

MA2021-2

**MARINE ACCIDENT
INVESTIGATION REPORT**

February 18, 2021



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.

TAKEDA Nobuo
Chairperson
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: Container Ship APL GUAM

IMO number: 9229609

Gross tonnage: 13,764 tons

Vessel type and name: Container Ship MARCLIFF

IMO number: 9343663

Gross tonnage: 9,610 tons

Vessel type and name: Container Ship HANSA STEINBURG

IMO number: 9436094

Gross tonnage: 18,252 tons

Accident type: Collision

Date and time: Around 23:27, March 21, 2019 (local time, UTC+9 hours)

Location: Anchorage YL4, Yokohama Section 5, Keihin Port
Around 344° true bearing, 1.1 nautical miles from Tokyo Wan Nakanose
Western No. 2 Light Beacon (approximately 35°25.4'N, 139°43.0'E)

January 20, 2021

Adopted by the Japan Transport Safety Board

Chairperson TAKEDA Nobuo

Member SATO Yuji

Member TAMURA Kenkichi

Member KAKISHIMA Yoshiko

Member OKAMOTO Makiko

SYNOPSIS

< Summary of the Accident >

At around 23:27 on March 21, 2019, as the container ship APL GUAM, with a master and 20 other crew members on board, was proceeding north toward her planned anchorage within Anchorage YL4 of Yokohama Section 5, Keihin Port, under the pilotage of a pilot, and while the container ship MARCLIFF, with a master and 15 other crew members on board, was proceeding south-southeast toward Nagoya Port, Aichi Prefecture, both vessels collided in Anchorage YL4. MARCLIFF subsequently collided with the anchored container ship HANSA STEINBURG, which had a master and 19 other crew members on board.

APL GUAM sustained dents and other damage with a hole to her bow's plating shell, MARCLIFF sustained dents and other damage to her bow's plating shell and starboard side bow's plating shell, and HANSA STEINBURG sustained dents and other damage with a hole to her starboard bow's plating shell. However, there were no casualties on any of the vessels involved.

< Probable Causes >

It is probable that the accident occurred when, as APL GUAM was proceeding north toward her planned anchorage and MARCLIFF was proceeding south-southeast toward the sea area west of Nakanose in Tokyo Bay at night within an anchorage of the Keihin Port Yokohama 5th District that had become confined with the presence of anchored vessels, and under conditions in which the courses of APL GUAM and MARCLIFF intersected between anchored vessel HANSA STEINBURG and another anchored vessel, and the danger of collision was rising, APL GUAM and MARCLIFF collided and then MARCLIFF turned to port and proceeded southeast with headway and collided with HANSA STEINBURG because both vessels maintained course and speed until they approached each other, as master and pilot of APL GUAM intended to pass MARCLIFF port-to-port and master of MARCLIFF intended to pass APL GUAM starboard-to-starboard.

It is probable that master and pilot of APL GUAM maintained course and speed until APL GUAM approached MARCLIFF with the intention of passing MARCLIFF port-to-port because they predicted that MARCLIFF, which had turned to starboard, would turn to starboard again and pass APL GUAM port-to-port rather than navigate in the narrow sea area between APL GUAM and HANSA STEINBURG.

It is probable that master of MARCLIFF maintained course and speed until MARCLIFF approached APL GUAM with the intention of passing APL GUAM starboard-to-starboard because he predicted that MARCLIFF would safely pass APL GUAM starboard-to-starboard if APL GUAM maintained her course and speed.

It is probable that, under conditions in which the course of each vessel intersected the course of the other and the danger of collision was rising, APL GUAM and MARCLIFF could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by international VHF radio telephone (VHF), and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

< Recommendations >

It is probable that the accident occurred when, as APL GUAM was proceeding north toward her planned anchorage and MARCLIFF was proceeding south-southeast toward the sea area west

of Nakanose in Tokyo Bay at night within an anchorage of the Keihin Port Yokohama 5th District that had become confined with the presence of anchored vessels, and under conditions in which the courses of APL GUAM and MARCLIFF intersected between anchored vessel HANSA STEINBURG and another anchored vessel, APL GUAM and MARCLIFF collided and then MARCLIFF turned to port and proceeded southeast with headway and collided with HANSA STEINBURG because both vessels maintained course and speed until they approached each other, as APL GUAM's master and pilot predicted that MARCLIFF would turn to starboard and pass port-to-port and MARCLIFF's master predicted that APL GUAM would maintain course and speed and pass safely starboard-to-starboard.

Additionally, it is probable that, under conditions in which the course of each vessel intersected the course of the other and the danger of collision was rising, APL GUAM and MARCLIFF could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by VHF, and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

In view of the result of this accident investigation, the Japan Transport Safety Board recommends APL MARITIME LTD., which is the management company of APL GUAM, and MARCONSULT SCHIFFAHR T GMBH, which is the management company of MARCLIFF, to take the following measures for the purpose of preventing the occurrence of a similar accident.

APL MARITIME LTD. and MARCONSULT SCHIFFAHR T GMBH are recommended to instruct the masters, etc., of all vessels they manage or operate to consistently implement the following items.

- (1) Whenever possible, large vessels avoid situations in which they approach other vessels on intersecting courses in anchorages that have become confined with the presence of anchored vessels.
- (2) When they see another vessel approaching, masters immediately confirm maneuvering intentions with the other vessel by actively and appropriately engaging in VHF communication, rather than making decisions based on assumptions about the other vessel's movements.
- (3) Masters consider the circumstances of nearby navigating vessels and anchored vessels, make judgments on whether the possibility that other vessels may come extremely close or the risk of collision with the other vessel exists, and, when they judge that such a possibility or risk exists, take measures to avoid collision by promptly reducing speed, etc., while sufficient time is available.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

At around 23:27 on March 21, 2019, as the container ship APL GUAM, with a master and 20 other crew members on board, was proceeding north toward her planned anchorage within Anchorage YL4 of Yokohama Section 5, Keihin Port, under the pilotage of a pilot, and while the container ship MARCLIFF, with a master and 15 other crew members on board, was proceeding south-southeast toward Nagoya Port, Aichi Prefecture, both vessels collided in Anchorage YL4. MARCLIFF subsequently collided with the anchored container ship HANSA STEINBURG, which had a master and 19 other crew members on board.

APL GUAM sustained dents and other damage with a hole to her bow's plating shell, MARCLIFF sustained dents and other damage to her bow's plating shell and starboard side bow's plating shell, and HANSA STEINBURG sustained dents and other damage with a hole to her starboard bow's plating shell. However, there were no casualties on any of the vessels involved.

1.2 Outline of the Accident Investigation

1.2.1 Setup of the Investigation

The Japan Transport Safety Board (JTSB) appointed an investigator-in-charge (Yokohama Office) and one other local accident investigator to investigate this accident on March 22, 2019.

It should be noted that the JTSB subsequently replaced the investigator-in-charge and other investigator with marine accident investigator.

1.2.2 Collection of Evidence

March 22, 2019: On-site investigation and interviews, March 29, 2019: Interviews

May 8, 14, 16, 17, 28, June 7, 24, July 24, August 15, September 30, October 1, 4, December 6, 2019 and December 17, 2020: Collection of questionnaires

1.2.3 Comments from 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 states of APL GUAM, MARCLIFF, and HANSA STEINBURG.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 The Navigation 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 tracks of APL GUAM (hereinafter referred to as “Vessel A” except for Chapter 6), MARCLIFF (hereinafter referred to as “Vessel B” except for Chapter 6), and HANSA STEINBURG (hereinafter referred to as “Vessel C” except for Chapter 6) from around 23:22 to 23:28 on March 21, 2019, were as shown in Table 1, Table 2 and Table 3 below, respectively.

The positions of Vessel A, Vessel B and Vessel C refer to the positions of GPS antennas attached to the upper side of the respective bridge. The position information of the GPS antennas was as follows: Vessel A was 130 m from the bow, 23 m from the stern, 16 m from the port side, and 9 m from the starboard side; Vessel B was 121 m from the bow, 22 m from the stern, 12 m from the port side, and 11 m from the starboard side; Vessel C was 159 m from the bow, 16 m from the stern, 13 m from the port side, and 14 m from the starboard side. The course over the ground and heading are true bearings.

Table 1 AIS Record of Vessel A (excerpt)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground* ² (knots [kn])
	Latitude (N) (° ' ")	Longitude (E) (° ' ")			
23:22:04	35-24-52.3	139-42-50.1	011.3	010	5.9
23:22:15	35-24-53.4	139-42-50.4	012.2	009	5.9
23:22:24	35-24-54.2	139-42-50.7	014.0	009	6.0
23:22:34	35-24-55.2	139-42-51.0	014.9	007	6.0
23:22:45	35-24-56.2	139-42-51.3	014.9	005	6.0
23:22:54	35-24-57.1	139-42-51.6	014.4	004	6.1
23:23:04	35-24-58.2	139-42-52.0	013.4	002	6.1
23:23:15	35-24-59.2	139-42-52.2	011.7	000	6.1
23:23:24	35-25-00.1	139-42-52.4	009.0	359	6.0
23:23:34	35-25-01.2	139-42-52.6	005.7	359	5.9
23:23:45	35-25-02.1	139-42-52.7	003.8	359	5.9
23:23:54	35-25-03.1	139-42-52.8	003.4	358	5.9
23:24:04	35-25-04.0	139-42-52.9	002.0	358	5.9
23:24:15	35-25-05.1	139-42-52.9	001.8	359	5.9
23:24:24	35-25-06.0	139-42-53.0	002.3	359	5.9
23:24:34	35-25-07.0	139-42-53.0	001.4	359	5.9
23:24:45	35-25-08.1	139-42-53.1	001.0	000	5.9
23:24:54	35-25-09.0	139-42-53.0	002.2	000	6.0

^{*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 to exchange information with other vessels or land-based navigation aids.

^{*2} “Speed over the ground” refers to the speed of a vessel as measured against one point on the earth’s surface. The speed of a vessel as measured against the water on which the vessel is floating is called “speed over the water”.

23:25:05	35-25-10.0	139-42-53.1	003.1	359	6.0
23:25:15	35-25-11.1	139-42-53.2	003.0	359	6.0
23:25:24	35-25-12.0	139-42-53.2	000.8	359	6.0
23:25:34	35-25-13.0	139-42-53.3	359.2	000	6.0
23:25:45	35-25-14.2	139-42-53.2	357.9	003	6.1
23:25:54	35-25-15.1	139-42-53.2	356.6	006	6.2
23:26:04	35-25-16.2	139-42-53.1	356.6	011	6.4
23:26:15	35-25-17.3	139-42-53.0	358.0	017	6.6
23:26:25	35-25-18.5	139-42-53.0	000.5	023	6.8
23:26:34	35-25-19.5	139-42-53.1	004.1	030	6.8
23:26:45	35-25-20.8	139-42-53.3	010.4	037	6.5
23:26:54	35-25-21.7	139-42-53.5	015.6	042	6.0
23:27:04	35-25-22.7	139-42-53.9	019.3	048	5.5
23:27:15	35-25-23.5	139-42-54.2	005.8	059	5.0
23:27:25	35-25-24.2	139-42-54.3	003.1	073	4.2
23:27:34	35-25-24.8	139-42-54.4	010.5	083	3.2
23:27:45	35-25-25.3	139-42-54.5	013.5	092	2.7
23:27:54	35-25-25.7	139-42-54.6	010.0	099	2.0
23:28:04	35-25-26.1	139-42-54.7	005.0	106	1.9
23:28:15	35-25-26.5	139-42-54.6	353.2	112	2.0
23:28:25	35-25-26.9	139-42-54.5	342.4	117	2.1
23:28:34	35-25-27.1	139-42-54.4	338.8	121	2.3
23:28:45	35-25-27.5	139-42-54.1	332.3	126	2.4
23:28:54	35-25-27.9	139-42-53.9	331.3	129	2.6

Table 2 AIS Record of Vessel B (excerpt)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (N) (° . ' . ")	Longitude (E) (° . ' . ")			
23:22:00	35-26-15.9	139-42-14.2	125.0	126	12.4
23:22:09	35-26-14.8	139-42-16.1	125.0	126	12.4
23:22:20	35-26-13.4	139-42-18.6	125.0	126	12.4
23:22:30	35-26-12.2	139-42-20.6	125.0	126	12.3
23:22:39	35-26-11.2	139-42-22.4	125.0	126	12.3
23:22:49	35-26-10.1	139-42-24.3	125.0	127	12.2
23:22:58	35-26-09.0	139-42-26.3	123.0	130	12.1
23:23:09	35-26-07.9	139-42-28.3	124.0	134	12.0
23:23:20	35-26-06.4	139-42-30.4	127.0	139	12.0
23:23:30	35-26-05.0	139-42-32.1	130.0	144	11.9
23:23:39	35-26-03.7	139-42-33.4	134.0	147	11.7
23:23:49	35-26-02.1	139-42-34.7	139.0	150	11.6
23:23:58	35-26-00.4	139-42-36.1	142.0	154	11.6
23:24:09	35-25-58.7	139-42-37.1	147.0	156	11.5

23:24:20	35-25-56.8	139-42-38.2	150.0	157	11.4
23:24:30	35-25-55.1	139-42-39.2	152.0	157	11.5
23:24:39	35-25-53.5	139-42-40.1	153.0	157	11.5
23:24:49	35-25-51.5	139-42-41.1	155.0	157	11.5
23:24:58	35-25-49.9	139-42-42.0	155.0	156	11.6
23:25:09	35-25-48.1	139-42-43.0	155.0	156	11.7
23:25:20	35-25-46.0	139-42-44.2	155.0	156	11.7
23:25:30	35-25-44.2	139-42-45.2	154.0	156	11.7
23:25:39	35-25-42.5	139-42-46.2	154.0	156	11.8
23:25:49	35-25-41.0	139-42-47.2	154.0	156	11.8
23:25:58	35-25-39.2	139-42-48.2	154.0	156	11.8
23:26:08	35-25-37.4	139-42-49.3	154.0	155	11.8
23:26:19	35-25-35.6	139-42-50.3	154.0	154	11.8
23:26:30	35-25-33.6	139-42-51.4	155.0	150	11.9
23:26:39	35-25-32.0	139-42-52.3	154.0	144	11.8
23:26:49	35-25-30.4	139-42-53.5	150.0	138	11.5
23:26:58	35-25-29.1	139-42-55.0	144.0	137	11.0
23:27:10	35-25-28.6	139-42-56.0	138.0	136	10.5
23:27:19	35-25-27.8	139-42-57.0	138.0	128	9.7
23:27:30	35-25-27.1	139-42-58.3	131.0	123	9.0
23:27:39	35-25-26.5	139-42-59.8	124.0	122	8.5
23:27:49	35-25-26.2	139-43-00.5	115.0	125	5.4
23:27:58	35-25-26.1	139-43-01.0	109.0	129	3.6
23:28:10	35-25-26.0	139-43-01.4	104.0	133	2.7
23:28:19	35-25-25.9	139-43-01.8	106.0	136	2.2
23:28:30	35-25-25.9	139-43-02.3	102.0	140	2.0
23:28:39	35-25-25.9	139-43-02.7	100.0	142	2.0
23:28:49	35-25-25.9	139-43-03.1	096.0	145	2.0

Table 3 AIS Record of Vessel C (excerpt)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (N) (° . ' . ")	Longitude (E) (° . ' . ")			
23:22:52	35-25-27.9	139-43-07.7	123.0	225	0.1
23:25:52	35-25-27.5	139-43-07.9	151.0	228	0.0
23:28:53	35-25-27.6	139-43-07.8	165.0	196	0.4

2.1.2 Information on Voice Communication, etc., Recorded by the Voice Data Recorders

According to the records of the voyage data recorders (hereinafter referred to as “VDR”) of Vessel A, Vessel B, and Vessel C, information on voice communication, etc., on the bridges of Vessel A and Vessel B from around 23:18 to 23:27 on March 21, 2019, and information on voice communication, etc., on the bridge of Vessel C from around 23:24 to 23:27 on the same date was as provided in Table 4, Table 5, and Table 6.

Table 4 Information on Voice Communication, etc., on Vessel A (Excerpt)

Time	Voice Communication, etc.
23:18:00	Crew member at Vessel A's bow: <i>Working lights up forward?</i> Master of Vessel A: <i>Yeah, comin' up.</i>
23:22:03	Pilot: <i>000°</i> Master of Vessel A: <i>000°.</i> Quartermaster of Vessel A: <i>000°.</i>
23:24:48	Pilot: <i>one long blast.</i> Whistle: One long blast
23:25:01	Pilot: <i>Hard starboard.</i> Quartermaster of Vessel A: <i>Hard starboard.</i>
23:25:25	Pilot: <i>Slow ahead.</i> Master of Vessel A: <i>Slow ahead.</i> Navigation officer of Vessel A: <i>Slow ahead.</i>
23:25:41	Master of Vessel A: <i>What are they doing?</i>
23:25:48	Pilot: [Unintelligible] <i>One long blast.</i> Whistle: Six short blasts
23:26:15	Whistle: Nine short blasts
23:26:23	Master of Vessel A: <i>Stop engine.</i> Navigation officer of Vessel A: <i>Stop engine.</i>
23:26:32	Master of Vessel A: <i>Full astern.</i> Navigation officer of Vessel A: <i>Full astern.</i> Whistles of Vessel B and Vessel C: Nine short blasts, continuous blast
23:26:56	Master of Vessel A: <i>What's up...</i> Pilot: <i>Hey! Oy...oy.</i>
23:27:06	(Impact sound)

Table 5 Information on Voice Communication, etc., on Vessel B (Excerpt)

Time	Voice Communication, etc.
23:18:01	Master of Vessel B: <i>125°.</i> Quartermaster of Vessel B: <i>125°.</i>
23:22:37	Master of Vessel B: <i>155°.</i> Quartermaster of Vessel B: <i>155°.</i>
23:24:56	Vessel A's whistle: One long blast
23:25:49	Vessel A's whistle: Six short blasts
23:26:08	Master of Vessel B: <i>145°.</i> Quartermaster of Vessel B: <i>145°.</i>
23:26:15	Vessel A's whistle: Nine short blasts Navigation officer of Vessel B: [Unintelligible] <i>Shall we set astern?</i> Master of Vessel B: [Unintelligible] <i>Ahead.</i>

23:26:32	Whistles of Vessel B and Vessel C: Nine short blasts, continuous blast Master of Vessel B: [Unintelligible]: <i>Slow ahead.</i>
23:26:35	Master of Vessel B: [Unintelligible]: <i>Hard port.</i>
23:26:37	Master of Vessel B: <i>Steady.</i> Navigation officer of Vessel B: <i>Steady.</i>
23:26:45	Master of Vessel B: <i>Half astern.</i>
23:27:06	(Impact sound)
23:27:20	Master of Vessel B: <i>Full astern.</i> Navigation officer of Vessel B: <i>Full astern.</i>
23:27:26	Master of Vessel B: <i>Full astern.</i> Navigation officer of Vessel B: <i>Full astern.</i>
23:27:34	(Impact sound)

Table 6 Information on Voice Communication, etc., on Vessel C (Excerpt)

Time	Voice Communication, etc.
23:24:56	Vessel A's whistle: One long blast
23:25:49	Vessel A's whistle: Six short blasts
23:26:15	Vessel A's whistle: Nine short blasts
23:26:32	Whistles of Vessel B and Vessel C: Nine short blasts, continuous blast
23:27:28	Navigation officer of Vessel C: (To Vessel C's quartermaster) <i>Stand by emergency.</i>
23:27:34	(Impact sound)

2.1.3 Events Leading to the Accident according to Statements of Crew Members, etc.

According to statements by Vessel A's master (hereinafter referred to as "Master A" except for Chapter 6), a navigation officer of Vessel A (hereinafter referred to as "Navigation Officer A"), and the pilot aboard Vessel A (hereinafter referred to as "Pilot A" except for Chapter 6); Vessel B's master (hereinafter referred to as "Master B" except for Chapter 6) and a navigation officer of Vessel B (hereinafter referred to as "Navigation Officer B"); and Vessel C's master (hereinafter referred to as "Master C") and a navigation officer of Vessel C (hereinafter referred to as "Navigation Officer C") and the replies to the questionnaire by APL MARITIME LTD., which is Vessel A's management company (hereinafter referred to as "Company A" except for Chapter 6), MARCONSULT SCHIFFAHR T GMBH, which is Vessel B's management company (hereinafter referred to as "Company B" except for Chapter 6), and the Tokyo Bay Licensed PILOTS' Association (hereinafter referred as "the Pilots' Association), the events leading to the accident were as follows.

(1) Vessel A

Vessel A departed Busan Port, Republic of Korea, for Keihin Port on March 19, 2019, with Master A (national of the United States of America) and 19 other crew members (all nationals of the United States of America) aboard.

Vessel A, with navigation lights on, brought Pilot A aboard at a pilot station^{*3} near the Uraga Suido Traffic Route Center No. 1 Light Buoy at around 21:55 on March 21. Vessel A then proceeded north after Master A and Pilot A exchanged information pertaining to Vessel A and her entry into port.

With Master A conning the vessel, under Pilot A's pilotage, and assigning Navigation Officer A to lookout and operation of the main engine remote control system and a quartermaster to manual steering, Vessel A navigated in the sea area west of Nakanose in Tokyo Bay at a course of approximately 350° (true bearing; hereinafter the same) and speed of approximately 9 kn (speed over the ground; hereinafter the same) toward Anchorage YL4, Yokohama Section 5, Keihin Port.

At around 23:09, Pilot A instructed crew members on the bridge to reduce speed and, because Vessel C and an oil tanker (gross tonnage of 66,082 tons; hereinafter referred to as "Vessel D") were already anchored in Anchorage YL4, set Vessel A's planned anchorage to the north of Vessel D within Anchorage YL4.

Master A and Pilot A decided to approach the planned anchorage from the east due to a southwesterly wind, and they decided to change course to the west toward Vessel D's north side after passing between Vessel C and Vessel D.

Master A first observed Vessel B on radar at around 23:17. However, because Vessel D was anchored to the west of Vessel C, he thought that Vessel B would navigate to the east of Vessel C.

Vessel A turned on her bow's work lights (white lights) to prepare for the work of letting go anchor.

At around 23:20, Pilot A observed Vessel B navigating southeast in the Yokohama Passage while showing her starboard lights, after which he navigated by setting Vessel A's course to approximately 000° and speed to approximately 6 kn.

At around 23:23, Master A and Pilot A observed Vessel B turn to starboard. However, because they were taking Vessel A north while staying close to Vessel C's side, they thought that Vessel B would turn to starboard again and pass Vessel A port-to-port rather than navigate in the narrow sea area between Vessel A and Vessel C, and therefore they continued at the same course and speed.

Although Master A and Pilot A expected Vessel B to make a starboard turn, Vessel B was navigating toward Vessel A without turning to starboard, and therefore they blew one long blast of the whistle to alert Vessel B.

Although Master A and Pilot A understood that that the situation was hazardous, they thought they could pass Vessel B port-to-port if Vessel B again turned to starboard after hearing Vessel A's whistle.

At around 23:25, Pilot A observed that Vessel B was continuing to approach Vessel A without changing course and he ordered a hard starboard.

At around 23:26, Master A blew whistle blasts and a light signal linked with the whistle blasts in response to Pilot A's order. However, he sensed the danger of collision with Vessel B, which was continuing to approach without a change in course, and therefore ordered Navigation Officer A to set the engine to full astern; nevertheless, Vessel A's bow collided with Vessel B's starboard bow at around 23:27.

^{*3} "Pilot station" refers to a waters area that was set up for a pilot to join with a pilot-requesting vessel and to go aboard the vessel.

Pilot A notified Japan Coast Guard of the accident via international VHF radio telephone equipment (hereinafter referred to as “VHF” except for Chapter 6) and Vessel A anchored in Anchorage YL4 after it was verified by crew members that there was no flooding.

(2) Vessel B

At around 23:06 on March 21, Vessel B, with Master B (national of the Russian Federation) and 15 other crew members (11 nationals of the Republic of the Philippines, three nationals of the Russian Federation, and one national of Ukraine) aboard, left Honmoku Pier’s BC Container Terminal in Yokohama Section 2, Keihin Port, for Nagoya with navigation lights on.

Vessel B proceeded east with Master B conning the vessel and assigning Navigation Officer B to lookout and operation of the main engine remote control system and a quartermaster to manual steering. At around 23:15, Master B observed Vessel A’s two mast lights approximately 3 nautical miles (M) off of Vessel B’s starboard side and, after checking the radar, entered the Yokohama Passage and proceeded southeast.

Master B observed Vessel A’s work lights after leaving the Yokohama Passage but, because he could not see any side lights, Vessel A appeared to him to be an anchored vessel. However, he learned that Vessel A was navigating at slow speed when he checked the Electronic Chart Display and Information System (ECDIS)^{*4}.

Master B decided to navigate between the anchored Vessel C and Vessel D off of Vessel B’s starboard bow in order to avoid approaching two vessels that were proceeding southwest off of Vessel B’s port bow, and at around 23:23 Vessel B turned to starboard toward the sea area west of Nakanose in Tokyo bay.

Master B predicted that Vessel B would pass Vessel A starboard-to-starboard at a distance of 0.2 to 0.3 M if Vessel A maintained her course and speed and would also pass the anchored Vessel C at a distance of 0.2 to 0.3 M, and therefore Vessel B continued navigating at the same course and speed.

Master B observed that Vessel A’s side lights were on at around 23:24.

At around 23:26, Vessel A initiated turn to starboard. Sensing the danger of collision, Master B sounded the whistle as a warning and also ordered half astern.

At around 23:27, Vessel B’s starboard bow collided with Vessel A’s bow. Vessel B subsequently proceeded southeast while turning to port with headway toward Vessel C’s bow, and Vessel B’s bow and Vessel C’s starboard bow collided.

Vessel B was called by Japan Coast Guard by VHF and Master B informed Japan Coast Guard of the accident, and then Vessel B anchored in Anchorage YL3, Keihin Port Yokohama Section 3, after it was verified by crew members that there was no flooding.

(3) Vessel C

At around 15:48 on March 21, Vessel C, with Master C (national of the Republic of the Philippines) and 19 other crew members (seven nationals of the Republic of the Philippines and 12 nationals of the Republic of Kiribati) aboard, left Keihin Port Tokyo Section 3 and, at around 17:36, she began riding at single anchor in Anchorage YL4 by letting go her starboard anchor and extending out seven shackles of anchor chain for the purpose of waiting.

^{*4} “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 official 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.

At around 23:26, Navigation Officer C observed that Vessel A and Vessel B were navigating very near Vessel C and he blew the whistle as a warning to Vessel A and Vessel B. However, Vessel A and Vessel B collided, after which Vessel B proceeded southeast while turning to port with headway toward Vessel C's bow and Vessel C's starboard bow and Vessel B's bow collided.

Master C received a report from Navigation Officer C, went to the bridge, and notified Japan Coast Guard of the accident via VHF. It was verified by crew members that there was no flooding aboard Vessel C.

The date and time of occurrence of the accident was at around 23:27 on March 21, 2019, and the location was around 1.1 M at 344° true bearing from the Tokyo Wan Nakanose Western No. 2 Light Beacon.

(See Annex Figure 1 “Estimated Navigation Routes” and Annex Figure 2 “Estimated Navigation Routes (Enlarged)”

2.2 Injuries to Persons

According to the statements of Master A, Master B, and Master C, there were no casualties.

2.3 Damage to Vessel

- (1) Vessel A sustained dents and abrasions with a hole in her bow's plating shell.
- (2) Vessel B sustained dents and abrasions in her bow's plating shell and starboard side bow's plating shell.
- (3) Vessel C sustained dents and abrasions with a hole in her starboard side bow's plating shell.

(See Photo 1, Photo 2, and Photo 3)

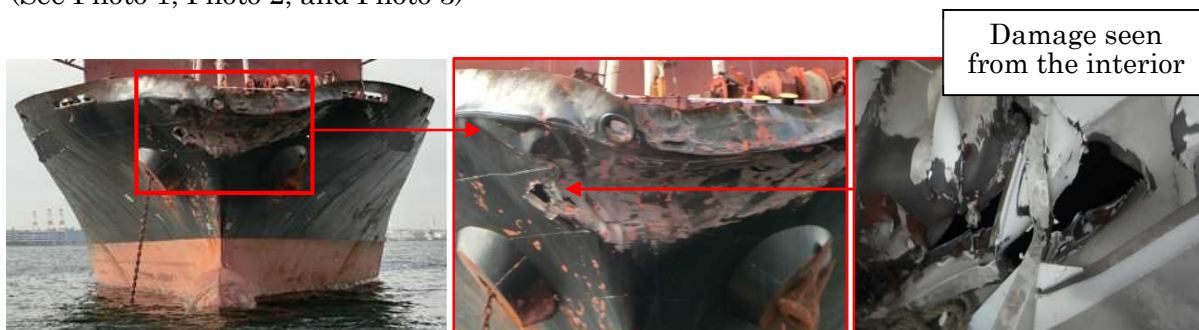


Photo 1 Damage to Vessel A



Photo 2 Damage to Vessel B



Photo 3 Damage to Vessel C

2.4 Crew Information

(1) Gender, Age, and Certificate of Competence

Master A: Male, 44 years old Nationality: United States of America

Master's certificate (issued by the United States of America)

Date of issue: October 27, 2014

(valid until October 27, 2019)

Navigation Officer A: Female, 25 years old Nationality: United States of America

Navigation officer's certificate of competency (issued by the United States of America)

Date of issue: December 19, 2015

(valid until December 19, 2020)

Pilot A: Male, 72 years old

Tokyo Bay Pilot District First Grade Pilot's License

Date of issue: December 19, 2000

Date of revalidation: November 15, 2018

Date of expiry: December 18, 2021

Master B: Male, 58 years old Nationality: Russian Federation

Endorsement attesting the recognition of certificate under STCW regulation I/10: Master (issued by the Antigua and Barbuda)

Date of issue: April 25, 2017

(valid until January 24, 2022)

Navigation Officer B: Male, 34 years old Nationality: Russian Federation

Endorsement attesting the recognition of certificate under STCW regulation I/10: Navigation officer (issued by the Antigua and Barbuda)

Date of issue: February 15, 2019

(valid until March 12, 2023)

Master C: Male, 62 years old Nationality: Republic of the Philippines

Endorsement attesting the recognition of certificate under STCW regulation I/10: Master (issued by the Republic of Liberia)

Date of issue: August 11, 2016

(valid until July 14, 2021)

Navigation Officer C: Male, 36 years old Nationality: Republic of the Philippines

Endorsement attesting the recognition of certificate under STCW regulation I/10: Navigation officer (issued by the Republic of Liberia)

Date of issue: August 18, 2016

(valid until April 21, 2020)

(2) Sea-going Experience, etc.

According to the statements of Master A, Pilot A, and Master B and the reply to the questionnaire by the Pilots' Association, sea-going experience was as follows.

1) Master A

Master A became a master in October 2009, came aboard Vessel A as her master in July 2017, and entered Keihin Port's Yokohama Section as master on 28 occasions, as an officer on 74 occasions.

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

2) Pilot A

Pilot A joined a shipping company in 1970 and served as master aboard ore and oil carriers and other vessels. He began working as a pilot in Tokyo Bay in January 2001 and engaged in piloting operations about 17 times a month.

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

3) Master B

Master A became a master in 2005, came aboard Vessel B as her master in October 2007, and entered Keihin Port's Yokohama Section as master on numerous occasions.

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

2.5 Vessel Information

2.5.1 Particulars of Vessels

(1) Vessel A

IMO number: 9229609

Port of registry: Wilmington, United States of America

Owner: R&D INVESTMENTS INC (United States of America)

Management company: Company A (United States of America)

Class: American Bureau of Shipping

Gross tonnage: 13,764 tons

L×B×D: 154.00m×25.00m×13.60m

Hull material: Steel

Engine: Diesel engine × 1

Output: 11,060 kW

Propulsion: 6-blade fixed pitch propeller × 1

Date of launch: May 12, 2001

(See Photo 4)



Photo 4 Vessel A

(2) Vessel B

IMO number: 9343663

Port of registry: St. John's, Antigua and Barbuda

Owner: MARCLIFF SCHIFFFAHRTS GMBH (Federal Republic of Germany)

Management company: Company B (Federal Republic of Germany)

Class: DNV GL

Gross tonnage: 9,610 tons

L×B×D: 142.70m×22.60m×11.20m

Hull material: Steel

Engine: Diesel engine × 1

Output: 7,860 kW

Propulsion: 4-blade fixed pitch propeller × 1

Date of launch: February 16, 2007

(See Photo 5)



Photo 5 Vessel B

(3) Vessel C

IMO number: 9436094

Port of registry: Monrovia, Republic of Liberia

Owner: HANSA STEINBURG MBH & CO KG (Federal Republic of Germany)

Management company: LEONHARDT & BLUMBERG SHIPMGMT (Federal Republic of Germany)

Class: DNV GL

Gross tonnage: 18,252 tons

L×B×D: 175.00m×27.00m×14.30m

Hull material: Steel

Engine: Diesel engine × 1

Output: 16,660 kW

Propulsion: 5-blade fixed pitch propeller × 1

Year of construction: 2010

(See Photo 6)



Photo 6 Vessel C

2.5.2 Loading Conditions

(1) Vessel A

According to the reply to the questionnaire by Master A, at the time of the accident, Vessel A was loaded with 205 containers (1,078 TEU*⁵ when fully loaded). Her draft was about 6.10 m at the fore and about 7.20 m at the stern.

(2) Vessel B

According to the reply to the questionnaire by Master B, at the time of the accident, Vessel B was loaded with 496 containers (1,049 TEU when fully loaded). Her draft was about 5.20 m at the fore and about 6.81 m at the stern.

(3) Vessel C

According to the reply to the questionnaire by Master C, at the time of the accident, Vessel C was loaded with 1,036 containers (1,740 TEU when fully loaded). Her draft was about 7.60 m at the fore and about 8.80 m at the stern.

2.5.3 Information on the Vessels' Equipment

(1) Vessel A

Vessel A had a steering stand installed in the center of the bridge; one radar console installed on the starboard side of the stand; and a main engine remote control system, two radar consoles, and an ECDIS capable of displaying superimposed radar images installed on the port side of the stand.

(2) Vessel B

Vessel B had a steering stand installed in the center of the bridge; a main engine remote control system, one radar console, and an ECDIS capable of displaying superimposed radar images installed on the starboard side of the stand; and one radar console installed on the port side of the stand.

(3) Vessel C

Vessel C had a main engine remote control system installed in the center of the bridge; one radar console, an ECDIS capable of displaying superimposed radar images, a steering stand, and other equipment installed on the starboard side of the remote control system; and one radar console installed on the port side of the remote control system.

2.5.4 Visibility from the Bridge

No structures existed on Vessel A, Vessel B, and Vessel C that could blind spots toward the bow.

*⁵ "TEU (Twenty-foot Equivalent Unit)" refers to the number of containers when a 20-foot container is considered to be one unit.

2.5.5 Information on the Maneuverability

(1) Vessel A

According to Vessel A's speed chart and maneuverability chart, Vessel A's maneuverability was as provided below.

1) Main engine revolutions and speed

Classification	Main engine revolutions per minute (rpm)	Speed loaded (kn)	Speed in ballast (kn)
Full ahead	75.0	11.5	12.4
Half ahead	65.0	9.0	11.1
Slow ahead	54.0	7.5	9.6
Dead slow ahead	38.0	5.5	6.9

2) Turning characteristics

	Classification	Advance* ⁶ (m)	Transfer* ⁷ (m)	Tactical diameter* ⁸ (m)	Time (sec.)
Starboard turn	Full ahead	351.6	219.3	524.6	264
	Half ahead	339.6	209.4	505.5	276
Port turn	Full ahead	364.4	192.0	486.4	250
	Half ahead	349.3	196.0	470.8	251

3) Time and distance until stopping after setting engine to full astern

Condition when "astern" is ordered	Time (sec.)	Distance (m)
When operating at 90% MCR* ⁹	324	1731.0
When operating at 50% MCR	285	1354.9

(2) Vessel B

According to Vessel B's speed chart and sea trial operational performance chart, Vessel B's maneuverability was as provided below.

1) Main engine revolutions and speed

Classification	Main engine revolutions per minute (rpm)	Speed loaded (kn)
Harbor full speed	90.0	13.8
Half ahead	72.0	10.8
Slow ahead	50.0	7.2
Dead slow ahead	35.0	4.7

2) Turning test results

*⁶ "Advance" refers to the distance advanced by the hull's center of gravity in the direction of the original course when the vessel turns by 90° from the position of the hull's center of gravity at the time of steering.

*⁷ "Transfer" refers to the sideways distance the hull's center of gravity moves from the original course when the vessel turns by 90° from the position of the hull's center of gravity at the time of steering.

*⁸ "Tactical diameter" refers to the sideways distance the hull's center of gravity moves from the original course when the vessel turns by 180° from the position of the hull's center of gravity at the time of steering.

*⁹ "MCR" (Maximum Continuous output Rating) refers to the maximum continuous output of the main engine.

	Main engine revolutions per minute (rpm)	Advance (m)	Time (sec.)	Tactical diameter (m)
Starboard turn	129.2	403.5	293	593.8
Port turn	125.8	407.1	278	561.7

3) Time and distance until stopping after setting engine to full astern

Speed when “astern” is ordered (kn)	Time (sec.)	Distance (m)
18.3	270	1,706

2.5.6 Information pertaining to Hull, Main Engine, etc.

According to the statements of Master A, Master B, and Master C, there was no malfunction or failure in the hull, engine, or machineries of Vessel A, Vessel B, and Vessel C at the time of the accident.

2.6 Weather and Sea Conditions

2.6.1 Weather and Tide Data

(1) Meteorological observations

Observations at the Yokohama Local Meteorological Office, which is located approximately 6.1 km west of the accident site were as follows. The weather was clear and visibility was 20.0 km at around 23:00.

Time	Wind direction	Average wind speed (m/s)	Maximum instantaneous wind speed (m/s)	Precipitation (mm)
23:20	SW	6.6	13.4	None
23:30	SW	5.7	11.5	None

(2) Tides

According to the tide table published by Japan Coast Guard, the tide in the Yokohama Section of Keihin Port at the time of the accident was almost low tide.

2.6.2 Observations by Crew

According to the logbook of Vessel A, the weather at 22:00 was clear, the wind was blowing from the west-southwest at a speed of 8 m/s, and visibility was at least 20 km.

According to the reply to the questionnaire by Pilot A, the weather at the time of the accident was cloudy, the wind was blowing from the southwest at a speed of 8 m/s, and visibility was good.

According to the reply to the questionnaire by Master C, the weather at the time of the accident was clear, the wind was from the southwest, the wind force was 5, and visibility was at least 5 M.

2.7 Information on Vessel A’s Safety Management

The following points pertaining to the responsibilities of masters and officers of the watch when a pilot is aboard were established in Company A’s Safety Management System Manual.

(1) Responsibilities of the ship's Bridge Team do not transfer to the Pilot; the duties of the

Master and his Bridge Team remain the same as those without a Pilot.

- (2) The Master and the Bridge Team are required to closely monitor the Pilot's advice.
- (3) If the Master/Officer of the Watch does not receive a satisfactory response from the Pilot, he must immediately take direct control of the vessel until he is satisfied that the vessel is back on her intended track or until the vessel is in a safe position.

2.8 Information on Radio Communication by Vessel A and Vessel B

According to the statements of Pilot A and Master B, the situation was as follows.

- (1) At the time of the accident, Pilot A predicted that Vessel B would turn to starboard and pass port-to-port, and therefore he did not feel any need to communicate by VHF.
- (2) At the time of the accident, Master B predicted that Vessel B would safely pass Vessel A starboard-to-starboard, and therefore he did not feel that communication by VHF was warranted.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

According to 2.1, the situation was as follows.

- (1) Vessel A
 - 1) It is highly probable that Vessel A departed Busan Port, Republic of Korea, for Keihin Port on March 19, 2019.
 - 2) It is probable that Vessel A took Pilot A aboard at a pilot station near Uruga Suido Traffic Route Center No. 1 Light Buoy at around 21:55 on March 21 and then navigated in the sea area west of Nakanose in Tokyo Bay toward Anchorage YL4, Yokohama Section 5, Keihin Port.
 - 3) It is highly probable that, at around 23:22:04, Vessel A was navigating on a course of 011.3° and at a speed of 5.9 kn toward the space between Vessel C and Vessel D, which were anchored in Anchorage YL4.
 - 4) It is highly probable that, at around 23:24:04, Vessel A was navigating on a course of 002.0° and at a speed of 5.9 kn.
 - 5) It is highly probable that, at around 23:25, Vessel A set her rudder to hard starboard and then subsequently set her main engine to slow ahead.
 - 6) It is highly probable that, at around 23:26, Vessel A stopped her engine and then set it to full astern.
 - 7) It is highly probable that Vessel A collided with Vessel B while turning to starboard.
- (2) Vessel B
 - 1) It is probable that Vessel B left Honmoku Pier's BC Container Terminal in Yokohama Section 2, Keihin Port, for Nagoya Port at around 23:06 on March 21 and then entered the Yokohama Passage and proceeded southeast.
 - 2) It is highly probable that Vessel B left the Yokohama Passage at around 23:20 and then began a starboard turn toward the space between the anchored Vessel C and Vessel D at around 23:22:36.
 - 3) It is highly probable that, at around 23:24:49, Vessel B was navigating on a course of

155.0° and at a speed of 11.5 kn.

4) It is highly probable that Vessel B began turning to port at around 23:26:08.

5) It is highly probable that Vessel B set her engine to half astern at around 23:26:45.

6) It is highly probable that Vessel B collided with Vessel A while turning to port, after which Vessel B turned to port and proceeded southeast with headway before colliding with Vessel C.

(3) Vessel C

1) It is probable that Vessel C began riding at single anchor in Anchorage YL4 at around 17:36 on March 21.

2) It is highly probable that Vessel B, which had collided with Vessel A, turned to port and proceeded southeast with headway, and that Vessel C and Vessel B collided while Vessel C was anchored.

3.1.2 Date, Time and Location of the Accident Occurrence

According to 2.1, it is highly probable that the date and time of occurrence of the accident were at around 23:27 on March 21, 2019, when the sound of the impact was recorded on the VDRs of Vessel A, Vessel B, and Vessel C, and the location was around 1.1 M at 344° true bearing from the Tokyo Wan Nakanose Western No. 2 Light Beacon.

3.1.3 Injuries to Persons

According to 2.2, it is probable that there were no casualties on Vessel A, Vessel B, or Vessel C.

3.1.4 Damage to Vessel

According to 2.3, the situation was as follows.

(1) Vessel A sustained dents and abrasions with a hole in her bow's plating shell.

(2) Vessel B sustained dents and abrasions in her bow's plating shell and starboard side bow's plating shell.

(3) Vessel C sustained dents and abrasions with a hole in her starboard side bow's plating shell.

3.2 Causal Factors of the Accident

3.2.1 Situation of Crew Members

According to 2.4, the situation was as follows.

(1) Master A

Master A possessed a legally valid certificate of competence.

It is probable that Master A was in good health at the time of the accident.

(2) Pilot A

Pilot A possessed a legally valid pilot's certificate.

It is probable that Pilot A was in good health at the time of the accident.

(3) Master B

Master B possessed a legally valid endorsement attesting the recognition of certificate under STCW regulation I/10.

It is probable that Master B was in good health at the time of the accident.

3.2.2 Condition of the Vessels

According to 2.5.6, it is probable that there was no malfunction or failure with the hull,

engine, or machineries of Vessel A, Vessel B, and Vessel C at the time of the accident.

3.2.3 Weather and Sea Conditions

According to 2.6, it is probable that, at the time of the accident, the weather was clear, the wind direction was from the southwest, the wind force was 5, visibility was at least 5 M, and the tide was almost low tide.

3.2.4 Conditions of Lookout and Ship Maneuvering

According to 2.1, 2.8 and 3.1.1, the situation was as follows.

(1) Vessel A

- 1) It is highly probable that Master A ordered work lights at the bow turned on in preparation for anchoring at around 23:18.
- 2) It is probable that, at around 23:23, Master A and Pilot A observed Vessel B turn to starboard, but because Vessel A was proceeding north while staying close to Vessel C's side, they predicted that Vessel B would turn to starboard again and pass Vessel A port-to-port rather than navigate in the narrow sea area between Vessel A and Vessel C, and therefore they continued at the same course and speed with the intention of passing Vessel B port-to-port.
- 3) It is highly probable that, although Master A and Pilot A expected Vessel B to make a starboard turn, they blew one long blast of the whistle to alert Vessel B, which was navigating toward Vessel A without turning to starboard.
- 4) It is probable that, although Master A and Pilot A recognized that the situation was hazardous, they thought they could pass Vessel B port-to-port if Vessel B again turned to starboard after hearing Vessel A's whistle.
- 5) It is highly probable that, at around 23:25, Pilot A observed that Vessel B was continuing to approach Vessel A without changing course, ordered a hard starboard, and then ordered the whistle sounded, and that Master A blew one long blast of the whistle and a light signal linked with the whistle blasts.
- 6) It is highly probable that, at around 23:26, Master A sensed the danger of a collision with Vessel B and ordered Navigation Officer A to stop the engine and then set it to full astern.
- 7) It is probable that, at the time of the accident, Pilot A predicted that Vessel B would turn to starboard and pass port-to-port and did not feel any need to communicate by VHF.

(2) Vessel B

- 1) It is probable that Master B observed Vessel A's work lights after leaving the Yokohama Passage but, because he did not see any side lights, he understood Vessel A to be an anchored vessel but later learned that Vessel A was navigating at slow speed when he checked the ECDIS. *
- 2) It is probable that Master B decided to navigate between the anchored Vessel C and Vessel D in order to avoid approaching two vessels that were proceeding southwest off of Vessel B's port bow, and at around 23:23 Vessel B turned to starboard toward the sea area west of Nakanose in Tokyo Bay.
- 3) It is probable that Master B predicted that Vessel B would pass Vessel A starboard-to-starboard at a distance of 0.2 to 0.3 M if Vessel A maintained her course and speed and would also pass the anchored Vessel C at a distance of 0.2 to 0.3 M, and therefore he

continued navigating at the same course and speed with the intention of passing Vessel A starboard-to-starboard.

4) It is probable that Master B sensed the danger of collision with Vessel A at around 23:26, when Vessel A initiated turn to starboard, and he sounded the whistle as a warning and also ordered half astern.

5) It is probable that, at the time of the accident, Master B predicted that Vessel B would safely pass Vessel A starboard-to-starboard and did not feel that communication by VHF was warranted.

(3) Vessel C

It is probable that, at around 23:26, Navigation Officer C observed Vessel A and Vessel B navigating very near Vessel C and he sounded the whistle as a warning to Vessel A and Vessel B.

3.2.5 Analysis of the Level of Collision Risk

To quantify the risk of collision between Vessel A and Vessel B, the level of collision risk was assessed using five evaluation indicators (OZT, ^{*10} CJ, ^{*11} SJ, ^{*12} CR, ^{*13} and BC^{*14}) based on the AIS records.

However, the results of the assessment of level of collision risk were calculated based on the vessels' positions, speeds, and other information. The maneuvering intentions and recognition of the collision danger of Master A, Pilot A, and Master B were not taken into account.

It should be noted that the positions of Vessel A's and Vessel B's GPS antennas were used as the reference points for the positions of Vessel A and Vessel B.

(1) Assessment of collision avoidance using OZT

The occurrence of an OZT means that a zone in which the own ship's course will become obstructed by the target ship in an area extending to 10° to the right and left of that course (set value in this accident investigation) within 5 minutes exists, and some action must be taken to avoid the area where OZT has occurred.

The time of occurrence of OZT in Vessel A and Vessel B was at around 23:23 for both

^{*10} "OZT (Obstacle Zone by Target)" indicates the area likely to be obstructed by another vessel (target ship) in the near future. Specifically, it refers to a water area where one's own ship and target ship can approach within the minimum safe navigating distance (a distance from the hull's center of within 0.1 M is set in this accident investigation) in the future under the condition that the course and speed of the target ship are constant at a certain time. Since it is assumed that the course of own ship is variable, the own OZT by the target ship will be present only on the course of the target ship. Similarly, the target ship's OZT by the own ship will be present only on the course of own ship.

^{*11} "CJ (Collision Judgment)" is an indicator expressing the collision risk level of two vessels in a one-on-one relationship. It is calculated from the relative distance to another vessel, its rate of change, and the relative orientation and its rate of change. The risk level increases as the other vessel approaches.

^{*12} "SJ (Subject Judgment)" means the evaluation of the subjective collision risk level between two vessels from a general operator's point of view, such risk level being changed depending on the combination of the distance from one vessel to another and the rate of change of the relative orientation.

^{*13} "CR (Collision Risk)" means an evaluation of collision risk level in consideration of vessel characteristics such as maneuverability using the time to closest point of approach and the distance of closest point of approach determined from the relative position and relative speed between two vessels.

^{*14} "BC (Blocking Coefficient)" is an indicator showing the degree to which a vessel is blocked by vessels present in the vicinity when the vessel is giving way by changing speed and course. It is based on the risk level of collision with other vessels present in the vicinity, multiplied by a weighting factor that express preference for changing course and speed as a means of giving way (desirable for vessel's maneuvering).

Also, at the time of the accident, the situation was just before entering the port and the engine could be decelerated, and thus it is assumed that the means available for giving way are both a change of course and a deceleration.

vessels, and the situation was in a dangerous condition whereby the distance between the two vessels would be 0.1 M or less within five minutes (set as the minimum safe navigating distance in this accident investigation).

The OZT of Vessel A occurred in the sea area on the starboard side of Vessel A's course while the OZT of Vessel B occurred in the sea area on Vessel B's course from around 23:23 to just before the collision.

(See Figure 1)

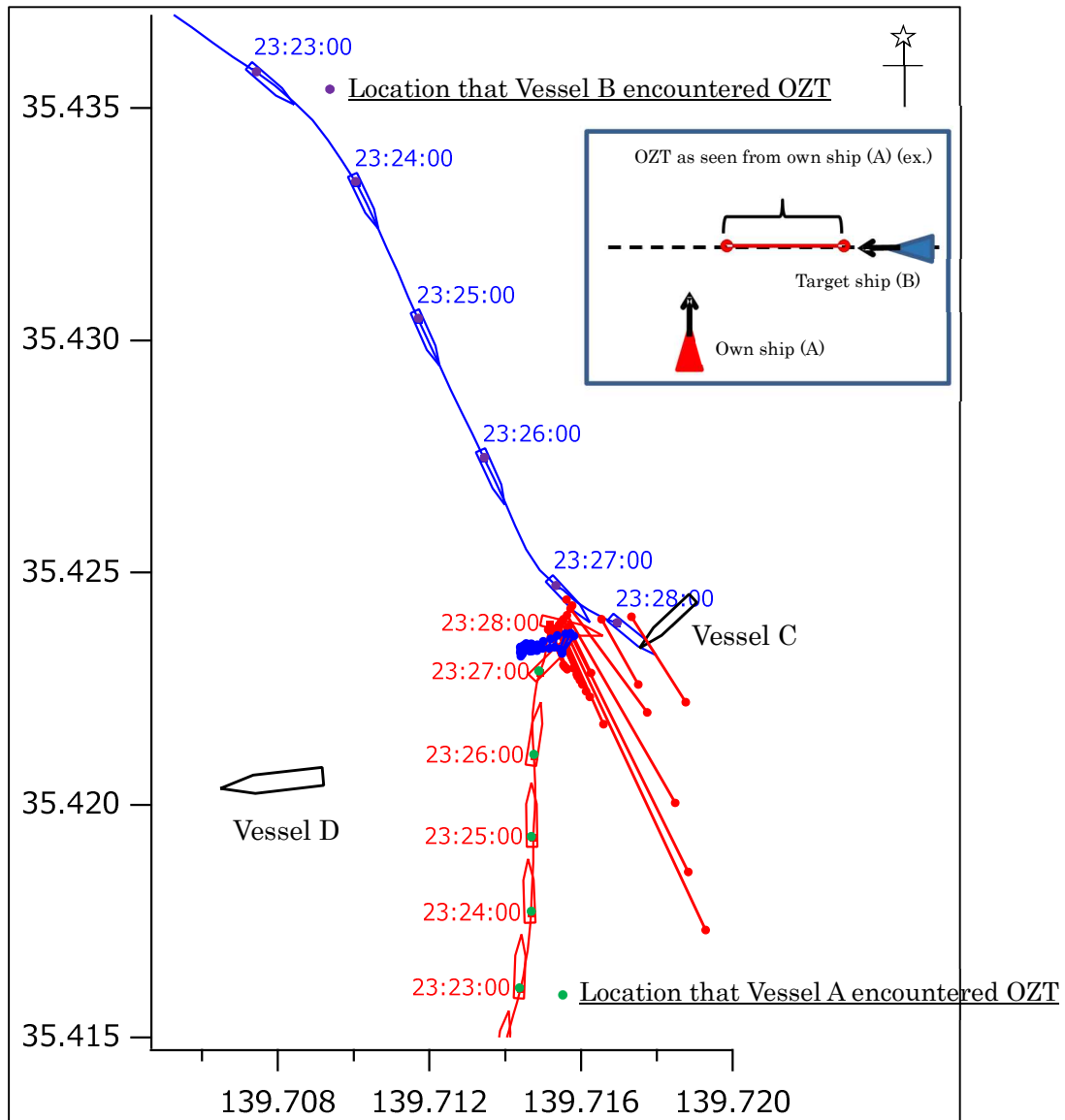


Figure 1 Locations that Vessel A and Vessel B encountered OZT

(2) Assessment of the dangerous condition between the two vessels using CJ, SJ, and CR

1) CJ

The CJ value is an index that indicates the collision risk level of two vessels calculated from the relative relationship. The range of the CJ value is from $-\infty$ to $+\infty$, with a positive value indicating a danger.

The CJ values evaluated for Vessel A and Vessel B with respect to each other begin to rise for both vessels from around 23:23. Vessel A's CJ value moves from negative to positive, indicating danger, from around 23:24, while Vessel B's CJ value does the same after 23:24.

Those values subsequently continue to rise and then rise sharply from around 23:26.

2) SJ

The SJ value is an index indicating the collision risk level of two vessels through a filter such as the average value of the operator's experience, and is a value indicating the collision risk level felt by the operator. The range of SJ values is between -3 to +3, with negative values indicating danger.

SJ = -3: Extremely dangerous, SJ = -2: Dangerous, SJ = -1: Somewhat dangerous
SJ=0: Not either
SJ = +1: Slightly safe, SJ = +2: Safe, SJ = + 3: Extremely safe

The SJ values of Vessel A and Vessel B move from positive to negative, indicating danger, at around 23:24. After 23:24, Vessel A shows an SJ value of -2 and Vessel B shows an SJ value exceeding -2.

The SJ values of Vessel A and Vessel B both move to positive, on the safe side, at around 23:26. However, this is because bearing rate of change is included in the SJ value's input variables and, from around the same time, both vessels had approached to very close proximity and were in a state in which their bearing rates of change vis-à-vis each other had grown large.

3) CR

The CR value is an index of the collision between two vessels, taking into account the time to closest point of approach (TCPA) and the distance of closest point of approach (DCPA) as well as vessel characteristics such as the maneuverability, etc. The range of CR values is -1 to 1, with larger absolute values of values indicating higher danger and negative values indicating a state after passing the closest point of approach.

The CR values of Vessel A and Vessel B rise from around 23:22 and reach the maximum value after 23:25.

(See Figure 2)

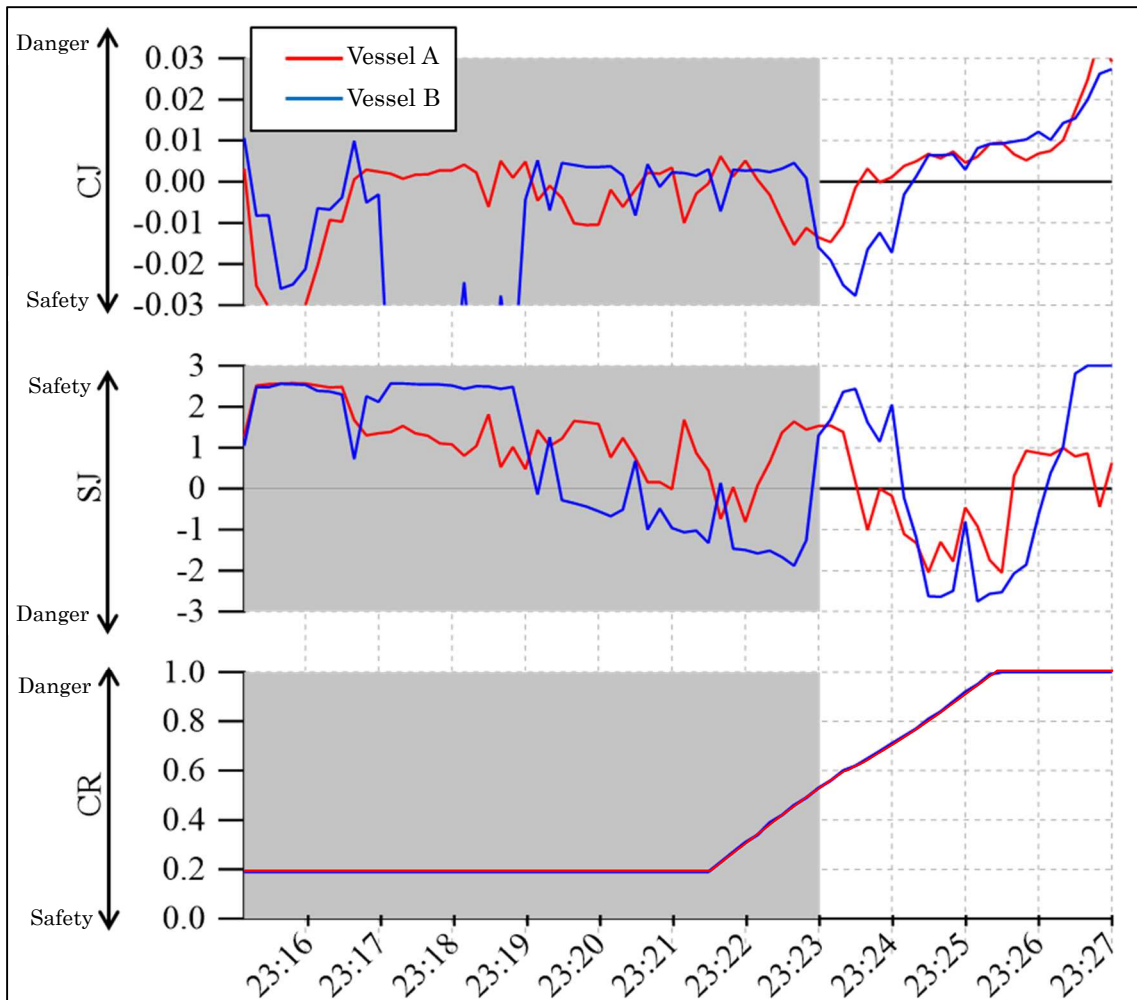


Figure 2 Time-related Changes in Level of Collision Risk (CJ, SJ, CR)

(3) Assessment of maneuvering freedom using BC

A rising BC value indicates decreasing freedom of maneuverability. The range of values is 0 to 1.

The BC values that were evaluated with consideration for Vessel A, Vessel B, and nearby anchored vessels are somewhat larger than BC values that do not consider the anchored vessels from 23:23 and rise rapidly after that time. Vessel A's values approach their highest points at around 23:24 and Vessel B's values reach their highest points at around 23:26.

(See Figure 3)

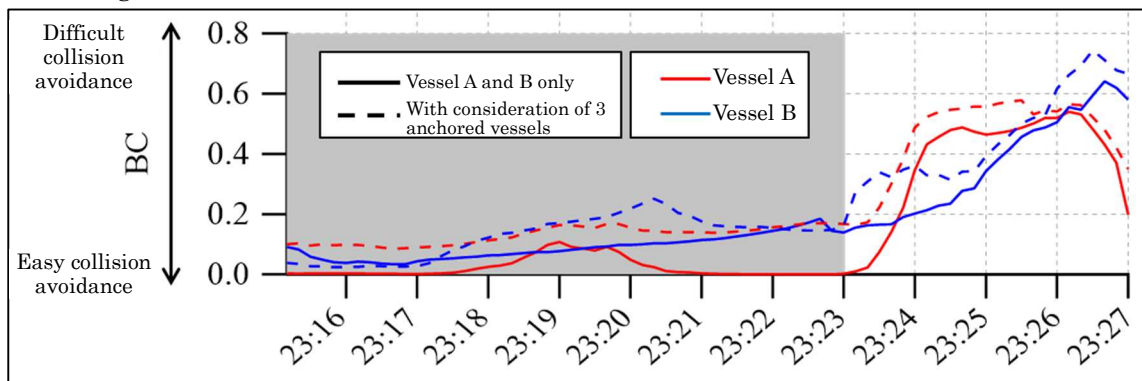


Figure 3 Time-related Changes in Level of Collision Risk (BC)

3.2.6 Analysis of Lookout and Ship Maneuvering using the Qualitative Assessment of Level of Collision Risk

According to 3.2.4 and 3.2.5, the situation was as follows.

(1) Vessel A

- 1) Given that, after 23:23, following Vessel B's starboard turn, Vessel A's BC value evaluated with consideration for Vessel B and nearby anchored vessels is somewhat larger than her BC evaluated for Vessel B only and rises continuously, it is probable that Vessel A was in a continuing state in which her freedom of maneuverability decreased as a result of her approach to Vessel B within a situation whereby sea area for collision avoidance was limited by the presence of anchored vessels.
- 2) Given that an OZT by Vessel B occurred in the sea area to the starboard side of her course at around 23:23, it is probable that Vessel A was in a situation in which altering course to starboard was restricted.
- 3) Given that Vessel A's CJ value evaluated for Vessel B rises at around 23:23 and her SJ value shows -2 after 23:24, it is probable that Vessel A was in a situation of rising danger of collision with Vessel B.
- 4) According to the indicators for level of collision risk 1) to 3) mentioned above, it is probable that, in a state in which Vessel A's freedom of maneuverability decreased and the danger of collision with Vessel B was rising, Master A and Pilot A predicted that Vessel B, which had turned to starboard, would turn to starboard again and pass Vessel A port-to-port rather than navigate in the narrow sea area between Vessel A and Vessel C, and therefore they continued at the same course and speed with the intention of passing Vessel B port-to-port.
- 5) It is probable that, in a state in which, like 4) above, Vessel A's freedom of maneuverability decreased and the danger of collision with Vessel B was rising, Master A and Pilot A recognized the danger of collision with Vessel B, which was navigating toward Vessel A without turning to starboard, blew one long blast of the whistle to alert Vessel B, and thought that they could pass Vessel B port-to-port if Vessel B again turned to starboard after hearing the whistle.
- 6) Given that Vessel A's CR value reached the maximum at around 23:25 and her CJ value continued to rise rapidly from around 23:26, it is probable that, in a situation in which the danger that Vessel A and Vessel B would collide was extremely high, Pilot A ordered a hard starboard and then a whistle blast and that Master A recognized the danger of colliding with Vessel B and ordered Navigation Officer A to stop the engine and then set it to full astern.
- 7) From 1) to 6) above, it is probable that, within a confined anchorage with the presence of anchored vessels, in a situation in which sea area available for giving way was restricted by anchored vessels and altering course to starboard was likewise restricted by Vessel B, and as freedom of maneuverability decreased and the danger of collision increased after 23:23, Vessel A could have prevented the accident by taking such measures as promptly reducing speed, without expecting Vessel B to make a starboard turn.

(2) Vessel B

- 1) Given that, after 23:23, following her starboard turn, Vessel B's BC value evaluated with consideration for Vessel A and nearby anchored vessels is somewhat larger than her BC evaluated for Vessel A only and rises continuously, it is probable that Vessel B was in

a continuing state in which her freedom of maneuverability decreased as a result of her approach to Vessel A within a situation whereby sea area for collision avoidance was limited by the presence of anchored vessels.

- 2) Given that an OZT by Vessel A occurred in the sea area on Vessel B's course at around 23:23, it is probable that Vessel B needed to avoid that sea area.
- 3) Given that Vessel B's CJ value evaluated for Vessel A rises at around 23:23 and her SJ value shows a value exceeding -2 after 23:24, it is probable that Vessel B was in a situation of rising danger of collision with Vessel A.
- 4) According to the indicators for level of collision risk 1) to 3) mentioned above, it is probable that, in a state in which Vessel B's freedom of maneuverability decreased and the danger of collision with Vessel A was rising, Master B predicted that Vessel B would safely pass Vessel A starboard-to-starboard if Vessel A maintained her course and speed, and therefore he continued at the same course and speed with the intention of passing Vessel A starboard-to-starboard.
- 5) Given that Vessel B's CR value reached the maximum at around 23:25 and her CJ value continued to rise rapidly from around 23:26, it is probable that, in a situation in which the danger that Vessel B and Vessel A would collide was extremely high, Master B recognized the danger of colliding with Vessel A, which had turned to starboard, and he sounded the whistle as a warning and also ordered half astern.
- 6) From 1) to 5) above, it is probable that, within a confined anchorage with the presence of anchored vessels, in a situation in which sea area available for giving way was restricted by anchored vessels and staying on the present course was likewise restricted by Vessel A, and as freedom of maneuverability decreased and the danger of collision increased after 23:23, Vessel B could have prevented the accident by taking such measures as promptly reducing speed, without attempting to navigate near Vessel A's bow.

(See Figure 4)

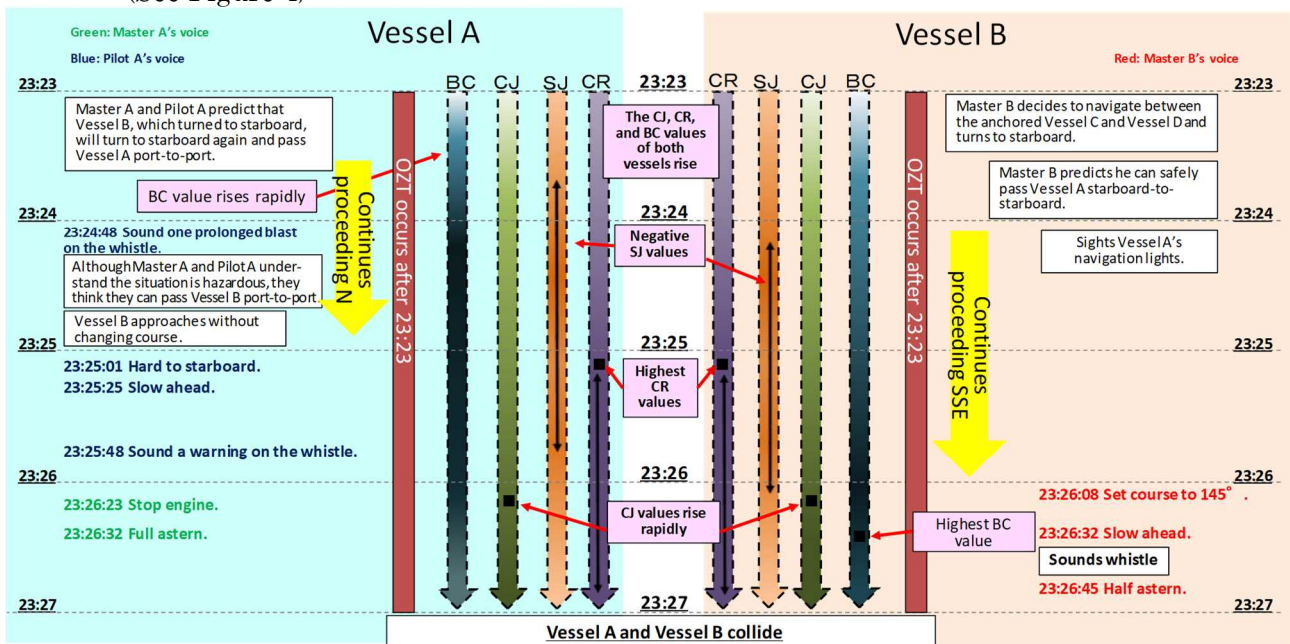


Figure 4 Sequence of Events relating to the Quantitative Assessment of Lookout and Ship Maneuvering Conditions as well as Level of Collision Risk

3.2.7 Analysis of the Accident's Occurrence

According to 3.1.1 and 3.2.4 to 3.2.6, the situation was as follows.

- (1) It is probable that Vessel A proceeded north between the anchored Vessel C and Vessel D toward her planned anchorage, and that Vessel B decided to navigate between the anchored Vessel C and Vessel D in order to avoid approaching two vessels that were proceeding southwest off of her port bow and therefore turned to starboard toward the sea area west of Nakanose in Tokyo Bay at around 23:23 and proceeded south-southeast.
- (2) It is probable that, in a state in which Vessel A's freedom of maneuverability decreased and the danger of collision with Vessel B was rising that existed after 23:23, when Vessel B turned to starboard, Master A and Pilot A predicted that Vessel B would turn to starboard again and pass Vessel B port-to-port rather than navigate in the narrow sea area between Vessel A and Vessel C, and therefore they continued at the same course and speed until approaching Vessel B with the intention of passing Vessel B port-to-port.
- (3) It is probable that, in a state in which Vessel B's freedom of maneuverability decreased and the danger of collision with Vessel A was rising that existed after 23:23, when she turned to starboard, Master B predicted that Vessel B would safely pass Vessel A starboard-to-starboard if Vessel A maintained her course and speed, and therefore he continued at the same course and speed until approaching Vessel A with the intention of passing Vessel A starboard-to-starboard.
- (4) It is probable that, in a state in which the danger of collision with Vessel B was rising, Master A and Pilot A recognized the danger of collision with Vessel B, which was navigating toward Vessel A without turning to starboard, sounded the whistle, and thought that they could pass Vessel B port-to-port if Vessel B again turned to starboard after hearing the whistle.
- (5) It is probable that, at around 23:25 to 23:26, in a situation in which Vessel A was crossing Vessel B's course while proceeding north and the danger of collision was extremely high, Pilot A ordered a hard starboard and then a whistle blast and that Master A recognized the danger of colliding with Vessel B and ordered Navigation Officer A to stop the engine and then set it to full astern; however, despite these actions, Vessel A's bow and Vessel B's starboard side bow collided.
- (6) It is probable that, at around 23:25 to 23:26, in a situation in which Vessel B was crossing Vessel A's course while proceeding south-southeast and the danger of collision was extremely high, Master B recognized the danger of colliding with Vessel A, which had turned to starboard, and he sounded the whistle as a warning and also ordered half astern; however, despite these actions, Vessel B's starboard side bow collided with Vessel A's bow and then Vessel B turned to port and proceeded southeast with headway and collided with Vessel C.
- (7) It is probable that, at the time of the accident, under conditions in which Vessel A and Vessel B were not engaged in communication by VHF but the course of each vessel intersected the course of the other and the danger of collision was rising, Vessel A and Vessel B could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by VHF, and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

4 PROBABLE CAUSES

It is probable that the accident occurred when, as Vessel A was proceeding north toward her planned anchorage and Vessel B was proceeding south-southeast toward the sea area west of Nakanose in Tokyo Bay at night within an anchorage of the Keihin Port Yokohama 5th District that had become confined with the presence of anchored vessels, and under conditions in which the courses of Vessel A and Vessel B intersected between the anchored Vessel C and Vessel D and the danger of collision was rising, Vessel A and Vessel B collided and then Vessel B turned to port and proceeded southeast with headway and collided with Vessel C because both vessels maintained course and speed until they approached each other, as Master A and Pilot A intended to pass Vessel B port-to-port and Master B intended to pass Vessel A starboard-to-starboard.

It is probable that Master A and Pilot A maintained course and speed until Vessel A approached Vessel B with the intention of passing Vessel B port-to-port because they predicted that Vessel B, which had turned to starboard, would turn to starboard again and pass Vessel A port-to-port rather than navigate in the narrow sea area between Vessel A and Vessel C.

It is probable that Master B maintained course and speed until Vessel B approached Vessel A with the intention of passing Vessel A starboard-to-starboard because he predicted that Vessel B would safely pass Vessel A starboard-to-starboard if Vessel A maintained her course and speed.

It is probable that, under conditions in which the course of each vessel intersected the course of the other and the danger of collision was rising, Vessel A and Vessel B could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by VHF, and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

5 SAFETY ACTIONS

It is probable that the accident occurred when, as Vessel A was proceeding north and Vessel B was proceeding south-southeast at night within an anchorage of the Keihin Port Yokohama 5th District that had become confined with the presence of anchored vessels, and under conditions in which the courses of Vessel A and Vessel B intersected between the anchored Vessel C and Vessel D and the danger of collision was rising, Vessel A and Vessel B collided and then Vessel B turned to port and proceeded southeast with headway and collided with Vessel C because both vessels maintained course and speed until they approached each other, as Master A and Pilot A predicted that Vessel B would turn to starboard and pass port-to-port and Master B predicted that Vessel A would maintain course and speed and pass safely starboard-to-starboard.

Additionally, it is probable that, under conditions in which the course of each vessel intersected the course of the other and the danger of collision was rising, Vessel A and Vessel B could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by VHF, and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

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

- (1) Whenever possible, large vessels avoid situations in which they approach other vessels on intersecting courses in anchorages that have become confined with the presence of anchored

vessels.

- (2) When they see another vessel approaching, masters and pilots immediately confirm maneuvering intentions with the other vessel by actively and appropriately engaging in VHF communication, rather than making decisions based on assumptions about the other vessel's movements.
- (3) Masters and pilots consider the circumstances of nearby navigating vessels and anchored vessels, make judgments on whether the possibility that other vessels may come extremely close or the risk of collision with the other vessels exists, and, when they judge that such a possibility or risk exists, take measures to avoid collision by promptly reducing speed, etc., while sufficient time is available.

5.1 Safety Actions Taken

5.1.1 Safety Actions Taken by Company A

Company A documented the accident in Company A's Safety Management System for full transparency and took the following measures after the accident.

- (1) A reminder on Bridge Team Management (BTM) ^{*15} protocols was sent to entire Fleet.
- (2) Entire Fleet were informed that they should always prepare their own escape plans in case other vessels fail to comply with the law or behave unexpectedly.
- (3) Reviewed policies with deck officers regarding increased vigilance necessary when anchoring and with pilot onboard.
- (4) The accident is routinely reviewed and discussed at annual Senior Officer's Conferences and at training seminars.

5.1.2 Safety Actions Taken by the Pilots' Association

The Pilots' Association made the following points known to its member pilots.

- (1) When letting go anchor, make every effort to avoid situations in which encounters with other vessels will occur in a confined anchorage where anchored vessels are present, and when such a situation is anticipated, reduce speed or change course prior to entering the anchorage and avoid coming into a relationship that could result in a collision.
- (2) When letting go anchor in an anchorage near a passage entrance, check whether ships will be entering or leaving the passage by communicating with the port radio, etc., beforehand, and if entering/leaving ships are present and may come near, communicate with them by VHF and confirm their maneuvering intentions.
- (3) When navigating near anchored vessels at night, be aware that own vessel may be difficult to see from other vessels due to the presence of the anchor lights of anchored vessels, etc.
- (4) When having doubts about the movements of another vessel, proactively issue warnings using a daytime signaling lamp if it is night and take measures to avoid hazardous relationship.
- (5) When sensing the danger of a collision, etc., do not hesitate to take such measures as immediately turning the rudder hard over or setting the engine to full astern.

^{*15} "Bridge Team Management (BTM)" refers to a practical management method by which team members on the bridge utilize all the resources on the bridge and systematically achieve safe navigation under clear standards.

6 SAFETY RECOMMENDATIONS

It is probable that the accident occurred when, as APL GUAM was proceeding north toward her planned anchorage and MARCLIFF was proceeding south-southeast toward the sea area west of Nakanose in Tokyo Bay at night within an anchorage of the Keihin Port Yokohama 5th District that had become confined with the presence of anchored vessels, and under conditions in which the courses of APL GUAM and MARCLIFF intersected between anchored vessel HANSA STEINBURG and another anchored vessel, APL GUAM and MARCLIFF collided and then MARCLIFF turned to port and proceeded southeast with headway and collided with HANSA STEINBURG because both vessels maintained course and speed until they approached each other, as APL GUAM's master and pilot predicted that MARCLIFF would turn to starboard and pass port-to-port and MARCLIFF's master predicted that APL GUAM would maintain course and speed and pass safely starboard-to-starboard.

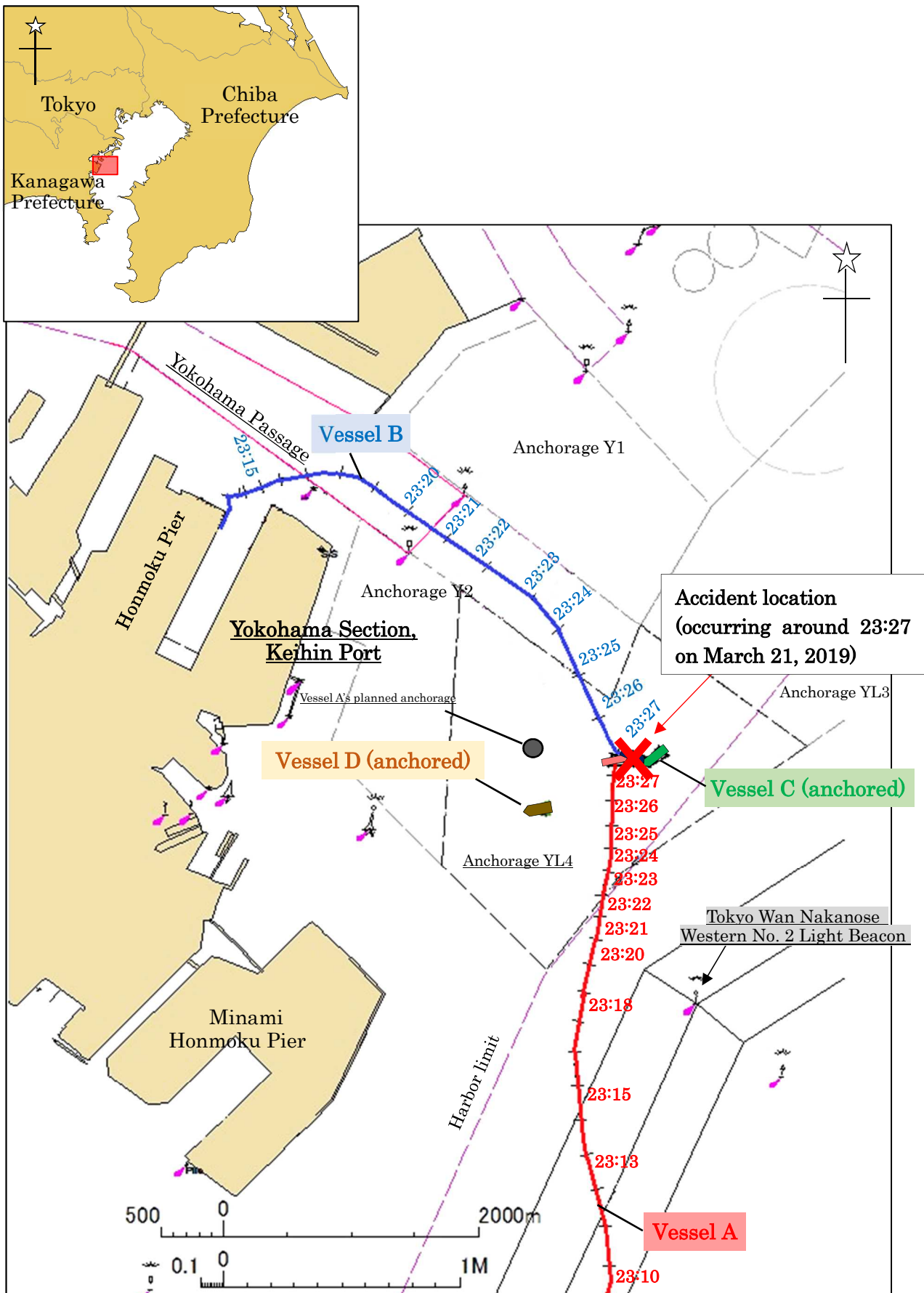
Additionally, it is probable that, under conditions in which the course of each vessel intersected the course of the other and the danger of collision was rising, APL GUAM and MARCLIFF could have taken measures to avoid a collision, such as confirming each other's maneuvering intentions and promptly reducing speed, by communicating early by international VHF radio telephone (hereinafter referred to as "VHF"), and therefore it is probable that both vessels' continued navigation without communicating by VHF contributed to the accident's occurrence.

In view of the result of this accident investigation, the Japan Transport Safety Board recommends APL MARITIME LTD., which is the management company of APL GUAM, and MARCONSULT SCHIFFFAHRT GMBH, which is the management company of MARCLIFF, to take the following measures for the purpose of preventing the occurrence of a similar accident.

APL MARITIME LTD. and MARCONSULT SCHIFFFAHRT GMBH are recommended to instruct the masters, etc., of all vessels they manage or operate to consistently implement the following items.

- (1) Whenever possible, large vessels avoid situations in which they approach other vessels on intersecting courses in anchorages that have become confined with the presence of anchored vessels.
- (2) When they see another vessel approaching, masters immediately confirm maneuvering intentions with the other vessel by actively and appropriately engaging in VHF communication, rather than making decisions based on assumptions about the other vessel's movements.
- (3) Masters consider the circumstances of nearby navigating vessels and anchored vessels, make judgments on whether the possibility that other vessels may come extremely close or the risk of collision with the other vessel exists, and, when they judge that such a possibility or risk exists, take measures to avoid collision by promptly reducing speed, etc., while sufficient time is available.

Annex Figure 1 Estimated Navigation Routes



Annex Figure 2 Estimated Navigation Routes (Enlarged)

