MA2018-2

MARINE ACCIDENT
INVESTIGATION REPORT

February 22, 2018

Japan Transport Safety Board

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

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 EASTERN PHOENIX
IMO number:	9552692
Gross tonnage:	3,380 tons
Vessel type and name:	Oil Tanker KEIHIN MARU No. 8
IMO number:	132012
Gross tonnage:	144 tons
Accident type:	Collision
Date and time:	Around 09:27:27, August 7, 2016 (local time, UTC +9 hours)
Location:	Off to the Southeast of Higashi-Ogishima Island, Kawasaki City, Kanagawa Prefecture Around 170° true bearing, 1.5 nautical miles from the Kawasaki Higashi-Ogishima Breakwater East Lighthouse (approximately 35°28.2'N, 139°47.3'E)

January 31, 2018

Adopted by the Japan Transport Safety Board

Chairman Kazuhiro Nakahashi
Member Yuji Sato
Member Kenkichi Tamura
Member Toshiyuki Ishikawa
Member Makiko Okamoto

SYNOPSIS

< Summary of the Accident >

At around 09:27:27 on August 7, 2016, the chemical tanker EASTERN PHOENIX was proceeding south-southwest toward Uraga Channel after leaving the Kawasaki Passage of the Kawasaki Section of Keihin Port with a master and 14 crew members onboard and the oil tanker KEIHIN MARU No. 8 was proceeding west-southwest toward the Yokohama Section of Keihin Port with a master and two crew members onboard when the two vessels collided off to the southeast of Higashi-Ogishima Island in Kawasaki City, Kanagawa Prefecture.

EASTERN PHOENIX had a dent and other damage to her bow's shell plating and KEIHIN MARU No. 8 had a hole and other damage on her port bow that resulted in a spill of light oil she was carrying as cargo onto the ocean's surface.

There were no fatalities or injuries on either vessel.

< Probable Causes >

It is probable that the accident occurred when, as EASTERN PHOENIX (hereinafter referred to as "Vessel A") was proceeding south-southwest and KEIHIN MARU No. 8 (hereinafter referred to as "Vessel B") was proceeding west-southwest off to the southeast of Higashi-Ogishima Island, both vessels collided because, despite turning and other maneuvers to avoid a collision by both vessels, Vessel A's Master was not properly conducting lookout of the surroundings and Vessel B was late in taking action to avoid a collision

It is probable that Vessel A's Master was not properly conducting lookout of the surroundings because he was giving continuous instruction concerning position reports and other matters to Vessel A's Navigation Officer and Able Seaman.

It is probable that Vessel B was late in taking action to avoid a collision because, although Vessel B's Master judged that there was a risk of collision with Vessel A and ordered Vessel B's Navigation Officer, who was steering, to take avoiding action, Vessel B's Navigation Officer preferred his own judgment and continued navigating by maintaining course and speed.

It is somewhat likely that Vessel B's Navigation Officer preferred his own judgment in part because it appeared to him that Vessel A's bearing was moving toward Vessel B's stern and because he normally had a weak awareness of his hierarchal relationship with Vessel B's Master.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

At around 09:27:27 on August 7, 2016, the chemical tanker EASTERN PHOENIX was proceeding south-southwest toward Uraga Channel after leaving the Kawasaki Passage of the Kawasaki Section of Keihin Port with a master and 14 crew members onboard and the oil tanker KEIHIN MARU No. 8 was proceeding west-southwest toward the Yokohama Section of Keihin Port with a master and two crew members onboard when the two vessels collided off to the southeast of Higashi-Ogishima Island in Kawasaki City, Kanagawa Prefecture.

EASTERN PHOENIX had a dent and other damage to her bow's shell plating and KEIHIN MARU No. 8 had a hole and other damage on her port bow that resulted in a spill of light oil she was carrying as cargo onto the ocean's surface.

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 (JTSB) appointed an investigator-in-charge and two other marine accident investigators to investigate this accident on August 8, 2016.

1.2.2 Collection of Evidence

August 8, 9, and September 20, 2016: On-site investigations and interviews

August 10, September 8, 2016, April 10, and July 10, 2017: Interviews

August 12, November 9, and 30, 2016: Interviews and collection of questionnaire

August 14 to 16, October 19, 24, November 15, December 6, 11, 20, 22, 27, 28, 2016, January 4, 10, 17, 25, and 27, 2017: Collection of questionnaire

1.2.3 Test and Research by Other Institutes

Advice concerning analysis of whistle sound was received from the National Maritime Research Institute of the National Institute of Maritime, Port and Aviation Technology.

1.2.4 Comments from Parties Relevant to the Cause

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

1.2.5 Comments from the Flag State

Comments on the draft report were invited from the flag state of the EASTERN PHOENIX.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 The Navigational Track according to the Voyage Data Recorder

According to radar images recorded at 15-second intervals by the Voyage Data Recorder (VDR)*1 (hereinafter referred to as the "Radar Images") of "EASTERN PHOENIX" (hereinafter referred to as "Vessel A"), the information on Vessel A's navigation between 09:16:25 and 09:28:25 on August 7, 2016, is as shown in Table 2.1-1 below.

It should be noted that the times are Japan Standard Time and the positions of Vessel A are the positions of the GPS antennas located on the upper side of the bridge. The course over ground and heading are true bearings (hereinafter the same).

Table 2.1-1 VDR Record of Vessel A

Time (HH:MM:SS)	Ship's position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground *2 (knots [kn])
	Latitude (N) (°-'-")	Longitude (E) (°-'-")			
09:16:25	35-30-02.3	139-47-28.9	135.2	139.7	6.6
09:17:25	35-29-56.8	139-47-33.4	144.6	150.0	6.6
09:18:25	35-29-50.1	139-47-35.5	174.1	169.2	6.8
09:19:25	35-29-42.7	139-47-36.4	173.5	168.7	7.7
09:20:25	35-29-35.0	139-47-37.9	169.1	164.7	8.4
09:21:25	35-29-25.4	139-47-39.0	178.0	174.6	10.0
09:22:25	35-29-14.3	139-47-38.3	187.0	185.6	11.2
09:23:25	35-29-02.8	139-47-35.8	190.1	190.5	12.1
09:24:10	35-28-53.7	139-47-32.0	201.3	200.1	12.7
09:24:25	35-28-50.9	139-47-30.6	202.3	200.3	12.8
09:24:40	35-28-47.7	139-47-29.0	202.6	200.5	12.9
09:24:55	35-28-44.9	139-47-27.6	203.0	200.7	13.0
09:25:10	35-28-41.9	139-47-26.0	202.3	200.7	13.1
09:25:25	35-28-38.7	139-47-24.3	202.9	200.7	13.0
09:25:40	35-28-35.9	139-47-22.9	203.0	200.3	13.0
09:25:55	35-28-32.8	139-47-21.3	202.0	200.7	13.1
09:26:10	35-28-30.1	139-47-19.8	202.6	202.7	13.0
09:26:25	35-28-27.0	139-47-18.0	205.1	204.2	13.0
09:26:40	35-28-24.3	139-47-16.3	206.1	202.9	13.0
09:26:55	35-28-21.3	139-47-14.8	206.5	194.5	12.9
09:27:10	35-28-18.2	139-47-14.2	195.9	170.7	12.2
09:27:25	35-28-15.8	139-47-14.9	175.2	147.5	11.1
09:27:40	35-28-13.8	139-47-16.4	152.7	122.7	9.0
09:28:25	35-28-11.9	139-47-21.9	107.3	092.2	6.3

*1 "Voyage Data Recorder (VDR)" is an instrument that is able to record the position, course, speed, radar information and other data about navigation as well as communication by VHF radio telephone and voices in the bridge.

*2 "Speed over the ground" refers to the speed of a vessel as measured based on one point on the Earth's surface. The speed of a vessel as measured based on the water upon which the vessel is floating is called "speed over the water."

2.1.2 Operating Conditions of KEIHIN MARU No. 8 based on Vessel A's Radar Images

According to Vessel A's Radar Images, the operating conditions of KEIHIN MARU No. 8 (hereinafter referred to as "Vessel B") were as shown in Annex Figure 1.
(See Annex Figure 1 Radar Images from Vessel A)

2.1.3 Voices, etc., on the Bridge of Vessel A

According to Vessel A's VDR record, information on main voice communication, etc., on Vessel A's bridge between around 09:12:20 and around 09:50:20 was as shown in Table 2.1-2.

It should be noted that the table includes information concerning the voices of Vessel A's master (hereinafter referred to as "Master A"), third officer (hereinafter referred to as "Navigation Officer A"), and able seaman on watch (hereinafter referred to as "Able Seaman A") and a pilot as well as whistle sounds and other noises together with information concerning operation of the main engine and rudder that were recorded in the VDR.

Additionally, unintelligible voices occurring when Master A was speaking to Navigation Officer A and Able Seaman A were recorded at between around 09:16 and 09:17, 09:18 and 09:19, 09:20 and 09:21, and 09:24 and 09:26. According to the replies to the questionnaire by Master A and Sansho Kaiun Co. Ltd., which is the operator of Vessel A (hereinafter referred to as "Company A"), Master A was giving instructions concerning position reports[*3] to the Tokyo Wan Vessel Traffic Service Center (hereinafter referred to as "Tokyo MARTIS"), handling of international signal flags, and other matters to Navigation Officer A and Able Seaman A.

Table 2.1-2 Voice and Other Information Recorded in the VDR (Excerpt)
[ ]: Information concerning whistle noise, etc.
< >: Information concerning operation of the main engine or rudder

Time (HH:MM:SS)	Main Voice Communication, etc.
Around 09:12:20 – 09:13:20	Pilot: So, there aren't any vessels that will cross our course, right? Tugboat YAMATO (hereinafter referred to as "Tug A"): No. None right now. Pilot: Captain, no dangerous vessels. Master A: Fishing boat too much… Pilot: Fishing boat, where? Nothing. No fishing boat. Master A: It's the Uraga Channel. Because it's Sunday. Pilot: Ah, Uraga. Keep an eye out in the distance.
Around 09:15:43 – 09:15:57	Pilot: One four zero. Dead slow ahead, around 6 or 7 knots. Thank you, Good bye. Unknown: Thank you, sir.
Around 09:16:07 – 09:17:10	Master A: [Continuing to talk to Navigation Officer A and Able Seaman A, but voice is unintelligible]
Around 09:16:47	Master A: Hard starboard.
Around	Able Seaman A: Hard starboard, sir.

[*3] A "position report" is a report provided to a vessel traffic service center when a vessel passes through the center's radar surveillance area. The vessel makes the report when it passes a previously established line (Position Report Line) so that the center can identify the vessel on its radar screen.

09:17:00	
Around 09:17:10	Navigation Officer A: …go down pilot flag, sir. [Sound of door opening and closing]
Around 09:17:30	Master A: Midships.
Around 09:17:36	＜From dead slow ahead to slow ahead＞
Around 09:17:41	＜From slow ahead to half ahead＞
Around 09:17:43	Able Seaman A: Midships, sir. Master A: Steady.
Around 09:18:02	＜From half ahead to harbor full ahead＞
Around 09:18:10 – 09:19:10	Able Seaman A: Steady one seven zero, sir. [Sound of door opening and closing] Master A: [Continuing to talk to Navigation Officer A and Able Seaman A, but voice is unintelligible]
Around 09:19:17	Master A: Automatic. Able Seaman A: Automatic. One seven zero, sir.
Around 09:19:20	＜From harbor full ahead to navigation full ahead＞
Around 09:19:57	[Sound of door opening and closing]
Around 09:20:19	＜Course set to 178° by autopilot＞
Around 09:20:37 – 09:21:30	Master A: [Continuing to talk to Navigation Officer A and Able Seaman A, but voice is unintelligible]
Around 09:21:30	＜Course set to 183° by autopilot＞
Around 09:21:34	＜Course set to 190° by autopilot＞
Around 09:21:37	Master A: OK, maximum. KE line, not yet? Navigation Officer A: Not yet, sir.
Around 09:23:09	＜Course set to 202° by autopilot＞
Around 09:23:25 – 09:24:35	Navigation Officer A: [Position report to Tokyo MARTIS]
Around 09:24:35 – 09:26:15	Master A: [Continuing to talk to Navigation Officer A and Able Seaman A, but voice is unintelligible]
Around 09:26:25	Master A: Where going this ship? Where going?
Around 09:26:32	[Whistle　7 short blasts]

–09:26:36	
Around 09:26:38	Master A: Hard port.
Around 09:26:58 –09:27:15	Unknown: Also change, sir. Ah! Unknown: Hard starboard, hard starboard. Unknown: Engine stop, engine stop.
Around 09:27:27	[Sound of impact]
Around 09:28:05	Unknown: [Shipboard announcement] Emergency, emergency, emergency! Master A: Hard starboard, hard starboard.
Around 09:28:40 – 09:29:40	Tokyo MARTIS: Vessel A, this is Tokyo MARTIS. You seem to have come very near to what appears to be a small vessel. Are you all right? Master A: We touched her slightly. We are bringing the vessel around now. Hard port. Unknown: Hard port, sir. Tokyo MARTIS: Will you contact Yokohama Coast Guard Radio? Master A: Yes. We will head to KK1 Anchorage now. Tokyo MARTIS: Understood. Can we get you to contact Yokohama Coast Guard Radio (coastal radio station of the 3rd Regional Coast Guard Headquarters)? Master A: Yes, understood. We will report now.
Around 09:31:55 - 09:33:30	Master A: [Report of intention to let go anchor at the KK1 Anchorage to Kawasaki Port Radio]
Around 09:35:15 - 09:38:00	Master A: [Report of the accident's occurrence to the Yokohama Coast Guard Radio]
Around 09:46:50	Master A: Barge, how do you read me? This is Vessel A, over.
Around 09:49:45 - 09:50:20	Master A: Tugboat, how do you read me? This is Vessel A. Tugboat NAGATO MARU (hereinafter referred to as "Tug B"): Vessel A, this is Tug B. We have just rescued the crew. We will now contact the Coast Guard Office. Oil is spilling.

2.1.4 Events of the Navigational Operation according to the Statements of Crew Members

According to the statements of Master A, Navigation Officer A, Able Seaman A, and the pilot; Vessel B's master (hereinafter referred to as "Master B") and chief officer (hereinafter referred to as "Navigation Officer B"); and the master of Tug B as well as the replies to the questionnaire by Master A, Navigation Officer A, Company A, and Showa Nittan Corporation, which is the operator of Vessel B (hereinafter referred to as "Company B_1"), the events of the vessels' navigational operation were as follows.

(1) Vessel A

Vessel A, with Master A (national of the Republic of Korea), Navigation Officer A (national of the Republic of the Philippines), and 13 other crew members (one national of the Republic of Korea, 12 nationals of the Republic of the Philippines) aboard, took on one pilot and, at around 08:55 on August 7, 2016, departed from the Kawasaki Section of Keihin Port for Zhangjiagang, People's Republic of China, under the pilotage of the pilot and with Master A conning the vessel, Navigation Officer A on lookout, and Able Seaman A on hand

steering on the bridge.

The pilot instructed Tug A to confirm the circumstances of vessels navigating in the area and he also personally checked the area visually and by radar. The pilot did not observe any vessels that would cross Vessel A's path and therefore informed Master A that there were no vessels that presented a hazard in the area. Then, at around 09:16, the pilot set Vessel A's course at 140° near the Kawasaki Passage No. 1 Light Beacon and disembarked from Vessel A.

At around 09:17, Master A observed the presence of anchored vessels on the intended course of 144° of the original passage plan. He ordered the rudder set hard to starboard and altered the course to approximately 170°, and raised the main engine's operation from dead slow ahead to harbor full ahead in a stepped manner.

At around 09:19, Master A instructed Able Seaman A to switch from hand steering to autopilot and put the main engine navigation full ahead.

Able Seaman A switched to autopilot and then went to the compass deck to lower the international signal flags.

At around 09:20, Master A altered the set course in autopilot, and Vessel A subsequently continue navigating while gradually turning to starboard.

At around 09:23, Vessel A passed the Position Report Line (KE Line), and thus Navigation Officer A made a position report to Tokyo MARTIS using the VHF radio telephone (hereinafter referred to as "VHF").

After the position report was made, Master A and Navigation Officer A observed, visually and by radar, Vessel B proceeding west at approximately 0.5 nautical miles (M) off the port bow. Master A thought that Vessel A could pass ahead of Vessel B's bow and Navigation Officer A felt that the situation was hazardous as Vessel A was already very close to Vessel B.

Master A subsequently sensed the danger of collision with Vessel B and personally blew the whistle. At that time, as he also sensed that the Tonen Ogishima Sea Berth, which was on Vessel A's starboard side, was near and thought that Vessel B would maintain a straight course, he ordered the rudder set hard to port, intending to avoid Vessel B by heading for Vessel B's stern.

Approximately 20 or 30 seconds later, Master A observed that Vessel B had turned to starboard and was approaching and he therefore ordered the rudder set hard to starboard and the main engine stopped. However, at around 9:27, Vessel A's bow and Vessel B's port bow collided and then Vessel A's starboard midship and Vessel B's port stern collided.

After the collision, Master A communicated that a collision had occurred in response to a call by Tokyo MARTIS via VHF and then he called the Yokohama Coast Guard Radio to report the accident. Vessel A subsequently let go anchor in the anchorage of the Kawasaki Section of Keihin Port at around 09:55.

As he headed to the anchorage of the Kawasaki Section of Keihin Port while checking Vessel A's damage, Master A called Vessel B by VHF but did not receive a response from Vessel B.

Master A subsequently witnessed Tug B rescuing crew members of Vessel B and he confirmed the safety of those crew members by calling Tug B via VHF.

(2) Vessel B

Vessel B, with Master B, Navigating Officer B, and a chief engineer aboard, completed

cargo loading at a privately-operated berth in the Chiba No. 4 Section, Chiba Port, Chiba Prefecture and departed said berth for the Yokohama Section of Keihin Port at around 08:15 on August 7, 2016.

Vessel B navigated at a speed of approximately 9 kn (speed over the ground; hereinafter the same) with the main engine running at approximately 360 rpm, with Master B on hand steering in the wheel house and Navigation Officer B on lookout.

Master B maintained course and speed for an area near the Tsurumi Passage of the Yokohama Section of Keihin Port. Then, at around 09:15, he had Navigation Officer B take over steering and he conned the vessel and conducted lookout while eating right next to Navigation Officer B.

After taking over steering from Master B, Navigation Officer B navigated with a nearly constant course and speed using hand steering.

At around 09:21, Master B observed Vessel A off the starboard side proceeding south at an approximate distance of between 1.2 and 1.5 M in the sea area to the east of Kawasaki Higashi-Ogishima Breakwater East Lighthouse. He could see Vessel A's port side up to the stern end and therefore understood that Vessel B was in a crossing situation with Vessel A and that his own vessel was in a position to avoid Vessel A. Master B notified Navigation Officer B of Vessel A's presence and, because Vessel A was heading in the direction of the Uraga Channel, instructed him to avoid Vessel A by taking action with appropriate timing.

Navigation Officer B observed Vessel A and, because Vessel A's bearing was moving toward Vessel B's stern and it appeared that Vessel B would pass ahead of Vessel A's bow, he continued navigating by maintaining course and speed with the intention of watching the situation for a while.

Based on past experience, Navigation Officer B thought that, even if Vessel A came a little closer and was in a position to pass ahead of Vessel B's bow, he could avoid Vessel A if he turned to starboard and headed astern of Vessel A. Additionally, Navigation Officer B knew from information concerning the availability of cargo-handling facilities that he obtained the previous day that Vessel B could begin unloading earlier than scheduled. For this reason, together with the fact that he had a vacation planned from August 8, he wanted to arrive at the destination quickly and finish work early.

At around 09:24, as he was monitoring Vessel A's movements using a window frame of the wheel house for reference, Master B did not observe any clear changes in Vessel A's bearing and thus thought that the two vessels would collide if they continued navigating as is. He therefore ordered Navigation Officer B to avoid Vessel A by heading toward her stern.

About the time he received Master B's order to take avoiding action, Navigation Officer B thought that he could see Vessel A's bearing continuing to move, albeit slightly, toward Vessel B's stern, and he therefore continued navigating by maintaining course and speed. Master B sensed that the vessels were in a delicate position, but he also thought that the situation appeared that way because the heading of Vessel B, which was navigating under hand steering, was changing. Over the course of repeated exchanges between Master B and Navigation Officer B concerning the taking of avoiding action, Vessel A came closer. Master B strongly ordered Navigation Officer B to take avoiding action, and Navigation Officer B set the rudder hard to starboard with the steering lever.

Just as Master B and Navigation Officer B thought they had successfully avoided Vessel A, they observed Vessel A turn to port and approach. Sensing that a collision was

imminent, Master B took over steering from Navigation Officer B and personally continued setting the rudder hard to starboard with the steering lever. However, the vessels were now in positions in which collision was unavoidable, Master B ordered Navigation Officer B to leave the wheel house, disengaged the main engine's clutch, and then also left the wheel house.

Approximately 30 seconds after Master B took over steering from Navigation Officer B, Vessel B's port bow and Vessel A's bow collided and then Vessel B's port stern and Vessel A's starboard midship collided.

Vessel B's crew members did not remember hearing Vessel A's whistle.

After the collision, Master B observed light oil that had been loaded on Vessel B spilling onto the ocean's surface from near the No. 1 cargo hold. He contacted Japan Coast Guard (JCG) by mobile telephone and also ordered Navigation Officer B to prepare lifejackets.

Navigation Officer B prepared the lifejackets and also closed valves of the cargo holds and openings.

Tug B headed out to conduct rescue for Vessel B in response to a communication from Tokyo MARTIS and, at around 09:48, rescued all of Vessel B's crew members.

The date and time of occurrence of the accident was at around 09:27:27 on August 7, 2016, and the location was around 170°, 1.5 M from the Kawasaki Higashi-Ogishima Breakwater East Lighthouse.
(See Annex Figure 2 Estimated Navigation Routes)

2.2 Injuries to Persons

According to the statements of Master A and Master B, there were no fatalities or injuries on either vessel.

2.3 Damage to Vessel

(1) Vessel A

Vessel A had a dent and breach in her bow shell plating and a dent and other damage in her starboard midship shell plating. Additionally, according to the reply to the questionnaire by Company A, there was a dent and other damage to Vessel A's bulbous bow. (See Photo 2.3-1 and Photo 2.3-2)

Photo 2.3-1　Damage to the bow (Vessel A)

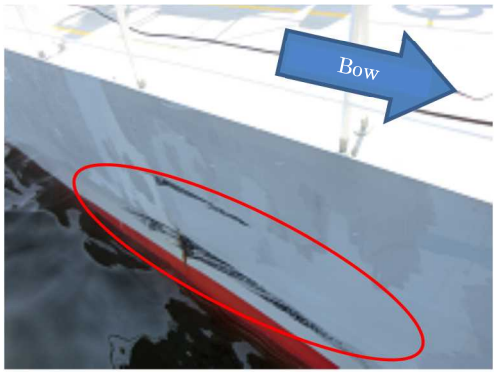


Photo 2.3-2　Damage to the starboard midship (Vessel A)

(2) Vessel B

Vessel B had dents and breaches in her port bow's fender and bottom and a dent and other damage to her port stern fender. (See Photo 2.3-3 and Photo 2.3-4)

Photo 2.3-3　Damage to the port bow (Vessel B)

Photo 2.3-4　Damage to the port stern (Vessel B)

2.4 Crew Information

(1) Gender, Age, and Certificate of Competence

1) Master A: Male, 67 years old, national of the Republic of Korea

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

Date of Issue: March 2, 2012

(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: July 25, 2016

(Valid until June 7, 2021)

3) Able Seaman A: Male, 40 years old, national of the Republic of the Philippines
Certificate: Deck Watchkeeper

4) Master B: Male, 27 years old
Fourth grade maritime officer (navigation)
Date of issue: May 22, 2009
Date of revalidation: May 16, 2014
Date of expiry: May 21, 2019

5) Navigation Officer B: Male, 26 years old
Fourth grade maritime officer (navigation)
Date of issue: March 29, 2010
Date of revalidation: March 3, 2015
Date of expiry: March 28, 2020

(2) Sea-going Experience, etc.

According to statements of Master A, Navigation Officer A, Able Seaman A, Master B, and Navigation Officer B as well as the replies to the questionnaire by Company A and Funatomi Kaiun Limited, which is the owner of Vessel B (hereinafter referred to as "Company B_2"), the situation was as follows.

1) Master A

Master A became a crew member in 1968 and became of master in 1990. Ever since coming aboard Vessel A as master for the first time in February 2011, Master A had served aboard Vessel A for a total of approximately three years and eight months and had experiencing navigating Tokyo Bay multiple times.

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

2) Navigation Officer A

Navigation Officer A became a crew member in 1999 and had served aboard Vessel A since June 20, 2016. The instance of navigating in Tokyo Bay at the time of the accident was his third aboard Vessel A.

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

3) Able Seaman A

Able Seaman A became a crew member in 2002 and had served aboard Vessel A since February 24, 2016.

He did not have any health problems that would affect the execution of duties at the time of the accident.

4) Master B

Master B became a crew member in 2009 after graduating from school. He had served as an ordinary seaman, chief officer, and master aboard tankers navigating smooth water areas. He came aboard Vessel B as master after joining Company B_2 in August 2013.

Master B had been close to Navigation Officer B since early childhood, and his relationship with Navigation Officer B was more friendly than hierarchal. Consequently, after the accident, Master B thought that their mutual relationship may have had a role in the situation whereby he had ordered Navigation Officer B to take avoiding action but Navigation Officer B did not follow said order.

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

5) Navigation Officer B

Navigation Officer B became a crew member in 2010 after graduating from the same school as Master B. He had served as a wiper, second engineer, and first engineer aboard ocean-going tankers and as an ordinary seaman, first engineer, chief engineer aboard tankers navigating smooth water areas. He came aboard Vessel B as chief officer after joining Company B_2 in May 2015. At the time of the accident, approximately one year and three months had passed since he first handled ship maneuvering of Vessel B, and he felt he had become accustomed to ship maneuvering.

Navigation Officer B had been close to Master B since early childhood. After the accident, he felt that his having a relationship with Master B that allowed him to speak more easily than in a typical master-navigation officer relationship may have had a role in his not following Master B's order and maintaining a direct course at the time of the accident.

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

2.5 Vessel Information

2.5.1 Particulars of Vessel

(1) Vessel A

IMO number:	9552692
Port of registry:	Panama, Republic of Panama
Owner:	SANSHO LINE, S.A. (Panama)
Operator:	Company A
Management company:	Company A
Classification Society:	Nippon Kaiji Kyokai
Gross tonnage:	3,380 tons
L×B×D:	97.03 m x 16.00 m x 8.00 m
Hull material:	Steel
Engine:	Diesel engine x 1
Output:	2,600 kW
Propulsion:	Fixed pitch propeller x 1
Date of launch:	September 17, 2009

(See Photo 2.5-1)

Photo 2.5-1 Vessel A

(2) Vessel B

Vessel number:	132012
Port of registry:	Kyonan Town, Chiba Prefecture
Owner:	Company B_2
Operator:	Company B_1
Gross tonnage:	144 tons
L×B×D:	40.38 m x 8.50 m x 2.80 m
Hull material:	Steel
Engine:	Diesel engine x 1
Output:	367 kW
Propulsion:	3-blade fixed pitch propeller x 1
Date of launch:	September 8, 1990
Navigation area:	Smooth water

(See Photo 2.5-2)

Photo 2.5-2 Vessel B

2.5.2 Load Conditions

(1) Vessel A

According to the statement of Master A and the reply to the questionnaire by Company A, at the time of Vessel A's departure from the Kawasaki Section of Keihin Port, she was loaded with approximately 4,200 tons of molten sulfur. The draft was about 5.90 m at the bow and about 6.25 m at the stern.

(2) Vessel B

According to the statement of Master B and the reply to the questionnaire by Company B_1, at the time of Vessel B's departure from the privately-operated berth of Chiba No. 4 Section, Chiba Port, she was loaded with approximately 500 kl of light oil. The draft was about 1.8 m at the bow and about 2.8 m at the stern.

2.5.3 Navigation Equipment, etc.

(1) Vessel A

Vessel A had a steering stand located in the center of her bridge, on the port side of which were installed two radar consoles and an Electric Chart Display and Information System (ECDIS)[*4] and on the starboard side of which was installed the main engine control

[*4] An 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

panel. The radar consoles could provide a superimposed display of information from an Automatic Identification System (AIS)*5 on the screens, and echo trail*6 functions and an Automatic Radar Plotting Aid (ARPA)*7 were provided.

According to the statements of Master A and Navigation Officer A, at the time of the accident, Master A was using the No. 2 radar set to a range of 0.75 M and Navigation Officer A was using the No. 1 radar set to a range of 3 M. They were using the echo trail function but neither was using the ARPA.

According to the reply to the questionnaire by Company A, there was no malfunction or failure in the hull, engine, or machineries at the time of the accident.
(See Figure 2.5)

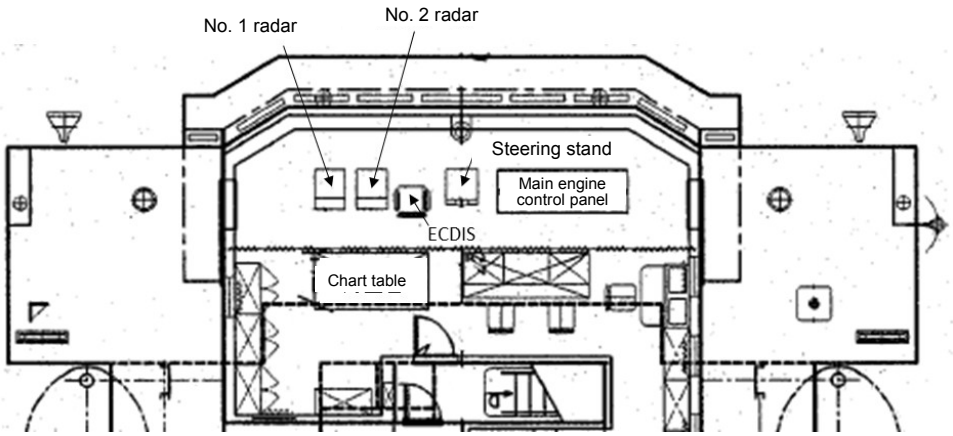


Photo 2.5 Arrangement Plan of Vessel A's Bridge

(2) Vessel B

Vessel B had a steering stand with a helm in the center of the wheel house. A magnetic compass was positioned in front of the steering stand and a steering lever and other equipment was positioned on the starboard side of the steering stand. Vessel B was not equipped with a radar, AIS, or VHF, the installation of which is not required on vessels with a gross tonnage of under 300 tons that operates in smooth water areas.

According to the statement of Master B and the reply to the questionnaire by Company B_2, Vessel B's whistle (air horn) was in a state that did not permit its immediate use at the time of the accident, as there was a leak in the air tube that supplies air to the whistle and, consequently, the tube's valve in the engine room had been shut. However, other than said air tube, there was no malfunction or failure with the hull, engine, or machineries of the vessel. (See Photo 2.5.3)

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.

*5 An Automatic Identification System (AIS) is a device that automatically transmits and receives information such as vessel identification code, ship type, name, position, course, speed, destination, and conditions of navigation and exchanges information with other vessels and land-based navigation aids.

*6 "Echo trial" refers to a function that displays the track of a target's radar image as afterglow.

*7 "Automatic Radar Plotting Aid (ARPA)" refers to a device that automatically processes by computer changes in the positions of images of other vessels that were detected by radar; that displays other vessels' course, speed, time to closest point of approach, distance at closest point of approach, and predicted position in the future; and that sounds an alarm if the danger of collision is predicted by the approach of other vessels.

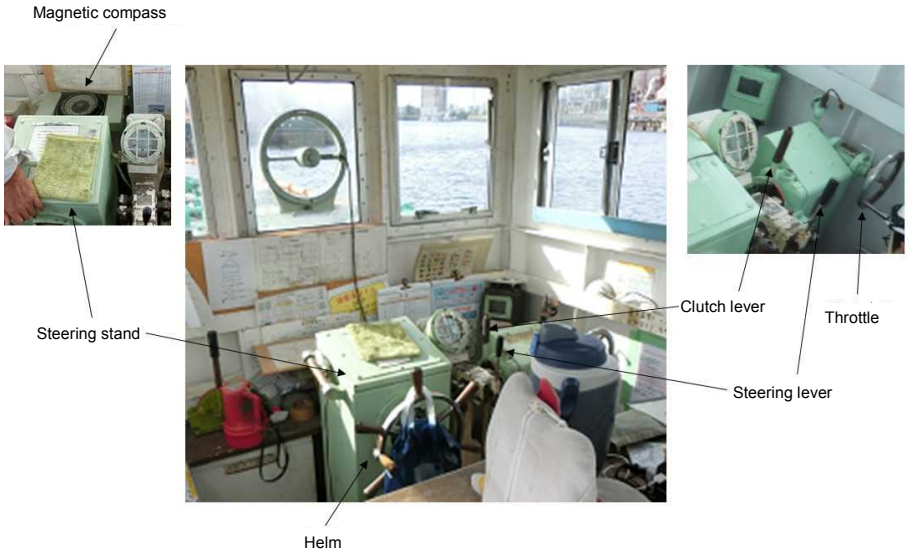


Photo 2.5-3 Vessel B's Wheel House

2.5.4 Maneuverability

(1) Vessel A

According to the sea trial operational performance chart and the reply to the questionnaire by Company A, Vessel A's turning and stopping performance when 40% loaded (fore draft of 3.187 meters, stern draft of 4.627 meters) were as provided below.

	Starboard turn	Port turn
Advance at turning 30° (Required time)	218.2 m (27.8 sec.)	205.3 m (26.2 sec.)
Advance*8 (Required time)	393.9 m (1 min. 01.1 sec.)	381.4 m (58.2 sec.)
Tactical diameter*9 (Required time)	353.0 m (1 min. 54.4 sec.)	319.0 m (1 min. 47.7 sec.)
Shortest stopping distance (Required time)	854 m (2 min. 40 sec.)	

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

*9 "Tactical diameter" refers to the sideways distance a vessel's center of gravity moves in relationship to its original course line after the direction of the vessel is turned 180°.

(2) Vessel B

According to the maneuverability chart that was displayed on board Vessel B, Vessel B's turning and stopping performance were as provided below.

	Starboard turn	Port turn
Advance at turning 30° (Required time)	60 m (07 sec.)	60 m (08 sec.)
Time required to turn 360°	110 sec.	113 sec.
Maximum advance *10	77 m	77 m
Maximum transfer *11	77 m	77 m
Shortest stopping distance when fully loaded (Required time)	120 m (80 sec.)	

2.5.5 Visibility from the Bridge/Wheel House

(1) Vessel A

There were no structures that would obstruct lookout when looking toward the bow from the bridge.

(2) Vessel B

According to the statement of Master B, there were no problems with visibility from the wheel house when engaged in lookout at the time of the accident.

2.6 Weather and Sea Conditions

2.6.1 Meteorological Observations

(1) Meteorological observations at Yokohama Local Meteorological Observatory, which is located approximately 12.9 km southwest from the accident site, were as follows.

August 7

09:00 Temperature: 29.1°C Wind speed: 3.5m/s Wind direction: East
Weather: clear Visibility: 20 km

10:00 Temperature: 30.6°C Wind speed: 4.3m/s Wind direction: East

(2) According to the tide table published by JCG, the tide near Kawasaki Section No. 1 of Keihin port at around the time of the accident was at the beginning of the outgoing tide, the current in the area approximately 2.7 M off to the east-southeast of Kawasaki North Breakwater Lighthouse turned from a northwesterly flow to a southeasterly flow at 07:37, and the maximum current speed of the southeasterly flow was approximately 0.2 kn at 10:29.

*10 "Maximum advance" refers to the maximum distance of vertical movement on the trajectory that a vessel's center of gravity takes as a result of a rudder turn (turning circle) from the center of gravity's position at the moment that the rudder was turned.

*11 "Maximum transfer" refers to the maximum distance of lateral movement in the turning circle that a vessel's center of gravity takes from center of gravity's position at the moment that the rudder was turned.

2.6.2 Observations of Crew Members

(1) According to the logbook of Vessel A, at around 09:00, the weather was cloudy, the wind was blowing from the northeast with a wind force of 3, and visibility was 7 (10 to 20 km).

(2) According to the logbook of Vessel B, at around 08:00, the weather was clear and the wind was blowing from the northeast with a wind force of 3.

2.7 Information on the Sea Area of the Accident

According to Sailing Directions for South & East Coasts of Honshu (published in March 2014) published by JCG, the Yokohama Section and Kawasaki Section, which comprise the southern half of Keihin Port, has very heavy large-vessel traffic, and the area near the port boundary from Tonen Ogishima Sea Berth to the Yokohama Section of Keihin Port has within it a quarantine anchorage and an anchorage used by tankers carrying hazardous materials.

2.8 Information on the Oil Spill

According to the statement of Master B and replies to the questionnaire by Company B[1] and the Yokohama Coast Guard Office, the circumstances of the oil spill were as follows.

(1) Amount and scope of the spill

Approximately 66 kl of light oil that had been loaded into Vessel B's No. 1 cargo hold spilled onto the sea's surface. The spill covered a sea area extending from the area off the coast of Higashi-Ogishima Island in Kawasaki City to Honmoku Pier in Yokohama City, Kanagawa Prefecture.

(2) Response to the release

At around 09:59, floating oil was observed near Vessel B, which was adrift approximately 3,200 meters off of Higashi-Ogishima Island, by a JCG patrol craft. Subsequently, work to control the spill by spraying water and then by sailing dispersal was conducted by patrol vessels and crafts that arrived on the scene.

At around 13:12, a JCG special rescue team completed the closing of all air vent pipes and cargo-related valves of Vessel B's cargo holds and confirmed that no new oil could be seen coming from the breach in the port bow.

Work by the patrol vessels and crafts and others to control the spill by spraying water and sailing dispersal continued until being discontinued at sunset at around 18:40. It was confirmed in the morning of the next day, August 8, that floating oil could not be seen in nearby water areas.

2.9 Information concerning Vessel A's Whistle Sounds

(1) Performance, etc., of Vessel A's whistle

According to the reply to the questionnaire by Company A, two whistles (air horns) powered by compressed air were installed facing the bow on the compass deck on the upper part of Vessel A's bridge, and one of these whistles was used at the time of the accident. Additionally, according to the reply to the questionnaire by the company that manufactured Vessel A's whistles (hereinafter referred to as "Company C"), the sound pressure measured during approval tests for the whistle's model was 141 dB(A)[*12] at a distance of 1 meter.

[*12] "dB(A)" is dB (decibel), which expresses the sound pressure level, that has been corrected with consideration for the tendency of human auditory perception to differ depending on the frequency (A-weighting).

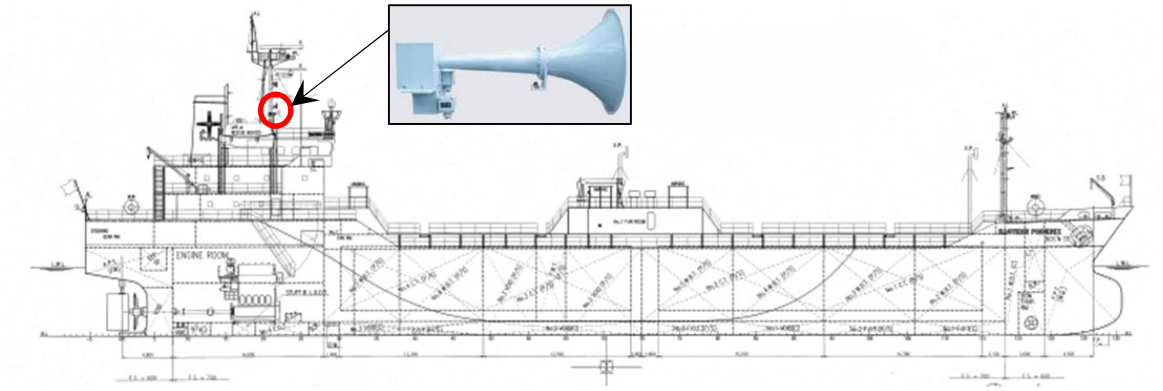


Figure 2.8-1　Location of Vessel A's Whistles

(2)　Circumstances of Vessel B's wheel house and engine room

According to the statement of Master B, the entrance door on the aft side and the windows on the port and starboard sides of Vessel B's wheel house were open.

According to Vessel B's general arrangement, Vessel B's wheel house was adjacent to the engine room.

It should be noted that, according to a literary source[*13], *"The average noise level of an engine room reaches around 100 to 105 dB(A), having little to do with the size of the vessel or the size of the main engine's output."*

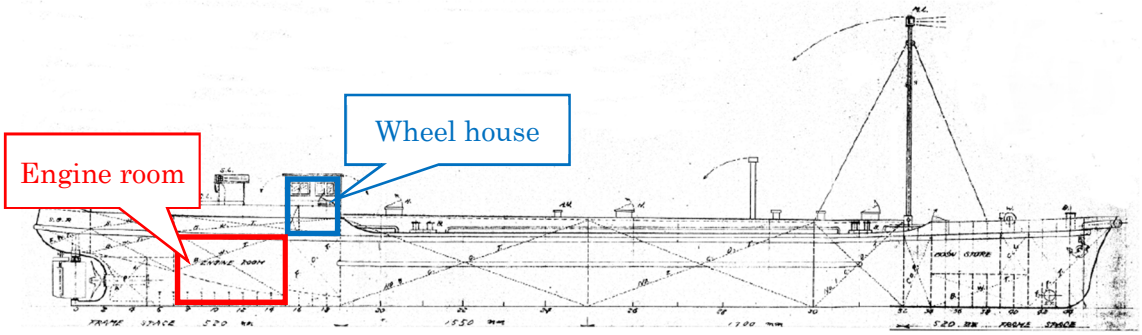


Figure 2.8-2　Locations of Vessel B's Wheel House and Engine Room

(3)　Decay of sound pressure and other effects

According to the National Maritime Research Institute of the National Institute of Maritime, Port and Aviation Technology and Company C, distance-based decay of a whistle's sound pressure in the air can be expressed with the following formula. Moreover, there are cases in which, in addition to sound pressure decay, the effects of engine room noise, sound of the vessel moving through the wind and waves while sailing, and other factors may result in a condition in which a whistle is hard to hear.

$P = P_0 - 20 \times \mathrm{Log}_{10}(R)$

P:　Sound pressure at the point of observation [dB(A)]

P_0:　Sound pressure at a distance of 1 meter [dB(A)]

R:　Distance [m]

[*13] Literary source: "Shosen Sekkei no Kiso Chishiki" (fundamentals of merchant ship design) (by Zosen Tekisuto Kenkyukai; published in February 2006)

3 ANALYSIS

3.1 Situation of the Accident

3.1.1 Analysis of the Bearings and Distances between Both Vessels and of Vessel B's Course and Speed

The bearings and distances between both vessels obtained from Vessel A's Radar Images of Annex Figure 1 were as shown in Table 3.1.

From the statements of 2.1.4(2) that Vessel B was navigating at a nearly constant course and speed and from a straight line linking Vessel B's position between around 09:16:25 and around 09:26:25 of Table 3.1, it is probable that Vessel B had an average course over the ground of approximately 262°. Additionally, given that the distance covered by Vessel B between said two times was approximately 1.6 M, it is probable that Vessel B had an average speed of approximately 9.6 kn during those times.

Furthermore, from the voices recorded in Vessel A's VDR that is thought to be from when Vessel A's crew member on bridge watch observed Vessel B make a starboard turn at around 09:26:58 as well as from 2.5.4 (2), it is probable that Vessel B was in the state of making a starboard turn at around 09:26:58.

Table 3.1 Bearing and Distance between the Two Vessels

Time (HH:MM:SS)	Bearing of Vessel B seen from Vessel A (°)	Distance between two vessels (M)	Bearing of Vessel A seen from Vessel B (°)	One-minute bearing variation (°)
09:16:25	137.0	2.21	317.0	
09:17:25	140.2	2.01	320.2	3.2
09:18:25	143.4	1.84	323.4	3.2
09:19:25	146.4	1.65	326.4	3.0
09:20:25	148.9	1.47	328.9	2.5
09:21:25	152.9	1.27	332.9	4.0
09:22:25	156.1	1.07	336.1	3.2
09:23:25	159.1	0.85	339.1	3.0
09:24:25	161.1	0.64	341.1	2.0
09:25:25	162.8	0.46	342.8	1.7
09:26:25	164.1	0.26	344.1	1.3
09:26:40	163.9	0.21	343.9	-

3.1.2 Course of the Events

According to 2.1, 2.5.4, and 3.1.1, the situation was as follows.

(1) Vessel A

1) It is probable that Vessel A departed the Kawasaki Section of Keihin Port for Zhangjiagang, People's Republic of China, at around 08:55 on August 7, 2016.

2) It is highly probable that, after leaving the Kawasaki Passage, Vessel A altered her course from approximately 140° to 170° between around 09:17 and 09:18 and navigated

while accelerating on a course of approximately 170° between around 09:18 and 09:20.

3) It is highly probable that Vessel A navigated while repeatedly altering her course under autopilot by around 10°and accelerating between around 09:20 and around 09:24.

4) It is probable that Vessel A began turning to port at around 09:26:38.

5) It is probable that Vessel A collided with Vessel B while turning to port.

(2) Vessel B

1) It is probable that Vessel B departed from a privately-operated berth in Chiba No. 4 Section of Chiba Port for the Yokohama Section of Keihin Port at around 08:15.

2) It is probable that Vessel B navigated at a speed of approximately 9 kn after leaving port.

3) It is probable that Vessel B navigated on an average course over the ground of approximately 262° and at an average speed of approximately 9.6 kn between around 09:16:25 and around 09:26:25.

4) It is probable that Vessel B was in the state of turning to starboard at around 09:26:58.

5) It is probable that Vessel B collided with Vessel A while turning to starboard.

3.1.3 Date, Time and Location of the Accident Occurrence

According to 2.1, it is probable that the date and time of occurrence of the accident was at around 09:27:27 on August 7, 2016, when the sound of impact was recorded on Vessel A's VDR, and the location was around 170°, 1.5 M from the Kawasaki Higashi-Ogishima Breakwater East Lighthouse from Vessel A's position at said date and time.

3.1.4 Damage to the Vessels

According to 2.3, damage to the vessels was as follows.

(1) It is probable that Vessel A had a dent and breach in her bow shell plating and dents and other damage in her bulbous bow and starboard midship shell plating.

(2) Vessel B had dents and breaches in her port bow's fender and bottom and a dent and other damage to her port stern fender.

3.1.5 Situation of the Collision

From 2.1 and 3.1.2 to 3.1.4, it is probable that Vessel A's bow and Vessel B's port bow collided and then Vessel A's starboard midship and Vessel B's port stern collided while Vessel A was turning to port from a course of approximately 202° and Vessel B was turning to starboard from a course of approximately 262°.

3.2 Causal Factors of the Accident

3.2.1 Situation of Crew Members

According to 2.4, the situations of the crew members were as follows:

(1) Vessel A

Master A and Navigation Officer A possessed a legally valid endorsement attesting the recognition of certificate under STCW regulation I/10, and Able Seaman A possessed a legally valid deck watchkeeper certificate. Additionally, it is probable that Master A and Navigation Officer A were in good health at the time of the accident.

(2) Vessel B

Master B and Navigation Officer B possessed a legally valid certificate of competence. Additionally, it is probable that they were in good health at the time of the accident.

Given that Master B and Navigation Officer B had had a close friendship since early childhood, it is somewhat likely that they normally had a weak awareness of their hierarchal relationship.

3.2.2 Situation of the Vessels

According to 2.5.3, the situations of the vessels were as follows:

(1) Vessel A

It is probable that there was no malfunction or failure with the hull, engine, or machineries at the time of the accident.

(2) Vessel B

It is probable that, with the exception of the whistle's being in a state that did not permit its immediate use, there was no malfunction or failure with the hull, engine, or machineries at the time of the accident. It should be noted that Vessel B was not equipped with a radar, AIS, or VHF.

3.2.3 Weather and Sea Conditions

From 2.6, it is probable that, at the time of the accident, the weather was clear, the wind was force three from the east, visibility was approximately 20 km, and the current was flowing to the southeast at a speed of approximately 0.2 kn.

3.2.4 Analysis of Lookout and Ship Maneuvering

According to 2.1, 2.4(2), 2.5.3, 3.1, 3.2.1(2), and 3.2.3, the situation was as follows.

(1) Vessel A

1) It is probable that Master A and Navigation Officer A were navigating while conducting lookout visually and with two radars set to a range of 0.75 M and to a range of 3 M, and that they were using the echo trail function but were not using the ARPA.

2) It is highly probable that Master A navigated while repeatedly altering her course under autopilot by around 10°and accelerating between around 09:20 and around 09:24.

3) Given that Master A was giving continuous instruction concerning position reports to Tokyo MARTIS, handling of international signal flags, and other matters to Navigation Officer A and Able Seaman A and first observed Vessel B by radar and visually at a distance of 0.5 M off the port bow at around 09:25, it is probable that Master A was not properly conducting lookout of the surroundings.

4) Given that Master A thought that Vessel A could pass ahead of Vessel B's bow when he first observed Vessel B but then questioned Vessel B's movements at around 09:26:25, it is probable that he sensed the danger of collision with Vessel B and gave the whistle seven short blasts from around 09:26:32.

5) Given that Master A sensed that the Tonen Ogishima Sea Berth, which was on Vessel A's starboard side, was near at the time that he sensed the danger of collision with Vessel B and that he thought that Vessel B would maintain a straight course, it is somewhat likely that he ordered the rudder set hard to port with the intention of avoiding Vessel B by heading for Vessel B's stern.

6) It is probable that, at around 09:26:58, Master A observed Vessel B turn to starboard and approach Vessel A and he ordered the rudder set hard to starboard and the main engine stopped.

(2) Vessel B

1) It is probable that, at around 9:15, while navigating for an area near the Tsurumi Passage, Master B had Navigation Officer B take over steering and began conning the vessel while conducting lookout.

2) It is probable that, at around 09:21, while navigating by hand steering on an average course over the ground of approximately 262°at an average speed of 9.6 kn, Master B and Navigation Officer B observed Vessel A at 70° off the starboard bow and a distance of approximately 1.3 M.

3) Given that, when Master B observed Vessel A, he could see Vessel A's port side up to the stern end and therefore understood that Vessel B was in a crossing situation with Vessel A and that his own vessel was in a position to avoid Vessel A, it is probable that he told Navigation Officer B to avoid Vessel A by taking action with appropriate timing.

4) Given that, when Navigation Officer B observed Vessel A, Vessel A's bearing was moving toward Vessel B's stern and it appeared that Vessel B would pass ahead of Vessel A's bow, it is probable that Navigation Officer B continued navigating by maintaining course and speed.

5) Given that, at around 09:24, Master B, who was monitoring Vessel A's movements using a window frame of the wheel house for reference, did not observe any clear changes in Vessel A's bearing, it is probable that Master B judged there was a risk of collision and ordered Navigation Officer B to avoid Vessel A by heading astern of her.

6) Given the following points, it is somewhat likely that, although ordered by Master B to take avoiding action at around 09:24, Navigation Officer B preferred his own judgment and continued navigating by maintaining course and speed.

a It appeared to him that Vessel A's bearing continued to move, albeit slightly, toward Vessel B's stern

b He felt he had become accustomed to maneuvering Vessel B and, based on past experience, thought that, even if Vessel A came a little closer and was in a position to pass ahead of Vessel B's bow, he could avoid Vessel A if he turned to starboard and headed astern of Vessel A.

c He knew that Vessel B could begin unloading earlier than scheduled and he had a vacation planned from the next day, and thus he wanted to arrive at the destination quickly and finish work early.

d He had had a close friendship with Master B since early childhood, and thus he normally had a weak awareness of his hierarchal relationship with Master B.

7) It is probable that Vessel B began turning to starboard when Navigation Officer B set the rudder hard to starboard with the steering lever in response to a strong order from Master B.

3.2.5 Analysis concerning the Avoiding Action taken by Vessel B

According to 2.1, 2.7, 3.1.1, 3.1.2, and 3.2.4, the situation was as follows.

(1) Master B and Navigation Officer B

It is probable that, at around 09:21, Master B and Navigation Officer B both observed Vessel A, which was in a position to cross paths with Vessel B, and then conducted lookout of Vessel A.

Given that Vessel A's bearing was moved approximately 10° toward Vessel B's stern

between around 09:20:25 and 09:23:25 and it appeared to him that Vessel B would pass ahead of Vessel A's bow, it is somewhat likely that Navigation Officer B continued navigating by maintaining course and speed.

On the other hand, given that, when Master B was observing the approach of Vessel A using a window frame of the wheel house for reference, Vessel A's bearing had moved approximately 4° during the one minute between around 09:20:25 and around 09:21:25 but had moved approximately 2° between 09:23:25 and 09:24:25, and Vessel A had approached from a distance of approximately 1.5 M to approximately 0.6 M with her bow headed ahead of Vessel B's bow, it is somewhat likely that Master B was no longer observing any clear changes in Vessel A's bearing and judged that there was a risk of collision.

Given that, at around 9:24, Master B judged that there was a risk of collision with Vessel A and ordered Navigation Officer B, who was steering, to take avoiding action, but Navigation Officer B preferred his own judgment and continued navigating by maintaining course and speed, it is probable that Vessel B was late in taking action to avoid collision.

(2) Special characteristics and ease of ship maneuvering in the sea area of the accident

Given that the area near the port boundary stretching from the vicinity of Tonen Ogishima Sea Berth to the Yokohama Section of Keihin Port has very heavy large-vessel traffic and has within it a quarantine anchorage and an anchorage used by tankers carrying hazardous materials and is a sea area that normally has a large numbers of navigating and anchored vessels, it is somewhat likely that Master A intended to avoid areas with many navigating and anchored vessels leaving the Kawasaki Passage and heading toward the Uraga Channel. On the other hand, it is probable that Vessel B, which was heading for the area near the Tsurumi Passage, was in a situation whereby its path was crossing the path of Vessel A, which was heading for Uraga Channel, and that Vessel B could turn and stop more easily than Vessel A.

Accordingly, considering the circumstances of the surrounding area, ease of ship maneuvering, and other factors, it is probable that Vessel B needed to take action to avoid a collision without hesitation when sufficient room for maneuvering existed.

3.2.6 Analysis concerning Vessel A's Whistle Sounds

According to 2.1.3, 2.1.4, 2.9, 3.1.1, and 3.2.3, the situation was as follows.

(1) According to the voice record of the VDR, Vessel A blew its whistle with seven short blasts between 09:26:32 and 09:26:36. It is probable that at that time Vessel B was proceeding west-southwest approximately 400 meters off of Vessel A's port bow.

(2) If it is assumed that, at the time of the accident, the sound pressure of the whistle that Vessel A sounded was at the same level as the sound pressure measured during approval tests for the same whistle model, then, based on the following calculation, it is probable that the sound pressure of Vessel A's whistle, which was 141 dB(A) at a distance of one meter, had decayed to approximately 89 dB(A) at a distance of approximately 400 meters, where Vessel B was situated.

$$P = 141 - 20 \times \mathrm{Log}_{10}(400) \fallingdotseq 89 \ [\mathrm{dB(A)}]$$

(3) Given that the sound pressure of Vessel A's whistle had decayed with distance; that noise from the engine room located adjacent to the wheel house, sound of the vessel moving through the wind and waves while sailing, wind direction, and other factors had effects in Vessel B's wheel house; and that the attention of Vessel B's crew members was directed at

the approaching Vessel A, it is somewhat likely that Vessel B's crew members did not notice Vessel A's whistle.

3.2.7 Analysis of the Accident Occurrence

According to 2.1, 2.4(2), 3.1.1, 3.1.2, 3.2.1, 3.2.4, and 3.2.5, the situation was as follows.

(1) Vessel A

1) It is highly probable that, after departing the Kawasaki Passage, Vessel A changed course from approximately 140° to 170° between around 09:17 and 09:18 on August 7 and navigated while accelerating on a course of approximately 170° between around 09:18 and 09:20.

2) It is highly probable that Vessel A navigated while repeatedly altering her course under autopilot by around 10° and accelerating between around 09:20 and around 9:24.

3) It is probable that Master A was giving continuous instruction concerning position reports and other matters to Navigation Officer A and Able Seaman A and was not properly conducting lookout of the surroundings.

4) It is probable that Master A first observed Vessel B by radar and visually at a distance of 0.5 M off the port bow at around 09:25 and thought that Vessel A could pass ahead of Vessel B's bow, but he subsequently sensed the risk of collision with Vessel B at around 09:26:25 and gave the whistle seven short blasts from around 09:26:32.

5) It is probable that, after Master A sensed the danger of collision with Vessel B and ordered the rudder set hard to port with the intention of avoiding Vessel B by heading for her stern, he observed that Vessel B had turned to starboard and was approaching and therefore ordered the rudder set hard to starboard and the main engine stopped, but Vessel A collided with Vessel B nonetheless.

(2) Vessel B

1) It is probable that Vessel B navigated toward an area near the Tsurumi Passage of the Yokohama Section of Keihin Port by hand steering on an average course over the ground of approximately 262° and at an average speed of approximately 9.6 kn.

2) It is probable that, at around 09:21, Master B and Navigation Officer B observed Vessel A at 70° off the starboard bow and a distance of approximately 1.3 M.

3) It is probable that Master B observed Vessel A and understood that Vessel B was in a crossing situation with Vessel A and that Vessel B was in a position to avoid Vessel A and he ordered Navigation Officer B to avoid Vessel A by taking action with appropriate timing. On the other hand, it is probable that Navigation Officer B continued navigating by maintaining course and speed because Vessel A's bearing was moving toward Vessel B's stern and it appeared that Vessel B would pass ahead of Vessel A's bow.

4) It is probable that, at around 9:24, Master B judged there was a risk of collision and ordered Navigation Officer B, who was steering, to avoid Vessel A by heading astern of her.

5) It is somewhat likely that, although Navigation Officer B had been ordered by Master B to take avoiding action, he preferred his own judgment and continued navigating by maintaining course and speed in part because it appeared to him that Vessel A's bearing was moving toward Vessel B's stern and because he normally had a weak awareness of his hierarchal relationship with Master B.

6) It is probable that Vessel B began a turn to starboard when Navigation Officer B set the rudder hard to starboard with the steering lever in response to a strong order from Master

B; however, Vessel B was late in taking action to avoid a collision and collided with Vessel A.

4 PROBABLE CAUSES

It is probable that the accident occurred when, as Vessel A was proceeding south-southwest and Vessel B was proceeding west-southwest off to the southeast of Higashi-Ogishima Island, both vessels collided because, despite turning and other maneuvers to avoid a collision by both vessels, Master A was not properly conducting lookout of the surroundings and Vessel B was late in taking action to avoid a collision

It is probable that Master A was not properly conducting lookout of the surroundings because he was giving continuous instruction concerning position reports and other matters to Navigation Officer A and Able Seaman A.

It is probable that Vessel B was late in taking action to avoid a collision because, although Master B judged that there was a risk of collision with Vessel A and ordered Navigation Officer B, who was steering, to take avoiding action, Navigation Officer B preferred his own judgment and continued navigating by maintaining course and speed.

It is somewhat likely that Navigation Officer B preferred his own judgment in part because it appeared to him that Vessel A's bearing was moving toward Vessel B's stern and because he normally had a weak awareness of his hierarchal relationship with Master B.

5 SAFETY ACTIONS

It is probable that the accident was the result of a collision by Vessel A, which was proceeding south-southwest, and Vessel B, which was proceeding west-southwest, that occurred off to the east of Higashi-Ogishima Island because, aboard Vessel A, lookout of the surroundings was not conducted properly and, aboard Vessel B, Master B judged there was a risk of collision and ordered avoiding action but Navigation Officer B preferred his own judgment and continued navigating and Vessel B was late in taking action to avoid collision.

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

(1) Conning officers will at all times maintain proper lookout so that they can make a full appraisal of the situation and of the risk of collision with other vessels.

(2) When they judge that the risk of collision exists and that their own vessel is a position to avoid the other vessel, conning officers will consider not only their own maneuverability but also the size and other qualities of the other vessel and, to the degree possible, take action to avoid collision without hesitation when sufficient room for maneuvering exists.

(3) Masters will command and supervise crew members, and crew members will follow the orders of their master and seniors in the course of their duties.

(4) Owners, etc., will instruct crew members to ensure that above items (1) to (3) are applied unfailingly.

5.1 Safety Actions Taken

5.1.1 Safety Actions Taken by Company A

(1) Implemented training that included the following items for crew members of Vessel A.

1) BRM[*14] and BTM[*15]

2) International Regulations for Preventing Collisions at Sea (lookout, collision avoidance measures, etc.)

3) Radar and ARPA

(2) Issued a notice to the vessels it manages concerning the general details of the accident and compliance with navigational procedures established in its SMS Manual (hereinafter referred to as "Navigational Procedures") and instructed the vessels to hold onboard meetings on safe operation.

(3) Revised its SMS Manual to, among other modifications, specify the content of BRM and the holding of passage plan meeting before commencement of voyage.

(4) Conducted navigational audit to the vessels it manages to conform compliance with the Navigation Procedures, and conducted a review of routine bridge conditions using VDR records on each vessel.

5.1.2 Measures Taken by Company B_1 and B_2

(1) Company B_1 held a meeting for owners of the vessels it operates and requested them to pursue the horizontal development of accident causes and countermeasures and thoroughness in safe operation by crew members through onboard instruction.

(2) Company B_1 conducted comprehensive onboard inspections of operating vessels.

(3) Company B_1 implemented training that included the following items for crew members of Vessel B and representatives of Company B_2.

1) Safe ship maneuvering based on the Act on Preventing Collision at Sea

2) Maintenance of order onboard based on the Mariners Act

(4) Company B_1 decided to sequentially install international VHF, which can be installed voluntarily, and simplified AIS[*16] into all operating vessels of less than 500 gross tons operating in smooth water areas, and to install simplified AIS into all operating vessels of less than 500 tons operating in coastal areas.

(5) Company B_2 implemented training on safe operations and other matters for Vessel B's crew members.

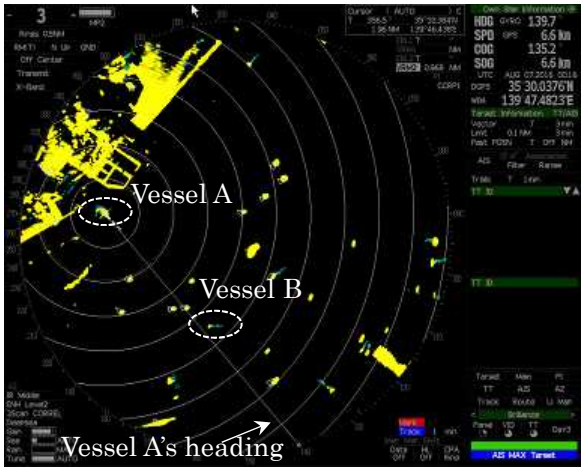
[*14] "BRM (Bridge Resource Management)" refers to the effective management of crew members, equipment, information, and other available resources on the bridge to maintain and improve operational functions on the bridge. It is a concept that focuses on the functions that resource managers (principally masters) must provide.

[*15] "BTM (Bridge Team Management)" is a concept with the same purpose as BRM that focuses on the functions that must be provided not only by resource managers but also each member of the team that is organized on the bridge (individual crew members, including the master). BRM is positioned as part of BTM.

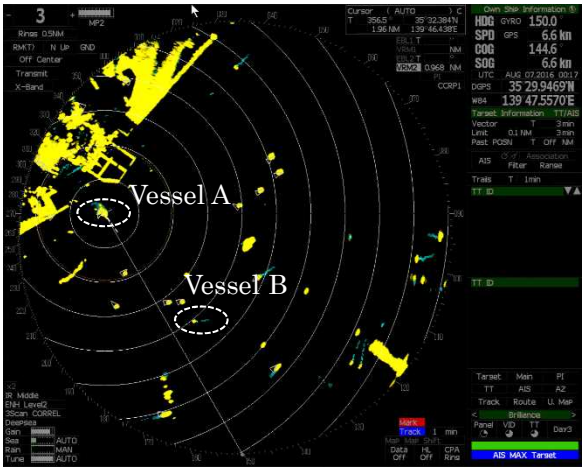
[*16] "Simplified AIS" refers to an AIS device that has smaller output than the AIS required in specified vessels under international conventions and which can only send and receive information pertaining to ship name, position, speed, course, and ship type.

Annex Figure 1　Vessel A's Radar Images

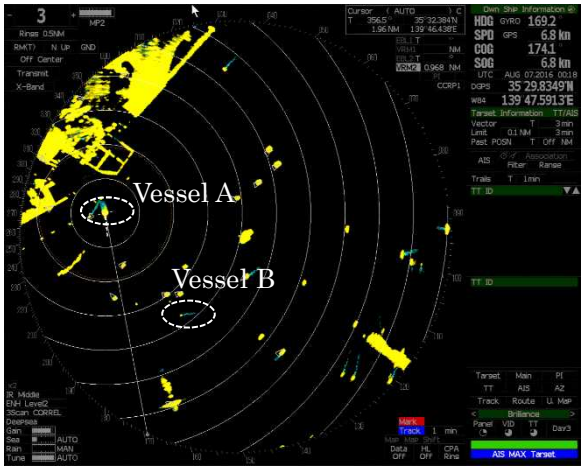
(1) Around 09:16:25



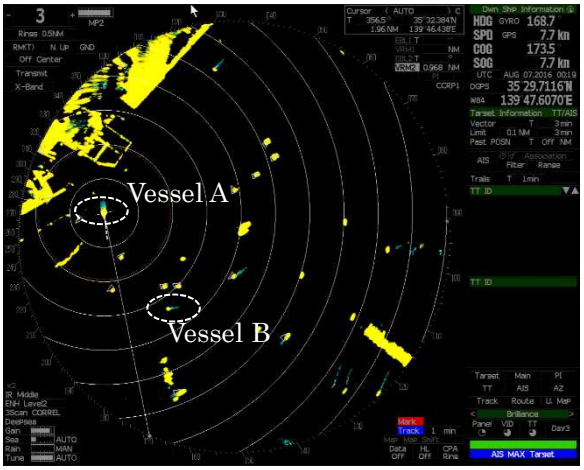
(2) Around 09:17:25



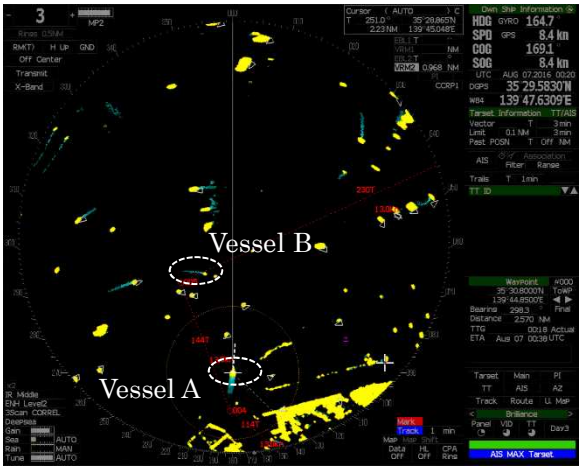
(3) Around 09:18:25



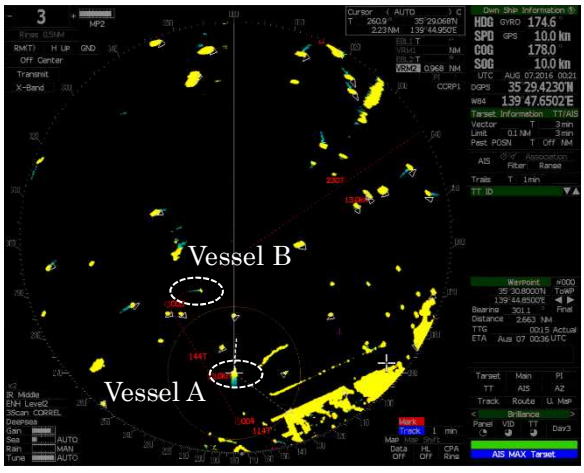
(4) Around 09:19:25



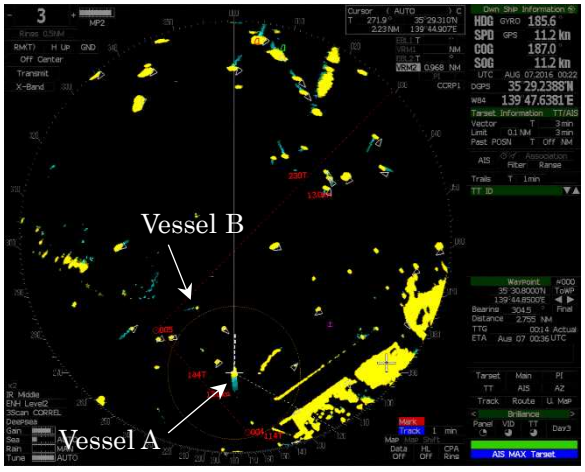
(5) Around 09:20:25



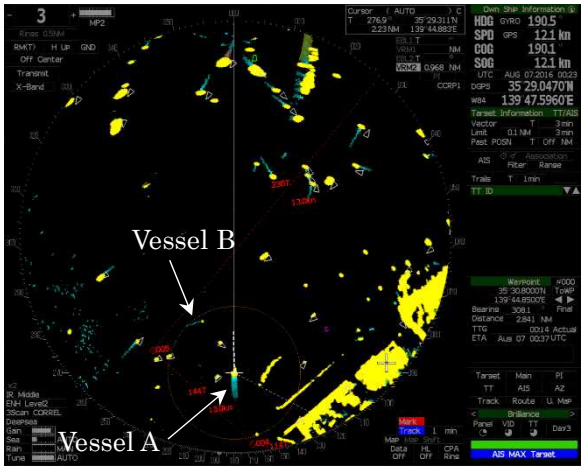
(6) Around 09:21:25



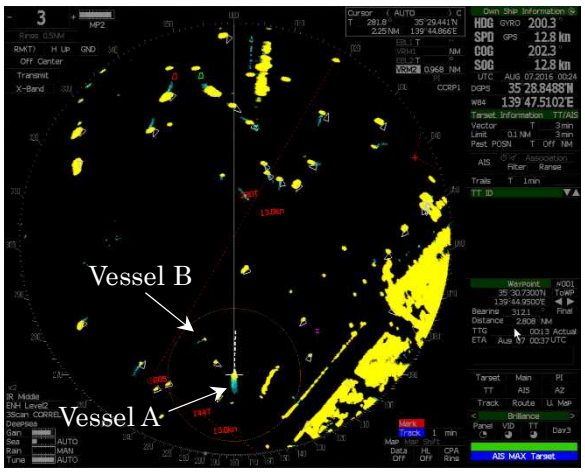
(7) Around 09:22:25



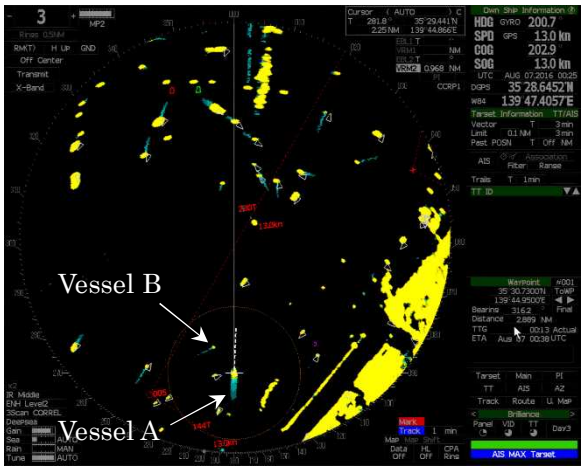
(8) Around 09:23:25



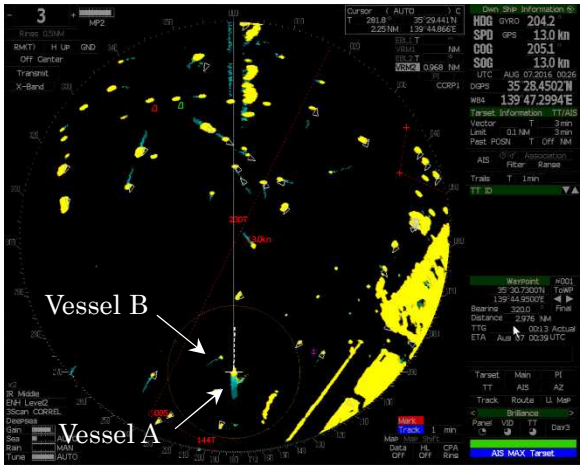
(10) Around 09:24:25



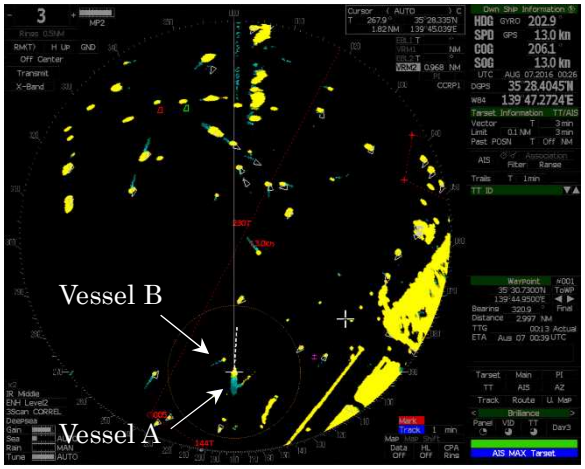
(10) Around 09:25:25



(11) Around 09:26:25



(12) Around 09:26:40



Annex Figure 2 Estimated Navigation Routes