MA2015-3

MARINE ACCIDENT
INVESTIGATION REPORT

February 26, 2015

Japan Transport Safety Board

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

Norihiro Goto
Chairman,
Japan Transport Safety Board

Note:

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

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name:	Car Carrier NOCC OCEANIC
IMO number:	9624029
Gross tonnage:	58,250 tons

Vessel type and name:	Fishing Vessel YUJIN MARU No. 7
Fishing vessel registration number:	KO2-7011
Gross tonnage:	19 tons

Accident type:	Collision
Date and time:	Around 09:44, June 23, 2013 (local time, UTC+9 hours)
Location:	Off the Southeast of Kinkazan, Ishinomaki City, Miyagi Prefecture Around 132° true bearing, 161 nautical miles from the Kinkazan Lighthouse (approximately 32°28.1'N, 144°05.4'E)

February 5, 2015

Adopted by the Japan Transport Safety Board

Chairman Norihiro Goto
Member Kuniaki Shoji
Member Satoshi Kosuda
Member Toshiyuki Ishikawa
Member Mina Nemoto

SYNOPSIS

<Summary of the Accident>

At around 09:44 on June 23, 2013, while the Car Carrier NOCC OCEANIC, with a master and 21 other crew members on board, departing Keihin Port, was heading east-northeast to Balboa Port, the Republic of Panama, and the Fishing Vessel YUJIN MARU No. 7, with a master and eight other crew members on board, departing Sendai Shiogama Port, Miyagi Prefecture, was heading southeast to fishing grounds, the two vessels collided in the sea southeast of Kinkazan, Ishinomaki, Miyagi Prefecture.

The master of the YUJIN MARU No. 7 went missing, and the center of the fishing vessel was separated at around the midship. The NOCC OCEANIC had no casualties while she suffered scratches on the outer plate of both bows.

<Probable Causes>

It is probable that the accident of collision between the vow of the NOCC OCEANIC and the starboard center of the YUJIN MARU No. 7 occurred while the NOCC OCEANIC was heading east-northeast and the YUJIN MARU No. 7 was heading southeast off the southeast of Kinkazan because in restricted visibility caused by a heavy shower of rain, the third officer of the NOCC OCEANIC and the deckhand of the YUJIN MARU No. 7 that took over bridge duty from another deckhand at around 08:00 did not notice the other vessel and sailed ahead maintaining the same course and speed.

It is probable that the third officer did not notice the other vessel (YUJIN MARU No. 7) because the display of the No. 2 radar did not display the YUJIN MARU No. 7 as a result of the rainfall.

It is somewhat likely that the deckhand of the YUJIN MARU No. 7 did not notice the other vessel (NOCC OCEANIC) because he kept watch by sight while there was a blind area caused by a wall in the watch room and because the NOCC OCEANIC approached 83° on the starboard bow that is the blind area caused by the wall.

It is somewhat likely that the failure of both vessels to conduct audio signals in restricted visibility was related to the occurrence of this accident.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

At around 09:44 on June 23, 2013, while the Car Carrier NOCC OCEANIC, with a master and 21 other crew members on board, departing Keihin Port, was heading east-northeast to Balboa Port, the Republic of Panama, and the Fishing Vessel YUJIN MARU No. 7, with a master and eight other crew members on board, departing Sendai Shiogama Port, Miyagi Prefecture, was heading southeast to fishing grounds, the two vessels collided in the sea southeast of Kinkazan, Ishinomaki, Miyagi Prefecture.

The master of the YUJIN MARU No. 7 went missing, and the center of the fishing vessel was separated at around the midship. The NOCC OCEANIC had no casualties while she suffered scratches on the outer plate of both bows.

1.2. Outline of the Accident Investigation

1.2.1 Setup of the Investigation

The Japan Transport Safety Board appointed an investigator-in-charge and two other investigators to investigate this accident on June 24, 2013.

1.2.2 Collection of Evidence

June 25, 26, and July 22, 2013: On-site investigation and interviews
June 28 and August 7, 2013: Interviews
July 4 and 5, 2013: On-site investigation
December 20, 2013: Collection of written replies to the questionnaires

1.2.3 Tests and Research by Other Institutes

For investigation and analysis of the accident, JTSB entrusted investigation of the paint film and deposits gathered from the NOCC OCEANIC and YUJIN MARU No. 7 to Analysis Center Co., Ltd.

1.2.4 Comments from the 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 NOCC OCEANIC.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 Navigational Conditions of the NOCC OCEANIC Based on the Records of the Voyage Data Recorder (VDR)

According to the voyage data recorder (hereinafter referred to as "VDR")[*1] of the NOCC OCEANIC (hereinafter referred to as "Vessel A"), the passage from around 08:00:12 to around 09:55:12 on June 23, 2013 was as displayed in the following table.

Note that the time is Japan Standard Time, the bow direction is true bearing, and the speed (speed over the ground, the same shall apply hereinafter) is knots (kn).

Time (Hours:minutes:seconds)	Speed (kn)	Ship position		Bow position (°)
		North latitude (°-′)	East longitude (°-′)	
08:00:12	16.0	36-15.474	143-35.089	063.4
08:05:12	15.9	36-16.107	143-36.545	063.7
08:10:12	15.9	36-16.735	143-37.997	063.5
08:15:12	15.8	36-17.364	143-39.442	063.4
08:20:12	15.7	36-17.981	143-40.876	064.5
08:25:12	15.7	36-18.580	143-42.306	064.3
08:30:12	15.7	36-19.185	143-43.747	064.3
08:35:12	15.7	36-19.793	143-45.186	064.5
08:40:12	15.8	36-20.407	143-46.642	064.7
08:45:12	15.7	36-21.014	143-48.077	064.3
08:50:12	15.8	36-21.624	143-49.519	064.2
08:55:12	15.9	36-22.239	143-50.979	064.1
09:00:12	15.8	36-22.847	143-52.425	064.5
09:05:12	15.9	36-23.456	143-53.887	064.3
09:10:12	15.9	36-24.060	143-55.345	064.3
09:15:12	15.9	36-24.664	143-56.819	064.5
09:20:12	16.1	36-25.263	143-58.286	064.3
09:25:12	16.0	36-25.868	143-59.762	064.3
09:30:12	16.0	36-26.478	144-01.247	064.5
09:35:12	16.0	36-27.075	144-02.728	063.7
09:40:12	16.0	36-27.665	144-04.208	061.5
09:43:12	16.1	36-28.018	144-05.102	065.6
09:43:27	16.1	36-28.044	144-05.173	065.6
09:43:42	16.1	36-28.069	144-05.244	065.6
09:43:57	16.1	36-28.098	144-05.324	065.8
09:44:07	16.0	36-28.113	144-05.378	065.4
09:44:08	16.0	36-28.115	144-05.383	065.4
09:44:09	16.0	36-28.116	144-05.388	065.4
09:44:10	16.1	36-28.118	144-05.394	065.4

[*1] A "voyage data recorder (VDR)" is a device that records data related to the navigation such as position and speed, as well as VHF wireless telephone messages and audio in the bridge in a capsule that can be recovered when an accident occurs.

09:44:11	16.1	36-28.120	144-05.399	065.4
09:44:12	16.1	36-28.123	144-05.395	065.8
09:44:13	16.1	36-28.123	144-05.409	065.6
09:44:14	16.1	36-28.125	144-05.414	065.6
09:44:15	16.1	36-28.127	144-05.419	065.6
09:44:16	16.1	36-28.129	144-05.424	065.6
09:44:17	16.1	36-28.131	144-05.429	065.6
09:44:27	15.9	36-28.154	144-05.481	065.8
09:44:42	15.8	36-28.178	144-05.551	065.7
09:44:57	15.8	36-28.204	144-05.621	065.2
09:45:12	15.8	36-28.233	144-05.700	065.2
09:50:12	16.2	36-28.788	144-07.206	064.6
09:55:12	16.6	36-29.378	144-08.735	064.1

2.1.2 VDR Audio Records

The VDR has six microphones, with four located on the ceiling of the bridge and each outside of the left and right of the bridge. The VDR recorded the following audio from around 09:32 to around 10:02 on June 23, 2013.

(1) Audio records by microphones outside the bridge

1. The noise of rain was recorded from around 09:33:25 to around 10:02:00 (the sound of rain became intense at around 09:34:00, and after the sound of rain became weaker at around 10:01:30, subsequently at around 10:02:00 the sound of rain could no longer be heard).
2. A loud sound different from the sound of rain was recorded for approximately 3 seconds from 09:44:12.

(2) Audio records by microphones inside the bridge

1. At around 09:32:33 there was an announcement by paging system in Tagalog stating that "Master, there is something I would like to talk to you about on the telephone, so please return to your room."
2. At around 09:32:45, after a telephone ring, the following audio in Tagalog was recorded, "It will start raining soon, so please have the crew close the doors to the elevator hall."
3. A loud sound was not recorded by the microphones inside the bridge during the approximately 3 seconds from 09:44:12.

2.1.3 Radar Display Records of the VDR

The radar display records of the VDR are images recorded from the radar installed on the port side of the bridge of Vessel A (hereinafter referred to as "No. 2 radar"), according to which the state of the accident was as follows.

(See Figure 2 (1) to (10) Radar Display Records at Approximately 15-Minute Intervals from 08:00 to 10:00 on June 23)

(1) From around 08:00 to around 10:00, the No. 2 radar was set for north-up*2 and off-

*2 "North-up" refers to the display method (true bearing display) in which the true bearing (000°) is directly above the radar display is. Because the true bearing (000°) is constantly directly above the radar display, if the course is change, only the heading flash

center*3 with a range of 12 nautical miles (M), displaying approximately 20M to the front, and the FTC*4 was not used.

(2) From around 08:30 to around 09:30, the rapid development of rain clouds in front of Vessel A was displayed.

(3) From around 09:34 to around 10:00, Vessel A was located within the rain clouds displayed.

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

The events up until the accident occurred and from the occurrence of the accident until the rescue were as follows according to the statements of the master of Vessel A (hereinafter referred to as "Master A"), the third officer of Vessel A (hereinafter referred to as "Third Officer A"), the chief engineer (hereinafter referred to as "Chief Engineer B") of YUJIN MARU No. 7 (hereinafter referred to as "Vessel B"), the four deckhands of Vessel B, the three oilers of Vessel B, the charterer of Vessel B (hereinafter referred to as "Company B"), and the master (hereinafter referred to as "Master C") of the YOSHIMARU No. 55 (hereinafter referred to as "Vessel C") that is the consort of Vessel B.

(1) Vessel A

Vessel A, with Master A, Third Officer A, and 20 other crew members on board, left Keihin Port in Kawasaki Ward for Balboa Port, the Republic of Panama, at around 17:00 on June 22, 2013.

Master A assigned bridge watch to the second officer from 00:00 to 04:00, the chief officer from 04:00 to 08:00, and the third officer from 08:00 to 12:00, with a deckhand also assigned for each rotation, adopted a watchkeeping arrangement of two watchmen working in three shifts of four hours each. However, in order to provide holidays to seamen based on the Maritime Labour Convention, sole lookout duties were assigned to officers as long as they complied with the Bridge Procedure Manual (see page 13) prepared by the management company (WILHELMSEN SHIP MANAGEMENT; hereinafter referred to as "Company A").

When Master A visited the bridge at around 07:30 on the 23rd, because it was Sunday, the weather was good, visibility was positive, and there were no ships in the vicinity that would be obstacles, he deemed that the conditions allowing for the officer on watch to act as sole lookout had been fulfilled, and he assigned Third Officer A to sole lookout duty from 08:00.

Third Officer A came to the bridge at around 07:50 and was told by the chief officer of the previous duty that visibility was good and that there were no ships in the area. Third Officer A confirmed that the course set for automatic pilot was 063° (true bearing; the same shall apply hereinafter) and that the speed was approximately 15.8kn, set the radar installed on the starboard side of the bridge (hereinafter referred to as "No. 1 radar") at the 6M range and the No. 2 radar at the 12M range, and commenced sole lookout duty at around 08:15.

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will follow the new route, and the visuals such as those for the ship, shore, and breakwaters will not move.

*3 Off-center refers to the movement of the position of the ship (a central bright point) on the radar display, and it is used to expand the forward scope of detection (the navigation direction) when the ship's position is opposite (backward) from the navigation direction.

*4 FTC (fast time constant) is a circuit that attenuates radar waves reflected from rain and snow.

Third Officer A noticed that rain had started to fall at around 09:15, saw that thick rain clouds was approaching from the forward port side, and suggested Master A on the telephone that because it would start raining soon, it would be better to have off-duty crew members confirm that the doors to living quarters were closed.

As Vessel A had entered thick clouds at around 09:30 and visibility had deteriorated due to heavy showers of rain so that the bow mast approximately 30m to the front could barely be seen, Third Officer A stopped keeping watch by eyesight and began keeping watch by the No. 2 radar. Because other ships could not be recognized on the radar display due to the influence of rainfall and because there was no information displayed for other ships from the automatic identification system[5] (hereinafter referred to as "AIS") on the electronic chart display, the Third Officer A thought there were no other ships around as they were sailing in the middle of the ocean, did not report to Master A that visibility was restricted, and sailed ahead maintaining the same course and speed without conducting audio signals in restricted visibility.

After the rain had started falling until around 10:00 when it became a light drizzle, Third Officer A did not notice any sounds other than the sound of rain, and confirmed that the rain had stopped and visibility became positive at around 11:00.

Vessel A was called by an aircraft of the Japan Coast Guard patrolling in the sky by VHF radio (hereinafter referred to as "VHF") at around 16:30 and was told that these was a scratch on the hull of Vessel A. While Master A instructed the crew to check the condition of the ship's hull at around 17:00, no damage was found.

At around 19:10 Master A was contacted by the agency by satellite phone and was told that the Japan Coast Guard requested Vessel A to stop the recording of the VDR and return to Japan. Vessel A stopped the VDR at around 19:25, changed the destination to Sendai Shiogama Port (hereinafter referred to as "Shiogama Port") in accordance with the instructions by Company A at around 22:20, and anchored at the quarantine anchorage of Shiogama Port at around 19:25 on the 24th. (See Photo 2.1-1 and Photo 2.1-2)

Photo 2.1-1 Vessel A (1)

Photo 2.1-2 Vessel A (2)

(2) Vessel B

Vessel B, with her master (hereinafter referred to as "Master B"), Chief Engineer B,

[5] An automatic identification system (AIS) is a device that automatically sends and receives information such as the ship identification code, type, ship name, ship position, course, speed, destination, and information on the navigational status, enabling the exchange of information between ships, navigational support facilities at land stations, etc.

and seven other crew members on board, left Shiogama Port, Miyagi Prefecture, for fishing ground in the sea east of the Mariana Islands at around 12:10 on June 22, 2013. (See Photo 2.1-3)

Photo 2.1-3 Sister Ship of Vessel B

Vessel C had made previous arrangements to accompany Vessel B and left Shiogama Port following Vessel B at around 14:00. At around 05:00 on the 23rd, Master C discussed the route to the fishing grounds with Master B, and confirmed that Vessel B was approximately 30M to the east of Vessel C.

Master B had ordinarily adopted a bridge watchkeeping system with eight shifts covered by the eight crew members other than the master, with each crew member serving as sole lookout on two-hour shifts.

The deckhand that took over bridge watch from the previous deckhand at around 08:00 (hereinafter referred to as "Deckhand B") commenced sole lookout; confirmed that the course set for automatic pilot was 125°, that the speed was approximately 9.0kn, and that the radar was set at the 12M range and course-up*6; and entered the watch room above the steering room.

At around 09:00 Deckhand B noticed that he could not see far as rain had started falling, went down from the watch room to the steering room at around 09:30, and confirmed from the radar display clouds and one other boat around 60° on the starboard stern, 6M. However, because there was no ship forward of the abeam, and because there is a blind area (restricted visibility) due to the bow construction if watch is conducted from a seated posture in the steering room, Deckhand B went up to the watch room at around 09:35, sat on the floor and leaned against the rear wall, and continued watch with a blind area from approximately 45° starboard to behind caused by a wall. The Deckhand B then suddenly felt an impact, and immediately after that, he fell into the water.

Immediately after feeling the impact, Chief Engineer B and six other crew members that had been in the crew's quarter behind the engine room saw that sea water was coming in from the bottom of the door to the engine room and escaped from the living quarter. At this time six crew members recognized a large blue ship and one crew member recognized the letters "OCEANIC" on the bow, and they inflated the inflatable life raft (hereinafter referred to as "life raft") at the port stern.

When Deckhand B floated up to the sea surface, he confirmed that he was very near a blue car carrier and then swam to the life raft and boarded it on his own.

*6 "Course-up" refers to the display method in which the true bearing of the radar display is the planned route of your ship.

Chief Engineer B and six other crew members boarded the life raft. When Chief Engineer B noticed that Master B was not in the life raft, he yelled toward Vessel B but received no response. Seeing Vessel B continuing to sink, he released the mooring rope that connected the life raft with Vessel B and activated an emergency position indication radio beacons (EPIRB)*7.

Although the eight crew members of Vessel B that were on the life raft were rescued by Vessel C that had rushed to the scene, Master B could not be found.

The accident occurred at around 09:44 on June 23, 2013, approximately 132°, 161M from the Kinkazan Lighthouse.
(See Figure 1: Estimated Navigation Routes)

2.2 Information regarding Search, Rescue, and Damage Mitigation Measures

Measures were taken as follows according to the statements of Chief Engineer B, the seven crew members of Vessel B, and Master C and the official newsletter disclosed by the Japan Coast Guard.

After evacuating in the life raft, the eight crew members of Vessel B excluding Master B sent a distress signal using the EPIRB.

The Marine Operations Center of the Japan Coast Guard received the first distress signal from Vessel B at around 10:14 on the 23rd and then contacted Company B, which then communicated to Vessel C through the owner of Vessel C.

Although Vessel C called Vessel B by radio at around 11:00, there was no response. As Vessel B had been approximately 30M east of Vessel C on the morning of the accident, Vessel C began to sail east to rescue Vessel B. Vessel C learned the position of the distress signal transmission by a satellite phone call from the Japan Coast Guard at around 11:15 and headed towards that position. At around 13:45, Vessel C discovered the life raft, rescued the eight crew members of Vessel B, and then continued to search for Master B.

A patrol boat of the Japan Coast Guard arrived at the area near to where the accident occurred at around 17:15 on the 23rd. At around 19:40 the eight crew members of Vessel B moved from Vessel C to the patrol boat. At around 10:46 on the 24th the patrol boat returned to Shiogama Port, and the eight crew members of Vessel B disembarked.

Although the search for Master B was continued until the 26th by three patrol boats and four aircraft of the Japan Coast Guard, two aircrafts of the Maritime Self-Defense Force, Vessel C, and a consort ship, Master B was not found.

2.3 Injuries to Persons

(1) Vessel A

There were no casualties according to the statements of Master A.

(2) Vessel B

Master B went missing and there were no casualties among the eight crew members according to the statements of the eight crew members of Vessel B.

2.4 Damage to Vessels

*7 An emergency position indication radio beacon (EPIRB) is a device that uses the 406MHz frequency to send distressed ship position data and distress reports via satellites circling the earth to the land stations of search and rescue organizations.

(1) Vessel A

According to the on-site investigation, there were scratches on the hull at both sides of the bow of Vessel A.

(See Figure 2.4-1 and Figure 2.4-2)

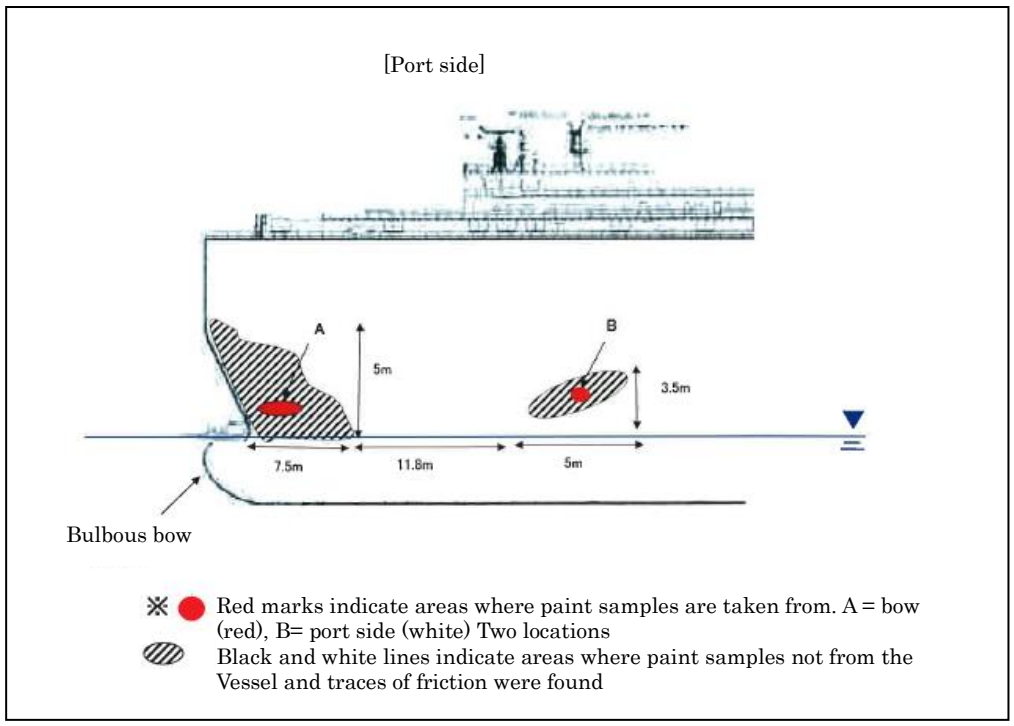


Figure 2.4-1 Damage Conditions of Scratches on the Port Side of Vessel A

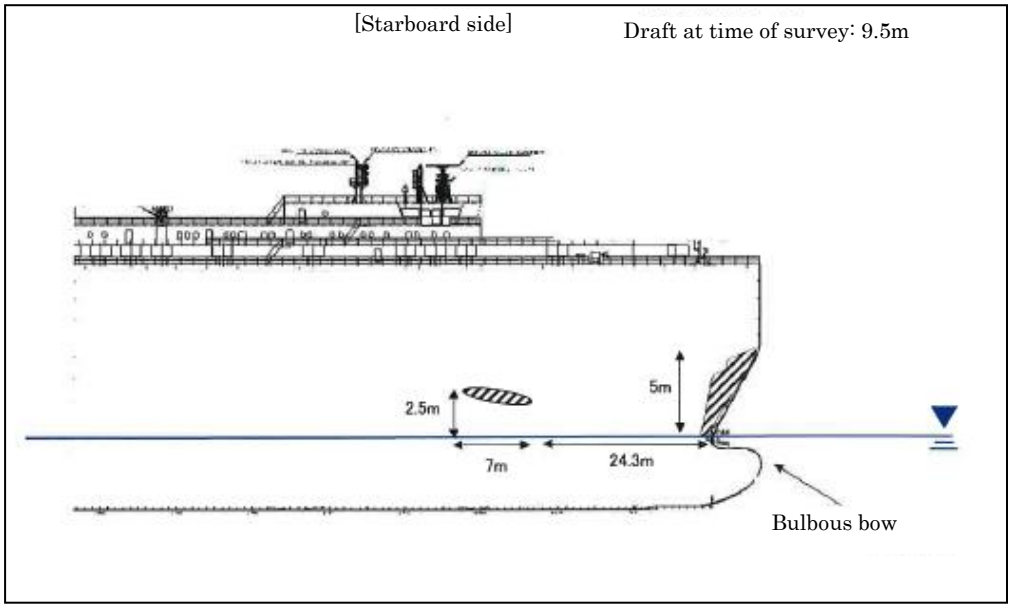


Figure 2.4-2 Damage Conditions of Scratches on the Starboard Side of Vessel A

(2) Vessel B

According to the on-site investigation of the forward part of Vessel B (see Photo 2.4-1) and the photos of the backward part of Vessel B provided by the Japan Coast Guard (see Photo 2.4-2), the central part including the steering room was lost, and Vessel B was separated into the forward part and the backward part. (See Figure 2.4-3)

Photo 2.4-1 Forward Part of Vessel B

Photo 2.4-2 Backward Part of Vessel B

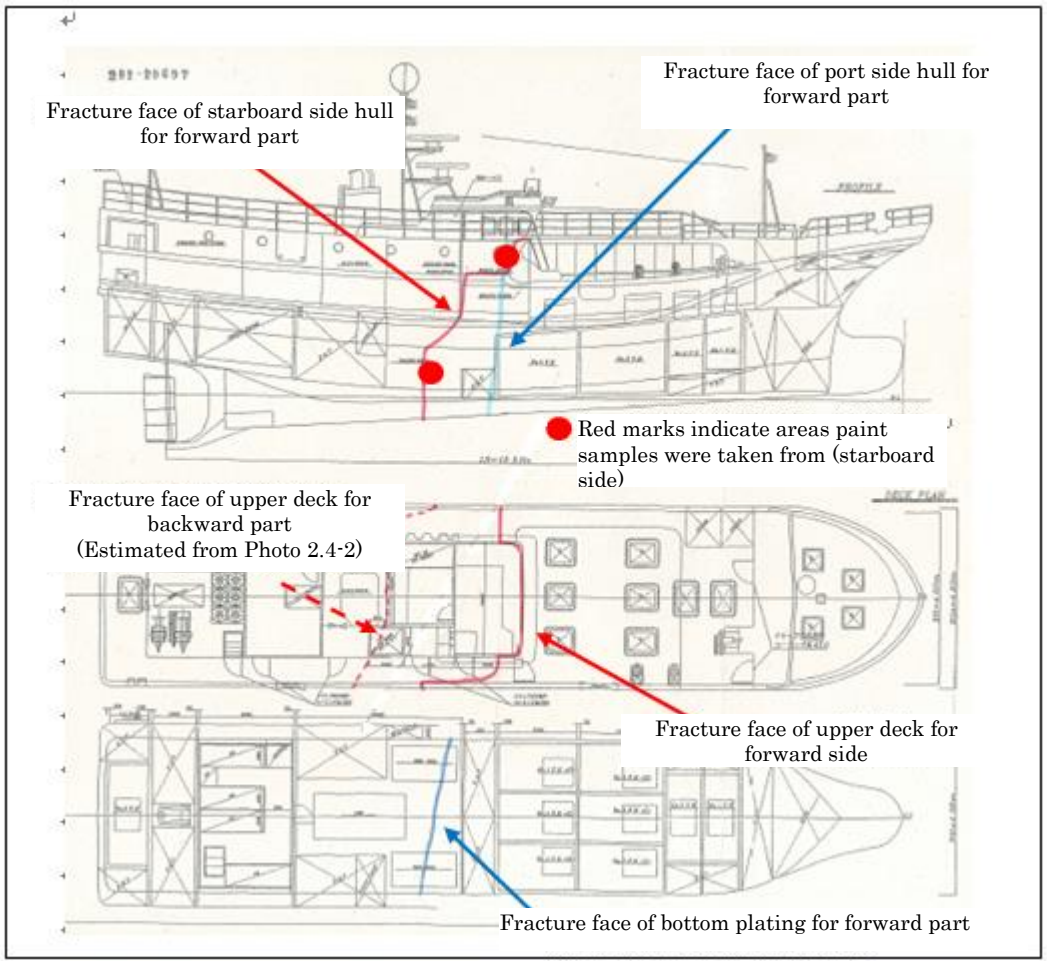


Figure 2.4-3 Damage Conditions of Vessel B

2.5 Crew Information

(1) Gender, Age, and Certificate of Competence

Master A: Male, 40 years old

Nationality: Republic of the Philippines

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

Date of issue: September 26, 2011 (valid until September 19, 2015)

Third Officer A: Male, 41 years old

Nationality: Republic of the Philippines

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

Date of issue: April 23, 2013 (valid until January 24, 2014)

Master B: Male, 52 years old

Certificate: First class boat's operator

Date of Issue: September 7, 2007

Date of revalidation: May 9, 2013 (valid until May 8, 2018)

Deckhand B: Male, 24 years old

Nationality: Republic of Indonesia

No maritime license

Certificate: Navigation watch rating in the deck

Date of certification: April 27, 2010

(2) Seagoing experiences

1. Master A

According to the statement from Master A, his experience was as follows.

After serving as an apprentice officer for approximately two years from 1995, he served as a third officer from 1997, a second officer from 2000, a chief officer from 2004, and a master for approximately five years from 2008. All ships he served on were car carriers.

He served on Vessel A since December 16, 2012.

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

2. Third Officer A

According to the statement from Third Officer A, his experience was as follows.

After serving as an oiler for approximately four years from 1990, he received training from an educational institution for four year period from 1994 and became qualified as a navigator. He served as a third officer during the seven year period from 2006 and served on five car carriers and two bulk carriers.

He served on Vessel A since March 14, 2013.

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

3. Master B

According to the statements from Chief Engineer B and a representative of Company B, the experience of Master B was as follows.

He worked on a fishing vessel since age 18, served as chief engineer for a fishing vessel of Company B since August 1995, and in 2007 he received a first class small vessel operator license and became able to serve as a master. He served as master of Vessel B since May 5, 2011.

4. Chief Engineer B

According to the statement from Chief Engineer B, his experience was as follows.

He started working on ships since age 17, and after obtaining a license as a sixth grade maritime officer (Engineering) around 1997, he gained experience as a chief engineer for approximately eight years.

He served as chief engineer of Vessel B since May 5, 2011.

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

5. Deckhand B

According to the statement from Deckhand B, his experience was as follows.

After graduating from school in the Republic of Indonesia, he served as a deckhand on a fishing vessel of Company B since around age 20. He served as a deckhand of Vessel B since May 5, 2011.

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

2.6 Vessel Information

2.6.1 Particulars of Vessels

(1) Vessel A

IMO number: 9624029
Port of registry: Majuro (Republic of the Marshall Islands)
Owner: NOCC OCEANIC AS (Kingdom of Norway)
Management company: Company A (Kingdom of Norway)
Classification society: DET NORSKE VERITAS (Kingdom of Norway)
Gross tonnage: 58,250 tons
L×B×D: 199.98m × 32.26m × 32.64m
Hull material: Steel
Engine: 1 diesel engine
Output: 13,570kW
Propulsion: Single 4-blade fixed pitch propeller
Date of launch: June 1, 2012
Use: Car carrier
Number of crew members: 22 (nationality: all from the Republic of the Philippines)

(2) Vessel B

Fishing vessel registration number: KO2-7011
Ship inspection completion slip number: 282-20697
Base port: Susaki, Kochi Prefecture
Owner: Owned by an individual
Gross tonnage: 19 tons
Lr×B×D: 18.95m × 4.56m × 2.10m
Hull material: FRP
Engine: 1 diesel engine
Output: 736kW
Propulsion: Single 4-blade fixed pitch propeller
Date of launch: March 10, 2011
Use: Tuna long-liner
Number of crew members: 9 (two with a nationality of Japan and seven with a nationality of the Republic of Indonesia)

2.6.2 Loading Condition

(1) Vessel A

According to the loading record, Vessel A was loaded with 3,615 vehicles (8,966.3t). According to the bell book*8, the draft when the vessel left the port was approximately

*8 The bell book is a note book used by junior officers (typically, the third officer) for stating information in accordance with orders of the master when moving in and out of ports such as the use of the main engine, movements of the ship, the names of pilots and their movements such as embarkation and disembarkation, the names of tug boats, and the tug's mooring position.

9.70m at the bow and approximately 9.85m at the stern.

(2) Vessel B

According to the statements of Chief Engineer B, fish holds 1 and 2 contained fishing bait, and fish holds 3 and 4 contained clean water, but there was no catch.

According to the general arrangement and water stains on the hull, the draft was approximately 1.4m at the bow and approximately 3.0m at the stern.

2.6.3 Lookouts

(1) Vessel A

According to the statements of Third Officer A and the general arrangement, when the rain fell heavily while Third Officer A was on duty, he kept watch while standing in front of the No. 2 radar. The distance between the position where Third Officer A was standing and the foremast was approximately 30m, and the height of his line of vision was approximately 1.54m from the bridge floor. (See Figure 2.6-1 and Photo 2.6-1)

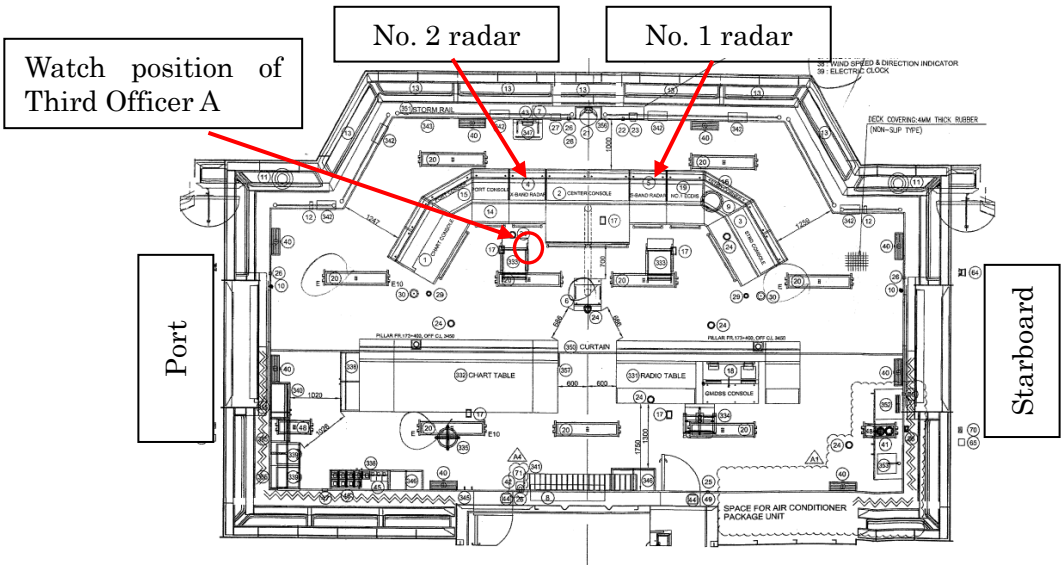


Figure 2.6-1 Bridge of Vessel A and Watch Position of Third Officer A

Photo 2.6-1 View in Front of the Bridge from the Watch Position of Third Officer A

(2) Vessel B

According to the statements of Chief Engineer B, the seven crew members other than the chief engineer were not permitted to operate navigational instruments and had been instructed to report to Master B if they found another ship. The two radars were operating at all times while sailing. The automatic pilot was in a navigation mode that

would make automatically corrections for the deviation by the tidal current.

2.6.4 Navigational Watch

(1) Vessel A

1. Order Book

According to the Master's Standing Orders of the Order Book, the following was written by the master, and the signatures of the chief officer, second officer, and third officer were obtained to indicate that the contents of these statements were understood.

12. Report to the Master when you observe any of the following.
   a) any remarkable change in barometer reading, wind direction & force, sea condition, visibility (3 miles), or any indication of incoming bad weather.
   b) when not making land fall or sighting a shoreline as expected, or sighting them unexpectedly.
   c) when damage to any part of the ship or accident to crew is noted.
   d) when uncertain about the vessel's and /or crew's safety.

Moreover, the June 22, 2013 page of the ORDER BOOK had the following statements written by the master at 21:00, and the signatures of the chief officer, second officer, and third officer were obtained to indicate that the contents of these statements were understood.

1) Keep sharp look out at all time.
2) Keep constant monitoring on both radars as well as ECDIS.
3) Regularly check ship's position by GPS or if possible by radar.
4) Follow Master Standing Order as attached on page 14.
5) If in doubt call master at anytime w/out hesitation.

2. Bridge Procedure Manual

The Bridge Procedure Manual contained the following description.

2.3 Lookout Requirements

2.3.4 Sole Lookout

The Master shall not permit the OOW as sole lookout during period of darkness (watch Level 2). However he may permit the OOW to be the lookout during the daytime (watch Level 1), provided full account has been taken of all relevant factors including, but not limited to:

- Visibility is good and there is little or no traffic around.
- There are no navigational hazards in the vicinity.
- Assigned personnel are on easy call in case the above circumstances change.
- The assigned personnel are aware that they are on call.
- The OOW understands that he shall not engage in activity such as Chart correction when he is the sole lookout.

3. Watch manning levels

The Bridge Procedure Manual contains a chart on the watch manning levels, and this chart is also posted on the bridge.

Watch Level	Watch Personnel	Situation

Level 1	OOW	● Open seas in day light conditions ● Day light at anchor
Level 2	OOW Dedicated Lookout	● Open seas from sunset to sunrise ● Moderate traffic conditions ● At anchor at night, in restricted visibility or high density anchorage
Level 3	OOW Master (may be additional officer) Dedicated Lookout Helmsman	● Dense traffic conditions ● Restricted waters ● Reduced visibility in open seas ● River/canal transit (may also be under pilotage)
Level 4	OOW Master (may be additional officer) Dedicated Lookout Helmsman Extra Lookout (at the discretion of the Master)	● Dense traffic conditions ● Restricted waters ● Reduced visibility ● Arrival/departure ports ● Pilotage* ● River/canal transits ● Arrival/departure anchorages

(2) Vessel B

1. Navigational watch seafarer

According to the mariner's pocket ledger of Deckhand B, he had been certified as a rating forming part of watch (Koshu-deck).

2. Duties of navigational watch seafarer

In accordance with the Enforcement Regulations of the Mariners Act, the duties of navigational watch seafarers are as follows.

Article 77, Paragraph 2-2

The duties of deck department navigational watch seafarers include measuring the ship's position, course, and speed; lookout; gathering and analyzing information on weather and sea conditions; manuevering the ship; monitoring the operating conditions of navigational equipment; handling mooring ropes and anchors; making rounds of the ship; handling wireless communications; and implementing emergency measures in response to fires and other disasters; as well as handing off and recording these operations.

Paragraph 2 and Paragraph 3 (omitted)

4. The navigational watch seafarers in the preceding three paragraphs shall conduct their duties in accordance with the work instructions of their superiors (excluding those that are seafarers).

2.6.5 Other Relevant Information of the Vessels

Other information concerning the vessels is as follows according to the statements of Master A, Third Officer A, and Chief Engineer B; the maneuverability characteristic table; and general arrangement.

(1) Vessel A

1. Hull structure

Vessel A is a car carrier that has 12 decks for carrying vehicles and a distance of approximately 33m from the front of the bridge to the front edge of the bow. At the time of the accident there were no faults or failures involving the hull, machinery, or equipment.

(See Figure 2.6-2)

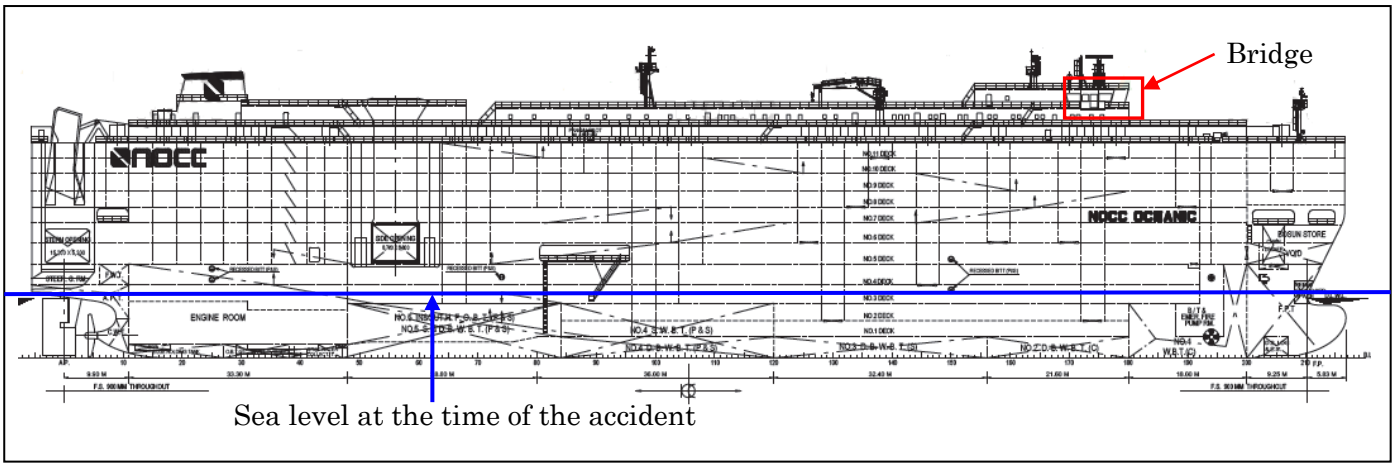


Figure 2.6-2 Vessel A General Layout Diagram

2. Navigational equipment

The cockpit-type navigational console located approximately 1m behind the wall at the front of the bridge was equipped in the following order from the port side to the starboard side with a chart table, two GPS units, AIS, lighting switches, the No. 2 VHF, navigation light switches, the No. 2 radar, whistle control equipment, windshield wiper control equipment, a ship microphone, operation information monitor display, a bow thruster controller, an engine remote controller, the No. 1 radar, ECDIS, the No. 1 VHF, a bridge navigational watch alarm system, an intercom, a warning display, and a VDR controller. A steering stand was located in the center of the steering room behind this console.

There was a chart table on the port side and radio equipment on the starboard side to the back of the bridge.

3. No. 2 radar

When a marine accident investigator set the No. 2 radar at range of 6M for north-up in the quarantine anchorage of Shiogama Port on June 26 and observed the fishing vessel detection distance, it was possible to detect a fishing vessel operating within 4M. At this time the weather was slightly overcast and there was no rainfall. (See Photo 2.6-2)

Red circles: light beacons
Blue circle: fishing boats
Green circle: cargo ship

Photo 2.6-1 No. 2 Radar Target Detection Status

4. Maneuverability, etc.

a. Engine operation status and speed

Engine operation status	Advancing at full speed	Advancing at half speed	Advancing at slow speed	Advancing at dead slow speed
Revolutions per minute (RPM)	87	70	53	38
Speed when loaded (kn)	17.28	14.29	10.64	7.10
Speed when not loaded (kn)	18.01	14.76	11.04	8.26

b. Tactical diameter (speed 17.3kn, steering angle 35°)

When loaded: anticlockwise diameter of approximately 600m, clockwise diameter of approximately 600m

When not loaded: anticlockwise diameter of approximately 780m, clockwise diameter of approximately 880m

(2) Vessel B

1. Hull structure

Vessel B is a tuna long-liner with a through single deck. The top deck contained in the following order from the bow to stern the boatswain's store, the steering room, the master's cabin, the upper engine room, and the dining room, while the lower deck contained in the following order from the bow to stern a void space (empty area), a fuel tank, fish holds 1 to 4, a fuel tank, the lower engine room, the crew's quarters, a fuel tank, and fish hold 5, while the life raft was installed at the port stern. At the time of the accident there were no faults or failures involving the hull, machinery, or equipment. (See Figure 2.6-3)

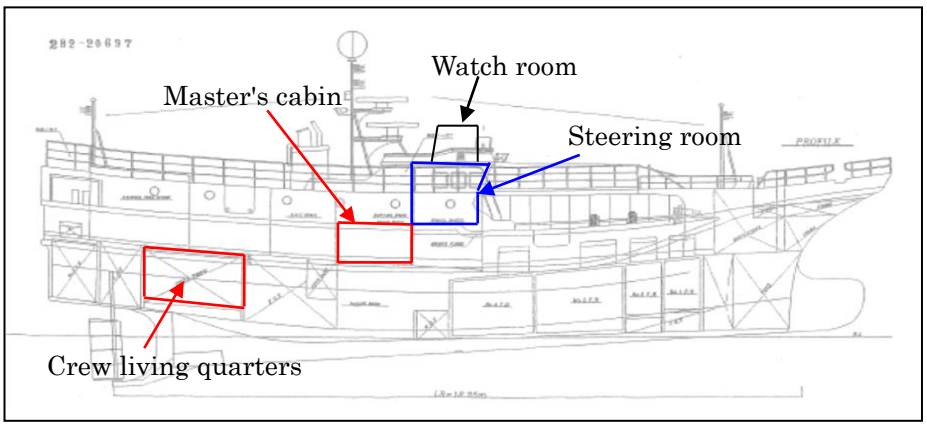


Figure 2.6-3 Vessel B General Layout Diagram

2. Navigational equipment

The area in front of the helm chair above the window frame was equipped in the following order from the port side to the starboard side with a rudder angle indicator, a satellite compass, a radio direction finder, radio communication equipment (SSB), and an automatic pilot, while the area in front of the helm chair was equipped with the rudder and main engine remote control, the area to the left of the helm chair was equipped with a GPS plotter, the No. 1 radar, steering equipment, a fish-finder, and a tidal current meter, and the master's cabin behind the steering room was equipped with GPS, the No. 2 radar, a facsimile machine, and a transceiver. The ship was not obligated to be equipped with AIS and did not have this equipment. (See Figure 2.6-4)

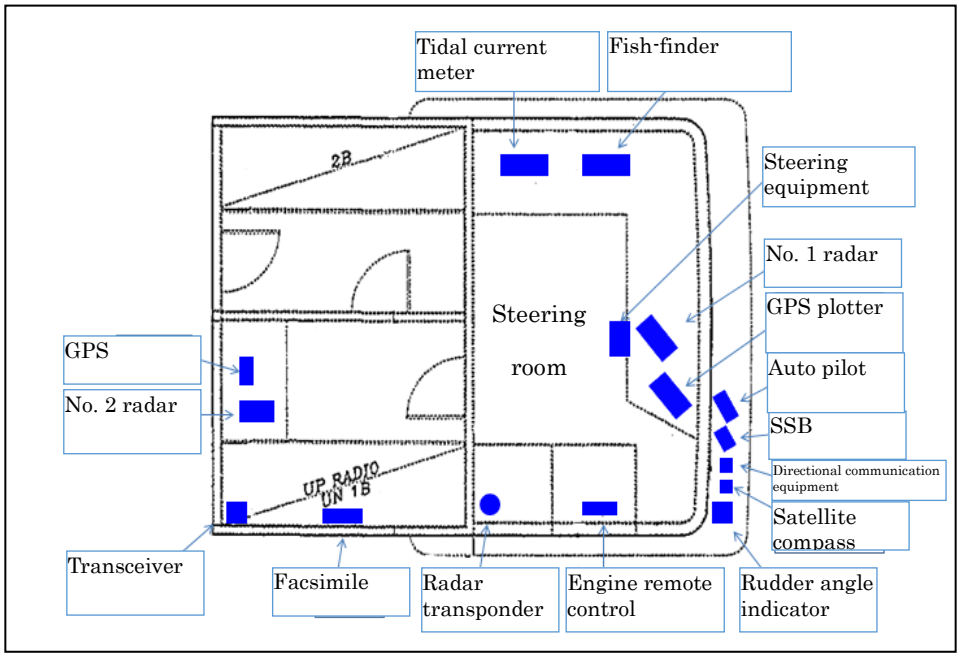


Figure 2.6-4 Vessel B Navigational Equipment

3. Steering room and watch room blind area

In terms of visibility from the steering room there was a blind area within the range of approximately 23° to the left and 8° to the right of the bow when the sea is calm (peaceful) and if one looks forward in a seat position in the helm chair on the port side of the steering room. When the boat is pitching due to waves, one could see forward when the bow lowers, and when the boat was not pitching the blind area caused by

the bow could be avoided by standing up from the helm chair and looking forward through the window of the watch room above the steering room. (See Figure 2.6-5, Photo 2.6-3, and Photo 2.6-4)

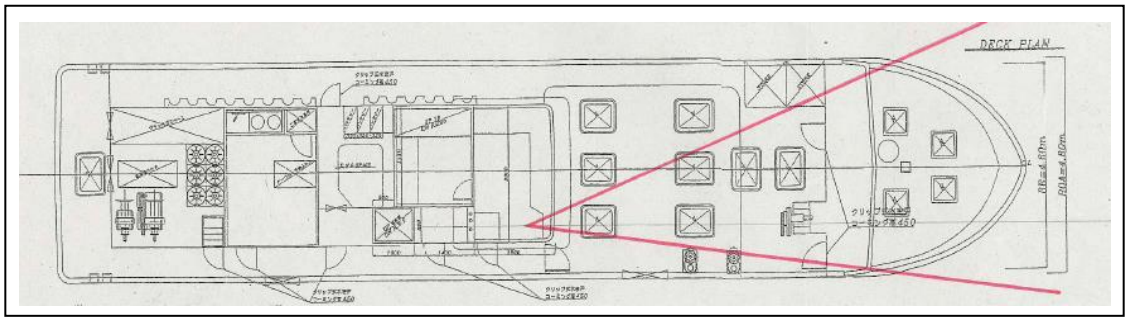


Figure 2.6-5 Blind Area from the Helm Chair Caused by the Bow

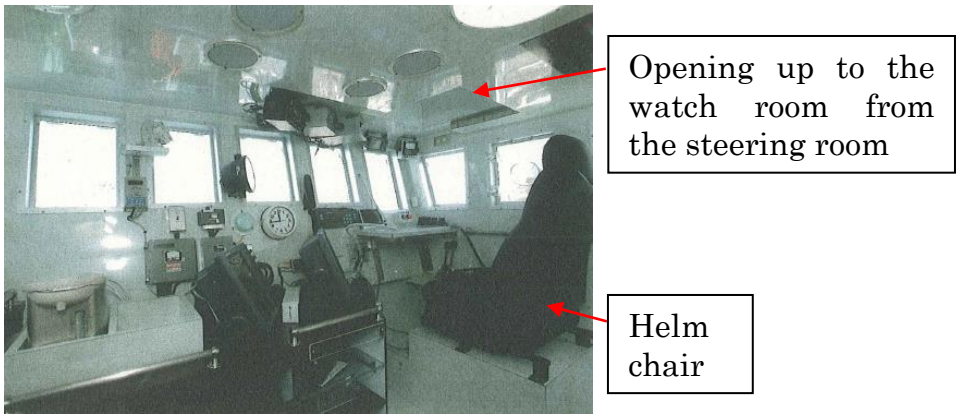


Photo 2.6-3 Near the Helm Chair in the Steering Room

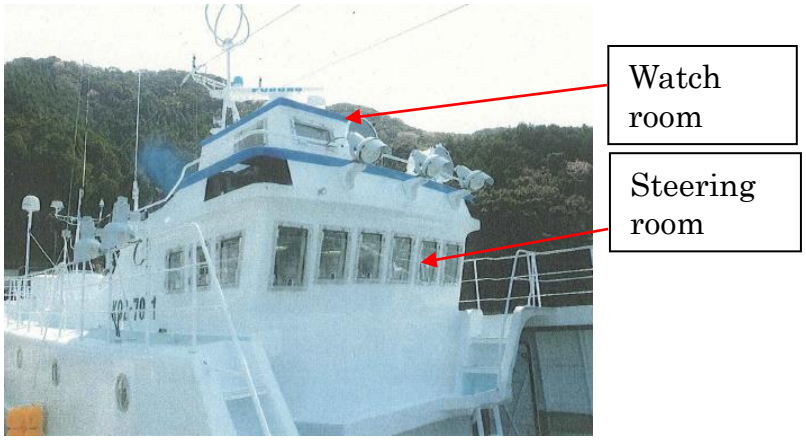


Photo 2.6-4 External View of Steering Room and Watch Room

According to the design diagrams, the watch room had a longitudinal length of 1,259mm, a width of 660mm, and a height of 730mm. There was an opening in the front floor of the watch room that allowed one to go down into the steering room, and one could sit to the back of the watch room on the floor to keep watch. While there was no navigational equipment in the watch room, one could see the No. 1 radar by looking down through the opening to the steering room.

The watch room contained rectangular glass windows with a width of 460mm and a height of 220mm on the front, left, and right walls and a circular glass window with a

diameter of 200mm on the back wall. The windows on the left and right walls were located toward the bow, and if one kept watch with ones back against the back wall, the structure resulted in a blind area in the back from approximately 45° port and starboard of the bow. (See Figure 2.6-6)

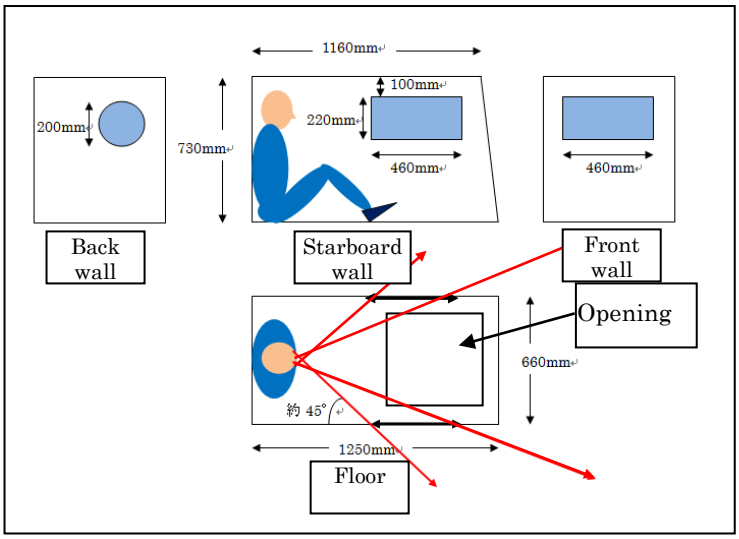


Figure 2.6-6 Watch Room Dimensions Diagram

2.7 Weather and Sea Conditions

2.7.1 Observations by Crew Members

(1) Vessel A

1. According to the deck logbook of Vessel A, the weather was cloudy and there was a squall at around 10:00 on June 23.
2. According to the statements of Third Officer A, at around 09:30 the rain became intense, the wind speed was approximately 4 to 5kn, the winds were blowing west-southwest, and the wave height was approximately 1 to 1.5m.

(2) Vessel B

According to the statements of Deckhand B, it was not possible to see far as rain had started falling at around 09:00 on June 23.

(3) Vessel C

According to the statements of Master C, the weather was good, there were no winds or waves, and rain was not falling when he discovered the life raft at around 13:45 on June 23.

2.7.2 Observations of the Japan Coast Guard

According to the official newsletter disclosed by the Japan Coast Guard, there was a northeast wind with a wind velocity of 10m/s, and the wave height was approximately 1m at the a site of the accident at around 14:10 on June 23,.

2.8 Investigation through Paint Film Debris Analysis

The result of the identification analysis of the paint film and paint debris gathered from Vessel A and Vessel B entrusted to Analysis Center Co., Ltd. are as follows.

Infrared spectroscopy (IR) is a method that utilizes the characteristics by which substance

absorbs infrared rays, as infrared ray absorbing characteristics are unique to structural components (materials). Infrared ray absorbing characteristics are called an IR spectrum, and they can be visualized as a graph. Identification of compounds is possible by mutually comparing the waveforms of the IT spectrum that are gained as measurement results.

A comparison of the IT spectrum of blue paint film on the ship body of Vessel A and blue debris on the upper starboard side of Vessel B and the IR spectrum of red paint film on the lower starboard side of Vessel B and red debris on the bow of Vessel A indicated that there was a positive match for the infrared absorption wavenumber domain and spectrum form for each of the above. (See Photo 2.8-1, Figure 2.8-1, and Figure 2.8-2)

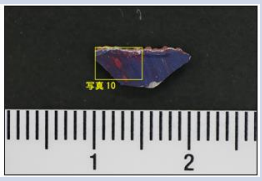
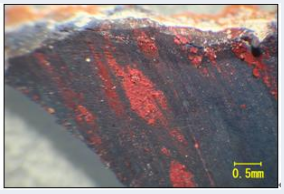
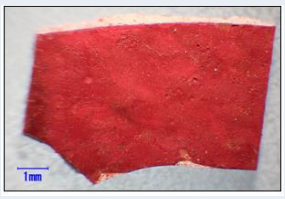
	Deposits	**Comparison target**
Comparison sample 1	Vessel B: blue debris on upper starboard side 	Vessel A: blue paint film on ship body 
Comparison sample 2	Vessel A: red debris on bow 	Vessel B: red paint film on lower starboard side 

Photo 2.8-1 Sample Used in Paint Film Component Analysis

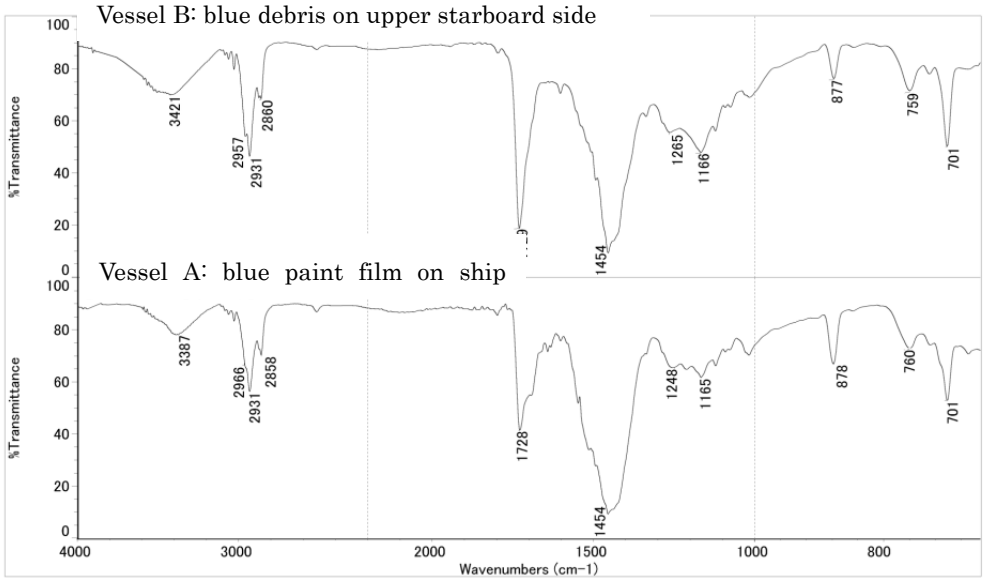


Figure 2.8-1 Identification Results for Comparison Sample 1

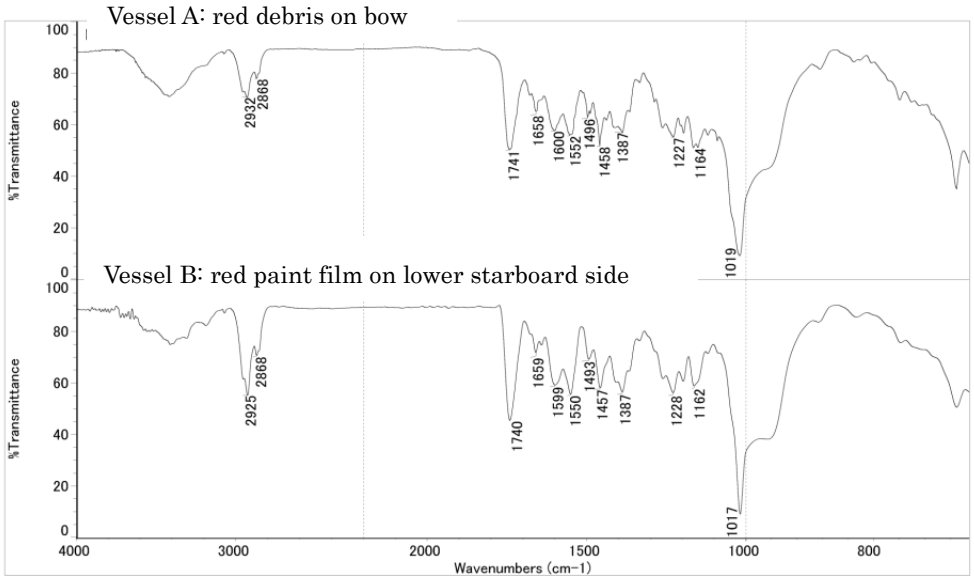


Figure 2.8-2 Identification Results for Comparison Sample 2

2.9 Information on Similar Accidents

2.9.1 Similar Accidents

About eight months prior to this accident, there was an accident on September 24, 2012 in which a merchant ship and a fishing boat collided (hereinafter referred to as "the prior accident").*9

According to the Marine Accident Investigation Report for the prior accident released on June

*9 At around 01:56 on September 24, 2012, the bulk carrier NIKKEI TIGER (25,074 tons) and fishing vessel HORIEI MARU (119 tons) collided in the sea around 930km off the east of Kinkazan, Miyagi Prefecture. The fishing boat foundered, and 13 of 22 crew members went missing. The cargo ship had no major damage and no casualties.

27, 2014 after the occurrence of this accident, the prior accident and this accident had the following points in common.

1. They occurred on the open sea.
2. They were collision accidents between merchant ships and fishing boats on the open seas.
3. Although the merchant ships were equipped with AIS, the fishing boats were not obligated to be equipped with AIS and did not have this equipment.

Furthermore, according to Marine Accident Investigation Reports released by the Japan Transport Safety Board from January 2009 to January 2013, there were at least ten collision accidents in which a merchant ship was not able to detect the fishing boat by radar.

According to the Marine Accident Investigation Report of the prior accident, it is probable that AIS has the following characteristics that are useful for preventing collision accidents.

1. The influence of rain and waves to AIS is less than radar, making it easy to obtain information such as the position of the other ship.
2. While the detection ability of radar is affected by factors such as the size of the other ship because it captures reflected radio waves, because AIS emits radio waves on its own, its detection ability is not affected by the size of ships equipped with AIS.
3. Compared to the detection distance of small ships by radar, simplified AIS[*10] can also stably send and receive information such as ship position from a comparable distance (more than approximately 4.5M) between ships.
4. It can send and receive information on the ship name and ship type that cannot be obtained from radar information.
5. In particular, simplified AIS does not require operators with radio qualifications, reducing the burden on the business owner.

2.9.2 Measure to Prevent Recurrence of Similar Accidents by the Japan Transport Safety Board and Fisheries Agency

The Japan Transport Safety Board expressed its opinion as follows to the Commissioner of the Fisheries Agency in order to prevent recurrence of similar accidents on October 25, 2013.

1. For fishing vessels that are currently not equipped with AIS, particularly for fishing vessels that operate and navigate in the open sea (second-class fishing boats prescribed in the Ship Safety Act[*11]), consider conducting further education and awareness raising activities towards ship owners on the effectiveness of AIS in preventing collision accidents and other necessary measures.
2. Instruct the owners of fishing vessels to obtain and use information on the status of accidence occurrence at fishing grounds and routes and the navigation routes of merchant ships from sources such as the Japan-Marine Accident Risk Safety Information System[12] of the Japan Transport Safety Board in order to prevent

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[*10] Simplified AIS refers to AIS that have an output that is smaller than the AIS that certain ships are obligated to install in accordance with international conventions, or AIS that have limitation in the information items sent and received, such as the ship name, ship position, speed, course, and ship type.

[*11] Second-class fishing boats prescribed in the Ship Safety Act are fishing boats that conduct bonito angling fishing or tuna longline fishing on second-class fishing boats (20 tons or more) or small second-class fishing boats (less than 20 tons) in accordance with the Special Rules for Fishing Vessels. As it can be assumed that these boats will be operated in the sea far from land, the standards for equipment such as lifesaving equipment and navigational equipment are generally higher than for fishing boats that operate near the shore.

[*12] the Japan-Marine Accident Risk Safety Information System consists of an Internet service from the Japan Transport Safety Board

collision accidents.

Subsequently, the Fisheries Agency released a notice (dated October 25, 2013) to fishery organizations (National Federation of Fisheries Co-operative Associations, Japan Fisheries Association, and Nationwide Fishermen's Employment and Training Center) and prefectural governors nationwide suggesting that they promote the spread of AIS among fishing boats and instruct fishing businesses to obtain and use accident occurrence information from the Japan-Marine Accident Risk Safety Information System of the Japan Transport Safety Board.

As measures to promote the spread of AIS among fishing vessels, the Fisheries Agency established a financing system with effectively free interest for AIS installation costs in April 2014, and also established in July 2014 a support system that subsidizes a portion of seamen's insurance as preferential treatment for fishing vessels that have installed AIS.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

In consideration of 2.1 and 2.7.1., the course of events is as follows.

(1) Vessel A

1. It is probable that Vessel A left Keihin Port at around 17:00 on June 22, 2013.
2. It is probable that Vessel A was sailing by automatic pilot on a course of approximately 063° at a speed of approximately 15.8kn while Third Officer A was on sole lookout duty from around 08:15 on June 23, 2013.
3. It is highly probable that Vessel A encountered heavy showers of rain at around 09:34.
4. It is highly probable that there was a sound different from the sound of rain outside the bridge of Vessel A at around 09:44.

(2) Vessel B

1. It is probable that Vessel B left Shiogama Port at around 12:10 on June 22, 2013.
2. It is probable that Vessel B was sailing by automatic pilot on a course of approximately 125° at a speed of approximately 9.0kn while Deckhand B was on sole lookout duty in the watch room from around 08:00 on June 23, 2013.
3. It is probable that Deckhand B went down to the steering room at around 09:30 because rain had started falling, and that after confirming that there were no other ships forward of the abeam on the radar display, he went up to the watch room at around 09:35 and kept watch there.
4. It is probable that Deckhand B felt an impact and immediately after that, he fell into the water.

3.1.2 Time, Date, and Location of the Occurrence of the Accident

In consideration of 2.1.1 and 2.1.2 (1)2., it is probable that the accident occurred at around 09:44 on June 23, 2013, around 132°, 161 nautical miles from the Kinkazan Lighthouse.

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that displays information on marine accidents and marine safety on a world map. URL:http://jtsb.mlit.go.jp/hazardmap/

3.1.3 Situation of the Collision

In consideration of 2.1.1, 2.4, and 2.8, it is probable that the bow of Vessel A collided with the starboard center of Vessel B while Vessel A was proceeding on a course of approximately 066° at a speed of approximately 16kn and Vessel B was proceeding on a course of approximately 125° at a speed of approximately 9kn.

3.1.4 Damage

In consideration of 2.4, it is probable that there were scratches on the outer plates of both bows of Vessel A, that for Vessel B the central part including the steering room was lost, and that Vessel B was separated into the forward part and the backward part..

3.1.5 Injuries to Persons

In consideration of 2.3, it is probable that the situation was as follows.

(1) Vessel A

There were no casualties.

(2) Vessel B

Master B went missing, and there were no casualties among the other crew members.

3.2 Causal Factors of the Accident

3.2.1 Crew

The situation for 2.5 is as follows

(1) Vessel A

Master A and Third Officer A had legal and valid maritime licenses. It is probable that they were in good health.

(2) Vessel B

Master B has a legal and valid boat license. While Deckhand B did not have a legal and valid boat license, he was certified as navigation watch rating in the deck. It is probable that he was in good health.

3.2.2 Vessels

In consideration of 2.6.5 (1)1. and (2)1., it is probable that at the time of the accident there were no faults or failures involving the hull, machinery, or equipment for Vessel A or Vessel B.

3.2.3 Weather and Sea Conditions

In consideration of 2.1.3, 2.1.4, and 2.7, it is probable that there were heavy showers of rain, the winds were blowing west-southwest, and the wind speed was approximately 4 to 5kn at the time of the accident.

3.2.4 Visibility

In consideration of 2.1.4(4), 2.6.3(1), and 3.2.3, it is probable that heavy showers of rain caused visibility to be limited to approximately 30m.

3.2.5 Analysis on the Navigation Route of Vessel A and Vessel B

In consideration of 2.1.1, 3.1.1, and 3.1.3, the estimated tracks of Vessel A and Vessel B from around 08:00 to the collision were as displayed in Figure 1.

3.2.6 Analysis of the Distance Which Vessel B Enters the Blind Area of the Bridge Window Frame of Vessel A

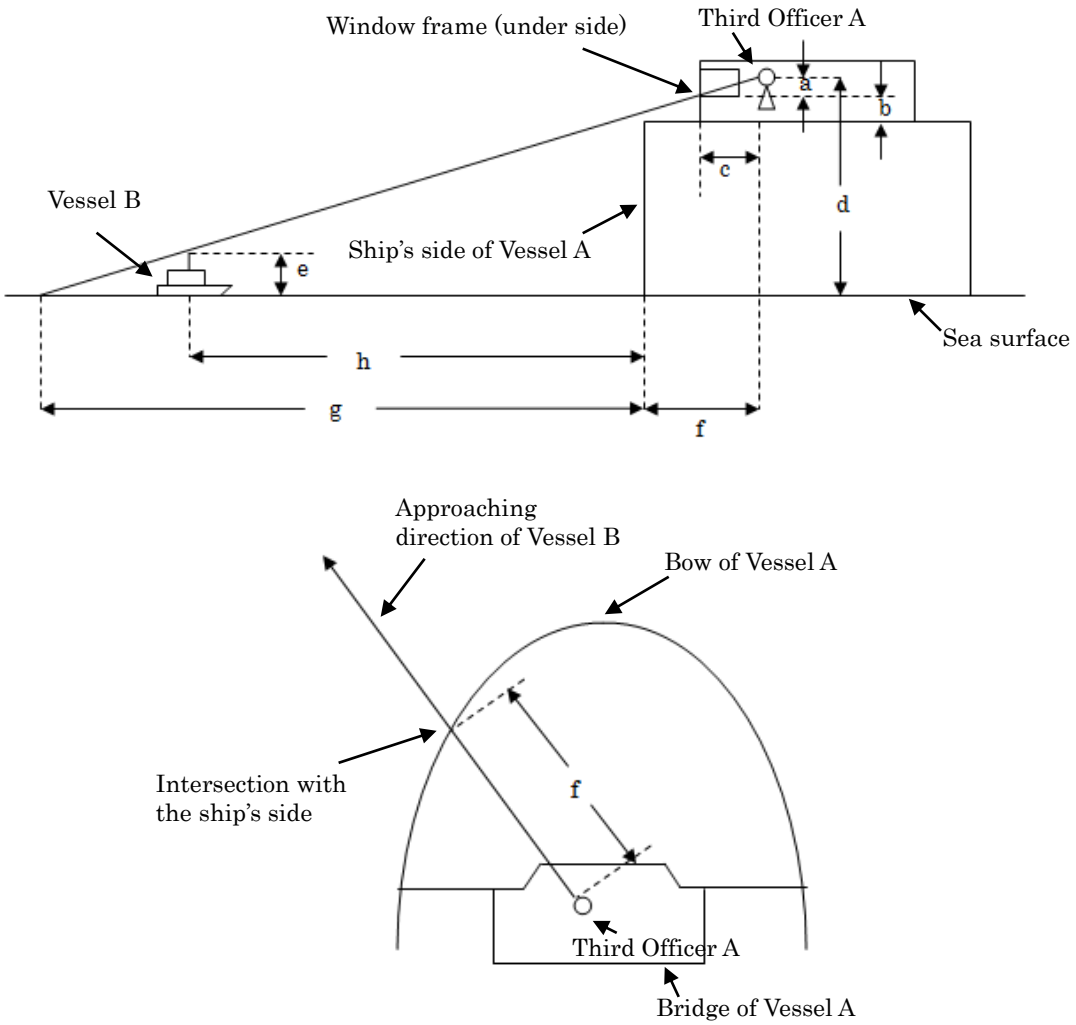
In consideration of 2.6.2, 2.6.3, 2.6.5, 3.2.4 and 3.2.5, it is probable that the situation was as follows.

(1) According to Figure 1, if one connects the positions of both ships with straight lines over five minute intervals from 08:00:12 to identify how each vessel saw the other vessel at each time interval, the direction of Vessel B as seen from Vessel A was approximately 028° (approximately 35° on the port bow of Vessel A) and the direction of Vessel A as seen from Vessel B was approximately 208° (approximately 83° on the starboard bow of Vessel B).

(2) When one in the position where Third Officer A was standing looked in the direction in which Vessel B was approaching, it was not possible to see the sea surface for a horizontal distance of up to about 175m from the ship's side as it was hidden by the window frame at the front of the bridge.

(3) When one in the position where Third Officer A was standing looked in the direction in which Vessel B was approaching, the horizontal distance from the ship's side when the mast top became hidden under the window frame at the front of the bridge and it became impossible to see was approximately 130m.

(4) Visibility at the time of the accident was 30m due to heavy showers of rain, and Vessel B had entered the blind area caused by the window frame at the front of the bridge before it could be sighted by Third Officer A. (See Figure 3.2)



a= approximately 0.54m: Vertical distance from viewpoint of Third Officer A to window frame (under side)

b= approximately 1.00m: Vertical distance from window frame (under side) to bridge floor

c= approximately 3.70m: Horizontal distance from viewpoint of Third Officer A to window frame

d= approximately 30m: Vertical distance from viewpoint of Third Officer A to sea surface

e= approximately 7m: Vertical distance from mast top of Vessel B to sea surface

f= approximately 29m: Horizontal distance from viewpoint of Third Officer A to the intersection between a straight line extended from viewpoint of Third Officer A in the approaching direction of Vessel B and the ship's side of Vessel A

g= approximately 175m: Horizontal distance from the ship's side to the point where the sea surface is hidden by the window frame and cannot be seen when Third Officer A looks in the approaching direction of Vessel B

h= approximately 130m: Horizontal distance from the ship's side to the point where the mast top of Vessel B is hidden by the window frame when Third Officer A looks in the approaching direction of Vessel B

Figure 3.2 Distance Which Vessel B Enters the Blind Area of the Bridge Window Frame of Vessel A

3.2.7 Analysis of Navigational Watch and Lookout

The situation was as follows in consideration of 2.1.3, 2.1.4, 2.6.4, 2.6.5, 2.9.1 and 3.2.6.

(1) Vessel A

1. It is probable that when Master A visited the bridge at around 07:30, because visibility was positive and there were no ships in the vicinity that would be obstacles, he deemed that the conditions stated on the Bridge Procedure Manual allowing for sole lookout duty had been fulfilled and assigned Third Officer A to sole lookout duty from 08:00.
2. It is probable that visibility became approximately 30m as Vessel A had encountered heavy showers of rain at around 09:34 while sailing by automatic pilot on a course of approximately 063° at a speed of approximately 15.8kn, and that Third Officer A stopped keeping watch by eyesight and began keeping watch by the No. 2 radar. It is probable that because other ships could not be recognized on the radar display due to the influence of rainfall and because there was no information displayed for other ships from the AIS on the electronic chart display, the Third Officer A thought there were no other ships around as they were sailing in the middle of the ocean, did not report to Master A that visibility was limited, and sailed ahead maintaining the same course and speed without conducting audio signals in restricted visibility.
3. Although it is highly probable that there was a sound different from the sound of rain outside the bridge of Vessel A at around 09:44, it is probable that Third Officer A did not notice any sound other than the sound of rain as no sounds other than voices were recorded by the microphones inside the bridge until about 10:00 after the rain started falling.
4. It is highly probable that the No. 2 radar screen did not display image of Vessel B between 08:00 to 10:00.
5. In consideration of 4. above, it is probable that Third Officer A did not notice Vessel B, and in consideration of 3. above, did also not notice the collision with Vessel B.
6. Although Master A did not go up to the bridge to take command or increase the number of seafarers keeping watch in accordance with the watch manning levels of the Bridge Procedure Manual as Third Officer A did not report that visibility had become limited due to heavy showers of rain, it is somewhat likely that Vessel B would have noticed Vessel A if Master A had received a report from Third Officer A and gone up to the bridge to conduct audio signals in restricted visibility.

   Accordingly, it is somewhat likely that the failure of Vessel A to conduct audio signals in restricted visibility was related to the occurrence of this accident.

(2) Vessel B

1. It is probable that Master B had ordinarily adopted a bridge watchkeeping system with eight shifts covered by the eight crew members other than the master, with each crew member serving as sole lookout on two-hour shifts; had not permitted crew members other than the chief engineer to operate navigational instruments; had instructed crew members to report to Master B if they found another ship; and had assigned Deckhand B to sole bridge duty from 08:00.
2. It is probable that Vessel B was sailing by automatic pilot on a course of approximately 125° at a speed of approximately 9.0kn while Deckhand B was on bridge duty in the watch room.
3. It is probable that when rain started falling at around 09:00, Deckhand B went down to the steering room and confirmed from the radar display one other boat around 60° on the starboard stern, 6M. However, it is probable that because there were no other ships

forward of the abeam, and because there is a blind area due to the bow construction if watch is conducted from a seated posture in the steering room, Deckhand B went up to the watch room, sat on the floor and leaned against the rear wall keeping watch with a blind area caused by a wall from approximately 45° port and starboard of the bow to behind, and sailed ahead maintaining the same course and speed.

4. While it is probable that Deckhand B did not conduct audio signals in restricted visibility as he was not permitted by Master B to operate navigational instruments including the ship whistle, because he had been instructed to report to Master B if he found another ship, it is somewhat likely that if he had reported to Master B upon recognizing another ship from the starboard stern and if Master B had gone up to the bridge to conduct audio signals in restricted visibility, Vessel A would have noticed Vessel B.

   Accordingly, it is somewhat likely that the failure of Vessel B to conduct audio signals in restricted visibility was related to the occurrence of this accident.

5. It is probable that Deckhand B did not notice Vessel A because he felt an impact and immediately after that, he fell into the water.

6. As described in 3. above, it is probable that Deckhand B had kept watch by eyesight in the watch room because of the blind area from the bow if watch was conducted from a seated posture in the steering room, and it is probable that Vessel A would have been sighted if she approached by approximately 30m (visibility at the time of the accident). However, it is somewhat likely that because Deckhand B conducted watch with a blind area caused by a wall from approximately 45° port and starboard of the bow to behind, he did not notice Vessel A as she approached from approximately 83° on the starboard bow that is the blind area caused by the wall.

   It is somewhat likely that while Deckhand B could see the display of the No. 1 radar from the watch room, because he was not permitted to make radar adjustments, it would have been difficult to detect the image of Vessel A as a result of the heavy showers of rain. However, it was not possible to determine how Vessel A was displayed as it was not clear how the radar was set.

(3) It is probable that the collision occurred because visibility for both ships was so limited by heavy showers of rain that it was not possible to promptly discover the other ship by keeping watch by eyesight; because Vessel B was not visible in the radar display of Vessel A due to the effect of rainfall; and because both ships sailed while the crew on watch duty did not notice the other ship. However, because Third Officer A checked the information of AIS, it is probable that had Vessel B been equipped with AIS and used it, Vessel A would have been able to understand the movements of Vessel B. Moreover, it is somewhat likely that Vessel B would have also been able to understand the movements of Vessel A.

Accordingly, it is somewhat likely that if Vessel B had been equipped with AIS and used it, both ships would have understood the movements of the other ship and would have been able to act to avoid the collision.

3.2.8 Analysis on Accident Occurrence

The analysis is as follows in consideration of 2.1.2(2)3., 2.1.4, 2.6.3, 2.6.5(2)3., 2.7, 3.2.4, 3.2.6, and 3.2.7

(1) It is probable that while Vessel A was sailing east-northeast by automatic pilot at a speed of

approximately 15.8kn off the southeast of Kinkazan, heavy showers of rain caused visibility to be limited at around 09:34 on June 23.

(2) It is probable that when the visibility of Third Officer A became limited by heavy showers of rain, he began keeping watch by the No. 2 radar. It is probable that because other ships could not be recognized on the radar display due to the influence of rainfall, and because there was no information displayed for other ships from the AIS on the electronic chart display, Third Officer A thought there were no other ships around as they were sailing in the middle of the ocean, did not report to Master A that visibility was restricted or conduct audio signals in restricted visibility, and sailed ahead maintaining the same course and speed.

(3) Although it is highly probable that there was a sound different from the sound of rain outside the bridge of Vessel A at around 09:44, it is probable that Third Officer A did not notice any sound other than the sound of rain until about 10:00 after the rain started falling, and it is highly probable that the No. 2 radar screen did not display image of Vessel B between 08:00 to 10:00.

(4) As stated in (3) above, it is probable that Vessel A and Vessel B collided because Third Office A did not notice Vessel B as Vessel B was not displayed in the display of the No. 2 radar.

(5) It is probable that while Vessel B was sailing southeast by automatic pilot at a speed of approximately 9.0kn in off the southeast of Kinkazan, rain started falling at around 09:00.

(6) It is probable that Deckhand B went down to the steering room but did not recognize another ship forward of the abeam from the radar display, and that because there was a blind area due to the bow construction if watch is conducted from a seated posture in the steering room, Deckhand B went up to the watch room, kept watch with a blind area caused by a wall from approximately 45° port and starboard of the bow to behind, and sailed ahead maintaining the same course and speed.

(7) It is probable that Deckhand B did not conduct audio signals in restricted visibility because he was not permitted by Master B to operate navigational instruments including the ship whistle.

(8) It is probable that Vessel A and Vessel B collided because Deckhand B did not notice Vessel A as he felt an impact and immediately after that, he fell into the water.

(9) As stated in (6) above, because Deckhand B kept watch by eyesight while there was a blind area caused by a wall in the watch room, it is somewhat likely that Deckhand B did not notice Vessel A as Vessel A approached from 83° starboard from the bow that is the blind area caused by the wall.

(10) It is somewhat likely that the failure of both vessels to conduct audio signals in restricted visibility was related to the occurrence of this accident.

3.3 Analysis of Rescue and Damage Mitigation Measures

It is probable that the situation was as follows in consideration of 2.1.4(2), 2.2, 2.3, 2.4, 2.6.5 (2), and 2.7.1 (3).

3.3.1 Survival of Crew of Vessel B

(1) Because the crew members of Vessel B excluding Master B and Deckhand B were in the crew's quarters which located at the backward of Vessel B and away from the starboard center of Vessel B that collided with the bow of Vessel A, they survived.

(2) Because the crew members that escaped from living quarters were able to inflate and board the life raft equipped at the port stern and because Deckhand B was able to swim and board the life raft despite having fallen in the water due to the impact, these crew members survived.

3.3.2 Prompt Rescue of Crew of Vessel B

(1) The crew member of Vessel B could be promptly rescued because Vessel C had accompanied Vessel B.

(2) It was possible to promptly move towards the confirmed position of Vessel B to rescue the crew members of Vessel B because the Japan Coast Guard that received the first distress signal from the EPIRB activated by Chief Engineer B contacted Company B, which communicated with Vessel C through the owner of Vessel C, and because Master C communicated with Master B at around 05:00 on the 23rd and confirmed that Vessel B was approximately 30M to the east of Vessel C.

(3) Because the Vessel C learned the position of the distress signal transmission by a satellite phone call from the Japan Coast Guard while sailing towards the position of Vessel B, it was possible to promptly sail towards the position of Vessel B and promptly discover the life raft.

(4) When Vessel C approached the position of the distress signal transmission, it was daytime, visibility was good, and the wave height was approximately 1m; therefore, it was possible to promptly discover and rescue the life raft.

4 CONCLUSIONS

4.1. Probable Causes

It is probable that the accident of collision between the vow of Vessel A and the starboard center of Vessel B occurred while Vessel A was heading east-northeast and Vessel B was heading southeast off the southeast of Kinkazan because in restricted visibility cause by a heavy shower of rain, Third Officer A and Deckhand B that took over bridge duty from another deckhand at around 08:00 did not notice the other vessel and sailed ahead maintaining the same course and speed.

It is probable that Third Officer A did not notice the other vessel (Vessel B) because the display of the No. 2 radar did not display Vessel B as a result of the rainfall.

It is somewhat likely that Deckhand B did not notice the other vessel (Vessel A) because he kept watch by sight while there was a blind area caused by a wall in the watch room and because Vessel A approached from 83° on the starboard bow that is the blind area caused by the wall.

It is somewhat likely that the failure of both vessels to conduct audio signals in restricted visibility was related to the occurrence of this accident.

4.2 Other Discovered Safety-Related Matters

(1) Although Third Officer A had signed the Master's Standing Orders that stated that the master shall be reported to if there is a rapid change in visibility, Third Officer A did not report to the master that visibility was restricted. It is somewhat likely that if Master A had been reported to, he would have increased the number of seafarers on watch and that efforts would have been made on Vessel A to understand the surrounding situation through means such as radar adjustments.

(2) It is somewhat likely that while Deckhand B had been instructed to report to Master B if other ships were seen, Master B was not reported to because no ships were recognized ahead of the abeam. It is, however, somewhat likely that because another ship had been recognized behind the starboard stern, if Master B had been reported to, he would have gone up to the bridge and made efforts to understand the surrounding situation through means such as radar adjustments.

5. SAFETY ACTIONS

It is probable that the accident of collision between the vow of Vessel A and the starboard center of Vessel B occurred while Vessel A was heading east-northeast and Vessel B was heading southeast off the southeast of Kinkazan because in restricted visibility caused by a heavy shower of rain, Third Officer A and Deckhand B that took over bridge duty from another deckhand at around 08:00 did not notice the other vessel and sailed ahead maintaining the same course and speed.

It is probable that Third Officer A did not notice the other ship (Vessel B) because the display of the No. 2 radar did not display Vessel B as a result of the rainfall.

It is somewhat likely that Deckhand B did not notice the other ship (Vessel A) because he kept watch by sight while there was a blind area caused by a wall in the watch room and because Vessel A approached from 83° on the starboard bow that is the blind area caused by the wall.

It is somewhat likely that the failure of both ships to conduct audio signals in restricted visibility was related to the occurrence of this accident.

Although Third Officer A had signed the MASTER'S STANDING ORDERS that stated that the master shall be reported to if there is a rapid change in visibility, Third Officer A did not report to the master that visibility was limited. It is somewhat likely that if Master A had been reported to, he would have increased the number of seafarers on watch and that efforts would have been made on Vessel A to understand the surrounding situation through means such as radar adjustments.

It is somewhat likely that while Deckhand B had been instructed to report to Master B if other ships were seen, Master B was not reported to because no ships were recognized ahead of the abeam. It is, however, somewhat likely that because another ship had been recognized behind the starboard stern, if Master B had been reported to, he would have gone up to the bridge and made efforts to understand the surrounding situation through means such as radar adjustments.

It is probable that the collision occurred because visibility was so restricted by heavy showers of rain that it was not possible to notice the other ship while keeping watch by eyesight; because Vessel B was not visible in the radar display of Vessel A due to the effect of rainfall; and because both ships sailed while the seafarer on duty did not notice the other ship. However, because Third Officer A confirmed other ship information using AIS, it is probable that had Vessel B been equipped with AIS and used it, Vessel A would have been able to understand the movements of Vessel B. Moreover, it is somewhat likely that Vessel B would have also been able to understand the movements of Vessel A.

Accordingly, it is somewhat likely that if Vessel B had been equipped with AIS and used it, both ships would have understood the movements of the other ship and would have been able to act to avoid the collision.

Therefore, in order to prevent the recurrence of similar accidents, it is essential for Company A to ensure their ship crew members understand the necessity to increase the number of seafarers in accordance with the watch manning levels of the Bridge Procedure Manual if it is discovered that visibility is restricted and to conduct audio signals. It is necessary for Company B to establish a proper system for their ships to ensure that the master is reported to and that the number of seafarers on duty is increased when visibility is restricted and to conduct audio signals, and it is recommended that Company B install AIS.

It is also recommended that the spread of AIS among fishing vessels be promoted even further.

5.1 Safety Actions Taken

5.1.1 Actions Taken by Company A

Company A took the following actions after the accident occurred.

1. Onboard investigation carried out by company management.
2. Experience feed-back share with all fleet based on investigation result.
3. Fleet has been informed of the accident and instructed to train and verify that all navigators are familiar with on-board navigation equipment and the limitations of navigational equipment.
4. Included in agenda for senior officer pre-joining briefing.
5. Included in agenda for officer conference during 2013/2014.

5.1.2 Actions Taken by Company B

Company B took the following actions after the accident occurred.

1. Have two people conduct bridge duty.
2. When navigating near the routes of large ships, have one of the two people on duty be a Japanese person (the same applies when entering and exiting ports).
3. Do not turn off the radar alarm.
4. When navigating near the routes of large ships, make contact with other ships and exchange information.
5. Replace radars that have been used for ten years or more as a general rule, and consider replacement even before ten years have passed if it becomes difficult to see the display.
6. Make calls for caution when passing another ship.
7. When visiting their ships at ports, gather the entire crew and provide guidance to ensure that crew members do not fall asleep.

5.2 Safety Action Required

(1) Company A

It is necessary to ensure their ship crew members understand the necessity to increase the number of personnel in accordance with the watch manning levels of the Bridge Procedure Manual if it is discovered that visibility is limited and to conduct audio signals while there are visibility limits.

(2) Company B

1. It is necessary to establish a proper system for their ships to ensure that the master is reported to and that the number of personnel on bridge duty is increased when visibility is limited and to conduct audio signals while there are visibility limits.
2. It is recommended that AIS be installed on their ships.

Figure 1 Estimated Vessel Tracks

The figure below shows straight lines to connect the positions of Vessel A according to her VDR over five minute intervals from 08:00:12 and the estimated positions of Vessel B during the same period.

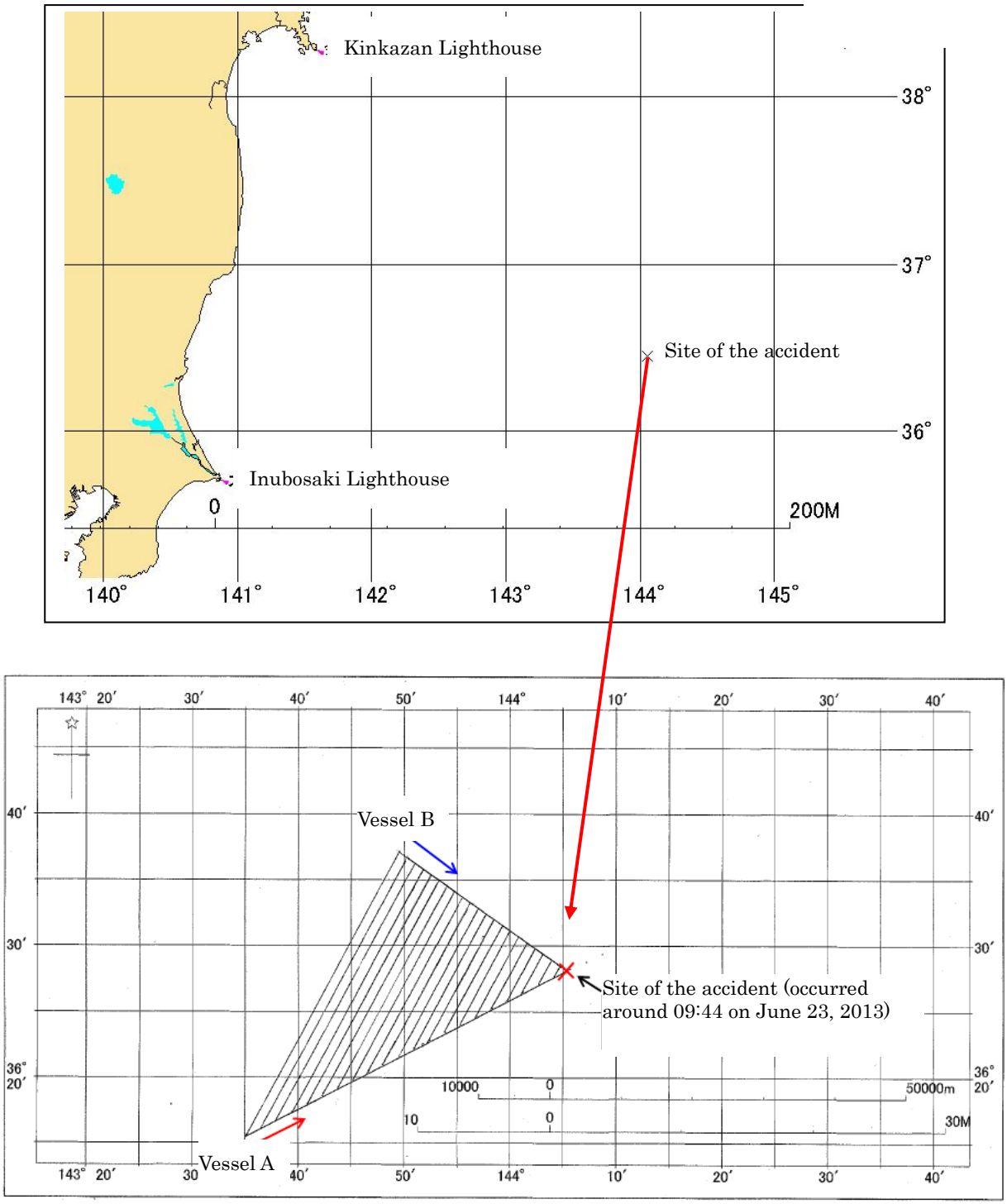
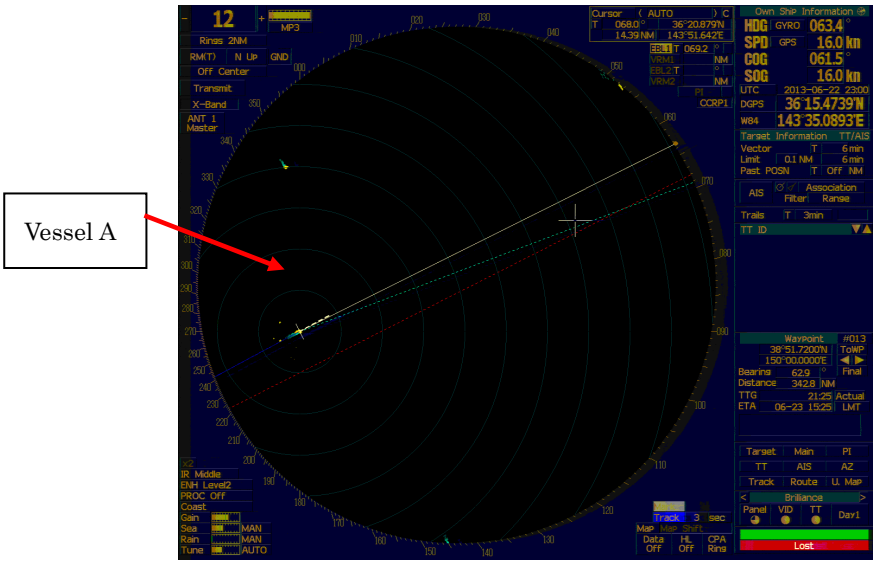


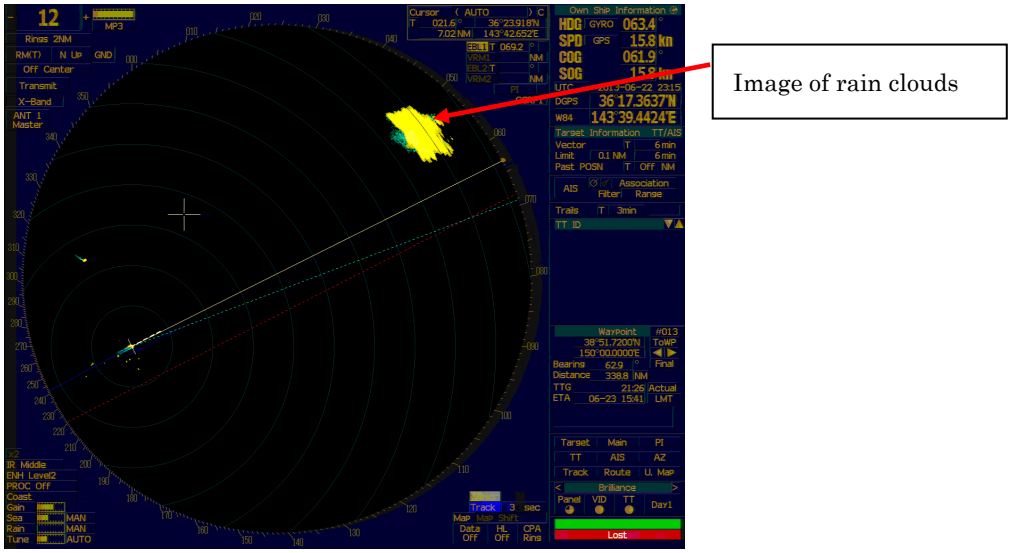
Figure 2 Radar Image for Approximately 15 Minute Intervals from 08:00 to 10:00 on June 23

(1) Radar Image for 08:00 on June 23



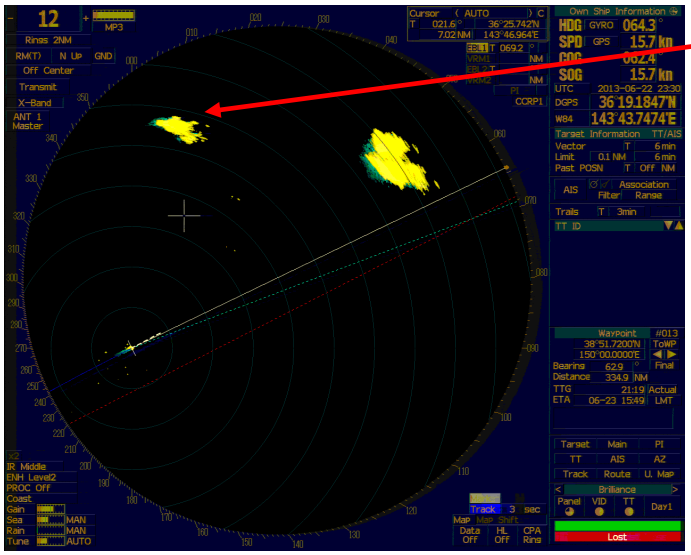
When Third Officer A took over bridge duty from chief officer, there were no rain clouds ahead of Vessel A.

(2) Radar Image for 08:15 on June 23



Rain clouds occurred approximately 17M ahead of the port side of Vessel A. Third Officer A began sole lookout duty at around this time.

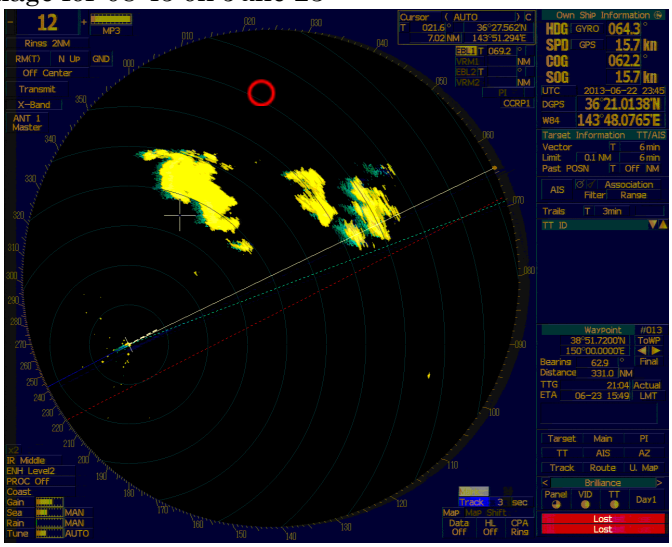
(3) Radar Image for 08:30 on June 23



Rain clouds newly occurred approximately 50° to the port side of Vessel A.

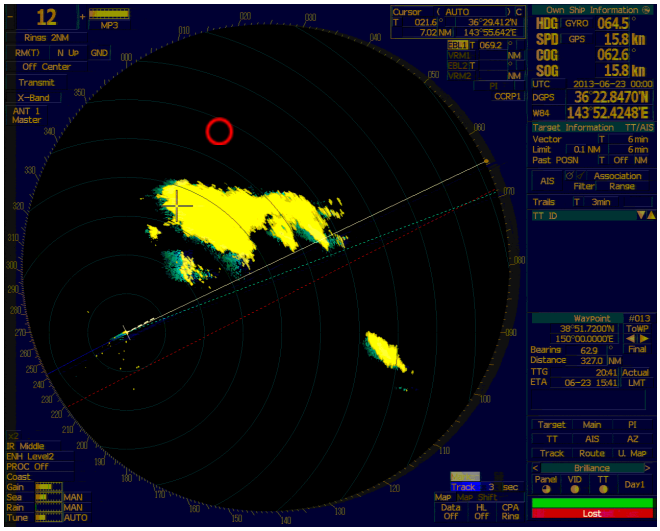
The red circles on the radar images in (4) to (8) below indicate the position of Vessel B as estimated from the VDR data of Vessel A and the automatic pilot course and speed of Vessel B.

(4) Radar Image for 08:45 on June 23



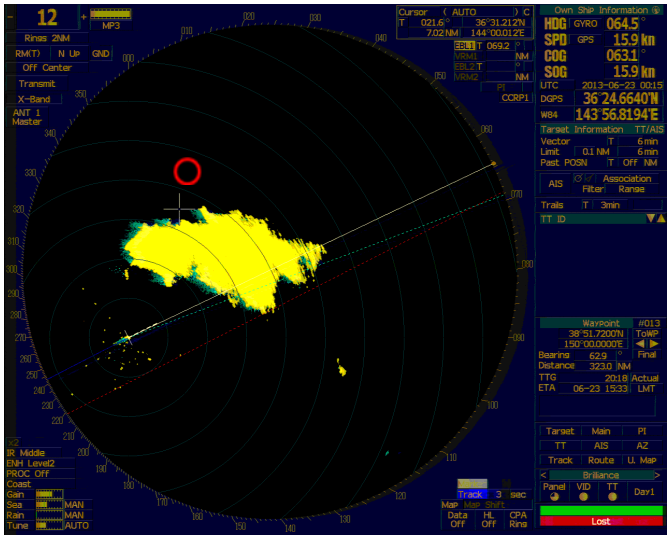
Two rain clouds approached the front of Vessel A while developing. Vessel B is not displayed in the image.

(5) Radar Image for 09:00 on June 23



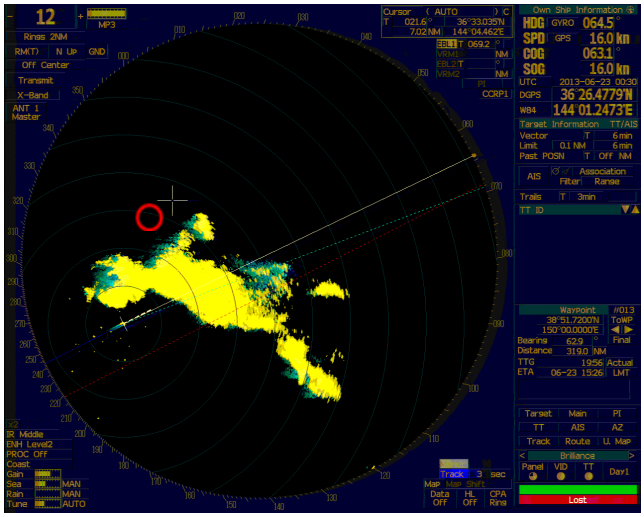
The two rain clouds to the front of Vessel A came together and approached the vessel. Vessel B is not displayed in the image.

(6) Radar Image for 09:15 on June 23



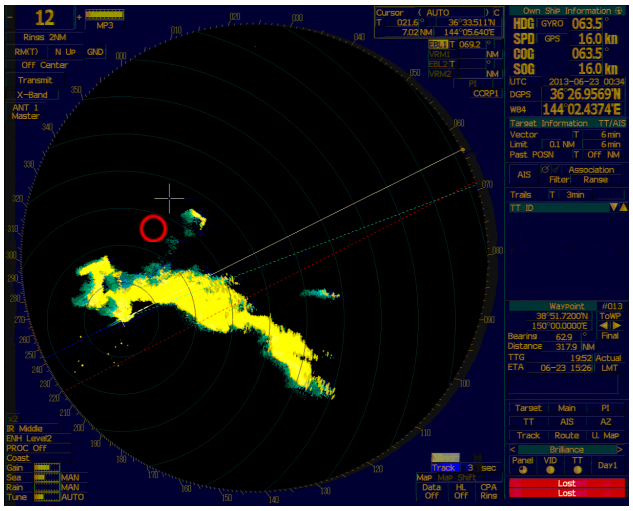
The rain cloud approached while developing. Third Officer A recognized that a thick rain cloud was approaching ahead of the port side. Vessel B is not displayed in the image.

(7) Radar Image for 09:30 on June 23



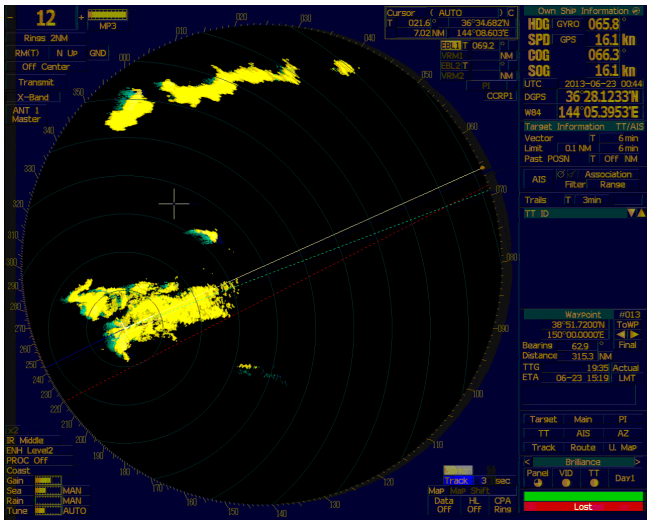
The rain cloud approached while developing. Third Officer A recognized that a thick rain cloud was approaching ahead of the port side. Vessel B is not displayed in the image.

(8) Radar Image for 09:34 on June 23



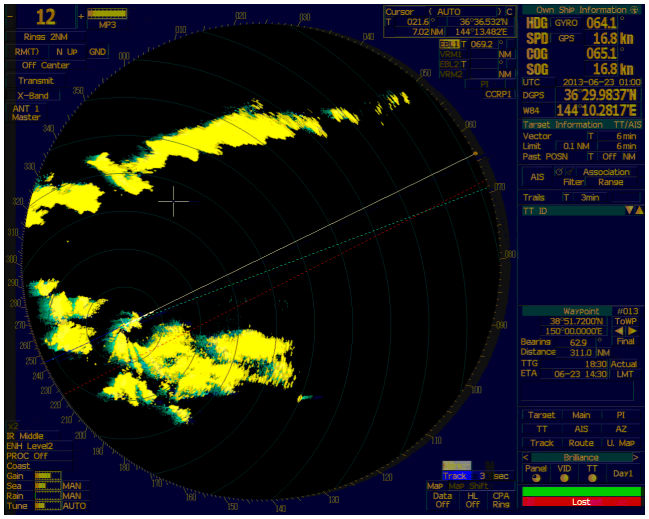
The VDR microphone outside the bridge started to record the sound of rain falling on the deck of Vessel A at around 09:34. While Third Officer A began to keep watch using the No. 2 radar at that time, no other ships were visible on the radar display.

(9) Radar Image for 09:44 on June 23



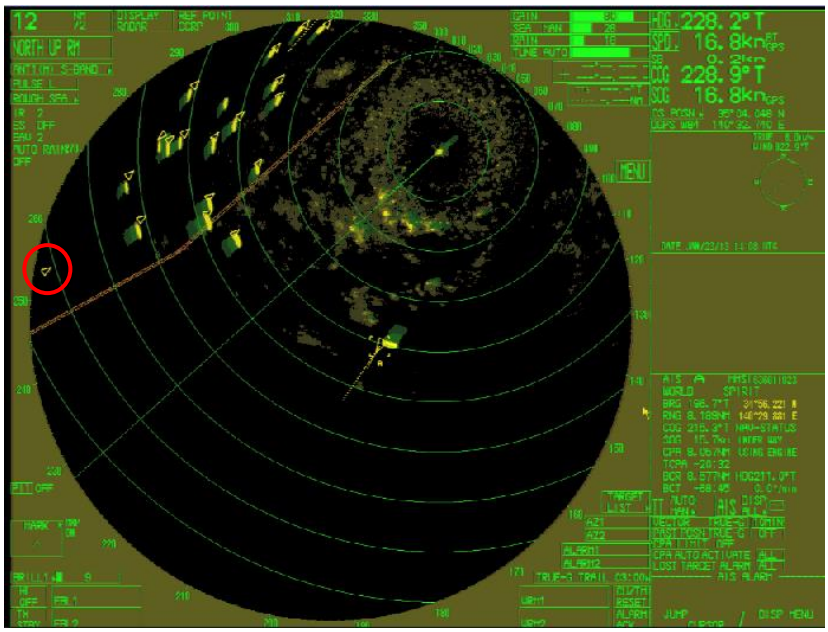
While the VDR microphone outside the bridge recorded a loud sound at around 09:44, no loud sound was recorded by the microphone inside the bridge.

(10) Radar Image for 10:00 on June 23



Vessel A moved out of the rain cloud as 10:00.

Figure 3 Reference: Position of Other Ships Displayed with AIS



While Figure 3 is from an accident investigation other than this accident, it is an example of the position of other ships' images on the radar display with AIS.

The triangle marks on the radar display are the positions of other ships obtained with AIS.
The display of yellow bars near the triangle marks are the positions of other ships obtained with the radar.

The ship inside the red circle is a ship position that was displayed by AIS before it was displayed by radar.