REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

HOUSTON CASUALTY INVESTIGATION REPORT

Fall From Height

North Atlantic Ocean | 10 November 2021

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IMO Number: 9539602

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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

ASD	Able Seafarer Deck
BA	Breathing Apparatus
C/E	Chief Engineer
C/O	Chief Officer
CPR	Cardiopulmonary Resuscitation
DPA	Designated Person Ashore
GT	Gross Tons
ILO	International Labour Organization
IMO	International Maritime Organization
ISM	International Safety Management
m	Meters
m^3	Cubic Meters
MLC, 2006	Maritime Labour Convention, 2006
mm	Millimeters
MSC	Maritime Safety Committee
OOW	Officer of the Watch
OS	Ordinary Seafarer
PPE	Personal Protective Equipment
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
STCW Code	Seafarers Training, Certification and Watchkeeping Code

PART 1: EXECUTIVE SUMMARY

On 10 November 2020, the Republic of the Marshall Islands-registered bulk carrier HOUSTON, managed by Diana Shipping Services S.A. (the "Company"), was underway in the North Atlantic Ocean on a ballast voyage from Dunkirk, French Republic (hereinafter "France") to Baltimore, Maryland, United States of America (hereinafter "United States").

Planned work for the day included cleaning Cargo Holds Nos. 1 and 6. The required PPE included a safety harness with lifeline. Based on the risk assessment completed for this work, the Australian ladders were to be used to enter and exit the holds and the vertical ladders were to be used only as an emergency exit. Additionally, the safety harnesses and lifelines were to be used when a crewmember was more than 2 m above the tank top.

While entering Cargo Hold No. 6 to start work after lunch, the Bosun fell to the tank top. Though his fall was not witnessed, based on available information, it is considered likely that he fell from the vertical ladder. He was wearing a safety harness with a single lifeline when he fell. The Bosun was unconscious, without a pulse, and not breathing when examined immediately after he was found lying on the tank top. Efforts to revive him were not successful and the Master determined he was deceased.

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the "Administrator") identified the following:

1. Causal factors that contributed to this very serious marine casualty include:
   (a) the Bosun's apparent decision to use the vertical ladder to enter Cargo Hold No. 6 rather than the Australian ladder, as required by the risk assessment that had been completed for cleaning the cargo holds, which increased both the potential likelihood and consequences of a fall from height;
   (b) inadequate communications between the Bosun, C/O, and OSs; and
   (c) the lifeline on the Bosun's safety harness not being connected to a strongpoint when he fell due to either:
      (i) the use of less effective PPE because the safety harnesses on board the ship had a single lifeline and clip rather than either two lifelines with clips or a portable fall arrester; or
      (ii) the Bosun was not making use of the required PPE by not connecting the lifeline on his safety harness to a strong point while using the vertical ladder to enter the cargo hold.
2. Additional issues that were identified but that did not contribute to this very serious marine casualty include:
   (a) the atmosphere inside Cargo Holds Nos. 1 and 6 were not retested as required by the Company's enclosed space entry procedures; and
   (b) a crewmember was not posted at the entrance of each cargo hold to monitor the crewmembers working in the holds as required by the Company's enclosed space entry procedures.

PART 2: FINDINGS OF FACT

1. The following Findings of Fact are based on the information obtained during the Administrator's marine safety investigation.
2. Ship particulars: *see* chart to right.

SHIP PARTICULARS

Ship Name
HOUSTON

Registered Owner
Gala Properties Inc.

ISM Ship Management
Diana Shipping Services S.A.

Flag State
Republic of the Marshall Islands

IMO No.	Official No.	Call Sign
9539602	3656	V7SH7

Year of Build	Gross Tonnage
2009	91,407

Net Tonnage	Deadweight Tonnage
57,770	177,728

Length x Breadth x Depth
283 x 45 x 24.8 m

Ship Type
Bulk Carrier

Document of Compliance Recognized Organization
Lloyd's Register

Safety Management Certificate Recognized Organization
Lloyd's Register

Classification Society
Bureau Veritas

Persons on Board
22

3. On 6 November 2020, the nine-cargo hold bulk carrier HOUSTON departed Dunkirk, France on a ballast voyage to Baltimore, Maryland, United States after discharging a cargo of coal *(see Figure 1)*.

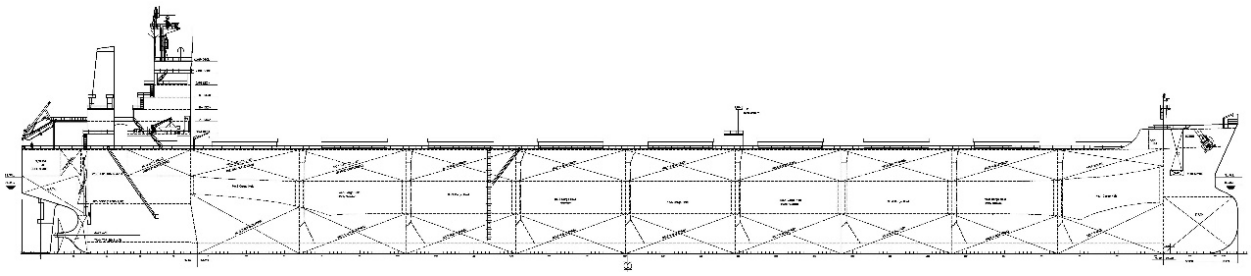

Figure 1: General arrangement of HOUSTON.

Cargo Hold Cleaning

4. After the ship's departure, the Master, C/O, Bosun, and deck ratings completed a risk assessment for cargo hold cleaning during the voyage. Some of the identified hazards[1] and controls were:

HAZARD	CONTROLS
Entry into a cargo hold with an unsafe or unknown atmosphere	• Enclosed Space Entry Permit • Ventilation of cargo hold • Entry with hatch covers open • Atmospheric testing • Use of BA if entry is required and atmosphere is unknown or not safe
Fall from cargo hold access ladders	• Primary access by the Australian ladder • Emergency exit by the vertical ladder • Use of safety harness when on a vertical ladder and more than 2 m above the tank top

5. The Master stated that it was an accepted standard practice on board HOUSTON to use a safety harness with lifeline when climbing up or down a vertical ladder.

6. On the mornings of 7–9 November 2020, the C/O held work planning meetings with the Bosun and deck ratings to review the day's planned work, which included cleaning the cargo holds in preparation for loading at Baltimore. These meetings included a review of the Enclosed Space Entry Permits that had been issued for the cargo holds that would be entered during the day, the risk assessment completed on 6 November 2020, and the required PPE.

7. The required PPE for cargo hold cleaning included coveralls, safety helmet, rubber safety boots, gloves, flashlight, and safety harness with lifeline. Crewmembers were also required to wear a personal gas meter.[2]

1 Other identified hazards included: the access hatch cover dropping on personnel when entering or exiting the cargo hold, head injury due to dropped tools or materials, and pneumonia or cold when entering refrigerated cargo holds.

2 Additional PPE included locating a BA at the entrance to the cargo hold being cleaned.

8. Between 7–9 November 2020, the Bosun and deck ratings cleaned Cargo Holds Nos. 1–5 without incident. The crewmembers used the Australian ladders when entering and exiting the cargo holds.

9. The atmosphere inside the cargo holds was tested before the crewmembers entered. It was retested every two hours until the work was finished as required by the Company's procedures.

Cleaning Cargo Hold No. 6

10. On 9 November 2020, 22,129 m^3 of ballast water was discharged from Cargo Hold No. 6 so that it could be cleaned the next day.[3]

11. At 0600[4] on 10 November 2020, the C/O conducted a daily work planning meeting with the Bosun and the deck ratings. The planned work for cleaning Cargo Holds Nos. 1 and 6, the Master's Enclosed Space Entry Permit conditions, the previously completed risk assessment, and the required PPE were reviewed.

12. Just after 0800, the C/O tested the atmosphere inside Cargo Holds Nos. 1 and 6 and determined it was safe for entry. The hatch covers for both cargo holds had been opened earlier that morning to ventilate them.

13. The crewmembers entered the cargo holds using the Australian ladders. Three ASDs were in Cargo Hold No. 1 and the Bosun and two OSs were in Cargo Hold No. 6. They cleaned the cargo holds until coffee break at 1000. It was reported that the Australian ladders were also used when the crewmembers exited the cargo holds. The hatch covers were left open during coffee break.

14. At about 1000, the C/O checked the atmosphere inside of Cargo Holds Nos. 1 and 6 as required by the Company's procedures and determined they remained safe for entry.

15. Just before 1030, the Bosun and deck ratings reentered Cargo Holds Nos. 1 and 6 and continued cleaning them without incident until stopping for lunch at 1200. The Australian ladders were used both to enter the two cargo holds after coffee break and to exit them before lunch. The hatch covers were left open during lunch.

16. At 1255, the Bosun told the C/O that he and the deck ratings would continue cleaning Cargo Holds Nos. 1 and 6. The Bosun and OSs then left the Accommodation and started walking forward. They were followed by the ASDs.

17. The atmosphere inside Cargo Holds Nos. 1 and 6 was not checked either at 1200 or before the crewmembers' planned reentry after lunch as required by the Company's procedures. Because the hatch covers had been left open during lunch, the Enclosed Space Entry Permit that had been issued in the morning remained valid.

18. It was reported that when the Bosun and two OSs reached the aft end of Cargo Hold No. 6, the OSs proceeded toward the access hatch for the Australian ladder and the Bosun continued walking forward. The Bosun did not tell either of the OSs why he was going forward.

19. The Bosun was not seen climbing on either the coaming or the hatch cover for Cargo Hold No. 6 after he and the OSs reached the cargo hold.

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3 Cargo Hold No. 6 could be completely flooded and Cargo Holds Nos. 2, 4, and 8 could be partially flooded to provide extra ballast capacity.

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

20. By 1305, the OS1 had climbed down the ladder that extended from the main deck to the platform at the top of the Australian ladder in Cargo Hold No. 6. As he prepared to start down the Australian ladder, he saw the Boson lying motionless on the tank top near the bottom of the vertical ladder *(see Figure 2)*.

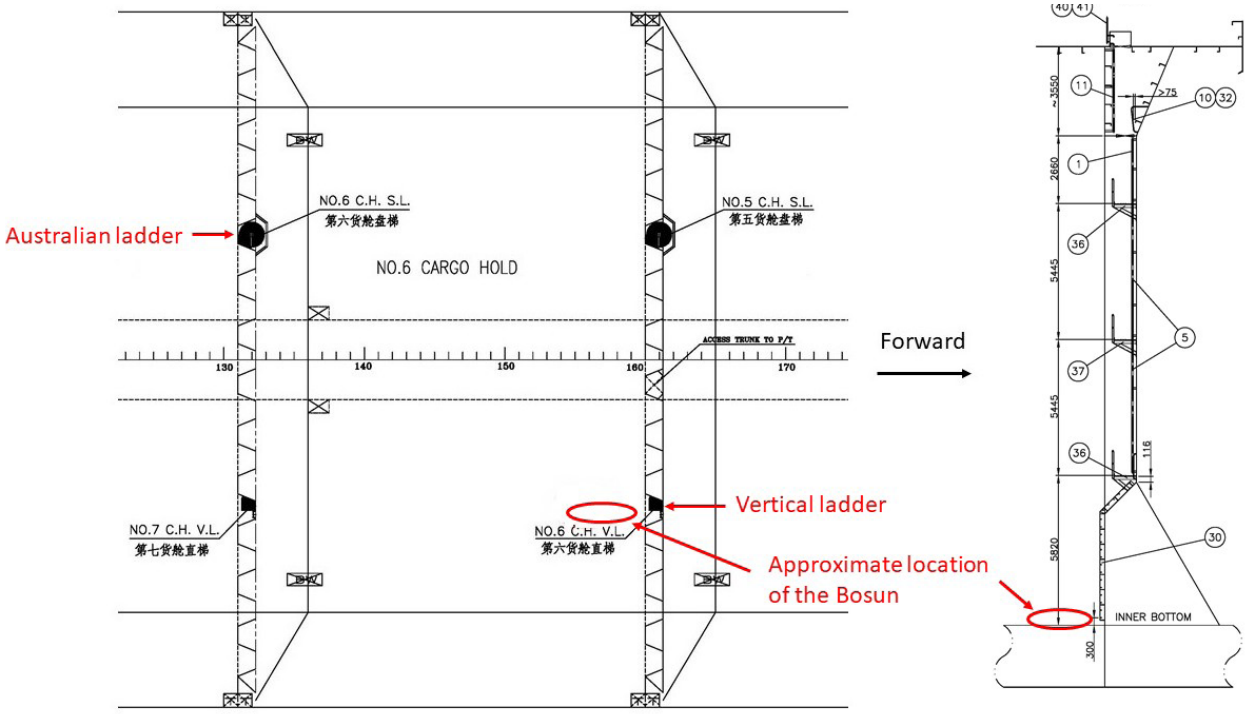

Figure 2: The approximate location where the Bosun was seen lying on the tank top in Cargo Hold No. 6 near the bottom of the vertical ladder (a sectional view is on the left and a profile view is on the right).

Cargo Hold No. 6 Vertical Ladder

21. The vertical ladder for Cargo Hold No. 6 is located on the starboard side at the forward end of the cargo hold *(see Figure 2)*. This ladder was accessed by climbing down a vertical ladder that extended from the main deck through the upper stool. From there, it is necessary to step through a 600 mm x 700 mm manhole in the upper stool's bottom plate onto the vertical ladder.

22. The vertical ladder had four sections that extended from the opening in the upper stool's bottom plate to the tank top. There were three intermediate platforms *(see Figure 3)*. The topmost ladder section was 2.3 m long, the two middle sections were 6.5 m long, and the bottom section was 6.1 m long. The intermediate platforms were each spaced less than 6 m apart vertically. The highest platform was less than 3 m below the upper stool and the lowest platform was less than 6 m above the tank top.[5]

5 The vertical spacing of the intermediate platforms was consistent with the requirements of IMO Resolution MSC.133(76), Adoption of Technical Provisions for Means of Access for Inspections. This resolution was adopted by the IMO to facilitate the implementation of SOLAS regulation II-1/3-6, which is applicable to bulk carriers of 20,000 GT and over constructed on or after 1 January 2006.

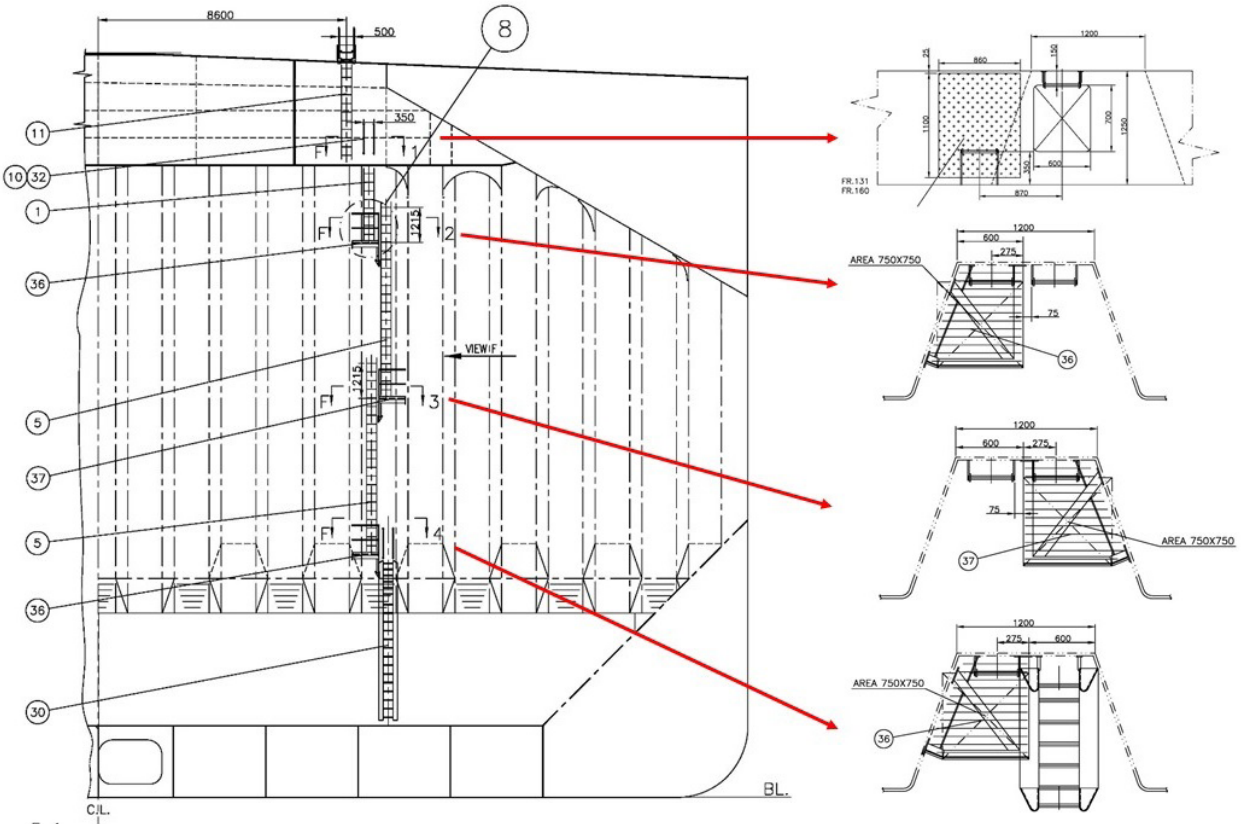

Figure 3: Drawing of the vertical ladder in Cargo Hold No. 6 (left) with plan view of the access from the upper stool and each of the three platforms (right). The side of the platform next to the ladder was open.

23. Two sides of each intermediate platform were welded to the forward bulkhead of the cargo hold. There was a guardrail on the side of the platform that faced the cargo hold. The side that faced the ladder was open so that it was possible to move between the ladder and the platform *(see Figure 3)*.

24. The sections of the vertical ladder were not fitted with positive fall protection devices. Such devices are not required by the applicable requirements in IMO Resolution MSC.133(76).

25. The configuration of the vertical ladders on HOUSTON is similar to the configuration on other bulk carriers.

26. On 30 October 2020, a Bureau Veritas surveyor attended the ship in Rotterdam, the Kingdom of the Netherlands, for a routine structural inspection of Cargo Hold No. 6 after the cargo in the hold was discharged. No observations or defects were identified.

Incident Response

27. After seeing the Bosun lying on the tank top, an OS immediately climbed up the Australian ladder to the main deck and shouted for help. He then reported the emergency to the OOW by radio.

28. The Master, who was making a round on the main deck, heard the call for help and immediately went to the access hatch for the Australian ladder for Cargo Hold No. 6. After being told that the Bosun was lying on the tank top, the Master and an ASD, who had been going to Cargo Hold No. 1, entered the hold using the Australian ladder.

29. The Master and the ASD examined the Bosun and determined he was unconscious, without a pulse, and not breathing. They did not observe any external bleeding. His safety helmet was still on his head.

30. The Master and the ASD started CPR at 1312. At the same time, the C/O directed a crewmember to take medical oxygen to Cargo Hold No. 6 while he prepared the rescue team.

31. A couple of minutes later, the C/E arrived on scene to assist the Master and the ASD.

32. The Bosun did not respond to CPR. At 1330, the Master determined the Bosun was deceased. He then called the Company and reported the incident to the DPA.

33. By 1400, the Bosun's body had been removed from Cargo Hold No. 6. When examined after his coveralls were removed, they observed bones sticking through the skin near the heels of both feet. No other bleeding or external injuries were noted. The Master reported that both of his legs appeared broken just above the ankles.

34. At 1415, the Master reported the incident to the Hellenic Red Cross. The doctor with whom he spoke indicated that the Bosun most likely died due to internal injuries.

35. At 1700, the Master directed the OOW to alter course to Praia Da Vitoria in the Azores, Portuguese Republic, where it was planned to disembark the Bosun's body.

36. On 12 November 2020, the Bosun's body was disembarked at Praia Da Vitoria. The death certificate issued by the local public health authorities did not state a cause of death.

Safety Harness

37. The safety harnesses worn by the Bosun and the deck ratings while cleaning the cargo holds had a single lifeline with clip *(see Figure 4)*. When inspected, the harness and lifeline were found in serviceable condition. The latch interlock was stiff when pressed.[6]

Figure 4: The safety harness worn by the Bosun when entering Cargo Hold No. 6 on 10 November 2020 (left) and the clip on the lifeline (right). The surface corrosion was in areas where the plating was missing.

6 The latch interlock must be pressed to allow the hook latch to open.

Ship's Crew

38. HOUSTON had 22 crewmembers on board, six more than required by the Minimum Safe Manning Certificate issued by the Administrator. All held the appropriate Republic of the Marshall Islands-issued seafarer documentation required for their position on board.

39. The experience of the Master, C/O, and Bosun when the incident occurred:

RANK	TIME ON BOARD HOUSTON	TIME IN RANK	TIME WITH COMPANY	TOTAL TIME AT SEA
Master	1 month	17 years	8.5 years	36 years
C/O	2.5 months	8.5 years	15 years	28 years
Bosun	2.5 months	18 years	15 years	26 years

40. Although the Master, C/O, and Bosun had been on board HOUSTON for short periods of time when this incident occurred, they were all very experienced seafarers. They were also all knowledgeable regarding bulk carrier operations and the Company's safe work procedures.

41. The Bosun completed the required familiarization training after signing on HOUSTON. This training included a review of the Company's safe work practices.

42. The Administrator found no indications that any crewmembers involved with this incident had not received the amount of rest mandated by the STCW Code, Section A-VIII/1, paragraphs 2 and 3 and MLC, 2006, Regulation 2.3.

Company SMS Procedures and Emergency Readiness

43. As required by the ISM Code, the Company's SMS provides procedures, as well as the required PPE, for shipboard operations and maintenance. These include general procedures for safe work and specific procedures for entering enclosed spaces and cargo holds.

44. The Company's enclosed space entry procedures required:

    (a) ventilation using either natural or mechanical ventilation before entry and for as long as persons are in the enclosed space;

    (b) the atmosphere be tested before entry, at least every two hours, and after breaks;

    (c) the completion of a risk assessment;

    (d) that an Enclosed Space Entry Permit be issued;

    (e) that a BA set with spare bottles and rescue equipment be ready for use at the entrance to the enclosed space; and

    (f) that a crewmember remain outside the enclosed space and monitor the persons working inside.

45. The Company had conducted a risk assessment to identify a list of enclosed spaces on board the ships in their fleet and the hazards associated with those spaces. The list that was developed included cargo holds. The identified hazards associated with cargo holds when open or empty were:

(a) structural deficiencies of the permanent means of access;

(b) unguarded openings, obstructions, and projections;

(c) inadequate illumination; and

(d) fatigue due to heat and humidity exposure.

46. The Company's general safe work procedures included a requirement that crewmembers not work alone. They also required that a crewmember remain on deck to monitor the work and to quickly summon assistance if needed when crewmembers were working in a cargo hold.

PART 3: ANALYSIS

The following Analysis is based on the above Findings of Fact.

The Bosun's Fall

Although the Bosun was not seen entering the access hatch for the vertical ladder, he was found lying on the tank top in Cargo Hold No. 6 near the base of the ladder *(see Figure 2)*. He had not been seen climbing on the hold coaming or hatch cover from the time he and the OSs reached Cargo Hold No. 6 until he was seen lying on the tank top inside the hold. This suggests he most likely fell either while climbing down the vertical ladder or while stepping from one of the platforms when transitioning between sections *(see Figure 3)*.

It is not known why the Bosun fell. There is no indication that the vertical ladder had been damaged after the 30 October 2020 survey of Cargo Hold No. 6. This indicates that the fall was not due to a structural defect. Possible explanations for why the Bosun fell include that one of his feet slipped and he was unable to hold onto the ladder. It is also possible that he lost his grip on the ladder while connecting or disconnecting the clip on the safety line to a strong point.

It is also not known from how high he fell. Given that both of his legs appeared broken near the ankles and that bones were protruding through the bottoms of both feet near the heel suggests he landed on his feet with significant force.

Use of PPE

The Bosun was wearing a safety harness with a lifeline when he fell. There were no indications that the safety harness, lifeline, or clip had failed. Based on this and the observed injuries, it can be determined that the clip on the safety line on his safety harness was not secured to a strong point when he fell.

As discussed below, the Bosun was an experienced seafarer and should have been aware of the risk of falling from a vertical ladder and the requirement to use a safety harness when on a vertical ladder and more than 2 m above the deck. However, because he was not seen on the vertical ladder while entering the cargo hold, it cannot be determined if he was making use of the safety harness and lifeline.[7]

7 Because the sections of vertical ladders were not fitted with positive fall protection devices, the only available strong points were either the side rail or the rungs of the ladders.

The safety harnesses worn by the Bosun and deck ratings had a single lifeline and clip. Although the interlock was stiff, it was possible to open the clip with one hand. Therefore, it would have been possible for the Bosun to maintain three points of contact when moving the clip between strong points. The fact that there was only one lifeline made it necessary to disconnect the clip when moving it from one strong point to another when climbing on a ladder. This would have increased the likelihood of falling since it would have been necessary to repeatedly disconnect and move the clip between strong points while climbing down the ladder.

A safety harness with two lifelines and clips would have reduced the potential risk of falling since one clip could always remain connected to a strong point while the other one was being connected to the next strong point.

The use of safety harnesses with either a single lifeline and clip or two lifelines and clips increase the time required to climb up or down a vertical ladder since the user would need to stop climbing each time it was necessary to connect to a different strong point. This might contribute to seafarers not always using this PPE when climbing on vertical ladders.

The use of safety harnesses connected to portable fall arresters would reduce the risk of falls by providing a means of continuous positive fall protection while not significantly slowing a seafarer climbing on a vertical ladder. This is because the use of fall arresters eliminates the need to frequently stop and connect to a different strong point while climbing a vertical ladder.

Safe Work Practices

The Company had procedures in place to ensure that crewmembers could safely enter cargo holds. These included their general procedures for safe work and specific procedures for enclosed space entry. The information that is available indicates that the Master, C/O, Bosun, and other crewmembers were familiar with these procedures and that they had generally been complied with both when planning for cargo hold cleaning and while the conducting the work. A significant exception was when the Bosun apparently used the vertical ladder to enter Cargo Hold No. 6 on the afternoon of 10 November 2020.

Before going out on deck and while walking forward, the Bosun did not inform the C/O nor the OSs that he planned to use the vertical ladder to re-enter the cargo hold. As a result, they were not aware of the Bosun's possible intentions and did not have an opportunity to question how he planned to enter the cargo hold, which was contrary to the hazard controls identified during the risk assessment and the ship's standard practice of using the Australian ladder to enter and exit the cargo holds. This lack of communication was inconsistent with the Company's requirement that crewmembers not work alone.

The Bosun participated in the completion of the risk assessment conducted on 6 November 2020 while preparing to clean the ship's cargo holds. He had also participated in the daily work planning meetings that were held on the mornings of 7–10 November 2020 before he and the deck ratings started work cleaning the holds. During each meeting, the 6 November 2020 risk assessment was reviewed.

As a very experienced seafarer with extensive experience on board bulk carriers, the Bosun should have been aware that crewmembers were supposed to use the Australian ladder to enter cargo holds. He also should have known of the risk of falling from cargo hold access ladders and that the vertical ladders were only to be used as an emergency exit.

The information available does not provide any indication why he apparently acted contrary to his knowledge and awareness by using the vertical ladder to enter the cargo hold.

It cannot be determined if the Bosun had been connecting the lifeline on his safety harness to a strong point as required while using the vertical ladder.

The atmosphere inside of Cargo Holds Nos. 1 and 6 was not checked at 1200 or after lunch, as required by the Company's enclosed space entry procedures.[8] Additionally, a crewmember did not remain on deck near the entrance to each cargo hold to monitor the crewmembers who were working in them as required by the Company's procedures.

PART 4: CONCLUSIONS

The following Conclusions are based on the above Findings of Fact 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) the Bosun's apparent decision to use the vertical ladder to enter Cargo Hold No. 6 rather than the Australian ladder, as required by the risk assessment that had been completed for cleaning the cargo holds, increased both the potential likelihood and consequences of a fall from height;
   (b) inadequate communications between the Bosun, C/O, and OSs; and
   (c) the lifeline on the Bosun's safety harness not being connected to a strongpoint when he fell due to either:
      (i) the use of less effective PPE because the safety harnesses on board the ship had a single lifeline and clip rather than either two lifelines with clips or a portable fall arrester; or
      (ii) the Bosun was not making use of the required PPE by not connecting the lifeline on his safety harness to a strong point while using the vertical ladder to enter the cargo hold.
2. Additional issues that were identified but that did not contribute to this very serious marine casualty include:
   (a) the atmosphere inside Cargo Holds Nos. 1 and 6 were not retested as required by the Company's enclosed space entry procedures; and
   (b) a crewmember was not posted at the entrance of each cargo hold to monitor the crewmembers working in the holds as required by the Company's enclosed space entry procedures.

8 As stated previously, the Enclosed Space Entry Permit that had been issued in the morning remained valid since the hatch covers had been left open during lunch.

PART 5: PREVENTIVE ACTIONS

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

1. The Master and C/O reviewed the incident with the ship's crew with a particular focus on the importance of thinking before acting, implementing safe work practices, and working together as a team when performing assigned tasks.
2. The Company made crewmembers on all ships in their fleet aware of the incident and the importance of basic seamanship and proper implementation of safe work practices.
3. The Company provided their investigation report to their training centers for use as a case study during pre-embarkation briefings for on-signing crewmembers and periodic seafarer refresher training.

PART 6: RECOMMENDATION

The following Recommendation is based on the above Conclusions and in consideration of the Preventive Actions taken.

1. It is recommended that the Company consider using safety harnesses with fall arrestors on board ships in their managed fleet.

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