REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

YENISEI RIVER MARINE SAFETY INVESTIGATION REPORT

Occupational Fatality

Pyeongtaek, Republic of Korea | 2 May 2024

Official Number: 5072

IMO Number: 9629586

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AUTHORITY

An investigation, under the authority of the Republic of the Marshall Islands laws and regulations, including all international instruments to which the Republic of the Marshall Islands is a Party, was conducted to determine the cause of the casualty.

Maritime Administrator

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LIST OF ABBREVIATIONS AND ACRONYMS

2/O. . . . . Second Officer

ASD. . . . . Able Seafarer Deck

ETO. . . . . Electro-Technical Officer

HSE. . . . . Health, Safety, and Environment

kn. . . . . Knots

LNG . . . . . Liquefied Natural Gas

m . . . . . Meters

mm . . . . . Millimeters

m^3 . . . . . Cubic Meters

No. . . . . .Number

OS . . . . . Ordinary Seafarer

PMS. . . . . Planned Maintenance System

UHMWPE. . . . . Ultra-high Molecular Weight Polyethylene

UTC. . . . . Universal Coordinated Time

DOCUMENTS CITED

MLC, 2006 . . . . . .Maritime Labour Convention, 2006

STCW Code . . . . . Seafarers' Training, Certification and Watchkeeping Code

PART 1: EXECUTIVE SUMMARY

On the morning of 2 May 2024, the Republic of the Marshall Islands-registered gas carrier YENISEI RIVER was berthing starboard side to alongside Jetty No. 1 of the LNG terminal at the port of Pyeongtaek, Republic of Korea. The final mooring arrangement, as agreed during the Master and Pilot information exchange, consisted of 17 synthetic mooring lines of which nine were forward and eight were aft, including two fore springs and two aft springs.

To protect the mooring ropes from surface abrasion with steel surfaces of the fairlead rollers, chafe protection sleeves were wrapped around the mooring lines. The sleeves were installed around the mooring lines before lowering the lines from the ship to the mooring boat. The correct position of the sleeves could be adjusted upon completion of the mooring operation using the handling ropes connected to the sleeves.

The fore springs were the first lines that were sent ashore, followed by the aft springs. The running ends of the mooring lines were paid out through the universal roller fairleads and then passed to mooring boats, which brought the lines to the jetty where they were secured around mooring hooks. When the aft springs were sent out, an unusual sound was heard from the winch. At 0948,[1] all the springs were secured on the mooring hooks.

As the ship approached the jetty, the crew started heaving the lines by using the mooring winches to pick up the slack. It was observed that the winch being used to heave the aft springs was running slowly and could not catch up with the ship's movement. It was necessary to move the ship 20 m astern after it was alongside to align the manifold with the loading arms. The engines were put astern and the ship started moving slowly astern, bringing the aft springs under tension. Due to problems with the aft winch, the lines could not be slacked. The Bridge was informed about the

1 Unless stated otherwise, all times are ship's local time (UTC +9).

tension in the lines and the snap-back area for the aft springs was cleared. Subsequently, the engines were put ahead to release the tension in the aft springs. The ship came to stop and thereafter started moving forward, slacking the aft springs. The Master ordered the fore springs be paid out as the ship was moving forward.

The ASD1 took the initiative to adjust the chafing sleeves on one of the fore springs and positioned himself adjacent to the fairlead roller before the ship was moved forward. When the ship started to move forward, he got caught between the roller of the fairlead and the mooring line and got pulled through the fairlead into the water.

The mooring boats which were assisting the ship immediately approached the ASD1 in the water, recovered him, and brought him ashore, whereafter he was transferred to the hospital by ambulance. Upon arrival in the hospital at 1058, the ASD1 was declared deceased.

The below lessons learned were identified.

- The need for clear communication between the Bridge and Supervisors of mooring stations and between Supervisors and the deck crew manning the mooring stations.
- The need for effective supervision on deck during mooring operations. Crewmembers must be aware of danger zones, including snap-back zones and rolling parts of mooring equipment.

PART 2: FACTUAL INFORMATION

The following Factual Information is based on the information obtained during the Administrator's marine safety investigation.

Ship particulars at the time of the incident: *see* chart to right.

YENISEI RIVER

YENISEI RIVER was built in 2013 in Ulsan, Republic of Korea, by Hyundai Heavy Industries, Co., Ltd. It is a 155,000 m^3 Class LNG carrier with four cargo tanks *(see Figure 1)*.

SHIP PARTICULARS

Vessel Name
YENISEI RIVER

Registered Owner
Navajo Marine Limited

ISM Ship Management
Dynagas Ltd.

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9629586	5072	V7AU8

Year of Build	Gross Tonnage
2013	100,236

Net Tonnage	Deadweight Tonnage
33,759	84,565

Length x Breadth x Depth
277.1 x 44.2 x19.7 m

Ship Type
Gas Carrier

Document of Compliance Recognized Organization
Bureau Veritas

Safety Management Certificate Recognized Organization
Bureau Veritas

Classification Society
Lloyd's Register

Persons on Board
35

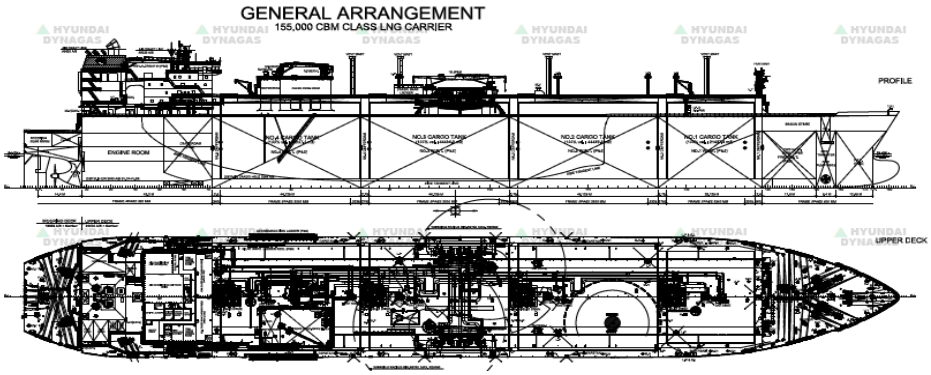

Figure 1: YENISEI RIVER General Arrangement.

Mooring Equipment

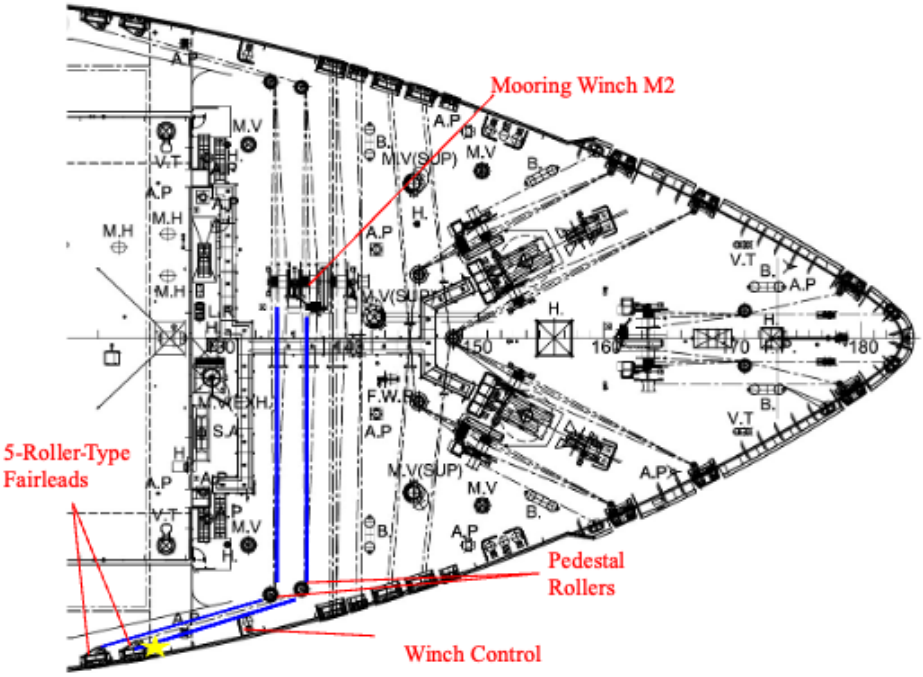

Figure 2: Forward mooring station. The blue lines show how the two fore springs were running. The yellow star represents the location where the ASD1 was standing.

The mooring lines on board YENISEI RIVER consisted of UHMWPE ropes, 42 mm in diameter. The mooring ropes were received on board in January 2022 and put into service in February 2022.

The fore and aft springs were controlled by double split drum electric mooring winches manufactured by Aker Solutions ASA. The winch for the aft springs was designated winch M3. It was positioned on the starboard side of the Upper Deck. The winch for the fore springs was designated winch M2. It was positioned in the middle of the Upper Deck,

at the Forecastle *(see Figure 2)*. The winches were last used from 26–28 March 2024 in Zeebrugge, Belgium and the last quarterly maintenance was performed in April 2024. The most recent brake holding load test was performed in July 2023.

The ship's fore springs were guided by pedestal rollers, which were found in good working condition and greased in April 2024, and 5-roller type universal fairleads *(see Figure 3)*. The roller fairleads are subject to weekly inspections, in accordance with the ship's PMS, to confirm the external condition and the freeness of movable parts. A photographic report is sent to the office on a monthly basis. The latest report was dated 10 April 2024 and showed no shortcomings.

Figure 3: Five-roller universal fairlead on board YENISEI RIVER. This fairlead was involved in the accident.

The chafe protection sleeves were used on board YENISEI RIVER to protect the mooring ropes from surface abrasion with steel surfaces. The sleeves are wrapped around the mooring lines and closed using a hook and loop fastener. The chafe sleeves are prepared and installed prior to lowering the mooring lines from the ship. The sleeves' position is adjusted upon completion of mooring operation using handling ropes attached to either end of the sleeves. One handling rope for each sleeve is made fast on a strong deck fitting.

Figure 4: Chafing sleeve on the outer fore spring where it passes through the fairlead.

Narrative

On 28 March 2024, YENISEI RIVER departed Zeebrugge, Belgium to load LNG at Jetty No. 1 of the LNG terminal in the port of Pyeongtaek with expected arrival on 2 May 2024. A mooring configuration consisting of 16 lines in a 2-4-2 configuration fore and aft was calculated[2] and agreed with the LNG terminal before arrival.

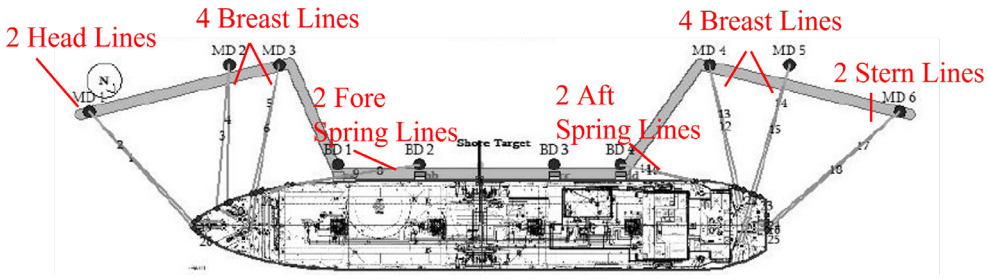

Figure 5:Mooring configuration as calculated.

One day prior to arrival, on 1 May 2024, a work plan meeting was conducted from 1030 to 1100, which included the Master and the mooring teams. The meeting subject included the pilot arrangement, the mooring plan,[3] the mooring sequence, and the mitigating factors that were determined during the risk assessment of the mooring operation.[4] Later that day, a checklist was completed to inspect the condition of the mooring equipment. All equipment was found to be in good operational order.[5]

On 2 May 2024, YENISEI RIVER arrived at the port of Pyeongtaek. A southwesterly, Beaufort Force 4 wind was blowing. A slight sea was observed without swell and there was a northwesterly current of 0.1 kn. The visibility was good.

At 0705, two pilots boarded the ship. The Pilot and Master Exchange of Information[6] was finished at 0715. During this meeting the pilots requested one additional head line be added to the mooring configuration.

Around 0900, a Toolbox Talk was carried out on board by the team leaders of each mooring team. The Toolbox Talk included the new mooring configuration, tugboat and mooring boat procedures, task assignments, and a warning message regarding snap-back zones. At 0909, the four tugs to assist the ship were made fast.

The forward mooring team consisted of the 2/O-1[7], Bosun, ASD1, ASD2 and OS1. The 2/O-1 was the team leader and had to keep the general overview of the team and the tugs; he was in communication with the Bridge by means of a handheld radio.

The Bosun was in charge of positioning the mooring lines on the split drums. The ASD1 and the OS1 had to pass the mooring lines to the mooring boats and had to adjust the chafing sleeves. The ASD2 was the winch operator at the remote control station *(see Figure 6)*.

2 Calculation made by OPTIMOOR, mooring calculation software.
3 The mooring plan was detailed in Part 3 of the Discharging and Ballasting Plan, HSE manual reference F.OPS.6b, latest revision 01 May 2024.
4 Risk Assessment — mooring and unmooring operation at Pyeongtaek, South Korea, HSE manual reference V-20240430/009.
5 As per the Company's Mooring Equipment Operation checklist F.OPS.30, as part of the HSE manual on board.
6 According to Company's Form F.NAV.15, as part of the HSE manual on board.
7 YENISEI RIVER had two 2/Os on board.

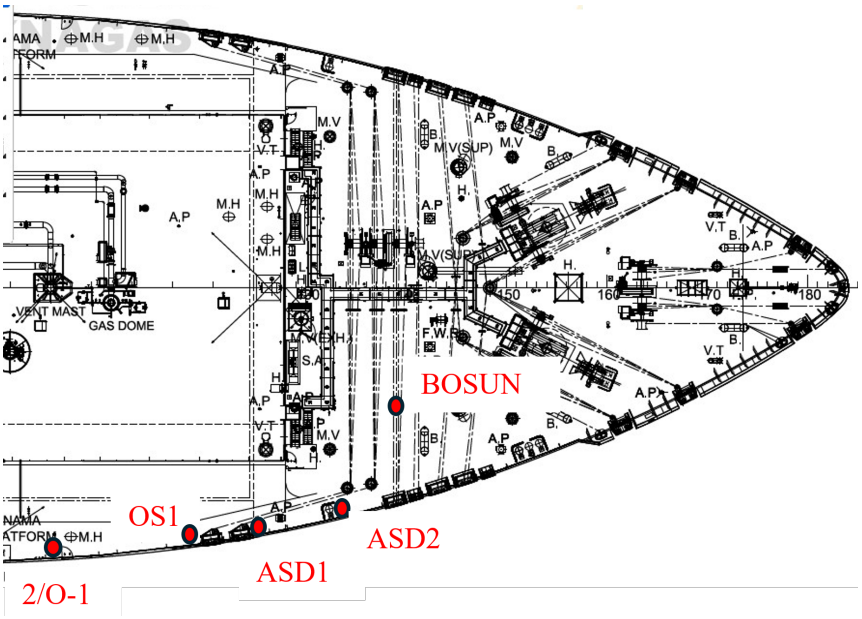

Figure 6: Position of the members of the forward mooring team.

At the aft mooring station, the 2/O-2 was the team leader and the OS2 was operating the mooring winch. ASD3 and ASD4 were standing by to pass the aft spring lines to the mooring boats.

When YENISEI RIVER approached the berth, the springs were lying ready on deck, with the chafing sleeves wrapped around them. The two fore springs were passed through the universal roller fairleads to the mooring boats, which brought the lines to the jetty. Subsequently, the two aft springs were passed to another mooring boat. When the lines were paid out, an unusual sound was heard from mooring winch M3. The 2/O-2 reported this to the bridge and requested the ASD3 to check that all the stoppers of the winch were fully opened. The ASD3 checked the stoppers and confirmed that they were fully opened.

At 0946, the fore springs were secured to the mooring hooks on the jetty. At 0948, the aft springs were secured as well. At that moment, the forward part of the ship was coming close to the jetty and the aft end was approximately 50 m away. The slack was taken up from the lines as the ship approached the jetty. The 2/O-2 noticed that mooring winch M3 was running slowly and informed the Bridge by his handheld radio. The brakes and the stoppers of the winch were checked again, and all were observed to be fully open. The slow response of mooring winch M3 resulted in the inner aft spring line being slack and getting caught between the fenders and the ship when the aft part of the ship touched the fenders. As soon as the ship came clear from the fender, the aft spring line also became clear again.

At 0949, when the ship was alongside the jetty, the terminal's Gas Engineer informed the Master that the ship had to move 20 m astern, to align with the loading arms. At this moment, the ship had a speed forward of 0.2 kn. At 0950, The Master ordered the engine slow astern, followed by dead slow astern. At 0951, the ship started moving astern.

The ASD3 observed smoke coming out of mooring winch M3 as the ship started moving astern. This was reported to the Bridge. The engine was immediately stopped and the ETO and the Chief Engineer were sent to check the mooring

winch. The ship was now moving astern with a speed of -0.2 kn and increasing. As the aft spring line could not be paid out, the line came under tension and the 2/O-2 ordered the crewmembers to move clear of the snap-back zones for the aft springs. To take the tension from the line, the Master alternately ordered the engine slow ahead and stop. No malfunctions in the electrical system of the winch were observed by the ETO.

As soon as the ship had stopped moving ahead, the ASD1and the OS1 started to adjust the chafing sleeves of the spring lines on their own initiative. The ASD1 was positioned close to the roller fairlead, in between the outer fore spring and the railing. The OS1 was positioned on the other side of the fairleads, in front of the 2/O-1.

At 0955, in response to the Master's command to start the main engine ahead, the ship started to move forward with a speed of 0.4 kn. Consequently, the fore springs came under tension and the Master gave orders to pay out the fore springs and to put the engine astern to stop the forward movement. As the ship moved ahead, the ASD1 got caught between the roller of the fairlead and the spring line and got pulled through the fairlead. The 2/O-1, who was signaling to the winch operator to pay out the fore springs, immediately alerted the Bridge about the man overboard. Upon receipt of the emergency situation on deck, the Master requested the mooring boats to recover the ASD1 from the water. He also asked the terminal to arrange for an ambulance to transport the ASD1 to the hospital.

The ship was stopped and the ASD1 was recovered from the water by one of the mooring boats. Thereafter, the ASD1 was transported to the hospital by the ambulance that was called by the terminal.

At 1058, the ambulance arrived at the hospital where the ASD1 was declared deceased.

At 1121, the ship was made fast starboard side at Jetty No. 1 of the LNG terminal.

After the incident, mooring winch M3 was examined by the Company's Marine Superintendent. An abnormal noise was heard when the winch was operated. Further examination revealed that the brake band supporting arrangement had become loose, causing friction between the brake liner and the brake drum. When the supporting arrangement was adjusted, the noise disappeared, and the winch worked as designed.

Crew

YENISEI RIVER had a complement of 34 crewmembers, 18 more than what was required by the Minimum Safe Manning Certificate issued by the Administrator. In addition to the crew, there was one supernumerary on board. All of the ship's crewmembers were found medically fit and held valid Republic of the Marshall Islands seafarer documentation required for their positions on board.

The forward mooring team consisted of five crewmembers, including the 2/O-1, who was in charge. After the incident, an alcohol test was taken from the forward mooring team, the Master, and the two Pilots. All tests were negative.

Experience of YENISEI RIVER crewmembers:

RANK	TIME ON BOARD YENISEI RIVER	TIME IN RANK	TIME WITH COMPANY
Master	75 days	1.2 years	4.2 years
2/O-1	77 days	2.7 years	0.9 years
Bosun	255 days	7.1 years	19.1 years
ASD2	159 days	5.5 years	13.6 years
ASD1	159 days	8.8 years	10.6 years

The ASD1 joined the YENISEI RIVER on 26 November 2023. It was his first contract on board after serving multiple contracts on Company-managed ships equipped with the same mooring equipment. On 2 May 2024 the ASD1 kept the bridge morning watch between 0000 and 0400. At approximately 0900, he reported at the forward mooring station.

The Administrator did not find any indication that any crewmembers involved with this marine casualty did not receive the required amount of rest mandated by the IMO's STCW Code, Section A-VIII/1, paragraphs 2 and 3 and ILO's MLC, 2006, regulation 2.3.

Mooring Preparations

A mooring plan was calculated and approved by the terminal. The mooring plan was part of the ship's Discharge and Ballasting Plan. A risk assessment[8] was completed on 30 April 2024. The risk assessment addressed 45 potential hazards with control measures, including:

(a) identification of and familiarization with snap-back zones;

(b) testing of mooring equipment;

(c) mooring training to be conducted with all crew involved;

(d) toolbox meeting to be executed prior to mooring operations;

(e) proper communication with the bridge, including at least two hand-held radios at the fore and aft mooring stations;

(f) sufficient and experienced crew;

(g) helicopter view of the duty officer in charge of mooring operations to anticipate safety aspects and analyze developing hazards; and

(h) duty officer to keep the mooring gangs in visual contact.

The mooring training was conducted on 1 May 2024. A Toolbox Talk was conducted prior to the mooring operations.

8 Form F.RA.1- Risk Assessment form, as part of the HSE Manual on board.

PART 3: ANALYSIS

The following Analysis is based on the above Factual Information.

Development of the Accident and Situational Awareness

At 0950, the terminal's Gas Engineer informed the Master that the ship had to move 20 m astern. At this moment the ship had a speed of 0.2 kn forward. The engine was put astern and at 0951 the ship started to move slowly astern. There was no inherent danger with adjusting the chafing sleeves of the fore springs when the ship was slowly moving astern.

The OS1 and the ASD1 were positioned close to the roller fairleads *(see Figure 6)*. The OS1 was positioned on the outside of the inner spring line and the ASD1 was positioned between the outer spring line and the ship's guardrail.

Due to the mechanical failure identified with mooring winch M3, the aft spring lines could not be paid out and came under tension as soon as the ship started to move astern at 0951. The engines were put alternately to dead slow and slow ahead to release the tension in the lines.

Due to the astern motion of the ship when the engines were put ahead, the ship slowly started moving ahead four minutes later at 0955, resulting in the fore springs becoming tensioned and thus creating a potential hazard. The forward movement of the ship was observed on the speed log on the Bridge, but it could not be determined if this information was communicated to the 2/O-1 and 2/O-2, by means of the handheld radios, at the mooring stations on deck. The ASD1 and the OS1 were not alerted to keep clear of the mooring lines when the ship started moving ahead.[9] Very shortly after the ship started moving ahead, the Master ordered the 2/O-1 to pay out the fore springs. Consequently, the 2/O-1 ordered the ASD2 at the winch operation station *(see Figure 2)* to pay out the lines.

The forward movement of the ship and the slacking of the lines caused the vertical fairlead rollers of the respective fairleads to turn in an anti-clockwise direction *(see Figure 7)*.

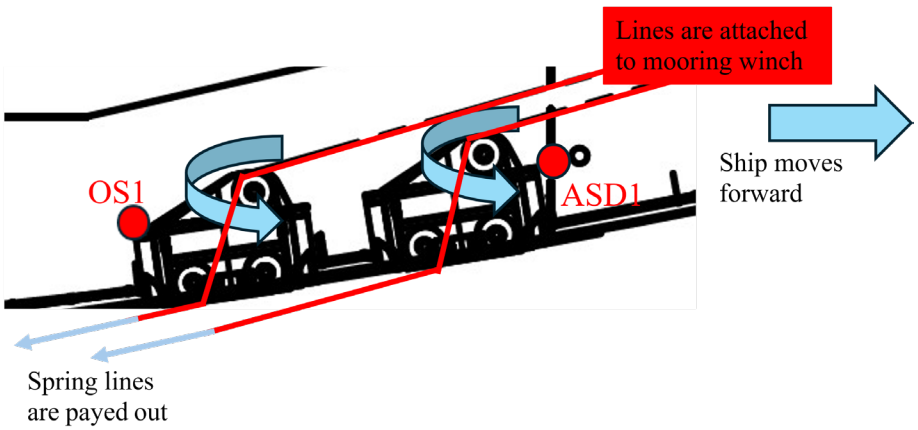

Figure 7: Movement of the vertical roller of the fairlead.

9 As indicated in F.RA.1-Risk Assessment Form, number 37: "It is the duty of the officer in charge of mooring operations to maintain a helicopter view, both forward and aft. They must always anticipate safety aspects and analyze any developing hazards, as these can sometimes arise during mooring operations, which are inherently dynamic in nature."

It was not witnessed how the ASD1 became stuck between the moving fairlead roller and the spring line and how he was further pulled into the water.

The ASD1 was positioned behind the fairleads *(see Figure 4)*. The ASD1, who was leaning forward and completely covered by the fairleads, was not visible to the supervising 2/O-1. One of the identified safeguards in the risk assessment was to keep the mooring gangs in visual contact with the supervising Officer.[10]

Risk Acceptance

On board YENISEI RIVER, the adjusting of the chafing sleeves generally happened upon the initiative of the mooring crew when the ship was in its final position. It could not be determined if the supervising Officer generally confirmed when the ship was in its final position before the adjustment of the chafing sleeves started. Neither the mooring plan nor the risk assessment addressed the positioning of the chafing sleeves. Consequently, the positioning of the chafing sleeves was not discussed during the mooring training or the Toolbox Talk. This led to a situation where the crew was exposed to moving fairlead rollers and mooring lines before the ship had reached its final position.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Factual Information and Analysis and shall in no way create a presumption of blame or apportion liability.

1. Causal factors that contributed to this very serious marine casualty include:
   (a) ineffective communication between the Bridge, the supervising officers, and the mooring crew as the ship was being positioned on the jetty; and
   (b) safe adjustment of the chafing sleeves was not addressed during the risk assessment nor the Toolbox Talk.

PART 5: PREVENTIVE ACTIONS

In response to this very serious marine casualty, the Company has taken the following Preventive Actions:

1. The lessons learned from this incident were shared with the entire fleet to increase awareness.
2. A safety campaign about safe mooring was launched over the entire fleet.
3. Marine Superintendents had to conduct on board mooring training during ship attendance.
4. Instructions on chafing protection were prepared and implemented over the entire fleet.
5. Mooring procedures, risk assessments, and audit practices have been reviewed for appropriate guidance.
6. A safety campaign on the human element was launched, based on incident findings.

10 As indicated in HSE Manual F.RA.1-Risk Assessment Form, number 37.

PART 6: RECOMMENDATIONS

The following Recommendations are based on the above Conclusions and in consideration of the Preventive Actions taken.

1. The Company is recommended to include:
   (a) the positioning of chafing sleeves in the risk assessment related to mooring operations; and
   (b) warnings about ship movements in the mooring communication procedures.

The Administrator's marine safety investigation is closed. It will be reopened if additional information is received that would warrant further review.