

MA2021-4

**MARINE ACCIDENT
INVESTIGATION REPORT**

April 22, 2021



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

TAKEDA Nobuo
Chairperson
Japan Transport Safety Board

Note:

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

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name: Cargo Ship AZUL CHALLENGE

IMO number: 9271559

Gross tonnage: 101,933 tons

Accident type: Grounding

Date and time: Around 09:28, July 22, 2019 (local time, UTC+9 hours)

Location: Shallows on the western side of Nakato Shima, Imabari City, Ehime Prefecture

Around 180 m at true bearing 017° from Nakato Shima Lighthouse
(approximately 34°07.1'N, 133°00.1'E)

March 17, 2021

Adopted by the Japan Transport Safety Board

Chairperson TAKEDA Nobuo

Member SATO Yuji

Member TAMURA Kenkichi

Member KAKISHIMA Yoshiko

Member OKAMOTO Makiko

SYNOPSIS

< Summary of the Accident >

The cargo ship AZUL CHALLENGE, with a master and 20 other crew members as well as a pilot aboard, proceeded east in the Seto Inland Sea and then was proceeding south in the Kurushima Kaikyo Naka Suido off of Uma Shima, Imabari City, Ehime Prefecture, for Fukuyama Port, Hiroshima Prefecture, when she ran aground on shallows on the western side of Nakato Shima, Imabari City, at around 09:28 on July 22, 2019.

The vessel sustained dents to the port-side plating shell of her No. 1 to 7 ballast tanks and other damage. However, there were no fatalities or injuries.

< Probable Causes >

It is probable that the accident occurred when, as the Vessel made a turn to starboard toward the Naka Suido after the tide turned to the south in the Kurushima Kaikyo Traffic Route, which is the most difficult point encountered when navigating the strait, the Vessel's turn slowed and, consequently, she was pushed by the current, crossed the eastern edge of the traffic route and went outside the traffic route, approached the west side of Nakato Shima with her starboard turn still slowing, and ran aground on shallows on the west side of Nakato Shima.

It is probable that the Vessel's turn slowed because, in maneuvering away from Uma Shima, Pilot A decided to execute course indication-based ship maneuvering that differed from rudder angle indication-based ship maneuvering guidelines.

It is probable that the Vessel approached the west side of Nakato Shima in a starboard turn that continued to slow because, even after the Vessel went outside the traffic route, Pilot A continued to engage in ship maneuvering by giving course indications while checking the Vessel's position by visual means only, and because Quartermaster A did not set large rudder angles for the reason that he was given course indications.

It is somewhat likely that Master A's thinking that he had no choice but to trust Pilot A's piloting abilities and entrust ship maneuvering to him, as it was Master A's first time navigating through the Kurushima Kaikyo's Naka Suido, where unique tidal currents exist, in the eastbound direction, and that Master A's not quickly giving ship maneuvering advice to Pilot A and not taking over conning the Vessel without hesitation as specified in the Safety Management System Manual even after the Vessel left the traffic route contributed to the accident's occurrence.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

The cargo ship AZUL CHALLENGE, with a master and 20 other crew members as well as a pilot aboard, proceeded east in the Seto Inland Sea and then was proceeding south in the Kurushima Kaikyo Naka Suido off of Uma Shima, Imabari City, Ehime Prefecture, for Fukuyama Port, Hiroshima Prefecture, when she ran aground on shallows on the western side of Nakato Shima, Imabari City, at around 09:28 on July 22, 2019.

The vessel sustained dents to the port-side plating shell of her No. 1 to 7 ballast tanks and other damage. However, there were no fatalities or injuries.

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 1, 2019.

1.2.2 Collection of Evidence

August 7 to 9, 28, September 10,11, On-site investigations and interviews
November 26 to 28, 2019 and
January 23, 2020:
August 2, 2019 and July 8, 2020: Collection of questionnaires

1.2.3 Comments from Parties Relevant to the Cause

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

1.2.4 Comments from Flag State

Comments on the draft report were invited from the flag state of AZUL CHALLENGE.

2 FACTUAL INFORMATION

2.1 Events Leading to the Accident

2.1.1 The Navigation Track according to the Automatic Identification System

According to the records of the Automatic Identification System (AIS)¹ data (hereinafter referred to as “the AIS record”) received by a data company in Japan, the navigation tracks of AZUL CHALLENGE (hereinafter referred to as “the Vessel”) from around 09:21 to 09:28 on July 22, 2019, were as shown in Table 1 below.

Table 1 AIS Record (excerpt)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground* ² (knots [kn])
	Latitude (N) (° ′ ″)	Longitude (E) (° ′ ″)			
09:21:03	34-08-22.5	132-59-34.2	122.3	127	12.9
09:21:23	34-08-20.1	132-59-38.4	124.6	128	12.9
09:21:44	34-08-17.7	132-59-42.7	123.7	131	12.9
09:22:03	34-08-15.2	132-59-47.0	125.4	134	12.9
09:22:23	34-08-12.7	132-59-51.2	126.6	138	12.9
09:22:43	34-08-10.1	132-59-55.3	127.6	145	12.9
09:23:07	34-08-06.9	132-59-59.7	132.9	154	12.6
09:23:19	34-08-04.9	133-00-01.9	137.2	158	12.4
09:23:43	34-08-01.0	133-00-05.3	146.1	164	11.9
09:24:13	34-07-56.0	133-00-08.5	153.4	170	11.6
09:24:54	34-07-48.5	133-00-11.9	163.0	180	11.3
09:25:13	34-07-45.2	133-00-12.7	169.9	183	11.1
09:25:33	34-07-41.6	133-00-13.2	173.6	186	11.1
09:26:03	34-07-36.0	133-00-13.4	182.4	192	11.0
09:26:24	34-07-32.1	133-00-13.1	183.6	195	11.1
09:26:44	34-07-28.4	133-00-12.4	189.9	196	11.0
09:27:03	34-07-25.0	133-00-11.8	187.8	198	11.1
09:27:24	34-07-21.3	133-00-11.0	190.2	201	11.1
09:28:03	34-07-13.5	133-00-09.3	191.9	211	11.3
09:28:24	34-07-10.1	133-00-08.5	191.4	226	9.8
09:28:30	34-07-09.2	133-00-08.2	194.7	231	8.5

*: Times are Japan Standard Time and the Vessel’s position is the position of the GPS antenna installed above the bridge. The location of the GPS antenna was 259 m from the bow, 41 m from the stern, 30 m from the port side, and 20 m from the starboard side. Course over the ground and heading are true bearings (hereinafter the same).

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

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

2.1.2 Information on Voice Data Recorders

(1) Voice communication, etc., on the bridge

According to the records of the voyage data recorders³ (hereinafter referred to as “VDR”) of the Vessel, main voice information that was recorded on microphones installed on the bridge and bridge wings between 09:21 and 09:29 on July 22 was as shown in Table 2. Utterances in Tagalog are denoted in italics and provided with an English translation..

Table 2 Voice Information (Excerpt)

Time (HH:MM:SS)	Main Voice Communication, etc.
9:21:49	Pilot* ⁴ who was providing pilotage at the time of the accident (hereinafter referred to as “Pilot A”): 146. The quartermaster on watch (hereinafter “Quartermaster A”) 146.
9:22:16	Pilot A: Starboard 15. Quartermaster A: Starboard 15.
9:23:00	Pilot A: Ease to 10. Quartermaster A: Ease to 10.
9:23:10	Quartermaster A: Ease to 10 now. Pilot A: Thank you.
9:23:20	Pilot A: Midship. Quartermaster A: Midship.
9:23:29	Quartermaster A: Roger, midship sir. Pilot A: Good.
9:24:05	Pilot A: 177. Quartermaster A: 177.
9:24:18	Pilot A: 180. Quartermaster A: 180.
9:24:34	Pilot A: 184. Quartermaster A: 184.
9:25:05	Pilot A: 187. Quartermaster A: 187. Pilot A: OK.
9:25:08	Pilot A: 187 Steady. Quartermaster A: 187 Steady.
9:25:48	Pilot A: (calmly) 195. Quartermaster A: 195.
9:26:04	Pilot A: 195. Quartermaster A: 195.
9:26:26	Pilot A: (more quickly) 195. Quartermaster A: 195. Master of the vessel (hereinafter referred to as “Master A”): (in Tagalog) <i>I speak i lan na cio.</i> (After saying Quartermaster A’s nickname) <i>I speak i lan na cio.</i> (How much now? I want to know course.) you checking.
9:26:32	Quartermaster A: 196, sir. 196, sir.
9:26:39	Pilot A: No good.
9:26:42	Pilot A: Starboard 10.
9:26:48	Pilot A: 199. Quartermaster A: 199.
9:26:50	Kurushima Kaikyo Vessel Traffic Service Center (hereinafter referred to as

³ A “Voyage Data Recorder” (VDR) records the position, movements, voice information of the bridge, AIS (see separate footnote) information on nearby vessels, radar screen information, and other information pertaining to the vessel on which it is installed. It is used for the purpose of investigating maritime accidents and the like.

⁴ “Pilot” refers to a person who has been issued a pilot’s certificate for a certain pilot district based on the Pilotage Act.

	<p>“Kurushima MARTIS”): AZUL CHALLENGE AZUL CHALLENGE Kurushima MARTIS Pilot A: Kurushima MARTIS We are now on the right. Please watch out for us. Kurushima MARTIS: Roger.</p>
9:27:05	<p>Pilot A: No good. Change to another one. Philippine. Master A: (to the pilot) No, sir.</p>
9:27:16	<p>Master A: No, sir. 200.</p>
9:27:17	<p>Pilot A: No. Starboard 10. Quartermaster A: Starboard 10. (To Pilot A) Starboard 10, sir.</p>
9:27:23	<p>Pilot A: Starboard 15.</p>
9:27:27	<p>Pilot A: Call another man.</p>
9:27:33	<p>Pilot A: Quickly.</p>
9:27:36	<p>Pilot A: Starboard 15. Quartermaster A: Starboard 15.</p>
9:27:43	<p>Pilot A: Midship. Quartermaster A: Midship. Deck trainee (hereinafter referred to as “Trainee A”): (calling another quartermaster over the ship’s telephone) Good morning.</p>
9:27:56	<p>Third officer (hereinafter referred to as “Navigation Officer A”): More to starboard, pilot.</p>
9:27:58	<p>Quartermaster A: Starboard 10.</p>
9:28:00	<p>Pilot A: Midship.</p>
9:28:11	<p>Master A: More to starboard, pilot. More to starboard.</p>
9:28:15	<p>Pilot A: Port 20. Quartermaster A: Port 20.</p>
9:28:16	<p>Pilot A: Hard port. Quartermaster A: Hard port.</p>
	<p>Sound of whistle</p>
9:28:22	<p>Electronic sound of vibration</p>
9:28:28	<p>Master A: Ah. Hard port.</p>
9:28:37	<p>Pilot A: Starboard side shallow water. Master A: No good.</p>
9:28:42	<p>Master A: Hard port now.</p>
9:28:49	<p>Kurushima MARTIS: SOUTHERN STAR (cargo ship following the Vessel) SOUTHERN STAR, Kurushima MARTIS. Do you read me? Pilot A: Go ahead. We’re hard port now. Kurushima MARTIS: Roger. SOUTHERN STAR, 14 please. Pilot A: Roger. 14, roger.</p>
9:29:05	<p>Pilot A: Kurushima MARTIS, AZUL CHALLENGE. Go ahead. Kurushima MARTIS: Uh,... Are you alright? Pilot A: Yes. We are now on the left. Kurushima MARTIS: Roger. Wait, you are proceeding without contact, right? Pilot A: Well, we had a bit of a shock. Kurushima MARTIS: Roger. Let’s see. The first thing to do is pass through the Naka Suido safely.</p>

(2) Records concerning operation of the main engine

According to engine telegraph recorder, the record of operation of the main engine remote control system between 08:35 and 09:40 is as shown in Table 3.

Table 3 Operation of the Main Engine Remote Control System (Excerpt)

Time	Operation of the main engine remote control system
08:53.5	Dead slow ahead → Stop engine
08:54.5 to 08:56.5	Dead slow ahead - Slow ahead - Half ahead
08:58.0 to 09:07.0	Full ahead - Navigation full ahead
09:14.5	Full ahead
09:40.5	Half ahead

(3) Radar images

Radar images are recorded as still images in the VDR every 15 seconds. Images of the following cargo ship SOUTHERN STAR (overall length of 199.9 m) navigating the Kurushima Kaikyo Traffic Route were recorded from around 09:21. (See Figure 1)

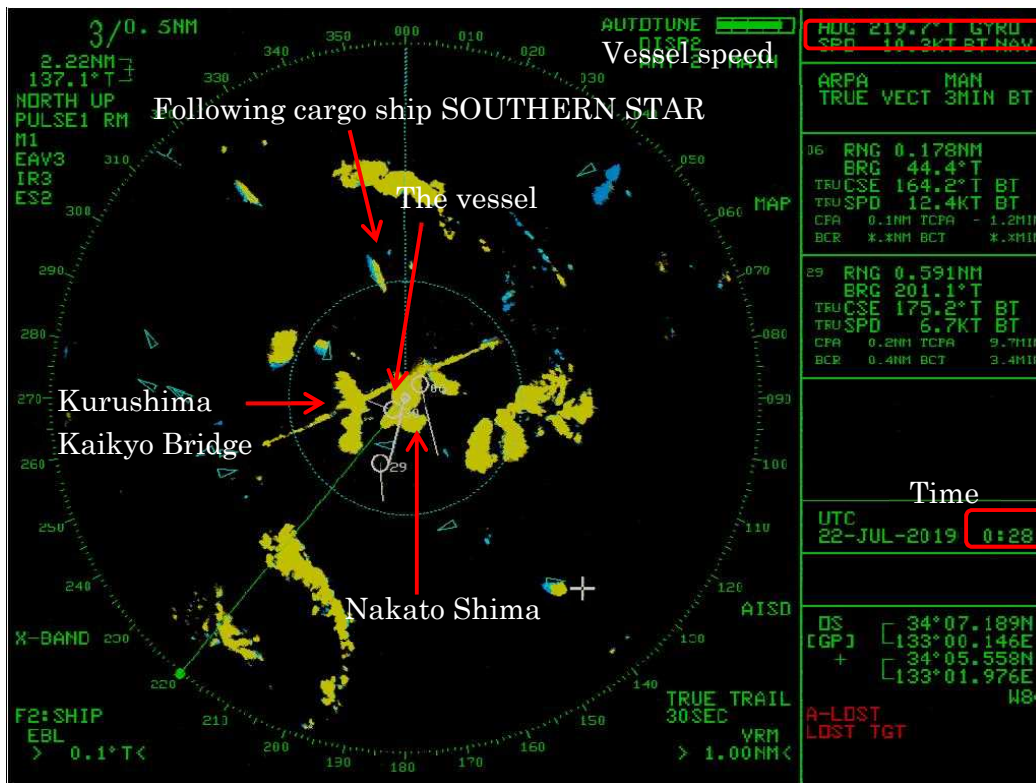


Figure 1 Radar Image (around 09:28)

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

According to the replies to the statements of Master A, Navigation Officer A, Quartermaster A, Trainee A, and Pilot A as well as the replies to the questionnaire of Mizuho Sangyo Co., Ltd., which manages the Vessel's hull and manning (hereinafter referred to as "Company A") and the Licensed Inland Sea Pilots' Association, the events leading up to the accident and circumstances of grounding were as follows.

The Vessel, with Master A and 20 other crew members aboard (all nationals of the Republic of the Philippines), departed Teluk Rubiah, Malaysia, on July 13, 2019, proceeded to Villanueva in the Republic of the Philippines, and then arrived at the Sekizaki Pilot Station on July 22 and took Pilot A on board.

Master A remembered when Pilot A came aboard that he had been anxious when Pilot A provided pilotage from the Fukuyama Anchorage up to arriving at Fukuyama in the past.

Master A also felt anxious because Pilot A's hands were shaking from old age. However, Master A entrusted pilotage to Pilot A to without conveying his anxiety.

At around 02:30 on July 22, the Vessel began proceeding east toward Fukuyama Port with Pilot A providing pilotage and Master A remaining on the bridge in preparation for navigating in the Seto Inland Sea.

Pilot A placed a Portable Pilot Unit ^{*5} (hereinafter referred to as "PPU") at the front of the bridge, and when he confirmed the ship maneuvering method and the Vessel's particulars while looking at a Pilot Information Card with Master A, he informed Master A that he would navigate through the Naka Suido of the Kurushima Kaikyo Traffic Route (hereinafter referred to as "Naka Suido") and that he would approach the west side of Nakato Shima because ship maneuvering becomes difficult due to swirling currents that occur on the Uma Shima side when approaching Uma Shima in Naka Suido.

Master A had passed through the Nishi Suido of the Kurushima Kaikyo Traffic Route (hereinafter referred to as "Nishi Suido") going westbound four times before but this was the first time he would navigate through Kurushima Kaikyo's Naka Suido going eastbound, and therefore he initially thought they would navigate through the Nishi Suido.

At around 08:00, the Vessel was navigating in the sea area to the west of Kurushima Kaikyo with Navigation Officer A and Trainee A stationed on lookout and Quartermaster A stationed at the helm.

While proceeding east off to the north of Uma Shima, Imabari City, the Vessel began making a starboard turn toward Kurushima Kaikyo's Naka Suido at around 09:21. Pilot A ordered rudder amidships at around 09:23, after which he decided to try ship maneuvering using ship maneuvering commands that differed from those in ship maneuvering guidelines prepared by the Licensed Inland Sea Pilots' Association. He gave ship maneuvering commands that indicated the course rather than the rudder angle (hereafter referred to as "course indication") and, at around 09:24, navigated on the eastern side outside of the Kurushima Kaikyo Traffic Route.

Because the Vessel would approach the west side of Nakato Shima, Pilot A was watching the area near Kurushima Kaikyo Bridge with binoculars while considering ship maneuvering methods in the narrowest part, thinking that he could pass through the narrowest part while riding the tidal current toward the southern area by setting the rudder amidships and engaging in ship maneuvering that avoided adding turning moment of inertia. He continued giving instructions in small course adjustments and navigating without noticing that the Vessel had been pushed outside of the traffic route by the current.

Pilot A was concentrating passing the narrowest part without adding turning momentum as he was also observing conditions around the narrow seaway, and he was checking the Vessel's position by visual means only.

At around 09:26, Pilot A noticed from the surrounding situation that the Vessel was outside of the traffic route when he ordered a course of 195°. However, he thought that he could navigate near Nakato Shima if he ordered small course adjustments, and therefore he continued issuing course indications.

At around 09:26:50, Pilot A received a VHF communication from Kurushima MARTIS indicating the Vessel was outside of the Kurushima Kaikyo Traffic Route. However, he

^{*5} Portable Pilot Unit (PPU) refers to an electronic device that displays information necessary for pilotage services. It consists of a position information receiver and laptop computer containing electronic sea charts.

continued to think that he could navigate safely by approaching Nakato Shima.

Master A had doubts about the fact that the Vessel was outside of the Kurushima Kaikyo Traffic Route and approaching the western side of Nakato Shima. Although he became anxious about the situation and checked the heading with Quartermaster A, he entrusted ship maneuvering to Pilot A.

Quartermaster A operated the rudder in accordance with Pilot A's ship maneuvering commands while responding to Master A's request to confirm heading.

At around 09:27, Pilot A asked for Quartermaster A to be replaced by another quartermaster. However, Master A thought that changing quartermasters in a tense situation was not an instruction normally given and therefore he thought Pilot A was panicking. Master A gave ship maneuvering advice to Pilot A but he did not take over conning the Vessel himself.

Navigation Officer A sensed danger because the Vessel was navigating toward Naka Shima and he suggested a starboard turn to Pilot A. Master A followed by also demanding that Pilot A turn to starboard.

Pilot A ordered the rudder set amidships and then hard to port to keep the Vessel's stern away from shallows to the west of Nakato Shima. However, immediately after Quartermaster A set the rudder hard to port, the Vessel's bottom ran aground on the west side of Nakato Island at around 09:28.

The Vessel rode over the shallows on the west side of Nakato Shima with her rudder still to port and passed the narrowest part of Naka Suido, after which Pilot A admitted to running aground when asked about grounding by Kurushima MARTIS via VHF. The Vessel headed toward the southern side of the Kurushima Kaikyo Traffic Route under instructions by Kurushima MARTIS with Pilot A still providing pilotage and, at around 10:15, anchored to check for damage and undergo inspection by Japan Coast Guard.

The date and time of occurrence of the accident was at around 09:28 on July 22, 2019, and the location was around 180 m at 017° true bearing from Nakato Shima Lighthouse.

(See Attached Figure 1 "Navigation Track (Overall View)" and Attached Figure 2 "Navigation Track (Around Kurushima Kaikyo)")

2.2 Injuries to Persons

According to the statement of Master A, there were no fatalities or injuries.

2.3 Damage to Vessel

According to onsite investigations, the repair dock's damage plan, and reply to the questionnaire of Company A (underwater investigation report), the Vessel sustained dents to the port plating shell of ballast tanks No. 1 to 7, deformation of the port-side bilge keel, and holes to the ballast tanks' port plating shell in three places and consequently underwent plating shell replacement. (See Figure 2 and Figure 3)

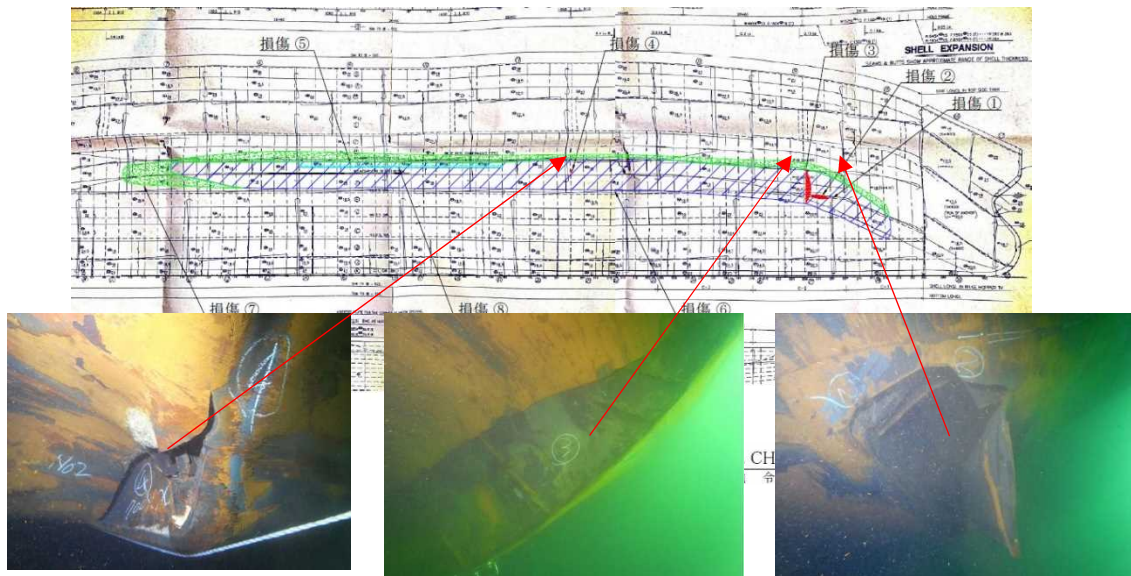


Figure 2 Underwater Investigation Report (Excerpt)

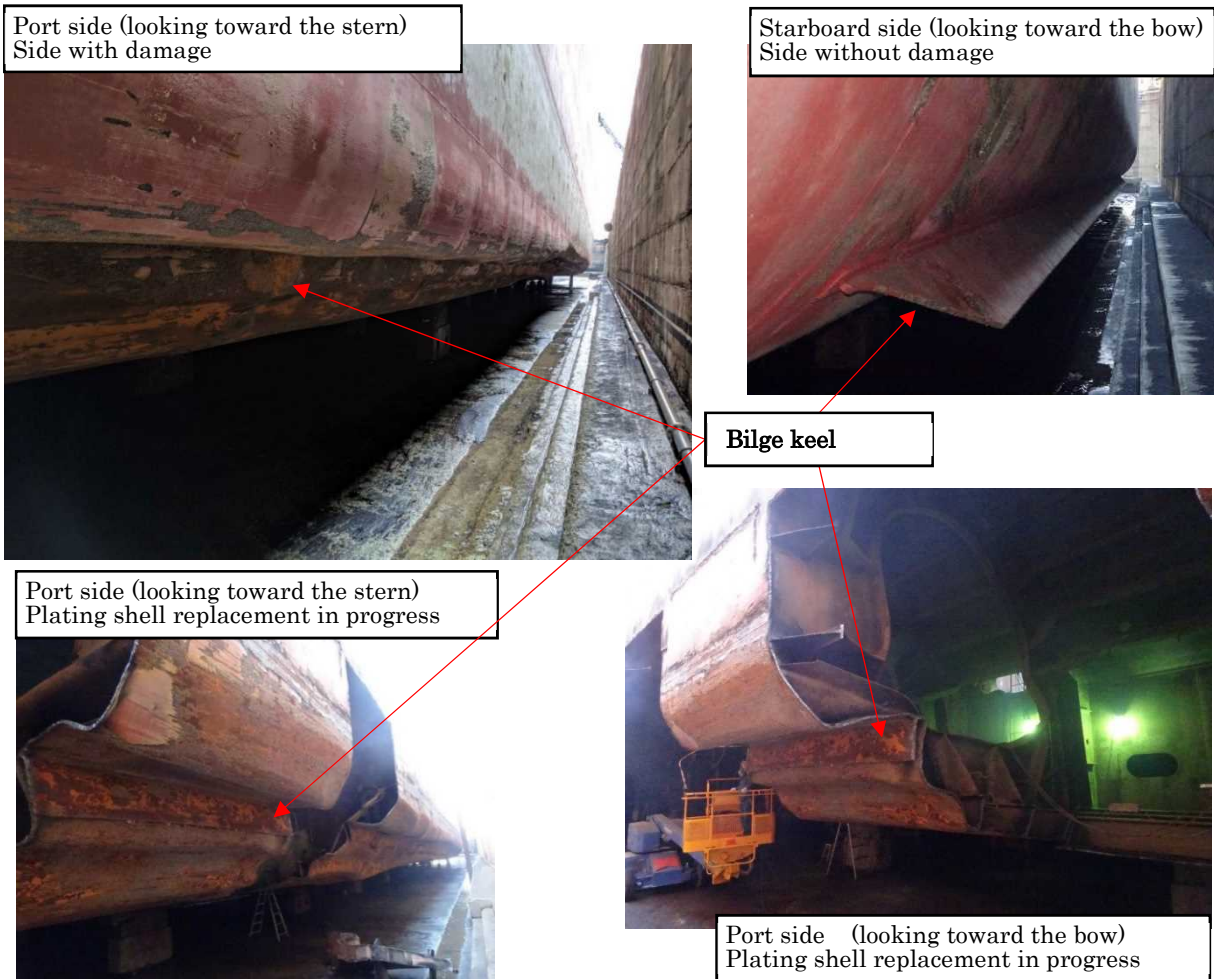


Figure 3 Damage Found in On-Site Investigation

2.4 Crew Information

(1) Gender, Age, and Certificate of Competence

1) Master A: Male, 62 years old Nationality: Republic of the Philippines

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

Date of issue: November 25, 2016

(valid until March 22, 2021)

2) Quartermaster A: Male, 32 years old Nationality: Republic of the Philippines

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

Date of issue: July 19, 2017

(valid until July 14, 2022)

3) Pilot A: Male, 71 years old

Inland Sea Pilot District First Grade Pilot's License

Date of issue: January 25, 2005

Date of revalidation: January 22, 2018

Date of expiry: January 24, 2021

(2) Sea-going Experience, etc.

According to the statements of Master A, Quartermaster A, Pilot A, and the physician attending Pilot A as well as the replies to the questionnaire of the Licensed Inland Sea Pilots' Association and Company A, the sea-going experience was as follows.

1) Master A

Master A came aboard the Vessel as a navigation officer in around 2014. After he was promoted to master in 2016, he navigated in the Seto Inland Sea going westbound and passed through the Nishi Suido four times. However, the day of the accident was his first experience navigating through the Kurushima Kaikyo's Naka Suido going eastbound.

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

2) Quartermaster A

Quartermaster A served aboard large cargo ships, including Panamax-class ships, as a deck trainee with Company A for one year in 2010. He came aboard the Vessel as a quartermaster in 2013. He had plentiful experience navigating through the Kurushima Kaikyo Traffic Route.

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

3) Pilot A

a. Sea-going Experience, etc.

Pilot A joined a shipping company and served as a master aboard LNG carriers and other vessels. He later began working as a pilot for the Inland Sea Pilot District in March 2005. As of July 22, 2019, he had provided pilotage services for 1,712 vessels at a rate of over 100 vessels a year (continuous service of 14 years 5 months).

b. Record of Service Aboard the Vessel

Because Pilot A was involved in pilotage services for numerous cargo ships of the same type as the Vessel throughout the year, he thought that he was providing pilotage services for the Vessel for the first time. Pilot A's record of providing pilotage services for the Vessel is provided in Table 4.

Table 4 Pilot A's Record of Pilotage Services for the Vessel

Date	Location of Pilotage Services	Extreme Draft (m)
March 2007	From Fukuyama Anchorage to docking at Fukuyama (assistant pilot)	16.0
March 2011	From Fukuyama Anchorage to Sekizaki Pilot Station	8.88
October 2016	From Mizushima to Wada Misaki Pilot Station	9.50
June 2019	From Fukuyama Anchorage to docking at Fukuyama	16.0

c. Condition of Health

In around December 2011, Pilot A experienced a subarachnoid hemorrhage while providing pilotage services and received in-hospital medical care. He returned to work around August 2012. He underwent a higher brain function evaluation and examination in around April 2018 that showed no significant decline.

Although he took medicine to prevent epileptic seizures as per a prescription on July 21, 2019, the day before the accident, he provided pilotage services on the day of the accident and was in good health.

2.5 Vessel Information

2.5.1 Particulars of Vessels

IMO number: 9271559

Port of registry: Panama, Republic of Panama

Owner: FAIR WIND NAVIGATION S.A. (Republic of Panama)

Management company: Company A

Operation management company: Mitsui O.S.K. Lines, Ltd. (hereinafter referred to as "Company B")

Class: NK

Gross tonnage: 101,933 tons

L×B×D: 299.95m×50.00m×24.10m

Hull material: Steel

Engine: Diesel engine × 1

Output: 16,860 kW

Propulsion: Fixed pitch propeller × 1

Year of construction: 2004

(See Photo 1)



Photo 1 The Vessel

2.5.2 Loading Conditions

According to the statement of Master A and the reply to the questionnaire of Company A, at the time of the accident, the Vessel was loaded with approximately 64,809 tons of iron ore in cargo holds No. 3, 5, and 7 of her nine cargo holds, and her draft was about 9.04 m at the bow and about 9.98 m at the stern. The Vessel's extreme draft was about 18.0 m.

2.5.3 Information on the Vessels' Equipment

(1) Hull Structure

According to the general arrangement plan, the Vessel was a cargo ship with a docking bridge. She had nine cargo holds that were numbered in order from the bow. (See Figure 4)

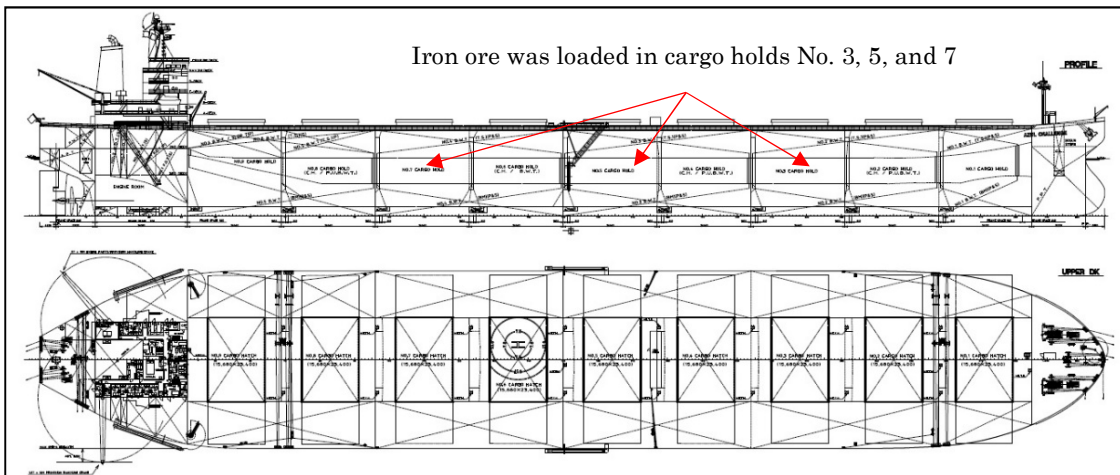


Figure 4 General Arrangement Plan (Excerpt)

(2) Bridge

According to the onsite investigations, the statements of Pilot A and Master A, and the reply to the questionnaire by Company A, there was a gyro compass repeater (hereinafter referred to as “compass repeater”) situated in the front center of the bridge and a steering unit equipped with a steering wheel and gyro compass behind it. On the left side of the unit was installed a console equipped with the main engine remote control system and other equipment. On the lower right side of the compass repeater was a VHF, and on the right side of the VHF were two radar consoles. Behind and to the right of the radar consoles was installed an ECDIS, and in the rear of the bridge on the starboard side was a chart table provided with paper sea charts.

(See Figure 5)

There was no malfunction or failure in the hull, engine, or machineries at the time of the accident.

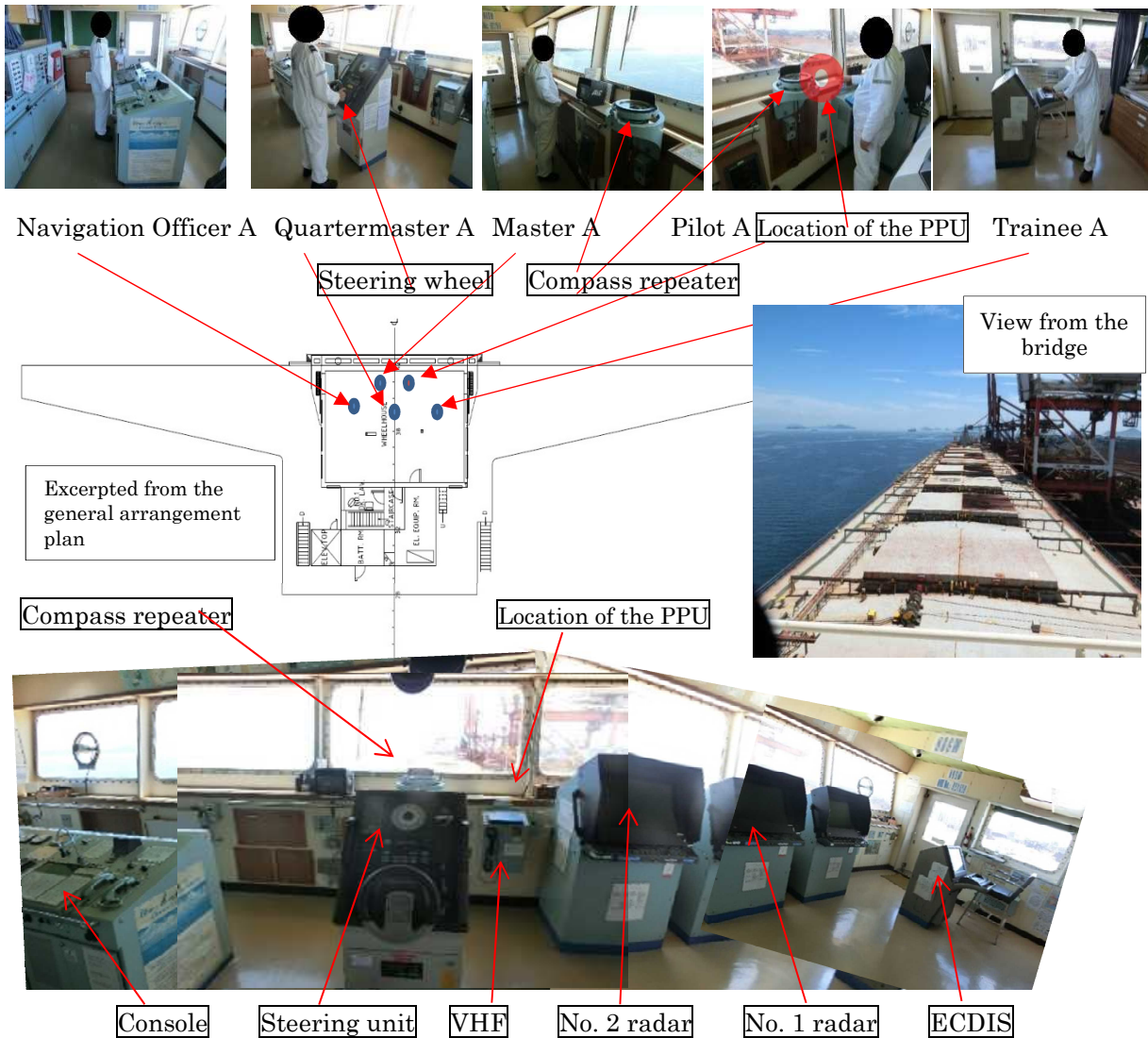


Figure 5 The Vessel's Bridge (for Illustrative Purposes)

(3) Maneuverability

According to the Vessel's sea trial operational performance chart and her maneuverability chart posted on the bridge, the Vessel's maneuverability in ordinary loading condition and in ballast were as provided below. (See Table 5 and Table 6)

Table 5 Speed

	Main engine revolutions per minute (rpm)	Speed (kn) in normal loading	Speed in ballast (kn)
Navigation full ahead	91	15.7	16.9
Full ahead	63	10.9	12.4
Half ahead	54	9.5	11.1
Slow ahead	38	6.8	8.4
Dead slow ahead	28	5.1	6.5

Table 6 Turning Characteristics (Normal Loading Condition) and Stopping Performance

	Starboard turn (initial speed of 15.7 kn, rudder angle of 35°)	Port turn (initial speed of 15.7 kn, rudder angle of 35°)
Advance during 90° course change (Required time)	0.47 nautical miles (M) (2 min. 32 sec.)	0.49 M (2 min. 40 sec.)
Transfer during 90° course change (Required time)	0.18 M (2 min. 32 sec.)	0.20 M (2 min. 40 sec.)
Stopping performance	1.32 M (15 min. 7 sec.) (full ahead)	

All maneuverability characteristics satisfied IMO maneuverability standards.

2.6 Weather and Sea Conditions

According to the Japan Meteorological Agency and Japan Coast Guard, the situation was as follows.

(1) Meteorological observations

Meteorological observations for July 22 at the Imabari Regional Meteorological Observation Station, which is located approximately 7.6 km south-southwest from the accident site, were as follows. (See Table 7)

Table 7 Meteorological Observations at the Imabari Regional Meteorological Observation Station

Time	Wind direction	Wind speed (m/s)	Precipitation (mm)
09:00	NNW	0.9	0.5
09:10	NNW	0.5	-
09:20	NW	0.7	-
09:30	NNW	1.5	-

(2) Tides

According to tide tables for 2019 published by Japan Coast Guard (Pub. No. 781, published in February 2018), the Japan Coast Guard website, and the Vessel's navigational track chart, the tides were as follows. (See Figure 6)

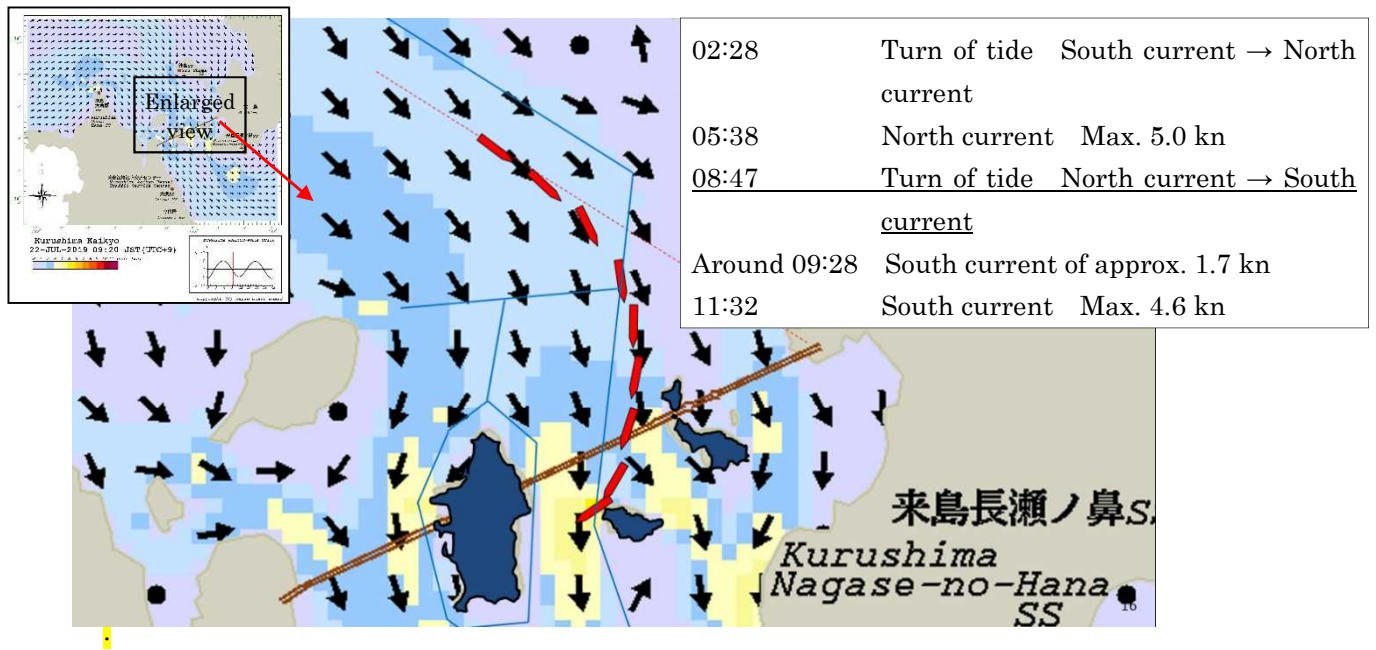


Figure 6 Tide and Navigation Track in Kurushima Kaikyo at 09:20

2.7 Information on the Kurushima Kaikyo Traffic Route

(1) Overview of the Kurushima Kaikyo

According to Sailing Directions for Seto Naikai published by Japan Coast Guard (Pub. No. 103, published in March 2018), the following is an overview of the Kurushima Kaikyo.

Kurushima Kaikyo is a key point in the Seto Inland Sea connecting Hiuchi Nada and Aki Nada and is the most difficult point encountered when passing. Many islands exist here and there in the strait, among them O Shima, Uma Shima, Nakato Shima, and Tsu Shima. The presence of these islands make the navigable width in the strait narrow. Moreover, the tide is strong and complex and an extremely large number of vessels navigate through. Looking at maritime accidents by type, many groundings occur on the eastern shore of Uma Shima. These accidents occur because, at the entrance to Naka Suido during a north current, vessels riding on a fair tide lose the opportunity to change direction and head to Naka Suido's center when they approach the south exit and are pushed by the current.

(2) Navigation control

According to the statements of the person in charge at Kurushima MARTIS and Pilot A as well as VDR voice information, when large vessels will navigate through the Kurushima Kaikyo Traffic Route, they become vessels under Kurushima MARTIS's control and receive navigation control so as to pass through Naka Suido during a favorable current. At that time, the Vessel received instructions to pass through between 09:00 and 09:40, after there was a turn of tide from north current to south current, and Pilot A was engaged in VHF communications with Kurushima MARTIS to coordinate the time for entering the traffic route.

2.8 Information on Ship Maneuvering in the Kurushima Kaikyo Traffic Route

2.8.1 Exchange of Information on the Passage Plan

According to the statements of Master A and Pilot A as well as the reply to the questionnaire by the Licensed Inland Sea Pilots' Association, at the time that Pilot Information Card information was exchanged and vessel information was provided when Pilot A came aboard, Master A told Pilot A that he thought they would navigate through the Nishi Suido, but he was told by Pilot A that they would navigate through the Naka Suido. Additionally, Pilot A informed Master A of the time for entering the Kurushima Kaikyo Traffic Route and that they would navigate through the Naka Suido. Pilot A requested navigation at an average speed of approximately 12.5 kn (speed over the ground; hereinafter the same) to match with the traffic route entry time, and when they passed through Naka Suido, Pilot A told Master A that they would navigate close to Nakato Shima.

2.8.2 Ship Maneuvering Guidelines, etc.

According to the statement of the person in charge in the Licensed Inland Sea Pilots' Association and the reply to the questionnaire by the same association, ship maneuvering guidelines prepared by the Licensed Inland Sea Pilots' Association for the Kurushima Kaikyo are as follows.

When navigating through Naka Suido or Nishi Suido, course keeping can become difficult if the vessel enters swirling currents. Therefore, engage in ship maneuvering that maintains course in the direction of the main current. In this case, the pilot shall personally issue ship maneuvering commands and shall never keep course by issuing the command "steady" (maintain course) to the quartermaster.

Furthermore, the Licensed Inland Sea Pilots' Association instructed pilots of the Inland Sea Pilot District to not approach swirling currents that occur next to Uma Shima during a south current. In addition, from the results of a ship maneuvering simulation that the Licensed Inland Sea Pilots' Association conducted after the accident, it was shown that it would be fundamentally difficult for a large vessel that went far outside the traffic route, as was the case with this accident, to return to the traffic route and navigate through the Kurushima Kaikyo Naka Suido.

2.8.3 Steering Commands based on Course Indications and Rudder Angle Indications

According to the statements of the person in charge in the Licensed Inland Sea Pilots' Association and Company B, in general, when the navigator turns with a course indication, the quartermaster tends to set a smaller rudder angle and adjusts to the course with a small rudder angle. Consequently, the speed at which the course changes (turning angle speed) is slower than turning with a steering command whereby the navigator directly indicates a rudder angle (hereinafter referred to as "rudder angle indication") and thus the track becomes larger. The Kurushima Kaikyo, in particular, has severe tidal currents that make the rudder less effective, and therefore the Licensed Inland Sea Pilots' Association advises engaging in ship maneuvering by indicating rudder angle.

2.9 Information on Safety Management, etc.

2.9.1 Document of Compliance and Safety Management Certificate

Company A was issued a Document of Compliance based on the International Management Code for The Safe Operation of Ships and for Pollution Prevention*⁶ (ISM Code) and the Vessel was issued a Safety Management Certificate based on the ISM Code. Both were issued by NK.

2.9.2 Company A's Safety Management System Manual

Company A's Safety Management Manual (instituted 1996/12/17 Version-Up:2018/06/04) states the following regarding times when a pilot is on board.

Clarify the Responsibility during Pilot on board

<1>Master's duty and responsibility for ship's safety, shall not relieve regardless the duty and responsibility of pilot.

<2>When Master judged that pilot miss conduct or ignore ship's safety navigation, Master shall immediately advice to pilot.

<3>When pilot not care the advice and Master judge the safety of ship to be menaced, he shall order himself without hesitate.

*⁶ The "International Management Code for the Safe Operation of Ships and for Pollution Prevention" (ISM Code) applies to all passenger vessels and vessels with a gross tonnage of 500 tons or more that engage in international navigation as well as to ship owners for the purposes of ensuring the safe navigation of vessels and protecting the environment.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

According to 2.1, it is highly probable that the situation was as follows.

- (1) Pilot A came aboard the Vessel and at around 02:30 on July 22 the Vessel departed Sekizaki Pilot Station and headed to Fukuyama Port.
- (2) At around 08:58, the Vessel passed the Kurushima Kaikyo Traffic Route No. 2 Light Buoy on her starboard side and entered the Kurushima Kaikyo Traffic Route.
- (3) At around 09:21, the Vessel passed O Shima, with the island abeam on her starboard side, and began a gradual starboard turn.
- (4) At around 09:23, Pilot A ordered rudder amidships and then issued a course indication, and the Vessel's starboard turn slowed.
- (5) At around 09:24, the Vessel was pushed by the current, crossed the eastern edge of the traffic route, and went outside the traffic route; nonetheless, Pilot A continued to issue course indications.
- (6) After Pilot A ordered hard to port, the Vessel's bottom ran aground on shallows on the west side of Nakato Shima at around 09:28.

3.1.2 Date, Time and Location of the Accident Occurrence

According to 2.1, it is highly probable that, from the AIS record showing a rapid drop in speed, the time and date of the accident were around 09:28 on July 22, 2019, and that the location of the accident was shallows on the west side of Nakato Shima, around 180 m at 017° true bearing from Nakato Shima Lighthouse.

3.1.3 Injuries to Persons

According to 2.2, there were no fatalities or injuries.

3.1.4 Damage to Vessel

According to 2.3, it is certain that the Vessel sustained holes in the plating shells of her No. 1, No. 3, and No. 4 ballast tanks (P); dents in the plating shells of her Nos. 1 to 7 ballast tanks (P); and deformation of her port bilge keel were confirmed.

3.2 Causal Factors of the Accident

3.2.1 Situation of Crew Members and Pilot

According to 2.4, it is certain that Master A and Quartermaster A possessed legally valid endorsements attesting the recognition of certificate under STCW regulation 1/10. In addition, it is probable that both were in good health at the time of the accident.

According to 2.1 and 2.4, it is certain that Pilot A possessed a legally pilot's certificate of competence. In addition, although Pilot A engaged in behavior that is ordinarily not expected, it is probable that he was in good health at the time of the accident based on the results of a higher brain function evaluation and examination that checked for residual effects of a past subarachnoid hemorrhage.

3.2.2 Condition of the Vessel

According to 2.5.2 and 2.5.3, it is probable that, based on her draft and maneuverability, the Vessel had difficulty navigating near the west side of Nakato Shima while still outside of the Kurushima Kaikyo Traffic Route.

According to 2.5.3 (2), it is probable that there was no malfunction or failure with the hull, engine, or machineries of the Vessel.

3.2.3 Weather and Sea Conditions

According to 2.6, it is highly probable that, at the time of the accident, the weather was cloudy, there was almost no wind, the sea was calm, and visibility was good. In addition, it is highly probable that the current at the time of the accident was beginning to flow south after the turn of tide and there was a south current of around 1.7 kn.

3.2.4 Situation of Ship Maneuvering and Pilotage

According to 2.1, 2.8.3 and 3.1.1, the situation was as follows.

- (1) It is probable that, because Pilot A had experience piloting vessels of a similar type, Pilot A was fully familiar with ship maneuvering methods in the Naka Suido.
- (2) It is probable that, because Master A remembered when Pilot A came aboard that Pilot A's pilotage made him anxious during previous navigation from the Fukuyama Anchorage to docking at Fukuyama, and because Pilot A was showing his age with shaking hands, Master A felt anxiety but, because it was his first time navigating through the Kurushima Kaikyo's Naka Suido in the eastbound direction, he had no choice but to trust Pilot A's abilities and entrust ship maneuvering to him.
- (3) It is probable that Quartermaster A had worked as a quartermaster on the Vessel for about six years and had plentiful experience steering in the Kurushima Kaikyo Traffic Route.
- (4) It is highly probable that, when turning to starboard while navigating toward the Naka Suido, the Vessel's starboard turn slowed because Pilot A, who, in maneuvering away from Uma Shima, decided to use course indications that differed from the pilots' association's ship maneuvering guidelines, continued turning by giving course indications.
- (5) It is highly probable that Pilot A knew that if the Vessel approached Uma Shima in the Naka Suido, she would be swept by swirling currents that occur next to Uma Shima and ship maneuvering would become difficult, and therefore he ordered rudder amidships early during the turn to starboard to avoid approaching Uma Shima.
- (6) It is probable that, because Pilot A was concentrating his attention on navigating through the narrowest part without adding turning momentum and was checking the Vessel's position by visual means only, he was late in noticing that the Vessel had crossed the eastern edge of the traffic route and was outside the traffic route.
- (7) It is highly probable that, because Pilot A thought he could safely navigate around Nakato Shima by issuing course indications, he continued ship navigation with course indications even after he noticed that the Vessel had been pushed outside of the traffic route, and the starboard turn slowed.
- (8) It is highly probable that, because the turning angle speed slowed when Quartermaster A, who was following Pilot A's course indication-based ship maneuvering instructions, adjusted to the course using small rudder angles where unique tidal currents exist, but

achieving the indicated course took time, the starboard turn slowed and became larger and the Vessel approached the west side of Nakato Shima.

3.2.5 Analysis of Safety Management

According to 2.1.2, 2.1.3, 2.9.2, and 3.2.4 (2), although Company A clearly noted masters' safety responsibilities when a pilot is on board in its Safety Management System Manual, it is highly probable that, because Master A thought he had no choice but to trust Pilot A's piloting abilities and entrust ship maneuvering to him, as it was Master A's first time navigating through the Kurushima Kaikyo's Naka Suido in the eastbound direction and there are unique tidal currents in the Kurushima Kaikyo, Master A did not quickly provide ship maneuvering advice to Pilot A even when the Vessel moved outside of the Kurushima Kaikyo Traffic Route and did not take over conning the Vessel without hesitation.

3.2.6 Analysis of the Accident's Occurrence

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

- (1) It is probable that, when turning to starboard while navigating toward the Naka Suido, the Vessel's starboard turn slowed because Pilot A, who, in maneuvering away from Uma Shima, decided to execute course indication-based ship maneuvering that differed from rudder angle indication-based ship maneuvering guidelines and executed the turns by giving course indications.
- (2) It is probable that Pilot A was late in noticing that the Vessel had crossed the eastern edge of the traffic route and was outside the traffic route because he was checking the Vessel's position by visual means only.
- (3) It is probable that, because the turning angle speed slowed when Quartermaster A, who was following Pilot A's instructions, adjusted to the course using small rudder angles where unique tidal currents exist, but achieving the indicated course took time, the starboard turn slowed and became larger and the Vessel approached the west side of Nakato Shima.
- (4) It is somewhat likely that Master A's thinking that he had no choice but to trust Pilot A's piloting abilities and entrust ship maneuvering to him, as it was Master A's first time navigating through the Kurushima Kaikyo's Naka Suido, where unique tidal currents exist, in the eastbound direction, and that Master A's not quickly giving ship maneuvering advice to Pilot A and not taking over conning the Vessel without hesitation as specified in the Safety Management System Manual even after the Vessel left the traffic route contributed to the accident's occurrence.

4 PROBABLE CAUSES

4.1 Probable Causes

It is probable that the accident occurred when, as the Vessel made a turn to starboard toward the Naka Suido after the tide turned to the south in the Kurushima Kaikyo Traffic Route, which is the most difficult point encountered when navigating the strait, the Vessel's turn slowed and, consequently, she was pushed by the current, crossed the eastern edge of the traffic route and went outside the traffic route, approached the west side of Nakato Shima with her starboard turn still slowing, and ran aground on shallows on the west side of Nakato Shima.

It is probable that the Vessel's turn slowed because, in maneuvering away from Uma Shima, Pilot A decided to execute course indication-based ship maneuvering that differed from rudder angle indication-based ship maneuvering guidelines.

It is probable that the Vessel approached the west side of Nakato Shima in a starboard turn that continued to slow because, even after the Vessel went outside the traffic route, Pilot A continued to engage in ship maneuvering by giving course indications while checking the Vessel's position by visual means only, and because Quartermaster A did not set large rudder angles for the reason that he was given course indications.

It is somewhat likely that Master A's thinking that he had no choice but to trust Pilot A's piloting abilities and entrust ship maneuvering to him, as it was Master A's first time navigating through the Kurushima Kaikyo's Naka Suido, where unique tidal currents exist, in the eastbound direction, and that Master A's not quickly giving ship maneuvering advice to Pilot A and not taking over conning the Vessel without hesitation as specified in the Safety Management System Manual even after the Vessel left the traffic route contributed to the accident's occurrence.

5 SAFETY ACTIONS

It is probable that the accident occurred when, at the time that the Vessel turned starboard to head toward the Naka Suido in the Kurushima Kaikyo Traffic Route after the tide turned to a south current, Pilot A engaged in ship maneuvering by giving course indications that differ from the pilots' association rudder angle-based ship maneuvering guidelines and he continued course indication-based ship maneuvering while checking the Vessel's position by visual means only even after the Vessel went outside the traffic route.

In addition, it is somewhat likely that Master A's thinking that he had no choice but to trust Pilot A's piloting abilities and entrust ship maneuvering to him and then Master A's not quickly giving ship maneuvering advice to Pilot A and not taking over conning the Vessel without hesitation as specified in the Safety Management System Manual even after the Vessel left the traffic route contributed to the accident's occurrence.

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

- (1) Pilots follow ship maneuvering guidelines that were prepared by their pilots' association.
- (2) Pilots constantly verify vessel position by using ECDIS, PPU, and other devices rather than rely on visual observation only.
- (3) Pilots stay within the traffic route when navigating in the Kurushima Kaikyo Traffic Route.
- (4) When they have doubts about a pilot's ship maneuvering, masters quickly give ship maneuvering advice to the pilot in accordance with the Safety Management System Manual and, when they judge that the pilot's ship maneuvering endangers the vessel's safe navigation, take over conning of the vessel without hesitation.

5.1 Safety Actions Taken

5.1.1 Measures taken by Company A

- (1) Company A instructed masters that navigate in the Kurushima Kaikyo Traffic Route to send information on the planned channel of navigation and tide information to Company A by email after sharing this information with pilots.
- (2) Company A sent information on the accident to the vessels it manages and called their attention to preventing the recurrence of similar accidents.
- (3) Company A confirmed with masters and crew members that they should make maximum use of the cooperative "bridge team" system, with the master exchanging information with the pilot quickly and without hesitation when the pilot's ship maneuvering becomes dangerous, and that Company A will give advice to the pilot on the master's behalf if the pilot remains uncooperative.

5.1.2 Measures taken by Company B

Company B made information on the accident involving Company A known to the vessels it manages and called their attention to preventing the recurrence of similar accidents.

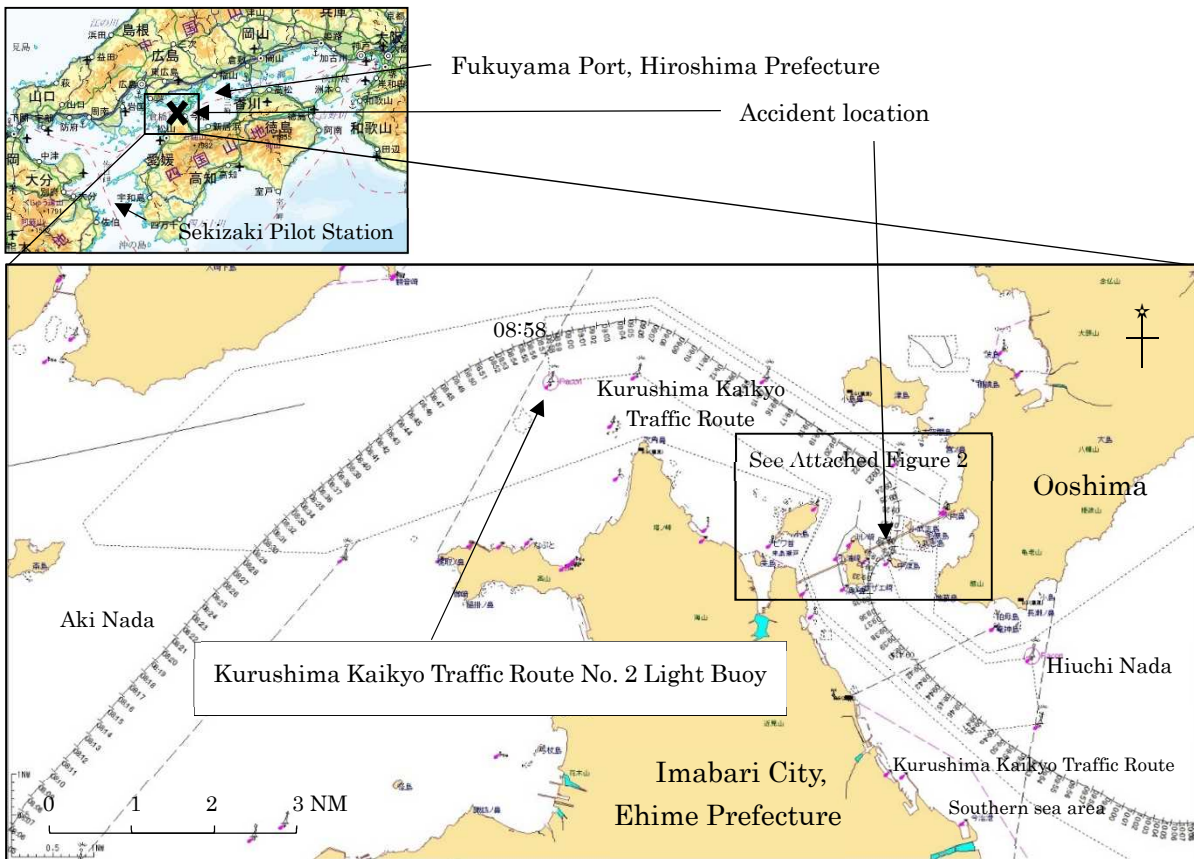
5.1.3 Measures taken by the Licensed Inland Sea Pilots' Association

- (1) Established a marine accident response headquarters to respond to accidents and gave association members an outline of it.
- (2) Reminded association pilots of the ship maneuvering guidelines and urged them to fully

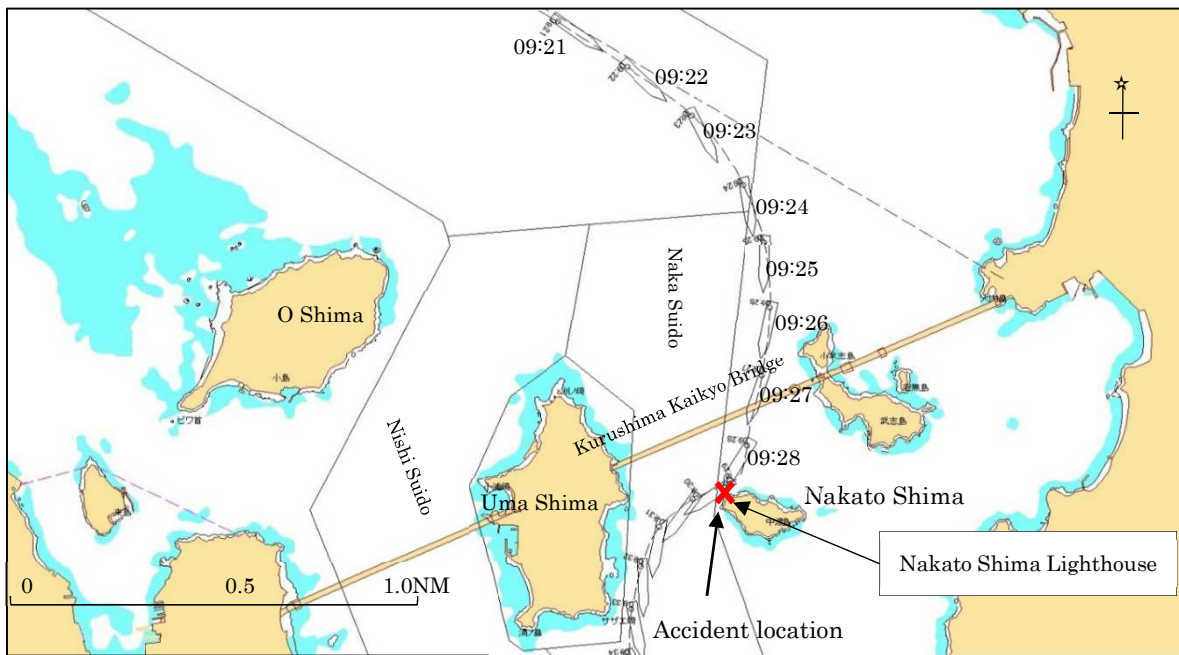
follow the guidelines.

- (3) Established an accident response committee to investigate the accident's cause and compile preventative measures that included the following items, and made the measures known to association pilots.
 - 1) Carry out ship maneuvering in accordance with the "Navigation Directions for the Kurushima Kaikyo Traffic Route" noted in operational reference materials of the Licensed Inland Sea Pilots' Association.
 - 2) Refer to the "Kurushima Kaikyo Navigation Reference Map."
 - 3) When navigating in a narrow channel, check position using conspicuous targets and the like, effectively use electronic devices (e.g., ECDIS, PPU, etc.), and reconfirm own vessel's position, conditions of driving currents, etc.
 - 4) As a means of contributing to the consistent practice of BRM on the Vessel, strive to maintain an effective communication environment so that information on ship's position and surroundings can be provided by crew members continuously by, for example, indicating the specific planned course beforehand.

Attached Figure 1 Navigation Track (Overall View)



Attached Figure 2 Navigation Track (Around Kurushima Kaikyo)



(Around 09:28 on July 22, 2019)