

MA2017-2

**MARINE ACCIDENT
INVESTIGATION REPORT**

February 23, 2017



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.

Kazuhiro Nakahashi
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: Chemical Tanker "SULPHUR GARLAND"
IMO number: 9209013
Gross tonnage: 3,498 tons

Vessel type and name: Oil Tanker "WAKOMARU NO. 2"
IMO number: 141721
Gross tonnage: 2,018 tons

Accident/Incident type: Collision
Date and time: Around 03:26:39, October 17, 2015
Location: East off Mutureshima Island, Shimonoseki City, Yamaguchi Prefecture
(Kanmon Passage, Kanmon Port)
Around 071° true bearing, 1,360 meters from the Mutureshima Lighthouse
(approximately 33°58.9'N, 130°52.9'E)

February 9, 2017

Adopted by the Japan Transport Safety Board

Chairman	Kazuhiro Nakahashi
Member	Kuniaki Shoji
Member	Satoshi Kosuda
Member	Toshiyuki Ishikawa
Member	Mina Nemoto

SYNOPSIS

< Summary of the Accident >

While chemical tanker SULPHUR GARLAND was proceeding north-northeast along Kanmon Passage of Kanmon Port toward Zhenjiang Port, People's Republic of China, with a master and a second officer and other 15 crew members onboard, and while oil tanker WAKOMARU NO. 2 was proceeding south-southeast along the same passage toward Oita Port, Oita Prefecture, with a master and a second officer and other 8 crew members aboard, the two vessels collided at about 03:26 on October 17, 2015, near the West Entrance of Kanmon Passage, east of Mutureshima Island, Shimonoseki City, Yamaguchi Prefecture.

The bow of SULPHUR GARLAND was crushed, and the aft starboard side shell plating of WAKOMARU NO. 2 was holed and dented, which resulted in an oil spill.

There were no fatalities or injuries on either vessel.

< Probable Causes >

It is probable that, SULPHUR GARLAND and WAKOMARU NO. 2 collided during nighttime, at off the eastern coast of Mutsureshima Island, because, while SULPHUR GARLAND was proceeding north-northwest through Kanmon Passage toward the West Entrance of the passage, and WAKOMARU NO. 2 was proceeding south-southeast toward the West Entrance of Kanmon

Passage having medium-sized purse seine fishing vessel sailing in the same direction in her starboard bow, WAKOMARU NO. 2 came close to Medium-sized purse seine fishing vessel and turned to port to an entered the left part side of Kanmon Passage, while SULPHUR GARLAND maintained course and speed.

It is somewhat likely that the reason that WAKOMARU NO. 2 came close to Medium-sized purse seine fishing vessel, turned to port and entered the left part of Kanmon Passage was that, after observing SULPHUR GARLAND proceeding north through Kanmon Passage and Medium-sized purse seine fishing vessel proceeding Southeast toward the West Entrance of the passage, he did not maintain proper lookout om SULPHUR GARLAND and Medium-sized purse seine fishing vessel, and therefore, he was unable to anticipate that WAKOMARU NO. 2 would be in a situation crossing ahead of SULPHUR GARLAND, which was proceeding north through the Kanmon Passage, and at that time, sailing the port side of Medium-sized purse seine fishing vessel, and further, he made WAKOMARU NO. 2's speed almost same with the speed of Medium-sized purse seine fishing vessel which was sailing in the starboard ahead that made WAKOMARU NO. 2 unable to take starboard turn and Navigation WAKOMARU NO. 2's second officer became confused.

It is somewhat likely that the fact that Navigation WAKOMARU NO. 2's second officer had never experience bride watch without master's conning and was handling lookout, steering, and VHF radio telephone communication by his own in Kanmon Passage, contributed to Navigation WAKOMARU NO. 2's second officer's confusion.

It is probable that the reason that SULPHUR GARLAND maintained course and speed was that second officer thought that information provided by the Kanmon Kaikyo Vessel Traffic Service Center to keep to the starboard side was an instruction, and that he thought that WAKOMARU NO. 2 would eventually turn to starboard and pass port to port with SULPHUR GARLAND navigating the starboard side of the passage.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

While chemical tanker SULPHUR GARLAND was proceeding north-northeast along Kanmon Passage of Kanmon Port toward Zhenjiang Port, People's Republic of China, with a master and a second officer and other 15 crew members onboard, and while oil tanker WAKOMARU NO. 2 was proceeding south-southeast along the same passage toward Oita Port, Oita Prefecture, with a master and a second officer and other 8 crew members aboard, the two vessels collided at about 03:26 on October 17, 2015, near the West Entrance of Kanmon Passage, east of Mutureshima Island, Shimonoseki City, Yamaguchi Prefecture.

The bow of SULPHUR GARLAND was crushed, and the aft starboard side shell plating of WAKOMARU NO. 2 was holed and dented, which resulted in an oil spill.

There were no fatalities or injuries on either vessel.

1.2 Outline of the Accident Investigation

1.2.1 Setup of the Investigation

The Japan Transport Safety Board appointed an investigator-in-charge and one other investigator to investigate this accident on October 17, 2015.

1.2.2 Collection of Evidence

October 17 and 29, 2015: On-site investigations

October 18, 30 and 31, 2015: On-site investigations and interviews

October 19, 2015 and February 2, 2016: Interviews and collection of questionnaires

October 21, 26 and 28, November 5, 13, 17, 24 and 28, 2015 and February 22, March 25, April 11 and June 13, 2016: Collection of questionnaires

December 2, 10 and 15, 2015: Interviews

1.2.3 Comments of Parties Relevant to the Cause

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

1.2.4 Comments from Flag State

Comments on the draft report were invited from the flag State of the SULPHUR GARLAND.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 The Navigational Track according to the Automatic Identification System

According to the "records of the Automatic Identification System (AIS)^{*1} data (hereinafter referred to as "the AIS record") received by a data company in Japan," the navigation track of the "SULPHUR GARLAND" (hereinafter referred to as "Vessel A") and "WAKOMARU NO. 2" (hereinafter referred to as "Vessel B") from 03:00:02 to 03:28:19 on October 17, 2015 were as shown

^{*1} Automatic Identification System (AIS) is a device that each vessel uses to automatically transmit and receive information such as vessel identification code, ship type, name, position, course, speed, destination, and conditions of navigation and exchanges information with other vessels or land-based navigation aids.

in Table 2.1.1 and 2.1.2 below.

The positions of Vessel A and of Vessel B are the positions of the GPS antennas located on the upper side of their respective bridges. The course over ground and heading are true bearings (hereinafter the same).

Table 2.1-1 AIS Record of Vessel A (Excerpt)

Time (HH:MM:SS)	Ship's position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (N) (° -' -")	Longitude (E) (° -' -")			
03:00:02	33-54-58.3	130-53-51.2	318.8	321	9.3
03:05:02	33-55-35.2	130-53-12.2	318.7	319	9.9
03:10:02	33-56-14.2	130-52-34.5	324.0	323	10.2
03:15:02	33-56-58.5	130-52-06.8	001.1	001	9.8
03:20:01	33-57-44.3	130-52-27.8	033.4	032	10.6
03:21:01	33-57-53.6	130-52-34.6	026.8	021	10.7
03:21:51	33-57-53.6	130-52-37.8	008.7	007	10.6
03:22:51	33-58-12.6	130-52-39.4	006.5	008	10.8
03:23:32	33-58-19.9	130-52-40.6	007.3	008	10.9
03:24:32	33-58-30.8	130-52-42.8	011.3	011	11.0
03:25:02	33-58-36.1	130-52-44.3	014.4	013	10.9
03:25:32	33-58-41.4	130-52-46.2	014.9	018	11.0
03:26:02	33-58-46.7	130-52-48.4	022.3	026	10.9
03:26:12	33-58-48.5	130-52-49.4	027.3	028	11.0
03:26:32	33-58-51.6	130-52-51.4	031.9	033	11.0
03:26:41	33-58-53.1	130-52-52.6	034.0	035	11.0
03:26:52	33-58-54.1	130-52-53.5	058.0	055	6.4
03:28:19	33-58-55.9	130-53-01.1	078.0	072	5.3

Table 2.1-2 AIS Record of Vessel B (Excerpt)

Time (HH:MM:SS)	Ship's position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (N) (° -' -")	Longitude (E) (° -' -")			
03:00:03	34-04-18.9	130-51-13.9	167.1	166	12.7
03:05:03	34-03-16.0	130-51-31.2	167.0	167	12.8
03:10:03	34-03-13.3	130-51-48.3	167.3	167	12.8
03:15:03	34-01-10.0	130-52-05.8	167.4	166	13.1
03:20:04	34-00-06.4	130-52-21.7	171.8	172	13.0
03:21:04	33-59-53.6	130-52-23.9	172.3	172	13.0
03:22:04	33-59-40.7	130-52-26.0	172.2	172	13.0
03:23:04	33-59-27.8	130-52-28.0	172.5	170	13.0
03:24:33	33-59-13.2	130-52-37.8	140.2	143	10.7
03:25:14	33-59-07.4	130-52-42.5	149.4	144	10.1
03:26:02	33-59-00.4	130-52-48.3	143.8	138	10.3
03:26:29	33-58-57.2	130-52-52.0	140.2	120	10.7

03:26:39	33-58-55.9	130-52-53.8	131.5	107	10.4
03:26:50	33-58-56.1	130-52-55.7	089.2	131	9.4
03:27:59	33-58-55.6	130-53-01.8	113.0	229	2.1

2.1.2 Events in Navigation according to the Voyage Data Recorder, etc.

(1) Voice record data

According to transcripts of VHF radio telephone (hereinafter referred to as “VHF”) communication by the Kanmon Kaikyo Vessel Traffic Service Center (hereinafter referred to as “Kanmon MARTIS”) and the data record of the Voyage Data Recorder (VDR)*2 of Vessel A (hereinafter referred to as the “VDR Record”), the main voice record pertaining to Vessel A, Vessel B, and Kanmon MARTIS as well as Audio in the bridge of Vessel A between 03:21:45 and 03:27:40 on October 17, 2015, were as provided in Table 2.1.3.

It should be noted that communication where VHF communication and the VDR record are overlapped, voice in the bridge of Vessel A is omitted, and the conversation on the bridge of Vessel A carried out in Tagalog is translated into and presented in English.

Table 2.1-3 Transcript of VHF Communication (Excerpt) and Audio in the bridge of Vessel A (Provisional Translation)

Time	Channel Used	Transcript of VHF Communication (Vessel A, Vessel B, and Kanmon MARTIS)	Audio in the bridge of Vessel A
03:21:45 - 50	16	<u>Kanmon MARTIS</u> : Vessel without AIS that is currently proceeding south near Matsuse North Buoy, identify yourself. *Kanmon MARTIS is calling a medium-sized purse seine fishing vessel that was sailing ahead of Vessel B (hereinafter referred to as “Vessel C”).	
03:22:12 - 35	16	<u>Kanmon MARTIS</u> : Vessel B, this is Kanmon MARTIS. <u>Vessel B</u> : Kanmon MARTIS, this is Vessel B.	
	13	<u>Kanmon MARTIS</u> : Is the vessel to your front starboard a fishing vessel or something? <u>Vessel B</u> : Yes, it appears to be a fishing vessel. <u>Kanmon MARTIS</u> : Understood. Please use caution.	
03:23:01 - 59	16	<u>Kanmon MARTIS</u> : Vessel A, this is KANMON MARTIS. Keep to the starboard side of the fairway vessel on the opposite course ahead of you. <u>Vessel A</u> : OK sir, keep starboard side.	<u>Second officer (hereinafter referred to as “Navigation Officer A”)</u> : Kanmon MARTIS, this other ship will be passing with me starboard to starboard?
03:24:02 - 59	16	<u>Kanmon MARTIS</u> : Vessel B, this is Kanmon MARTIS. <u>Vessel B</u> : This is Vessel B.	<u>Navigation Officer A</u> : Are we on hand steering now?

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

	14	<p><u>Kanmon MARTIS</u>: You have another vessel approaching you on the opposite course. What is your action?</p> <p><u>Vessel B</u>: We are reducing speed now.</p> <p><u>Kanmon MARTIS</u>: Will you switch to port to port (pass port to port)?</p> <p><u>Vessel B</u>: That would be helpful.</p> <p><u>Kanmon MARTIS</u>: Port to port. And are you avoiding the fishing vessel?</p> <p><u>Vessel B</u>: Yes, we are. We are avoiding her right now.</p> <p><u>Kanmon MARTIS</u>: OK, keep to the starboard side when you're done.</p> <p><u>Vessel B</u>: Understood.</p>	<p><u>Able seaman on watch</u> (hereinafter referred to as "Able Seaman A"): Um, what are we going to do. That's a green light.</p> <p><u>Navigation Officer A</u>: Yeah. Are we on hand steering?</p>
	16	<p><u>Kanmon MARTIS</u>: Vessel A, this is Kanmon MARTIS.</p> <p><u>Vessel A</u>: Yes, go ahead.</p>	
03:25:00 - 59	13	<p><u>Kanmon MARTIS</u>: Vessel on your port bow, keep to the starboard side, and vessel on opposite course, pay attention her movement. Over.</p> <p><u>Kanmon MARTIS</u>: Pass her port to port over.</p>	<p><u>Navigation Officer A</u>: There, she showing green sir.</p> <p><u>Navigation Officer A</u>: Port to port.</p> <p><u>Navigation Officer A</u>: Starboard 20°. (03:25:38)</p> <p><u>Able Seaman A</u>: Starboard 20°. (03:25:39)</p>
03:26:00 - 40	13	<p><u>Kanmon MARTIS</u>: Vessel A, this is KANMON MARTIS. Keep clear of vessel ahead of you, WARNING. Vessel ahead of you. Keep clear. (03:26:14)</p>	<p><u>Navigation Officer A</u>: Hard to port?</p> <p><u>Able Seaman A</u>: Do you want to turn hard to port? Won't it be a bit difficult to turn hard to port?</p>
	16	<p><u>Kanmon MARTIS</u>: Vessel B, pay attention vessel on opposite course. (03:26:40)</p>	<p><u>Navigation Officer A</u>: This (port to port) won't work if something doesn't happen (the port side light becomes visible).</p> <p><u>Able Seaman A</u>: Hard to port. (03:26:13)</p> <p>*Sound of impact at 03:26:39 (VDR Record)</p>
03:27:03 - 40			<p><u>Navigation Officer A</u>: What was that?</p> <p><u>Able Seaman A</u>: The vessel in front cut across.</p> <p><u>Master of Vessel A</u> (hereinafter referred to as "Master A"): Hey, did we hit something?</p>

			<p><u>Navigation Officer A:</u> Yes, sir.</p> <p><u>Master A:</u> What happened?</p> <p><u>Navigation Officer A:</u> A vessel cut across.</p>
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(2) Radar images of the VDR Record

Vessel A’s VDR Record included images from a radar installed on the port side of the bridge. According to the images, the circumstances of the accident were as follows.

- 1) The image of what looked like a small vessel to the front starboard of Vessel B appeared on Vessel A’s radar from about 03:21.
- 2) Information for Vessel B appeared on Vessel A’s radar from a function that superimposes AIS data from about 03:23.
- 3) The image of the apparent small vessel was not captured or tracked by the capture function of Vessel A’s radar.

(See Figure 1 Radar Images from Vessel A)

2.1.3 Events in Navigation according to Navigation Record of the Electronic Chart Display and Information System

(1) Circumstances of Vessel B’s steering

According to the navigation record of Vessel B’s Electronic Chart Display and Information System*³ (hereinafter referred to as “ECDIS”), the circumstances of steering between 03:21:07 and 03:27:19 on October 17, 2015, were as shown in Table 2.1.4.

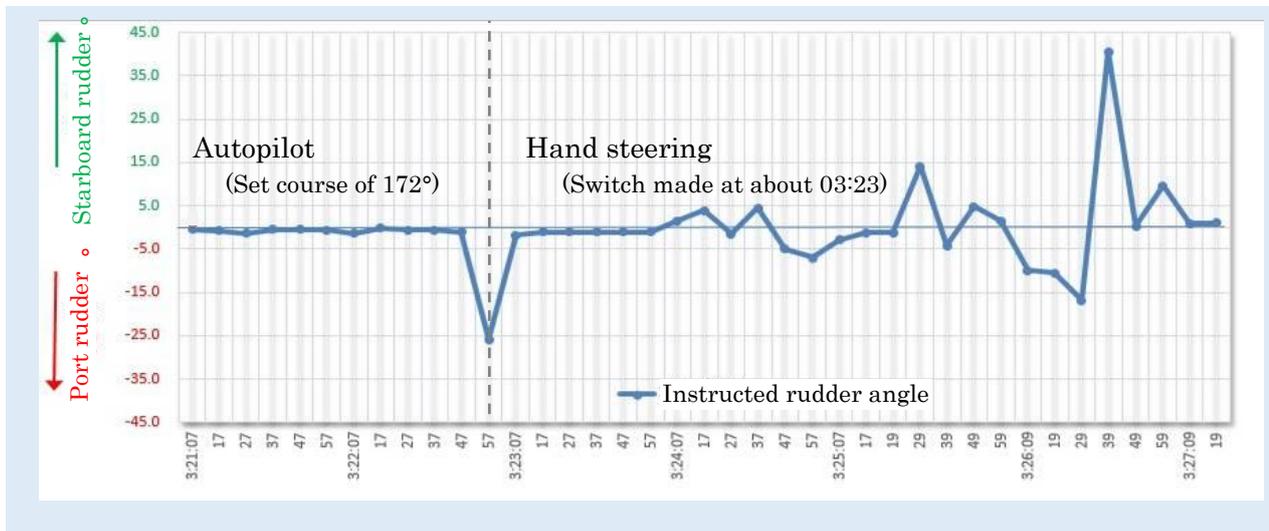


Table 2.1-4 Circumstances of Vessel B’s Steering

*³ Electronic Chart Display and Information System (ECDIS) is a device that displays the position of the vessel into which the device is installed on an electronic chart (Electronic Navigation Chart or Raster Navigational Chart) that satisfies criteria of the International Hydrographic Organization (IHO). An ECDIS also superimposes radar data, planned route, and other information on the display and has a function that issues proximity warnings for shoals, etc.

(2) Events in Vessel C's navigation

According to the navigation record of Vessel B's ECDIS, the events in the navigation of Vessel C, which was sailing ahead of Vessel B, between 03:20:07 and 03:27:09 on October 17, 2015, were as shown in Table 2.1.5.

Table 2.1-5 Record of Vessel C according to the ECDIS Record of Vessel B (Excerpt)

Time (HH:MM:SS)	Ship's position		Course Over the Ground* (°)	Speed Over the Ground (knots [kn])
	Latitude (N) (° -' -")	Longitude (E) (° -' -")		
03:20:07	33-59-44.7	130-52.06.6	141.1	10.2
03:21:07	33-59-36.8	130-52-14.3	141.0	10.1
03:21:37	33-59-32.3	130-52-17.6	141.0	10.1
03:22:07	33-59-27.8	130-52-21.3	141.2	10.4
03:22:37	33-59-24.2	130-52-24.8	143.5	10.2
03:23:07	33-59-19.6	130-52-32.6	145.5	10.2
03:23:37	33-59-15.2	130-52-40.6	143.9	10.5
03:24:07	33-59-10.9	130-52-42.8	144.6	10.4
03:25:07	33-59-01.6	130-52-40.6	147.0	10.3
03:25:29	33-58-57.8	130-52-42.8	147.4	10.4
03:26:09	33-58-51.4	130-52-45.5	148.8	10.3
03:26:39	33-58-47.3	130-52-47.2	149.5	10.2
03:27:09	33-58-42.1	130-52-48.5	151.0	10.2

2.1.4 Events Leading to the Accident according to the Statements of Crew members

According to the statements of Master A, Navigation Officer A, Able Seaman A; Vessel B's master (hereinafter referred to as "Master B"), second officer (hereinafter referred to as "Navigation Officer B"), second engineer (hereinafter referred to as "Engineer B"), and able seaman on watch (hereinafter referred to as "Able Seaman B"); and Vessel C's master (hereinafter referred to as "Master C") and two ordinary seamen, the events leading to the accident were as follows.

(1) Vessel A

At about 16:24 on October 16, 2015, Vessel A left Iwakuni Port in Yamaguchi Prefecture, heading to Zhenjiang Port, People's Republic of China, with Master A and Navigation Officer A and other 15 crew members onboard.

At about 02:00 on October 17, Vessel A entered the East Entrance of Kanmon Passage with Master A conning the vessel near the center front of the wheel house, Navigation Officer A of the watch assigned to lookout duty, and Able Seaman A of the watch assigned to hand steering.

At about 03:18, Navigation Officer A observed by radar that Vessel B was proceeding south-southeast toward the western gate of Kanmon Passage and reported this fact to Master A. Navigation Officer A and Master A then together visually observed the starboard side light of Vessel B.

At about 03:20, Vessel A altered course to 006° in parallel with Kanmon Passage near Kanmon Passage No. 5 Light Buoy.

At about 03:21, Master A felt the need to visit the head. Because Master A did not observe any vessels in the vicinity with the exception of Vessel B, he departed the bridge after ordering

Navigation Officer A to pay attention to the vessel's course and the movements of Vessel B.

At about 03:23, Navigation Officer A could see Vessel B's starboard side light strongly and thought she was turning to port, but he did not understand the intent behind Vessel B's maneuvering.

Navigation Officer A subsequently received a message from Kanmon MARTIS to keep to the right side of the passage and watch for a vessel on an opposite course. Navigation Officer thus maintained course and speed, thinking that Vessel B would eventually turn to starboard and pass on the port side.

Neither Navigation Officer A nor Able Seaman A observed any vessel to the front other than Vessel B.

At about 03:24, Navigation Officer A felt that Vessel B, which continued to show its starboard side light and was approaching, posed a danger. However, he could not turn to port so as to pass Vessel B on the starboard side in violation of the established navigation scheme of Kanmon Passage, nor could he turn to starboard because he sensed that the shore and light buoys to the front starboard were near. He therefore telephoned the master's cabin but received no response from Master A.

At about 03:25, Navigation Officer A received and acknowledged a message from Kanmon MARTIS saying to pass Vessel B port to port, and ordered Able Seaman A to put the rudder to 20°starboard.

Navigation Officer A thought the message from Kanmon MARTIS was an instruction.

At about 03:26, Navigation Officer A sensed there was danger that the vessel would collide with Vessel B and ordered the rudder put to hard port, and Able Seaman A put the rudder to hard port. Nevertheless, the bow of Vessel A and the aft starboard side of Vessel B collided.

(2) Vessel B

At about 12:35 on October 15, 2015, Vessel B left Niigata Port in Niigata Prefecture, heading to Oita Port, Oita Prefecture, with Master B and Navigation Officer B and eight crew members onboard.

At about 23:45 on October 16, the bridge watch was passed from Master B to Navigation Officer B. At about 03:00 on October 17, Vessel B was sailing toward the West Entrance of the Kannon Passage under auto pilot at a speed of 12.7 knots (speed over the ground; hereinafter the same), with Navigation Officer B conning the vessel and keeping lookout, standing behind the steering stand in the center of the wheel house, and Able Seaman B keeping lookout at the port side of the bridge's front.

At about 03:10, Navigation Officer B made a position report to Kanmon MARTIS as the vessel passed the MN Line.*⁴

At about 03:11, Navigation Officer B telephoned Engineer B, who had engine watch, to ask him to come to the bridge at about the position that Master B marked "call master" on the chart. Navigation Officer B then telephoned the master's cabin but did not receive a response from Master B. Navigation Officer B decided to telephone again near the entrance to the passage.

Navigation Officer B was aware that Kanmon Passage is a narrow waterway regulated by the Safety Management Manual.

*⁴ The "MN Line" is one of the lines for which the 7th Regional Coast Guard Headquarters requires a report to Kanmon MARTIS as a navigational safety instruction. It is a line that connects the Mutureshima Lighthouse, a point 6,930 meters at bearing 000° from Mutureshima Lighthouse, and the Kurumise Light Beacon.

At about 03:13, Engineer B arrived on the bridge and took the engine operation station, standing behind the main engine control panel.

At about 03:19, Navigation Officer B visually observed Vessel C proceeding southeast to the front starboard and observed Vessel A, which was proceeding north in Kanmon Passage, by AIS data displayed on the ECDIS.

At about 03:21, Navigation Officer B visually observed Vessel A proceeding north to the south of Kanmon Passage No. 5 Light Buoy.

Because Vessel B was approaching Vessel C, which was located to her front starboard, Navigation Officer B was unable to turn to starboard and sail in parallel with the passage. He therefore switched to hand steering and made a gradual turn to port. At about 03:23, Vessel B entered Kanmon Passage.

Because Vessel B continued to approach Vessel C, Navigation Officer B ordered a reduction in speed by changing the blade angle of the controllable pitch propeller from 15° to 10°. Engineer B changed the blade angle by telegraph.

At about 03:24, Navigation Officer B thought he had been asked by Kanmon MARTIS whether he would pass Vessel A on the starboard side. He acknowledged the message and kept a straight course.

At about 03:26, Navigation Officer B sensed that there was a danger of collision with the approaching Vessel A and made a turn to port. He ordered Able Seaman B to go to the master's cabin and call Master B as he continued to maintain a port rudder. However, Vessel B and Vessel A collided.

After the accident, Navigation Officer B realized that he had been confused by the continuing situation in which he could not make a starboard rudder due to the presence of Vessel C, and that he had interpreted the question from Kanmon MARTIS concerning whether he would pass Vessel A on the port side as a question concerning passing on the starboard side.

(3) Vessel C

Vessel C was sailing from fishing grounds to Shimonoseki Fishing Port in Shimonoseki City, Yamaguchi Prefecture, with Master C and nine crew members on board, and with regulation lights for a power-driven vessel that is underway and work lights on the stern turned on. At about 03:20, Master C visually observed Vessel B approaching from the rear port side of Vessel C near the Matsuse North Light Buoy.

At about 03:22 or 03:23, approximately two or three minutes after visually observing Vessel B, Master C observed Vessel B, which continued to approach Vessel C, and Vessel A, which was proceeding north to the front starboard side. He therefore made a starboard rudder toward a course for Vessel A's stern and continued sailing.

Two ordinary seamen of Vessel C who were working on the stern heard the sound of the collision of Vessel A and Vessel B but did not hear any whistles or other acoustic signals from other vessels.

The date and time of occurrence of the accident were at about 03:26:39 on October 17, 2015, and the location was at about 1,360 meters at 071° true bearing from the Mutureshima Lighthouse. (See Figure 2 Navigation Paths and Figure 3 Navigation Paths [Enlarged])

2.2 Injuries to Persons

No one was injured.

2.3 Damage to Vessel

(1) Vessel A

According to the statement of Master A and the reply to the questionnaire by Daiichi Tanker Co., Ltd., which is the operator of Vessel A (hereinafter referred to as “Company A₁”), the bow and bulbous bow of Vessel A were crushed. (See Figure 2.3.1)

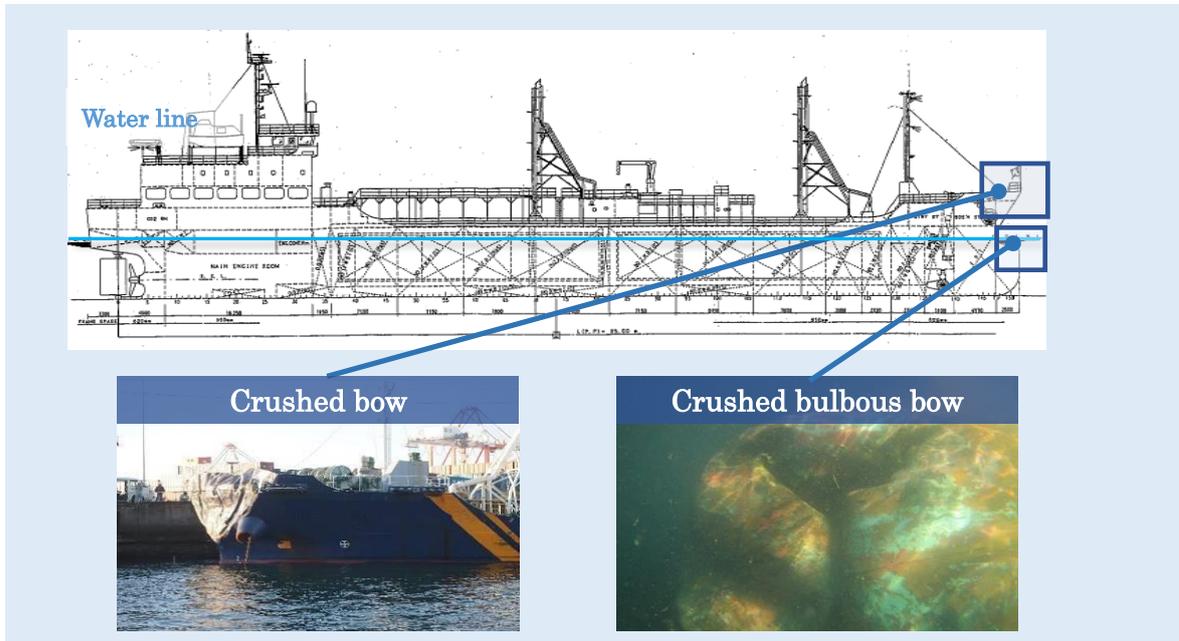


Figure 2.3-1 Damage to Vessel A

(2) Vessel B

According to the reply to the questionnaire of Showa Nittan Corp., which is the operator of Vessel B (hereinafter referred to as “Company B₁”), the aft starboard side shell plating was holed and dented. (See Figure 2.3.2)

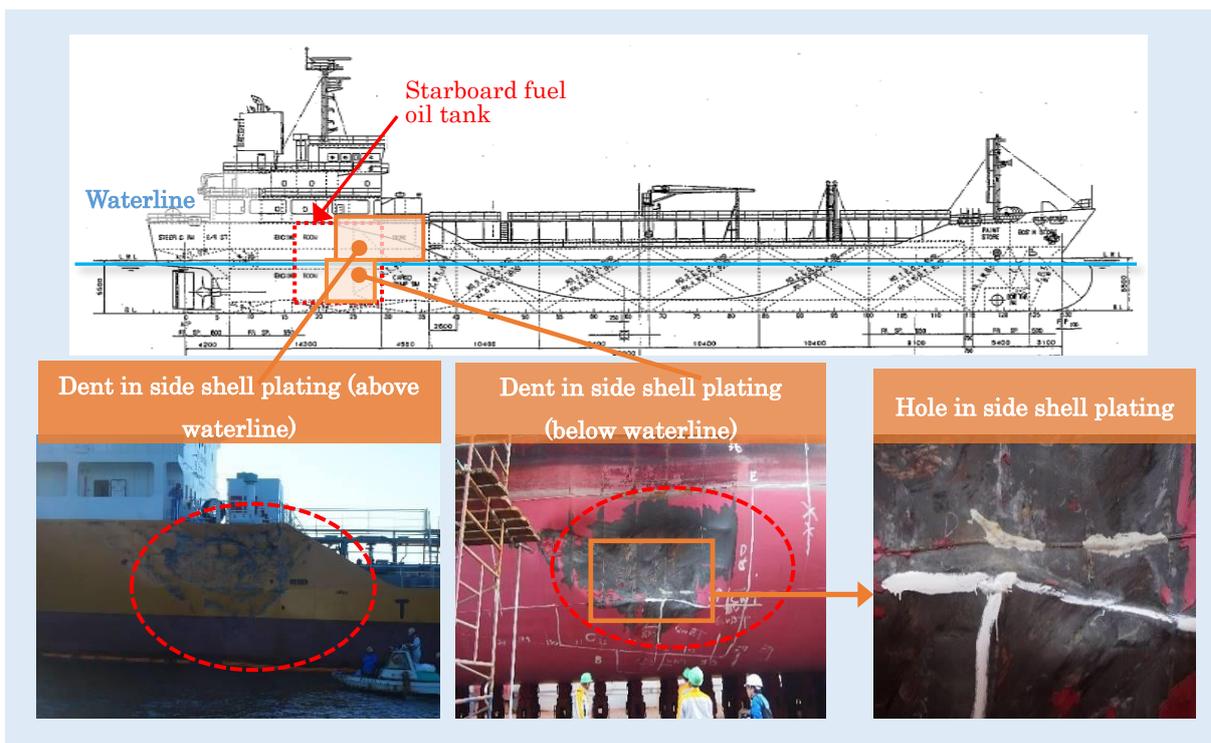


Figure 2.3-2 Damage to Vessel B

2.4 Crew Information

(1) Gender, Age, and Certificate of Competence

- 1) Master A: Male, 51 years old, national of the Republic of the Philippines
Endorsement attesting the recognition of certificate under STCW regulation I/10:
Master (issued by the Republic of Panama)
Date of Issue: January 7, 2014
(Valid until December 31, 2016)
- 2) Navigation Officer A: Male, 41 years old, national of the Republic of the Philippines
Endorsement attesting the recognition of certificate under STCW regulation I/10:
Second Officer (issued by the Republic of Panama)
Date of Issue: January 14, 2015
(Valid until May 16, 2016)
- 3) Master B: Male, 63 years old
Fourth grade maritime officer (navigation)
Date of Issue: January 27, 1995
Date of revalidation: August 7, 2014
Date of expiry: January 26, 2020
- 4) Navigation Officer B: Male, 22 years old
Fourth grade maritime officer (navigation)
Date of Issue: March 26, 2013
Date of revalidation: June 17, 2014
Date of expiry: March 25, 2018
- 5) Able Seaman B: Male, 52 years old
Sixth grade maritime officer (navigation)
Date of Issue: October 21, 2011
Date of revalidation: October 21, 2011
Date of expiry: October 20, 2016

(2) Sea-going Experience

According to the statements of Master A, Navigation Officer A, Master B, Navigation Officer B and Able Seaman B, their experience was as follows.

1) Master A

Master A joined Foscon Shipping & Marine Transport, Inc. (hereinafter referred to as "Company A₂") in 2006 and became a master of vessels operated by Company A₁. He had been aboard Vessel A since October 3, 2015.

His experience navigating Kanmon Passage amounted to roughly once every two weeks since 1999.

He was in good health at the time of the accident.

2) Navigation Officer A

Navigation Officer A joined Company A₂ in 2009. He had been aboard Vessel A since August 27, 2015.

His experience navigating Kanmon Passage amounted to eight times, all of which he spent stationed on the bridge with the master conning the vessel.

He was in good health at the time of the accident.

3) Master B

Master B joined Heiwa Shipping Co., Ltd. (hereinafter referred to as "Company B₂") in 1968.

He had been aboard Vessel B since August 29, 2015.

He had approximately 20 years of experience as a master with Company B₂. He had navigated Kanmon Passage about fifty times a year.

At the time of the accident, he had bridge watch from 08:00 to 12:00 and from 20:00 to 24:00.

He was in good health at the time of the accident.

4) Navigation Officer B

Navigation Officer B joined Company B₂ in April 2013. He had been aboard Vessel B since September 5, 2015.

After serving as an able seaman, he became a second officer about one year before the accident.

His experience navigating Kanmon Passage amounted to between twenty and thirty times, all of which he spent stationed on the bridge with the master conning the vessel.

He was in good health at the time of the accident.

5) Able Seaman B

Able Seaman B joined Company B₂ in November 2014. He had been aboard Vessel B since September 30, 2015.

His experience navigating Kanmon Passage amounted to approximately 20 times. However, he handled lookout when on Vessel B's bridge watch and had never steered on Vessel B.

He was in good health at the time of the accident.

2.5 Vessel Information

2.5.1 Particulars of the Vessels

(1) Vessel A

IMO number:	9209013
Port of registry:	Panama (Republic of Panama)
Owner:	PALM S.A. (Republic of Panama)
Management company:	Company A ₂
Operator:	Company A ₁
Classification Society:	Nippon Kaiji Kyokai
Gross tonnage:	3,498 tons
L×B×D:	101.05m×16.00m×7.80m
Hull material:	Steel
Engine:	Diesel engine x 1
Output:	3,236kW
Propulsion:	4-blade fixed pitch propeller x 1
Date of launch:	May 14, 1999

(See Photo 2.5-1)



Photo 2.5-1 Vessel A

(2) Vessel B

Vessel number:	141721
Port of registry:	Kure City, Hiroshima Prefecture
Owner:	Company B ₂
Management company:	Company B ₂
Operator:	Company B ₁
Classification Society:	Nippon Kaiji Kyokai
Gross tonnage:	2,018 tons
L×B×D:	89.56m×14.60m×6.70m
Hull material:	Steel
Engine:	Diesel engine x 1
Output:	2,065kW
Propulsion:	4-blade controllable pitch propeller x 1
Date of launch:	June 20, 2012

(See Photo 2.5-2)



Photo 2.5-2 Vessel B

2.5.2 Hull and Load Conditions

(1) Vessel A

According to the replies to the questionnaire by Master A and Company A₁, at the time of

Vessel A's departure from Iwakuni Port, she was loaded with approximately 4,400 tons of dissolved sulfur. The draft was about 2.75 m in the bow and about 5.20 m in the stern.

According to the statements of Master A and Navigation Officer A, at the time of the accident, the fore and aft mast lights, starboard light, port light, and stern light were lit, and there was no malfunction or failure in the hull, engine, or machineries.

(2) Vessel B

According to the replies to the questionnaire by Master B and Company B₁, at the time of the accident, Vessel B did not carry cargo. The draft was about 2.20 m in the bow and about 4.60 m in the stern.

According to the statement of Navigation Officer B, at the time of the accident, the fore and aft mast lights, starboard light, port light, and stern light were lit, and there was no malfunction or failure in the hull, engine, or machineries.

According to the reply to the questionnaire of Company B₂, the storeroom on the deck was equipped with oil fences (20 m x 5), oil treatment reagent (18 liters x 21 drums), oil absorbing mats (17 kg x 10 drums), oil gelation agent (9 kg x 3 drums), and sawdust (10 kg x 10 bags) as equipment and materials for controlling oil spills.

2.5.3 Information on the Hull Structure, Navigation Equipment, etc.

(1) Vessel A

1) Hull structure

According to the general arrangement plan, Vessel A is a chemical tanker with forecabin and poop and aft engine. In order from the bow side are a deck store, cargo tanks No. 1 to No. 6, and the bridge house. Underneath them are a deck storeroom, fuel oil tanks, engine room, wheel house, etc.

2) Navigation equipment, etc., on the bridge

On the bridge were arranged the AIS display device, VHF, and Gyro Repeater at the front; an Electronic Chart System (ECS),*⁵ two radar consoles, the steering stand, and the main engine control panel at the center; and the VDR control panel at the back. (See Figure 2.5.1)

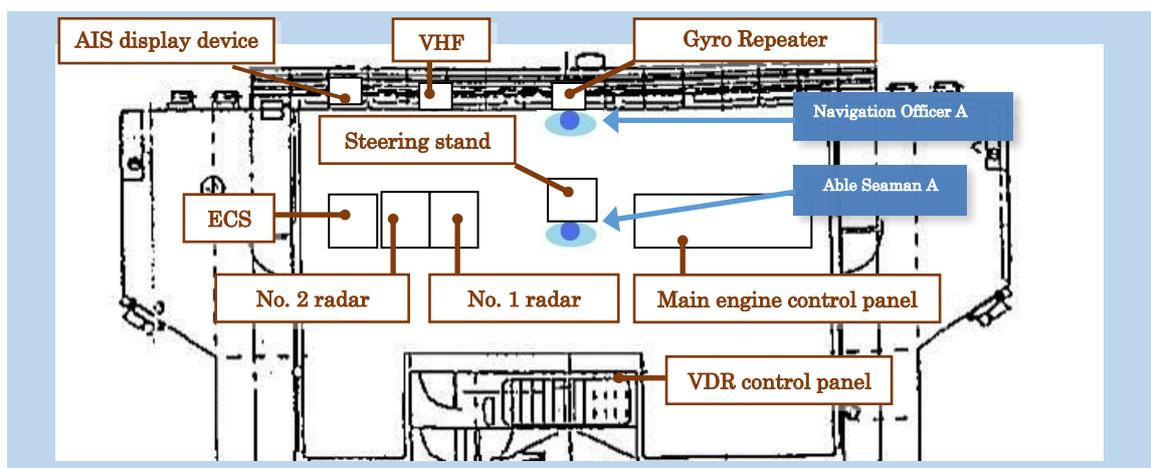


Figure 2.5-1 Bridge Layout of Vessel A and Crew Stations at the Time of the Accident

*⁵ Electronic Chart System (ECS) refers to a type of navigational information system. It is a system that displays chart data and information on a screen. (ECS does not satisfy all requirements for ECDIS that are established by the International Maritime Organization [IMO].)

(2) Vessel B

1) Hull Structure

According to the general arrangement plan, Vessel B is an oil tanker with forecastle and poop and aft engine. In order from the bow side are a deck storeroom, cargo tanks No. 1 to No. 5, and flying bridge. Underneath them are a pump room, fuel oil tanks, engine room, steering gear room, etc. On the starboard side under the flying bridge, the starboard side fuel oil tank is arranged along the shell plating. At the time of the accident, the tank carried approximately 26,200 kl of fuel oil C.

2) Navigation equipment, etc., on the bridge

On the bridge were arranged the Gyro Repeater, VHF, ECDIS, AIS display device, steering stand, and No. 1 radar at the front, and the No. 2 radar and main engine control panel at the center. (See Figure 2.5.2)

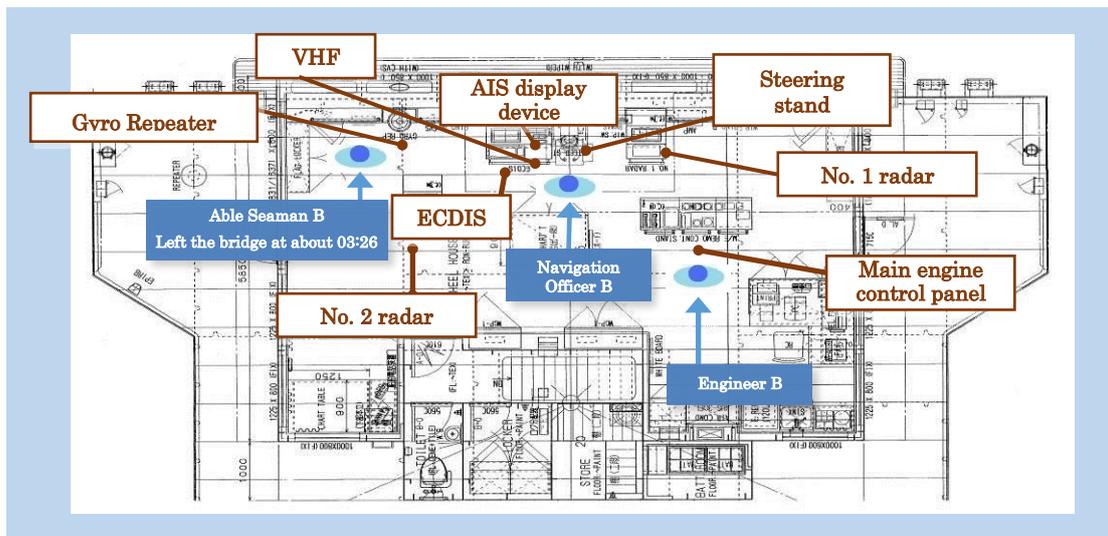


Figure 2.5-2 Bridge Layout of Vessel B and Crew Stations at the Time of the Accident

2.5.4 Maneuverability

(1) Vessel A

According to the Maneuverability Characteristics Tables, Vessel A's turning and stopping performance when moving full speed ahead (10.5 kn) and loaded with cargo is as follows.

	Starboard turn	Port turn
Advance* ⁶	256 m	276 m
Transfer* ⁷	245 m	258 m
Time required to turn 90°	Approx. 2 min 30 sec	Approx. 2 min 42 sec
Shortest stopping distance (after order to go astern is issued when moving full speed ahead)	1,217 m (stop time: 8 min 35 sec)	

(2) Vessel B

According to the Maneuverability Characteristics Tables, Vessel B's turning and stopping performance when moving full speed ahead (14.0 kn) and loaded with cargo is as follows.

*⁶ "Advance" refers to the distance a vessel's center of gravity advances along its course after the direction of the vessel is turned 90°.

*⁷ "Transfer" refers to the sideways distance a vessel's center of gravity moves from its course after the direction of the vessel is turned 90°.

	Starboard turn	Port turn
Advance	231 m	222 m
Transfer	206 m	195 m
Time required to turn 90°	Approx. 48 sec	Approx. 47 sec
Shortest stopping distance (after order to go astern is issued when moving full speed ahead)	554 m (stop time: 2 min 48 sec)	

2.5.5 Information on Radio Telephone Equipment

(1) Radio telephone equipment

The radio equipment installed in Vessel A, Vessel B, Kanmon MARTIS, and Vessel C was as follows.

Vessel, etc.	Radio equipment
Vessel A	VHF
Vessel B	VHF
Kanmon MARTIS	VHF
Vessel C	27 MHz radio telephone and 40 MHz radio telephone

Vessel A and Vessel B were required to install VHF in accordance with the International Convention for the Safety of Life at Sea (SOLAS Convention)” and the Ship Safety Act, respectively.

(2) Legal revision to encourage voluntary VHF installation in vessels

For the purpose of achieving safer ship navigation, the Ministry of Internal Affairs and Communications partially revised a government ordinance establishing the scope of operations, etc., of radio operators in July 1990 to allow operation of VHF with a Maritime III-Category Special Radio Operator’s license, and made the following institutional revisions in May 2014 to encourage greater use of “inexpensive international VHF radio devices that can be installed into small vessels, etc., voluntarily” (hereinafter referred to as “Voluntary VHF”).

- 1) Periodic inspections of ship stations were made unnecessary when, specifically, their radio equipment is voluntary VHF, simple AIS, or radar (5 kW or lower).
- 2) Radio station procedures were simplified for the new installation of voluntary VHF, simple AIS, or other such equipment in radar-only radio stations.

(See Photo 2.5.3)



Photo 2.5-3 Example of a voluntary VHF

2.5.6 Provision of Information via Kanmon MARTIS's VHF

(1) Use of message markers

Kanmon MARTIS began using message markers*⁸ on July 1, 2010, in line with a revision of the Act on Port Regulations (instructions based on the stipulations of Article 14-2, recommendations based on the stipulations of Article 37 (4), provision of the information stipulated in Article 37-3 (1), and recommendations stipulated in Article 37-4 (1) of the Act on Port Regulations).

(2) Procedure of Provision of Information, etc., Conducted by Kanmon MARTIS and the Moji Vessel Traffic Signal Station which is Operated by Kanmon MARTIS

The "Procedure of Provision of Information, etc. Conducted by the Kanmon Kaikyo Vessel Traffic Service Center and the Moji Vessel Traffic Signal Station which is Operated by the Kanmon Kaikyo Vessel Traffic Service Center" (hereinafter referred to as the "Procedure of Provision of Information, etc. ") (Article 4 (1) of Japan Coast Guard Notice No. 170 of 2010) stipulates the following.

Relevant stipulation of the Act on Port Regulations	Procedure of Provision of Information, etc.		
	Message type	Message marker at beginning of message	Method
Article 37-3 (1)	(1) Provision of information (excluding cases falling under (2))	INFORMATION	VHF
	(2) Provision of information when the possibility that a risk to vessel navigation will arise is recognized	WARNING	VHF
Article 37-4 (1)	(3) Recommendation	ADVICE	VHF
Article 14-2	(4) Instruction* ⁹	INSTRUCTION	VHF

It is regulated by Act on Port Regulations that providing "INFORMATION" is informing observed facts, situations, etc. observed by Kanmon MARTIS and is not giving navigational instructions, and "ADVICE" is providing advice to take any necessary action such as altering the vessel's way and so forth and is not giving navigational instructions.

(3) According to the statement of the person in charge of Kanmon MARTIS, Kanmon MARTIS issued messages to Vessel A and to Vessel B that were not led by message markers with the intention of communicating information Kanmon MARTIS had concerning Vessel B to Vessel A and information it had concerning Vessel A to Vessel B, respectively.

2.6 Weather and Sea Conditions

2.6.1 Weather and Tide Data

(1) Meteorological observations at the Shimonoseki Local Meteorological Observatory, which is located approximately 5 km southeast from the accident site, were as follows.

October 17

03:00 Temperature: 15.9°C Wind speed: 1.2 m/s Wind direction: Southwest

04:00 Temperature: 15.7°C Wind speed: 1.8 m/s Wind direction: Southwest

*⁸ "Message marker" refers to a code used at the beginning of a message sent by a vessel traffic service center, etc., to improve the probability that the intent of the message will be appropriately understood.

*⁹ "Instruction" is an instruction to wait outside of the passage when visibility is less than 500 meter, or for ships navigating Hayatomo-Seto against tidal current when they are not likely to maintain speed of four knots or more over the current speed.

- (2) According to observations of the Kanmon Nishiguchi AIS Signal Station, which is located approximately 1.7 km north of the accident site, wave height was 0.5 m at about 03:25 on October 17.
- (3) According to the tide table published by Japan Coast Guard, the current near Kanmon Passage No. 13 Light Buoy, which is located approximately 3 nautical miles (M) south of the location of the accident, on October 17 was as follows.

01:59	Turn of tide (west to east current)
04:49	Strongest easterly current: 2.4 kn
08:56	Turn of tide (east to west current)
- (4) According to the nautical almanac published by Japan Coast Guard, sunrise was at about 06:22.

2.6.2 Observations by Crew Members

- (1) According to the logbook of Vessel A, at about 04:00, the weather was clear, the wind was blowing from the northwest at a speed of 3 (Beaufort scale) and visibility was good.
- (2) According to the logbook of Vessel B, at about 04:00, the weather was clear, the wind was blowing from the south-southeast at a speed of 2 (Beaufort scale), and visibility was good.

2.7 Characteristics of the Area

2.7.1 Overview of Kanmon Passage

The Sailing Directions for Seto Naikai published by Japan Coast Guard (published March 2013) includes the following basic description of Kanmon Passage.

Kanmon Passage has many curved points. The navigable width is around 1M at the widest channel and 500m at the narrowest channel. The tidal current is rapid and vessel traffic is busy.

Kanmon Kaikyo is one of the of most difficult navigating spots in japan and full caution must be paid since casualties like collision often occur.

2.7.2 Navigation Rules in the Kannon Passage

Article 38 (1)-i of the Ordinance for Enforcement of the Act on Port Regulations (Ministry of Transport Order No. 19 of 1949) stipulates the following.

(Specific Navigation Rules)

Article 38 Vessels shall operate in accordance with the following navigation rules in Kanmon Port.

i. Steamships navigating Kanmon Passage or Kanmon No. 2 Passage shall navigate to the right side of the passage whenever possible.

2.7.3 Marine Accidents in the Sea Area of the Accident

According to Japan-Marine Accident Risk and Safety Information System (J-MARISIS),^{*10} the number of collision accidents occurring in the vicinity of the accident location between 1989 and the time of this accident was 26. Of them, 19 were collision accidents involving cargo ships and 15 were collision accidents involving fishing vessels. (See Figure 2.7 and Table 2.7)

^{*10} “J-MARISIS” refers to an internet service provided by the Japan Transport Safety Board that displays information on marine accidents and navigational safety on a world map. URL: <http://jtsb.mlit.go.jp/hazardmap/>



Figure 2.7 J-MARISIS

Table 2.7 Breakdown of Collision Accidents

Vessel type	No. of accidents
Cargo ship and fishing vessel	11
Two cargo ships	5
Two fishing vessels	4
Cargo ship and pleasure craft	3
Between other vessels	3

*Tankers are included in cargo ships in this table.

2.8 Information on Vessel Safety Management, etc.

2.8.1 Vessel A

The Procedure for Navigation in the Safety Management System (SMS) Manual prepared by Company A₂ specified the crew members' stations on the bridge and their duties in accordance with the particular sea area. For narrow seaways, a bridge watch schedule in the procedure specified that the master will con the vessel; the officer of the watch will handle lookout, radar monitoring, VHF, position measurement, and engine telegraph operation; and an able seaman will handle steering. Additionally, a remarks column in the chart stated that the master can change actual watch standards at his discretion based on the surrounding sea conditions.

2.8.2 Vessel B

(1) SMS Manual

1) Procedure for Navigation

The Procedure for Navigation in the SMS Manual prepared by Company B₂ noted the master is to be notified 30 minutes before the vessel approaches a narrow seaway. However, at the time of the accident, the chart being used noted the location at which the master was called to the bridge was at a position approximately 2.5 M from the West Entrance of Kanmon Passage (approximately 12 minutes before at the vessel's speed at the time of the accident).

2) General Regulations

The General Regulations of the SMS Manual prepared by Company B₂ noted that the master must personally con the vessel when navigating a narrow seaway, etc.

(2) Shipboard Oil Pollution Emergency Plan (SOPEP)

The SOPEP provided for Vessel B (prepared by Company B₂) establishes the following regulations regarding response to oil spills.

Response when Oil is Released (Excerpt)
<ul style="list-style-type: none"> • The Master shall order Crew Members to take their oil control stations. • In the event that an accident resulting in oil pollution occurs, the Master shall immediately report the accident to the nearest Japan Coast Guard office and parties concerned with the vessel. • The Master shall immediately get the vessel into the optimum condition for

preventing the release of oil by, for example, adjusting ballast.

- The Master shall immediately transfer remaining oil in the tank to another tank to prevent the continuing release of oil.
- If the vessel is equipped with supplies and equipment to control oil releases and the Master determines, based on consideration of the accident's circumstances and other factors, that using those supplies and equipment is possible, the Master shall prevent the diffusion of oil by extending an oil fence and shall recover the oil with oil-absorbing materials, etc., to the maximum extent possible.

(3) Standards Regarding the Master and Deck Department

The following regulations are provided in (2) General Rules concerning Lookout in the Standards Regarding the Master and Deck Department (Ministry of Transport Notice No. 704 of 1996):

(2) General Rules concerning Lookout

i. The Master and persons in charge of a navigational watch shall maintain watch with sufficient consideration for the following items.

(i) (Omitted)

(ii) (Omitted)

(iii) The duties of the persons on lookout duty and the duties of the helmsman shall be distinguished from each other, and the helmsman must not be considered to be a person on lookout when he is steering. (The rest is omitted.)

2.9 Information on Oil Spill

2.9.1 Oil Spill

(1) Amount of Spilled Oil

According to the statement of the chief engineer of Vessel B and the reply to the questionnaire by Japan Coast Guard, approximately 13 kl of fuel oil C was spilled onto the ocean's surface from Vessel B's starboard fuel oil tank.

(2) Extent of Spill, etc.

According to the replies to the questionnaire of Japan Coast Guard and the Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism, the extent of the spill was as follows.

- 1) At about 11:00 on October 17, the fuel oil that was spilled from Vessel B was observed to be in a band of floating oil that covered an area stretching from near the West Entrance of Kanmon Passage to the sea area on the eastern side of Hikoshima Island in the passage. (See Figure 2.9)

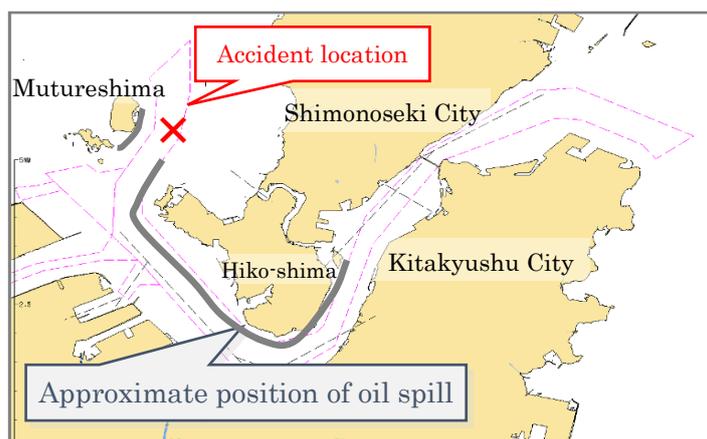


Figure 2.9 Approximate Position of Oil Spill

2) Oil control operations were conducted by Japan Coast Guard patrol vessels and other vessels until October 22.

(3) Response by Vessel B at the Time of the Oil Spill

According to the statement of the chief engineer of Vessel B and reply to the questionnaire of Company B₂, the response was as follows.

At about 04:05, the crew of Vessel B confirmed a spill of fuel oil C onto the ocean's surface. Master B contacted Company B₁ and ordered the crew to extend an oil fence and recover oil with oil absorbing mats.

At about 04:30, the crew of Vessel B completed extension of the oil fence.

At about 05:40, Master B received instructions from Company B₁ and began transferring oil from the starboard fuel oil tank, which had been holed, to the port fuel oil tank.

The crew of Vessel B was busy with the work of recovering the spilled oil and therefore only first noticed that transfer was necessary when it received the instructions from Company B₁.

At about 07:05, Master B stopped the transfer after receiving a report from the chief officer that the spill had been stopped.

(See Photo 2.9.1 and Photo 2.9.2)

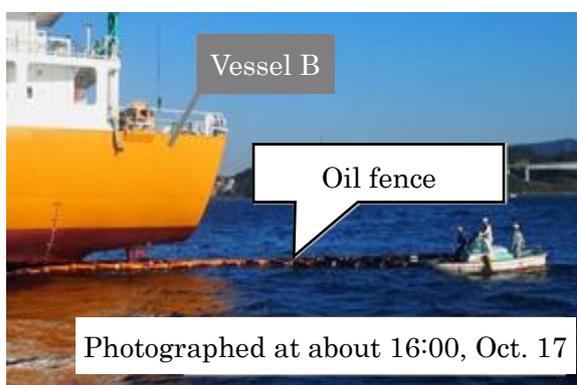


Photo 2.9-1 Vessel B's Oil Fence



Photo 2.9-2 Oil Recovery Work with Oil Absorbing Mats

(4) Oil Spill Control Drills on Vessel B

According to the reply to the questionnaire of Company B₂, oil spill control drills were held once every six months based on the Emergency drill plan of the SMS Manual. The drills

involved using the oil fence, oil treatment reagent, and oil absorbing mats. However, the transfer of oil in a damaged tank to another tank was not established as a drill item and thus was not included in the drills.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

From 2.1, the situation was as follows.

(1) Vessel A

- 1) It is probable that Vessel A entered Kanmon Passage from its East Entrance and proceeded west along the passage at about 02:00 on October 17, 2015.
- 2) It is probable that Vessel A began a turn to port while navigating near Kanmon Passage No. 5 Light Buoy on a course of 032° and speed of 10.6 kn at about 03:20:01.
- 3) It is highly probable that Vessel A was navigating on a course of 007° and speed of 10.6 kn at 03:21:51.
- 4) It is probable that Vessel A was navigating on a course of 013° and speed of 10.9 kn at 03:25:02 and then began a turn to starboard.
- 5) It is probable that Vessel A collided with Vessel B.

(2) Vessel B

- 1) It is highly probable that Vessel B was navigating toward the West Entrance of Kanmon Passage on a course of 166° and speed of 12.7 kn at 03:00:03.
- 2) It is probable that Vessel B began a port turn at 03:22:57 and entered Kanmon Passage at about 03:23.
- 3) It is probable that Vessel B was navigating on a course of 143° and speed of 10.7 kn at 03:24:33 and then entered the left side of the Kanmon passage at about 03:25.
- 4) It is probable that Vessel B began a port turn at 03:25:59.
- 5) It is probable that Vessel B collided with Vessel A.

(3) Vessel C

- 1) It is probable that Vessel C was navigating toward Shimonoseki Fishing Port from an area near the West Entrance of Kanmon Passage on a course of 141° and speed of 10.1 kn at 03:21:07.
- 2) It is probable that Vessel C made a starboard turn at about 03:22.

3.1.2 Circumstances of the Approach, etc., of Vessel A, Vessel B, and Vessel C

From 2.1.1 and 2.1.3(2), it is probable that the bearing and distance of Vessel A as seen from Vessel B and the bearing and distance of Vessel C as seen from Vessel B were as shown in Table 3.1.

Table 3.1 Bearing and Distance of Vessel A as seen from Vessel B, and Bearing and Distance of Vessel C as seen from Vessel B

Time (HH:MM:SS)	Vessel A seen from Vessel B		Vessel C seen from Vessel B	
	Bearing (°)	Distance (m)	Bearing (°)	Distance (m)
About 03:20:04	181	4,440	212	760
About 03:21:04	176	3,780	206	590
About 03:22:04	179	3,020	200	400
About 03:22	Vessel C makes starboard turn			
03:22:57	Vessel B makes port turn			
About 03:23:04	174	2,420	195	350
About 03:24:33	174	1,660	169	200
About 03:25:14	176	1,080	187	290
About 03:26:02	178	430	194	310
About 03:26:29	184	200	198	400

*The positions of Vessel A and Vessel C at each time point were obtained by making estimates from AIS records, etc.

- (1) It is probable that the bearing of Vessel C as seen from Vessel B between about 03:20:04 and 03:22:04 changed to approximately 12° ahead and the distance shortened from approximately 760 m to approximately 400 m.
- (2) It is probable that, after Vessel B made its port turn, the bearing of Vessel A as seen from Vessel B between about 03:23:04 and 03:25:14 changed to approximately 2° astern, and that the distance between Vessel A and Vessel B was approximately 430 m at about 03:26:02.
- (3) It is probable that Vessel C made a starboard turn at about 03:22 and that the distance between Vessel B and Vessel C changed from approximately 200 m to approximately 400 m between about 03:24:33 and 03:26:29.

3.1.3 Date, Time and Location of the Accident Occurrence

From 2.1 and 3.1.1, it is probable that the date and time of occurrence of the accident was at about 03:26:39 on October 17, 2015, when the sound of the impact was recorded in the VDR's voice record, and the location was around 071°, 1,360 meters from the Mutureshima Lighthouse.

3.1.4 Damage to Vessels

From 2.3, it is probable that the situation was as follows.

- (1) Crushing of the bow and bulbous bow occurred in Vessel A.
- (2) Holing and denting of the aft starboard side shell plating occurred in Vessel B.

3.1.5 Situation at the Time of the Collision

From 2.1 and 3.1.1 to 3.1.4, it is probable that the bow of Vessel A, which was sailing on a course of approximately 033° and at a speed of approximately 11.0 kn, and the aft starboard side shell plating of Vessel B, which was sailing on a course of approximately 107° and at a speed of

approximately 10.4 kn, collided at about 03:26:39.

3.2 Causal Factors of the Accident

3.2.1 Situations of Crew Members and the Vessels

(1) Crew Members

From 2.4, the situation was as follows.

1) Vessel A

Master A and Navigation Officer A possessed legally valid endorsement attesting the recognition of certificate under STCW regulation I/10

Although Navigation Officer A had experience navigating Kanmon Passage, it is probable that he had never been stationed on the bridge when the master was not conning the vessel during navigation of the passage.

It is probable that Master A and Navigation Officer A were in good health.

2) Vessel B

Master B and Navigation Officer B possessed legally valid certificates of competence.

Navigation Officer B became a navigation officer approximately one year before the accident. Additionally, although Navigation Officer B had experience navigating Kanmon Passage it is probable that he had never been stationed on the bridge when the master was not conning the vessel during navigation of the passage.

Able Seaman B has had little experience steering and it is probable that he had not steered aboard Vessel B before.

It is probable that Master B, Navigation Officer B, and Able Seaman B were in good health.

(2) Vessels

From 2.5.2, it is probable that there was no malfunction or failure with the hull, engine, or machineries of either Vessel A or Vessel B.

3.2.2 Weather and Sea Conditions

From 2.6, it is probable that the situation was as follows.

- (1) At the time of the accident, the weather was clear, the wind direction was from the southwest, the wind speed was approximately 2 m/s, the air temperature was between 15.7 and 15.9 degrees Celsius, and visibility was good.
- (2) The current on October 17 near Kanmon Passage No. 13 Light Buoy, which is located approximately 3 M south of the location of the accident, turned to the east at 01:59, had its strongest easterly current of approximately 2.4 kn at 04:49, and turned to the west at 08:56.

3.2.3 Analysis of the Watchkeeping Arrangements

From 2.1, 2.4, 2.7.1, 2.8, and 3.2.1, the situation was as follows.

(1) Vessel A

1) It is probable that, at about 03:21, Master A felt the need to visit the head, and because he did not see any vessels in the vicinity with the exception of Vessel B, he departed the bridge after ordering Navigation Officer A to pay attention to the vessel's course and the movements of Vessel B.

2) Navigation Officer A had experience navigating Kanmon Passage eight times with the master conning the vessel, but it is probable that he had never been stationed on the

bridge when the master was not conning the vessel during navigation of the passage.

- 3) The Procedure for Navigation in the Safety Management System (SMS) Manual prepared by Company A₂ specified the crew members' stations on the bridge and their duties in accordance with the particular sea area and, for narrow seaways, such as Kanmon passage, specified that the master will con the vessel; the officer of the watch will handle lookout, radar monitoring, VHF, position measurement, and engine telegraph operation; and an able seaman will handle steering. Additionally, a remarks column in the chart stated that the master can change actual watch standards at his discretion based on the surrounding sea conditions. However, it is highly probable that there was notation that the master can make changes at his discretion.
- 4) It is probable that, after Master A left the bridge, Navigation Officer A conned the vessel and Able Seaman handled hand steering.

(2) Vessel B

- 1) It is probable that Navigation Officer B had bridge watch together with Able Seaman B at about 23:45 on October 16.
- 2) The Procedure for Navigation in the SMS Manual of Company B₂ noted that the master is to be notified 30 minutes before the vessel approaches a narrow seaway. However, at the time of the accident, the location at which the master was called to the bridge was noted on the chart being used at a position approximately 2.5 M from the West Entrance of Kanmon Passage (approximately 12 minutes before).
- 3) At about 03:11 on October 17, Navigation Officer B telephoned the master's cabin at about the place that Master B marked "called master" on the chart but did not receive a response from Master B. It is probable that Navigation Officer B decided to telephone again near the West Entrance to the passage.
- 4) It is probable that Engineer B received a communication from Navigation Officer B and arrived on the bridge and took the engine operation station at about 03:13.
- 5) It is probable that Navigation Officer B switched to hand steering and made a turn to port because Vessel B had entered Kanmon Passage at about 03:23 and approached Vessel C.
- 6) It is probable that Navigation Officer B ordered Able Seaman B to go to the master's cabin and call Master B at about 03:26.
- 7) From the above,
 - a It is somewhat likely that Navigation Officer B singlehandedly handled lookout, steering, and VHF communication at the time of the accident, as Able Seaman B had not handled steering on Vessel B before, and thus a situation in violation of the Standards Regarding the Master and Deck Department existed.
 - b It is probable that Master B had set the area around 2.5 M from the western gate of Kanmon Passage as the location to call the master to the bridge, and that Navigation Officer B telephoned the master's cabin at the said place location. However, it was not possible to determine the circumstances for Master B's not answering the telephone.
 - c It is somewhat likely that Navigation Officer B had intended to contact Master B near the West Entrance of Kanmon Passage, but because he had ordered Able Seaman B to call Master B to the bridge at about 03:26 while navigating the passage, he was unable to call Master B to the bridge during this time.
- 8) It is desired that masters must con their vessels and that crew members with

sufficient experience be assigned as helmsmen when navigating sea areas such as Kanmon Passage that are strongly affected by currents and congested with ship traffic.

3.2.4 Analysis of Radio Communications

From 2.1.2(1), 2.1.4(1) to 2.1.4(3), 2.5.5, 2.5.6, and 2.7, the situation was as follows.

- (1) Communications between Vessel A and Kanmon MARTIS
 - 1) Kanmon MARTIS issued messages to Vessel A and to Vessel B that were not led by message markers with the intention of communicating information to each vessel. However, it is probable that Navigation Officer A understood a message from Kanmon MARTIS to Vessel A to be an instruction.
 - 2) Navigation Officer A was given and acknowledged a message to keep to the starboard-side vis-à-vis Vessel B, which was approaching on the opposite course, at about 03:23. However, it is probable that the message was a question about intent to pass Vessel B starboard to starboard.
 - 3) When Navigation Officer A was told by Kanmon MARTIS to pay attention to the movements of Vessel B and to keep to the starboard side at about 03:25, he said that he could see Vessel B's starboard light. However, he was then told port to port and it is probable that that he thought he would pass Vessel B on the port side.
- (2) Communications between Vessel B and Kanmon MARTIS
 - 1) It is probable that when Kanmon MARTIS asked Vessel B's intention vis-à-vis Vessel A, which was approaching on the opposite course, using the words "port to port" at about 03:24, it received the response "that would be helpful," repeated "port to port" for the purpose of confirmation, additionally told Vessel B to keep to starboard after avoiding Vessel C, and received Vessel B's response indicating acknowledgement.
 - 2) From (1) and (1)3 above, it is somewhat likely that Kanmon MARTIS thought that Vessel B would eventually turn to starboard and pass Vessel A on her port side.
 - 3) Because Navigation Officer B understood that he had been asked if he intended to pass Vessel A on the port side, even though he had been asked Vessel B's intention by Kanmon MARTIS with the words "port to port," it is somewhat likely that Navigation Officer B was feeling tense, as he was singlehandedly handling lookout, steering, and VHF communication in a situation in which Vessel A was approaching on the opposite course and in which he could not turn to starboard because of the presence of Vessel C, which was in the same attitude as Vessel B.
- (3) Communications between Vessel C and Kanmon MARTIS
 - 1) Kanmon MARTIS called Vessel C by VHF at about 03:21; however, it is highly probable that Vessel C did not respond because it did not have VHF installed.
 - 2) In May 2014, the Ministry of Internal Affairs and Communications made institutional revisions, etc., that made periodic inspections unnecessary with the intent of encouraging greater use of voluntary VHF, which can be installed in small vessels.
 - 3) From 1) and 2) above, the installation of voluntary VHF would allow even vessels like Vessel C that are not required to have VHF to respond to calls from Kanmon MARTIS and to receive information on their surroundings by monitoring the messages of vessels navigating the passage. Thus the installation of voluntary VHF is desired.

3.2.5 Analysis of Lookout and Ship Maneuvering

From 2.1, 2.5.3, 2.7.1, 3.1.1 to 3.1.3, 3.2.3, and 3.2.4, the situation was as follows.

(1) Vessel A

- 1) It is probable that Vessel A entered the East Entrance of Kanmon Passage by hand steering at about 02:00.
- 2) It is probable that Navigation Officer A knew the specific navigation rules for Kanmon Passage that are specified in the Ordinance for Enforcement of the Act on Port Regulations but had never been stationed on the bridge when the master was not conning the vessel in the Kanmon Passage and was conning the vessel in the passage for the first time.
- 3) It is probable that Navigation Officer A thought Vessel B was turning to port at about 03:23 and inquired with Kanmon MARTIS because he did not understand Vessel B's intention for the port turn.
- 4) It is probable that the reason that Vessel A maintained course and speed was that Navigation Officer A thought that information provided by the Kanmon MARTIS to keep to the starboard side was an instruction, and that he thought that Vessel B would eventually turn to starboard and pass port to port with ship A navigating the starboard side of the passage.
- 5) Navigation Officer A subsequently felt that Vessel B, which showed its starboard side light and was approaching, posed a danger. However, it is probable that he could not turn to port so as to pass Vessel B on the starboard side in violation of the specific navigation rules for Kanmon Passage that are specified in the Ordinance for Enforcement of the Act on Port Regulations, nor could he turn to starboard because he sensed that the shore and light buoys to the front starboard were near.
- 6) It is probable that Navigation Officer A acknowledged the message from Kanmon MARTIS saying to pass Vessel B port to port and ordered Able Seaman A to turn 20° to starboard at about 03:25:38.
- 7) It is probable that Vessel A and Vessel B collided even though Navigation Officer A sensed there was danger of a collision with Vessel B and put the rudder hard to port at about 03:26:13.
- 8) Given that there was no information concerning Vessel C in the conversation on the bridge of Vessel A or in the statements of Navigation Officer A and Able Seaman A, it is probable that neither person had noticed the presence of Vessel C, which was navigating to Vessel B's front starboard.
- 9) Given that Vessel C appeared on Vessel A's radar screen at about 03:21, it is somewhat likely that if Master A had been on the bridge, Navigation Officer A would have been monitoring the radar and noticed Vessel C. (See Figure 1 Radar Images from Vessel A)
- 10) Given that there is no record of a whistle sound, etc., in the conversation on the bridge of Vessel A, it is probable that Navigation Officer A did not direct any signals to attract the attention of Vessel B, which was showing its starboard light and approaching.
- 11) It is somewhat likely that the accident's occurrence or the spread of damage may have been prevented if Navigation Officer A had made acoustic or other signals to attract attention, reduced speed, or taken other measures when he realized he did not understand Vessel B's intention.

(2) Vessel B

- 1) It is probable that at about 03:19, while navigating toward the West Entrance of Kanmon Passage by autopilot, Navigation Officer B visually observed Vessel C proceeding southeast to the front starboard and observed Vessel A by AIS data displayed on the ECDIS.
- 2) It is probable that Navigation Officer B visually observed Vessel A proceeding north to the south of Kanmon Passage No. 5 Light Buoy at about 03:21.
- 3) Given that Vessel B was maintaining course and speed between about 03:20:04 and 03:22:04, and that during this time Vessel C's bearing changed to approximately 12° ahead and the distance between Vessel B and Vessel C shortened from approximately 760 m to approximately 400 m, it is probable that Vessel B understood that Vessel C was navigating in a manner that was cutting across Kanmon Passage.
- 4) It is probable that Navigation Officer B switched to hand steering and turned to port at 03:22:57 because Vessel B had come even closer to Vessel C, which was ahead to starboard. Given that Vessel B was moving toward the front of Vessel A, which was proceeding north through Kanmon Passage, and that it is probable that Vessel B was in a situation in which she could be expected to navigate to the port side of Vessel C, it is somewhat likely that Navigation Officer B was not engaged in appropriate lookout vis-à-vis Vessel A and Vessel C at that time.
- 5) Although Navigation Officer B subsequently ordered Engineer B to reduce speed by changing the blade angle of the controllable pitch propeller from 15° to 10°, and as a result Vessel B's speed slowed to roughly equal that of Vessel C, it is probable that Navigation Officer B did not execute measures to greatly reduce speed, such as by setting the pitch to neutral, or to stop the vessel by switching to astern propulsion.
- 6) From 4) and 5) above, it is somewhat likely that Navigation Officer B was in a situation in which he could not turn to starboard because Vessel B's speed roughly matched that of Vessel C, which was ahead to starboard, while under circumstances in which Vessel B was moving toward the front of Vessel A, which was proceeding north through Kanmon Passage, as a result of his turn to port.
- 7) Given that Navigation Officer B was under circumstances in which he was singlehandedly handling lookout, steering, and VHF communication in Kanmon Passage with Master B absent from the bridge, despite never having been stationed on the bridge when the master was not conning the vessel during navigation of the passage, and that he could not turn to starboard despite the fact that Vessel B was moving toward the front of Vessel A, which was proceeding north through Kanmon Passage, it is probable that Navigation Officer B was in a state of confusion, understood Kanmon MARTIS's inquiry concerning "port to port" to be an inquiry concerning whether he intended to pass Vessel A on the starboard side, and, although Vessel A's bearing changed approximately 2° between 03:23:04 and 03:25:02, continued on a straight course and entered the left side of Kanmon Passage at about 03:25.
- 8) It is somewhat likely that if Navigation Officer B had engaged in appropriate lookout vis-à-vis Vessel C and Vessel A prior to making the port turn, he would have noticed the danger of making a port turn and, by making a turn to starboard toward the stern of Vessel C, would have passed Vessel C astern and not proceeded toward the front of Vessel A. Additionally, it is somewhat likely that if, when he reduced speed, Navigation Officer

B had executed measures to greatly reduce speed, such as by setting the pitch of the controllable pitch propeller to neutral, or to stop the vessel by switching to reverse propulsion, the accident's occurrence or the spread of damage may have been prevented.

9) It is probable that Navigation Officer B sensed that there was a danger of collision with the approaching Vessel A and made a turn to port at 03:25:59.

10) It is probable that Navigation Officer B continued the turn to port at about 03:26:39 but that Vessel B and Vessel A collided nevertheless.

3.2.6 Analysis of the Accident Occurrence

From 2.1, 3.1.1 to 3.1.5, and 3.2.3 to 3.2.5, the situation was as follows.

(1) Vessel A

1) It is probable that, at about 03:21, Master A felt the need to visit the head, and because he did not see any vessels in the vicinity with the exception of Vessel B, he departed the bridge after ordering Navigation Officer A to pay attention to the vessel's course and the movements of Vessel B.

2) It is probable that Navigation Officer A thought Vessel B was turning to port at about 03:23 and inquired with Kanmon MARTIS because he did not understand Vessel B's intention for the port turn.

3) It is probable that the reason that Vessel A maintained course and speed was that Navigation Officer A thought that information provided by the Kanmon MARTIS to keep to the starboard side was an instruction, and that he thought that Vessel B would eventually turn to starboard and pass port to port with ship A navigating the starboard side of the passage.

4) Navigation Officer A subsequently felt that Vessel B, which showed its starboard side light and was approaching, posed a danger. However, it is probable that he could not turn to port so as to pass Vessel B on the starboard side in violation of the specific navigation rules for Kanmon Passage that are specified in the Ordinance for Enforcement of the Act on Port Regulations, nor could he turn to starboard because he sensed that the shore and light buoys to the front starboard were near.

5) It is probable that Vessel A was in a situation where it was approaching Vessel B because it had maintained course and speed.

6) When Navigation Officer A was told by Kanmon MARTIS to pay attention to the movements of Vessel B and to maintain a starboard course at about 03:25, he said that he could see Vessel B's starboard light. However, it is probable that he was then told port to port and thus ordered Able Seaman A to turn 20° to starboard.

7) It is probable that, even though Navigation Officer A sensed the danger of collision with Vessel B and ordered the rudder hard to port, Vessel A collided with Vessel B at about 03:26:39.

(2) Vessel B

1) At about 03:11, Navigation Officer B telephoned the master's cabin at the position that Master B marked "call master" on the chart but did not receive a response from Master B. It is somewhat likely that Navigation Officer B decided to telephone again near the West Entrance to the passage but later was unable to call Master B to the bridge.

2) It is probable that at about 03:19, Navigation Officer B visually observed Vessel C proceeding southeast to the front starboard and observed Vessel A by AIS data displayed

on the ECDIS.

- 3) At about 03:22:57, Navigation Officer B switched to hand steering and turned to port because Vessel B had come even closer to Vessel C. However, it is probable that if Navigation Officer B had engaged in appropriate lookout vis-à-vis Vessel A and Vessel C, he would have been in a situation where he could have predicted that turning to port would put Vessel B on a course toward the front of Vessel A, which was proceeding north through Kanmon Passage, and have Vessel B navigating on Vessel C's port side.
- 4) It is probable that Navigation Officer B subsequently ordered Engineer B to reduce speed by changing the blade angle of the controllable pitch propeller from 15° to 10°.
- 5) It is probable that Vessel B entered Kanmon Passage at about 03:23.
- 6) Given that, amid circumstances in which Navigation Officer B had never having been stationed on the bridge when the master was not conning the vessel during navigation of Kannon Passage, Master B was absent from the bridge and Able Seaman B had never steered Vessel B, and that Navigation Officer B was singlehandedly handling lookout, steering, and VHF communication and, additionally, was in a situation whereby he was moving toward the front of Vessel A, which was proceeding north through Kanmon Passage, because of the turn to port but he could not turn to starboard because Vessel B's speed nearly matched that of Vessel C, which was ahead to starboard, it is somewhat likely that Navigation Officer B was in a state of confusion.
- 7) It is probable that, because the state of confusion continued, Navigation Officer B thought, when asked Vessel B's intention by Kanmon MARTIS with the words "port to port," that he had been asked if he intended to pass Vessel A on the starboard side, and, despite Vessel A's change in bearing of approximately 2°, he continued on a straight course and entered the left side of Kanmon Passage at about 03:25.
- 8) It is probable that, even though Navigation Officer B sensed the danger of collision with the approaching Vessel A and turned to port at 03:25:59, Vessel B collided with Vessel A on the left side of Kanmon Passage at about 03:26:39.

3.3 Analysis of the Oil Spill, etc.

3.3.1 Scope of the Oil Spill

From 2.1.4(2), 2.3(2), 2.6.1, 2.8.2(2), and 2.9, the situation was as follows.

- (1) At the time of the accident, the current of the Kanmon Passage was easterly. Near the West Entrance of the passage, the strongest easterly current was 2.4 kn at 04:49 and the tide turned westerly at 08:56.
- (2) It is probable that the collision opened up a hole in the side shell plating below the water level on Vessel B's aft starboard side, and that approximately 13 kl of fuel oil C spilled out of a fuel tank and flowed across a sea area extending from the West Entrance of Kanmon Passage to the east side of Hikoshima Island inside the passage.
- (3) From (1) and (2), it is probable that approximately 13 kl of fuel oil C spilled from the hole caused by the collision in Vessel B's aft starboard side shell plating, and that, during the time that elapsed until the tide turned westerly at about 08:56, the oil flowed on Kanmon Passage's current to the sea area east of Hikoshima in the passage.

3.3.2 Oil Control

From 2.1.4(2), 2.8.2(2), 2.9, and 3.3.1, the situation was as follows.

- (1) It is probable that the crew of Vessel B confirmed the spill of fuel oil C onto the ocean's surface and began to recover it by extending an oil fence and using oil absorbing mats.
- (2) It is probable that, because the crew of Vessel B was busy with the work of recovering the spilled oil, it began transferring fuel oil after receiving instructions from Company B₁ to do so approximately two hours after the accident, and it confirmed that the spill had stopped at about 07:05.
- (3) Although oil spill control drills were held aboard Vessel B based on the Emergency drill plan, it is probable that drills on transferring oil were not conducted.
- (4) It is highly probable that Vessel B's SOPEP mentioned the immediate transfer of remaining oil to another tank in order to prevent releases of oil.
- (5) From (1) to (4) above, it is desired that the crew of Vessel B conduct oil spill control drills so that, after confirming a spill of oil onto the ocean's surface, they can transfer oil, as is stated in the SOPEP, at the same time that they extend oil fences in accordance with the spill situation.

4 CONCLUSIONS

4.1 Probable Causes

It is probable that, Vessel A and Vessel B collided during nighttime, at off the eastern coast of Mutsureshima Island, because, while Vessel A was proceeding north-northwest through Kanmon Passage toward the West Entrance of the passage, and Vessel B was proceeding south-southeast toward the West Entrance of Kanmon Passage having Vessel C sailing in the same direction in her starboard bow, Vessel B came close to Vessel C and turned to port to an entered the left part side of Kanmon Passage, while Vessel A maintained course and speed.

It is somewhat likely that the reason that Vessel B came close to Vessel C, turned to port and entered the left part of Kanmon Passage was that, after observing Vessel A proceeding north through Kanmon Passage and Vessel C proceeding Southeast toward the West Entrance of the passage, he did not maintain proper lookout om Vessel A and Vessel C, and therefore, he was unable to anticipate that Vessel B would be in a situation crossing ahead of Vessel A, which was proceeding north through the Kanmon Passage, and at that time, sailing the port side of Vessel C, and further, he made Vessel B's speed almost same with the speed of Vessel C which was sailing in the starboard ahead that made Vessel B unable to take starboard turn and Navigation Officer B became confused.

It is somewhat likely that the fact that Navigation Officer B had never experience bride watch without master's conning and was handling lookout, steering, and VHF communication by his own in Kanmon Passage, contributed to Navigation Officer B's confusion.

It is probable that the reason that Vessel A maintained course and speed was that Navigation Officer A thought that information provided by the Kanmon MARTIS to keep to the starboard side was an instruction, and that he thought that Vessel B would eventually turn to starboard and pass port to port with ship A navigating the starboard side of the passage.

4.2 Other Discovered Safety-Related Matters

- (1) It is desired that masters must con their vessels and that crew members with sufficient experience be assigned as helmsmen when navigating sea areas such as Kanmon Passage that are strongly affected by currents and congested with ship traffic.

- (2) It is somewhat likely that the accident's occurrence or the spread of damage may have been prevented if Navigation Officer A had made acoustic or other signals to attract attention, reduced speed, or taken other measures when he realized he did not understand Vessel B's intention.
- (3) It is somewhat likely that if the crew of Vessel B had transferred oil to another tank earlier after confirming the spill of oil onto the ocean's surface, it may have been able to reduce the amount of oil spilled from the holed fuel oil tank.
- (4) The installation of voluntary VHF is desired, as this would allow even vessels like Vessel C that are not required to have VHF to respond to calls from Kanmon MARTIS and to obtain information on conditions in the passage, etc., by monitoring the messages of vessels navigating the passage.

5 SAFETY ACTIONS

It is probable that, during nighttime and off the eastern coast of Mutsureshima Island, as Vessel A was proceeding north-northwest through Kanmon Passage toward the West Entrance of the passage, and as Vessel B was proceeding south-southeast toward the West Entrance of Kanmon Passage in a situation in which Vessel C was proceeding on the same course off her starboard bow, Vessel B approached Vessel C and thus turned to port to enter the left side of Kanmon Passage, while Vessel A maintained course and speed, and as a result Vessel A and Vessel B collided.

It is somewhat likely that the reason that Vessel B approached Vessel C and thus turned to port and entered the left side of Kanmon Passage was that Navigation Officer B became confused when he did not engage in appropriate lookout vis-à-vis Vessel A and Vessel C, and thus was unable to anticipate that Vessel B would move toward the front of Vessel A, which was proceeding north through the Kanmon Passage, and would move on the port side of Vessel C, and additionally found himself in a situation whereby he would be unable to turn to starboard because Vessel B's speed roughly matched that of Vessel C, which was ahead to starboard.

It is somewhat likely that the fact that Navigation Officer B was singlehandedly handling lookout, steering, and VHF communication in Kanmon Passage with Master B absent from the bridge, despite never having been stationed on the bridge when the master was not conning the vessel during navigation of the passage, contributed Navigation Officer B's confusion. Additionally, it is somewhat likely that if Vessel B had transferred oil to another tank earlier after confirming the spill of oil onto the ocean's surface, it may have been to reduce the amount of spilled oil.

It is somewhat likely that the accident's occurrence or the spread of damage may have been prevented if Navigation Officer A had made acoustic or other signals to attract attention, reduced speed, or taken other measures when he realized he did not understand Vessel B's intention.

Accordingly, implementation of the following measures is necessary to prevent occurrence of a similar accident.

- (1) The Conning officer will conduct appropriate lookout for all vessels approaching of his vessel and engage in ship maneuvering to avoid collisions by reducing speed, etc., quickly and without hesitation.
- (2) The Conning officer will, if he does not understand the intention of a vessel in his vessel's vicinity, make signals to attract attention, etc., with acoustic signals.
- (3) The owner, etc., will engage in appropriate personnel stationing in narrow seaways, etc.,

and instruct crew members to establish a system that can fully confirm surrounding circumstances.

- (4) The owner, etc., will instruct crew members to conduct oil spill control drills that will give them the ability to transfer oil to another tank, as noted in the SOPEP, in accordance with the spill situation.

5.1 Safety Actions Taken

5.1.1 Safety Actions Taken by Company A₁ and Company A₂.

- (1) Company A₁ issued an explanation of the accident and notice concerning the responsibilities of masters and officers of the watch to its fleet.
- (2) Company A₁ conducted training for crew members of its fleet and used this accident as a case study covered in the training.
- (3) Company A₂ deleted the regulation stating that persons on watch can be changed at the master's discretion from Procedure for Navigation of its SMS.

5.1.2 Safety Actions Taken by Company B₁ and Company B₂.

- (1) Company B₁ instructed the crew of Vessel B to fully comply with the following items.
 - 1) The personnel of the bridge watch will report to the master 30 minutes before entering a narrow seaway and will continue reporting until he receives a response from the master.
 - 2) The master will make the position existing 30 minutes prior to entry into a narrow seaway the reporting position to be marked on the chart.
 - 3) The vessel will avoid approaching fishing vessels, etc., too closely and will take evasive action prior to the emergence of a hazardous meeting.
 - 4) "Evasive action" refers to major course changes, including engine operation, that are easily discernible to the other vessel and engine stoppage that are made without hesitation.
- (2) Company B₂ had the crew of Vessel B receive the following training for the purpose of ensuring navigational watch safety.
 - 1) BRM^{*11} training
 - 2) Handling of navigation equipment (radar, ECDIS, and steering equipment)
- (3) Company B₂ conducted maneuverability tests on Vessel B and machinery operations training for Vessel B's crew for the purpose of improving ship handling skills during an emergency.
- (4) A management supervisor of Company B₂ visited Vessel B and provided education on the SMS to her crew.
- (5) Company B₂ provided oil spill response training (including oil transfer) for Vessel B's crew.

5.2 Safety Actions Required

It is desired that Company A₁ and Company B₁ implement the following measures to prevent occurrence of a similar accident.

- (1) Instruct crews to engage in ship maneuvering to avoid collisions by reducing speed, etc.,

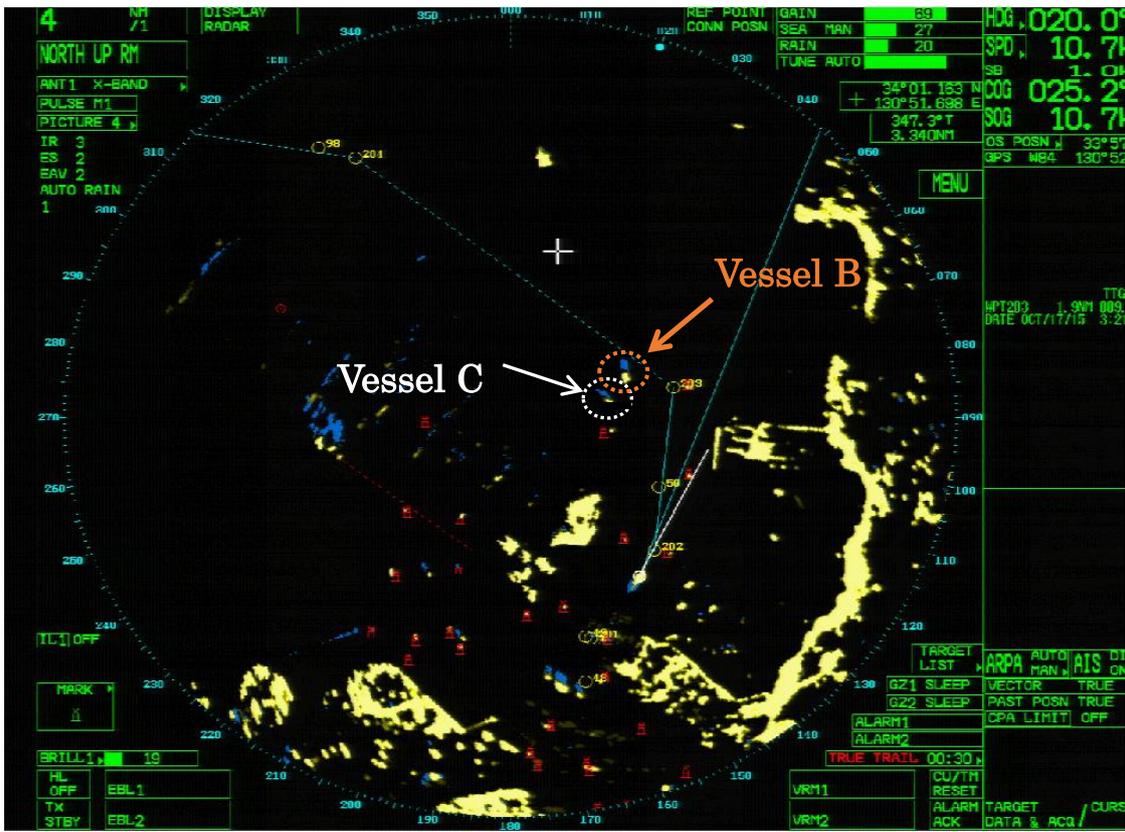
^{*11} "Bridge Resource Management (BRM)" refers to the effective management of all resources on the bridge, including crew members, equipment, and information, for safe vessel navigation.

quickly and without hesitation.

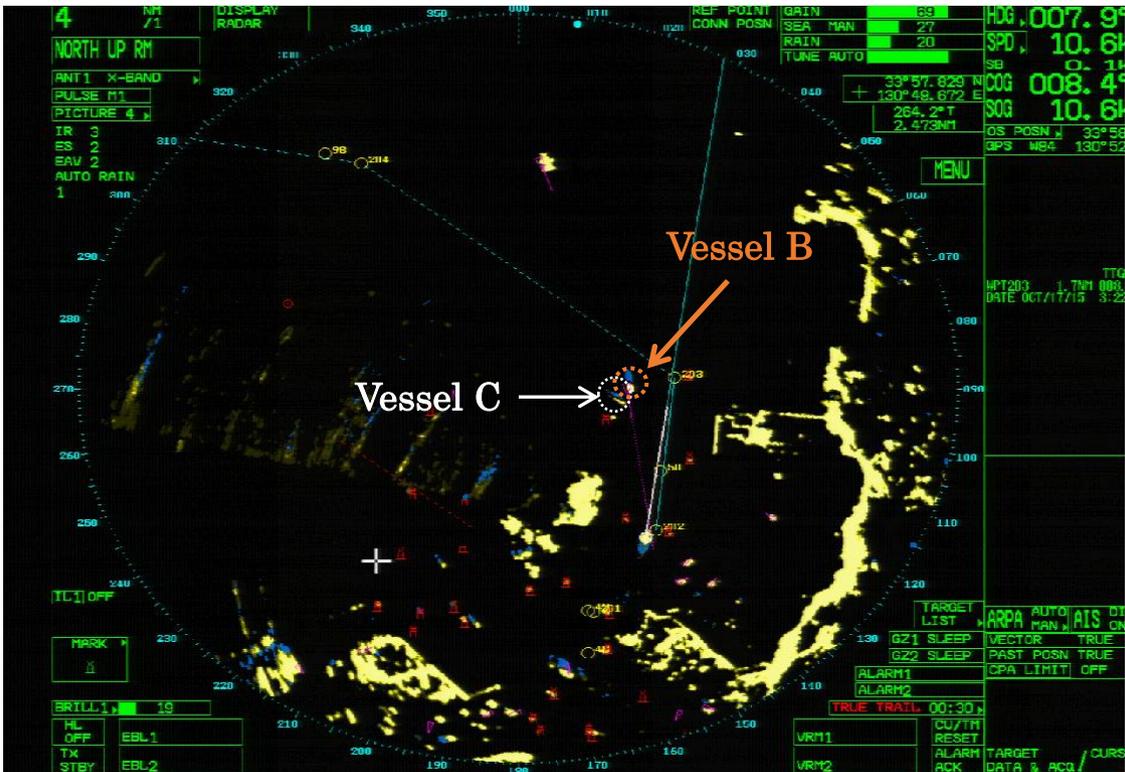
- (2) Instruct crews to make signals to attract attention, etc., with acoustic signals when they do not understand the intention of an approaching vessel.

Figure 1 Radar Images from Vessel A

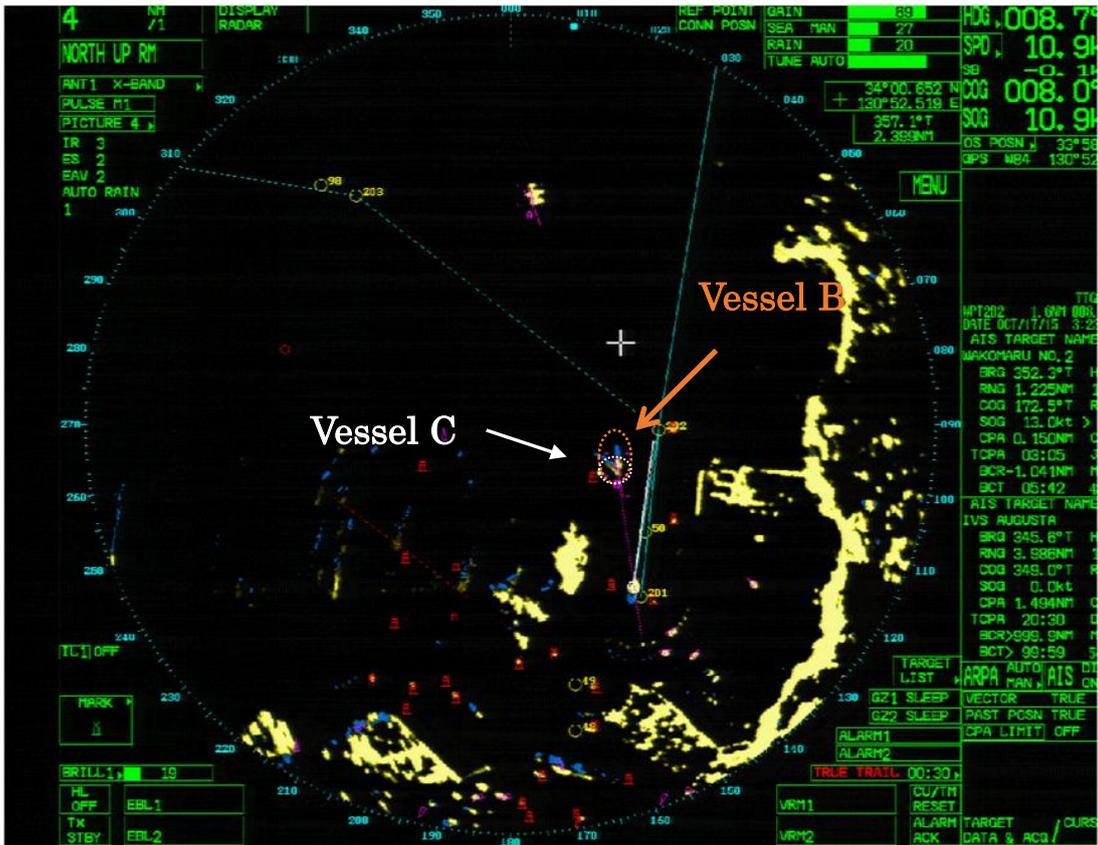
(1) Around 03:21



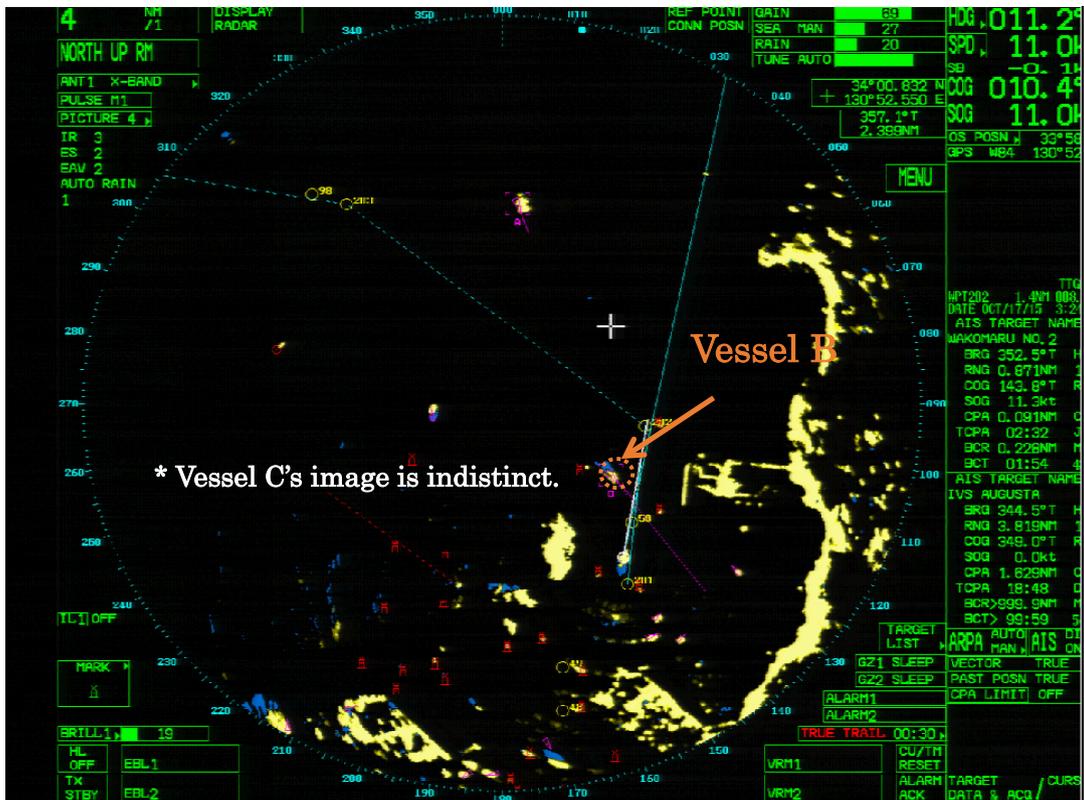
(2) Around 03:22



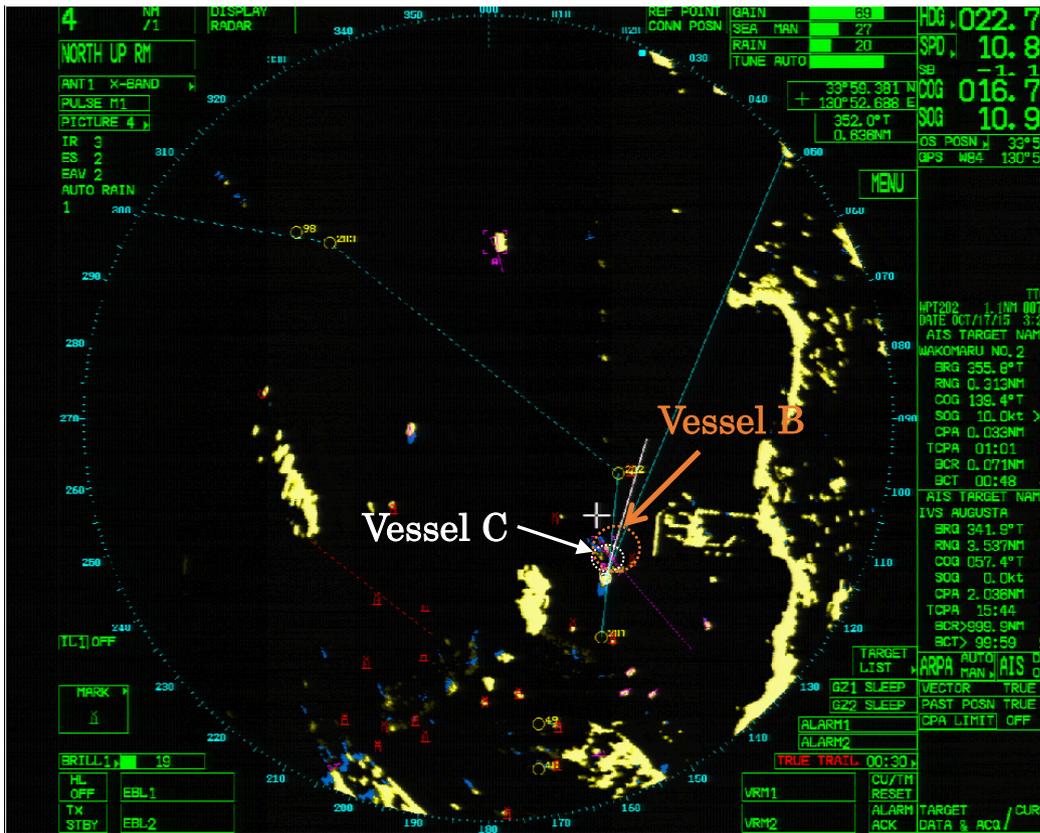
(3) Around 03:23



(4) Around 03:24



(5) Around 03:25



(6) Around 03:26

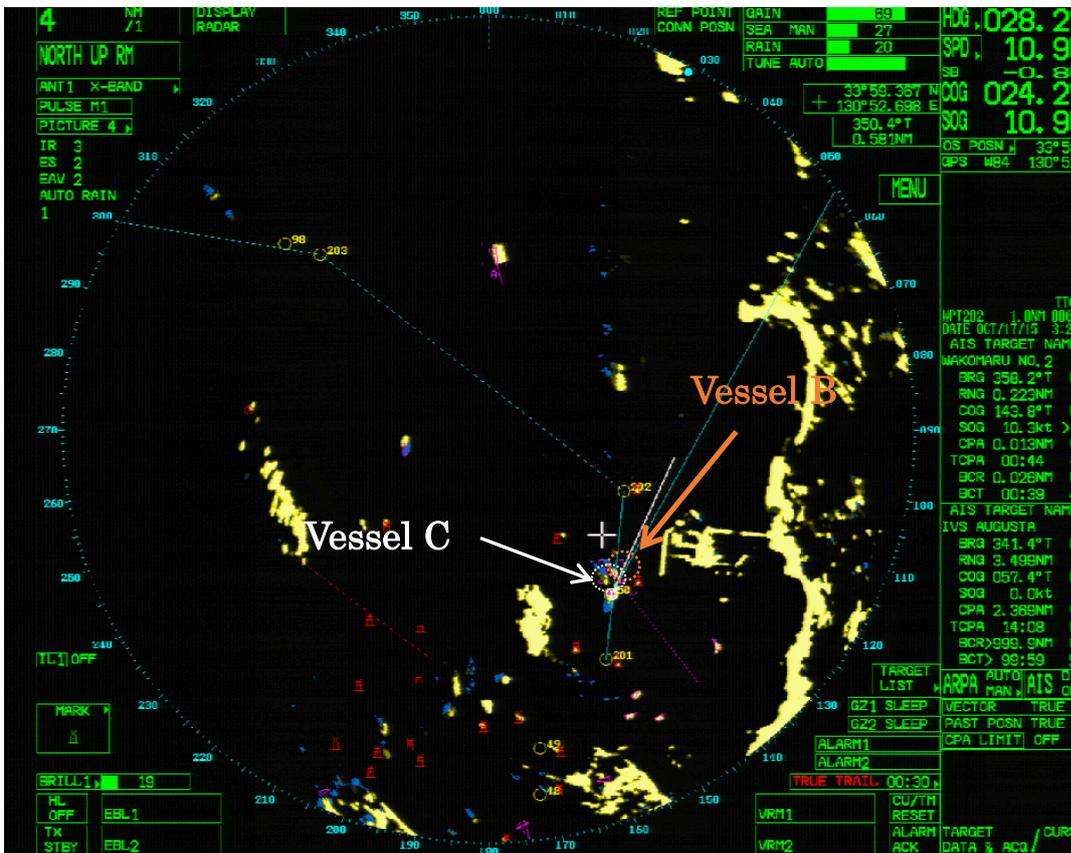


Figure 2 Navigation Paths

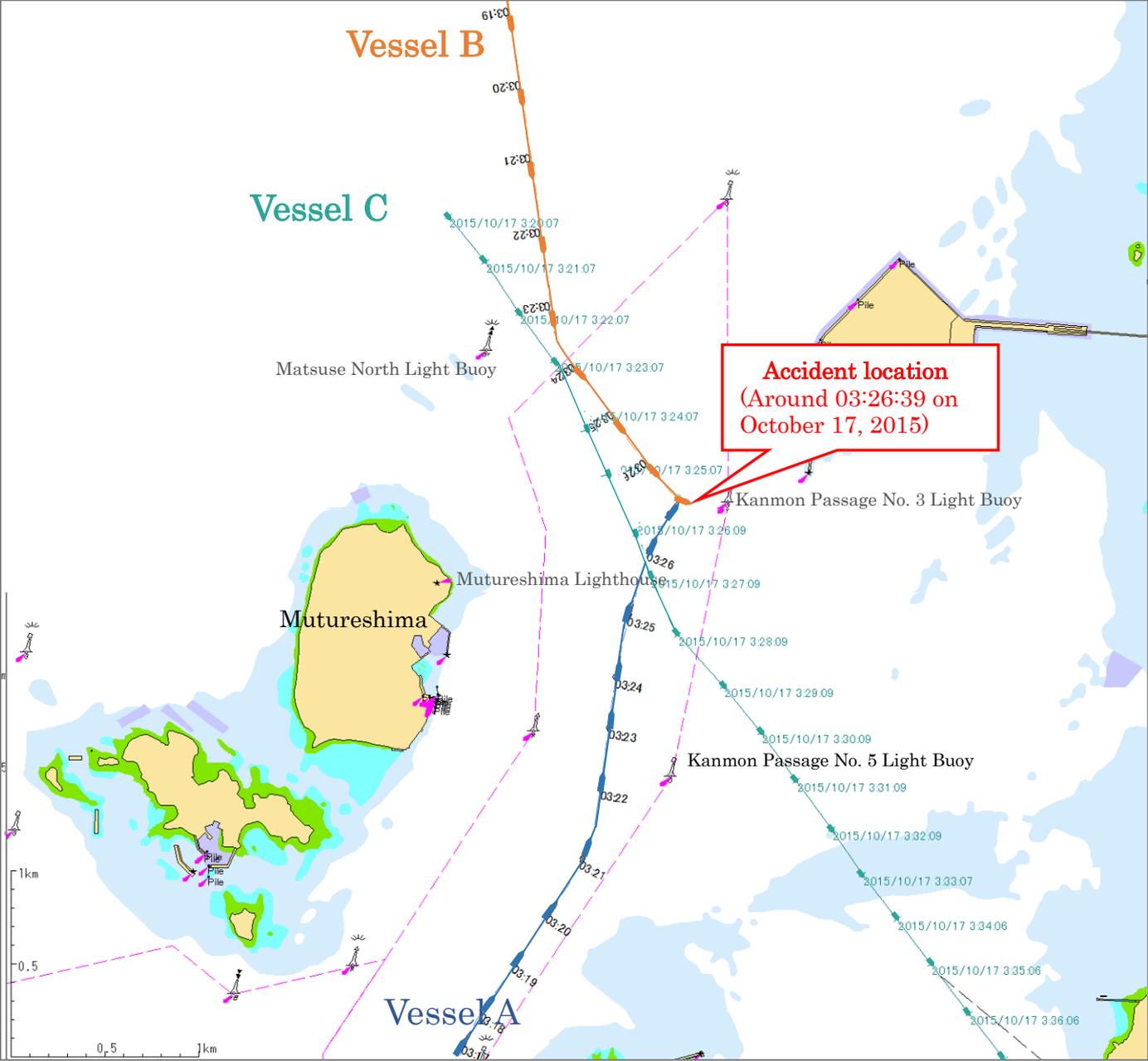


Figure 3 Navigation Paths (Enlarged)

