MA2021-6

MARINE ACCIDENT
INVESTIGATION REPORT

June 24, 2021

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.

MARINE ACCIDENT INVESTIGATION REPORT

May 26, 2021
Adopted by the Japan Transport Safety Board
Chairperson TAKEDA Nobuo
Member SATO Yuji
Member TAMURA Kenkichi
Member KAKISHIMA Yoshiko
Member OKAMOTO Makiko

Accident type	Fatality of a crew member
Date and time	Around 10:45 on September 9, 2019
Location	Kita Wharf, Maizuru Port, Maizuru City, Kyoto Around 208° true bearing 2.2 nautical miles (M) from Toshima Lighthouse, Maizuru Port. (Approximately 35°27.4′ N, 135°19.0′ E)
Summary of the Accident	While the cargo vessel FIRST AI was mooring, a boatswain died as his head was trapped in a hatch cover panel when performing hatch cover closing duty.
Process and Progress of the Investigation	An investigator-in-charge and a marine accident investigator were appointed to investigate this accident on September 10, 2019. September 10 and 11, 2019 On-site investigation and interviews; November 1, 2019, May 13, 2020, and June 12, 2020 Collection of questionnaires Opinions on the draft report were invited from parties relevant to the cause of the accident. Comments on the draft report were invited from the flag state of FIRST AI.
Factual Information	
Vessel Type and Name, Gross Tonnage	Cargo Vessel FIRST AI (registered in the Republic of Korea), 1,901 tons
Vessel Number	9124108 (IMO number)
Owner	JANGHO SHIPPING CO., LTD. (Company A)
Management Company	Company A
Class[1]	KRS: Korean Register of Shipping
L x B x D, Hull Material	80.0m x 12.8m x 7.65m, Steel
Engine, Output, Date of Launch, etc.	Diesel engine, 1,471 kW, 1995 (Keel laid)
	(See Figure 1)

[1]"Class (Classification Society)" refers to a third-party organization that executes inspections of hulls, engines, fittings, etc. in accordance with class rules based on the provisions of international conventions, and certifies the compliance of vessels with the rules. A classification society entrusted by the Flag State is responsible for providing guidance and supervision of registered ships on behalf of the Flag State in matters of compliance.

Figure 1 FIRST AI

Information on the Cargo Hold

Cargo vessel FIRST AI (hereinafter referred to as "the Vessel") was a general cargo vessel with a hatch cover that could be opened and closed from the center of the cargo hold in the direction of the bow and stern. (See Figure 2)

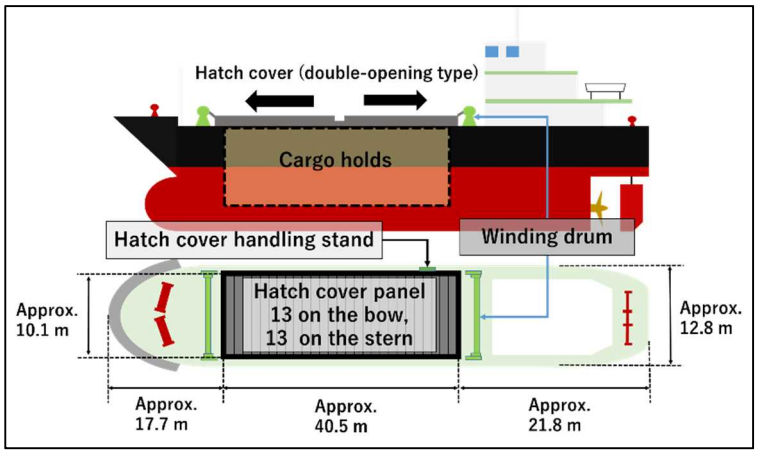


Figure 2 Outline of the Cargo Equipment

The hatch covers of the ship were of a type that opened and closed by hydraulically winding 13 hatch cover panels on the bow and stern sides, respectively, onto a drum or pushing them out of the drum. Each panel was designed to fit into the fourth-previously stored panel from above. (See Figure 3 and Figure 4)

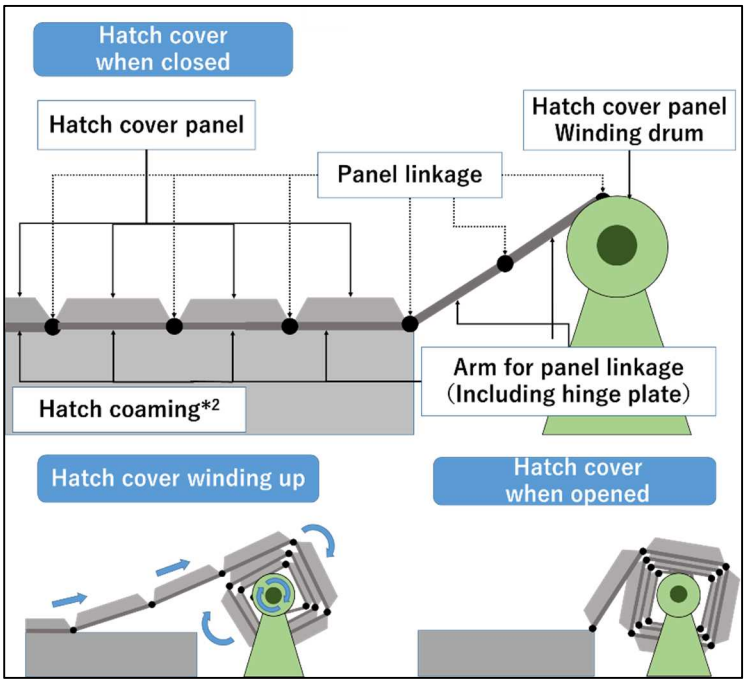


Figure 3 Overview of the Hatch Cover Mechanism

Figure 4 Hatch Cover Winding Up

Crew Information	Master (National of the Republic of Korea) Male, 70 years old First Class Deck Officer Certificate (issued by the Republic of Korea) Date of Issue: April 8, 2015 (Valid until April 7, 2020) Officer A (National of the Republic of Korea) Male, 69 years old Second Class Deck Officer Certificate (issued by the Republic of Korea) Date of Issue: February 19, 2019 (Valid until February 29, 2024) Chief Engineer (National of the Republic of Korea) Male, 72 years old Second Class Engineer Officer Certificate (issued by the Republic of Korea) Date of issue: February 10, 2015 (Valid until May 10, 2020) Boatswain (National of the Republic of the Union of Myanmar)

	Male, 34 years old Certificate of Proficiency for Rating Forming Part of Navigational Watch (issued by the Republic of the Union of Myanmar) Date of Issue: November 26, 2016 (Valid until November 4, 2021)
Injuries to Persons	Death of one person (boatswain)
Damage to Vessels and Other Facilities	Outward horizontal dent of the hinge plate (hereinafter referred to as "the Hinge Plate") attached with arms for connecting the port side panel between panel No. 11 and No. 10 of the stern side's hatch cover (hereinafter referred to as "the Arm"), flaking of the key plate attached with the Arm (hereinafter referred to as "the Key Plate"), and falling off of the pin attached with the arm (hereinafter referred to as "the Pin") (See Figure 5, Figure 6, Figure 7, Figure 8)

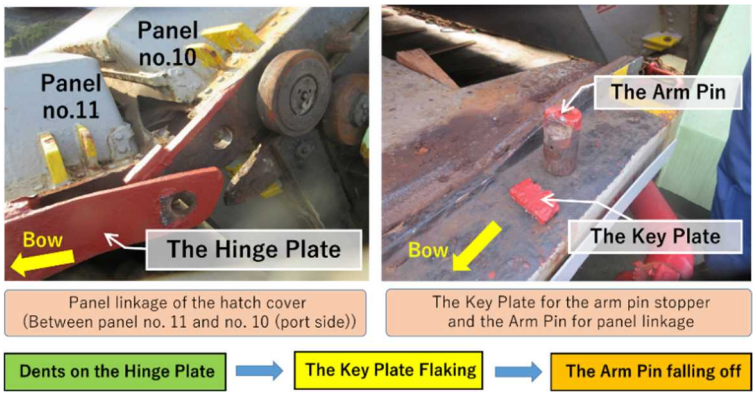


Figure 5 Damage to the Vessel

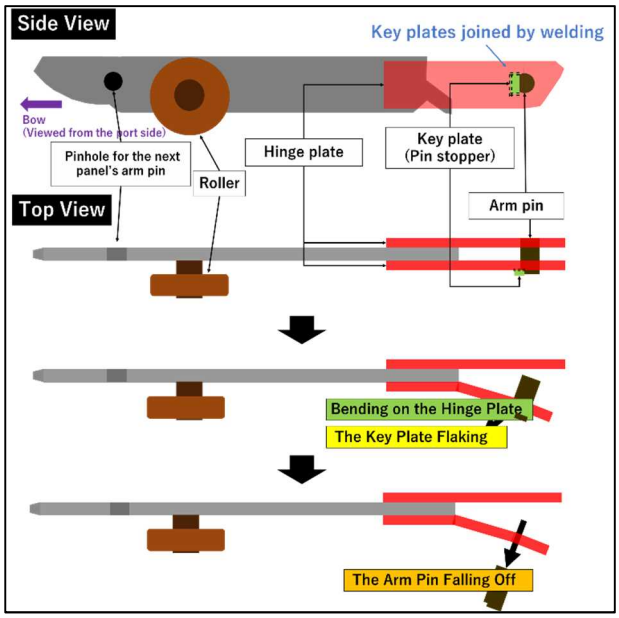


Figure 6 Arm for Connecting Panels

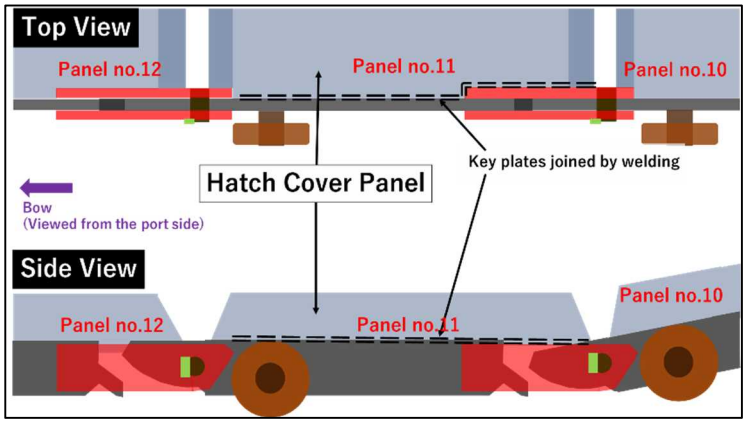
<table>
<tr><td></td><td> 

Figure 7 Outline of Connecting Panels Using an Arm

Figure 8 Traces of Flaking Off from the Key Plate</td></tr>
<tr><td>Weather and Sea Conditions</td><td>Weather: Weather Clear; Temperature 32.7° C; Wind Direction NNE; Wind Speed 3.4 m/s
Sea conditions: Wave Direction Northwest; Wave Height Approximately 45 cm</td></tr>
<tr><td>Events Leading to the Accident</td><td>A master, Officer A, a chief engineer, a boatswain, and six other crew members boarded the Vessel. While she was mooring at Maizuru Port in Kyoto, at around 10:45 on September 9, 2019, Officer A and the boatswain began closing the hatch covers in preparation for departure after finishing the unloading tasks.
While visually checking the condition of the hatch cover on the port upper deck during the closing of the hatch cover, Officer A noticed that the rubber packing[2] for sealing the hatch cover near the Arm that had been temporarily repaired during the previous navigation had flaked. Hence, he instructed the boatswain, who was operating the closure at the hatch cover handling stand on the starboard side of the upper deck, to stop the operation.</td></tr>
</table>

[2] Rubber packing adheres to the bottom surface around the hatch cover panel and is sealed by pressing it against the stainless steel bar installed on the hatch coaming side to prevent seawater and rainwater from entering.

	Officer A was checking the condition of the rubber packing after the hatch cover stopped moving. Then, the Arm Pin fell off and hit his right hip, so he turned to where the Arm Pin was inserted. At where the arm pin had fallen off, he noticed that the boatswain's head was caught between panel No. 11 (about 2.5 tons), which had fallen, and panel No. 7 which is already stored in the drum (See Attached Figure 2). He called out loudly for other crew members to come, and asked the stevedore who came to the scene to call an ambulance. The helmsman was in his room when he heard Officer A shouting and rushed to the scene of the accident. He confirmed that the head of the boatswain was caught between two hatch cover panels, reported the accident to the second officer in the chart room, and called the chief cook and the ordinary seaman. The second officer reported that the boatswain was injured to the master and immediately went to the scene of the accident. The helmsman and the chief cook transported the boatswain to the nearby corridor of the living quarter. As the boatswain was in cardiac arrest, he received chest compressions and artificial respiration from the rescue squad that arrived near the scene at around 11:02. At around 11:08, the rescue squad called for a medical helicopter to be dispatched. The boatswain was transported to a hospital in Toyooka City, Hyogo, at around 12:24 by a medical helicopter that arrived near the scene of the accident at around 11:31. (See Attached Figure 1 Overview of the Accident Location, Attached Figure 2 Overview of the Accident Situation)
Other Matters	(1) Brief History of the Vessel The Vessel was built in April 1995 and began her service as a Japanese domestic cargo ship. After that, her flag state was changed to the Republic of Panama and then the Republic of Korea. At the time of the accident, she operated as a general cargo ship between Japan and the Republic of Korea. (2) Notices of Dangerous Locations Before this accident, Officer A had warned the crew members not to pass through the space between the hatch cover panel winding drum and the hatch coaming (hereinafter referred to as "the Space") except for the situations of repair

	and inspection. (3) Repair Status of the Vessel's Hatch Cover Before the Accident ① On September 6, when closing the hatch cover after cargo handling at Pohang port in the Republic of Korea, the hinge plate, which was at the same place as the one in this accident, was bent outward horizontally. The key plate flaked off and the arm pin fell out the hatch cover. ② When the master reported that the arm was damaged and that a temporary repair could be made during the next voyage, Company A recognized that it was just a pin falling off and judged that it would not affect the navigation safety. The damage to the hatch cover was not reported to KRS, and Company A instructed the crew members to make a temporary repair during their navigation to Maizuru Port and then make a permanent repair of the damaged parts after the Vessel arrives in the port in the Republic of Korea. ③ The Vessel left Pohang Port for Maizuru Port at around 11:00 on the 6th, and during the voyage, the chief engineer hammered the hinge plate to correct the dent, pushed the arm pin in the hinge plate, and welded the Key Plate. (4) Deterioration of Material Strength Due to Temporary Repair As a result of the temporary repair done by the chief engineer, residual stress[3] had developed in the hinge plate, which reduced its strength against bending loads, but no measures, such as the addition of reinforcement, had been taken. (5) The Reason for the Hinge Plate Dent at the Previous Port When the manufacturer was asked for their opinion on why the hinge plate was bent outward horizontally at Pohang Port, they could not clarify the reason because the hatch cover was manufactured 24 years ago and could be affected by aging. (6) Cases of Hinge Plate Dent According to the manufacturer, out of approximately 220 same kind products manufactured in the last 30 years, there were at least three reports of bent hinge plates similar to this accident. The following information was provided on the

[3] Residual stress is caused by non-uniform strains inside the metal material due to plastic working such as rolling or heat treatment, and it occurs after processing, etc. Residual stress is a factor that reduces the material's strength against bending load.

reasons for the bent damage.

① Due to the grease clogging of the pin of the fourth previously-stored arm, the linked part was not folded to 90° during winding, and the Arm was not properly stored. The Arm was then pushed up from the fourth previously-stored arm, causing a bending load on the hinge plate and an outward pulling force on the key plate.

② The opening/closing operation exceeded the allowable tilt value of 3°, causing the port and starboard arms to be out of synch and exerting an outward force.

(7) Maintenance Conditions of the Moveable Part of the Hatch Cover

The maintenance and inspection of the grease condition of the movable part of the hatch cover are carried out every month in the safety management scheme on board in accordance with the regulations, and the safety management system and its implementation have passed the KRS inspection.

(8) Strength Standard for Hatch Covers

The standards for structural strength of hatch covers in the KRS regulations and the Japanese Ship Safety Law, which were applicable at the time of construction, specified the panel thickness, the cross-sectional coefficient for the assumed load, the corrosion reserve thickness, etc. However, there were no provisions for hinge plates, key plates, and arm pins at panel linkages, which were expected to be from a winding type hatch cover.

(9) Rules Concerning the Response to Malfunctions

① According to the KRS regulations, the owner must report to KRS without delay when the vessel is in a state of marine disaster deemed to affect the vessel's class registration. Also, the vessel will be subject to an additional inspection if any major part of the hull or engine, or any important equipment or device inspected by KRS is damaged or is about to be repaired or altered.

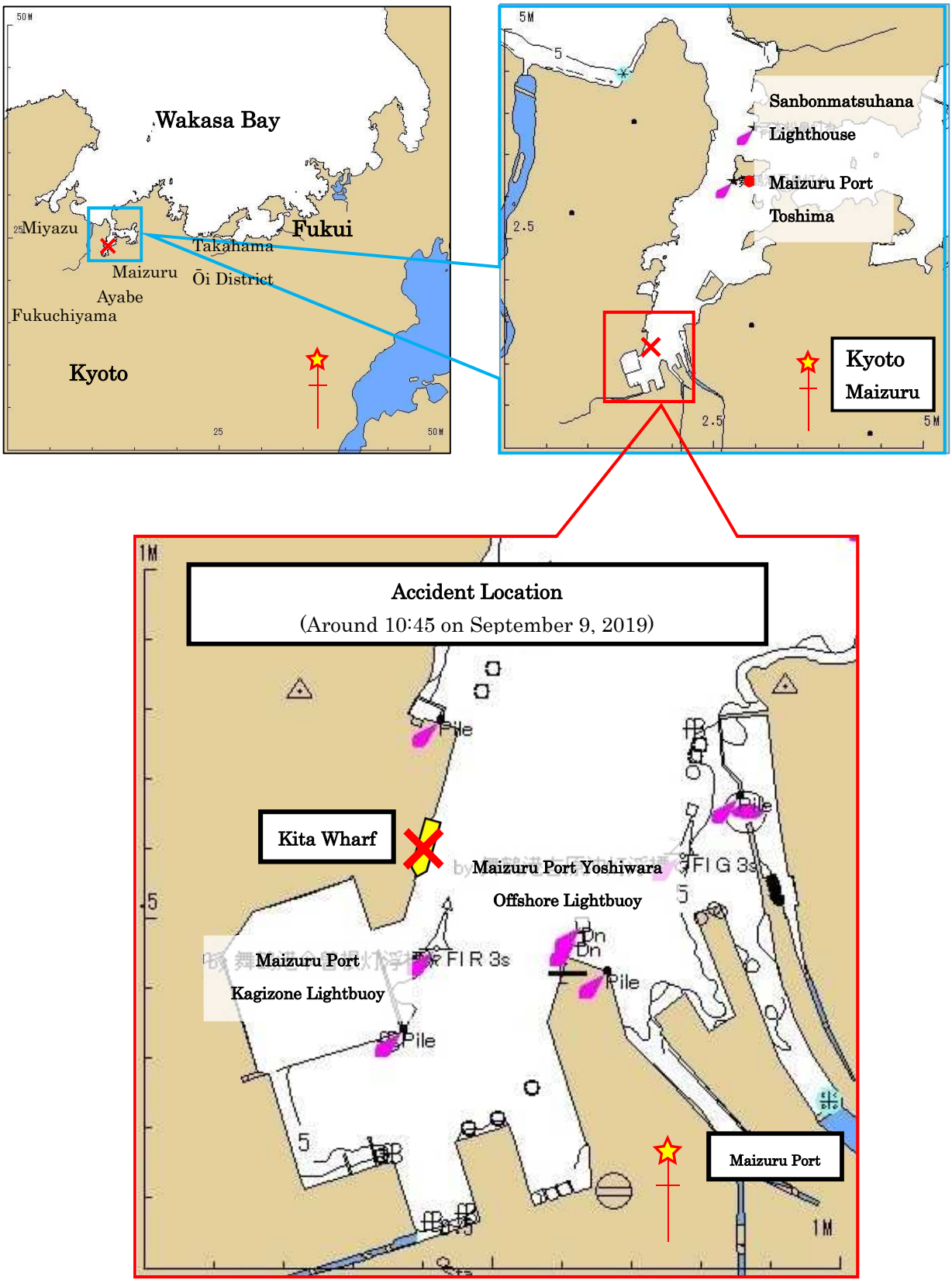
② After confirming with KRS on whether or not the damage to the Arm at Pohang Port is subjected to additional inspection, KRS responded that it is subjected to additional inspection.

Analysis	
Involvement of Crew Members	Applicable
Involvement of Vessel, Engine, etc.	Applicable
Involvement of Weather and Sea Conditions	Not Applicable
Analysis of the Findings	(1) Casualties The cause of death of the boatswain was a cerebral contusion, and it is probable that the cerebral contusion was caused by the head being trapped in the hatch cover panel. (2) Actions of the Boatswain ① It is probable that the boatswain was closing the hatch cover at the hatch cover handling stand on the starboard side of the upper deck when he received instructions from Officer A and stopped winding the drum. ② Since his head was trapped inside the Space, it is highly probable the boatswain had moved from the handling stand on the starboard side of the upper deck, passing the Space, to the port side of the upper deck where Officer A was. ③ The reason why the boatswain passed through the Space at the time of the accident although he had been instructed not to do so, could not be clarified due to his death. (3) Damages to the Linkages of Hatch Cover Panel ① It is probable that as the Arm was bent outward horizontally at the same place where it had been damaged previously in Pohang Port, at Maizuru Port, the Arm Pin had lost its holding power and fell off, and panel No. 11 fell. ② It is probable that the hinge plate was bent because the closing of the hatch cover took place after the temporary repair, which did not take residual stress into account, was carried out in Pohang Port, the Vessel's previous port. ③ It is probable that Company A did not discuss the repair measures with KRS because they judged that the falling off of the arm pin was simply a pin falling off and would not affect the safety of the vessel navigation. ④ Manufacturer’s Opinion as to why the hinge plate was bent in Pohang Port, the Vessel's previous port, was requested. However, the reason could not be clarified because the manufacturers did not confirm the situation

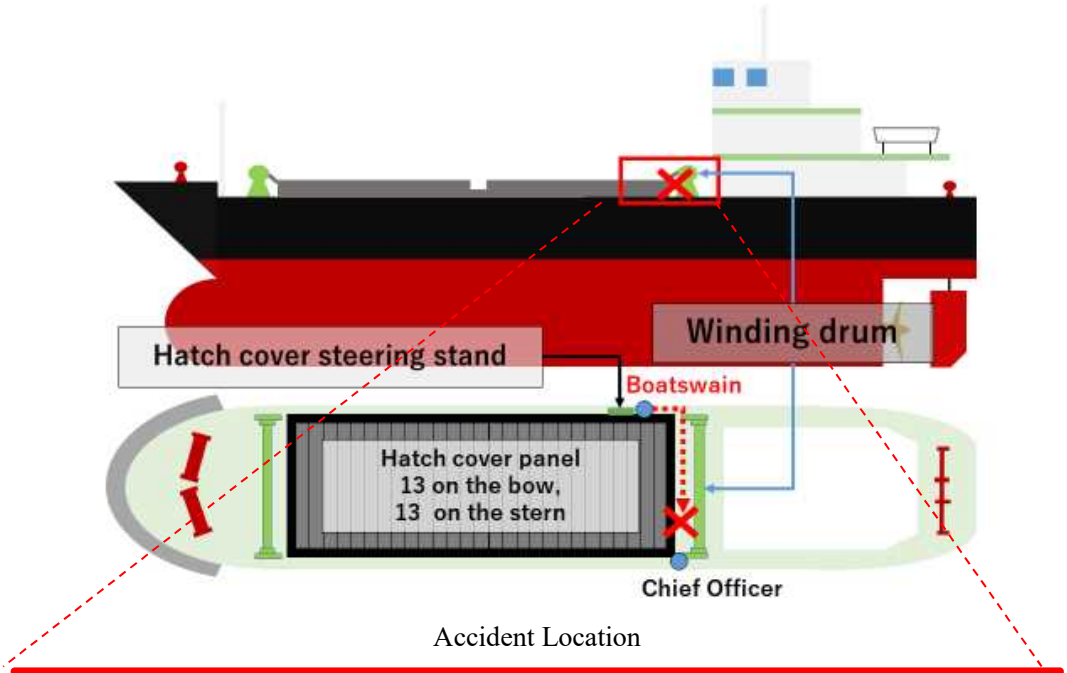
	directly.
Probable Causes	It is probable that the accident occurred due to the following situation. As the boatswain received instruction from Officer A, he stopped winding up the drum for the closing of the hatch cover after the Vessel had unloaded the cargo. Afterward, the boatswain passed through the Space, and the Hinge Plate bent outward horizontally, the Key Plate flaked off, and the Arm Pin, which was no longer restrained, fell off, causing panel No. 11 of the hatch cover to fall. As a result, his head was caught between panel No. 11 and panel No. 7, which was already stored in the drum. The reason why the boatswain passed through the Space, although he had been warned not to do so before the accident, could not be clarified. It is probable that the bent of the Hinge Plate occurred because the hatch cover was opened and closed after the temporary repair took place on the Vessel without taking account of the residual stress.
Safety Actions	It is probable that it is useful for the following measures to be implemented to prevent the recurrence of similar accidents. ・Company A should make the crew aware of the danger of being caught in the hatch cover, and instruct them not to pass through the Space except for the situations of absolutely necessary repairs and inspections. Also, if working from under the panel is unavoidable, the crew should be instructed to take measures to prevent falling before starting their work. ・If the hatch cover is damaged, Company A should carry out appropriate repairs before opening and closing it.
Safety Recommendations	In view of the results of this accident investigation, the Japan Transport Safety Board recommends that JANGHO SHIPPING CO., LTD., which is the management company of FIRST AI, takes the following measures for the purpose of preventing the reoccurrence of a similar accident and reducing damage. 1. JANGHO SHIPPING CO., LTD. should make the crew of ships under their management aware of the danger of being caught in the hatch cover and instruct them not to pass through the space between the winding drum and the hatch coaming unless it is absolutely necessary. Furthermore, when it is unavoidable to work under the panel, the crew should be instructed to take measures to prevent falling before starting the work.

	2. If the hatch covers of vessels managed by the company are damaged, JANGHO SHIPPING CO., LTD. should carry out appropriate repairing measures before opening and closing them.

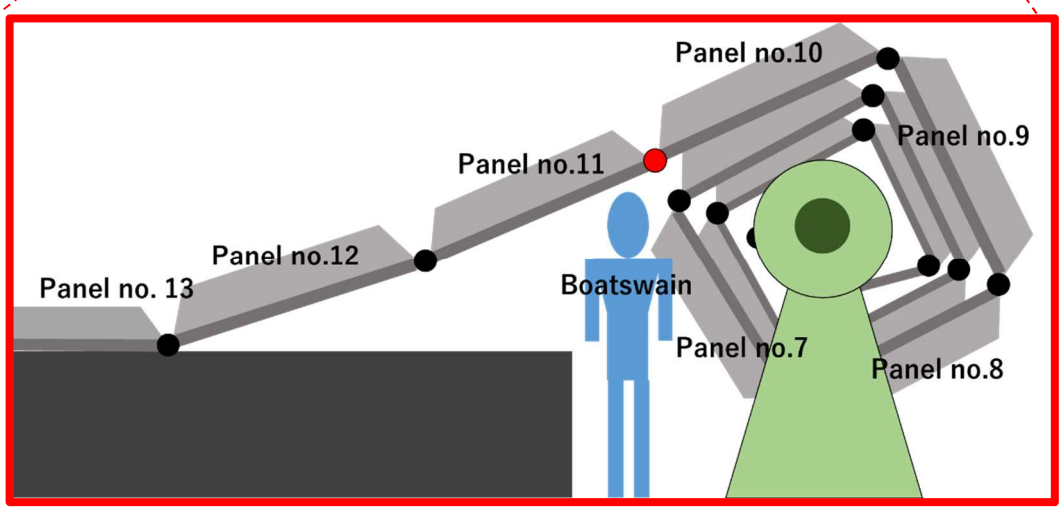
Attached Figure 1: Overview of the Accident Location



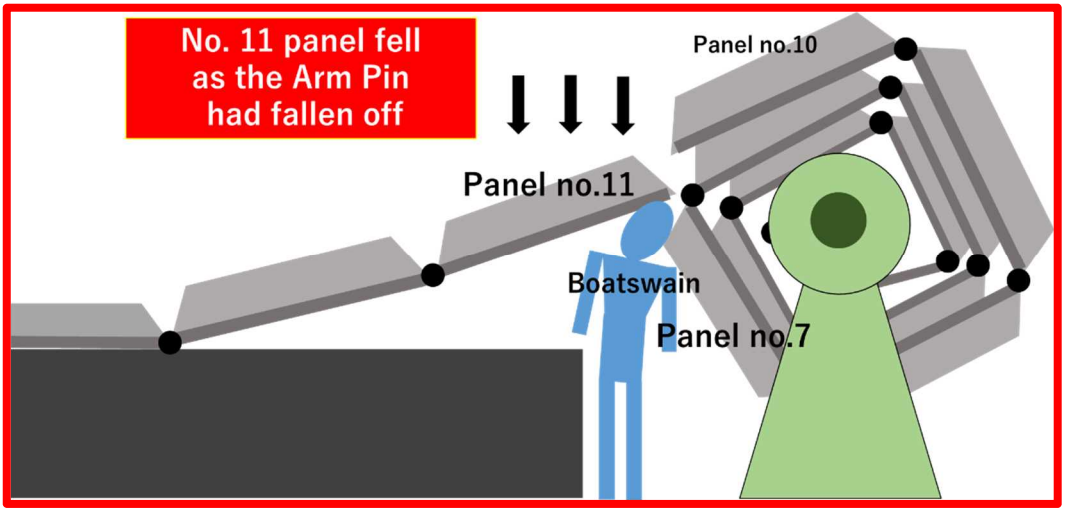
Attached Figure 2 Overview of the Accident Situation



Accident Location



The Situation before the Accident Occurred



The Situation at the Time of the Accident