MA2022-04

MARINE ACCIDENT
INVESTIGATION REPORT

April 28, 2022

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.

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.

《Reference》

The terms used to describe the results of the analysis in "3. ANALYSIS" of this report are as follows.

i) In case of being able to determine, the term "certain" or "certainly" is used.

ii) In case of being unable to determine but being almost certain, the term "highly probable" or "most likely" is used.

iii) In case of higher possibility, the term "probable" or "more likely" is used.

iv) In a case that there is a possibility, the term "likely" or "possible" is used.

MARINE ACCIDENT INVESTIGATION REPORT

Vessel type and name:	Cargo Ship BUNGO PRINCESS
IMO number:	9496654
Gross tonnage:	6,736 tons
Accident type:	Collision (bridge)
Date and time:	Around 03:12, September 9, 2019 (local time, UTC+9 hours)
Location:	Minami-Honmoku Hama Road, Keihin Port Around 171° true bearing, 1,220 m from the Nissan Honmoku Pier Lighthouse (approximately 35°24.7'N, 139°40.9'E)

March 16, 2022

Adopted by the Japan Transport Safety Board

Chairman TAKEDA Nobuo

Member SATO Yuji

Member TAMURA Kenkichi

Member KAKISHIMA Yoshiko

Member OKAMOTO Makiko

SYNOPSIS

< Summary of the Accident >

The cargo ship BUNGO PRINCESS, with a master and 16 other crew members aboard, was at anchor off of Honmoku Pier in the Yokohama district of Keihin Port under conditions in which Typhoon No. 15 of 2019 (Faxai) was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, when she dragged anchor under intensifying wind and waves from the approaching typhoon, was pushed to the south, and collided with the Minami-Honmoku Hama Road (bridge) at around 03:12 on September 9, 2019.

BUNGO PRINCESS sustained crushing and other damage to her hull's starboard-side plating shell and bulbous bow, and the Minami-Honmoku Hama Road sustained crushing, cracking, and other damage on the bridge. There were no fatalities or injuries among the crew members.

< Probable Causes >

It is probable that the accident occurred when, as the Vessel was anchored in nearly ballast condition at night in the Anchorage to take shelter under conditions in which Typhoon No. 15 was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, she dragged anchor and, despite setting her main engine to full ahead, she was pushed without being able to control her hull's attitude and collided with the Bridge because she continued riding at single anchor when the wind and waves intensified due to the typhoon.

It is probable that the Vessel continued riding at single anchor because the Master had no personal experience using multiple anchors at the same time during anchoring and was aware that problems could occur when using multiple anchors, such as the possibility of tangled anchors and reduced freedom of maneuvering, and, additionally, because the Master assumed that the effects of the typhoon would not exceed his previous experience and thought that the Vessel would be able to withstand the wind and waves by letting out eight shackles of anchor chain for storm anchoring in preparation for the typhoon.

It is probable that the hull's attitude could not be controlled despite the main engine's being set to full ahead because sufficient forward propulsion could not be obtained, as propulsive power was lost when the hull moved backward under the effects of the wind and waves and the propeller blades lost thrust.

1 PROCESS AND PROGRESS OF THE INVESTIGATION

1.1 Summary of the Accident

The cargo ship BUNGO PRINCESS, with a master and 16 other crew members aboard, was at anchor off of Honmoku Pier in the Yokohama district of Keihin Port under conditions in which Typhoon No. 15 of 2019 was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, when she dragged anchor under intensifying wind and waves from the approaching typhoon, was pushed to the south, and collided with the Minami-Honmoku Hama Road (bridge) at around 03:12 on September 9, 2019.

BUNGO PRINCESS sustained crushing and other damage to her hull's starboard-side plating shell and bulbous bow, and the Minami-Honmoku Hama Road sustained crushing, cracking, and other damage on the bridge. There were no fatalities or injuries among the crew members.

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 September 9, 2019.

1.2.2 Collection of Evidence

September 10 and 13, 2019:	On-site investigation and interviews
October 2, 3, and 28, November 12, and December 26, 2019; April 13, June 16, 17and 26, July 1, 3 and 16, 2020; May 26, June 21, 28 and July 6, 2021:	Collection of questionnaires

1.2.3 Comments from Parties Relevant to the Cause

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

1.2.4 Comments from Flag State

Comments on the draft report were invited from the flag states of BUNGO PRINCESS.

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) data (hereinafter referred to as "the AIS record") received by a data company in Japan, the navigation tracks of BUNGO PRINCESS (hereinafter referred to as "the Vessel") from around 01:32:17 to 03:51:23 on September 9, 2019, were as shown in Table 1 below.

The positions of the Vessel refer to the positions of GPS antennas attached to the upper side of the bridge. The GPS antenna's position was 83 m from the bow, 20 m from the stern, about 5 m from port side, and about 14 m from the starboard side. The course over the ground and heading are true bearings (hereinafter the same).

Table 1 AIS Record of the Vessel (excerpt)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground [*1] (knots [kn])
	Latitude (N) (°- ′- ″)	Longitude (E) (°- ′- ″)			
01:32:17	35-25-37.1	139-41-53.0	271	060	0.4
01:44:18	35-25-36.2	139-41-52.6	156	071	0.3
01:50:25	35-25-34.8	139-41-51.5	158	060	0.6
02:02:17	35-25-32.6	139-41-48.4	306	035	2.1
02:11:24	35-25-31.6	139-41-51.5	022	050	1.4
02:20:23	35-25-36.0	139-41-50.8	178	068	0.6
02:29:15	35-25-32.3	139-41-41.0	248	061	1.1
02:39:24	35-25-23.0	139-41-37.7	227	062	3.0
02:45:05	35-25-19.3	139-41-21.5	252	025	2.8
02:50:14	35-25-15.5	139-41-09.0	216	066	0.8
02:55:06	35-25-02.0	139-41-08.3	181	108	3.5
03:00:05	35-24-48.8	139-41-04.1	175	077	2.7
03:05:06	35-24-46.7	139-40-58.6	287	335	3.6
03:06:05	35-24-47.9	139-40-55.2	297	036	1.6
03:07:05	35-24-47.9	139-40-55.0	051	074	0.4
03:08:05	35-24-47.9	139-40-55.0	007	103	0.2
03:09:13	35-24-45.7	139-40-54.8	169	106	2.0
03:10:02	35-24-44.8	139-40-54.4	217	116	1.6
03:12:00	35-24-42.2	139-40-52.9	148	112	1.1
03:17:09	35-24-36.9	139-40-59.8	145	136	0.5
03:21:48	35-24-35.6	139-41-01.5	024	138	0.7
03:30:41	35-24-35.8	139-41-01.8	344	131	0.1
03:39:42	35-24-35.0	139-41-02.1	159	103	0.2
03:42:45	35-24-34.2	139-41-05.2	057	038	0.9
03:48:13	35-24-41.0	139-41-13.5	047	039	2.9
03:49:13	35-24-43.4	139-41-16.6	045	027	3.5

[*1] "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".

03:50:04	35-24-46.3	139-41-19.5	039	027	4.2
03:51:23	35-24-48.4	139-41-28.0	091	064	6.4

2.1.2 Information on Communications with Japan Coast Guard, etc.

(1) According to the reply to the questionnaire by the Tokyo Wan Vessel Traffic Service Center (hereinafter referred to as "Tokyo MARTIS"), a summary of communications by Tokyo MARTIS with the Vessel by VHF radio telephone (hereinafter referred to as "VHF") between 01:44 and 03:28 on September 9, 2019, was as shown in Table 2. (The "Center" appearing in the table refers to Tokyo MARTIS and *** indicates unintelligible speech.)

Table 2 Summary of Communications between Tokyo MARTIS and the Vessel (Excerpt)

Time	Sent by	Received by	Ch	Content
01:44 to 01:45	Center	Vessel	16	BUNGO PRINCESS, BUNGO PRINCESS, this is TOKYO MARTIS.
	Vessel	Center	16	TOKYO MARTIS, good morning. BUNGO PRINCESS.
	Center	Vessel	16	Channel 66, 66.
	Vessel	Center	16	66.
	Vessel	Center	66	BUNGO PRINCESS on channel 66, Good morning again, Over.
	Center	Vessel	66	BUNGO PRINCESS, this is TOKYO MARTIS, Good morning again. Warning. According to our radar, you seem to be dragging anchor. Are you dragging anchor now? Over.
	Vessel	Center	66	No dragging, and engine stand by. Over.
	Center	Vessel	66	You are now not dragging anchor and stand by engine. OK copy that. Please keep stand by engine and keep sharp lookout other vessels. Over.
	Vessel	Center	66	Yes,*** lookout to the another vessels and stand by engine.
	Center	Vessel	66	16.
	Vessel	Center	66	16.
02:44 to 02:45	Center	Vessel	16	BUNGO PRINCESS, BUNGO PRINCESS, call sign 3FXV8, this is TOKYO MARTIS, TOKYO MARTIS.
	Vessel	Center	16	Yes, this is BUNGO PRINCESS.
	Center	Vessel	16	This is TOKYO MARTIS. Change to channel 66, 66. Over.
	Vessel	Center	66	TOKYO MARTIS, BUNGO PRINCESS.
	Center	Vessel	66	BUNGO PRINCESS, This is TOKYO MARTIS.

				Warning. Now you are dragging anchor and getting closer to coast. Over.
	Vessel	Center	16	***
	Center	Vessel	16	Now you are full power, is that correct? Over.
	Vessel	Center	16	Full ahead and in maximum. Over.
	Center	Vessel	16	OK, back to channel 16 out.
03:05	Center	Vessel	16	BUNGO PRINCESS, BUNGO PRINCESS, this is TOKYO MARTIS.
03:11	Center	Vessel	16	BUNGO PRINCESS, BUNGO PRINCESS, this is TOKYO MARTIS, TOKYO MARTIS.
03:18	Center	Vessel	16	BUNGO PRINCESS, 3FXV8, this is TOKYO MARTIS, TOKYO MARTIS.
	Center	Vessel	16	BUNGO PRINCESS, BUNGO PRINCESS, this is TOKYO MARTIS, TOKYO MARTIS.
03:27 to 03:28	Vessel	Center	16	TOKYO MARTIS, BUNGO PRINCESS.
	Center	Vessel	16	BUNGO PRINCESS, this is TOKYO MARTIS. Change to channel 14, 14.
	Vessel	Center	14	TOKYO MARTIS, BUNGO PRINCESS.
	Center	Vessel	14	BUNGO PRINCESS, this is TOKYO MARTIS. Go ahead.
	Vessel	Center	14	Please *** We are *** breakwater ahead. We are improved not self, please ***.
	Center	Vessel	14	BUNGO PRINCESS, this is TOKYO MARTIS. You are on the ground, correct?
	Vessel	Center	14	Yes, *** we are ***.

(2) According to the reply to the questionnaire by the Port and Harbor Bureau, City of Yokohama, a summary of recorded VHF communications by Yokohama Port Radio (hereinafter referred to as "Port Radio") with the Vessel between 02:39 and 03:35 on September 9, 2019, was as shown in Table 3.

Table 3 Summary of Communication Records between Port Radio and the Vessel (Excerpt)

Time	Sent by	Received by	Ch	Content
02:39 to 02:40	Vessel	Port Radio	16 11	We cannot control our ship with the engine. Please notify other vessels.
	Port Radio	Vessel		Roger. Will inform immediately.
02:51 to 02:52	Vessel	Port Radio	16 11	Our engine is now and we are moving forward.
	Port Radio	Vessel		Understood. Contact us if you need assistance.
	Vessel	Port Radio		Roger.
02:53 to 02:54	Vessel	Port Radio	16 11	We want you to arrange a tugboat.
	Port Radio	Vessel		Roger. Will make arrangements. Keep monitoring Channel 16.
	Vessel	Port Radio		Roger.

03:00 to 03:01	Vessel	Port Radio	16 11	We are approaching a breakwater (bridge). We need a tugboat.
	Port Radio	Vessel		We are trying to get a tugboat now.
03:01 to 03:02	Vessel	Port Radio	16 11	No tugboat yet? We're about to collide with the wharf.
	Port Radio	Vessel		We are checking tugboat operations.
	Vessel	Port Radio		Roger.
03:04 to 03:05	Vessel	Port Radio	16 11	We are near the breakwater. We need assistance now.
	Port Radio	Vessel		Roger. We're awaiting the tugboat's response.
	Vessel	Port Radio		Roger
03:09 to 03:10	Port Radio	Vessel	11	We tried to get a tugboat, but it cannot provide assistance due to high winds.
	Vessel	Port Radio		We are about to collide with a breakwater (bridge) on our starboard side.
	Port Radio	Vessel		Did you collide?
	Vessel	Port Radio		Not yet.
	Port Radio	Vessel		Roger. Do what you can to avoid a collision. Tugboats cannot assist you.
03:12 to 03:15	Vessel	Port Radio	11	We collided with a bridge. We need rescue.
	Port Radio	Vessel		Do you have any injuries? What is the damage to your ship?
	Vessel	Port Radio		No injuries but there is damage to the hull's starboard side.
	Port Radio	Vessel		Is there an oil leak?
	Vessel	Port Radio		I don't know if there is an oil leak.
	Port Radio	Vessel		Contact the Coast Guard (Yokohama Coast Guard Radio [Yokohama Hoan]).
03:34 to 03:35	Port Radio	Vessel	16 11	Do you have any injuries?
	Vessel	Port Radio		No injuries, but we are in distress.
	Port Radio	Vessel		Roger.

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

According to the statements of the Master, a navigation officer (hereinafter referred to as "Navigation Officer A"), and the person in charge at the agent that the Vessel used when entering the Port of Yokohama (hereinafter referred to as "the Agent"); replies to the questionnaire of Dojima Marine Co., Ltd., which is the Vessel's management company (hereinafter referred to as "Company A"), and the Port and Harbor Bureau, City of Yokohama; as well as information provided by Japan Coast Guard (JCG), the situation was as follows. (Hereinafter, communications between the Vessel (Master) and Tokyo MARTIS and between the Vessel (Master) and Port Radio are by VHF.)

At around 11:18 on September 7, 2019, the Vessel, with the Master and 16 other crew

members aboard, entered Honmoku Pier A-5 in the Yokohama district of Keihin Port. She conducted unloading of cargo (steel frame materials) until around16:00 of the same day.

At around 10:45 on September 8, the Master, following instructions from the Agent, departed the pier in nearly ballast condition and full of ballast water except for some tanks for the purpose of sheltering at anchor in preparation for the approaching Typhoon No. 15. At around 11:16, the Master dropped the starboard anchor in Keihin Port's Y2 anchorage (depth of about 23.5 m with muddy bottom; hereinafter referred to as the "Anchorage") and began riding at single anchor (an anchoring method whereby an anchor is used on only one side of the vessel) with seven shackles (approximately 192.5 m) of anchor chain let out, and then he made preparations for heavy weather as necessary and assumed anchor watch after relieving three navigation officers who included Navigation Officer A.

At around 21:45, the Master ordered the main engine put on one-hour standby (i.e., putting the main engine in a state in which it can be used within one hour if the master demands it) to be ready for wind and waves from the typhoon, and at around 21:55 he conducted a trial operation of the main engine and propulsion machinery and verified that there were no abnormalities with either. Additionally, at around 22:00, the Master let out additional shackle of anchor chain to ride at single anchor with an anchor chain length of eight shackles (about 220 m) and he began conning the Vessel on the bridge.

The Master felt the wind's intensity suddenly increase at around 01:40 on September 9 and he therefore set the main engine to standby (i.e., a useable state), when, at around 01:44, he received a communication from Tokyo MARTIS to check his anchoring condition and be wary of anchor drag.

At around 01:50, the readings of the bridge's anemometer began exceeding 60 knots (about 31 m/s) and therefore the Master checked the Vessel's position on the radar, and observed that the Vessel had begun dragging anchor. At around 01:51, the Master began using the main engine, gradually raising the main engine's output from slow ahead, and he endeavored to engage in ship maneuvering to keep the bow pointed upwind.

At around 02:02, the Vessel's hull was being pushed by the intensifying wind despite the Master's setting the main engine to full ahead, and the Master thought that controlling the hull had become difficult. At around 02:22, the Master assembled all hands on the bridge except two crew members who were on engine room watch.

At around 02:39, the Master thought that he had completely lost the ability to control the hull using the main engine despite his continuing to keep the main engine's output at full ahead, and he communicated this to Port Radio.

At around 02:44, the Master received another warning that the Vessel was dragging anchor from Tokyo MARTIS and he answered that he was responding by using the main engine.

The Master continued attempting to control the hull by using the main engine but without effect. He believed that he could not stop the Vessel's drift under her own power and therefore began asking Port Radio to make arrangements for help by a tugboat from around 02:53; however, he could not receive said help due to the worsening weather and sea conditions.

The Vessel continued to drift toward the south, which was on her lee side, with her bow pointed east when, at around 03:12, her starboard-side stern area collided with a bridge of the Minami-Honmoku Hama Road in Yokohama City, Kanagawa Prefecture (hereinafter referred to as "the Bridge"). The starboard side of the hull was driven up alongside the Bridge and the Master repeatedly heard impact sounds from the starboard side. The Master notified Port Radio that the Vessel had collided with the Bridge, that there were no casualties, and that the

hull's starboard side was damaged.

At around 03:27, the Master notified Tokyo MARTIS that the Vessel had collided with the Bridge and was unable to separate from it under her own power. At the same time, he continued setting the main engine to full ahead and attempting to separate by moving from the port's far interior (south) toward the port's exterior (north) while repeatedly being pushed up against the Bridge when, at around 03:42, he managed to regain control of the hull.

At around 03:51, the Vessel separated from the port's far interior under her own power and proceeded toward the anchorage outside of the port.

The date and time of occurrence of the accident (hereinafter referred to as "the Accident") was at around 03:12 on September 9, 2019, and the location was the Bridge, around 1,220 m at 171° true bearing from the Nissan Honmoku Pier lighthouse.

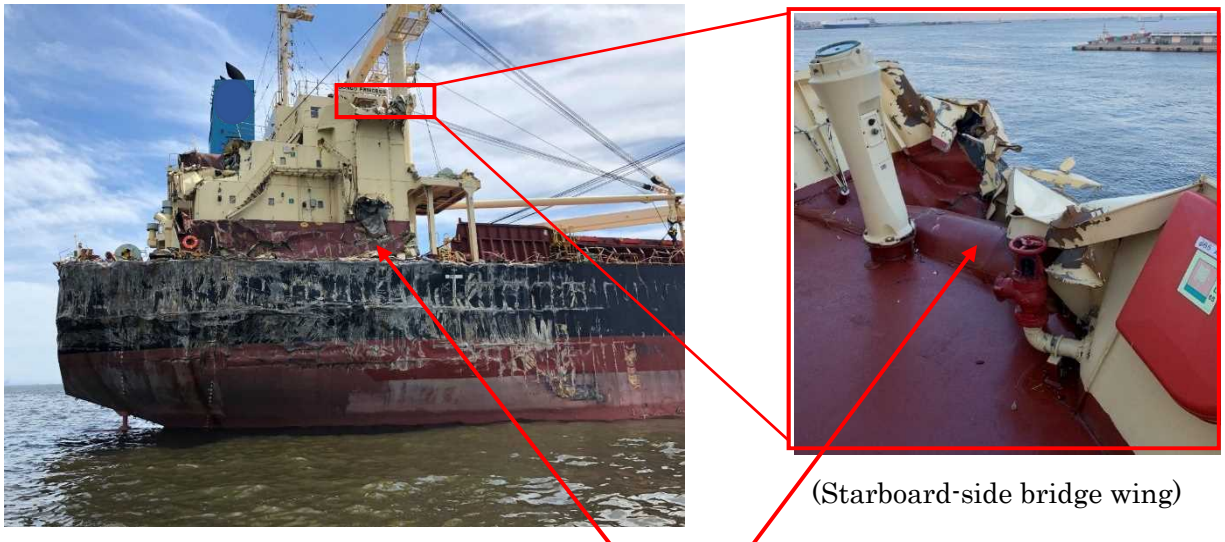
(See Attached Figure 1 "Estimated Navigation Route (Overall View)" and Attached Figure 2 "Estimated Navigation Route (Enlarged)"

2.2 Injuries to Persons

According to the statements of the Master, there were no casualties.

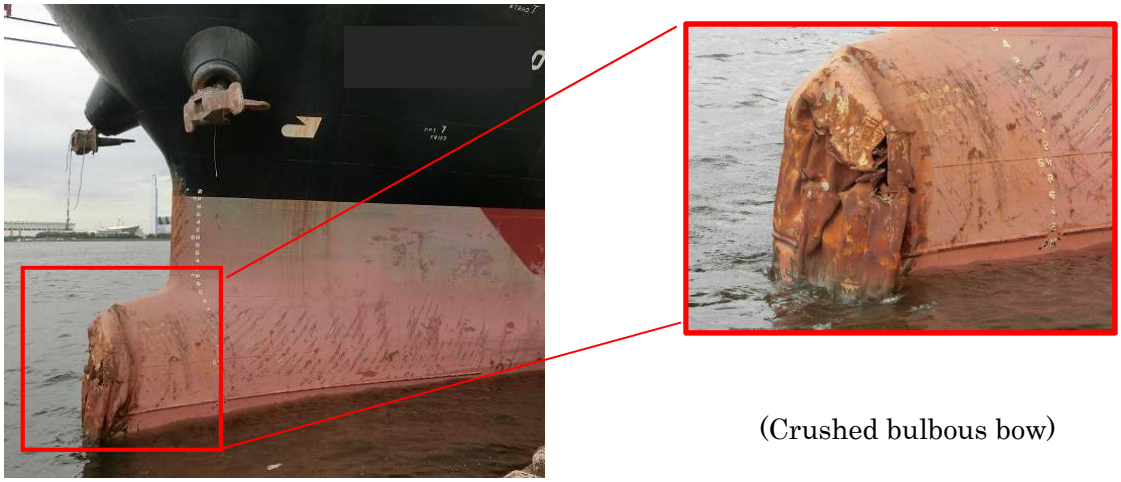
2.3 Damage to Vessel

According to on-site investigation and the reply to the questionnaire by Company A, the Vessel sustained crushing, denting, and other damage to her starboard-side stern plating shell and starboard bridge wing and crushing of her bulbous bow. Additionally, a starboard-side lifeboat cradle and lifeboat that were installed below the bridge were lost. (See Photo 1)



Location of the lost starboard lifeboat and cradle

(View of the hull from astern)



(Crushed bulbous bow)

Photo 1　Damage to the Vessel

2.4 Information on Damage to Facilities not Belonging to the Vessel

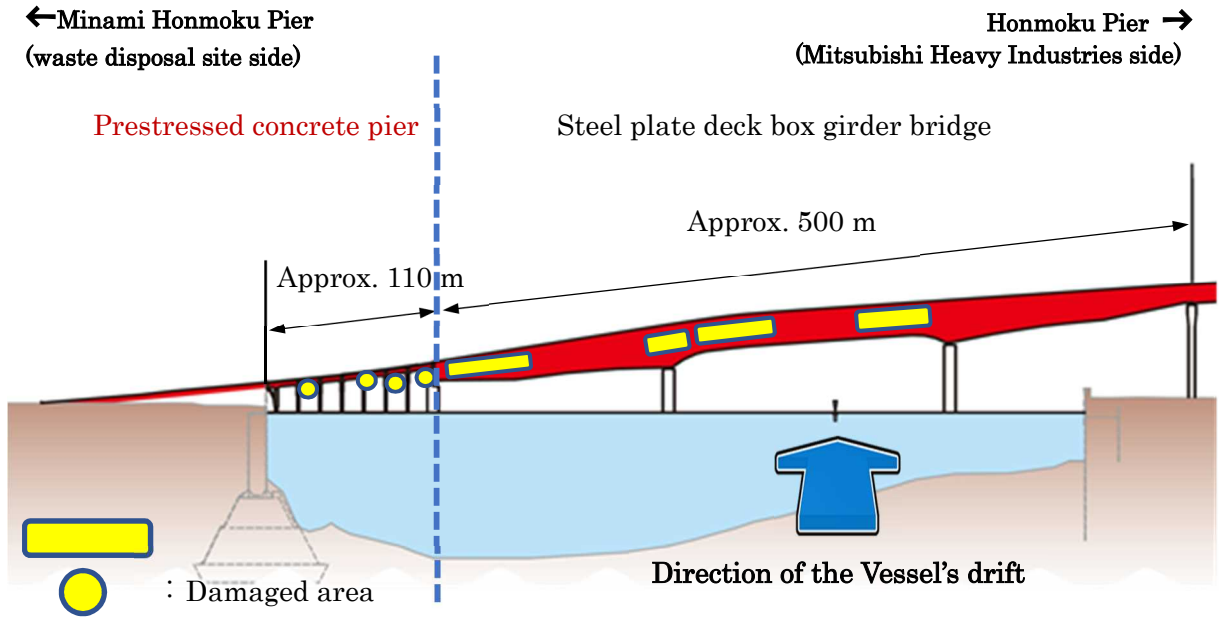
2.4.1　Minami-Honmoku Hama Road

According to the on-site investigation and the reply to the questionnaire by the Kanto Regional Development Bureau, which owns the Minami-Honmoku Hama Road, crushing, deformation, and other damage were sustained by about 122 m of the roughly 500-meter-long steel plate deck box girder bridge*2 and about 60 m of the roughly 110-meter-long prestressed concrete pier*3 constituting the Bridge, and damage was sustained by road lighting and other

*2 A “steel plate deck box girder bridge” is a bridge constructed by welding steel plates to a box-shaped section and then using assembled sections as main girders.

*3 A “prestressed concrete pier” is a pier constructed using factory-made girders of prestressed concrete (concrete given higher tensile strength by applying compressive forces beforehand) for the superstructure.

fixtures. The Minami-Honmoku Hama Road was closed for about eight months.
(See Figure 1 and Photo 2)



○Prestressed concrete pier portion
About 60 m of about 110 m damaged
(4 of 7 spans)

○Steel plate deck box girder bridge portion
About 122 m of about 500 m damaged

Figure 1　Damaged Areas of the Bridge (Summary)

Prestressed concrete pier

Photo 2　Damage to the Bridge

2.4.2 Seawall (Portion of Outer Perimeter Seawall E-1 and Outer Perimeter Seawall F of Minami Honmoku Pier)

According to the on-site investigation, the reply to the questionnaire by the Port and Harbor Bureau of the City of Yokohama, and the statement of the person in charge at said bureau, gouges, abrasions, and other damage were sustained by about 460 m of an approximately 560-meter-long seawall (concrete) that is adjacent to the eastern side of the Bridge. (See Photo 3)

Gouges and abrasions in the concrete

Abrasions and detached concrete

Photo 3 Damage to the Seawall (Excerpt)

2.5 Crew Information

(1) Age and Certificate of Competence

1) Master: 66 years old Nationality: Republic of the Philippines

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

Date of issue: May 20, 2019
(valid until September 29, 2020)

2) Navigation Officer A: 61 years old Nationality: Republic of the Philippines
Endorsement attesting the recognition of certificate as second officer under STCW regulation I/10 (issued by Republic of Panama)
Date of issue: February 9, 2017
(valid until July 1, 2021)

(2) Sea-going Experience, etc.

According to the statements of the Master, and Navigation Officer A, sea-going experience was as follows.

1) Master

The Master had been a seaman for 44 years, having begun serving as a navigation officer in 1975 after graduating from school. After serving as a master of cargo ships for approximately 10 years, he came aboard the Vessel as her master in May 2019 and had served in that position for about four months. He experienced entering port in Tokyo Bay, including Keihin Port, many times; however, at the time of the Accident, he was experiencing anchoring in Keihin Port's anchorage to take shelter from a typhoon for the first time.

He was in good health and not fatigued at the time of the Accident.

2) Navigation Officer A

Navigation Officer A had been a seaman for 32 years, having begun serving as a navigation officer in 1987 after graduating from school. He came aboard the Vessel as a navigation officer in October 2018 and had served in that position for about one year. He had experienced entering Keihin Port many times.

He was in good health and not fatigued at the time of the Accident.

2.6 Vessel Information

2.6.1 Particulars of Vessels

IMO number: 9496654
Port of registry: Panama, Republic of Panama
Owner: BUNGO WORLD SHIPPING S.A.
Management company: Company A
Classification Society: Nippon Kaiji Kyokai (NK)
Gross tonnage: 6,736 tons
L×B×D: 103.64 m × 18.80 m × 13.20 m
Hull material: Steel
Engine: Diesel engine × 1
Output: 3,900 kW
Propulsion: 4-brade fixed pitch propeller × 1
Year of construction: 2009
(See Photo 4)

Photo 4　The Vessel

2.6.2　Hull Structure of the Vessel

According to the on-site investigation and the general arrangement plan, the Vessel was a cargo ship with a docking bridge and two cargo holds numbered 1 and 2 in order from the bow. Two cranes for cargo handling were installed on the deck and one derrick was installed on the upper forward part of the bridge. The engine room was located in the Vessel's stern section.

(See Figure 2)

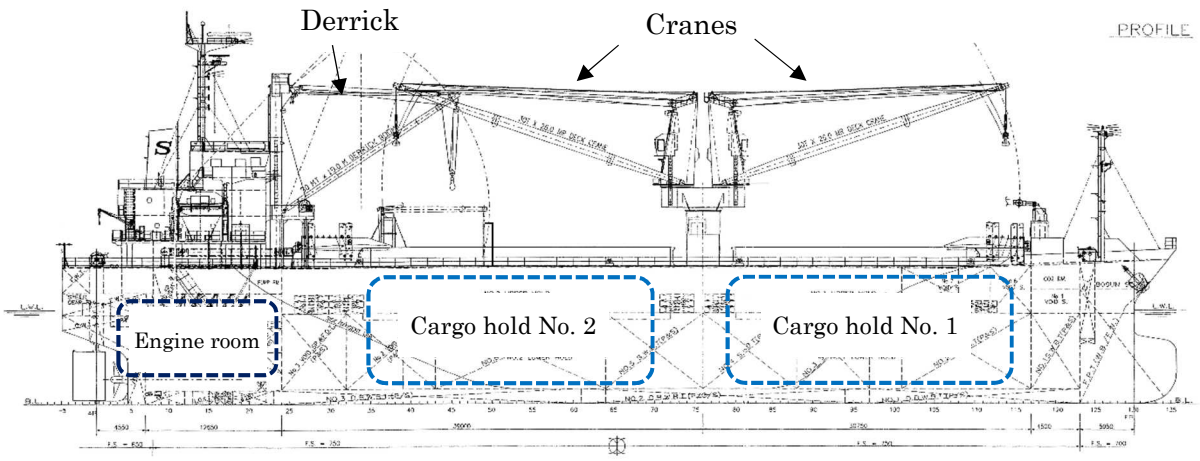


Figure 2　General Arrangement Plan

2.6.3　Loading Conditions

According to the statement of the Master and the logbook of the Vessel, the Vessel was in nearly ballast condition and full of ballast water except for some tanks at the time of the Accident, and her draft was about 4.70 m at the bow and about 5.30 at the stern for a trim by the stern of about 0.6 m.

2.6.4　Other Information on the Vessel

(1)　Condition of the hull, etc.

According to the statement of Master, there was no malfunction or failure in the hull, engine, or machineries at the time of the Accident.

(2)　Anchors and anchor chains

According to the reply to the questionnaire by Company A, the anchors on either side of the Vessel were both JIS anchors with a weight 3,540 kg. The anchor chains had a shackle length of 27.5 m, and nine shackles were available on each side.

2.7 Weather and Sea Conditions

2.7.1 The General Situation of Typhoon No. 15

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

The typhoon originated near Minami-Torishima Island on September 5, approached the Ogasawara Islands with strong force in the afternoon of September 7, and then approached the Izu Islands with extremely strong force in the afternoon of September 8, The typhoon passed the Miura Peninsula before 03:00 on September 9 and came ashore with strong force near Chiba City before 05:00 on September 9. It then moved northeastwardly across the Kanto region and passed out to sea in the morning of September 9. (See Attached Figure 3 Path of Typhoon No. 15; Attached Figure 4 Surface Weather Chart [03:00 on September 9]; Attached Figure 5 Infrared Image from a Weather Satellite during Landfall [05:00 on September 9]; and Attached Figure 6 Rainfall Intensity Observed by Weather Radar during Landfall [05:00 on September 9])

2.7.2 Situation of Typhoons in 2019 and Characteristics, etc., of Typhoon No. 15

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

(1) Situation of Approaches to Japan and Landfall

The number of typhoons that approached Japan was 15, which was higher than an average year (normal value: 11.4 typhoons) and the number that made landfall was five, which was higher than the normal value of 2.7.

(2) Characteristics, etc., of Typhoon No. 15

Typhoon No. 15 had a maximum wind speed of 40 m/s at landfall, making it the strongest typhoon to make landfall in the Kanto region since 1991, the first year for which statistics are available. It caused extensive damage with violent winds, particularly on the Boso Peninsula.

Typhoon No. 15 was named the "Reiwa 1 Boso Peninsula Typhoon" [*4] for being a typhoon that caused an extraordinary disaster in 2019.

2.7.3 Meteorological and Ocean Wave Observations, etc.

(1) Meteorological observations

1) Observations (extracted) made every ten minutes at the Yokohama Local Meteorological Office, which is located approximately 4 km northwest of the Accident's location, were as shown in Table 4. In addition, actual peak gusts and maximum instantaneous wind speed were 23.4 m/s (03:28 on September 9; northerly wind) and 41.8 m/s (03:12 on September 9; northerly wind), respectively.

[*4] The designation "Reiwa 1 Boso Peninsula Typhoon" was given to Typhoon No. 15 because it was a typhoon that caused an extraordinary disaster in the year 2019. (The Japan Meteorological Agency gives names to natural phenomena that caused extraordinary disasters in order to pass on experiences and lessons to future generations. It was the first typhoon in 42 years to be designated with a name since the "Okinoerabu Typhoon" of 1977.)

Table 4　Wind Direction and Wind Speed Observations
at the Yokohama Local Meteorological Office

Date and time (HH:MM)	Maximum instantaneous wind speed (m/s)		Average (during previous 10 minutes) (m/s)	
	Wind speed	Wind direction	Wind speed	Wind direction
Sept. 8 22:00	12.0	E	6.7	ENE
22:30	13.7	E	8.1	ENE
23:00	17.9	ENE	7.5	ENE
23:30	15.4	ENE	6.6	ENE
Sept. 9 00:10	15.5	E	8.2	ENE
00:30	16.4	ENE	8.3	ENE
01:00	18.6	ENE	9.4	ENE
01:30	20.6	ENE	10.5	ENE
02:00	23.6	ENE	11.9	NE
02:10	27.7	NE	12.0	NE
02:20	29.8	NE	12.3	NE
02:30	28.7	ENE	11.9	NE
02:40	32.3	ENE	14.0	NE
02:50	26.7	NE	11.9	NNE
03:00	29.4	NE	12.9	NNE
03:10	35.8	N	17.6	NNE
03:20	41.8	N	22.2	N
03:30	39.5	NNW	22.6	NNW
03:40	38.0	N	21.0	NNW
03:50	33.7	WNW	19.7	NW
04:00	32.0	NW	17.8	NW

2) Observations at the Tokyo MARTIS's Honmoku Traffic Signal Station, which is located approximately 3 km north of the Accident's location, were as shown in Table 5.

Table 5　Wind Direction and Wind Speed Observations at the Honmoku Traffic Signal Station

Date and time (HH:MM)	Average wind speed (m/s)	Wind direction	Date and time (HH:MM)	Average wind speed (m/s)	Wind direction
Sept. 8 22:10	9.0	E	Sept. 9 02:40	15.0	ENE
22:40	10.0	ENE	02:55	17.0	NE
23:40	11.0	ENE	03:10	20.0	NE
Sept. 9 00:25	11.0	ENE	03:25	34.0	N
01:40	15.0	ENE	03:40	38.0	NNW
01:55	15.0	ENE	03:55	36.0	NW
02:10	14.0	ENE	04:10	30.0	WNW
02:25	16.0	ENE	04:25	23.0	WNW

3) Observations at a shipyard located near (to the west) the Accident's location were as shown in Table 6.

Table 6 Observations at the Nearby Shipyard

Date and time (HH:MM)	Wind direction	Wind speed (m/s)		Wave height (m)
		Average	Peak	
Sept. 8 22:30	ENE	12.0	15.0	1.0
23:30	ENE	15.0	17.0	2.0
Sept. 9 00:30	ENE	17.0	20.0	2.5
01:30	ENE	21.0	28.0	3.0
See note	—	48.0	54.0	-
04:30	WNW	30.0	35.0	1.5
05:30	WNW	19.0	24.0	0.5
06:30	WNW	13.0	20.0	0.3

Note: Observation times, wind directions, and wave heights during this period were unknown.

4) Observations by Crew

According to the statements of the Master and the logbook of the Vessel, the readings of an anemometer installed on the bridge exceeded 60 knots (about 31 m/s) from 01:50 on September 9 and, additionally, observations between 02:00 and 04:00 were as follows.

Weather: rain; wind direction: E; wind force: 11 (wind speed of between about 28.5 and 32.6 m/s); visibility: about 2 to 4 km

(2) Ocean wave observations

1) Observations at the "Daini Kaiho" observation point of the Nationwide Ocean Wave information network for Ports and HarbourS (NOWPHAS) that is located about 6.6 nautical miles (M) south-southeast of the Accident's location showed that wave heights (significant wave height) between 02:00 and 03:00 on September 9 were 2.5 m or higher and that the wave direction was south. (See Attached Figure 7 Ocean Wave Observations at Daini Kaiho [September 9]).

2) According to the Japan Meteorological Agency, waves gradually grew higher from September 8 on seas from the Tokai Region and to Kanto Region as Typhoon No. 15 approached, and rough seas with swells exceeding 6 m existed from September 8 to September 9. (See Attached Figure 8 Coastal Waves Chart [September 8 and 9])

(3) Tides, etc.

According to tide tables published by Japan Coast Guard, the tide at Yokohama at the time of the Accident was in the mid-stage of an outgoing tide.

Additionally, according to the Japan Meteorological Agency, observational records at the Yokohama Tide Station indicated that the tide level was still high (high tide) at around 03:00 on September 9, when Typhoon No. 15 was making its closest approach, even though the most recent time of high tide (23:07 on September 8) had passed.

2.7.4 Announcement of Warnings

According to the Japan Meteorological Agency, a typhoon warning had been issued for the Northern Sea off Kanto at 23:40 on September 7 and storm, high waves, and heavy rain warnings had been issued for Yokohama City at 17:02 on September 8 and, additionally, a flood warning had been issued for Yokohama City at 20:42 of the same day. Each warning remained in effect at the time of the Accident.

2.8 Information on Anchoring, etc.

2.8.1 Recommendations and Order System under the Act on Port Regulations

(1) According to Article 39 paragraph 4 of the Act on Port Regulations, if there is a foreseeable risk of a marine traffic hazard occurring in a port due to abnormal meteorological or other circumstances, and the captain of the port finds it to be necessary, the captain of the port may recommend any vessel within the port or in the vicinity of the port's boundaries to take the measures required to smoothly prevent the hazard.

Moreover, according to Article 39 paragraph 3 of the Act on Port Regulations, if there is a foreseeable risk of a marine traffic hazard occurring in a port due to abnormal meteorological or other circumstances, and the captain of the port finds it to be necessary for preventing the hazard, the captain of the port may designate the location or means of anchoring for any vessel within the port or in the vicinity of the port's boundaries, restrict such vessel's movements, or order such vessel to leave the port or the vicinity of the port's boundaries.

Thus, based on these provisions, it is possible to issue orders to vessels that do not comply with recommendations.

(2) In accordance with Article 39 paragraph 4 of the Act on Port Regulations, ports for which the Act on Port Regulations applies throughout Japan recommend measures to be taken to prevent danger when a typhoon approaches or a similar situation occurs, such as preparing for stormy weather, strengthening countermeasures against anchor dragging, and taking shelter outside the port. The recommendations that are issued take into consideration the conditions of each port and the safety of vessels when taking shelter.

(3) In the case of Keihin Port (the Yokohama and Kawasaki districts), given the fact that Tokyo Bay becomes congested with anchoring vessels, it becomes necessary to avoid further congestion of the bay by vessels taking shelter outside of port. Thus, when a typhoon is approaching or a similar situation occurs, the recommendations issued to vessels tend to focus on preparing for stormy weather, letting out anchor chains appropriately, and taking shelter outside the breakwaters.

Moreover, recommendations that are in addition to those mentioned above are issued in the Reinforced Dragging Anchor Prevention Area,[*5] which was established to prevent collisions and other damage to LNG berths and other facilities following the collision of an oil tanker with the access bridge connecting Kansai International Airport to the shore that occurred as a result of anchor dragging in 2018. These recommendations urge anchored vessels to endeavor to detect and resolve anchor dragging as soon as possible and to start their engines and thrusters as necessary to prevent collisions with LNG berths and other

[*5] The " Reinforced Dragging Anchor Prevention Area" is a sea area that was established on June 28, 2019. The area within a 2-M radius from the Tokyo Gas/JERA-Ogishima LNG Berth (excluding shipping routes and some areas) and the Y2 anchorage have received this designation. (The designated area was expanded to a radius of 2M from the Tokyo Gas/JERA-Ogishima LNG Berth and Minami-Honmoku Hama Road [excluding shipping routes and some other areas] following the Accident.)

facilities.

2.8.2 Warning System in Keihin Port at the Time of the Accident, etc.

The harbor master of Keihin Port executed the measures described in 2.8.1(3) when Typhoon No. 15 was approaching.

In addition, Keihin Port's harbor master confirmed the status of implementation of recommendations individually for all vessels in the Reinforced Dragging Anchor Prevention Area, and as a result he judged that the recommendations were being implemented based on the responses obtained from each vessel. The harbor master had received responses from the Vessel indicating that she had completed putting her engine on standby and was not dragging anchor.

Reference No. 1: Recommendations issued in Keihin Port at the time of the accident

With Typhoon No. 15 approaching, Keihin Port's harbor master, acting in accordance with Article 39 paragraph 4 of the Act on Port Regulations, issued recommendations for the first stage of alert (preparedness and enhanced anchor dragging countermeasures) at 09:00 on September 8 and the second stage of alert (sheltering and enhanced anchor dragging countermeasures) at 11:00 on the same day for the second warning system. The recommendations were lifted at 08:45 on September 9. The items to be implemented for each recommendation classification were as follows.

(1) *First stage of alert (preparedness and enhanced anchor dragging countermeasures)*

1) *Vessels in port should prepare for stormy weather and be ready to operate immediately if necessary.*

2) *Strictly observe standards for cessation of cargo handling. Vessels in the process of cargo handling should be prepared to stop in case of sudden changes in weather.*

3) *The unloading of lumber on the water and raft operations shall strictly adhere to the cessation standards.*

4) *Vessels anchored in port should monitor VHF channel 16 and also take stringent measures to prevent maritime accidents attributable to anchor dragging by, for example, stationing additional personnel on bridge watch, ensuring appropriate extensions of anchor chain, maintaining AIS operation, and keeping their main engines on standby if necessary.*

5) *In particular, vessels anchored in the Reinforced Dragging Anchor Prevention Area should thoroughly implement the above-mentioned four measures to prevent maritime accidents attributable to anchor dragging and endeavor to detect and resolve anchor dragging as soon as possible, and also start their engines and thrusters as necessary to prevent collisions with the berth, etc., taking into account the fact that this is an area where many accidents due to anchor dragging occur.*

6) *Vessels moored in port should respond in accordance with the sheltering standards of each wharf and act with a sufficient margin of safety to avoid situations whereby they cannot leave port due to stormy weather.*

7) *A communication system that enables the arrangement of tugboats in an emergency should be established.*

(2) *Second stage of alert (sheltering and enhanced anchor dragging countermeasures)*

1) *Vessels should complete stormy weather preparations and be on high alert.*

2) *Vessels subject to sheltering should, in principle, be take shelter outside the*

breakwater (however, vessels for which it is deemed that sheltering outside the breakwater is inappropriate should take sufficient safety measures, such as strengthening moorings).

3) *Vessels that are other than those subject to sheltering should take shelter in a river, canal, or other safe location.*

4) *Vessels should complete measures to prevent the flowing away of lumber and work equipment/materials and be on high alert.*

5) *In particular, vessels anchored in the Reinforced Dragging Anchor Prevention Area should thoroughly implement measures to prevent maritime accidents attributable to anchor dragging and endeavor to detect and resolve anchor dragging as soon as possible, and also start their engines and thrusters as necessary to prevent collisions with the berth, etc., taking into account the fact that this is an area where many accidents due to anchor dragging occur.*

Reference 2: Information in sailing directions, etc.

(1) The Sailing Directions for South & East Coasts of Honshu published by Japan Coast Guard (Shoshi No. 101, published in March 2014) states the following. (Excerpt)

1) *Sheltering anchorages in a typhoon*

Each harbor master in Tokyo Bay issues sheltering advisories to ships in port when a typhoon approaches the port. Large vessels shall, in principle, take shelter out of port. (Omission)

When sheltering advisories have been issued by harbor masters in Tokyo Bay, the Tokyo Wan Vessel Traffic Service Center (Tokyo MARTIS) provides information on anchored vessels in the following manner. (Omission)

2) *Regarding anchor-dragging accidents near Keihin Port, Chiba Port, and Kisarazu Port*

The sea areas near Keihin Port, Chiba Port, and Kisarazu Port have poor bottom quality and therefore anchor dragging accidents occur due to poor anchor hold. When strong winds are forecasted, the harbor master or Coast Guard Office commander will issue an anchor drag advisory and request that vessels endeavor to prevent accidents by giving attention to the following points.

A *Take countermeasures against anchor dragging when anchored.*

B *Continuously monitor VHF radio telephone channel 16.*

C *Keep the main engine on "standby."*

D *Keep appropriate anchor watch at all times and prepare for changes in the weather while endeavoring to obtain the latest weather information.*

(2) According to a chart issued by Japan Coast Guard (W66 Keihin Ko Yokohama), the depth near the Anchorage was about 23.5 m and the bottom was muddy.

2.8.3 The Vessel's Anchorage Selection and Anchoring Method

According to the statements of the Master and the person in charge at the Agent, the Master used the starboard anchor at the Anchorage (Y2), which he was instructed to use by the Agent. The Master began riding at single anchor with seven shackles of anchor chain and then later rode at single anchor with eight shackles of anchor chain, which was the Vessel's state at the time of the accident.

2.9 Acquirement of Weather Information by the Vessel

According to the statement of the Master, the Master obtained typhoon tracking charts and other information produced by a private weather company via the internet and navigation warnings by satellite (NAVAREA XI [Western North Pacific and Southeast Asia]) in addition to emails provided by the Agent.

2.10 Information on Measures to be Taken in the Event of Anchor Drag and their Effects

The literary source *Theory and Practice of Ship Handling* (by Kinzo Inoue; Seizando-Shoten Publishing; first edition published in March 2011) states the following (excerpt).

(1) *Once a ship begins to drag anchor, it is difficult to stop it. This is due to the fact that once the ship starts to be pushed at a constant speed, its inertia of motion increases and a considerable amount of controlling force is required to suppress it.*

(2) *When a ship is being pushed at a constant speed after dragging anchor, it is best to assume that dropping a second anchor or extending the anchor chain will not be effective from the standpoint of stopping the push.*

(3) *After the ship drags anchor, it takes output of Slow Ahead plus full rudder at a wind speed of 20 m/s, Half Ahead at 25 m/s, and Full Ahead 30 m/s in order to use the main engine and rudder to point the bow into the wind and maintain at least that attitude.* (Omission) *In actual stormy weather, the ship's hull is swayed by waves. As a result it is often difficult to keep the main engine running continuously with high output due to propeller racing and other phenomena. Thus, main engine output is limited with respect to anchor drag while sheltering at anchor in stormy weather.*

(4) *When a ship moves astern as when dragging anchor, the angle of the water flowing into the propeller changes and the angle of attack becomes extremely large, causing the blades to lose propulsive power. When this happens, dynamic lift is no longer generated and very little thrust can be obtained no matter how much the blades (propeller) are rotated.*

2.11 Information on the Determination of Anchor Dragging Risk

After the Accident, an estimation of anchor dragging risk was conducted using a Risk Assessment Application for Dragging Anchor[*6] system developed by the Maritime Bureau of the Ministry of Land, Infrastructure, Transport and Tourism cooperated with the National Maritime Research Institute of the National Institute of Maritime, Port and Aviation Technology. The estimation was conducted by entering anchoring information (i.e., depth, bottom composition, anchoring method, and amount of anchor chain let out) and information on weather and sea conditions at the time of the Accident. The result was *"high anchor dragging risk" (high likelihood that the ship will drag anchor)*.

[*6] The "Risk Assessment Application for Dragging Anchor" system was developed by the Maritime Bureau of the Ministry of Land, Infrastructure, Transport and Tourism cooperated with the National Maritime Research Institute (NMRI) as a means of preventing anchor-dragging accidents, which have been occurring frequently in recent years. It allows masters and crew members (who are its users) to use their smartphones or other devices to determine their vessels' anchor-dragging risk in stormy weather by entering data on their vessel, available anchorages, weather and sea conditions, and other variables. The results are displayed in three levels (high, medium, and low). The system is intended to help masters and crew members use those results to take appropriate measures and prevent anchor-dragging accidents. The system has two versions: a PC version that can be used offline and an internet app version that can be used on smartphones and tablets. Both versions were released on July 1, 2021, and can be used free of charge from NMRI's website.

2.12 Awareness of the Master Concerning the Typhoon's Approach

According to the statement of the Master, the Master's awareness and actions concerning Typhoon No. 15's approach were as follows.

(1) From weather information from the internet and other sources, the Master estimated that Typhoon No. 15 was strong and would pass near the anchorage, and that the Time to Closest Point of Approach (TCPA) would be around 02:00 on September 9, and that its maximum wind speed would reach about 35 m/s.

(2) Although the Master had never sheltered from a typhoon (by anchoring) in Tokyo Bay before, he thought that the typhoon's effects would not exceed his previous experience.

(3) Although the Master was aware that, in the case of the Anchorage, using about five shackles of anchor chain was normally appropriate, he initially used seven shackles and then later let out an additional shackle for a total of eight shackles, and therefore he thought the Vessel would withstand the wind and waves.

(4) Regarding the use of two anchors at the same time when beginning anchoring and using a second anchor after anchoring, the Master did not take these steps because he had never done so since becoming a master and because he was aware that using multiple anchors at the same time in stormy weather would cause operational problems, such as the possibility of tangled anchors and reduced freedom of maneuvering.

(5) Due to his estimate of the situation as described in (3) above, the Master did not take any special steps to use the main engine continuously to mitigate the Vessel's swinging motion.

2.13 Steps to Prevent Anchor-Dragging Accidents following the Collision of an Oil Tanker with an Access Bridge at Kansai International Airport (Up to the Time of the Accident)

In response to an accident that occurred on September 4, 2018, when an oil tanker dragged anchor under the effects of Typhoon No. 21 (Jebi), which made landfall with extremely strong force, and collided with Kansai International Airport's access bridge, Japan Coast Guard established an "Expert Panel on the Prevention of Recurrence of Accidents Caused by Anchor Dragging in Stormy Weather" (hereinafter referred to as the "JCG Expert Panel") as a body comprised of the public sector, private sector, and academia in October of the same year. In December of the same year, the JCG Expert Panel issued an interim report stating that a system of navigational restrictions based on Article 26 of the Act on Maritime Traffic Safety, which stipulates penalties for the violators in this case, in the sea area around Kansai International Airport, should be utilized to prevent recurrence. In response, a public notice was issued on January 31, 2019, and it was decided that a system will be put into effect that can essentially prohibit ship navigation within three miles of Kansai International Airport when a major typhoon is expected to hit.

Following this, the JCG Expert Panel conducted a study for sea areas other than the sea area around Kansai International Airport in March 2019. It then prepared a final report that noted the importance of selecting important facilities and considering specific measures by taking into account the environment surrounding each sea area (e.g., actual anchoring conditions, topography, etc.) and unique circumstances (e.g., types of offshore facilities, social impact, etc.).

In response to JCG's actions, the 3rd Regional Coast Guard Headquarters, together with the Tokyo Wan Association for Marine Safety, decided to compile comprehensive measures to prevent anchor dragging by launching a "Study Committee for Measures to Prevent Accidents Caused by

Anchor Dragging, etc., in Tokyo Bay and Other Areas during Stormy Weather" (hereinafter referred to as the "Study Committee") as a body comprised of the public sector, private sector, and academia in May 2019. Specifically, the Study Committee was tasked with ascertaining the weather and sea conditions during stormy weather in Tokyo Bay, the actual anchoring conditions, and the actualities of anchor-dragging accidents and then, based on the characteristics of the sea areas of Tokyo Bay, conduct a multifaceted study of measures to prevent anchor-dragging accidents in stormy weather in cooperation with maritime officials, facility managers, and relevant government agencies, keeping new legal regulations in mind. The Study Committee was also charged with forming a consensus among a wide range of concerned parties in the course of this process and then compiling comprehensive measures to prevent anchoring accidents in Tokyo Bay during stormy weather, which would then be made widely known to the public in a manner that includes ensuring that necessary matters are accurately understood by vessels. With its purpose established in this way, and with the typhoon season of that year (2019) approaching, the Study Committee began its activities by first examining short-term measures to prevent anchor-dragging accidents in Tokyo Bay that could be executed under systems. The Accident occurred while this examination was taking place.

Meanwhile, the Japan Transport Safety Board, which had been conducting an investigation on the accident involving the oil tanker's collision with Kansai International Airport's access bridge, released factual information that had been confirmed up to that time as a "Process and Progress of the Investigation" report in December 2018. Ultimately, the Board's "Marine Accident Investigation Report," issued in April 2019, recommended to concerned companies (operators) that they "ensure that masters are fully aware of items for preventing anchor dragging accidents during extremely strong typhoons" and "provide necessary information to the vessels they operate and establish a safety support system whenever the possibility of danger exists due to abnormal weather or sea conditions."

In addition, the Board analyzed measures taken by individual vessels during the approach and passage of typhoons and their results based on a questionnaire survey of vessels that were anchored in Osaka Bay and Tokyo Bay at the time of the aforementioned accident and AIS data, etc. The Board then provided information to concerned organizations to prevent accidents caused by anchor dragging during typhoons by preparing a document titled *Hijo ni Tsuyoi Taifu-ji no Sobyo ni yoru Jiko-boshi Taisaku ni tsuite* (regarding measures to prevent accidents caused by anchor dragging during extremely strong typhoons) that summarized important points for preventing accidents caused by anchor dragging.

(See https://www.mlit.go.jp/jtsb/iken-teikyo/s-teikyo17_20190425.pdf)

2.14 Information on Safety Management

According to the reply to the questionnaire of Company A, the situation was as follows.

2.14.1 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 (ISM Code) and the vessel was issued a Safety Management Certificate based on the ISM Code. Both were issued by a classification society.

2.14.2 Safety Management System Manual

Company A formulates a Safety Management System (hereinafter referred to as "SMS") to ensure the safe operation of its vessels in conformity with the International Safety

Management Code, which is based on Chapter IX of the Annex to the SOLAS Convention,[*7] and prepares a manual concerning that system (hereinafter referred to as the "SMS Manual"). Company A furnished the SMS Manual to the Vessel.

2.14.3 Notations concerning Anchoring in Stormy Weather in the SMS Manual

The following items are stipulated under "Procedures for Anchoring" in Company's SMS Manual.

3. *Anchor Watch under Rough Weather Conditions*

Masters must take the following necessary countermeasures that are in addition to those of the previous paragraph (2. Guidelines for anchor watch under normal conditions) when stormy weather is expected or occurs while at anchor.

a) *Check with the agent or the nearest Coast Guard organization to see if a high winds advisory or other advisory is in effect.*

b) *Keep a listening watch on VHF channel 16 to obtain information and warnings from other ships.*

c) *Obtain weather information from weather charts, navigation warnings, etc.*

d) *Maintain a safe distance from other vessels and shift anchorage if possible.*

e) *Extend an appropriate anchor chain length or anchor with two anchors with consideration for draft, vessel length, depth, bottom material, and other factors; keep a standby anchor ready; and drop an anchor to restrain swing.*

f) *Put the main engine on standby if required based on assessment of weather and sea conditions.*

g) *Make steering equipment ready for immediate use.*

h) *If the vessel has a light draft, fill ballast tanks and reduce the vessel's wind pressure area as much as possible and also trim the vessel by the head.*

i) *Pay out extra anchor chain and use the engine at appropriate times to prevent the anchor from dragging.*

2.15 Information on the Situation of Anchored Vessels in Tokyo Bay During Typhoon No. 15's Approach and on the Occurrence of Similar Accident on the Day of the Accident

(1) According to information provided by Japan Coast Guard, the largest number of anchored vessels in Tokyo Bay was approximately 350 at around 19:00 on September 8, and the number of anchored vessels within the Reinforced Dragging Anchor Prevention Area while the recommendations described in 2.8.2 above were issued (09:00 on September 8 to 08:45 on September 9) was 24, which included the Vessel.

(2) In addition to the Accident, there were three collision accidents (two collisions between vessels and one collision with a facility) involving vessels that dragged anchor within Tokyo Bay (the Reinforced Dragging Anchor Prevention Area and Yokosuka Port).

The Marine Accident Investigation Reports for these three accidents are posted on the following Japan Transport Safety Board websites.

http://www.mlit.go.jp/jtsb/ship/rep-acci/2020/MA2020-10-11_2019yh0119.pdf
http://www.mlit.go.jp/jtsb/ship/rep-acci/2020/keibi2020-10-7_2019yh0114.pdf
http://www.mlit.go.jp/jtsb/ship/rep-acci/2021/MA2021-1-3_2019yh0115.pdf

[*7] "SOLAS Convention" is the abbreviation for "The International Convention for the Safety of Life at Sea" of 1974.

3 ANALYSIS

3.1 Situation of the Accident Occurrence

3.1.1 Course of the Events

According to 2.1 to 2.7, it is probable that the situation was as follows.

(1) At around 11:16 on September 8, the Vessel began riding at single anchor (starboard anchor, seven shackles of anchor chain let out) in nearly ballast condition in the Anchorage for typhoon sheltering in preparation for the approach of Typhoon No. 15.

(2) At around 21:55, the Vessel completed a trial operation of her main engine and propulsion machinery.

(3) At around 22:00, the Vessel extended out another one shackle of anchor chain and rode at single anchor with a total of eight shackles of anchor chain and the starboard anchor, and she continued in this state thereafter.

(4) The wind and waves intensified with Typhoon No. 15's approach to Tokyo Bay from around 01:30 on September 9, and the Vessel began to be pushed downwind from around 01:45.

(5) The Vessel began using her main engine from around 01:51 and gradually increased the main engine's output; however, despite setting her main engine to full ahead at around 02:02, hull control became difficult and she continued to be pushed.

(6) At around 03:12, the Vessel's starboard stern section collided with the Bridge with her bow pointed east.

3.1.2 Date, Time and Location of the Accident Occurrence

According to 2.1 and 2.4, it is highly probable that the date and time of occurrence of the Accident were at around 03:12 on September 9, 2019, and the location was the Bridge, around 1,220 m at 171° true bearing from the Nissan Honmoku Pier lighthouse.

3.1.3 Damage Situation

According to 2.1, 2.3 and 2.4, it is highly probable that the situation was as follows.

(1) The Vessel

The Vessel sustained crushing, denting, and other damage to her starboard-side stern plating shell and starboard bridge wing and crushing of her bulbous bow. Additionally, a starboard-side lifeboat cradle and lifeboat that were installed below the bridge were lost.

(2) The Bridge and seawall (portion of Outer Perimeter Seawall E-1 and Outer Perimeter Seawall F of Minami Honmoku Pier)

1) Crushing, deformation, and other damage were sustained along about 122 m of the steel plate deck box girder bridge portion and about 60 m of the prestressed concrete pier portion, and damage was sustained by road lighting and other fixtures.

2) Gouges, abrasions, and other damage were sustained by about 460 m of seawall.

3.2 Causal Factors of the Accident

3.2.1 Situation of Crew Members

According to 2.1.3 and 2.5, the situation was as follows.

(1) The Master and Navigation Officer A possessed legally valid certificates of competence.

(2) It is probable that the Master and Navigation Officer A were in good health and not fatigued at the time of the Accident.

3.2.2 Condition of the Vessels

According to 2.6.3 and 2.6.4, it is probable that the situation was as follows at the time of the Accident.

(1) There was no malfunction or failure with Vessel's hull, engine, or machineries

(2) The Vessel was in nearly ballast condition.

(3) The Vessel was anchored with a bow draft of approximately 4.70 m, a stern draft of approximately 5.30 m, and a trim by the stern of approximately 0.6 m.

3.2.3 Anchoring Situation

According to 2.1.3, 3.1.1 and 3.2.2, it is probable that the situation was as follows.

(1) At around 11:16 on September 8, the Vessel began riding at single anchor (letting out the starboard anchor and seven shackles of anchor chain) in nearly ballast condition in the Anchorage as instructed by the Agent, conducted operations to prepare for stormy weather as appropriate, and put personnel on anchor watch.

(2) At around 21:55, the Vessel completed a trial operation of her main engine and propulsion machinery and found no abnormalities.

(3) At around 22:00, the Vessel extended out an additional one shackle of anchor chain and rode at single anchor with a total of eight shackles of anchor chain, and she continued in this state thereafter.

3.2.4 Weather and Sea Conditions

According to 2.7 and in light of the fact that three vessels (including the Vessel) of the 24 vessels anchored in the Reinforced Dragging Anchor Prevention Area, in which the Vessel was anchored, at the time of the accident and one vessel in Yokosuka Port, which is near said area, had anchor dragging accidents (see 2.15), the situation was as follows.

(1) It is certain that Typhoon No. 15 attained extremely strong force and passed the Miura Peninsula before 03:00 on September 9, subsequently came ashore with strong force near Chiba City before 05:00 on September 9 and, with maximum wind speed reaching 40 m/s at that time of landfall, became the strongest typhoon to make landfall in the Kanto region since 1991 (the first year for which statistics are available), causing extensive damage with violent winds particularly on the Boso Peninsula.

(2) It is certain that, at the time of the Accident, a typhoon warning had been issued in the Northern Sea off Kanto, including Tokyo Bay, and storm, high waves, heavy rain, and flood warnings had been issued in Yokohama City with the approach of Typhoon No. 15.

(3) It is probable that winds near the Accident's location blew from the east-northeast with an average wind speed of under 10 m/s until around 01:00 and began to have a maximum instantaneous wind speed exceeding 20 m/s from around 01:30 on the same day, and that the wind direction changed to northeast and then north-northeast.

(4) It is probable that the wind's intensity suddenly increased from around 02:30 and that the wind was blowing from the north with an maximum instantaneous wind speed of about 42 m/s and waves of around 3.0 m were being generated at the time of the Accident (around 03:12 on the same day).

(5) It is somewhat likely that, between 01:30 and 4:30, extremely strong localized winds were blowing momentarily in the sea area from the vicinity of the Anchorage to the Accident location in comparison with nearby sea areas that were also in the typhoon's storm area at that time.

3.2.5 Analysis of the Master's Awareness, Judgments, and Actions with Respect to Typhoon No. 15

From 2.1, 2.9, 2.12 and 3.2.3, it is probable that the situation was as follows.

(1) The Master estimated that the typhoon was strong, that it would pass near the Anchorage, that the TCPA would be around 02:00 on September 9, and that the maximum wind speed would reach about 35 m/s.

(2) Although the Master had never taken shelter from a typhoon (by anchoring) in Tokyo Bay before, he assumed that the typhoon's effects would not exceed his previous experience.

(3) While being aware that using about five shackles of anchor chain was normally appropriate in the Anchorage, the Master initially let out seven shackles for storm anchoring in preparation for the typhoon and then later let out an additional shackle for a total of eight shackles, and therefore he thought the Vessel would withstand the wind and waves of the typhoon even while continuing to ride at single anchor.

(4) Regarding the use of multiple anchors at the same time when anchoring, the Master did not take this step because he had never done so since becoming a master, because he was aware of such problems as the possibility of tangled anchors and reduced freedom of maneuvering, and, additionally, because of the circumstances described in (2) and (3) above.

(5) The Master estimated that he could maintain the Vessel's position with the anchor and anchor chain alone, and therefore he did any take any special steps to use the main engine to restrain swinging motion.

(6) The Master was not sufficiently aware that once full-scale anchor dragging (being pushed at a constant speed) had begun, it would be difficult to control the hull even with the main engine.

(7) Until around 01:45, the Master responded to cautioning from Tokyo MARTIS about the possibility of anchor dragging by stating that the Vessel was not dragging anchor. However, he thought that the Vessel had begun to drag anchor when the anemometer on the bridge began showing readings exceeding 60 knots at around 01:50 and he observed her position by radar at around 01:51, and it was this time that he first began using the main engine.

3.2.6 Analysis of Events between the Anchor Drag and Collision

According to 2.1, 2.7, 2.10, 2.11, and 3.2.5, it is probable that the situation was as follows.

(1) Under conditions in which the Vessel was in nearly ballast conditions and wind and waves were intensifying due to the approach of Typhoon No. 15, the Vessel did not use the main engine to restrain the hull's swinging motion and continued to ride at single anchor in a state in which swinging motion was being assisted.

(2) The Vessel initially kept her position near where she dropped anchor in the Anchorage while swinging normally. However, at around 01:45 on September 9, without the Vessel using her main engine, the external force of the wind and waves on the hull exceeded the hold provided by the anchor and anchor chain and the Vessel's hull was pushed downwind and she began to drag anchor.

(3) The Master observed that the Vessel had begun to drag anchor by checking her position on the radar at around 01:51 and began using the main engine for the first time then. He gradually increased the main engine's output from slow ahead, setting it to full ahead at around 02:02.

(4) At around 02:22, the Vessel was receiving a northeasterly wind with a maximum

instantaneous wind speed of about 30 m/s, and her hull was pushed to the southwest while swinging.

(5) Because the Vessel continued be pushed to the southwest, the Master continued using the main engine at full ahead to stop the Vessel's drift and keep away from the shore. However, the hull moved backward under the influence of the wind and waves, the propeller blades lost propulsive power and could not generate thrust, and, from around 02:39, sufficient forward propulsion could not be obtained and ship maneuvering became difficult.

(6) The Vessel continued to be pushed even further to the south in a state in which ship maneuvering was difficult, and she collided with the Bridge, beginning with her starboard stern section, at around 03:12.

3.2.7 Analysis of Safety Management

According to 2.10 and 3.2.5, it is probable that the situation was as follows with respect to items for which necessary measures must be taken (noted in 2.14.3) in the guidelines for anchor watch during stormy weather provided within the "Procedures for Anchoring" of the SMS Manual prepared by Company A.

(1) Although extending an appropriate anchor chain length or anchoring with two anchors, keeping a standby anchor ready, and dropping an anchor to restrain swing are specified in the guidelines, the Master did not take these steps with respect to the anchor because his awareness was as described in 3.2.5(4).

(2) Although extending a large amount anchor chain and using the main engine as necessary to prevent anchor drag are specified in the guidelines, the Master did not take these steps because his awareness was as described in 3.2.5(5).

3.2.8 Analysis of the Accident's Occurrence

According to 2.1.1, 2.1.3, 2.6.3, 2.8 to 2.10, 3.1.1 to 3.2.3, and 3.2.3 to 3.2.7, the situation was as follows.

(1) It is probable that, under conditions in which Typhoon No. 15 was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, the Vessel began riding at single anchor, with seven shackles of anchor chain let out, in nearly ballast condition using her starboard anchor in the Anchorage from around 11:16 on September 8 in order to take shelter from the typhoon.

(2) It is probable that the Master ordered the main engine put on one-hour standby at around 21:45 to be ready for wind and waves from the typhoon, and that he conducted a trial operation of the main engine and propulsion machinery at around 21:55 and verified that there were no abnormalities with either.

(3) It is probable that the Master let out additional shackle of anchor chain at around 22:00 to ride at single anchor with an anchor chain length of eight shackles and he began conning the Vessel on the bridge.

(4) It is probable that the average wind speed near the Accident's location was under 10 m/s, blowing from the east-northeast, until around 01:00 on September 9; however, as Typhoon No. 15 approached Tokyo Bay, the maximum instantaneous wind speed began exceeding 20 m/s from around 01:30 and the wind direction changed to northeast and then north-northeast.

(5) It is probable that the Master put the main engine on standby (i.e., in a useable state) at around 01:40 because he felt the wind's intensity suddenly increase.

(6) It is probable that the Vessel initially kept her position near where she dropped anchor in the Anchorage while swinging normally; however, the hull began being pushed downwind at around 01:45 and the Vessel began to drag anchor.

(7) It is probable that the display for the bridge's anemometer began exceeding 60 knots at around 01:50 and therefore the Master checked the Vessel's position on the radar and observed that the Vessel had begun dragging anchor, and that the Master began using the main engine for the first time at around 01:51 and gradually raised the main engine's output from slow ahead, setting the main engine to full ahead at around 02:02.

(8) It is probable that the Vessel was receiving a northeasterly wind with a maximum instantaneous wind speed of about 30 m/s at around 02:22 and her hull was pushed to the southwest while swinging, and that the Master thought that controlling the hull had become difficult due to the intensifying wind and waves and therefore assembled all hands on the bridge except two crew members who were on engine room watch.

(9) It is probable that, because the Vessel continued be pushed to the southwest, the Master continued using the main engine at full ahead to stop the hull's drift and keep the Vessel away from the shore; however, the hull moved backward under the influence of the wind and waves, the propeller blades lost propulsive power and could not generate thrust, and, from around 02:39, sufficient forward propulsion could not be obtained and ship maneuvering became difficult.

(10) It is highly probable that the Master notified Port Radio by VHF that he could not control the hull at around 02:39 and that he replied to a warning from Tokyo MARTIS that the Vessel was dragging anchor at around 02:44 by saying that he was responding by using the main engine.

(11) It is highly probable that the Master continued attempting to control the hull by using the main engine but without effect, and that he believed that he could not stop the Vessel's drift with her own power and therefore began asking Port Radio to make arrangements for help by a tugboat from around 02:53 but could not receive said help due to the worsening weather and sea conditions.

(12) It is highly probable that the Vessel continued to be pushed even further to the south on the lee side in a state in which ship maneuvering was difficult, and that her starboard stern section collided with Bridge with her bow pointed east at around 03:12.

4 PROBABLE CAUSES

4.1 Probable Causes

It is probable that the Accident occurred when, as the Vessel was anchored in nearly ballast condition at night in the Anchorage to take shelter under conditions in which Typhoon No. 15 was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, she dragged anchor and, despite setting her main engine to full ahead, she was pushed without being able to control her hull's attitude and collided with the Bridge because she continued riding at single anchor when the wind and waves intensified due to the typhoon.

It is probable that the Vessel continued riding at single anchor because the Master had no personal experience using multiple anchors at the same time during anchoring and was aware that problems could occur when using multiple anchors, such as the possibility of tangled anchors and reduced freedom of maneuvering, and, additionally, because the Master assumed that the effects of the typhoon would not exceed his previous experience and thought that the Vessel would be able to withstand the wind and waves by letting out eight shackles of anchor chain for storm anchoring in preparation for the typhoon.

It is probable that the hull's attitude could not be controlled despite the main engine's being set to full ahead because sufficient forward propulsion could not be obtained, as propulsive power was lost when the hull moved backward under the effects of the wind and waves and the propeller blades lost thrust.

4.2 Other Identified Safety Issues

According to *Nihon no Kiko Hendo 2020* (climate change in Japan 2020), published by the Japan Meteorological Agency, climate change (including rising temperatures, increasing frequency of heavy rainfall, and other such phenomena) has been progressing in various regions in recent years and is expected to become more serious in the future.

Additionally, the report points out that the intensity of typhoons near Japan will increase, and that the frequency (number within an area for a certain period of time) of extremely strong tropical cyclones (equivalent to "violent"[*8] typhoons) over Japan's southern oceans is likely to increase. In addition, it predicts that the rain and wind from individual tropical cyclones, including typhoons, will intensify.

For this reason, it is conceivable that future typhoons approaching or striking Japan will generate effects from wind and wave that are beyond previous experience and that Japan may suffer enormous damage as a result.

[*8] "Violent" is the strongest among typhoon intensity categories. It applies to a typhoon whose maximum windspeed reaches or exceeds 54 m/s (105 knots).

5 SAFETY ACTIONS

5.1 Safety Actions to Address this Anchor Dragging Accident

It is probable that the Accident occurred when, as the Vessel was anchored in nearly ballast condition at night in the Anchorage to take shelter under conditions in which Typhoon No. 15 was approaching and a typhoon warning had been issued for the Northern Sea off Kanto, including Tokyo Bay, she dragged anchor and, despite setting her main engine to full ahead, she was pushed without the ability to control her hull's attitude, being unable to obtain sufficient forward propulsion, and collided with the Bridge because she continued riding at single anchor when the wind and waves intensified due to the typhoon.

Accordingly, it is probable that implementation of the following measures is necessary when sheltering from a typhoon by anchoring to prevent occurrence of a similar accident.

(1) Masters obtain the latest information on weather and sea conditions, make accurate predictions, and endeavor to decide on and execute responsive actions with plenty of time to spare.

(2) Masters select an appropriate anchorage and anchoring method after prior consultation with the operator/manager and others concerned, taking into consideration the following:
   1) Information on weather and sea conditions (forecasts)
   2) The state of own vessel
   3) Physical characteristics of the anchorage
   4) The situation of other anchored vessels in the anchorage
   5) Facilities of social importance around the anchorage
   6) The advantages and disadvantages of each anchoring method (e.g., single-anchor mooring, two-anchor mooring, etc.)
   7) The issuance of any recommendations to shelter outside the port, etc., by the harbor master or other authority

(3) Masters let out as much anchor chain as possible and secure sufficient hold with anchors and anchor chain. In doing so, consider to use anchors on both sides of the vessel (Two-anchor, Twin-anchor) and when riding at single anchor, consider to use the anchor on the other side as a "swing suppression anchor (snubber anchor)" as necessary.

When determining the amount of anchor chain to be let out, masters should not rely solely on their own experience but should also make an objective judgment on the possibility of anchor drag by, for example, using the "Risk Assessment Application for Dragging Anchor" system (described in 2.11 and 5.2.1(6)).

(4) While at anchor, masters maintain an appropriate and attentive stormy weather watch by monitoring the anchoring conditions of their own vessel and surrounding vessels (e.g., swinging motion, position, speed, etc.), monitoring (changes in) weather and sea conditions, and constantly monitoring international VHF.

(5) When being directly affected by a typhoon or other phenomenon while at anchor, masters prepare the main engine in advance with awareness that it may be difficult to keep the vessel's position with anchors alone, use the main engine and rudder continuously in accordance with rapidly changing wind direction and speed, maneuver the vessel so that the bow is pointed into the wind, and maintain the vessel's position by restraining swinging motion.

(6) When at anchor, masters bear in mind even before full-scale anchor drag begins that

controlling the hull with ship maneuvering may become impossible and, when they judge that keeping the vessel's position using the actions mentioned in (5) above will be difficult, lose no time in immediately shifting anchorage or moving to another sea area.

(7) Management companies ensure that the masters of the vessels they manage thoroughly understand the above items (1) to (6) and also explain the specifics of and provide guidance and education on those items using the "Guidelines for Preventing Anchor Dragging Accidents" (including foreign language versions) and other materials prepared by Japan Coast Guard, the Maritime Bureau, and others.

5.2 Safety Actions Taken Following the Accident

5.2.1 Measures Taken by Japan Coast Guard, etc.

(1) Following anchor dragging accidents caused by the effects of Typhoon No. 15 and with Typhoon No. 19 approaching, Japan Coast Guard recognized the need to implement additional, readily practical measures to prevent anchoring accidents and therefore provided strong guidance to maritime offices to, among other actions, issue a public awareness statement recommending moving outside of Tokyo Bay and sheltering outside of the bay. Additionally, harbor masters and the Tokyo Wan Vessel Traffic Service Center joined to take measures that included making prior confirmations of anchoring methods for vessels prone to anchor dragging accidents, providing guidance concerning self-restraint in anchoring, and issuing incremental and multiple recommendations on shifting anchorage and heaving to[*9] in the early stages of anchoring. The additional measures to prevent anchor dragging accidents functioned effectively and no collisions of vessels dragging anchor occurred as a result.

(2) In response to the collision of an oil tanker with the Kansai International Airport's access bridge caused by Typhoon No. 21 in September 2018, and from the standpoint of ensuring the safety of marine traffic, Japan Coast Guard began applying new regulations based on the Maritime Traffic Safety Act in the sea area around that airport on January 31, 2019. Moreover in addition to the sea area around the airport, JCG selected 40 locations as important facilities (i.e., facilities such as transport facilities and essential utilities that would bring detriment if interrupted or for which alternative means are nonexistent) in the sea areas of Japan in April 2019 and was implementing stormy weather anchoring restrictions in those sea areas. In response to the Accident, JCG decided to newly designate the Minami-Honmoku Hama Road as an important facility and to manage an area with a 2-M radius (excluding some sea areas) centered on the over-sea bridge section of said road in an integral manner with the existing Reinforced Dragging Anchor Prevention Area.

(3) In June 2020, the Study Committee (mentioned in 2.13) prepared a report (*Tokyo-wan-to ni okeru Koten-ji no Sobyo-to ni ki'in-suru Jikoboshi Taisaku ni tsuite* [regarding countermeasures against accidents caused by anchor dragging during stormy weather in Tokyo Bay]) that included the basic items of measures to prevent anchor dragging accidents, measures to prevent anchor dragging accidents for facilities and sea areas targeted for priority study, and verification of measures to prevent anchor dragging accidents during the typhoon season in 2019. The Study Committee also made recommendations for promoting sheltering outside of Tokyo Bay, measures concerning shipboard responses, and measures

[*9] "Heaving to" is a method of ship maneuvering for keeping a vessel in place by using enough forward propulsion from the engine to maintain the rudder's effectiveness during stormy weather and catching the wind and waves at slight angle to the bow.

concerning operational management and measures by facility managers.

In particular, recognizing the necessity of providing ship operators (including masters) with a broad range of knowledge and skills concerning measures to prevent anchor dragging accidents, the Study Committee is working with the public and private sectors to raise awareness so that such knowledge and skills will be consistently conveyed to ship operators by sending out guidelines ("Guidelines for Preventing Anchor Dragging Accidents") and leaflets ("Guide to Harborage in Tokyo Bay During Stormy Weather." etc.) and organizing training courses as measures relating to shipboard response.

(4) Taking into account the aforementioned recommendations of the Study Committee concerning current systems and measures to be taken, the Council of Transport Policy began a study in July 2020 on the expansion and reinforcement of new maritime traffic safety infrastructure to appropriately respond to accidents caused by anchor dragging and other phenomena due to the increasingly frequent and severe occurrence of abnormal weather of recent years. On January 28, 2021, the Council submitted a report titled *Hinpatsu Gekijin-ka-suru Shizen Saigai-to Arata-na Kotsu Kankyo ni Taio-shita Kaijo Kotsu Anzen Kiban no Kakuju-Kyoka ni tsuite* (regarding the expansion and reinforcement of maritime traffic safety infrastructure to respond to increasingly frequent and severe natural disasters and other new traffic environments) to the Minister of Land, Infrastructure, Transport and Tourism.

(5) In response to the developments described in (4) above, Japan Coast Guard submitted a "bill for partial amendment of the Maritime Traffic Safety Act" (creation of a system for issuing recommendations and orders to shelter outside of Japan's three major bays [Tokyo bay, Ise Bay, and Osaka Bay], etc.) to better ensure the safety of navigation by preventing hazards to maritime traffic caused by abnormal weather, etc., and ensuring the prompt restoration of buoys and other navigation aids managed by JCG. The amendment was approved by the Cabinet on March 2, 2021, enacted on May 25, and entered into force on July 1.

This amendment makes it possible to recommend to large high freeboard vessels, vessels carrying hazardous cargoes, and other vessels that they leave Tokyo Bay when a typhoon is approaching, thereby relieving congestion in the bay.

It is therefore anticipated that recommendations to shelter outside a port or Tokyo Bay and other advisories will be issued according to the anchor dragging risk and seaworthiness of each vessel, and that this will reduce congestion throughout the bay, including its ports, and help prevent anchor dragging accidents.

(6) In light of the oil tanker collision with the Kansai International Airport's access bridge that was caused by Typhoon No. 21 in September 2018 and other incidents, the Ministry of Land, Infrastructure, Transport and Tourism has been implementing comprehensive measures to prevent the recurrence of accidents in which vessels are pushed by strong winds during typhoons and other stormy weather and collide with other vessels or shore facilities (i.e., anchor dragging accidents). As one such measure, the Maritime Bureau developed a "Risk Assessment Application for Dragging Anchor" system (nicknamed "IKARI-ing") that helps mariners determine the risk of their vessel's dragging anchor (i.e., the possibility of anchor dragging) at places they are considering anchoring and then take measures to prevent an anchor dragging accident according to that risk (for example, by changing the anchorage or anchoring method). The system was made available to the public on July 1, 2021 (the English version was released on August 6). (See the Attachment [only

the Japanese version is provided])

5.2.2 Measures taken by Company A

(1) Company A drew attention to the accident by providing information on the accident to all masters of the vessels it manages and distributing a summary of the events of the accident with comments (including cautionary points and lessons learned) by email.

(2) Company A issued General Instructions to the vessels it manages titled "Anchoring when approaching Typhoon or Rough weather is expected," and issued instructions on countermeasures for preventing similar anchor dragging accidents that presents a summary of the Accident and the following points.

<Countermeasures>

The dangerous (sic) *of dragging anchor is collision, grounding and/or contact to facilities after uncontrolled condition.*

Early prediction and detection of the dragging anchor will avoid serious accident.

In order to detect dragging anchor as early as possible, below must be followed.

1. *Consider the weather forecast well and also consider the rapid development of typhoon, then look for suitable Safety Area for Drifting on a top priority as early as possible.*
2. *In case anchoring, keep at least 1NM from other vessel and at least 3NM from facilities if possible.*
3. *Must be entered "Bridge Turning Circle" on the Chart.*
4. *To check if dragging anchor at least once an hour in accordance with Anchor Watch Procedure.*

   Pay attention to Ship's position, and check if Ship's position is inside the Turning Circle, to try to notice dragging anchor.
5. *Consider to use of S/B Eng if wind became over 10-13m/s and Wind Force 5-6, when approaching Typhoon or Rough Weather is expected.*
6. *Weather and Sea Condition must be checked every an hour.*
7. *When anchoring in approaching Typhoon and/or Rough weather is expected, below should be reported to company.*
   1) *Date and time*
   2) *position Lat/Long Anchor or Drift*
   3) *Distance to surround vessel*
   4) *Distance and direction to nearest obstruction e.g. breakwater, buoy, bridge etc*
   5) *wind kts/direction*
   6) *gust kts/direction*
   7) *wave meters/direction*
   8) *swell meters/direction*
   9) *any info if any*
8. *SMS Manual ZZ-S-P-07.20.02 should be referred.*

(3) Company A revised and made additions to the section on "Procedures for Anchoring" in the SMS Manual.

The following points were added:

1) Endeavor to detect anchor drag quickly by conducting anchor drag detection work at least once an hour.
2) Maintain a safe distance from shore facilities and structures in the procedure for

anchor watch during stormy weather.

3) Take into account the time required to weigh anchor in the procedure for anchor watch during stormy weather.

(4) Company A changed its anchor watch checklist.

(5) Company A alerted the vessels it manages of the possibility of anchor dragging accidents when stormy weather is anticipated.

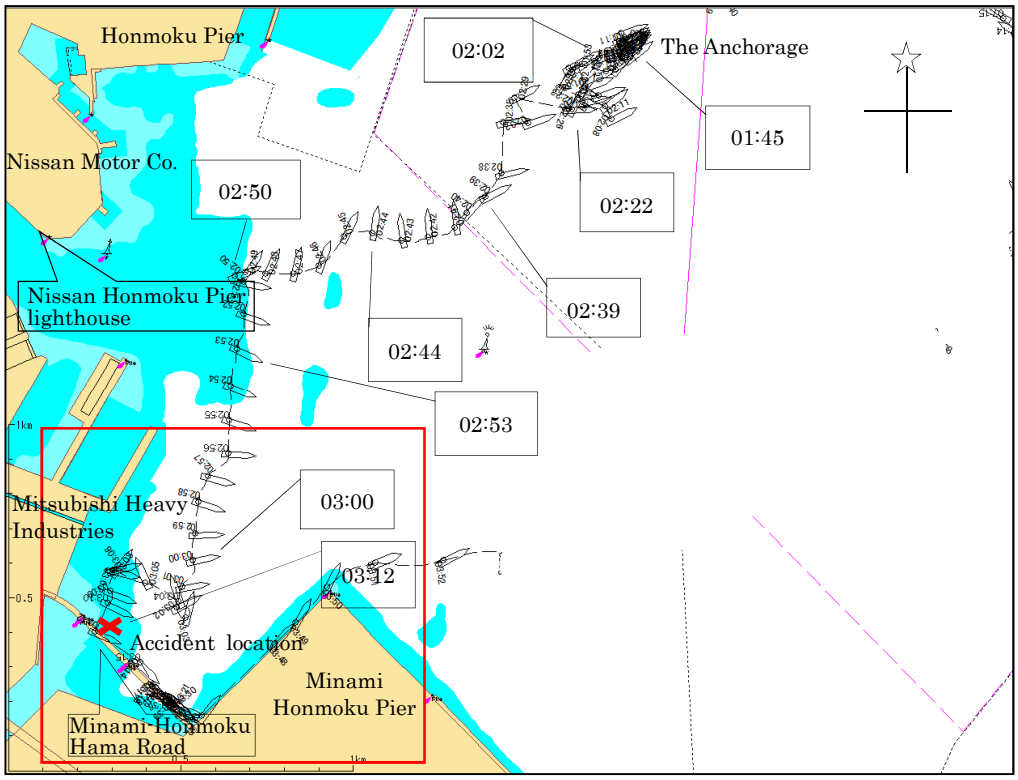
5.3 Other Accident Prevention Measures Deemed Necessary

As was indicated in 5.1 (1) through (6) above, measures to prevent the recurrence of an anchoring accident should be based on aspects of the vessel's operation, such as her master's judgment, when anchoring at an anchorage has been decided or selected as the method for typhoon sheltering.

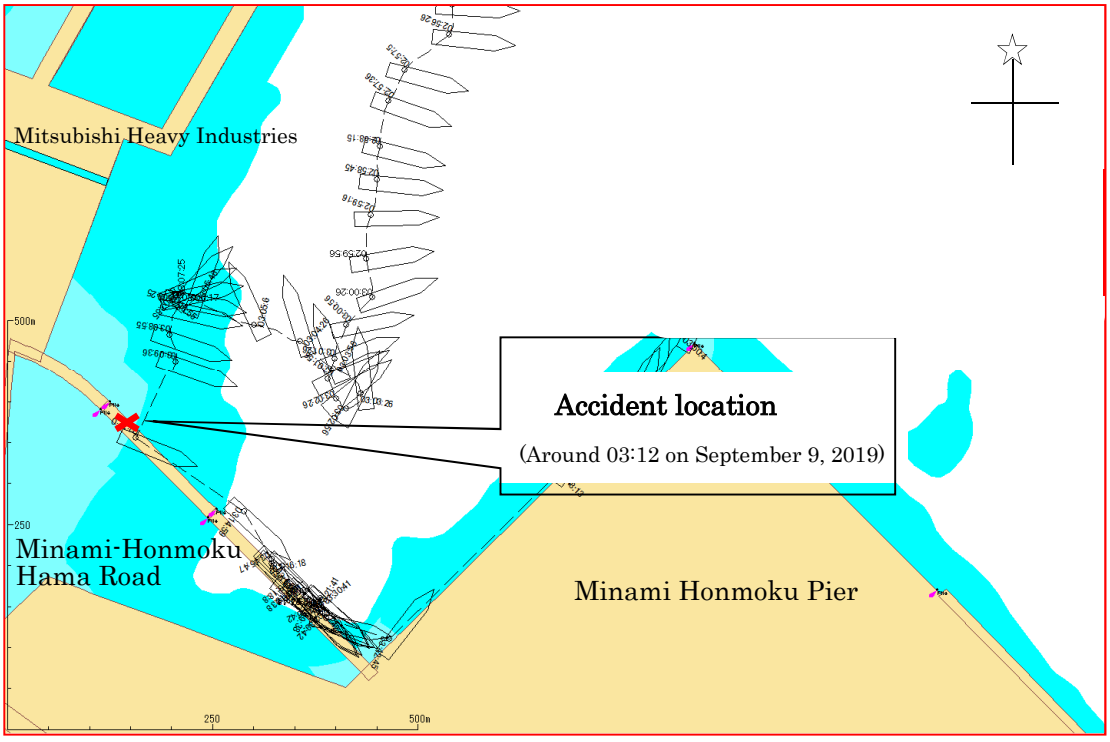
On the other hand, in light of the situation described in 4.2, if the current situation of Tokyo Bay and other sea areas where many anchored vessels are present during rough weather and many important facilities are located in both waterfront and sea areas are taken into account, it is probable that, although not a direct recurrence prevention measure with respect to the cause of the Accident (4.1), the promotion of sheltering outside of the bay can contribute greatly to the prevention of collisions with other vessels or shore facilities caused by vessels that drag anchor. It is thought that private businesses concerned with the Vessel's operation—including shippers as well as the management company, operating company, and agent—as well as Japan Coast Guard, port management bodies, and other related public agencies must work together to steadily promote this means of sheltering.

It is hoped that the parties concerned will continue to establish a common awareness of this issue and build a stronger system of partnership and cooperation to prevent anchor dragging accident, and by doing so, they can, depending on the circumstances, recommend sheltering outside of a bay rather than inside it during typhoons and other forms of stormy weather and ensure the effectiveness of this kind of sheltering so that masters on site can take appropriate action with plenty of time to spare and without any hesitation in their decision-making.

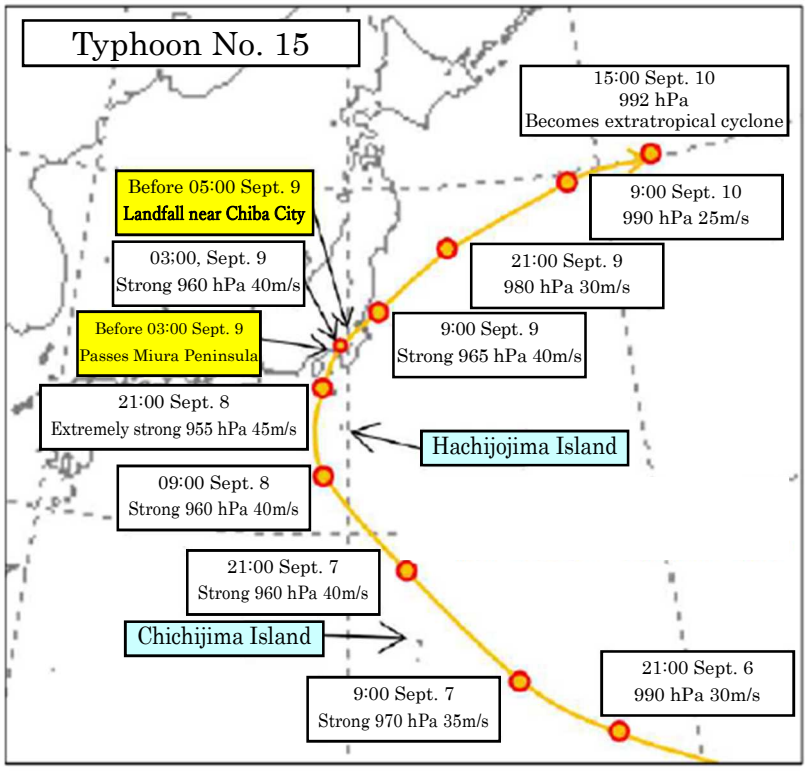
Attached Figure 1　Estimated Navigation Route (Overall View)



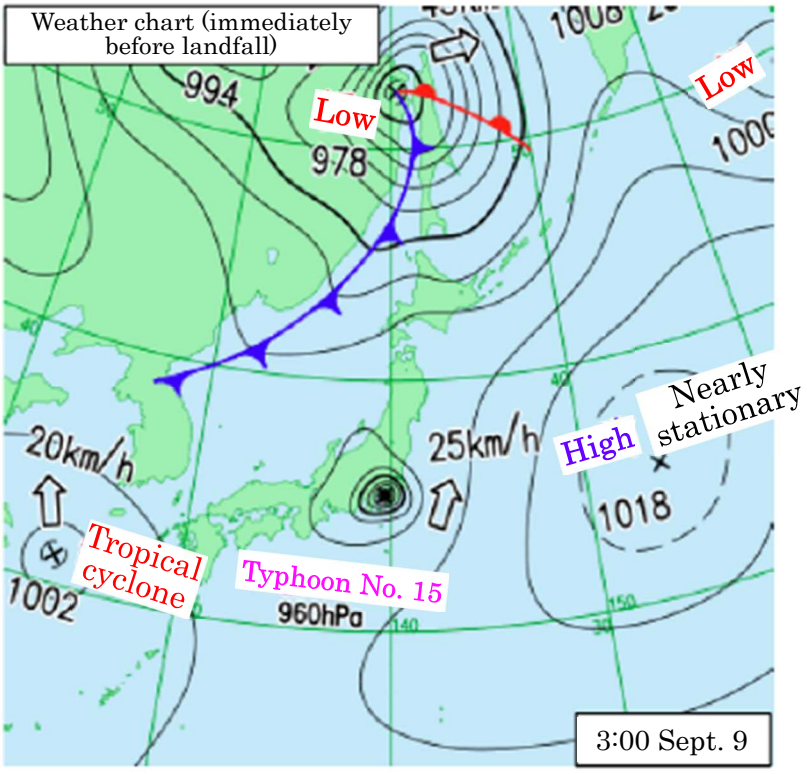
Attached Figure 2　Estimated Navigation Route (Enlarged)



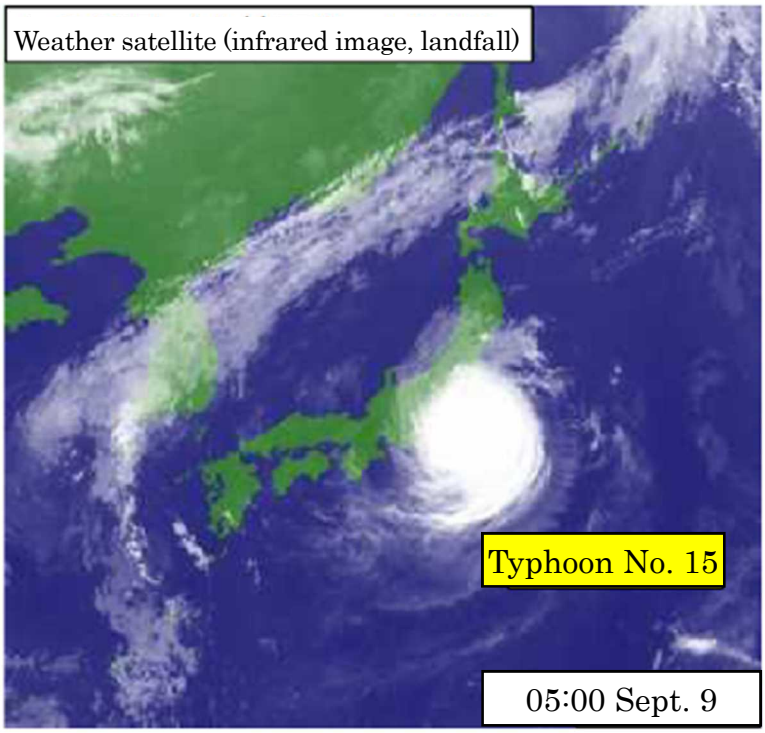
Attached Figure 3　Path of Typhoon No. 15



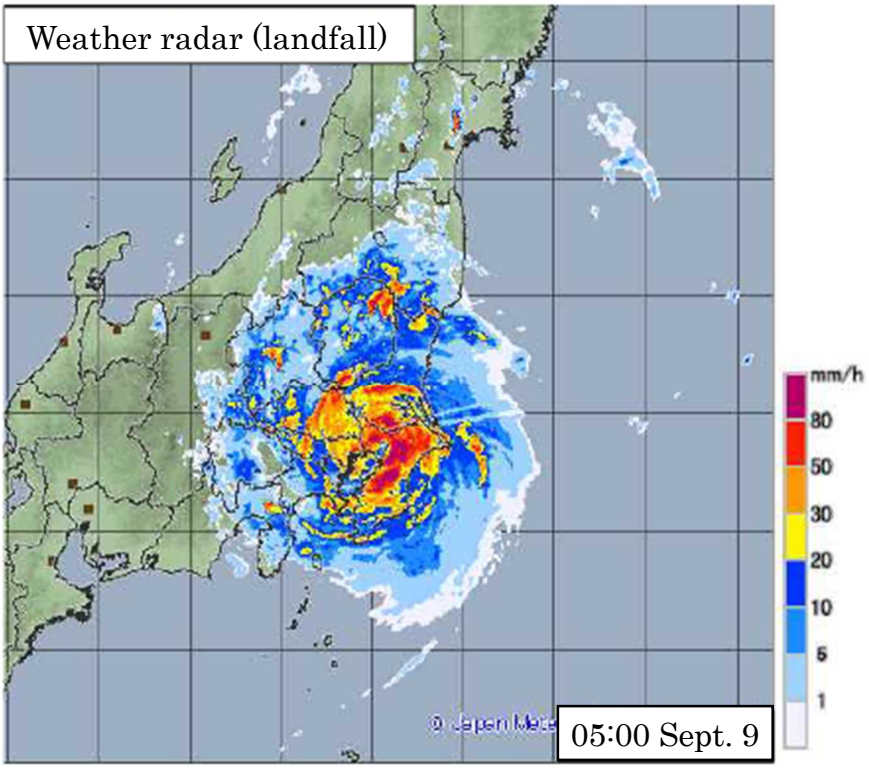
Attached Figure 4　Surface Weather Chart (03:00 on September 9)



Attached Figure 5　Infrared Image from a Weather Satellite during Landfall
(05:00 on September 9)



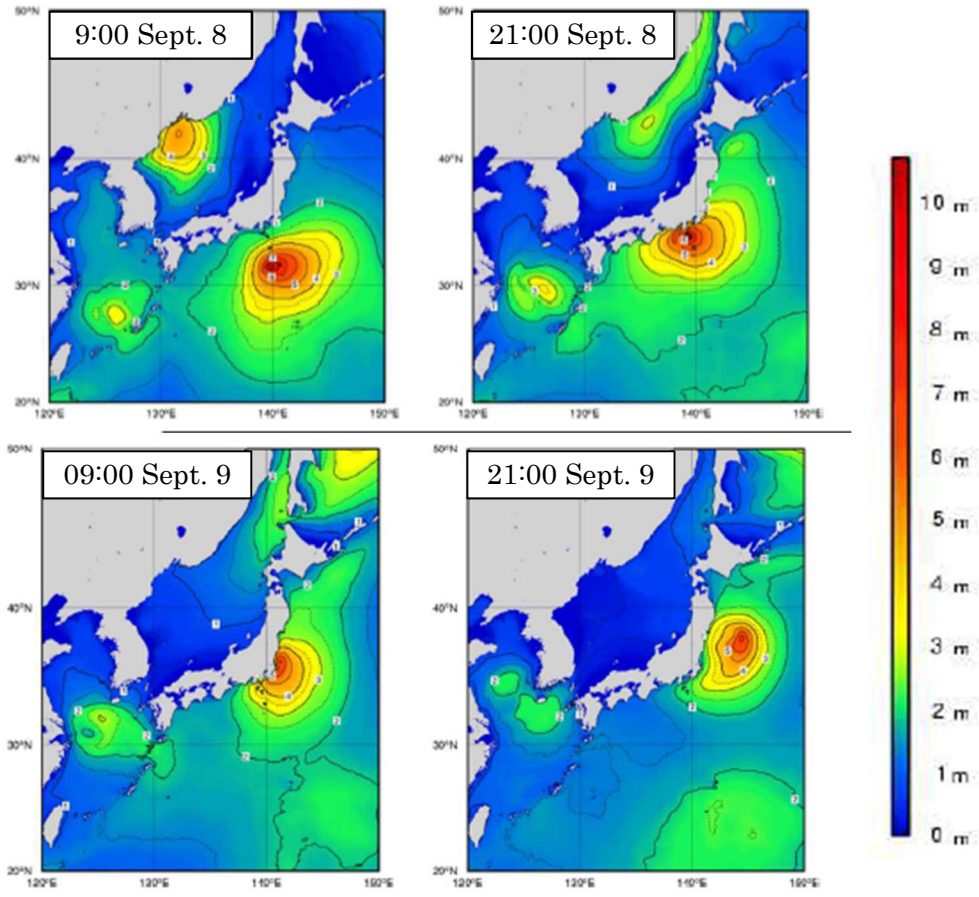
Attached Figure 6　Rainfall Intensity Observed by Weather Radar during Landfall
(05:00 on September 9)



Attached Figure 7　Ocean Wave Observations at Daini Kaiho (September 9)

02:00　03:00

Attached Figure 8　Coastal Waves Chart (September 8 and 9)



July 1, 2021
Safety Policy Division, Maritime Bureau

Announcing the Release of a System to Reduce Anchor Dragging Accidents by Ships that Runs on both Smartphones and PCs!

- Use this free system (nicknamed "IKARI-ing") to ascertain your vessels risk of anchor dragging -

We are releasing a free Risk Assessment Application for Dragging Anchor (nicknamed "IKARI-ing") that allows mariners to assess the anchor dragging risk of their own ships using their smartphones and other devices. The system's aim to reduce the number of accidents in which ships are pushed by strong winds during typhoons and collide with other ships or shore facilities (known as "anchor dragging accidents").

1. Background

○ Typhoon No. 21 of 2018 caused a ship to collide with the Kansai International Airport's access bridge. In response to this and other incidents, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is implementing comprehensive measures to prevent the recurrence of accidents in which ships are pushed by strong winds and collide with other ships or shore facilities (known as "anchor dragging accidents") during typhoons and other kinds of stormy weather.

○ One such measure is the development of an "Risk Assessment Application for Dragging Anchor" (nicknamed "IKARI-ing"). This system helps mariners determine the risk of their vessel's dragging anchor (i.e., the possibility of anchor dragging) at places they are considering anchoring and then take measures to prevent an anchor dragging accident according to that risk (for example, by changing the anchorage or anchoring method).

2. Outline of the Risk Assessment Application for Dragging Anchor (nickname: "IKARI-ing")

○ This system uses information inputted by a mariner (the user)—such as information on the ship (e.g., length, width, etc.), the anchoring point (depth and bottom material), and weather and sea conditions—to ascertain the risk of anchor drag in three levels (high, medium, and low). It thus helps the mariner take measures to prevent anchor dragging accidents according to that risk. Such measures can include changing the anchorage, changing the anchoring method (reconsidering the number of anchors used, for example), and starting the engine.

○ The system has two versions: a PC version that can be used offline and an internet app version that can be used on smartphones and tablets. Both versions can be downloaded and used free of charge from the website of National Institute of Maritime, Port and Aviation Technology (National Maritime Research Institute).

○ The widespread use of this system is expected to reduce the number of anchor dragging accidents by encouraging mariners to understand their own ships' risk of anchor dragging in advance and take appropriate measures to prevent such accidents in preparation for typhoons.

Where to download and use the Risk Assessment Application for Dragging Anchor

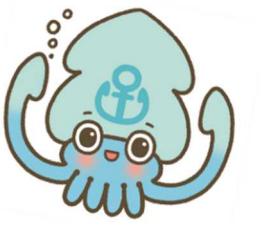
○PC version Apply here

https://www.nmri.go.jp/ikaring/index.html

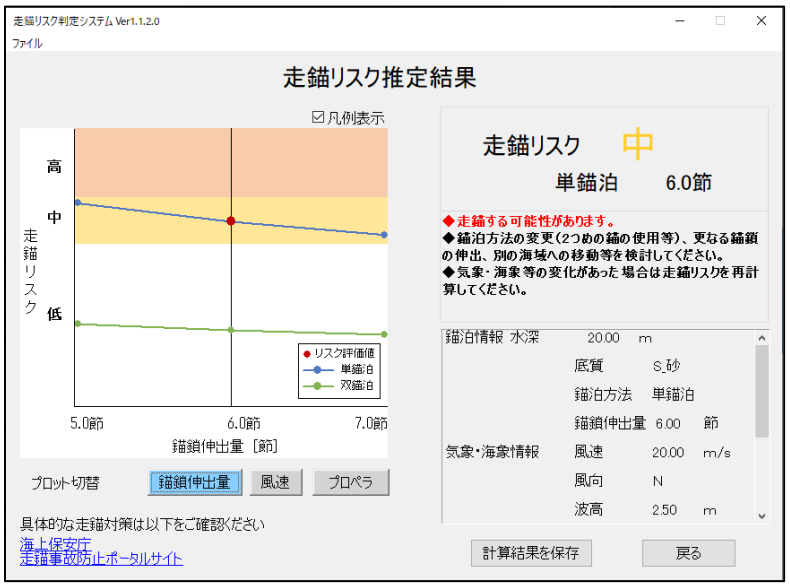
○Internet app version Available here

https://cloud.nmri.go.jp/apps/ikaring/

QR Code for the app version



IKARI-ing's mascot
Mr. IKARI-ing



PC version　Sample calculation results page

App version　Sample app page

For inquiries, please contact:
Safety Policy Division, Maritime Bureau,
MLIT (ask for Fukaishi or Hara)
Tel.: 03-5253-8111 (ex. 43-502, 43-567)
Fax : 03-5253-1642

Please Use the Risk Assessment Application for Dragging Anchor

Risk Assessment Application for Dragging Anchor

Free to use

Nickname: IKARI-ing

Mr. IKARI-ing

The Risk Assessment Application for Dragging Anchor can easily estimate anchor dragging risk for a ship at anchor based on the ship's main weight details and weather/sea information. Its main purpose is to help mariners make decisions when anchoring in sea areas where stormy weather is expected.

Two versions--an internet app version and PC software version--are available.

Internet app version

An internet connection is required for use.

Online

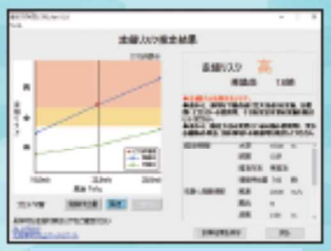
Access the internet app here

PC software version

Useable offline. Provides detailed analysis.

Offline

Risk of anchor drag per unit of anchor chain length



Risk of anchor drag per unit of wind speed

Download the PC version here *Runs on PCs with the Windows OS

https://www.nmri.go.jp/ikaring/index.html

国土交通省

海上技術安全研究所 National Maritime Research Institute

Risk Assessment Application for Dragging Anchor
Quick Estimation Template

Fill in this template after calculating the risk of anchor dragging at anchorages you often use and then keep it ready on your bridge.
It will help you check anchor dragging risk quickly during actually anchoring.

In ballast （draft:　　m)

Depth	m															
Bottom composition	Sand								Mud							
Amount of anchor chain let out (shackles)																
Wave height (m)																
Wind speed (m/s)																
Anchor dragging risk																

Fully loaded　（draft:　　m)

Depth	m															
Bottom composition	Sand								Mud							
Amount of anchor chain let out (shackles)																
Wave height (m)																
Wind speed (m/s)																
Anchor dragging risk																