MA2024-03

MARINE ACCIDENT
INVESTIGATION REPORT

March 28, 2024

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

February 21st, 2024
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member ITO Hiroyasu
Member UENO Michio
Member SODA Hisako
Member OKAMOTO Makiko

Accident type	Grounding
Date and time	Around 09:20 on January 24, 2023
Location	Off the northwest of Taketomi Island, Taketomi Town, Okinawa Prefecture Around 268° true bearing, 3.8 nautical miles (M) from Ryukyu Kannonzaki Lighthouse (Approx. 24°21.8'N 124°02.6'E)
Summary of the Accident	The cargo ship XIN HAI ZHOU 2 was drifting for the purpose of time adjustment off the west of Ishigaki Island, Ishigaki City, Okinawa Prefecture, when she was pushed by the wind and waves. She therefore started her main engine and navigation; however, she continued to be pushed without gaining sufficient propulsion or rudder effect and ran aground on a shallow reef off the northwest of Taketomi Island. XIN HAI ZHOU 2's hull subsequently broke in two at her center section.
Process and Progress of the Investigation	The Japan Transport Safety Board appointed an investigator-in-charge and two other marine accident investigators to investigate this accident on January 24, 2023. January 26 and 27, 2023: Interviews January 28, 2023: On-site investigation February 1, 7 to 9, 14, and 15; March 3 and 31; April 19 and 21 to 23; May 19; June 5 to 7, 14, 28, and 29; and August 17: Collection of documents Comments on the draft report were invited from parties relevant to the cause of the accident. Comments on the draft report were invited from XIN HAI ZHOU 2's flag state.
Factual Information Vessel type and name	 Cargo ship XIN HAI ZHOU 2 (registry: Republic of Panama)

Gross tonnage	8,461 tons
Deadweight tonnage	13,552.5 tons
Vessel number	9507104 (IMO number)
Owner	NEW SEALAND MARINE CO., LTD.
Management company	GRAND VOYAGE MARINE CO., LTD.
Class	OMCS (Overseas Marine Certification Services)
L×B×D	140.19 m × 20.0 m × 10.5 m
Hull material, data of launch	Steel, May 5 2008
Principal particulars of engine	Diesel engine, inboard, 2,970 kW 4-cycle, 650 rpm, 8 cylinders, 320-mm bore Fuel used: Low-sulfur fuel oil and marine diesel oil; date of manufacture: unknown Reduction ratio: 4.5:1
Principal particulars of propulsion	Propeller type: MAU; propeller diameter: 4,180 mm Pitch: 2.7839 m; blades: 5; direction of rotation: starboard

(See Photo 1 and Figure 1)

Courtesy of Japan Coast Guard

Photo 1　The Vessel

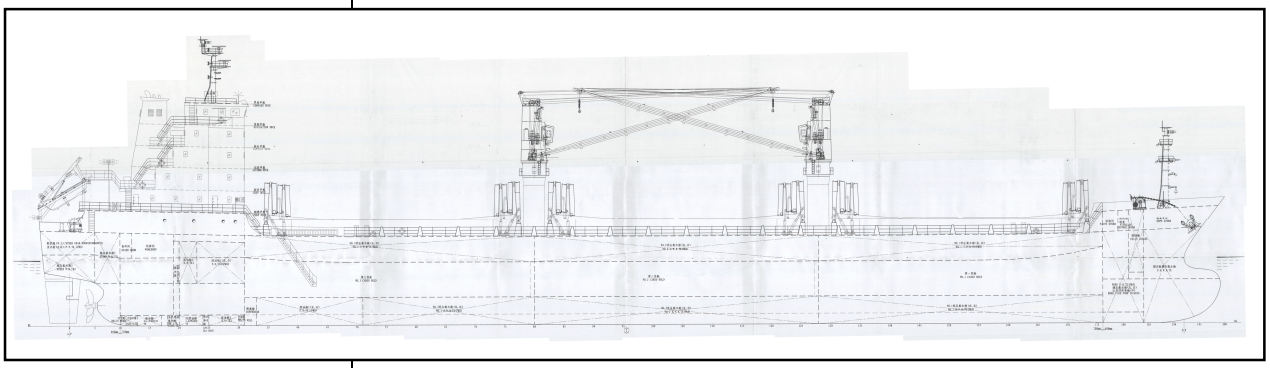


Figure 1　General Arrangement Plan (Excerpt)

Crew Information	Master (national of the People's Republic of China): 48 years old Endorsement attesting the recognition of certificate under STCW regulation I/10: Master (issued by the Republic of Panama) Date of Issue: August 10, 2021 (Valid until November 18, 2024) Officer A (national of the People's Republic of China): 33 years old

	Endorsement attesting the recognition of certificate under STCW regulation I/10: Chief Mate (issued by the Republic of Panama) Date of issue: November 25, 2022 (Valid until June 17, 2027) Chief Engineer (national of the People's Republic of China): 49 years old Endorsement attesting the recognition of certificate under STCW regulation I/10: Chief Engineer (issued by the Republic of Panama) Date of Issue: October 1, 2021 (Valid until May 25, 2026)
Injuries to Persons	None
Damage to Vessel (or Other Facilities)	The Vessel: The hull broke in two at the No. 3 hold (total loss) Other damage: Some of the coral under the Vessel's bottom was damaged by the grounding. The entirety of the Vessel's cargo (palm kernel shell*1) leaked into the sea. (See Photos 2 and 3)  Courtesy of the salvage company Photo 2 The Situation After the Vessel's Grounding (January 26, 2023)  Courtesy of Japan Coast Guard Photo 3 The Situation After the Vessel's Grounding (August 4, 2023)
Weather and Sea Conditions	Weather: Weather Cloudy; Wind direction N; Wind speed approx. 17 m/s; Visibility good Sea conditions: Swells; Wave direction N; Wave height approx. 2 m (From information provided by Japan Coast Guard) (1) Tide According to tide tables published by Japan Coast Guard, the tide at Ishigaki at the time of this accident was high tide and the height of tide was approximately 151 cm. (2) Announcement of Warnings and Advisories

*1 Palm kernel shell (PKS) is the shell of the oil palm seed. It is used as a biomass fuel (fuel made from biological resources derived from plants and animals).

A gale warning was issued for the sea south of Okinawa and southern part of the East China Sea at 05:35 on January 23 and a high winds advisory and heavy seas advisory were issued for Ishigaki City and Taketomi Town at 16:33 on January 23. The heavy seas advisory was changed to a heavy seas warning at 07:58 on January 24 and remained in effect until the time of the accident. The warning period of the heavy seas warning went into effect at 12:00 on January 24.

(3) The content of the gale warning for the sea south of Okinawa and southern part of the East China Sea that was announced by the Okinawa Meteorological Observatory at 23:40 on January 23 was as follows.

In the sea south of Okinawa, northerly winds are expected to gradually intensify, reaching a maximum of 35 knots (18 meters) by 03:00 on January 24 and 45 knots (23 meters) by 09:00 on January 24.

In the southern part of the East China Sea, northerly winds will be strong, reaching a maximum of 30 knots (15 meters) and 45 knots (23 meters) by 15:00 on January 24.

Additionally, the Ishigakijima Local Meteorological Observatory issued the following weather information concerning high waves and high winds for the Ishigaki Island area at 05:02 on January 24.

High waves

The coastal sea areas of the Yaeyama region are expected to have heavy seas, with high waves with swells that will rapidly intensify, from the evening of January 24 to the dawn of January 25. Be wary of high waves with swells at sea and near the coast.

Anticipated wave height on January 24:

Ishigaki Island area 6 meters With swells

High winds

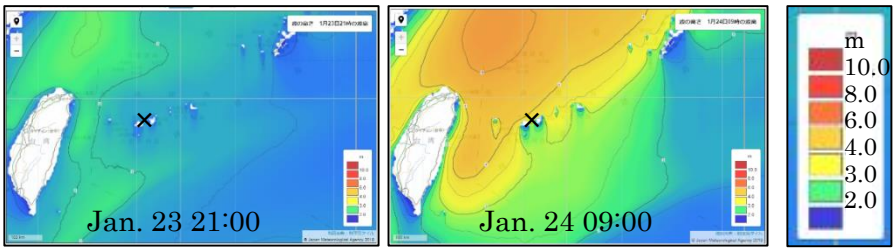
Northerly winds are expected to be very strong in the Ishigaki Island area from midday on January 24 and in the Yonaguni Island area from morning on January 24. Pay adequate attention to high winds on land and at sea. Strong winds are expected to continue until the dawn of January 25.

Peak gusts (maximum instantaneous wind speed) anticipated on January 24.

Ishigaki Island area Northerly winds 20 meters (30 meters)

(See Annex Figure 1 Weather Charts)

(4) According to the coastal wave analysis chart, significant wave heights in the sea area near the location of the accident were under 2 meters at 21:00 on January 23 and between approximately 2 and 3 meters at 09:00 on January 24. (See Figure 2 and Annex Figure 2 Coastal Wave Analysis Chart)



*The X indicates the vicinity of the accident location.

(from the Japan Meteorological Agency website)

Figure 2　Coastal Wave Analysis Chart

(5) Wave observations at the "Ishigaki-ko" observation point of the Nationwide Ocean Wave information network for Ports and HArbourS (NOWPHAS), which is located approximately 3 nautical miles (M) east of the accident site, at the time of the accident were as shown in Table 1.

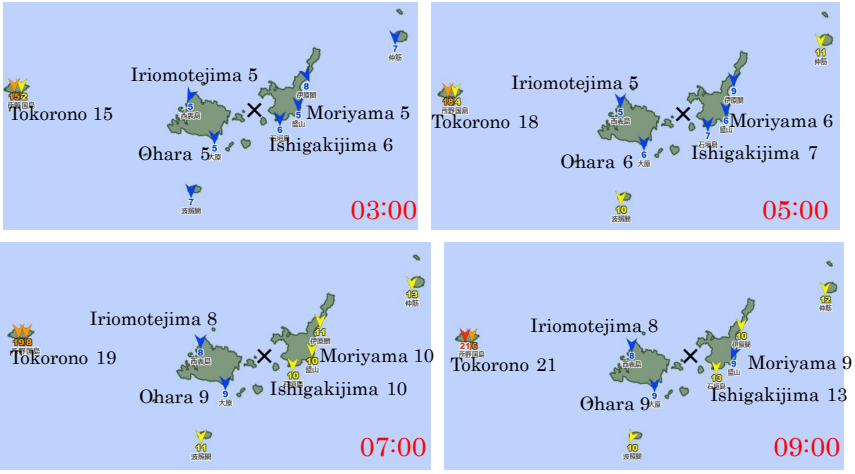
Table 1　Ocean Wave Observations (Ishigaki-ko, January 24)

Time	Significant wave height	Significant wave period	Wave direction
03:00	0.75 m	4.9 sec.	NNW
06:00	1.15 m	5.0 sec.	NNW
09:00	1.56 m	5.3 sec.	NNW
09:20	1.87 m	5.9 sec.	NW

*Significant wave height and significant wave period are values obtained by breaking down waveforms obtained between the time around ten minutes before the observation time and the observation time into individual wave heights and then averaging the highest third of those waves.

(6) According to the local meteorological observation system (AMeDAS) near the accident site, observations of wind direction and speed were as follows.

At 00:00 on January 24, wind speeds at the observation points of Ishigaki Island, Iriomote Island, and Yonaguni Island were under 10 m/s. However, at 03:00, a northerly wind of 15 m/s was observed at the Tokorono Meteorological Observation Station on Yonaguni Island, located approximately 59 M west of the accident site. The

	wind subsequently gained intensity at Iriomote Island and Ishigaki Island as well, and at 09:00, the wind speed was 13 m/s at Ishigakijima Meteorological Observation Station, located approximately 6.8 M east-southeast of the accident site. (See Figure 3 and Annex Figure 3　AMeDAS Observations)  (from the Japan Meteorological Agency website) *Wind speed (m/s) and wind direction at each time and observation point are averages for the period of 10 minutes before every hour. *The arrows in the charts indicate wind direction and the X indicates the vicinity of the accident location. Figure 3　AMeDAS Analysis Charts (Wind Direction and Wind Speed)
Events Leading to the Accident	On January 8, 2023, the Vessel, with the Master, Officer A, the Chief Engineer and 16 other crewmembers (all nationals of the People's Republic of China) on board, loaded approximately 9,240 tons of palm kernel shell (PKS) at Dumai Port, Republic of Indonesia, and departed for Tsu Matsusaka Port, Mie Prefecture (scheduled arrival on January 24), with a draft of approximately 6.88 m at the bow and approximately 7.40 m at the stern. On January 15, the Vessel encountered stormy weather with wind force of 9 to 11 (20.8 to 32.6 m/s) and sea state 6 (wave height 4 to 6 m) while navigating in the South China Sea. She drifted off the west of Luzon, Republic of the Philippines, on January 17 and resumed navigating on January 18. Under conditions in which the Vessel was receiving a northerly wind with a wind scale of 9, the Vessel could proceed north-northeast at a speed of approximately 2 to 3 kn (speed over the ground;

	hereinafter the same) at 550 revolutions per minute (rpm) with her main engine set at full ahead. Consequently, the Master was concerned that the Vessel would not be able to attain sufficient speed under a wind force of 9 or higher because she would not be able to obtain sufficient rudder effect if her speed dropped below 2 kn.. On January 19, as the Vessel was navigating at 550 rpm with her main engine set at full ahead, the main engine's No. 7 and No. 8 cylinders had high exhaust temperatures. The Vessel stopped her main engine and began drifting again. On January 20, the main engine was overhauled and an inspection was performed, but no abnormalities were found. The Vessel changed fuel oil from the low-sulfur fuel oil (LSFO) that she normally used to marine diesel oil (MDO) and tried navigating with her main engine set to full ahead. The exhaust temperature returned to normal and therefore the Vessel continued navigating using MDO as her fuel oil from January 21 on. The Vessel had fallen behind in her voyage and would be unable to reach Tsu Matsusaka Port on the scheduled arrival day and, additionally, a crew change had become necessary. Consequently, on the following day, January 22, the Master discussed the matter with the Vessel's operator, and the two sides decided that the Vessel would call at Ishigaki Port and conduct a change of crew between January 24 and 26. Coordination between the Master and ship's agent[*2] had made it possible for the Vessel to enter Ishigaki Port and anchor in the quarantine anchorage at 14:00 on January 24. The Vessel therefore sailed approximately 3 M off the coast of Iriomote Island at a speed of about 3 to 4 kn at slow ahead for the purpose of time adjustment. While underway, the Master obtained weather information from an overseas weather information website with Officer A, found that the wind speed forecast for January 24 was 25 to 30 kn (12.9 to 15.4 m/s; wind force 6 to 7), and judged that those conditions would not present a problem for navigation. After proceeding east off the north of Iriomote Island, the Vessel stopped her main engine at around 03:00 on January 24 to adjust the time until her scheduled entry into Ishigaki Port at a position approximately 5 M northwest of Ishigaki Oganzaki Lighthouse

[*2] "Ship's agent" refers to a business operator who, based on a contract, acts as an agent for the shipping company or master of a vessel when the vessel enters or leaves a port. The agent secures the wharf and other facilities, coordinates cargo handling arrangements, completes procedures for entering/leaving port with concerned government agencies, arranges for pilots and tugboats, and handles other necessary matters.

	(approximately 8 M north of "shallow reef between Ishigaki Island and Iriomote Island" [hereinafter referred to as "the Shallow Reef"]) and began drifting with her heading to east-northeast. There were no other vessels in the Vessel's vicinity from the time that she began drifting. (See Annex Figure 4　Estimated Navigation Route and Annex Table 1　AIS Record of the Vessel [Excerpt]) The Master thought based on the weather information he had obtained that the weather would not worsen while the Vessel was drifting. He noted in the night order book the Vessel's position when she started drifting and that, due to the low outside temperature, starting the main engine would take about 20 minutes and that the main engine's revolutions should be increased gradually after starting. Then the Master left the bridge, leaving the officer on bridge watch (hereinafter referred to as "Officer B") and a A.B (hereinafter referred to as "A.B A") on the bridge. According to the Vessel's AIS record, the Vessel's heading was pointed east-northeast and she was being pushed south-southeast at a speed of approximately 1 to 2 kn from 03:00. At around 04:30, Officer A came to the bridge with a A.B (hereinafter referred to as "A.B B") and took over the duty of bridge watch, receiving the Master's night orders from Officer B. Officer A observed that the wind and waves, whose effects on the Vessel were not particularly felt when he came to the bridge, were gradually gaining strength and that the Vessel's distance to the Shallow Reef had become approximately 3 to 4 M. He therefore thought the main engine would be needed soon, and, at around 06:00, he ordered the engineer on engine room watch (hereinafter referred to as "Engineer A") to start the main engine and asked the Master, who was resting in his cabin, to come to the bridge. (See Annex Figure 5　Estimated Navigation Route [Enlarged]) Engineer A reported to the Chief Engineer, who was resting in his cabin, and then warmed up and started the main engine. After Engineer A started the main engine, the Chief Engineer entered the engine room and took over the main engine's operation from Engineer A. After the Master came to the bridge, Officer A informed the Master that they should head to the north because the Vessel was approaching the Shallow Reef. The Master took over the con from Officer A and, at around 06:30,

learned that preparations for using the main engine had been completed. Using the bridge's engine telegraph, the Master ordered the engine room to increase the main engine's revolutions over a period of about 20 minutes, going from dead slow ahead to slow ahead and then to half ahead, or 480 rpm.

Because the Vessel's heading was approximately 080° (true bearing; hereinafter the same), the Master attempted to proceed north by setting the rudder hard to port. However, he could not change the heading to north more than approximately 040° because, contrary to his prediction that the weather would not worsen while the Vessel drifted, the Vessel's port side was receiving wind and waves from the north that had been intensifying since early morning.

The Vessel subsequently continued to be pushed south at a speed of approximately 1 to 2 kn with her heading east-northeast, her engine set at half ahead, and her rudder set hard to port.

As time passed, the Vessel received even stronger wind and waves from her port side. She continued to be pushed in an uncontrollable state, as she was unable to gain sufficient propulsion or rudder effect, and her distance to the Shallow Reef approached approximately 0.4 M. The Master thought about trying to turn to port by letting go the port anchor and maneuvering with the anchor, and he sent Officer A to the bow with instructions to prepare to let go anchor.

The Master received a report from Officer A indicating that the preparations to let go anchor were completed and, considering the distance to the Shallow Reef (approximately 0.1 M), at around 08:50 he ordered Officer A to let go the port anchor and veered out 5 shackles of anchor chain (one shackle equals 27.5 m).

The Master observed that, although the Vessel temporarily turned to port and her heading shifted to the north-northwest from the effect of letting go anchor, the Vessel could not move forward and would be pushed backwards.

At around 09:00, the Vessel received a call from a Japan Coast Guard patrol vessel by international VHF radio telephone, which notified the Vessel that approaching the shallow reef is dangerous. At around 09:05, the Vessel contacted the patrol vessel saying that she had weak engine power and was approaching the shallow reef, and requested a tugboat. The Vessel received a response from the patrol vessel saying to ask her ship's agent for a tugboat.

At around 09:17, the Master asked the ship's agent for a tugboat using a messaging app on his smartphone but received a reply

	indicated that no tugboats were immediately available at Ishigaki Port. At around 09:20, the Master felt an impact and noticed that the Vessel had run aground on the Shallow Reef. He instructed the engine room to set the main engine to neutral operation using the bridge's engine telegraph. When the Master had the officers check for tank flooding and the Chief Engineer check the engine room's condition, it was discovered that there was flooding in port-side No. 3 ballast tank and in the engine room and that the hull was inclined approximately 5° to port. Determining that the situation was hazardous, the Master decided to abandon ship. He instructed the Chief Engineer to stop the main engine and the two diesel generators and to close all valves in engine room. At around 09:35, the Master asked Japan Coast Guard for rescue. All 19 crew members gathered at the master station on the poop deck's port side, where they put on lifejackets and waited for rescue. The crew members subsequently moved to the bridge, where they were rescued by being lifted one-by-one from the port-side wing into a Japan Coast Guard helicopter. The Master was rescued last and the Vessel became unmanned at around 13:07. The 19 crew members transferred from the helicopter to a patrol vessel and arrived at Ishigaki Port the following day, January 25. After grounding, a salvage company began work to remove fuel oil, etc., from the Vessel. This work was completed on February 19. The Vessel remained grounded at the accident location with her heading east-southeast. With a portion of her cargo leaking out from a hole in her port-side shell plating, the salvage company began work to remove her hull and cargo and to recover her leaked cargo, etc., on July 13. However, the Vessel's hull broke into two at her No. 3 hold when Typhoon No. 6 (Khanun) approached the accident location on August 4. The Vessel's entire cargo leaked into the ocean as a result of the breakage of her hull. The hull's rear portion collapsed with an inclination of approximately 65° to port. Removal work for the hull and cargo subsequently continued; however, although the work was originally scheduled for completion in February 2024, the breakage of the hull and collapse of the hull's rear portion caused a change in the work process and resulted in an extension of the work period.

Other Matters

(1) Information on the Vessel's Output

(a) Main engine output and revolutions

The Vessel's speed-power curve obtained from the maximum continuous output of the Vessel's main engine (2,970 kW, 650 rpm; hereinafter referred to as "MCR") and marine engine characteristics (diesel engine output proportional to the cube of revolutions) is as shown in Figure 4. According to the speed-power curve and the Vessel's speed table, as shown in Table 2, at the time of the accident, the Vessel was operating at 480 rpm with her main engine set at half ahead and at approximately 40% of her output relative to the MCR.

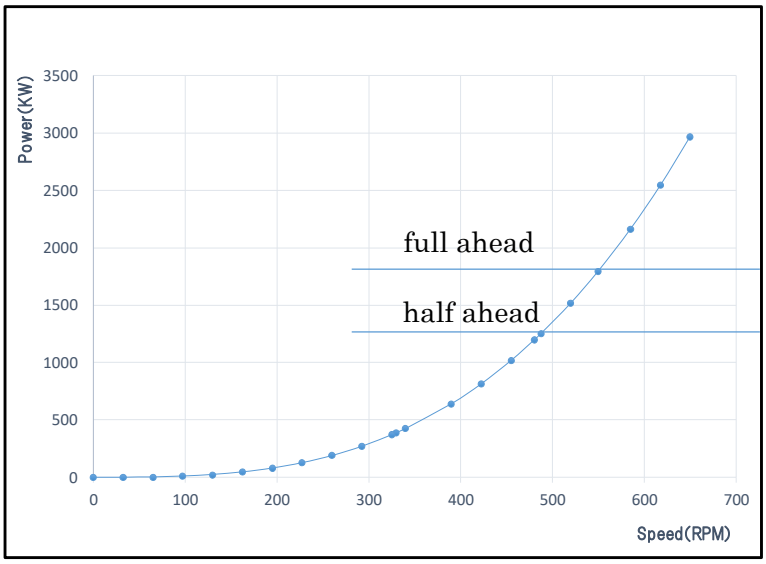


Figure 4 Speed-Power Curve of the Vessel's Main Engine

Table 2 Revolutions of the Vessel's Main Engine and Speed

	Output	Revolutions of the M/E	Loaded speed	Ballast speed
Full Ahead	61%MCR	550rpm	9.5kn	10.0kn
Half Ahead	40%MCR	480rpm	8.0kn	8.5kn
Slow Ahead	14%MCR	340rpm	5.0kn	6.0kn
Dead slow Ahead	13%MCR	330rpm	3.5kn	4.0kn

(b) Crew awareness of the main engine's revolutions and output

According to the statement of the Master, the Master believed with respect to the manner of handling the main engine that the main engine must not be increased to full ahead in narrow sea areas enclosed by islands and shallow reefs, such as that near the

accident location. Additionally, the Master stated that the Vessel's main engine revolutions were 525 to 535 rpm at full ahead and 500 rpm at half ahead, that there was little difference in revolutions between full ahead and half ahead, and that the Vessel would not have been able to overcome the wind and waves even if she had been going full ahead at the time of the accident. However, the revolutions shown on the Vessel's speed table were 550 rpm at full ahead and 480 rpm at half ahead, which differed from the Master's perception.

The Chief Engineer was aware of the strong winds and the fact that the Vessel was using the main engine at half ahead. However, he had not been ordered by the bridge to increase main engine's speed and did not know that the Vessel was being pushed due to insufficient propulsion.

According to the statement of the Chief Engineer, at the time of the accident, the Vessel was instructing the engine room on the main engine's revolutions by operating the engine telegraph on the bridge, that the operation could be used to order the engine room to increase the main engine's revolutions up to full ahead, and that the engine room could have increased the main engine's revolutions if it had been ordered to do so by the bridge.

(c) Information on the Vessel's encountering stormy weather during her voyage to Japan

According to the Vessel's deck logbook entries, the Vessel encountered stormy weather in the South China Sea during her voyage to Japan. Entries at 16:00, 20:00, and 24:00 on January 16 indicated that the Vessel was proceeding east-northeast at a speed of between 3.3 and 4.1 kn with her main engine set at full ahead (550 rpm) under conditions in which she was receiving wind and waves from the north (wind force of between 9 and 11, sea state 6). Entries at 04:00 and 08:00 on January 18 indicated that the Vessel was proceeding north to northeast at a speed of between 5.8 and 6.0 kn with her engine set at full ahead under conditions in which she was receiving wind and waves from the northeast (wind force of 9 to 10, sea state 6). (See Table 3)

Table 3　Deck Logbook Entries (Excerpt)

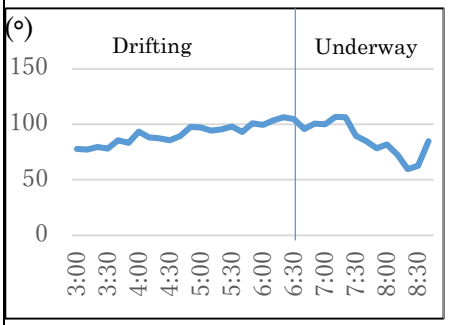
	Cource (°)	Gyro Cource (°)	SOG (kn)	Revolution (rpm)	Barometer (hPa)	Wind direction	Wind Force	Wave direction	Sea state
1月16日									
04:00	041	041	7.4	550	1010	N	5/6	N	3
08:00	040	040	5.3	550	1011	N	5/6	N	4
12:00	045	041	3.4	550	1013	N	9/10	N	5
16:00	051	061	3.5	550	1010	N	10/11	N	6

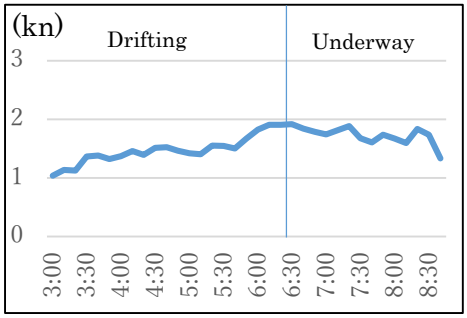
(d) Annual inspections by classification societies

The Vessel underwent an annual inspection by a classification society that was conducted in the presence of an inspector on June 1, 2022, which found that her hull, machinery, and electrical equipment were all in good order.

(2) Information on Propulsion at the Time of the Accident

According to the Vessel's AIS record, the angle of pushing by the wind and waves (direction of course over the ground relative to heading) and speed over the ground from 03:00, when the Vessel was drifting with her main engine stopped, was as shown in Figure 5 and Figure 6. Even after the main engine was started after 06:30, the Vessel was being pushed in the direction of 60-100° to starboard at a speed of approximately 1 to 2 kn.





*Values shown at each time are averages for the previous ten minutes.

Figure 5 Angle of Pushing (to Starboard)

Figure 6 Speed Over the Ground

According to the literary reference *Theory and Practice of Ship Handling* (by Kinzo Inoue; Seizando-Shoten Publishing; 2014), limiting conditions for wind-generated pressure force are as follows.

As for the limiting condition allowing a vessel to maintain a given course line by overcoming the downwind pressure caused by the wind using a maximum rudder angle of 35 degrees, when the vessel is receiving wind from an angle or abeam, the limit must be considered to have been exceeded if the ratio of wind speed to vessel speed is 8 or more.

Assuming that the Vessel was being pushed by wind and waves from the port side at a speed of less than 2 kn to starboard and that the difference between true wind speed and relative wind speed can be ignored as small, the wind speed at the time of the accident was about 17m/s and the limit of the wind speed to vessel speed ratio allowing the holding of a given course is 8. Therefore,

Given that the wind speed at the time of the accident ÷ wind speed to vessel speed ratio limit = 17 ÷ 8 ≒ 2 m/s,

The minimum speed at which the Vessel can maintain a given course is expected to be about 4 kn.

(3) Information on watch during drifting

(a) Information on the bridge watchkeeping arrangement

The bridge watchkeeping arrangement during ordinary navigation consisted of three shifts of four hours per shift, as shown in Table 4.

Table 4 Bridge Watchkeeping Arrangement

00:30-04:30 12:30-16:30	Officer B and A.B A
04:30-08:30 16:30-20:30	Officer A and A.B B
08:30-12:30 20:30-00:30	Master and A.B C

(Times are Japan Standard Time [UTC + 9 hours])

The Safety Management System (SMS) Manual specified the following items concerning navigational watch.

a To closely monitor the surrounding circumstances and report to Master on the occurrence of the following: sudden change of weather, ship well off the course, distress signal at sea, suspicious signal or objects.

b To be aware of the daily weather report and monitor any change of wind force, wind direction and atmospheric pressure. Before hazardous weather approaches, the ship position should be fixed and the log reading be noted.

c Before hazardous weather approaches, the ship position should be fixed and the log reading be noted.

d To closely implement Master's instructions on routes, course, compass error, leeway set other navigation instructions etc.

e Unless the ship is threatened by maritime incident such as collision or the ship is engage in rescuing lives or efficient action taken in an accident. The course and the engine revolution (or pitch angle of propeller) should not be changed without permission of Master.

(b) Information on Drifting and Bridge Watch at the Time of the Accident

The Master had planned to drift south of Iriomote Island if the Vessel were headed to Tsu Matsusaka Port; however, due to the need to change crew members at Ishigaki Port, the Vessel drifted west of Ishigaki Island.

The Vessel began preparing to start her main engine at around 06:00 and was ready to use it at around 06:30; however, at that time, the Vessel had already been pushed about 5 M south-southeast from her original drifting position and her distance from the Shallow Reef was about 3 M.

When the Vessel began drifting, the Master thought that the weather would not worsen during the drifting and noted the drifting position in the night order book. However, but he did not instruct the officer of the watch to use the main engine to maintain the drifting position, nor did he specify matters to be reported to the Master concerning changes in weather and sea conditions, etc., or the timing of such reports.

When the Master was called to the bridge by Officer A, the Master thought that Officer A would report to him that the distance to the shore was about 3 M, as is normally the case.

(4) Information on the Use of the Anchor

When the Master began drifting, he could not be anchoring because the water depth was deep at over 200 m.

After starting the main engine, the Master was navigating with the intention of heading north with the main engine set at half ahead and the rudder set hard to port. At around 08:20, when the Vessel's distance to the Shallow Reef closed to about 0.4 M, the Master made preparations to let go anchor for ship maneuvering using the anchor to assist in turning to port.

Undersea cables for electricity and telephone are laid on the seabed near the accident location. Consequently, the area is a

	prohibited anchorage in the Safety Rules for Entry Into Ishigaki Port. The Vessel entered said area at around 08:00 and passed over the undersea cables at around 08:20. At around 08:50, the Vessel let go anchor in the prohibited area for anchoring between the undersea cables and the Shallow Reef. At that time, the Vessel's distance from the Shallow Reef was about 0.1 M and the water's depth was about 30 m. The bottom sediment consisted of coral. (5) Information on Speed during Time Adjustment From around 07:00 on January 22 until she stopped her main engine at around 03:00 on January 24, the Vessel sailed approximately 44 hours at a speed of around 3 to 5 kn with her main engine set to slow ahead. The Vessel's speed at full ahead in loaded condition was around 9.5 kn. Although he was aware that the weather would worsen from January 24, the Master began drifting after navigating at slow ahead to meet the Vessel's port arrival time of 14:00 on January 24. He did not coordinate with the ship's agent concerning the possibility of changing the drifting location to south of Iriomote Island or other locations where the effects of the northerly wind and waves would be reduced and arrange for an earlier entry into Ishigaki Port. (6) Information on the Voyage Data Recorder Although the Vessel was equipped with a voyage data recorder (VDR), no voyage data for the time of the accident was recorded on it.
Analysis	
Involvement of crew members	Applicable
Involvement of vessel, engine, etc.	Not applicable
Involvement of weather and sea conditions	Applicable
Analysis of the findings	(1) Course of the Events It is certain that the Vessel was drifting while receiving northerly wind and waves from her port side that were pushing her south with her heading east-northeast off the west of Ishigaki Island, where the Shallow Reef exists to the south, under conditions in

which a gale warning for the sea south of Okinawa and southern part of the East China Sea as well as a high winds advisory and heavy seas warning for Ishigaki City and Taketomi Town had been issued.

It is probable that the Vessel continued to drift even after the northerly wind and waves intensified until her distance to the Shallow Reef to the south reached about 3 M, and that subsequently the Vessel started her main engine, increased the engine's revolutions to 480 rpm at half ahead, and navigated with her rudder turned hard to port with the intention of proceeding north to leave much distance from the Shallow Reef.

It is highly probable that the Vessel continued to be pushed south in an uncontrollable state, being unable to gain propulsion and rudder effect sufficient to overcome the external forces, and ran aground on the Shallow Reef.

(2) Analysis of the Drifting and the Using of the Main Engine

It is probable that the Vessel began using her main engine at around 06:30, after her distance to the Shallow Reef approached to around 3 M, but even after beginning to use the engine, she was pushed at a speed of about 1 to 2 kn in a direction of 60 to 100° to starboard, and therefore she continued to be pushed in an uncontrollable state, unable to acquire propulsion or rudder effect sufficient to overcome the external forces, and ran aground on the Shallow Reef.

It is probable that, despite the fact that the Vessel received intensified wind and waves as she drifted from around 06:00 and even stronger wind and waves intensified thereafter, the Master had confirmed when the Vessel began drifting that the forecasted wind force for January 24 was around 6 or 7 based sole on overseas weather information website, that he did not think the weather would worsen during drifting, and that he thought the weather and sea conditions would not present a problem for navigation if they were as forecasted.

It is probable that because the Master thought that the weather and sea conditions would not present a problem for navigation if they were as forecasted, he did not make such adjustments as changing the drifting location to south of Iriomote Island or other location where northerly wind and waves would be reduced or arranging for an earlier entry into Ishigaki Port and did not take

refuge steps, such as heaving to[*3] using the main engine, and also, despite the fact that the Vessel was drifting while receiving northerly wind and waves while off the west of Ishigaki Island, where the Shallow Reef existed to the south, he did not instruct the officer of the watch to monitor and maintain the Vessel's position during drifting nor did he specify matters to be reported to the Master concerning changes in weather and sea conditions, etc., or the timing of such reports.

It is probable that because Officer A had not received any particular instructions from the Master regarding bridge watch during drifting, Officer A continued to drift as the Vessel was being pushed south and, as is normally the case, he asked the engine room to start the main engine after the Vessel approached to a distance of about 3 to 4 M from the shore and reported this to the Master.

(3) Analysis of the Main Engine's Output

It is probable that, because the main engine had continued to be used at half ahead revolutions until the accident, the main engine's output was about 40% of the MCR.

It is probable that because the Vessel continued to navigate with her engine at half-ahead revolutions and her rudder turned hard to port as she attempted to proceed north while receiving wind and waves from the north to port side of her hull, which has large area, with her heading east-northeast, the port turning moment from the port rudder were not over the starboard turning moment from the wind and waves, and roughly in balance, and she continued to be pushed to starboard without gaining sufficient propulsion or rudder effect for going forward.

The Master stated that he continued to use the main engine at half ahead because it was not permissible to increase the main engine's speed to full ahead in narrow sea areas enclosed by islands and shallow reefs, such as that near the accident location. However, this statement is not reasonable as a reason for not using the maximum output available to deal with the situation where he could not gain sufficient propulsion and rudder effect to overcome the external forces as the Vessel continued to approach the Shallow Reef in an uncontrollable state, and his thinking behind not raising

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

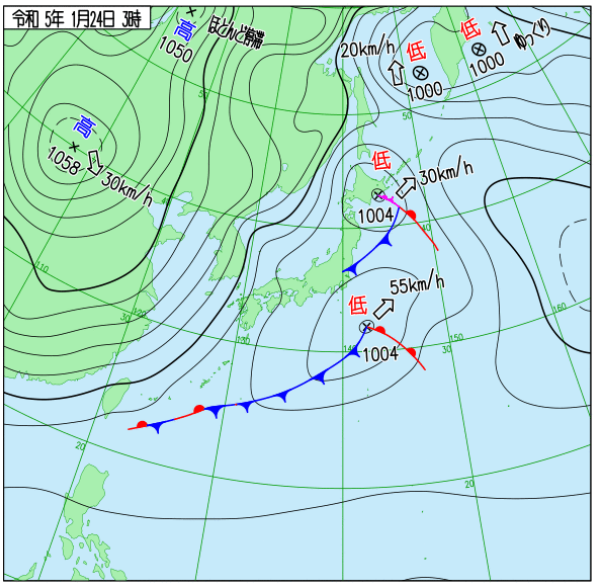
	the main engine's revolutions to full ahead or higher could not be ascertained from it. Given that, as the Vessel was in the South China Sea on her voyage to Japan, with the revolutions of her main engine set at 550 rpm at full ahead, she could sail at a speed of approximately 3 or 4 kn while receiving winds with wind force 9 to 11 and waves of sea state 6 from her port bow and could sail at a speed of approximately 6 kn when she received winds with a wind force of 9 or 10 and waves with sea state 6 from her bow, and that she could be expected to have a minimum speed of approximately 4 kn, which is sufficient to hold a given course when receiving wind from an angle or abeam, it is somewhat likely that, if the Vessel had been receiving wind and waves from the port side at the time of the accident, she would have been able to move forward with propulsion overcoming the external forces and obtain rudder effectiveness if the main engine had been operated at an output of approximately 61% or more of the MCR with its revolutions at full ahead or higher. (4) Analysis of Communication between the Bridge and Engine Room Given that, although the Vessel's main engine continued to be used at half ahead revolutions in a state whereby the Vessel was being pushed by the wind and waves with insufficient propulsion and in an uncontrollable state, the Chief Engineer was aware of the strong winds and that the main engine was being used at half ahead but had not been notified by the bridge that the Vessel was being pushed by the wind and waves with insufficient propulsion, it is probable that information on the Vessel's situation was not being shared between the bridge and engine room. Given that, although the Vessel's main engine was capable of increasing its revolutions to full ahead or higher at the time of the accident, the engine room was not notified of Vessel's situation, it is probable that the engine room could not advise the Master on the bridge concerning use of the main engine. (5) Analysis of the Use of the Anchor Given that the Master let go the port anchor when the Vessel's distance to the Shallow Reef had reached approximately 0.1 M with the intention of maneuvering with the anchor to turn to port and proceed north but, although the heading temporarily pointed north-northwest, the Vessel could not gain sufficient propulsion or rudder effect to overcome the external forces, it is probable that the Vessel continued to be pushed.

	Given that the sea area where the Vessel let go anchor was not suitable for anchoring because it had bottom sediment consisting of coral, and that the sea area was laid with undersea cables and therefore designated a prohibited anchoring area, it is probable that the Vessel needed to move to a safe sea area to the north with maximum available output at an earlier stage, before entering said area.
Probable Causes	It is probable that the accident occurred when, under conditions in which a gale warning for the sea south of Okinawa and southern part of the East China Sea as well as a high winds advisory and heavy seas warning for Ishigaki City and Taketomi Town had been issued, the Vessel drifted off the west of Ishigaki Island, where the Shallow Reef exists to the south, received northerly wind and waves from her port side and was pushed south; she continued to drift even after the wind and waves intensified until her distances to the Shallow Reef reached about 3 M; and she subsequently started her main engine and began navigating in an attempt to proceed north but could not gain sufficient propulsion and rudder effect to overcome the external forces, and therefore she continued to be pushed in an uncontrollable state and ran aground on the Shallow Reef. It is somewhat likely the Vessel could not gain sufficient propulsion and rudder effect after she started her main engine because the Master continued to use the main engine at half-ahead revolutions and did not use the maximum available output, resulting in main engine output that was approximately 40% of the MCR. It is probable that the Vessel drifted off the west of Ishigaki Island, where the Shallow Reef existed to the south and where she received wind and waves from the north, without taking refuging steps, such as heaving to using the main engine, because the Master thought based solely on weather information he obtained from on overseas weather information website that the weather and sea conditions would not present a problem for navigation if they were as forecasted. It is probable that the Vessel continued to drift even after the wind and waves intensified until her distance to the Shallow Reef reached about 3 M because the Master thought the weather and sea conditions would not present a problem for navigation if they were as forecasted and therefore did not instruct the officer of the watch to monitor and maintain the Vessel's position during drifting and did not specify matters to be reported to the Master concerning changes in weather and sea conditions, etc., or the timing of such reports.

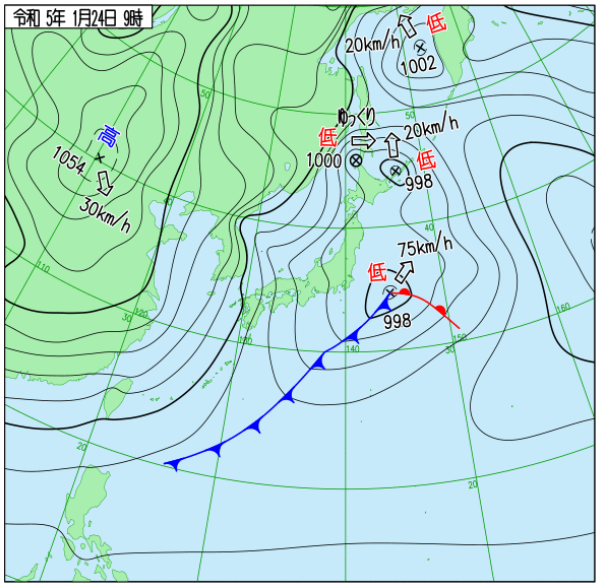
Safety Actions	After the accident, GRAND VOYAGE MARINE CO., LTD., the Vessel's management company, decided to make accident prevention measures—such as preparing detailed passage plans for stormy weather, conducting appropriate risk assessments before encountering stormy weather, obtaining the latest weather and other information, keeping the main engine on standby when anchoring or drifting in stormy weather, and fully understanding maneuvering performance and engine performance—known among its fleet and to strengthen in-company monitoring and support for its fleet during stormy weather as well as strengthen its education and training for crew members. The following measures are possible to prevent recurrence of and mitigate the damaged caused by similar accidents: ・In cases where a passage plan must be changed, the master of a vessel should obtain the latest data and information on the revised destination and weather and sea conditions from the ship management company or local ship's agent. ・The master should make weather predictions based on comprehensive judgments from multiple sources of weather information, including forecasts from local weather authorities. When weather and sea conditions are expected to worsen and a safer anchorage is available inside port, the master should coordinate with their ship's agent or other concerned party to permit early port entry. If a suitable place to refuge is unavailable, the master should consider moving to safe waters away from the shore and using the main engine to turn the bow to windward or heave to. ・When drifting, the master should select a drifting location with no shallow reefs or other such features downwind that is suitable for the forecasted weather and sea conditions as well as geographical conditions. ・The master should confirm in advance the possibility of arranging a tugboat in case the vessel's control becomes difficult. When intending to use a tugboat, the master should request it with plenty of time to spare. ・When drifting, the master should give clear instructions to the officer of the watch concerning monitoring and maintaining the ship's position and specify the matters to be reported to the master concerning changes in weather and sea conditions, etc., and the timing of such reports, and should have officers of the

	watch make reports to the master so that moving to a safe area can be completed as soon as possible before the danger of approaching a shallow reef, etc., increases. ・The master and officers should, based on a full understanding of the vessel's maneuvering performance and engine performance, handle the main engine within a range that extends to its maximum available output so that sufficient propulsion can be obtained for early movement to a safe area if the vessel encounters stormy weather. ・The master should share information on the status of ship operations, use of the main engine, and other matters between the bridge and the engine room, and should establish an operating environment that allows him or her to receive advice on the use of the main engine not only from the crew members on the bridge but also from those in the engine room.
Safety recommendations	In view of the results of this accident investigation, the Japan Transport Safety Board recommends that GRAND VOYAGE MARINE CO., LTD., as the management company of XIN HAI ZHOU 2, and the Panama Maritime Authority, as the flag state, take the following measures for the purpose of preventing the recurrence of similar accidents and reducing damage. 1. GRAND VOYAGE MARINE CO., LTD. should carry out, in accordance with the safety actions established after the accident, appropriately and continuously to enhance supervision and support of their management vessels when encountering a stormy weather, and to implement education and training for masters and other crew members. 2. The Panama Maritime Authority should instruct GRAND VOYAGE MARINE CO., LTD. to ensure the appropriate and continual implementation of the preventive measures by the company as referred in item 1 above set force.

Annex Figure 1　Weather Charts



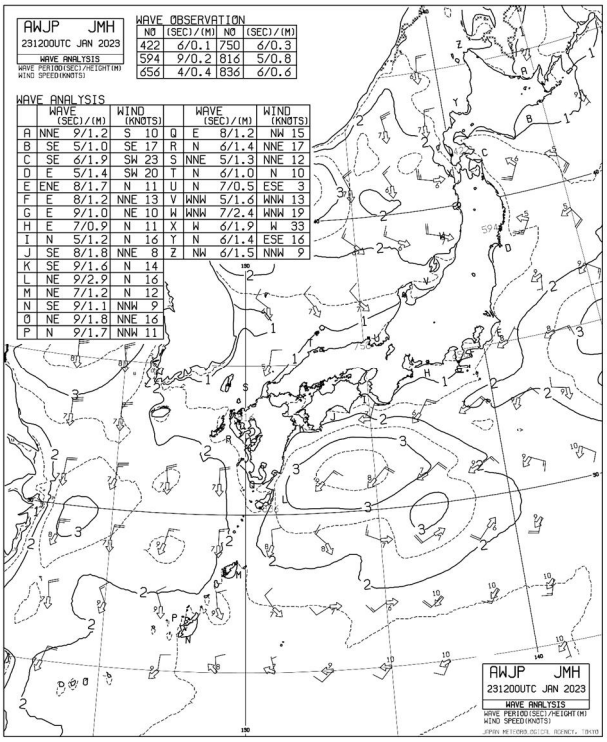
(January 24, 2023　03:00)



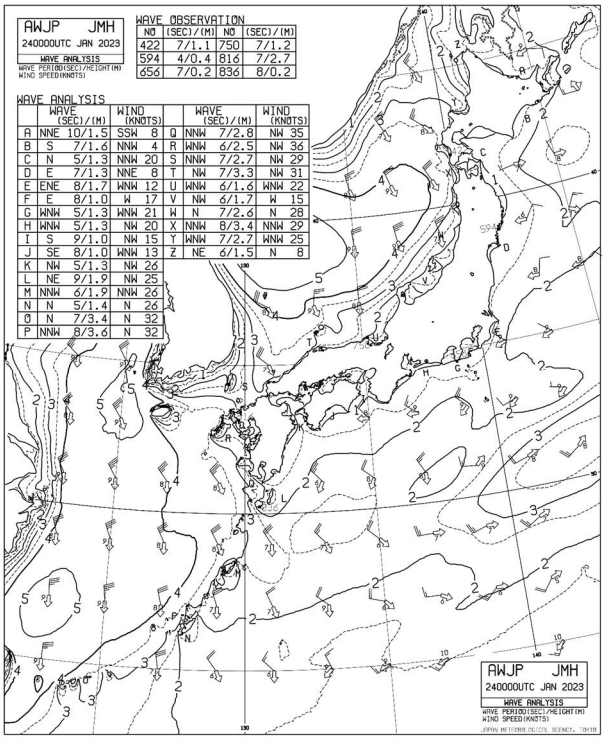
(January 24, 2023　09:00)

(from the Japan Meteorological Agency website)

Annex Figure 2　Coastal Wave Analysis Chart



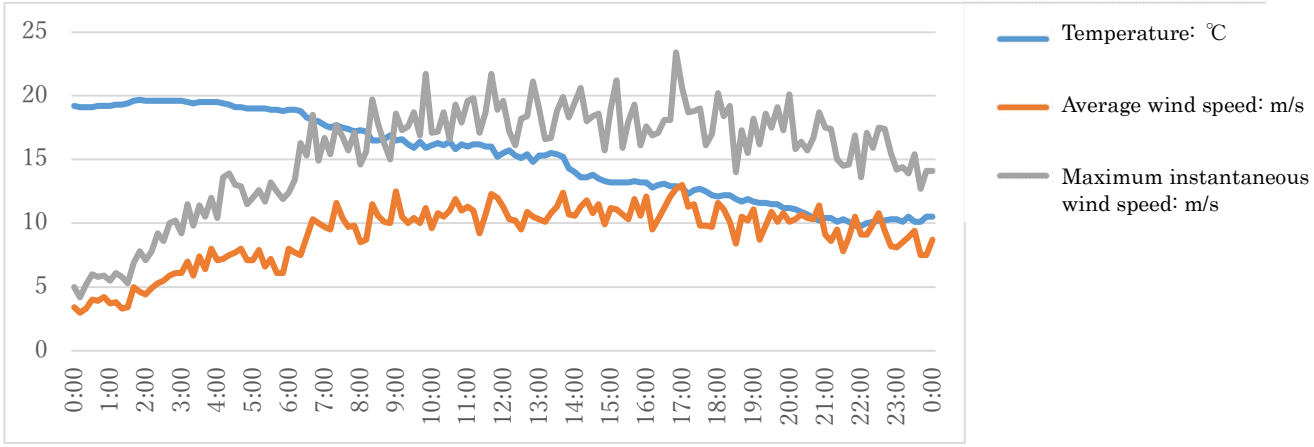
(January 23, 2023　21:00)



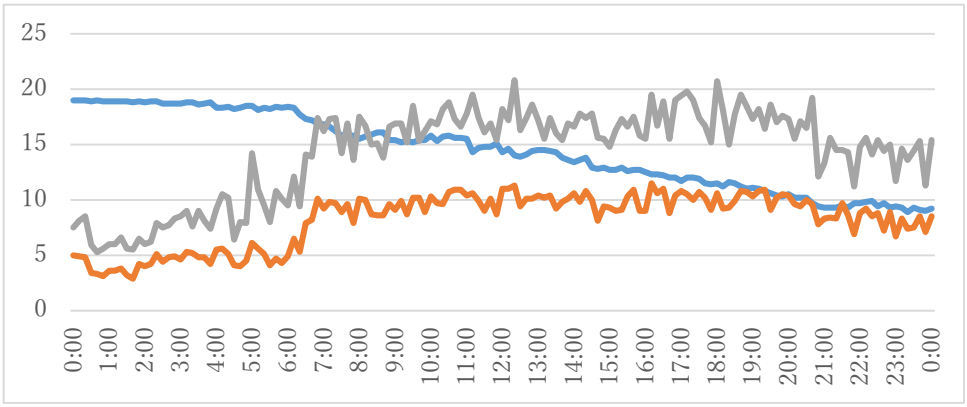
(January 24, 2023　09:00)

Annex Figure 3　AMeDAS Observations
(January 24, 2023)

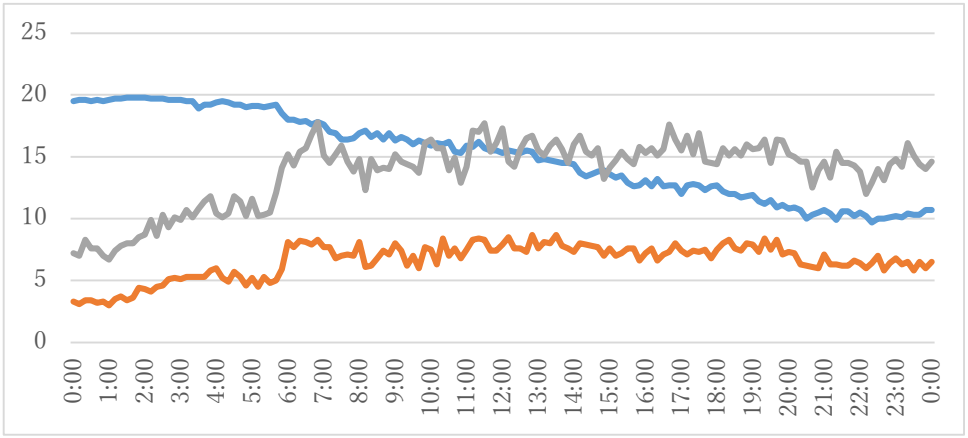
Ishigakijima Local Meteorological Observatory



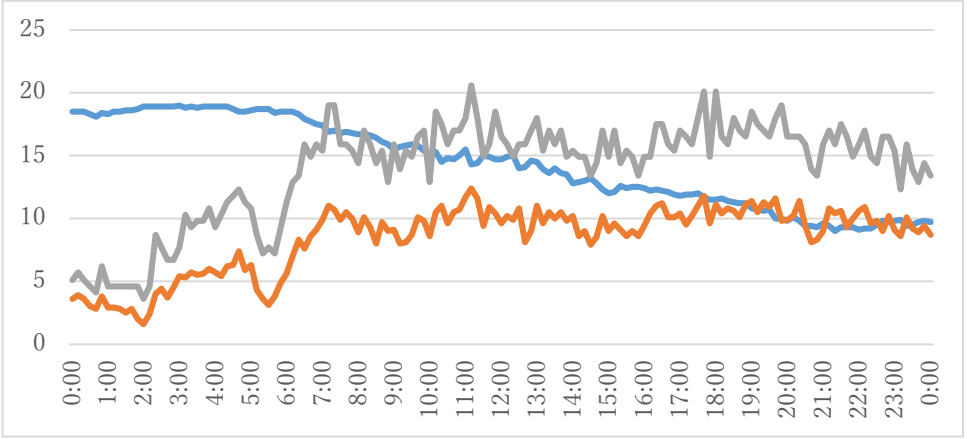
Ohara Regional Meteorological Observation Station



Moriyama Aeronautical Meteorological Observation Station

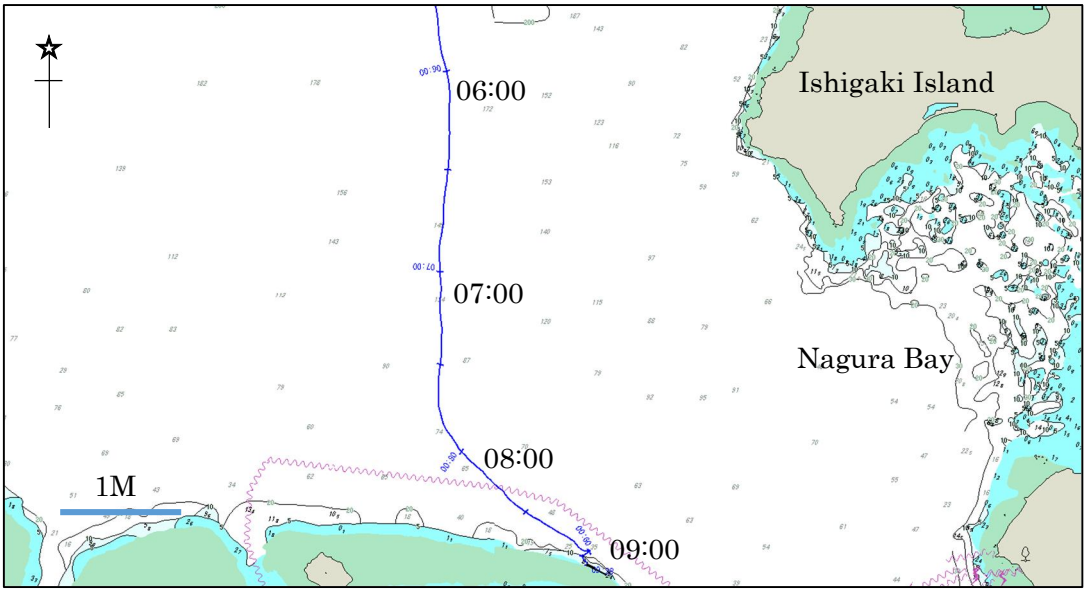


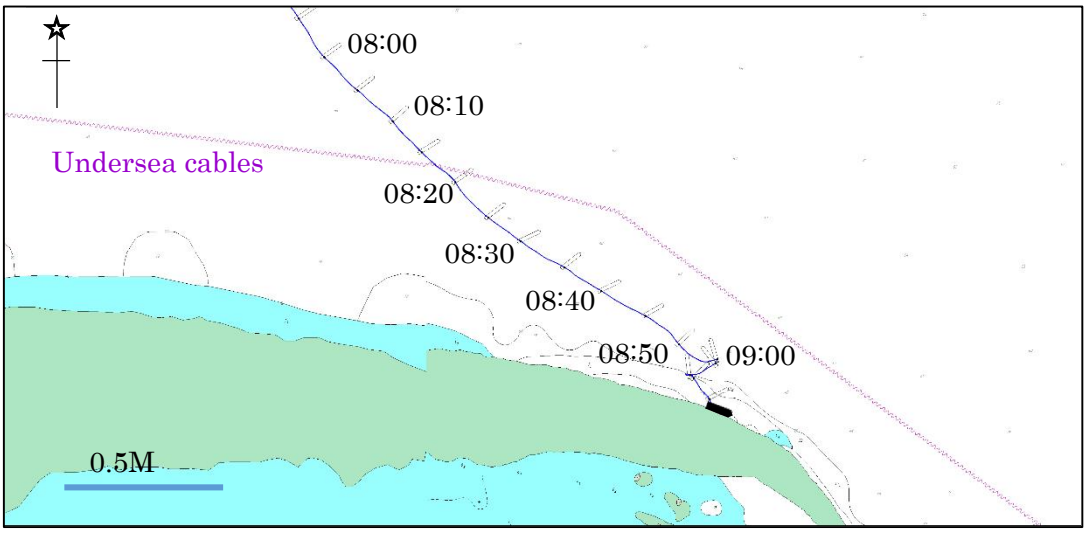
Iriomotejima Special Regional Meteorological Observation Station

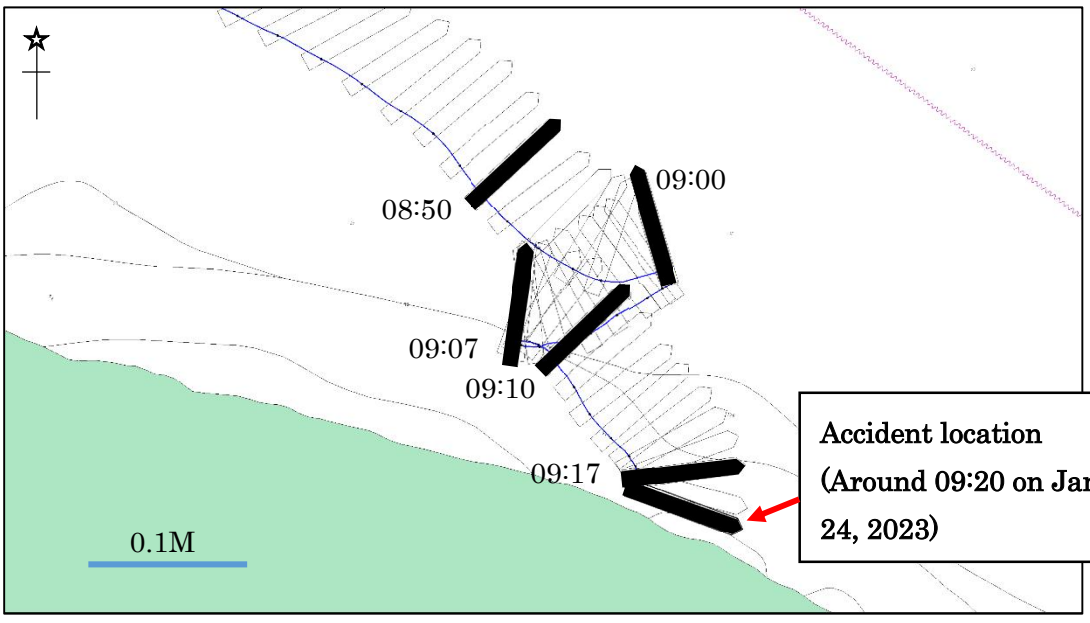


Annex Figure 4　Estimated Navigation Route

Annex Figure 5　Estimated Navigation Route (Enlarged)







Annex Table 1-1 AIS Record of the Vessel (Excerpt)
(03:30 to 08:50)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (S) (°-′-″)	Longitude (E) (°-′-″)			
03:00	24-30-21.5	123-59-50.3	092.5	061	2.6
03:30	24-29-52.8	124-00-06.7	154.7	077	1.1
04:00	24-29-15.6	124-00-22.9	162.3	077	1.4
04:30	24-28-34.2	124-00-34.4	165.8	078	1.5
05:00	24-27-51.8	124-00-50.6	159.7	070	1.5
05:30	24-27-08.1	124-00-58.4	169.8	076	1.4
06:00	24-26-22.6	124-01-08.9	165.9	073	1.5
06:30	24-25-28.6	124-01-09.7	182.2	079	1.9
07:00	24-24-32.9	124-01-04.9	181.3	086	1.8
07:30	24-23-41.4	124-01-05.1	185.7	079	1.8
08:00	24-22-53.4	124-01-17.8	144.2	060	1.6
08:30	24-22-20.4	124-01-56.6	129.1	057	1.6
08:50	24-22-01.9	124-02-27.7	121.0	058	1.7

*"Position" is the position of the Vessel's GPS antenna installed above the bridge. The location of the GPS antenna was 122 m from the bow, 18 m from the stern, 15 m from the starboard side, and 5 m from the port side.
Additionally, "course over the ground" and "speed over the ground" are true bearings. The values shown for course over the ground, heading, and speed over the ground are averages for the preceding ten minutes.

Annex Table 1-2 AIS Record of the Vessel (Excerpt)
(08:50 to 09:22)

Time (HH:MM:SS)	Position		Course Over the Ground (°)	Heading (°)	Speed Over the Ground (knots [kn])
	Latitude (S) (°-′-″)	Longitude (E) (°-′-″)			
08:50	24-22-01.9	124-02-27.7	140.5	050	1.6
08:51	24-22-01.0	124-02-28.7	137.1	051	1.1
08:52	24-21-60.0	124-02-29.8	130.6	037	1.7
08:53	24-21-59.2	124-02-31.2	119.7	037	1.7
08:54	24-21-58.8	124-02-32.4	112.6	025	1.0
08:55	24-21-58.8	124-02-33.3	090.1	013	1.0
08:56	-	-	-	-	-
08:57	24-21-59.2	124-02-35.2	096.1	344	0.5
08:58	-	-	-	-	-
08:59	-	-	-	-	-
09:00	24-21-58.5	124-02-34.9	248.3	325	0.75
09:01	24-21-58.2	124-02-34.3	237.8	323	1.0
09:02	24-21-57.6	124-02-33.2	239.3	324	1.2

09:03	24-21-56.9	124-02-32.1	235.5	328	1.2
09:04	24-21-56.5	124-02-30.9	249.2	336	1.1
09:05	24-21-56.4	124-02-30.0	260.1	348	0.9
09:06	24-21-56.4	124-02-29.2	267.0	359	0.6
09:07	24-21-56.5	124-02-28.9	299.1	013	0.4
09:08	24-21-56.6	124-02-29.1	048.0	027	0.3
09:09	24-21-56.4	124-02-29.8	084.6	037	0.7
09:10	24-21-55.9	124-02-30.5	123.1	041	1.0
09:11	24-21-54.9	124-02-31.2	144.3	047	1.1
09:12	24-21-54.0	124-02-31.8	154.0	051	1.2
09:13	24-21-53.1	124-02-32.7	138.8	051	1.2
09:14	24-21-52.4	124-02-33.5	139.5	049	1.0
09:15	24-21-52.0	124-02-33.7	159.8	059	0.6
09:16	24-21-51.6	124-02-34.0	181.6	063	0.5
09:17	24-21-51.4	124-02-34.0	156.3	077	0.3
09:18	-	-	-	-	-
09:19	24-21-51.4	124-02-34.0	014	105	0.8
09:20	-	-	-	-	-
09:21	-	-	-	-	-
09:22	24-21-50.8	124-02-34.0	266.3	110	0.1

*The values for “course over the ground,” “heading,” and “speed over the ground” at each time are averages for the preceding one minute. Times with blank value boxes are times for which no data was obtained for the preceding minute or more.