



REPUBLIC OF THE MARSHALL ISLANDS

Maritime Administrator

SINGAPORE SPIRIT CASUALTY INVESTIGATION REPORT

Enclosed Space Fatality

Atlantic Ocean | 15 March 2020

Official Number: 5971

IMO Number: 9246308



DISCLAIMER

In accordance with national and international requirements, the Republic of the Marshall Islands Maritime Administrator (the “Administrator”) conducts marine safety investigations of marine casualties and incidents to promote the safety of life and property at sea and to promote the prevention of pollution. Marine safety investigations conducted by the Administrator do not seek to apportion blame or determine liability. While every effort has been made to ensure the accuracy of the information contained in this Report, the Administrator and its representatives, agents, employees, or affiliates accept no liability for any findings or determinations contained herein, or for any error or omission, alleged to be contained herein.

Extracts may be published without specific permission providing that the source is duly acknowledged; otherwise, please obtain permission from the Administrator prior to reproduction of the Report.

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

TABLE OF CONTENTS

| | |
|-----------------------------------|-----------|
| PART 1: EXECUTIVE SUMMARY | 6 |
| PART 2: FINDINGS OF FACT | 7 |
| PART 3: ANALYSIS | 13 |
| PART 4: CONCLUSIONS | 16 |
| PART 5: PREVENTIVE ACTIONS | 16 |
| PART 6: RECOMMENDATIONS | 17 |



PART 1: EXECUTIVE SUMMARY

On 15 March 2020, the Republic of the Marshall Islands-registered multipurpose dry cargo SINGAPORE SPIRIT, managed by Asia Maritime Pacific (Shanghai) Limited (the “Company”), was underway from Ilhéus, Federative Republic of Brazil to Las Palmas, Canary Islands fully loaded with a cargo of logs. The work planned for that day was the inspection and periodic maintenance of the No. 4 port water ballast tank (WBT) control valve located inside a void space accessible from the trunking for Cargo Hold No. 5 port side ladder. In preparation for the planned work, the Chief Officer (C/O) directed opening the access hatch to the ladder.

The port side ladder of Cargo Hold No. 5 is comprised of two sections of vertical ladder which are connected by an inclined ladder and two intermediate platforms. The top 2.5 meters (m) of the upper vertical ladder is contained within a 750 millimeter (mm) x 600 mm trunk. This trunk is fitted with an access hatch on the upper deck and has a 685 mm x 600 mm opening into the cargo hold on the lower end. No closure or covering is provided for the opening in the bottom of the trunk. The void space that contains the No. 4 port WBT is 1.6 m below the top of the ladder trunking.

Later that day, the Bosun tasked the Able Seafarer Deck (ASD) 1 to place wood pieces near the cargo hold ladder entrance. The wood was necessary to construct a working platform below the void space manhole. The ASD2 was tasked with notifying the ASD1 it was the end of the workday. He went to Cargo Hold No. 5 and found the ASD1 lying on the first platform within the cargo hold, along with several wood pieces. The ASD1 had been working alone at the time.

The ASD2 immediately climbed into the trunk, without wearing a self-contained breathing apparatus (SCBA), to rescue the ASD1 who was found not breathing and had no pulse. However, the ASD2 was unable to carry him up the ladder.

The ASD2 then exited the trunk and notified the Officer on Watch (OOW), who raised the alarm. Available crewmembers mustered at the entrance to the cargo hold access ladder with the equipment needed to carry out an enclosed space rescue. The Bosun, wearing an SCBA, climbed down to the ASD1 and fitted a safety harness on him. After a line was attached, other crewmembers hoisted the ASD1 to the deck. Once on deck, the crewmembers immediately started cardiopulmonary resuscitation (CPR). However, the Master subsequently pronounced the ASD1 deceased.

The marine safety investigation conducted by the Republic of the Marshall Islands Maritime Administrator (the “Administrator”) identified the below factors.

1. Causal factors which may have contributed to this very serious marine casualty include:
 - (a) the ASD1 falling from the cargo hold access ladder in the trunk during an unauthorized entry presumably due to:
 - i. the likely oxygen depletion within the ladder trunking;
 - ii. an attempt to descend the ladder while carrying wood pieces; or
 - iii. an attempt to construct a working platform below the void space;
 - (b) non-compliance with the enclosed space entry procedures by failing to:
 - i. conduct a risk assessment before beginning work;
 - ii. adequately ventilate the space by mechanical means; and
 - iii. provide warning that the open Cargo Hold access hatch was not safe to enter when left unattended;
 - (c) the location of the void space manhole inside the Cargo Hold access ladder trunk, that required constructing a working platform to access it;
 - (d) ineffective communication during task assignments; and
 - (e) inadequate supervision of work by senior crewmembers.
2. An additional identified issue, which did not contribute to this incident, was the improper initial enclosed space rescue attempt where the necessary precautions were not taken.

PART 2: FINDINGS OF FACT

The following Findings of Fact are based on the information obtained during the Administrator's marine safety investigation. Due to travel restrictions imposed in response to the Coronavirus Disease 2019 (COVID-19) pandemic, the Administrator was not able to attend on board as part of its investigation of this very serious marine casualty. All related information available to the Administrator was obtained remotely.

1. Ship particulars: *see chart to right.*
2. On 14 March 2020, SINGAPORE SPIRIT departed Ilhéus, Federative Republic of Brazil after loading 22,948 metric

| SHIP PARTICULARS | | |
|--------------------------------------|--|------------------|
| Ship Name | SINGAPORE SPIRIT | |
| Registered Owner | Spirit Shipping Inc. | |
| ISM Ship Management | Asia Maritime Pacific (Shanghai) Limited | |
| Flag State | Republic of the Marshall Islands | |
| IMO No. | Official No. | Call Sign |
| 9246308 | 5971 | V7IO7 |
| Year of Build | Gross Tonnage | |
| 2002 | 19,882 | |
| Net Tonnage | Deadweight Tonnage | |
| 10,780 | 32,259 | |
| Length x Breadth x Depth | | |
| 164.3 x 27 x 14.8 meters | | |
| Ship Type | | |
| Multipurpose Dry Cargo | | |
| Document of Compliance | | |
| Recognized Organization | | |
| Nippon Kaiji Kyokai | | |
| Safety Management Certificate | | |
| Recognized Organization | | |
| Nippon Kaiji Kyokai | | |
| Classification Society | | |
| Nippon Kaiji Kyokai | | |
| Persons on Board | | |
| 21 | | |

tons (mt) of logs on deck and in all five cargo holds. The ship was proceeding towards Las Palmas, Canary Islands.

- On 15 March 2020, the routine inspection of the No. 4 port WBT control valve was planned.

No. 4 Port WBT Control Valve

- The No. 4 port WBT control valve is located in a void space inside Cargo Hold No. 5. This void is accessible through a manhole 1.6 m below the top of the access hatch of the Cargo Hold No. 5 port side ladder.
- The Cargo Hold No. 5 port side ladder consists of two sections of vertical ladder which are connected by two intermediate platforms and an inclined ladder (*see Figure 1*).

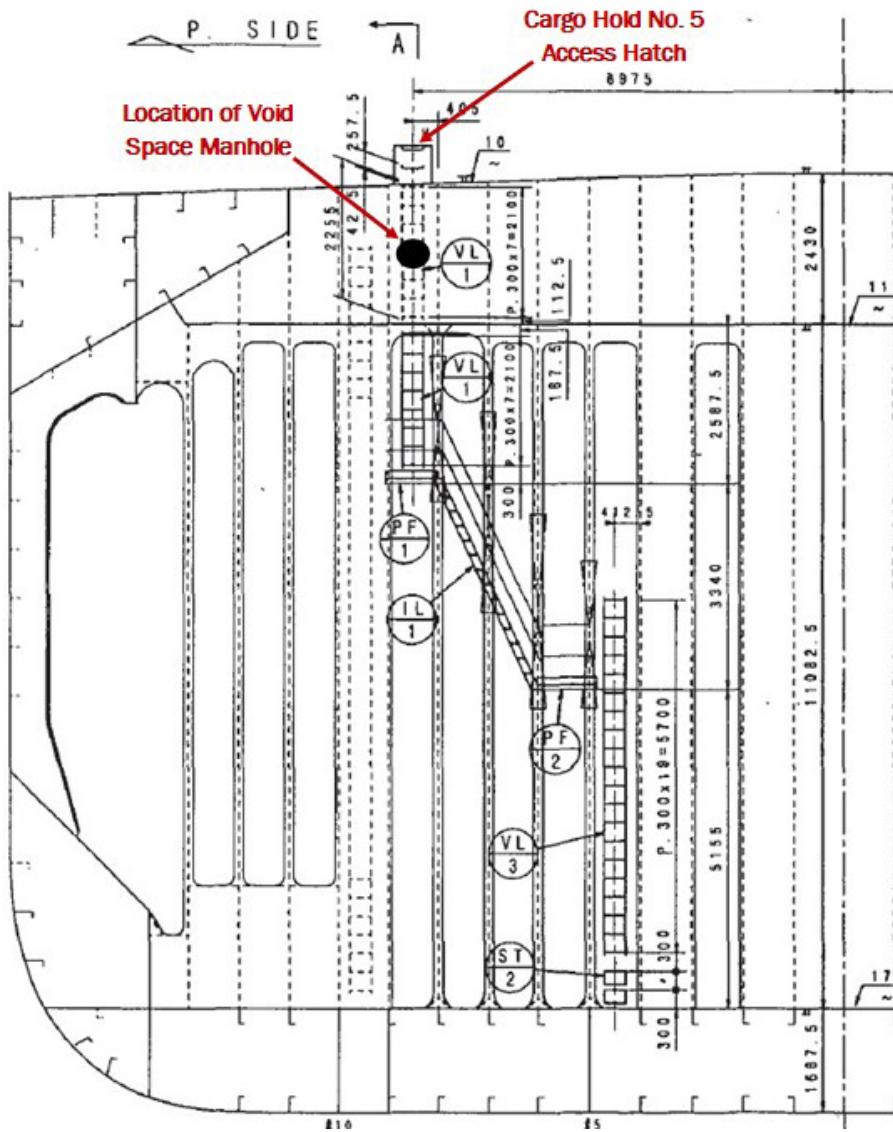


Figure 1: Location of Cargo Hold No. 5 access hatch and void space access.

6. The top 2.25 m of the upper most vertical ladder is contained within a 750 mm x 600 mm trunk. The top of this trunk is covered by the access hatch, while the lower end has a 685 mm x 600 mm opening into the cargo hold. No cover or grating is provided for this opening. The remaining sections of ladder and both intermediate platforms are open to the cargo hold (*see Figure 2*).

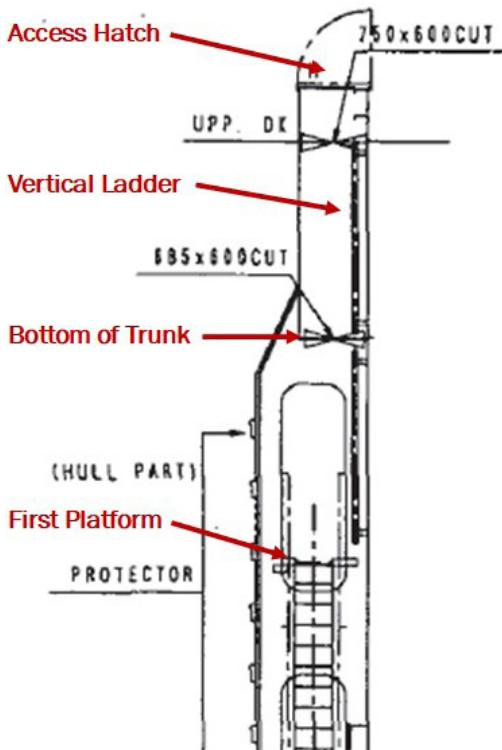


Figure 2: Profile view of the Cargo Hold No. 5 port side ladder from the upper deck to the first platform.

7. No permanent platform is provided below the void space manhole. The lower opening of the ladder trunk is smaller than the trunk, creating a ledge around the opening.

Incident

8. At about 1330¹ on 15 March 2020, the C/O ordered the deck crewmembers to open the access hatch for Cargo Hold No. 5 port side ladder. The C/O later stated that the hatch was opened before the planned work to allow for natural ventilation of the ladder trunk. No mechanical ventilation was provided.
9. Around 1720, the Bosun told the ASD1 to place wood pieces near the access hatch to prepare for inspecting the ballast control valve. The wood was needed to construct a working platform on the ledge around the lower opening of the trunk, about 0.7 m below the void space manhole.
10. At about 1725, the Bosun directed the ASD2 to tell the ASD1 that work for the day was completed. The ASD2 then went to Cargo Hold No. 5 to find the ASD1. At the time, the C/O was on the Bridge and the Bosun was standing on top of the logs on Cargo Hold No. 5 hatch cover.

¹ Unless otherwise specified, all times are ship's local time (UTC -3).

11. At about 1727, the ASD2 saw the ASD1 lying on the first platform of the cargo hold ladder, about 4.6 m below the access hatch (*see Figure 3*). He also saw that several pieces of wood were lying near the ASD1 on the first platform.

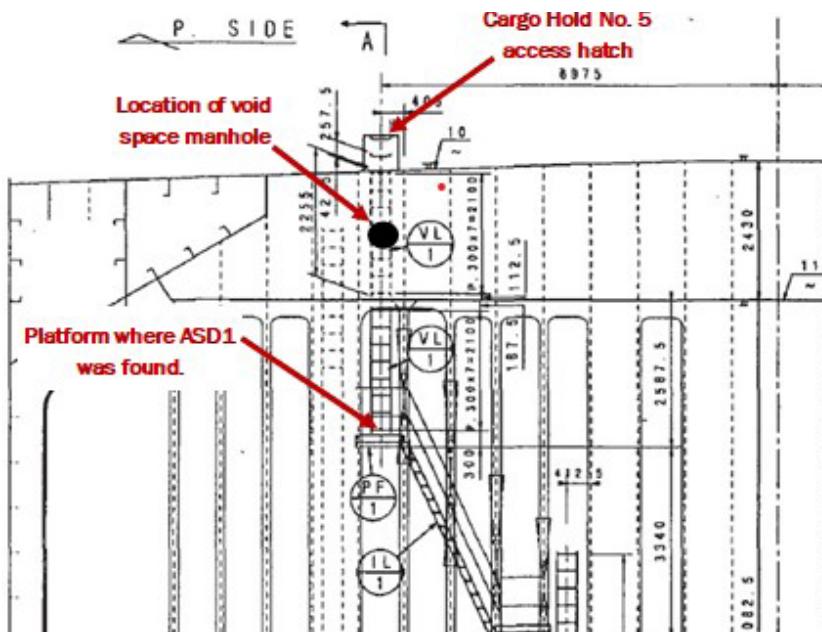


Figure 3: Location where the ASD1 was found.

12. The ASD2 climbed down to check the ASD1's condition. He was unresponsive, not breathing, and had no pulse. The ASD2 then tried to carry the ASD1 out of the cargo hold but was unable to carry him.
13. The ASD2 exited and notified the Third Officer (3/O), who was the OOW. The 3/O immediately activated the ship's alarm and made an announcement over the public address (PA) system.
14. All available crewmembers proceeded to the access hatch, bringing the equipment necessary to carry out an enclosed space rescue.
15. The Bosun donned an SCBA and entered the access hatch. He climbed down to the ASD1 and fitted a safety harness with rescue line to him. While crewmembers on deck hauled on the rescue line, the Bosun guided the ASD1 up the ladder. The crewmembers immediately began CPR when the ASD1 reached the upper deck.
16. At 2033 on 15 March 2020, lifesaving efforts were stopped, and the Master determined that the ASD1 was deceased.
17. The cause of the ASD1's death is not known as a postmortem examination has not been conducted due to the worldwide COVID-19 pandemic. Based on the information available to the Administrator, it is likely that the ASD1 was incapacitated due to a lack of oxygen within the ladder trunk.

International Maritime Organization (IMO) Instruments

18. The International Maritime Solid Bulk Cargoes Code (IMSBC Code) Individual Schedule of Solid Bulk Cargoes for “Wood Products - General”²² indicates that timber cargoes are liable to cause oxygen depletion in cargo holds and adjacent spaces.
19. The IMSBC Code also requires that the atmosphere of cargo holds, and adjacent enclosed spaces be tested to ensure the oxygen level is 21% before entering. The IMSBC Code incorporates by reference IMO Resolution A.1050(27) “Revised recommendations for entering enclosed spaces aboard ships.”
20. IMO Resolution A.1050(27) “Revised recommendations for entering enclosed spaces aboard ships,” Section 10.5 lists timber as a cargo which can cause oxygen depletion.
21. The Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 2011 (2011 TDC Code) Annex A, Section 4.17 states “prior to entering any enclosed hold that contains timber the atmosphere should be checked to make sure that the hold atmosphere has not been oxygen depleted by the timber.”

Safety Management System (SMS)

22. As required by the IMO’s International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management (ISM) Code), the Company’s SMS provided procedures for shipboard tasks that included requirements for the use of personal protective equipment (PPE), conducting pre-task hazard assessments, pre-task briefings (also known as “Toolbox Talks”), and issuing permits to work when conducting various shipboard tasks, including enclosed space entry.
23. The enclosed space entry procedures in the Company’s SMS designated cargo holds and adjacent spaces, such as cargo hold access trunkings, as enclosed spaces. The SMS also stated that timber cargoes have the potential to deplete oxygen within a space due to decomposition of the organic material. The enclosed space procedures also required that “suitable signs and barriers” be placed near each open access to an enclosed space.
24. The enclosed space entry procedures required issuing a permit to work and completing an enclosed space entry checklist before entering an enclosed space. Among other items, the checklist required:
 - (a) that an enclosed space be thoroughly ventilated mechanically;
 - (b) atmospheric testing be completed prior to entry and periodically while working inside;
 - (c) rescue and resuscitation equipment be made ready and an attendant be present at the entrance to the space; and
 - (d) all involved personnel participate in a Toolbox Talk.
25. Before the ASD1 entered the access hatch, no permit to work had been issued and no enclosed space entry checklist had been completed. Additionally, a Toolbox Talk had not been conducted with the crewmembers involved in the work.

²² This applies to “wood products transported in bulk, i.e. loaded and discharged by such means as elevator or grab and which are not specifically referred to in a separate schedule,” including logs and timber.

26. While planning work, the Company's SMS required completing risk assessments and putting in place adequate safeguards to mitigate identified risks before starting.
27. A risk assessment was not completed while planning for the ballast control valve inspection or before opening the Cargo Hold No. 5 access hatch, which is designated as an enclosed space by the Company's SMS.
28. The SMS also required all crewmembers to complete initial familiarization training on joining the ship. This training includes familiarization with the Company's safe work practices, risk assessments, and emergency response procedures. Records indicated that all crewmembers involved in this incident completed the required initial familiarization training on joining SINGAPORE SPIRIT.

Enclosed Space Entry and Rescue Drill

29. The last enclosed space entry and rescue drill was on 1 February 2020. The drill simulated rescuing a crewmember from Cargo Hold No. 5. An enclosed space entry checklist was completed and a permit to work was issued as part of this drill. The permit listed the C/O as the responsible person, the Bosun as the attendant, and the ASD1 and ASD2 as the persons entering the space. The drill was overseen by the Master, C/O, and Chief Engineer. Following completion, the Bosun, the ASD1, and the ASD2 signed as having participated in the drill.

Portable Gas Detection Device

30. SINGAPORE SPIRIT had a Gas Measurements Instruments Ltd (GMI) PS241 portable gas detector available on board. The unit could measure oxygen, hydrogen sulfide, carbon monoxide, and combustible gasses. This unit had an internal pump which allowed for remote sampling when a hose was fitted to it.
31. This portable gas detector was last calibrated on 3 December 2019. The calibration certificate issued by the service company stated that the unit was in good condition and that all calibration parameters were passed.
32. Records provided by the Company to the Administrator indicated that the atmosphere of the Cargo Hold No. 5 access ladder trunk was tested every five minutes, from 1600 to 1730 on 15 March 2020. The atmosphere was recorded as 20.9% oxygen with no flammable gasses, carbon monoxide, or hydrogen sulfide detected. It was not recorded where inside the ladder trunk, or how the atmospheric testing, was conducted.

SINGAPORE SPIRIT Crew

33. SINGAPORE SPIRIT had a complement of 21 crewmembers, more than what was required by the Minimum Safe Manning Certificate issued by the Administrator.
34. All involved crewmembers held the appropriate Republic of the Marshall Islands-issued seafarer documentation for their positions.
35. The Administrator did not find any indications that the crewmembers involved with this incident had failed to receive the amount of rest mandated by the IMO's Seafarers Training, Certification and Watchkeeping (STCW) Code, Section A-VIII/1, paragraphs 2 and 3, and the International Labour Organization's Maritime Labour Convention, 2006 (MLC, 2006), Regulation 2.3.

Crew Experience

| RANK | TIME ON BOARD SINGAPORE SPIRIT | TIME IN RANK | TIME WITH COMPANY | TOTAL TIME AT SEA |
|--------|-----------------------------------|--------------------|----------------------|----------------------|
| Master | 5 months, 25 days | 8 years | 6 years | 26 years |
| C/O | 9 months, 12 days | 5 years, 2 months | 9 months, 12 days | 13 years, 9 months |
| 3/O | 9 months, 12 days | 5 years, 5 months | 3 years, 10 months | 3 years, 10 months |
| Bosun | 3 months, 3 days | 5 years, 10 months | 3 years, 1 month | 12 years |
| ASD1 | 9 months, 12 days | 1 year, 6 months | 3 years | 4 years |
| ASD2 | 3 months, 3 days | 13 years | 3 months, 3 days | 15 years |

PART 3: ANALYSIS

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

ASD1's Cause of Death

The cause of death of the ASD1 is not known. At the time of this report's publication, the ASD1's postmortem examination had not been conducted by Brazilian authorities due to the COVID-19 pandemic. However, it is likely that the ASD1 was rendered unconscious due to a lack of oxygen in the Cargo Hold No. 5 access ladder trunk. The impact of carbon monoxide on the ASD1 is not known due to the lack of a postmortem examination.

Entry into Cargo Hold No. 5

The ASD1 was working alone after being tasked by the Bosun to collect and stage wood pieces near the Cargo Hold No. 5 access hatch. It is presumed that he entered the access hatch while carrying wood since he was found unconscious on the first platform inside the cargo hold, along with several pieces of wood. What happened immediately before and after his presumed entry is not known since there were no witnesses.

It is most likely that the ASD1 was overcome by a hazardous atmosphere while inside the ladder trunk, causing him to fall to the first platform. It is also possible that the ASD1 fell while attempting to climb down the ladder while holding wood pieces or while constructing a working platform in front of the void space.

Working Platform

To carry out the maintenance on the ballast valve, a working platform needed to be constructed below the void space opening. This necessitated positioning wood pieces over the lower opening of the ladder trunk while suspended from the vertical ladder. It is possible that the ASD1 fell while attempting to construct this platform without any assistance.

Enclosed Space Entry

The No. 4 port WBT control valve is in a void space accessible from inside Cargo Hold No. 5 port side ladder trunking. The Company's SMS classified this void as an enclosed space, as well as the cargo hold and access trunking. Before entering either space, the SMS required completing an enclosed space entry checklist and issuing a permit to work. The enclosed space procedures also required that:

- (a) atmospheric testing be completed prior to entry and periodically while working inside;
- (b) rescue and resuscitation equipment be made ready;
- (c) an attendant be present at the entrance to the space; and
- (d) all involved personnel participate in a Toolbox Talk.

The access hatch was opened before the planned entry to provide natural ventilation. However, the mechanical ventilation required by the Company's SMS was not provided. Natural ventilation of the hold and access way would likely not be effective due to the large size of the space, the small ventilation opening, and configuration of the spaces.

Additionally, a Toolbox Talk was not conducted with the crewmembers assigned to the task and a risk assessment was not completed before opening the access hatch.

The SMS also required that a warning sign and/or other barrier be placed at every open entrance to an enclosed space to prevent inadvertent or unauthorized entry. No warnings or barriers were placed near the access hatch once it was opened and left unattended.

Cargo Hold No. 5 Atmosphere

At the time of the incident, all cargo holds were loaded with timber. According to the IMSBC Code, timber cargoes have a propensity to deplete oxygen in cargo holds and adjacent spaces. The uppermost section of the Cargo Hold No. 5 access ladder is in an enclosed trunk which is open to the cargo hold at the bottom. This is considered an adjacent space and would be susceptible to oxygen depletion while timber was stowed in the hold. It is for this reason that the IMSBC Code requires that the atmosphere of holds and adjacent enclosed spaces be checked to ensure adequate oxygen levels before entering.

The C/O reported that the cargo hold atmosphere was checked with a portable gas detector after opening the access hatch. The C/O recorded that the check found 20.9% oxygen in the cargo hold. The record indicates that no carbon monoxide, hydrogen sulfide, or flammable gasses were detected. It is possible that isolated pockets of oxygen deficient air may have existed within the cargo hold and/or access trunking since only natural ventilation had been provided prior to the ASD1 entering, which may not have been identified when using the portable gas detector.

Enclosed Space Rescue Attempt

At the end of the workday, the Bosun directed the ASD2 to find the ASD1 and tell him to stop working for the day. He found the ASD1 lying on the first platform inside the Cargo Hold. He immediately entered the

access hatch and climbed down to the ASD1 to try rescuing him. The ASD2 was unable to carry him up the ladder himself, so he climbed out and notified the OOW. Although the ASD2 was able to exit the space, his impulsive and immediate entry into an enclosed space without taking any precautions could have resulted in his injury or death. Also, this improper rescue attempt delayed the notification of the incident to the OOW and delayed the overall rescue.

Enclosed Space Entry and Rescue Training

The C/O, Bosun, ASD1, and ASD2 all participated in an enclosed space entry and rescue drill on 1 February 2020. This drill simulated the rescue of a crewmember from Cargo Hold No. 5. As part of the drill, the enclosed space entry checklist was completed and a permit to work issued. The C/O, Bosun, ASD1, and ASD2 were all involved in completing the checklist and entry into Cargo Hold No. 5 as part of the drill.

This training held less than two months prior to this incident involved the exact same scenario as this incident, and all crewmembers involved in this incident had participated. Additionally, the ASD2 had participated in the enclosed space rescue drill as a rescuer. However, when faced with an actual incident, he immediately entered the enclosed space without taking any precautions. These are indications that the onboard enclosed space entry and rescue training were not effective.

Supervision

The C/O was overseeing the preparation for entry into an enclosed space, which was required to access the No. 4 port WBT control valve. On the morning of 15 March 2020, he directed that the access hatch to the Cargo Hold No. 5 ladder be opened for ventilation of the space. He did not remain on deck to supervise the preparation for entry into the enclosed space. At the time of the incident, he was on the Bridge.

While preparing for the planned work, the Bosun tasked the ASD1 with placing wood near the access hatch for the Cargo Hold No. 5 port side ladder. The Bosun was reported to be standing on top of the logs stowed on the Cargo Hold No. 5 hatch cover at the time. The ASD1, the least experienced member of the deck crew, proceeded to gather wood by himself. Unknown to any other crewmember, he then presumably entered the cargo hold access ladder.

The failure to properly supervise the preparation for entry into an enclosed space may have contributed to the ASD1's entry without taking any precautions.

Communication

While preparing for the planned inspection and maintenance of the No. 4 port WBT control valve, the Bosun directed the ASD1 to gather some wood and place it near the access hatch. Following the incident, the Bosun stated he intended to have the ASD1 place the wood on the deck near the access hatch. He did not specifically tell the ASD1 not to enter the access hatch. The communication between them was likely not effective since the ASD1 presumably entered the cargo hold access hatch carrying the wood. It is possible that the Bosun's message was not clear or that the ASD1 misunderstood the Bosun's instructions.

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 which may have contributed to this marine casualty include:
 - (a) the ASD1 falling from the cargo hold access ladder in the trunk during an unauthorized entry presumably due to:
 - i. the likely oxygen depletion within the ladder trunking;
 - ii. an attempt to descend the ladder while carrying wood pieces; or
 - iii. an attempt to construct a working platform below the void space;
 - (b) non-compliance with the enclosed space entry procedures by failing to:
 - i. conduct a risk assessment before beginning work;
 - ii. adequately ventilate the space by mechanical means; and
 - iii. provide warning that the open Cargo Hold access hatch was not safe to enter when left unattended;
 - (c) the location of the void space manhole inside the Cargo Hold access ladder trunk, that required constructing a working platform to access it;
 - (d) ineffective communication during task assignments; and
 - (e) inadequate supervision of work by senior crewmembers.
2. An additional identified issue, which did not contribute to this incident, was the improper initial enclosed space rescue attempt where the necessary precautions were not taken.

PART 5: PREVENTIVE ACTIONS

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

1. SINGAPORE SPIRIT crewmembers were retrained on the Company's enclosed space entry and permit to work procedures.
2. Senior crewmembers were retrained on conducting initial onboard familiarization training for new crewmembers.
3. The lessons learned from this incident were circulated to all ships in the Company's managed fleet to raise awareness.

PART 6: RECOMMENDATIONS

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

It is recommended that the Company:

1. review and update, as necessary, its enclosed space rescue training procedures to ensure that the dangers of immediate rescue attempts without taking the necessary precautions are reviewed during each enclosed space entry and rescue drill;
2. review and update, as necessary, its procedures related to training of crewmembers on the specific hazards posed by cargoes carried on board prior to loading; and
3. conduct a review of other ships in their managed fleet for similar void space accesses and consider implementing safe working procedures which reduce the risk of a fall from height during construction of a working platform.

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