriding Authority)

The Master has the overriding authority to make decisions required for safety of human

life and the vessel, maintenance of cargoes, and environmental protection as the chief executive on vessel managed by himself/herself irrespective of the provisions of the System. In addition, if exercising this authority, the Master shall report to the General Manager of the Operation Department without delay.

2) Pilot

a) Master's responsibility and authority

Master is not relieved his duty and responsibility for the safe operation of vessel even pilot is on-board.

b) Information exchange

There is no need to say that the pilot with the latest information is helpful for the safety of navigation in confined waters and for entry in or departure from port. Master, therefore, shall submit the pilot card and provide the pilot with basic information including her maneuverability and loading condition. He should also seek expert views from the pilot about future navigation plans in addition to obtaining information on the expected berth, anchorage and waters to navigate.

2.7 Characteristics of the Area

2.7.1 The prevailing circumstances and conditions of Kanmon Strait

According to the Charts and Publications and Report of the Investigation on Actual Conditions of Transiting Vessels issued by Japan Coast Guard, the details are as follows.

Kanmon Strait extends about 15 M from the eastern gateway of Hesaki in Moji Ku of Kitakyushu City to the western gateway of Mutsure Shima Island. It is a large, curved waterway in and out, and visibility is much restricted. In the narrowest part of the strait, off Mojisaki in Hayatomo Seto, the navigable width is only about 500 meters, where the current is very strong, and above all, congested with large and small vessels transiting to and from both ends.

The number of vessels passing through Hayatomo Seto per day was 629 in 2005 and 590 in 2006.

2.7.2 The situation of Kanmon Port

According to the Charts and Publications issued by Japan Coast Guard, the situation of Kanmon Port is as follows.

Kanmon Port is a Special Port defined in the Act on Port Regulations and includes the majority of Kanmon Strait in her port area. There are total of 7 passages set up at the port, 5 passages along Kanmon Passage, which is the main passage in the port and connects with Kanmon No. 2 Passage, Sunatsu Passage, Tobata Passage and Wakamatsu Passage. There are another two passages, Okudokai Passage and Anse Passage.

Kanmon Passage is curved in and out, with wide and narrow channel widths, however, near the junction to Tobata Passage, the waterway is straight and about 1,000 meters wide, marked by Light buoys at regular intervals of 1,000 meters on both sides. In Oseto, where the passage is curved, 3 leading lights are installed for vessels proceeding eastward. Vessels proceeding east in the

direction of Oseto can steer using Oseto No. 1 Leading Light as a navigation mark.

On the other hand, Kanmon Passage junction, from Tobata Passage to the east of Mutsure Shima Island, is also a junction with the Wakamatsu and Kanmon No.2 Passage, and visibility is restricted due to a big bend near Takenoko Island in Shimonoseki City, Yamaguchi Prefecture.

Tobata Passage is the passage used by vessels proceeding in and out of Seitetsu-Tobata Hakuchi in Wakamatsu Section 5 in Kanmon Port. It is about 1,100 meters long and the narrowest width at the south limit is about 500 meters. Navigation through this passage is controlled by control signals.

2.8 Data on pilotage service

2.8.1 Pilots and Kanmon Pilotage Area

The outline of the Pilotage Act is as follows.

(1) *The term “Pilotage” means to guide a vessel embarking thereon in a pilotage district. The term “Pilot” means a person who has been granted a pilot license for a definite pilotage district.*

(Paragraph 1 and 2 of Article 2)

(2) *A pilot shall, in a case where a request for a pilot has been received from the Master of a vessel, comply with the request and proceed to the vessel except in a case where there are justifiable reasons.* (Article 40)

(3) *The Master of a vessel shall, when a pilot has proceeded to the vessel, allow him to pilot the vessel unless there are justifiable reasons. This shall not be construed as to infringe upon the authority of the Master or release him from his responsibility for the safe navigation of his vessel even when a certified pilots is employed.* (Article 41)

(4) Compulsory Pilotage

1) There are 35 pilotage areas across the nation. The 10 areas of Yokohama Kawasaki Area, Yokosuka Area, Tokyo Bay Area, Ise Mikawa Bay Area, Osaka Bay Area, Bisan Seto Area, Kurushima Area, Kanmon Area, Sasebo Area, and Naha Area are set up as compulsory pilotage areas. The Master of any of the vessels as a enumerated below shall be compelled to take a pilot on board.

a. Non Japanese vessels of 300 gross tonnage or over

b. Japanese vessels of 300 gross tonnage or over engaged in service, between Japanese and foreign ports.

c. Any other Japanese vessel of 1,000 gross tonnage or over

Some vessels are exempt from this regulation; moreover there are exceptions to compulsory pilotage in Yokohama Kawasaki Area, Tokyo Bay Area, Ise Mikawa Bay Area, Osaka Bay Area, Bisan Seto Area, Kurushima Area, and Kanmon Area, the size of vessels that this Act applies to is stipulated specifically. (Article 35)

2) Kanmon Exceptional Area and vessels under compulsory pilotage

Within Kanmon Area, pilotage is compulsory in the areas excluding Wakamatsu Section 1 to 4 in Kanmon Port. The vessels under compulsory pilotage are as follows.

- a. Vessels whose gross tonnage is no less than 10,000 tons
- b. Vessels not navigating through Kanmon Area whose gross tonnage is no less than 3,000 tons and less than 10,000 tons
- c. Vessels loaded with dangerous materials which do not navigate Kanmon Area and whose gross tonnage is less than 3,000 tons (Foreign vessels and vessels engaged on international voyages whose gross tonnage is no less than 300 tons, and Japanese registered vessel not engaged on international voyages whose gross tonnage is no less than 1,000 tons).

(Article 35 of the Pilotage Act, Article 4 and 5 of the Cabinet Order, Paragraph 6 of Article 22 of the Ministry Ordinance)

2.8.2 Standard Pilotage Conditions

According to the Standard Pilotage Conditions of Kanmon Straits and Harbour Association, the outline is as follows.

(1) Scope of these conditions (Article 1)

The contract for the provision of pilotage services entered into by and between a pilot and the contracting party, shall be governed by the conditions, and any matter not explicitly provided for in the conditions shall be governed by law and common custom.

(2) Status of pilots (Article 2)

The pilot shall provide pilotage services in the capacity of an adviser to the master of a vessel for the purpose of enhancing the safety of traffic at sea, as well as contributing to the efficient operation of the vessel. The master's responsibility and authority for safe navigation shall not be affected by the presence of a pilot on board.

(3) Provision of pilotage services to a large-sized vessel (Article 7)

In order to ensure safe navigation, the pilot may provide pilotage services together with another pilot, after agreement with the master or owner of a vessel, if she is 30,000 gross tons or more in principle, or in special circumstances for navigation.

(4) Master's duty to notify (Article 11)

The master of a vessel shall notify the pilot of his/her vessel's gross tonnage, drafts, length, type of engine, speeds, functional status of navigational equipments, steering capability, and other particulars affecting her maneuverability.

(5) Master's obligations to cooperate (Article 12)

- 1) *The master shall exercise supervision to ensure that the pilot's advice on maneuvers is put into practice promptly and exactly.*
- 2) *The master shall keep a sharp lookout and, while proceeding through special waters or within a harbor, post lookouts at suitable places (using radar, if fitted, properly as well) and report anything unusual to the pilot immediately.*
- 3) *The master shall keep engines and anchors ready for use at any time.*
- 4) *The master shall cooperate with the pilot in the use of tugboats and in other matters required for the safe provision of pilotage services.*

2.8.3 International Convention

According to the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), 1978, Annex Chapter VIII, Part 3-1, navigation with a pilot on board is specified as follows.

- (1) *Despite the duties and obligations of pilots, their presence on board does not relieve the master or officer in charge of the navigational watch from their duties and obligations for the safety of the ship. The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics. The master and/or the officer in charge of the navigational watch shall cooperate closely with the pilot and maintain an accurate check on the ship's position and movement.*
- (2) *If in any doubt as to the pilot's actions or intentions, the officer in charge of the navigational watch shall seek clarification from the pilot and, if doubt still exists, shall notify the master immediately and take whatever action is necessary before the master arrives.*

2.9 Data on Kanmon Straits and Harbour Association

2.9.1 Kanmon Straits and Harbour Association

According to the statement and questionnaire from the executive of Kanmon Straits and Harbour Association, the association was formerly a voluntary organization and it was established as a corporation based on the Pilotage Law, which was revised on April 1, 2007. Each pilot who is an individual proprietor became a member of the association and 36 chief pilots belonged to it on July 1, 2009. It is a member of the umbrella organization, the Japan Federation of Pilots' Associations, of which 35 Pilots' associations throughout the nation became members.

2.9.2 Outline of the regulations of Kanmon Straits and Harbour Association

The outline of the regulations of Kanmon Straits and Harbour Association (enforced in April 2008) is as follows.

(1) Purpose and members

The purpose of Kanmon Straits and Harbour Association is to establish and operate a united office, train the pilots and members, deal with general affairs concerning communication and supervision in order to maintain the quality of members, and facilitate proper and smooth pilotage operations based on the purpose of the Pilotage Act.

(2) Maintenance of quality

Members shall comply with the laws necessary for pilotage operations, train themselves, improve their maneuvering and other necessary skills, and maintain their quality as pilots.

(3) Training of members

This association shall provide training for new members or those who the president acknowledges need training in navigation, safety assurance, or pilotage operations.

Members shall participate in the training offered by the Federation of Pilots' Associations and maintain and improve their pilotage skills.

(4) Restrictions on pilotage operations

The president of the association may restrict the operations of members depending on the regulations in order to ensure the marine traffic safety concerning the circumstances of waters, the difficulty of navigation, the danger of loaded materials, and other conditions.

1) *As a general rule, pilots who have been members for less than a year may board vessels entering and leaving the port in the daytime whose gross tonnage is less than 10 thousand tons or vessels navigating through the straits whose gross tonnage is less than 20 thousand tons.*

2) *Pilots who have been members for less than 2 years shall board 2-seater vessels whose gross tonnage is no less than 30 thousand tons with another pilot who has been a member for no less than 2 years, provided that the former pilots shall board 2-seater vessels loaded with dangerous materials whose gross tonnage is no less than 50 tons or passenger vessels with another pilot who has been a member for no less than 3 years and is younger than the standard retirement age; 2 pilots who have been members for no less than 3 years may board these vessels if one of them is younger than the standard retirement age. Pilots who have been members for no less than 2 years shall embark in the case where a vessel whose gross tonnage is no less than 30 thousand tons enters or leaves Tachiura Container Terminal.*

3) *Pilots who have been members for less than 5 years shall board LNG carriers or vessels whose gross tonnage is no less than 100 thousand tons with another pilot who has been a member for no less than 5 years and is younger than the standard retirement age in the case where the vessels enter or leave the port.*

4) *Pilots who have been members for no less than 2 years and are younger than the standard retirement age shall board in the case where vessels loaded with dangerous materials whose gross tonnage is no less than 50 thousand tons or passenger vessels navigate through*

the straits.

5) *Re-training of members*

The president may re-train members depending on the regulations in order to ensure their necessary knowledge and skills as pilots.

2.9.3 Working shift at Kanmon Straits and Harbour Association

According to the statements from Pilot A1 and A2, the Responding Rule to Requests and the Rule of General Affairs at Responding which are based on the Regulations of Kanmon Straits and Harbour Association, the outline of their working shift is as follows.

- 1) *At Kanmon Straits and Harbour Association, pilots may take 7 days off work within 3 weeks. Their working hours shall be based on the shift roster and they shall provide pilotage services depending on the shift schedule. There shall be 4 teams, each of which consists of 8 pilots. Each team shall shift from on duty, off duty, on stand-by, to holiday.*
- 2) *The duty as watchkeepers shall be allocated to pilots on duty and off duty. The working hours of pilots on duty shall extend 24 hours from 0630 to 0630 the next day in summer and from 0700 to 0700 the next day in winter, and those of pilots off duty shall extend from 0630 to sunset on the same day in summer and from 0700 to sunset on the same day in winter.*
- 3) *As a general rule, the pilot who has been a member for longer than the other shall be in charge of steering the vessel in the case where 2 pilots board a large vessel provided for in Article 7 of Standard Pilotage Conditions.*

2.9.4 Kanmon Pilotage Conference

Kanmon Pilotage Conference consists of Kitakyushu City Port, Harbor, and Airport Bureau, Shimonoseki City Port and Harbour Bureau, Kanmon Straits and Harbour Association, Western Marine Safety Association, corporations located in Kanmon Area (Cargo Owners), the agency association and scholars. The Conference issues the “Standard draft and type of vessels entering and leaving Kanmon Port” and “Watchkeeping Guidance for Large Vessels” in order to ensure the safety of vessels entering and leaving Kanmon Port or proceeding through Kanmon Strait. Kanmon Straits and Harbour Association undertakes pilotage operations depending on the “Standard draft and type of vessels entering and leaving Kanmon Port.”

2.9.5 Criteria for undertaking the pilotage of vessels leaving Seitetsu-Tobata Hakuchi and actual pilotage results

(1) Main undertaking criteria related to Vessel A

The gross tonnage of Vessel A is 88,594 tons and her length is 289.00 m. She leaves port in the daytime and she has to turn the bow after leaving the berth. Therefore, according to the “Standard draft and type of vessels entering and leaving Kanmon Port,” the main undertaking criteria are as follows.

- 1) Have 2 pilots get on board.
- 2) Place 4 large tugboats whose engines have a capacity of 3,000 hp or a propelling power of more than 30-tons.
- 3) Have the vessel leave port while the water is slack.

(2) Actual Pilotage Results

According to the answer sheet from Kanmon Straits and Harbour Association, the monthly average pilotage results in the latest 12 months for vessels leaving port from Tobata No. 3 and No. 4 Berth in Seitetsu-Tobata Hakuchi available to large-sized material vessels are as follows.

Vessels leaving port from Tobata No.3 Berth: 2.75 per month

Vessels leaving port from Tobata No.4 Berth: 5.50 per month

2.9.6 Necessity for 2 pilots and their cooperation

According to the statement from the executive of Kanmon Straits and Harbour Association and his memorandum, “Assurance of safety by 2 pilots and their cooperation,” the details are as follows.

(1) Necessity of 2 pilots

While providing pilotage operations for vessels, various points of attention and actions, including confirmation of the position, lookout, avoiding other vessels and obstacles, confirmation of speed and observance of the navigating method, are required of pilots. It is also necessary to report to and get information from Kanmon MARTIS, communicate with other vessels with VHF, report to and direct course watch vessels, utilize radar, ARPA, AIS, and other instruments, cooperate and share information with the crew and others. For large bulk carriers and LNG carriers, pilots have to pay attention to the deterioration of performance (minimum speed possible to steer the vessel, turning performance at low speed navigation, influence of shallow water, influence of wind and currents, decelerating procedure, vessel control utilizing tugboats, etc.). It is very difficult for one pilot to complete these operations, so two pilots are required to be on board.

The chief pilot and the assistant pilot have to do their best to ensure the safety of pilotage operations by talking about and confirming each other’s share of tasks before starting pilotage operations, devoting themselves to their own role, cooperating with each other, and keeping the vessel under double check.

(2) Details of tasks

1) Chief pilot

- a. Confirmation of pilot cards and other matters, discussion and cooperation with the master about the planning of navigation.
- b. Direction about steering, course, and speed (direction and confirmation of manoeuvring signals)
- c. Recognition of position and deviation

- d. Utilization of tugboats
- e. Confirmation of mooring lines

2) Assistant pilot

- a. Lookout (including confirmation of the information from radar, AIS, etc.)
- b. Reporting to Kanmon MARTIS, getting information and reporting about other vessels
- c. Communication with other vessels
- d. Direction and confirmation about Traffic Route Signals
- e. Confirmation of position
- f. Confirmation of headway
- g. Confirmation and reporting of wind direction, wind speed, and current signals
- h. Confirmation of steering order
- i. Confirmation of control of main engine
- j. Confirmation of whether chief pilot's directions are put in practice or not

2.10 Data on the service of Kanmon MARTIS

According to the material of Japan Coast Guard, the outline of services provided by Kanmon MARTIS is as follows.

2.10.1 Provision of information

Kanmon MARTIS always keeps watch for vessels proceeding through Kanmon Strait through the use of a high performance radar and AIS, and offers information about vessel movements, fishing boat operations, and meteorological information collected from passage patrol vessels, TV cameras and others for vessels that have reported their positions to Kanmon MARTIS, other vessels, and related people on shore in English or Japanese via VHF, AIS, telephone, facsimile, or the internet.

In the case where the risk of collision is forecasted for navigating vessels, their navigation should be modified, or where it is forecasted as they approach or enter dangerous waters, Kanmon MARTIS calls their attention with VHF and other instruments.

2.10.2 Navigation control

(1) Kanmon MARTIS calls the attention of navigating vessels by offering information about vessels proceeding through Hayatomo Seto Channel²¹ with a gross tonnage of no less than 10,000 tons (3,000 tons in the case of oil carriers) on the electric display at Hayatomo Seto Signal Station.

(2) Kanmon MARTIS controls the traffic on Tobata Passage by control signals on Tobata Signal Station in the case where vessels with a gross tonnage of no less than 1,000 tons proceed through Tobata Passage toward Seitetsu-Tobata Hakuchi .

²¹ "Hayatomo Seto Channel" is the part of Kanmon Passage between the west line of Kanmon Bridge and the 130° line from Hinoyamashita Tidal Stream Signal Station. (Article 40 of Ordinance for Enforcement of the Act on Port Regulations)

2.10.3 Cooperation with passage patrol vessels

Kanmon MARTIS gives guidance about navigations to proceeding vessels, collects passage information, and provides other services in cooperation with passage patrol vessels positioned in Kanmon Area.

2.11 Weather and Sea Conditions

2.11.1 Weather Data

The recorded data and figures on the weather observation at Shimonoseki Local Meteorological Observatory, which is located about 6 km east-northeast of the site of the accident, were as shown in the table below.

Observation Time	Weather	Wind Direction	Wind Speed(m/s)	Visibility(km)
0600, July 22	Clear	East	0.7	10.0
0700, July 22	—	East	1.6	—
0800, July 22	—	East-southeast	1.4	—
0900, July 22	Fair	East-southeast	1.7	15.0

2.11.2 Tides and tidal currents

(1) Tides in Kanmon Port

According to Tide Tables issued by Japan Coast Guard, the tide at Hiagari of Kokura Ward in Kanmon Port when the accident happened was at the early stage of rising.

0541, July 22 53 cm (Low tide)

1152, July 22 158 cm (High tide)

(2) Estimated data of tidal currents

According to the response to the questionnaire by Hydrographic and Oceanographic Department, Japan Coast Guard, the estimated tidal currents at the spot about 500 m east of the site of the accident near the central part of Kanmon Passage (N33°56.00', E130°52.65') were as shown in the table below. There was a slight current toward the east-northeast at the time of the accident.

Time	Direction	Speed
0735, July 22	045°	0.26 kn
0740, July 22	054°	0.28 kn
0745, July 22	062°	0.30 kn

2.11.3 Observation by Crew

(1) Crew

- 1) According to the statement from Third Officer A, the weather was fair, wind direction was south, wind speed was about 3 m per second and visibility was no less than 5 M.
- 2) According to the statement from Master B, the weather was fair, wind force was slight, visibility was about 5 M and there were small waves.

(2) Pilot A1

According to the statement from Pilot A1, the weather was fair, wind force was slight, visibility was good and there was a tidal current toward the east, the speed of which was about 0.5–1.0 kn.

2.12 Data on medical conditions

According to the statements from Pilot A1, Pilot A2, and Master B, the details were as follows.

(1) Pilot A1

Physical condition was good. Unassisted visual acuity of each eye was about 20-17. Hearing was normal. He was rested enough as he had the day before the accident off work.

(2) Pilot A2

Physical condition was good. Corrected visual acuity of each eye was 20-20 and he wore glasses at the time of the accident. Hearing was normal.

(3) Master B

Physical condition was good. Unassisted visual acuity of each eye was about 20-10. Hearing was normal. He slept well on the day before the accident and was not tired when the accident happened.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Events Leading to the Accident of Vessel A

Judging from 2.1.1(1), 2.1.2, and 2.1.3(1), the process leading to the accident of Vessel A was as follows.

(1) It is considered highly probable that Pilot A1 who was directing the vessel set the engine to dead slow ahead at about 0730, and slow ahead at about 0731.

(2) It is considered probable that Pilot A2, who was supporting Pilot A1, sighted Vessel B for the first time on the port bow of Vessel A at about 0730, and supposed she was stationary or proceeding at a very slow speed.

(3) It is considered probable that Pilot A2 received the information about Vessel C, which was sailing westward near Light buoy No. 19, when he reported to Kanmon MARTIS before entering Tobata Passage, communicated with the pilot of Vessel C, and agreed that Vessel A would go ahead of Vessel C.

- (4) It is considered probable that Pilot A2 took over from Pilot A1 under the approval of Master A at about 0732.
- (5) It is considered probable that Pilot A2 ordered the course to be set on 033° at about 0733.
- (6) It is considered probable that Pilot A2 ordered the engine to be set to harbor-full speed ahead before entering Tobata Passage as usual at about 0734.
- (7) It is considered probable that at about 0735, when Vessel A was about 3,290 m away from Daibahana Lighthouse in the direction of 200° and Vessel B was about 2,540 m away, ahead and to the left, in the direction of 37°, Vessel No. 3 reported to Pilot A2 that Vessel B was making her way toward Sakaigawa at a very slow speed, and that Pilot A2 directed Vessel No. 3 to request Vessel B to accelerate her speed and pass ahead of Vessel A swiftly.
- (8) It is considered probable that, on receipt of the order, Vessel No. 3 approached the port quarter of Vessel B, requested three or four times to promptly set the engine to full ahead, and confirmed the sign of consent by a hand signal at the bridge of Vessel B, so Vessel No. 3 reported to Pilot A2 that the Master of Vessel B had consented to accelerate.
- (9) It is considered probable that as every vessel had complied with the requests from tugboats before, Pilot A2 was convinced that Vessel B would comply with the request as usual, accelerate and pass ahead of Vessel A.
- (10) It is considered probable that Pilot A2 noticed the risk of colliding with Vessel B, sent out five short and rapid warning blasts on the whistle at about 0736, when Vessel B was about 2,310 m away, ahead and to the left in the direction of 28°, and sent out the same signals at about 0737.
- (11) It is considered highly probable that the bow of Vessel A entered Tobata Passage at about 0736, sailed toward the direction of 033° on the west side about 50 m away from the center of Tobata Passage, and passed through the south side line of Kanmon Passage at about 0741.
- (12) It is considered highly probable that at about 0738, when Vessel A was about 2,880 m away from Daibahana Lighthouse in the direction of 197° and proceeding toward the direction of 033° at about 6.2 kn, Vessel B was about 1,740 m away, ahead at to the left, in the direction of 23°. It is considered probable that Pilot A2 directed Vessel No. 3 to request Vessel B to pass on the starboard side of Vessel A, then changed his request and asked Vessel B to pass on the port side of Vessel A.
- (13) It is considered probable that Vessel No. 3 requested Vessel B to pass on the port side of Vessel A but Vessel B did not change her direction and speed, so at about 0739, it reported to Pilot A2 that Vessel B had not accelerated, and Pilot A1, who was supporting Pilot A2, directed Vessel No. 3 to request Vessel B to stop by setting her engine to full astern and putting the rudder to hard starboard if she would not accelerate, then Vessel No. 3 requested Vessel B to set her engine to full astern and put the rudder to hard starboard.

(14) It is therefore considered somewhat likely that Pilot A2 kept on accelerating Vessel A because she was supposed to go ahead of Vessel C, which was sailing westward.

(15) It is considered probable that at about 0740, while Vessel A was proceeding toward the direction of about 033° at about 7.9 kn near the spot 2,440 m away from Daibahana Lighthouse, in the direction of 194°, and when Vessel B was about 1,060 m away, ahead and to the left, in the direction of 22°, Pilot A2 ordered Vessel A to set her engine to slow ahead. It is therefore considered somewhat likely that shortly after, he gave a direction to put the rudder to hard starboard (35°), gave a direction again to put the rudder to center and then to hard port (35°) because Vessel B appeared to be turning to port.

(16) It is considered probable that Pilot A2 stopped the engine at about 0740:30. It is therefore considered somewhat likely that at this moment Pilot A1 asked Pilot A2 if it was necessary to set the engine to full astern, but Pilot A2 did not direct to do so immediately because the bow bearing of Vessel B was gradually turning to starboard.

(17) It is considered probable that at about 0741, when Vessel B was about 670 m away, ahead and to the left, in the direction of 19°, Master A and Pilot A2 almost simultaneously directed the engine to be set full astern.

(18) It is considered highly probable that the bow bearing of Vessel A was about 033° and she started to turn to port at about 0740:30.

(19) It is considered highly probable that Vessel A collided with Vessel B at about 0742:30 when Vessel A almost stopped turning to port.

3.1.2 Events Leading to the Accident of Vessel B

Judging from 2.1.1(2) and 2.1.3(2), the process leading to the accident of Vessel B was as follows.

(1) It is considered probable that that at about 0700, July 22, Vessel B weighed anchor from the quarantine anchorage located to the east of Mutsure Shima Island.

(2) It is considered probable that at about 0712, in the vicinity of 2,430 m away from Daibahana Lighthouse, in the direction of 017°, Vessel B set the engine to 290 rpm and blade angle at 16°, and entered Kanmon Passage from the north of Light buoy No. 5 at about 5.4 kn.

(3) It is considered probable that Vessel B turned to port at about 0722, in the vicinity of 1,390 m away from Daibahana Lighthouse, in the direction of 333°, and sailed southward toward the direction of Light buoy No. 10, a little to the right of the central part of Kanmon Passage.

(4) It is considered probable that at about 0732, in the vicinity of 820 m away from Daibahana Lighthouse, in the direction of 262°, while Vessel B was sailing southward at about 4.8 kn toward

the direction of about 180°, Master B saw Vessel A and 4 tugboats for the first time in the vicinity of 3,140 m away, ahead and to the right, in the direction of 9°, and supposed that Vessel A would avoid Vessel B, which was proceeding on Kanmon Passage, because Vessel A was navigating toward Kanmon Passage at a slow speed.

(5) It is considered probable that at about 0735, in the vicinity of 930 m away from Daibahana Lighthouse, in the direction of 232°, while Vessel B was sailing southward at about 5.1 kn toward the direction of 171°, Master B started to turn the vessel port side to direct her toward the direction line shown by Oseto No. 1 Leading Light (141°), when Vessel A was about 2,540 m away, ahead and to the right, in the direction of 18°, then proceeded toward the northeast of the direction line (near the central part of Kanmon Passage) in the direction of about 153°.

(6) It is considered probable that Vessel No. 3, which came near Vessel B, requested Master B to accelerate the vessel, and Master B gave his consent, changed the blade angle from 16° to 20° at about 0736, in the vicinity of 1,000 m away from Daibahana Lighthouse, in the direction of 223°.

(7) It is considered probable that Vessel B was fully loaded with cargo and her speed was about 5.2 kn when she raised the blade angle to 20° at about 0736, but her speed was almost the same, about 5.4 kn, at about 0740.

(8) It is considered probable that at about 0741, in the vicinity of 1,510 m away from Daibahana Lighthouse, in the direction of 192°, while Vessel B was proceeding toward the direction of about 150° at about 5.3 kn, Master B was requested by Vessel No. 3 to set the engine to full astern and put the rudder to hard starboard, but when Vessel A was about 670 m away, ahead and to the right, in the direction of 40°, he put the rudder to port 30° to avoid the collision.

(9) It is considered somewhat likely that Master B did not put the rudder to starboard because there was a Light buoy on the starboard side of Vessel B and the water outside the passage was not deep enough.

(10) It is considered probable that Master B did not slow down the vessel because he was raised the blade angle to 20° to increase her speed as Vessel No. 3 requested him.

3.1.3 Time, site and situation of the collision

(1) Time of the collision

Judging from 2.1.1, 2.1.3, and 2.6.3, calculating the time when the bow of Vessel A collided with the starboard center hull of Vessel B from the position of both vessels, their bow bearing, and the distance between the GPS antenna and the site of the collision, and considering that the speed of Vessel B recorded by AIS was 4.2 kn at 0742:31 but that it changed drastically and 3 seconds later at 0742:34 it was 6.2 kn (the speed of Vessel A at this moment was about 7.2 kn), it is considered highly probable that the time of the collision was about 0742:30, July 22, 2008.

(2) Site of the collision

Judging from 2.1.1, 2.6.3, and the description above (3.1.3(1)), calculating from the positions of both Vessels at the time of the collision, their bow bearing, and the distance between the GPS antenna and the site of the collision, it is considered highly probable that the site of the collision was about 1,630 m away from Daibahana Lighthouse in the direction of 185°.

(3) Situation of the collision

Judging from 2.1.1, and the description above (3.1.3(1)), it is considered highly probable that the speed of Vessel A and Vessel B at the time of the collision was 7.2 kn and 4.2 kn respectively, the bow bearings were 019° and 084° respectively, and the collision angle was about 65°.

3.2 Conditions of crew, others and vessels

(1) Crew and others

- 1) Master A held a first grade navigation officer certificate issued by the Republic of Panama.
- 2) Both Pilot A1 and A2 held legal and valid pilot licenses.
- 3) Master B held a valid master certificate issued by the Kingdom of Cambodia (Master of vessels larger than 3,000 gross tons).

(2) Vessels

- 1) Judging from 2.6.3, it is considered probable that the details were as follows.

a. Vessel A

There was no trouble with or breakdown of the hull, engine or instruments of Vessel A.

b. Vessel B

The crewmembers of the Vessel B controlled the pitch of the propellers with angle buttons due to the failure of the pitch control dial. The switch for the automatic load control system always remained “off”. Other than those above, there was no trouble with or breakdown of the hull, engine, or instruments of Vessel B.

- 2) Judging from 2.6.5, it is considered probable that the vessel management companies of both Vessel A and Vessel B had built up safety management systems based on the International Safety Management Code (ISM Code) and the safety management systems of both Vessel A and Vessel B satisfied the requirements of the ISM Code.

3.3 Dispositions of the crew and others on the bridges

Judging from 2.1.3, it is considered probable that the dispositions of the crew on the bridges of both vessels at the time of the accident were as follows.

(1) Vessel A

Master A was conning the steering at the starboard side of the steering gear and stationed Third Officer A on the engine control panel and Ordinary Seaman A on the manual steering gear.

Pilot A2 was directing the vessel at the front central part of the bridge and Pilot A1 was supporting Pilot A2 at the front starboard side of the bridge.

(2) Vessel B

Master B was conning the steering and stationed Ordinary Seaman B on the manual steering gear.

3.4 Analysis on pilotage operations

(1) Relations between command and pilotage operations

Judging from 2.8, the details were as follows.

- 1) The Pilotage Act stipulates that the master shall, when a pilot has proceeded to the vessel, allow him to pilot the vessel unless there are justifiable reasons. It also stipulates that the master shall steer the vessel himself provided there is a good cause and that the preceding paragraph shall not be construed as to infringe upon the authority of master or release him from his responsibility for safe navigation of his vessel even when a certified pilot is employed.

Standard Pilotage Conditions stipulate that pilots shall be engaged in pilotage operations faithfully in the capacity as advisors to the master, and the authority and responsibility of the master to ensure safe operation shall not be affected by the presence of pilots on board. The Conditions also enumerate the specific duties of the master to notify and cooperate.

- 2) The Pilotage Act does not stipulate the specific conduct of directing the vessel, but it is clear that the operation of the vessel is under the authority of the master and pilots are advisors to the master.

On the other hand, the master must let pilots direct the vessel except cases where there is justifiable reasons, that is, where it is necessary for ensuring the safety of operations, and as a general rule he is required to respect the advice from pilots, so it is considered probable that pilots are entrusted to steer the vessel with the permission of the master, who is the commander of steering.

Therefore it is considered probable that pilots provide pilotage services not only in their capacity as advisors to the master but as actual steersmen, and the master, as the commander of steering, must always supervise as to whether the pilots' steering is proper and safe or not.

- 3) It is considered probable that Master A was commanding the steering, Pilot A2 was steering the vessel under the permission of Master A, and Pilot A1 was supporting Pilot A2 at the time of the accident.

(2) Task sharing of pilots

Judging from 2.8.2, 2.9.2 and 2.9.6, it seems that the details were as follows.

- 1) The Responding Rule to Requests based on the Regulations of Kanmon Straits and

Harbour Association stipulates that the pilot who has been a member for longer than the other shall be in charge of steering in principle when 2 pilots board large vessels as provided in Article 7 of Pilotage Conditions, but it does not provide specific pilotage shifts or shift rotation points.

- 2) On the day of the accident, Pilot A1 was on the first shift and Pilot A2 the second, therefore, as agreed beforehand, Pilot A1 assumed the maneuvering of the vessel leaving from the berth. Depending on customs, they rotated shifts when the bow of Vessel A turned almost toward Tobata Passage before entering into the passage.
 - 3) The chief pilot, who steers the vessel, is mainly in charge of steering, utilization of tugboats and others, and the assistant pilot, who supports the chief pilot, is in charge of lookout, confirmation of the position, communication with Kanmon MARTIS and other vessels, getting information, reporting and other tasks, but Kanmon Straits and Harbour Association did not inform Pilot A1 and A2 completely about the task sharing and cooperation in the case where 2 pilots get on board.
- (3) Utilization and sharing of information, and mutual cooperation on the bridge of Vessel A
Judging from 2.1.3(1) and 2.1.5, the details were as follows.
- 1) When Pilot A1 and A2 accepted the pilot cards from Master A and handed over the pilot information card to Master A, they explained to him the outline of pilotage methods and other matters, but there was no question or direction from him and they were entrusted to direct the vessel. It is considered probable that after this moment Master A did not give any directions about the steering until he and Pilot A2 almost simultaneously directed that the engine be set to full astern before the collision.
 - 2) Commands from Pilot A1 and A2, and repeats from the crew were sent out in English, so it is considered probable that they could communicate well together.
 - 3) It is considered probable that both Pilot A1 and A2 did not report to Master A the details of communication with the tugboats, how to avoid Vessel B, and they did not give him proper advice.
 - 4) It is considered probable that Master A did not con the vessel properly because he entrusted Pilot A1 and A2 to steer the vessel and the pilots did not advise him properly.
 - 5) It is considered somewhat likely that Pilot A1 asked Pilot A2 if it was necessary to set the engine to full astern when Pilot A2 directed him to stop the engine, but Pilot A2 did not immediately direct him to do so because the bow bearing of Vessel B appeared to be turning to starboard, and he supposed Vessel B could pass ahead of Vessel A.
 - 6) It is considered probable that Master A had kept Third Officer A stationed at the engine

control panel all the time from leaving berth to the collision and did not position anyone at the radar.

7) It is considered probable that Pilot A2 did not direct Pilot A1 to confirm the speed of Vessel B and other matters by ARPA or AIS because visibility was quite good and he could sight Vessel B, and Pilot A1 did not report to Pilot A2 the speed of Vessel B, the distance between Vessel A and Vessel B, and other matters by utilizing ARPA and other instruments.

8) It is considered somewhat likely that Pilot A1 did not support Pilot A2 properly because Pilot A2 has more experience than Pilot A1 as a pilot and Pilot A1 felt some hesitation.

9) Judging from the description above, it is considered probable that the utilization and sharing of information, mutual cooperation on the bridge of Vessel A was not sufficient.

In order to command the steering properly, it is necessary for Master A to understand the content of information from Kanmon MARTIS, the communication with tugboats and Vessel C, the conversation among pilots and other matters as clearly as possible. Therefore, it is desirable for pilots to report to Master A such contents depending on necessity.

(4) Communication between Vessel A and Vessel B

1) Judging from 2.1.3, it is considered probable that the details were as follows.

Both pilots requested via tugboats that Vessel B accelerate. Vessel B understood the requests and complied with it. They could communicate well on this point, and they could also get in touch with each other with VHF and confirm their intentions of steering because both Vessel A and Vessel B could get information about vessel names and other matters by AIS. However, they did not get in touch with each other.

Vessel B's destination was Sakaigawa Hakuchi in Wakamatsu Section 5 in Kanmon Port, but there was an input error in the AIS information of Vessel B, which displayed "Yahata" as the destination. If Vessel B had proceeded toward Yahata in Kitakyushu City, she would have sailed into Wakamatsu Passage, which is located on the northwestern side of Tobata Passage and would not have met Vessel A. Therefore, it is necessary for vessels to input AIS information correctly.

2) It is important for large vessels like Vessel A to avoid situations where they meet or approach other vessels on passages because it is not easy for them to take evasive actions swiftly and drastically. Vessel A has made requests for cooperation depending on necessity to vessels, like Vessel B, that proceed through Kanmon Passage. It is quite an effective means to communicate with other vessels via tugboats to make requests, but it is desirable for both vessels to get in touch with each other directly with VHF depending on necessity because there a language problem and some fear of insufficient communication with foreign vessels may exist.

3.5 Information from Kanmon MARTIS

Judging from 2.1.3 and 2.1.7, it is considered probable that the details were as follows.

(1) Information before and after the accident

Kanmon MARTIS informed the pilots that Vessel C was sailing westward in the vicinity of Light buoy No. 29 at about 0716-0717, before Vessel A left the berth. At about 0732, it informed the pilots that Vessel C and four vessels behind her were sailing westward in the vicinity of Light buoy No. 19 and broadcasted (in Japanese) that Vessel A would enter Tobata Passage and proceed toward the MN Line. At about 0735, it broadcasted (in English) the same information toward each vessel. After that it did not offer any information until the accident happened. It did not offer Vessel B any information about Vessel A with VHF.

At about 0744, Kanmon MARTIS received the accident information from the pilot, and at about 0745, it broadcasted the information and called for the attention of proceeding vessels. While Vessel B was in Kanmon Passage after the accident, Kanmon MARTIS broadcasted the information about Vessel B toward each vessel with VHF. After Vessel B cast anchor outside of Kanmon Passage, it offered the information about Vessel B to vessels entering and leaving Nishiyama Ward in Kanmon Port, and the accident information with AIS to vessels equipped with AIS.

(2) Information from broadcasting

Kanmon MARTIS informed Vessel A about westbound vessels like Vessel C and broadcasted toward each vessel (both in English and in Japanese) with VHF, and offered information about Vessel A setting sail into Tobata Passage.

Every vessel equipped with VHF can listen to these broadcasts to unspecified vessels. It is an effective means of offering information because it can offer important information to many unspecified vessels simultaneously in cases where it is necessary to offer information to many vessels and their vessel names are not identified, and because it makes it possible to avoid the congestion of information. But on the other hand, it has a problem that Kanmon MARTIS cannot confirm whether each vessel has received the information by switching to the VHF channel or not.

In the case of this accident, there is some possibility that Vessel B did not listen to the broadcast, but it is considered probable that there was no problem of insufficient information because she sighted Vessel A quite early. However, it was desirable for Kanmon MARTIS to offer Vessel B the information about Vessel A because Vessel B was the only eastbound vessel that could meet Vessel A at that time and Kanmon MARTIS could identify Vessel B's name by utilizing AIS. Vessel A sighted Vessel B quite early, and it is considered probable that the information about the speed of Vessel B and other matters would be valuable to Vessel A.

At present in Japan, vessels with a gross tonnage of no less than 500 tons and others are obliged to be equipped with AIS, and almost all the vessels proceeding near the coast of Japan are equipped with AIS. So it is considered probable that vessels equipped with AIS should increase and that providing information by utilizing AIS and VHF should become more important from now on.

Therefore, it is desirable for Kanmon MARTIS to provide information more actively, including through the promotion of communication among bridges.

3.6 Analysis on navigation rules

Judging from 2.6.1, 2.11, 3.1, and 3.7, it is considered probable that the navigation rules applied to Vessel A and Vessel B were as follows.

(1) Main applicable provisions of navigation rules

This accident occurred in Kanmon Passage in Kanmon Port, which is a Specified Port provided in the Port Regulations Act.

Both Vessel A and Vessel B were not classified as Small Vessels (with a gross tonnage of no more than 300 tons) or Miscellaneous Vessels provided for in Article 18 of the Port Regulations Act. Vessel A was proceeding in Tobata Passage on an almost fixed course at about 4-8 kn. Vessel B, which was proceeding in Kanmon Passage, was requested to accelerate by Vessel No. 3, but she could not. She kept on proceeding through Kanmon Passage with an almost fixed course and speed until she was requested to set her engine to full astern and put the rudder to hard starboard. Vessel A and Vessel B were approaching each other with some risk of meeting in Kanmon Passage, so Item 7 in Paragraph 1, Article 38 of the Ordinance for Enforcement of the Port Regulations Act, and Article 16 and 17 of the Act on Preventing Collision at Sea should be applied to both of them.

Vessel A tried to avoid the risk of meeting Vessel B in Kanmon Passage by requesting Vessel B to accelerate. Vessel B consented to the request but could not accelerate, and the risk was not removed, so the above-mentioned provisions should be applied to both vessels. Therefore it was necessary for Vessel A to promptly judge whether the risk of meeting Vessel B still existed or not and to pay special attention to the lookout and steering vessels so as not to delay in taking evasive actions.

(2) Vessel A

According to Item 7 in Paragraph 1, Article 38 of the Ordinance for Enforcement of the Port Regulations Act, Vessel A, which was proceeding in Tobata Passage, had to give way to Vessel B, which was proceeding in Kanmon Passage. Vessel A had to take substantial evasive actions as early as possible.

(3) Vessel B

Vessel A had to give way to Vessel B. Therefore, Article 17 of the Act on Preventing Collision at Sea (stand-on vessels) should be applied to Vessel B according to Article 40 of the same Act. Vessel B had to keep her course and speed, as stipulated in Paragraph 1 of Article 17, and if Vessel B found itself so close that collision could not be avoided by the action of Vessel A alone, Vessel B had to take such action as would best aid the avoidance of collision, as stipulated in Paragraph 3 of Article 17.

3.7 Weather and Sea Conditions

Judging from 2.11, it is considered probable that the weather and sea conditions were as follows.

The weather was fair, wind direction is east, wind force was 2, and visibility was good. The tides in Kanmon Port were at the early stage of rising and there was a slight tidal current toward the east-northeast around the site of the accident.

3.8 Analysis on the accident occurrence

Judging from 2.1.1-2.1.3, 2.1.5, 2.1.7, 3.1, 3.4(3), 3.5 and 3.7, the details were as follows.

(1) Vessel A

- 1) It is considered probable that Pilot A2 received the information about Vessel C, which was sailing westward in the vicinity of Light buoy No. 29, and other vessels when he reported to Kanmon MARTIS at the time of leaving berth.
- 2) It is considered probable that Pilot A2 received the information about Vessel C, which was sailing westward in the vicinity of Light buoy No. 19, and other vessels when he reported to Kanmon MARTIS before entering Tobata Passage, got in touch with the pilot of Vessel C, and then agreed with the pilot of the Vessel C that Vessel A should go ahead of Vessel C, but Kanmon MARTIS did not offer any information about Vessel B and Pilot A2 did not ask Kanmon MARTIS for the information about eastbound vessels.
- 3) It is considered probable that when Pilot A2 sighted Vessel B for the first time, he supposed that Vessel B was either stationary or proceeding at a slow speed.
- 4) It is considered probable that both pilots did not confirm the direction, speed, vessel name and other matters of Vessel B by utilizing ARPA or AIS, and did not communicate with Vessel B directly with VHF because visibility was quite good and both pilots were able to sight Vessel B, and as described in 6) below, Vessel B had complied with the request from Vessel No. 3 to accelerate, so they did not notice that Vessel A was coming closer to Vessel B with some risk of meeting her in Kanmon Passage, before entering Tobata Passage.
- 5) It is considered probable that Pilot A2 took over the pilotage from Pilot A1 when Vessel A settled course on Tobata Passage, sent out commands about steering and speed, started the actual commanding of the steering, then instructed to set the direction to parallel with Tobata Passage, ordered harbor-full speed ahead, and entered Tobata Passage.
- 6) It is considered probable that Pilot A2 was reported to by Vessel No. 3 to the effect that Vessel B was proceeding toward Sakaigawa at a very slow speed, directed Vessel No. 3 to request Vessel B to accelerate and pass ahead of Vessel A promptly, and that Vessel B then consented to this request and took the action to accelerate.
- 7) It is considered probable that Pilot A2 was convinced that Vessel B would accelerate and pass ahead of Vessel A because other vessels normally complied with requests from tugboats.
- 8) It is considered probable that Pilot A2 kept on accelerating Vessel A after receiving the report from Vessel No. 3 that Vessel B had not accelerated.
- 9) It is considered probable that Pilot A2 kept on accelerating Vessel A, taking into account anticipated drift to port side due to the side current from port side in Tobata Passage and that

Vessel A was supposed to go ahead of Vessel C.

- 10) It is considered probable that Pilot A2 noticed the risk of colliding with Vessel B when Vessel A entered Tobata Passage, directed Vessel No. 3 to request Vessel B to pass Vessel A port side to port side, but that later he was reported to by Vessel No. 3 to the effect that Vessel B had not accelerated, so he sent out warning signals twice.
- 11) It is considered probable that Pilot A1 directed Vessel No. 3 to request Vessel B to stop by setting her engine to full astern or putting the rudder to hard starboard, and Vessel No. 3 requested Vessel B to do so.
- 12) It is considered probable that Pilot A2 kept on accelerating Vessel A in the same direction and did not avoid the collision with Vessel B by, for example, decelerating Vessel A drastically without delay or stopping her as a give-way vessel, as he was convinced Vessel B would accelerate and pass ahead of Vessel A because normally every vessel complied with requests from large-sized vessels, Vessel B had consented to the request of accelerating, and Vessel A was supposed to go ahead of Vessel C.
- 13) It is considered probable that Pilot A2 directed the engine to be set slow ahead and the rudder put to hard starboard 2 minutes and 30 seconds before the collision, shortly after directed the rudder to be put to hard port, and that then Pilot A1 asked Pilot A2 about the necessity of setting the engine to full astern when Pilot A2 noticed the risk of colliding with Vessel B and gave the direction to stop the engine 2 minutes before the collision, but he did not immediately direct the engine to be set to full astern because the bow bearing of Vessel B was gradually turning to starboard.
- 14) It is considered probable that Master A and Pilot A2 directed the engine to be set full astern about a minute and 30 seconds before the collision.

It is considered probable that Pilot A2 was actually in command of the steering, so he issued orders about steering the vessel without giving Master A advice to command the vessel properly by explaining to him beforehand about steering methods and other matters.
- 15) It is considered probable that Pilot A1 did not support Pilot A2 properly by communicating with Vessel B with VHF or reporting the speed and other matters of Vessel B to Pilot A2 by utilizing ARPA or AIS.
- 16) It is considered probable that Master A did not command the vessel properly because he could not understand the steering methods of Pilot A2 and other matters.
- 17) It is considered probable that information was not shared and utilized and cooperation was not sufficient between Master A and both pilots, and between Pilot A1 and A2.
- 18) It is therefore considered somewhat likely that Kanmon Straits and Harbour

Association's failure to inform both pilots completely about task sharing and mutual cooperation in the case where two pilots get on board was related to the occurrence of this accident.

(2) Vessel B

- 1) It is considered probable that Master B sighted Vessel A and four tugboats, and learned that Vessel A left port toward Kanmon Passage.
- 2) It is considered somewhat likely that Master B made the judgment that as Vessel B was proceeding in Kanmon Passage, Vessel A would avoid Vessel B even if Vessel B met Vessel A which was about to enter Kanmon Passage.
- 3) It is considered probable that Master B consented to the request from Vessel No. 3 and raised the blade angle from 16° to 20°.
- 4) It is considered probable that Vessel B kept on proceeding almost at the same speed after raising the blade angle to 20° because she was fully loaded with cargoes.
- 5) It is considered probable that Master B did not notice that Vessel B had come closer to Vessel A and that Vessel A could not avoid the collision only by her own motions until Vessel No. 3 requested him to set the engine to full astern and put the rudder to hard starboard.
- 6) It is considered probable that when Vessel B came closer to Vessel A and Vessel A could not avoid the collision only by her own motions, Master B tried to avoid the collision by turning the rudder to port 30° because there was a Light buoy on the starboard side and the water outside the passage was not deep enough, but that he did not decelerate the vessel and take the best action of cooperation to avoid the collision, such as stopping, because he was accelerating owing to the former request.
- 7) It is considered probable that Master B did not decelerate or stop Vessel B because he was accelerating owing to the request from Vessel No. 3.

3.9 Analysis on mitigation of damage

Judging from 2.2 and 3.5 (1), it is considered probable that this accident was a collision of large vessels that occurred in Kanmon Passage, which was congested with marine traffic, but that damage on both vessels did not expand and the bad influence on marine traffic was limited owing to the following factors.

- (1) Immediately after the accident, Kanmon MARTIS offered information on the accident to vessels navigating and called for their attention.
- (2) Vessel B was able to cast anchor outside Kanmon Passage.

- (3) The pilots immediately directed the tugboats to save the crew of Vessel B because Vessel B listed.
- (4) The vessels sailing westward near the site of the accident stopped or decelerated and did not enter the site.
- (5) Vessel A was able to be supported by the tugboats after the accident, maintained her balance in the passage, turned around after other vessels passed through, and proceeded toward the anchorage off Mutsure Shima Island.
- (6) Japan Coast Guard immediately mobilized patrol boats, saved the crew and controlled the marine traffic. Then it had its divers conduct a diving investigation of Vessel B, identified the leaking spot, closed the air pipes of the fuel tank and so on, and asked the China Maritime Search and Rescue Center to get in touch with the owner of Vessel B and direct him to salvage the vessel without delay.
- (7) The salvage company was able to start the salvage operation promptly, as the salvage contract came into effect about five hours after the accident. It stopped the leakage and finished the emergency waterproof operation about seven hours after the accident, and completed the drainage operation at the cargo hold and other places about nine hours after the accident, so Vessel B could avoid capsizing and sinking.
- (8) Guard boats and private lookout boats were positioned around Vessel B at anchor, traffic control and warning surveillance activities over navigating vessels were carried out, and Kanmon MARTIS offered information to vessels proceeding near Vessel B while Vessel B was at anchor.

4 PROBABLE CAUSES

It is considered probable that the accident occurred due to the collision of Vessel A, proceeding northward along the Tobata Passage to the Kanmon passage, and Vessel B, proceeding eastward along the Kanmon Passage, when Vessel A continued to accelerate without giving way to Vessel B, which Vessel A expected to encounter in the same passage, while Vessel B continued on the course along the Kanmon Passage keeping almost the same speed, without noticing that both ships were coming so close that a collision could not be avoided only by the action of Vessel A alone.

It is considered probable that Vessel A did not give way to Vessel B, which it expected to encounter in the Kanmon Passage, because Pilot A2, practically conning Vessel A, had thought that Vessel B would accelerate to pass ahead of Vessel A on being requested to do so, and because Master A did not con the vessel appropriately.

It is considered probable that Pilot A2 had thought that Vessel B would accelerate to pass ahead of Vessel A following the request to accelerate, because such a request had been usually

accepted by other ships.

It is considered probable that Master A did not con Vessel A appropriately, because the Pilots had given no appropriate advice and also because information was not fully utilized and cooperation between the master and the pilots was not sufficient on the bridge of Vessel A.

It is considered somewhat likely that the fact that the Kanmon Straits and Harbour Association did not keep both pilots fully informed about the task sharing and coordination in the case of two pilots on board was related to the occurrence of the accident.

It is considered somewhat likely that Vessel B did not notice that the collision could not be avoided by the action of Vessel A alone, because Master B had assumed that Vessel A would give way to Vessel B, which was proceeding in the Kanmon Passage.

It is considered probable that Master B did not take such action as would best aid to avoid collision, including halting, because Master B did not try to decrease the speed as Vessel B was accelerating according to the previous request, and steered Vessel B to 30° to port in order to avoid the collision despite the request from the Vessel No.3 for full astern and hard-starboard, because of a light buoy on the starboard side and the shallow water off the passage.

5 REMARKS

It is considered probable that the accident occurred in the Kanmon Passage due to the collision of Vessel A, accelerating northward along the Tobata Passage to the Kanmon Passage with two pilots on board, and Vessel B, proceeding eastward along the Kanmon Passage, and one of the main causes of the accident is that the pilots on Vessel A gave no appropriate advice to Master A, and that Master A, having left the command of the ship to the pilots, did not con the ship properly.

It is considered probable that the fact that the Kanmon Straits and Harbour Association did not keep both pilots fully informed about the task sharing and coordination in the case of two pilots on board is related to the occurrence of the accident, as the pilots did not give proper advice, and information was not fully utilized and cooperation between the master and the pilots was not sufficient.

Therefore, it is desirable that:

(1) The Kanmon Straits and Harbour Association should implement the following measures and keep the members fully informed.

1) Keeping the members fully informed about the task sharing and coordination in the case of two pilots on board, and providing the members with orientations and training (including simulator training) so as to ensure that proper advice is given to the master, and that the master and the pilots share and utilize information and cooperation with each other on the bridge;

2) Reporting to the master, depending on the situation, what the pilot has communicated with the Kanmon MARTIS, tug boats and other ships to enable the master to con the ship properly;

3) Securing mutual understanding and communication with other ships, by such a measure, if possible, as pilot's direct communication via VHF with other ships whose names are identifiable with AIS, especially in cases of foreign ships where detailed communications could be hampered by the language barrier, without relying solely on communications via tug boats, which have been used as an effective measure.

(2) In order to ensure safe marine traffic and provide a proper pilotage service in cases where two pilots are on-board as this accident, it is a common challenge for every pilot association to secure clear, prompt and certain communications between the pilots. Such mutual communications between pilots are vital and should not be hampered, for example, by hesitation to make comments due to differences in pilot careers.

It is desirable, in order to prevent a recurrence of such accidents, for the Japan Federation of Pilots' Associations to recommend member associations and groups to develop recurrence-prevention measures and keep the members well informed.

6 ACTIONS TAKEN

Recurrence-prevention measures by the Kanmon Straits and Harbour Association

The Kanmon Straits and Harbour Association held a committee on recurrence prevention in accordance with bylaws on August 1, 2008, discussed the recurrence-prevention measures for such accidents, came to a conclusion and announced to all their pilot members as follows:

1. The members are recommended to ascertain the surrounding situation, by capturing information on every ship that could be meeting head-on, through the utilization of all available information, including the information provided by Kanmon MARTIS.
2. In order to prevent serious close-quarters situations with other ships from occurring, members are recommended to proactively and promptly take the necessary and proper actions regarding engine operations and steering by effectively using information on other ships collected through on-board AIS and ARPA.
3. The members are recommended to maintain manoeuvre in cooperation with crew upon promptly gaining full knowledge of CPAs and TCPAs to other ships, by using BRM.²²
4. The members are recommended to use the proper manoeuvring signals and the proper warning signals.
5. The ships entering/leaving the Tobata Passage, including large ore-carriers and LNG carriers, are required to navigate with extreme care, because they are obliged to follow the locally-specified traffic rules. Therefore, members are recommended, in cases where they are in situations involving

²² "BRM" stands for Bridge Resource Management, which is a method of fully utilizing all resources on the bridge, including personnel, information and knowledge, for safer and more efficient navigation.

risk of collision with other ships going along the Kanmon Passage, to keep sufficient distances and use VHF properly, while requesting the other ships to coordinate navigational operations with assistance from the Kanmon MARTIS or the course watch ships when possible.

6. Two pilots are required on a large ship to ensure the safe navigation of the ship through the mutual cooperation and complement of the chief pilot and assistant pilot. Therefore, members are recommended, when onboard with another pilot, to confirm, prior to the boarding, the task sharing and the coordinated actions for smoother operations.

7. Utilization of tugboats

Tugboats, after completing the turning operations in the Seitetsu-Tobata Hakuchi, usually move to watch positions at the bow, the stern and the beam. However, the members are recommended to consider, as a future subject, keeping the tug lines from the tugboats at the beam (normally they are positioned at the bow and the stern), until safe entry into the passage is ensured.

Figure 1 Assumed Navigation Route

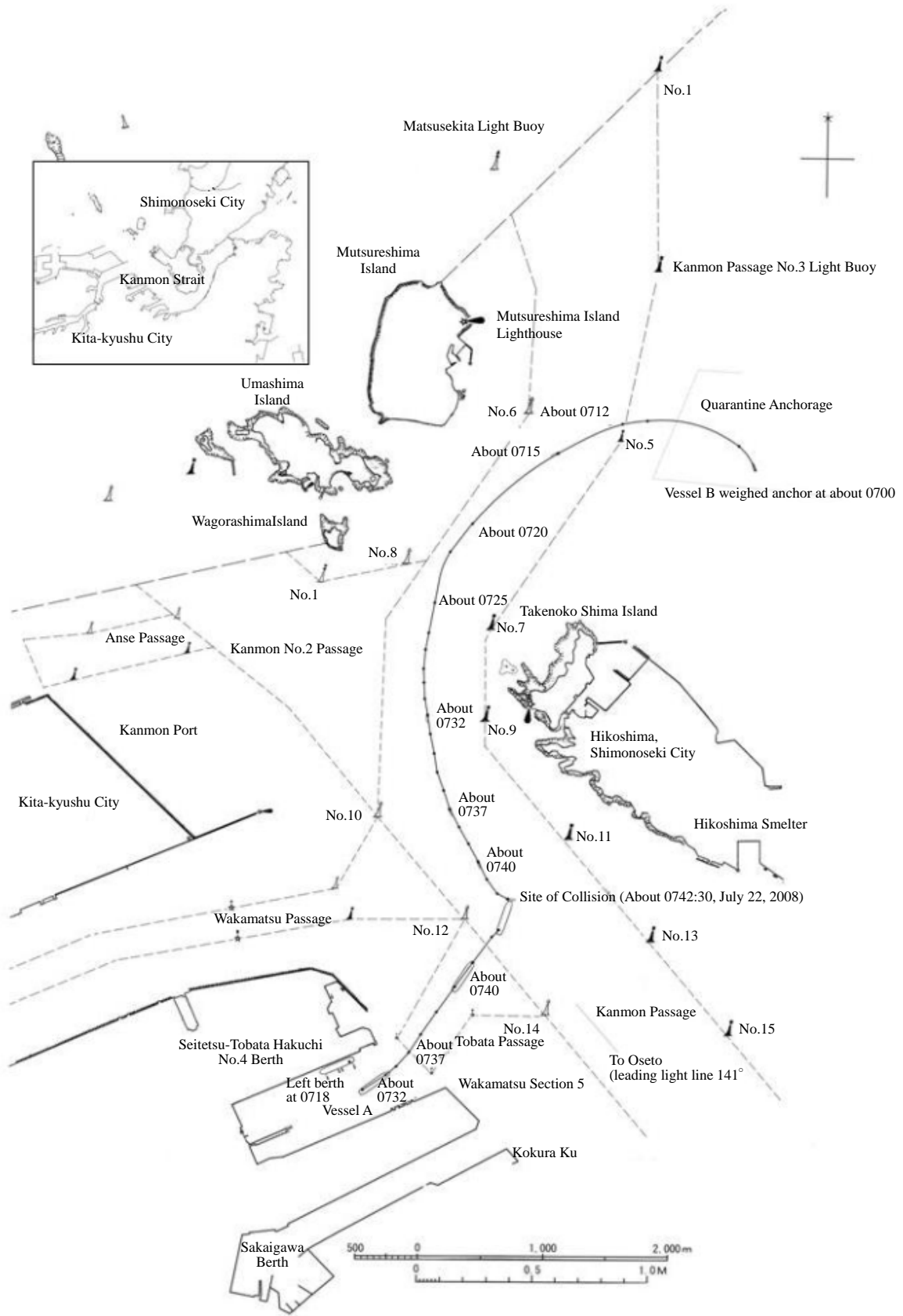


Figure 2 Assumed Navigation Route (Magnified)

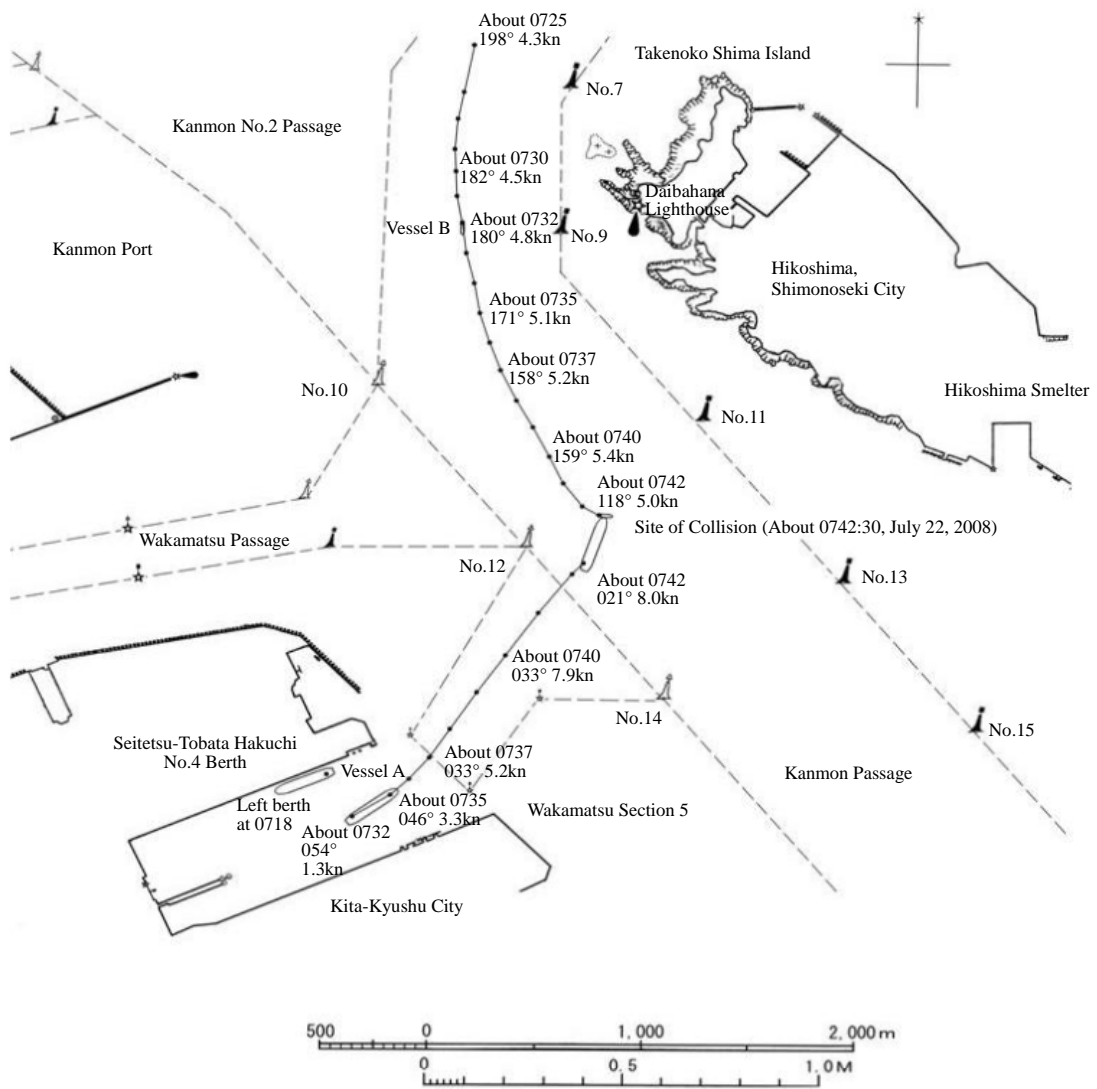


Figure 3 Situation of the Collision

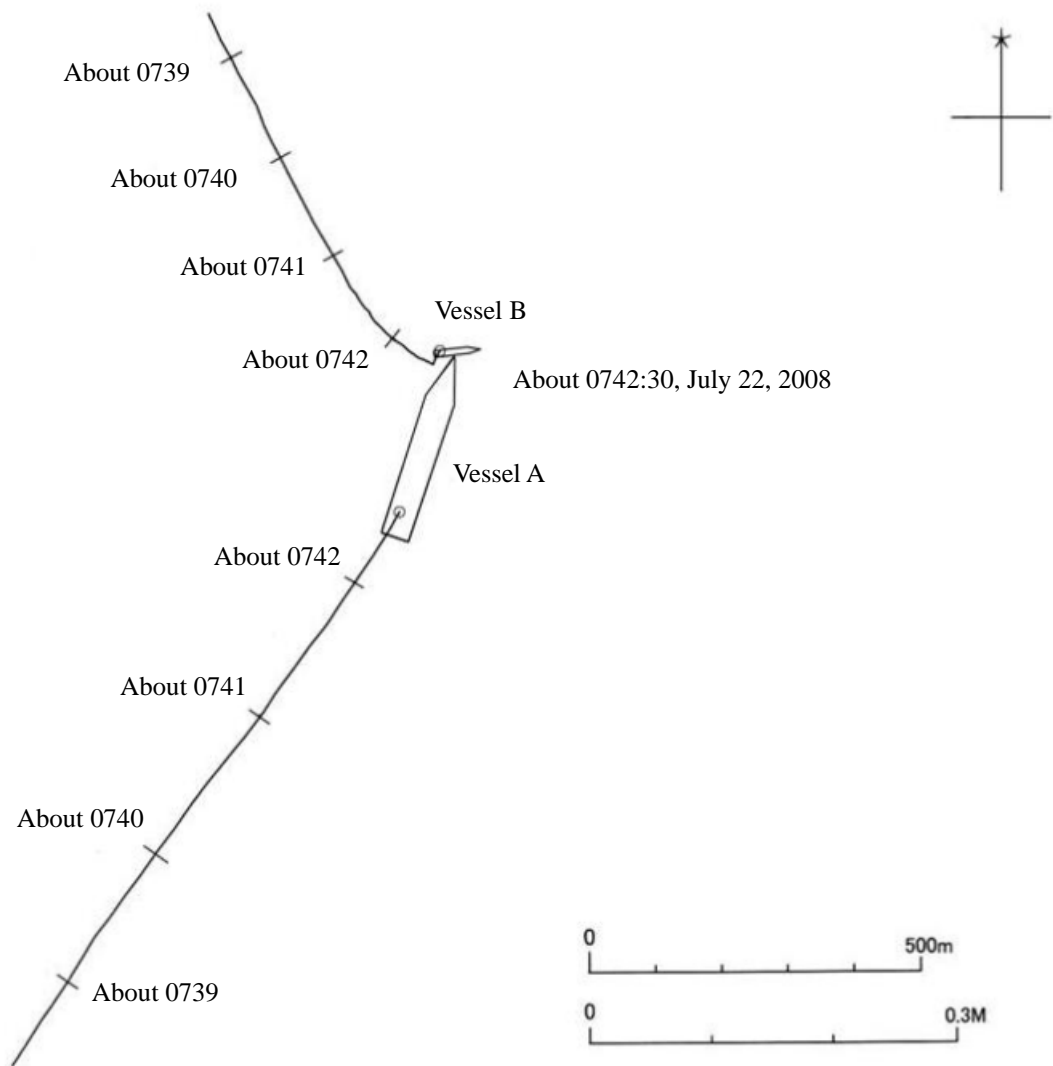


Table 1 AIS Record of Vessel A

Time (H : M : S)	Vessel Position:		Course OG (°)	Bow Bearing (°)	Speed OG (kn)
	N. Latitude	E. Longitude (° - ' - ")			
07:17:05	33-55-22.2	130-51-31.5	021	247	0.0
07:26:05	33-55-20.0	130-51-32.3	235	195	0.4
07:29:06	33-55-16.7	130-51-30.7	186	123	1.6
07:32:04	33-55-13.6	130-51-33.8	081	054	1.3
07:35:08	33-55-17.9	130-51-40.3	055	046	3.3
07:35:37	33-55-18.9	130-51-42.1	054	042	3.8
07:36:08	33-55-20.2	130-51-44.2	051	037	4.3
07:36:37	33-55-21.8	130-51-46.1	041	034	4.8
07:37:08	33-55-24.0	130-51-47.9	036	034	5.2
07:37:37	33-55-26.4	130-51-49.8	034	033	5.7
07:38:08	33-55-28.9	130-51-51.8	033	033	6.2
07:38:37	33-55-31.7	130-51-54.0	033	033	6.7
07:39:08	33-55-34.9	130-51-56.5	033	033	7.2
07:39:37	33-55-37.9	130-51-59.0	034	034	7.6
07:40:08	33-55-41.1	130-52-01.8	035	033	7.9
07:40:37	33-55-44.4	130-52-04.7	037	032	8.2
07:41:08	33-55-47.8	130-52-08.0	038	029	8.5
07:41:37	33-55-51.0	130-52-10.8	036	026	8.3
07:42:07	33-55-54.5	130-52-13.9	035	021	8.0
07:42:27	33-55-56.6	130-52-15.5	032	019	7.6
07:42:37	33-55-57.6	130-52-16.2	030	019	7.2
07:43:08	33-56-00.3	130-52-18.0	029	020	6.0

Note: Vessel position (excluding the position at the site of the collision) refers to the position of the GPS antenna installed at the port side front on the upper side of the bridge.

Table 2 AIS Record of Vessel B

Time (H : M : S)	Vessel Position:		Course OG (°)	Bow Bearing (°)	Speed OG (kn)
	N. Latitude	E. Longitude (° - ' - ")			
07:01:45	33-58-02.5	130-53-35.9	358.9	353	1.8
07:03:03	33-58-05.4	130-53-35.1	333.7	338	2.8
07:05:03	33-58-11.3	130-53-30.2	315.4	316	4.1
07:10:04	33-58-16.0	130-53-04.0	266.2	279	5.0
07:12:04	33-58-13.6	130-52-52.0	248.5	260	5.4
07:15:05	33-58-04.9	130-52-34.1	234.4	246	5.9
07:20:04	33-57-45.9	130-52-07.3	224.6	229	5.4
07:22:01	33-57-38.1	130-52-00.4	200.7	202	4.5
07:25:04	33-57-25.0	130-51-56.2	194.8	198	4.3
07:27:04	33-57-16.5	130-51-53.8	191.7	194	4.2
07:28:04	33-57-12.3	130-51-53.0	188.1	191	4.2
07:30:05	33-57-03.5	130-51-52.2	177.5	182	4.5
07:32:05	33-56-54.1	130-51-53.3	172.8	180	4.8
07:35:05	33-56-39.2	130-51-56.6	165.4	171	5.1
07:35:35	33-56-36.7	130-51-57.4	164.0	168	5.2
07:36:05	33-56-34.2	130-51-58.3	162.5	164	5.2
07:36:35	33-56-31.7	130-51-59.4	157.5	160	5.2
07:37:05	33-56-29.3	130-52-00.7	155.0	158	5.2
07:37:35	33-56-26.9	130-52-02.1	153.8	158	5.3
07:38:05	33-56-24.5	130-52-03.5	152.8	157	5.3
07:38:35	33-56-22.1	130-52-05.0	152.7	158	5.3
07:39:05	33-56-19.7	130-52-06.5	152.9	159	5.3
07:39:34	33-56-17.3	130-52-08.0	153.7	160	5.4
07:40:05	33-56-14.9	130-52-09.4	154.9	159	5.4
07:40:45	33-56-11.7	130-52-11.3	150.4	154	5.4
07:41:05	33-56-10.1	130-52-12.4	149.6	150	5.3
07:41:31	33-56-08.2	130-52-13.8	147.4	139	5.2
07:42:01	33-56-06.1	130-52-15.7	135.2	118	5.0
07:42:28	33-56-04.9	130-52-17.9	114.3	093	4.7
07:42:31	33-56-04.8	130-52-18.2	106.3	086	4.2
07:42:34	33-56-05.1	130-52-18.4	028.7	084	6.2
07:42:37	33-56-05.5	130-52-18.6	029.0	084	6.8
07:43:01	33-56-07.4	130-52-20.2	036.6	076	5.7

Note: Vessel position (excluding the position at the site of the collision) refers to the position of the GPS antenna installed at the portside stern on the upper side of the bridge.

Table 3 AIS Record of Vessel A

Time (H : M : S)	Vessel Position: Direction(°) and Distance(m) from Daibahana Lighthouse		Course OG (°)	Bow Bearing (°)	Speed OG (kn)	Direction (°) and Distance(m) of Vessel B from Vessel A	
07:17:05	205.9	3,250	021	247	0.0	—	—
07:26:05	204.2	3,310	235	195	0.4	—	—
07:29:06	204.1	3,420	186	123	1.6	—	—
07:32:04	202.3	3,480	081	054	1.3	Port bow 45	3,140
07:35:08	200.4	3,290	055	046	3.3	Port bow 37	2,540
07:35:37	199.8	3,250	054	042	3.8	Port bow 33	2,430
07:36:08	199.2	3,190	051	037	4.3	Port bow 28	2,310
07:36:37	198.6	3,130	041	034	4.8	Port bow 25	2,180
07:37:08	198.2	3,050	036	034	5.2	Port bow 25	2,040
07:37:37	197.8	2,960	034	033	5.7	Port bow 25	1,880
07:38:08	197.3	2,880	033	033	6.2	Port bow 23	1,740
07:38:37	196.7	2,780	033	033	6.7	Port bow 23	1,580
07:39:08	196.0	2,660	033	033	7.2	Port bow 22	1,400
07:39:37	195.2	2,560	034	034	7.6	Port bow 23	1,240
07:40:08	194.1	2,440	035	033	7.9	Port bow 22	1,060
07:40:37	193.0	2,330	037	032	8.2	Port bow 21	860
07:41:08	191.6	2,180	038	029	8.5	Port bow 19	670
07:41:37	187.9	2,090	036	026	8.3	Port bow 17	540
07:42:07	188.3	1,980	035	021	8.0	Port bow 14	360
07:42:27	187.4	1,910	032	019	7.6	Port bow 6	260
07:42:37	186.9	1,880	030	019	7.2	Port bow 5	250
07:43:08	185.8	1,800	029	020	6.0	Port bow 5	230

Note: Vessel position (excluding the position at the site of the collision) refers to the position of the GPS antenna installed at the port side front on the upper side of the bridge.

Table 4 AIS Record of Vessel B

Time (H : M : S)	Vessel Position: Direction(°) Distance(m) from Daibahana Lighthouse		Course OG (°)	Bow Bearing (°)	Speed OG (kn)	Direction (°) Distance(m) of Vessel A from Vessel B	
07:01:45	042.5	2,690	358.9	353	1.8	—	—
07:03:03	043.0	2,640	333.8	338	2.8	—	—
07:05:03	038.2	2,710	315.4	316	4.1	—	—
07:10:04	022.6	2,600	266.2	279	5.0	—	—
07:12:04	016.6	2,430	248.5	260	5.4	—	—
07:15:05	006.4	2,070	234.4	246	5.9	—	—
07:20:04	342.9	1,540	224.6	229	5.4	—	—
07:22:01	332.9	1,390	200.7	202	4.5	—	—
07:25:04	318.4	1,110	194.8	198	4.3	—	—
07:27:04	305.4	980	191.7	194	4.2	—	—
07:28:04	298.1	930	188.1	191	4.2	—	—
07:29:15	288.4	880	184.6	188	4.3	—	—
07:30:05	281.3	860	177.5	182	4.5	—	—
07:31:05	271.9	830	173.7	181	4.9	—	—
07:32:05	261.6	820	172.8	180	4.8	Starboard bow 9	3,140
07:33:05	251.1	840	170.7	179	4.9	—	—
07:34:05	240.9	870	168.4	176	5.1	—	—
07:35:05	231.5	930	165.4	171	5.1	Starboard bow 18	2,540
07:35:35	227.2	970	164.0	168	5.2	Starboard bow 21	2,430
07:36:05	223.1	1,000	162.5	164	5.2	Starboard bow 25	2,310
07:36:35	219.0	1,050	157.5	160	5.2	Starboard bow 29	2,180
07:37:05	215.2	1,080	155.0	158	5.2	Starboard bow 31	2,040
07:37:35	211.5	1,130	153.8	158	5.3	Starboard bow 30	1,880
07:38:05	208.2	1,170	152.8	157	5.3	Starboard bow 33	1,740
07:38:35	204.9	1,220	152.7	158	5.3	Starboard bow 32	1,580
07:39:05	202.0	1,270	152.9	159	5.3	Starboard bow 32	1,400
07:39:34	199.2	1,330	153.7	160	5.4	Starboard bow 31	1,240
07:40:05	196.8	1,390	154.9	159	5.4	Starboard bow 32	1,060
07:40:45	193.9	1,470	150.4	154	5.4	Starboard bow 37	860
07:41:05	192.4	1,510	149.6	150	5.3	Starboard bow 40	670
07:41:31	190.6	1,560	147.4	139	5.2	Starboard bow 49	540
07:42:01	188.5	1,620	135.2	118	5.0	Starboard bow 69	360
07:42:28	186.4	1,650	114.3	093	4.7	Starboard bow 100	260
07:42:31	185.7	1,780	106.3	086	4.2	—	—
07:42:34	185.9	1,640	028.7	084	6.2	—	—
07:42:37	185.8	1,620	029.0	084	6.8	Starboard bow 110	250
07:43:01	184.5	1,570	036.6	076	5.7	Starboard bow 119	230

Note: Vessel position (excluding the position at the site of the collision) refers to the position of the GPS antenna installed at the portside stern on the upper side of the bridge.

Photo 1 Vessel A



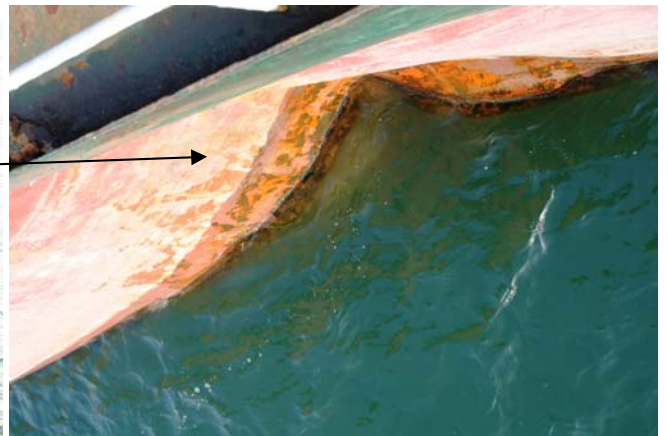
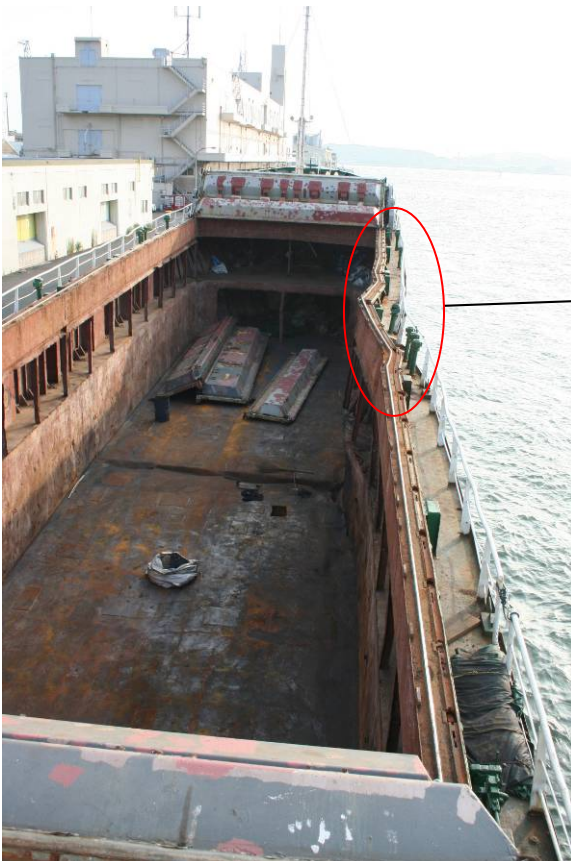
Photo 2 Outlook from Bridge of Vessel A



Photo 3 Vessel B



Photo 4 Starboard of Vessel B



Damage near the starboard waterline