

FINAL REPORT

FATAL INJURY ON BOARD GENERAL CARGO SHIP HAN ZHI AT THE PORT OF SOHAR ON 21 OCTOBER 2017

MIB/MAI/CAS.027

**Transport Safety Investigation Bureau
Ministry of Transport
Singapore**

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The Transport Safety Investigation Bureau of Singapore

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SYNOPSIS

On 21 October 2017, at about 0800H, the Singapore registered general cargo ship, Han Zhi, completed its cargo discharging operations for the tween deck, at the port of Sohar, Oman.

While shifting the tween deck pontoons to discharge cargo from the lower deck, the Bosun, being one of the team members assigned to unhook the lifting wires from the pontoons, entered the cargo hold from the access space and attempted to climb onto the moving pontoon. In doing so, the Bosun lost his footing, and was crushed between the edge of the pontoon and the aft bulkhead of the cargo hold, receiving injuries which were fatal.

The TSIB classified the occurrence as a Very Serious Marine Casualty and launched a marine safety investigation.

The investigation revealed that the lack of team work, coordination and communication among the crew had resulted in the Bosun entering the cargo hold while the pontoon was being moved.

The design of the cargo hold and related openings of the access space were likely not taken into consideration when planning for the pontoon shifting.

The investigation also revealed that the company's SMS procedures, such as prohibiting from standing on a moving pontoon, conduct of risk assessment and ensuring supervision of cargo related operations, were not effectively implemented on board the ship.

The company's SMS did not have verification method / screening process to scrutinise joining seafarers' medical examination reports and take appropriate actions, such as alerting the ship's Master accordingly for ensuring the safety of the person and the ship.

DETAILS OF THE SHIP

Name	Han Zhi
IMO number	9125877
Flag	Singapore
Classification society	Nippon Kaiji Kyokai (ClassNK)
Ship type	General cargo ship (multi-purpose carrier)
Hull	Steel
Delivery	1 March 1996
Owners	Han Zhi Heavylift Shipping Pte. Ltd.
Operators / ISM ¹ Managers	Han Ship Management Pte Ltd.
Gross tonnage	5799.00
Length overall	107.43m
Moulded breadth	19.00m
Moulded depth	10.60m
Summer draft	8.31m
Cargo onboard	Box packaged and project cargo ² , about 1591 metric tonnes



Han Zhi
(Photo source: Shipspotting.com)

¹ International management code for the safe operation of ships and for pollution prevention.

² Large, heavy, high value cargo or a critical pieces of equipment are carried on commercial ships, it is also commonly referred to as heavy lift.

1 FACTUAL INFORMATION

All times used in this report are Oman local time, four hours ahead of UTC (UTC + 4H), unless otherwise stated.

1.1 Sequence of events

- 1.1.1 On 18 October 2017, at about 2330H, Han Zhi berthed at no.5 berth, port of Sohar in Oman.
- 1.1.2 On 19 October 2017, at about 0115H, after clearing arrival port formalities, cargo discharging operation commenced using the ship's crane.
- 1.1.3 At about 0600H, the Chief Officer³ and the Third Officer⁴ were supervising the cargo discharging operation at the tween deck of the ship's cargo hold.
- 1.1.4 At about 0705H, the cargo above the tween deck had been discharged. The Bosun and an Ordinary Seaman (OS)⁵ were called on deck for shifting the pontoons to facilitate discharging cargoes below the tween deck. About 20 minutes later, the 8-12⁶ Able Seafarer Deck (ASD1) was also called on deck to assist the pontoon shifting operation. At about this time, the Third Officer relieved the 4-8 ASD⁷ (ASD2) from the gangway watch duty⁸ and assigned him to assist in the shifting of pontoons.
- 1.1.5 At about 0725H, when all the crew arrived at the tween deck, the Chief Officer who was supervising the shifting of the pontoons, briefed them on the shifting plan, i.e. no.6 and no.7 pontoons were to be shifted and stacked⁹ as second tier onto no.10, 11 and 12 pontoons which were located at aft of the cargo hold. No.8 pontoon was to be placed as third tier on top of no.7 pontoon (see **Figure 1**).

³ The head of deck department according to the company's safety management procedures. He was also the designated shipboard Safety Officer and in charge of cargo work. He kept 0400H-0800H & 1600H-2000H watch at sea and was being a day worker in port.

⁴ The Third Officer was the officer of the watch. He kept 0800H-1200H & 2000H-2400H watch at sea, and 0600H-1200H & 1800H-2400H watch in port.

⁵ Both the Bosun and OS were dayworkers in port with working hours from 0800H to 1700H.

⁶ Keeping watches for the periods of 0800H-1200H and 2000H-2359H at sea and in port.

⁷ Keeping watches for the periods of 0400H-0800H and 1600H-2000H at sea and in port.

⁸ Ensuring safe access at the ship's gangway and to control access in accordance with the Ship's Security Plan.

⁹ No.11 and no.12 pontoons were half the size of no.10. No.6 was to be stacked onto no.10 pontoon and no.7 was to be on top of no.11 and no.12 pontoons.

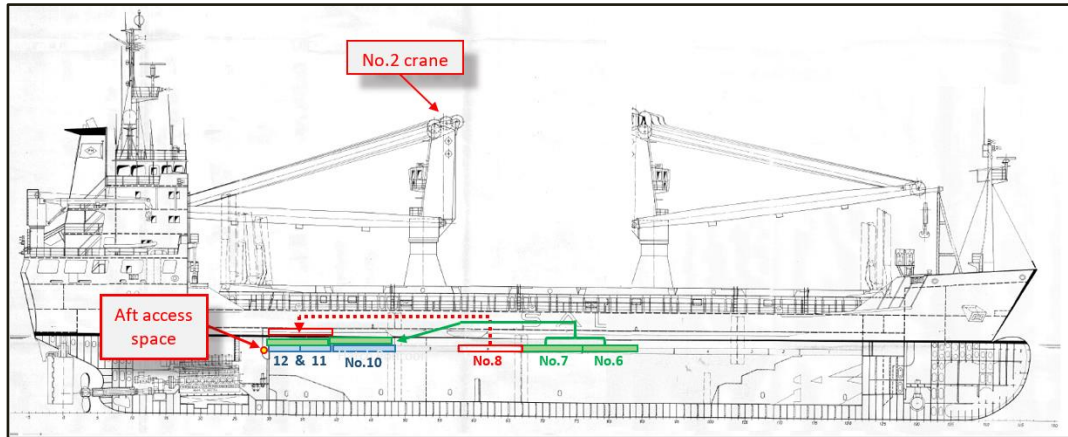


Figure 1 - Relevant pontoons' locations and shifting plan. Arrows indicate movement of pontoons planned for stacking
(Source: ISM Manager)

- 1.1.6 The Chief Officer split the crew into three teams for performing different tasks. The first team comprised the OS and himself, and were to hook up four lifting wire slings onto the pontoon to be shifted. The Bosun and ASD2 formed the second team and assigned to unhook the wire slings from the pontoon, once it was stacked at the planned position. ASD1 was assigned to operate the ship's cargo crane (no.2). All personnel carried portable radios (walkie-talkie) for communication.
- 1.1.7 At about 0735H, after the fork lifts used for moving cargo were removed from the tween deck and the shore stevedores left the ship, the pontoon shifting operation commenced.
- 1.1.8 About 15 minutes later, no.6 and no.7 pontoons were shifted and stacked at the planned positions. The ASD2 and Bosun moved into the aft access space and re-entered the cargo hold to unhook the lifting wire slings for no.7 pontoon.
- 1.1.9 At about 0755H, after no.8 pontoon had been lifted, the Chief Officer and the OS started preparations to remove the lashing of the box cargoes (see **Figure 2**) below the tween deck. ASD1 slowly swung the crane jib with no.8 pontoon towards the aft bulkhead where it was to be stowed. At this time, the Bosun and ASD2 were in the aft access space¹⁰, getting ready to unhook the lifting wire slings from no.8 pontoon.

¹⁰ To enter/exit the cargo hold from these access spaces. There were four different locations, two of these were located at the forward end while another two were at the aft part of the cargo hold.

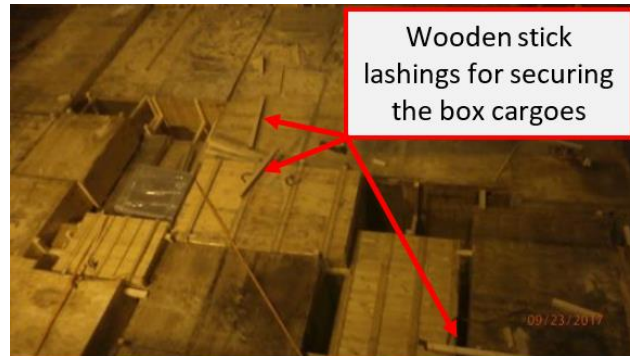


Figure 2 - View of wooden stick lashings
(Photo source: the ISM Manager)

- 1.1.10 When no.8 pontoon was about 4m away from the aft bulkhead and being gently moved into position, ASD2 informed ASD1 (crane operator) via the portable radio to stop the movement of the pontoon so that he could climb out of the aft access space, walk over no.7 pontoon and climb onto no.8 pontoon. Once the momentum of no.8 pontoon had stopped (by this time the pontoon was about 3m away from the aft bulkhead), ASD2 climbed onto it. Standing on the pontoon, he then signalled to ASD1 to continue moving the pontoon towards the aft bulkhead. At the same time, according to the ASD2, he shouted¹¹ across to the Bosun to stay within the aft access space and to wait there. He could not recall if the Bosun had acknowledged.
- 1.1.11 When the pontoon was about 1m away from the aft bulkhead, ASD2 saw that the Bosun suddenly came out from the aft access space. He was seen to raise one of his leg trying to climb onto no.8 pontoon, which was still moving.
- 1.1.12 He was then seen to lose his footing. ASD2 shouted on his radio to ASD1 to stop the movement of the pontoon. ASD1 who too had noticed the Bosun's action from the crane operator's cabin, could not stop the pontoon's movement in time. The Bosun was almost instantly crushed between the edge of no.8 pontoon and the aft bulkhead at his chest level. ASD1 subsequently moved crane jib to shift the pontoon away from the bulkhead and then stacked it onto no.6 pontoon.
- 1.1.13 Upon hearing the shouting on the radio, the Chief Officer rushed towards aft and saw the Bosun lying face down unconsciously on no.7 pontoon. The Bosun had a weak pulse and shallow breathing.

¹¹ The verbal call was not made using the portable radio. There was no other witness who could confirm whether this call was made.

1.1.14 The Chief Officer requested the shore foreman to call for medical assistance and the Master of Han Zhi requested the ship's agent at the port of Sohar for an ambulance.

1.1.15 About 20 minutes after the accident, an ambulance arrived and the Bosun was taken to a local hospital for treatment. Enroute to the hospital, the Bosun succumbed to his injuries.

1.2 The ship

1.2.1 Han Zhi, was a single hull multi-purpose carrier, built with one large cargo hold throughout (see **Figure 3**) without centre beams, for the carriage of a wide range of cargo such as container units and general solid bulk cargo. She was fitted with two cargo cranes on the deck edge at the port side, capable of loading and discharging heavy lift cargo, on deck and under deck, as well as shifting of the tween deck pontoons.



Figure 3 - View of the large cargo hold
(Photo source: the ISM Manager)

1.2.2 She was provided with 12 lift-away type of tween deck pontoons, of different weights¹² and sizes. All pontoons were 0.645m thick. Based on cargo carriage requirements, the large cargo hold could be separated into different levels by mounting these pontoons on foldable supports¹³ at three different heights¹⁴. The pontoons were also designed to be used as vertical cargo bulkheads at four different positions in the hold to separate different type of cargoes.

¹² Pontoon no.1 was 30 metric tonnes, pontoon no.2, 3, 11 and 12 were 18 metric tonnes each, and pontoon no.4, 5, 6, 7, 8, 9 and 10 were 33 metric tonnes each.

¹³ Those foldable supports were recessed on the longitudinal hold bulkheads, if not in use,

¹⁴ The first, second and third height above cargo hold tank top were 3.515m, 5.015m and 6.455m respectively.

1.2.3 The pontoons could either be stacked¹⁵ on top of each other in tiers inside the hold, on the main deck or on the quay (ashore). At the time of accident, the cargoes carried in the hold were separated into two levels by the tween deck pontoons. The cargoes at upper level had already been discharged ashore. The crew were in the process of preparing the under deck cargoes for discharge by shifting the relevant pontoons and stacking on top of each other. One of the aft access spaces i.e. the access space located on the port side bulkhead, was blocked after the no.6 pontoon was stacked as second tier.

1.2.4 All crew members including the Chief Officer entered the cargo hold from the aft access space (see **Figure 4**). This was the same place where ASD2 and Bosun were positioned prior to the accident.

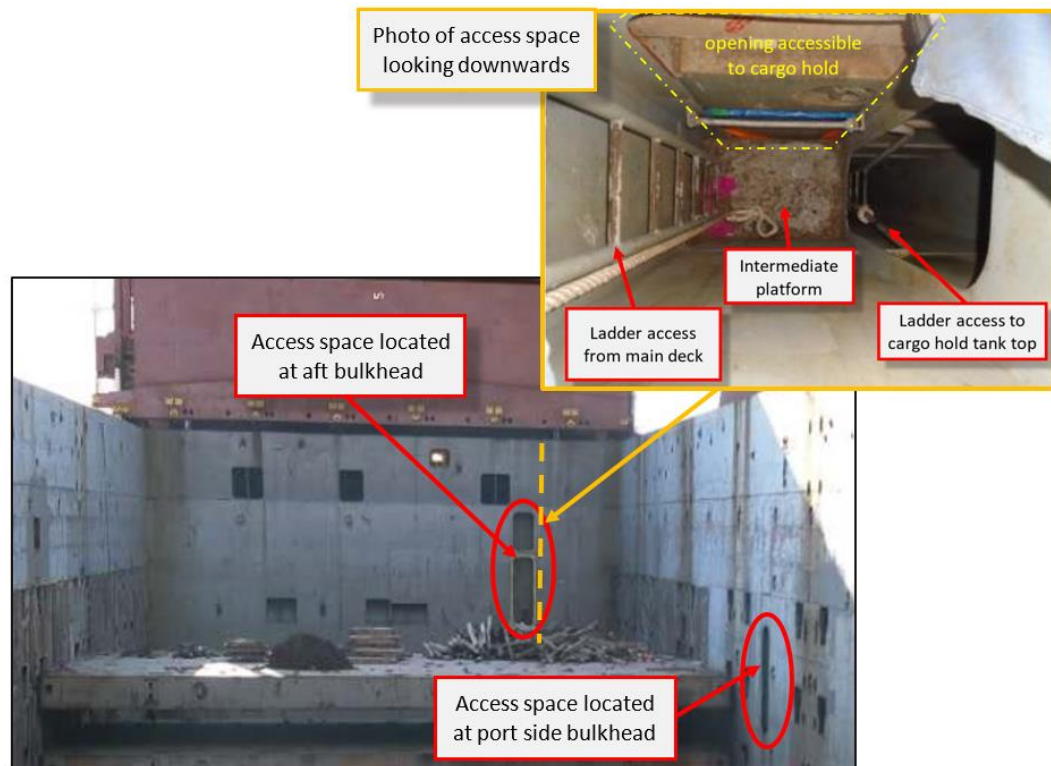


Figure 4 - Aft part cargo hold showing the two access spaces
(Photo source: the ISM Manager)

1.2.5 All the access spaces, were fitted with a vertical ladder to facilitate entering from the main deck and exiting from the cargo hold. The total height of the access space exceeded 9m and had an intermediate platform.

1.2.6 This intermediate platform was at the same level as the first tier tween deck pontoon.

¹⁵ The standard practice on board was to use wooden dunnage (each having size of length 200cm x width 10cm x height 10cm) to be placed between pontoons.

1.2.7 The aft access space consisted of two openings, for accessing the cargo hold, separated by 0.15m. The upper opening had a height of about 1.1m, and the lower opening had a height of about 2m (see **Figure 5**). Ship's crew could enter the cargo hold via the lower opening from the intermediate platform.

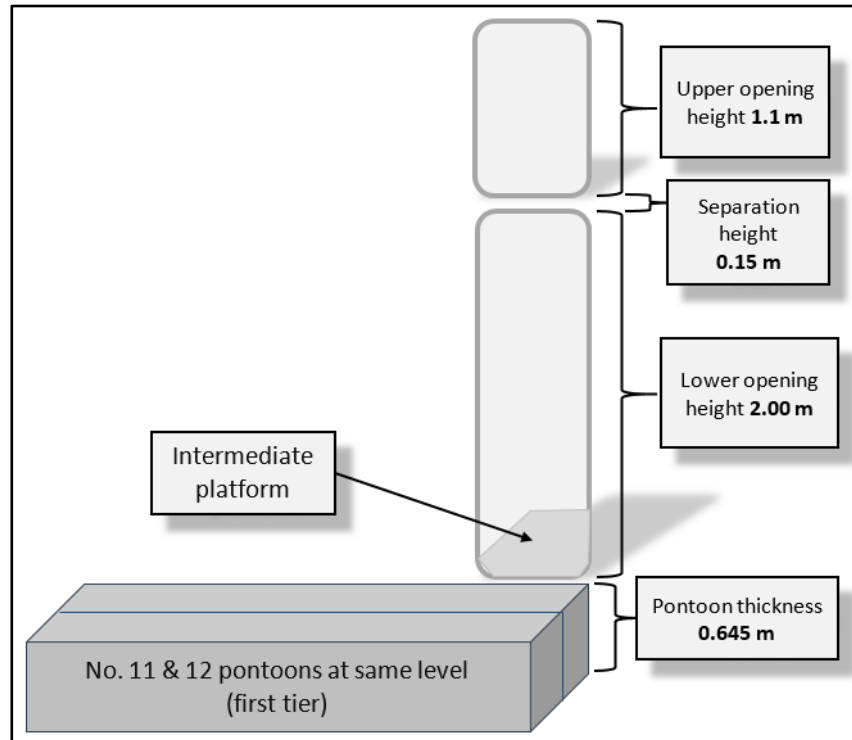


Figure 5 - Two openings at the aft access space, intermediate platform and first tier pontoons

1.3 The openings for entering cargo hold

1.3.1 When the tween deck pontoons (in this case no.11 and no.12) were placed next to the aft access space, the top of the pontoons would be at about the same level as the bottom of the lower opening.

1.3.2 Based on measurements and calculations, after no.7 pontoon was placed onto no.11 and no.12 pontoons as the second tier, the remaining height clearance¹⁶ between the top of no.7 pontoon and the top of the lower opening would be about 1.3m. This clearance would be further reduced to about 0.55m if no.8 pontoon was placed on top of no.7 pontoon as the third tier (see **Figure 6**). The upper opening (1.1m) remained unaffected after placing third tier pontoon.

¹⁶ After deducting the thickness of the pontoon and the wooden dunnage.

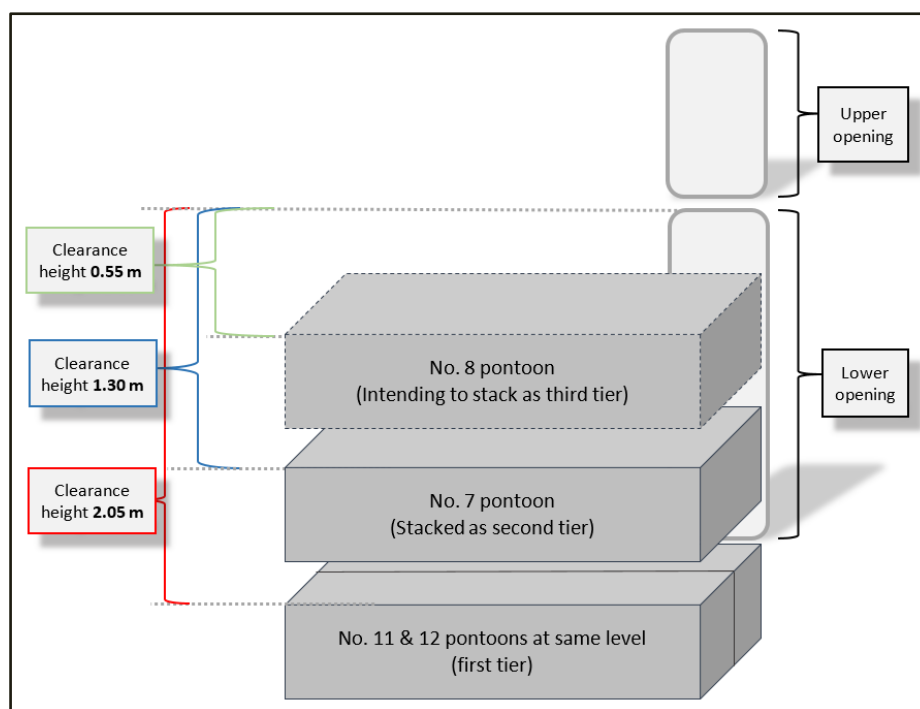


Figure 6 - The clearance of the lower opening after three tiers of the pontoons stacked (*not to scale, for illustration purpose only*)

1.4 The crew

1.4.1 At the time of the accident, 16 crew of different nationalities employed by the company (ship's Operator / ISM Manager) were on board. All crew held valid STCW¹⁷ competency certificates required for their respective positions held on board.

1.4.2 The qualification and experience of the Master, relevant officers and crew members were listed in Table 1.

Designation onboard	Nationality	Age	Qualification	Duration onboard (month)	Experience on this type of ship (month)	In rank service (month)	Service in company (Year)
Master	Filipino	52	COC – Master (Philippines)	4.9	48	23.9	3.5
Chief Officer	Filipino	42	COC – Chief Officer (Philippines)	2.9	15	23.9	2.2
Third Officer	Filipino	32	COC – Third Officer (Philippines)	4.9	35	29.9	0.4
Bosun	Filipino	50	Deck Rating per STCW	4.9	52	56.9	0.4
ASD1	Filipino	34		4.1	48	42.1	6.9
ASD2	Myanmar	36		4.1	8	7.1	1

¹⁷ The International Convention on Standards of Training, Certification and Watch keeping for Seafarers (or STCW), 1978 sets qualification standards for masters, officers and watch personnel on seagoing merchant ships.
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OS	Myanmar	26		4.1	31	23.1	0.3
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Table 1

- 1.4.3 The Master had been with this company few years and sailed on the same type of ships.
- 1.4.4 Similarly, the Chief Officer had served on three ships of the same type including Han Zhi.
- 1.4.5 The Third Officer, had sailed in the same rank on similar type of ships in another company. Han Zhi was his first ship in this company.
- 1.4.6 The Bosun (deceased), was also on his first ship in this company and had prior experience with general cargo ships. As per company's requirements, he had attended a pre-joining training course¹⁸ for seafarers, conducted by respective departments on 23 May 2017. Prior to the accident, he had worn personal protective equipment (PPE)¹⁹ and was inside the access space at the aft bulkhead.
- 1.4.7 ASD1 had an in-rank experience²⁰ of over three years, and was the assigned crane operator at the time of accident.
- 1.4.8 This was ASD2's second ship in his rank with this company. He could communicate in English and was communicating in English with others on his radio prior to the accident. At that time, he stood on top of no.8 pontoon and was took on the role of the signaling man for the crane operator.
- 1.4.9 Though the OS was first time with this company, he had prior experience as an ASD in another company.
- 1.4.10 Shipboard records indicated that deck crew received training on pontoon opening and closing operations conducted bi-monthly by the Chief Officer. The Bosun had attended this training twice since joining, the last attendance being on 16 September 2017.

¹⁸ The course reference materials included ISM Code booklet, the company's SMS documents, circulars and notifications issued to its fleet. Area of working safety and accident prevention were also briefed to those joining crew by the company's Marine and Technical departments.

¹⁹ Safety helmet with chin strap, safety boots and working gloves.

²⁰ His experience included driving cargo crane on board ships. There were no specific training requirements for crane operators on Singapore registered ships. However, his certificate under STCW A II/5 is deemed to possess the necessary knowledge and competence required to contribute for the safe operation of deck equipment and machinery.

1.4.11 All officers and crew met the STCW and MLC²¹ Convention's requirements concerning the hours of work and rest, according to Han Zhi's log records.

1.5 Pontoon shifting operation

1.5.1 According to maker's instruction manual, the lift-away tween deck pontoons on board Han Zhi were designed to be moved in a non-sequential order based on operational requirements.

1.5.2 The manual also stated that for positioning of pontoons, two persons were required in the cargo hold to monitor the operation and to guide the crane operator to move the pontoon to the correct position. The manual highlighted the importance of making sure that there were no persons or loose gear on top of the pontoon during shifting operation to prevent injury.

1.5.3 The maker's instruction manual further indicated the need of ensuring good communication between the crane operator and the signalling man using walkie-talkies, considering that the pontoons were large in size, heavy, and required considerable vertical distance when shifting them, which could lead to occasional blind spots from where the crane was operated during the movement. The company required the crew to also be familiar with the use of hand signals²² for pontoon shifting operation.

1.5.4 According to the practice on board the ship for shifting of pontoon the signalling man would typically follow the pontoon as it was moved, as long as there were other tween deck pontoons along the path or cargoes of similar level to ensure the crew's path was safe for walking (see position A in **Figure 7**). In cases where the cargo heights were significantly different (see position B) and difficult to walk through, for convenience, the signalling man would typically stand onto the pontoon being shifted. Alternatively, the signalling man could also be positioned on the main deck.

²¹ STCW - the International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 and its amendments set qualification standards for masters, officers and watch personnel on seagoing merchant ships. MLC - the Maritime Labour Convention, 2006.

²² Crane hand signals by The Standard Club.

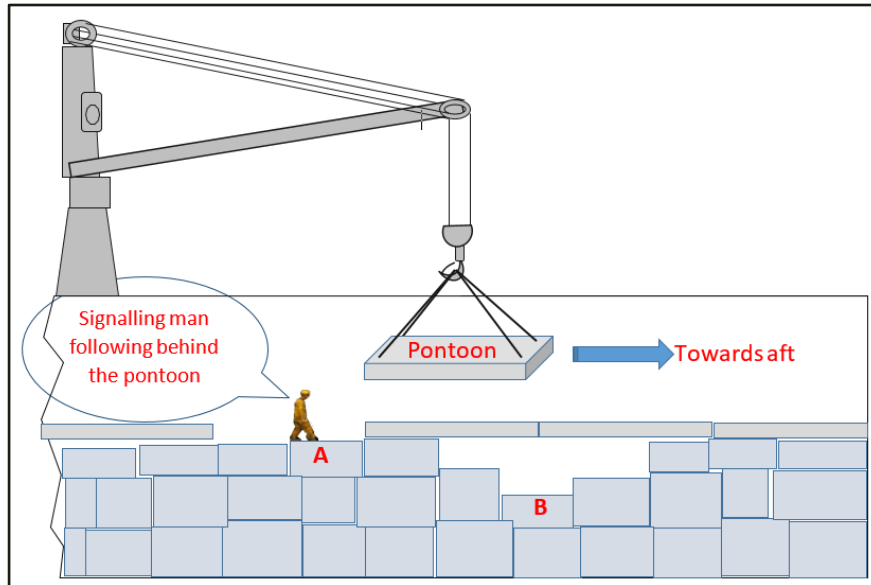


Figure 7 - Position of the signalling man inside cargo hold in relation to the pontoon moving direction (*not to scale, for illustration purpose*)

1.5.5 To hook and unhook the lifting wire slings from the pontoon after it was placed in the planned position, the common practice on board was to use a portable ladder to climb onto the second and third tier of the pontoons after stacked. If the pontoons were only stacked at first or second tier at either end of the cargo hold, then the access space for entering the cargo hold could also be used (as in this case) for getting onto the pontoon to unhook the lifting wire slings.

1.6 The company's safety management system

1.6.1 The ISM Manager managed a fleet of 10 ships of the same type. The company used a manning agent²³ in the Philippines to supply crew for its fleet of ships. The manning agent was responsible to the company for ensuring all crew held appropriate documentation for the capacity they were employed with the company. The documentation included pre-joining medical examinations.

1.6.2 The Document of Compliance certificate was issued to the ISM Manager by ClassNK on 6 October 2017²⁴ based on an audit conducted on 22 September 2017, and the certificate was valid until 16 October 2022.

1.6.3 The Safety Management certificate was issued to Han Zhi by ClassNK on 6 October 2017²⁵ and was valid until 10 April 2020. The certificate was based

²³ Agency services for supplying seafarers

²⁴ This certificate was rewritten due to a change in the company's address and types of the ships.

²⁵ This certificate was rewritten due to change of the company's address.

on the completion date of the audit on 11 April 2015 and last intermediate audit done on 29 May 2017.

1.6.4 ClassNK had conducted an intermediate audit of shipboard safety management system on Han Zhi between 26 and 29 May 2017. There were no non-conformities or observations raised. The auditor verified that risk assessments (RA) were conducted on board in accordance with the company's Safety Management System (SMS) procedures.

1.6.5 Prior to the accident, the last Port State Control inspection was carried out on 31 August 2017. Four deficiencies²⁶ were raised and rectified accordingly. The last Flag State Control inspection was carried out on 29 November 2012, 11 deficiencies²⁷ raised and rectified accordingly.

1.7 Procedures relating to cargo operations

1.7.1 The company's SMS with latest revision dated 1 November 2016, on Provision for Cargo Handling stated that, during the cargo discharging operation, the Master or the Chief Officer must maintain a strict watch so as to ensure that cargoes were discharged as per agreed sequence.

1.7.2 The SMS procedures also stated that for pontoon operation, one experienced crew must be assigned to monitor and supervise the entire operation. The crane operator was to be experienced and to ensure the crane was operated safely. Means of communication such as walkie-talkies were required to be in good working condition. During the briefing conducted by the Chief Officer, no specific person was assigned to supervise and monitor the pontoon shifting operation.

1.7.3 All persons involved in the pontoon shifting operation, were required to be familiar with radio SILENCE²⁸ and STOP²⁹ rules.

1.7.4 The only exception to the rule of radio SILENCE was the STOP rule, which allowed crew members to stop the crane operator if dangerous and/or extraneous activities which could harm personnel and hardware were seen.

²⁶ Out of the four deficiencies, three were machinery related, and another was navigation related.

²⁷ 11 deficiencies covered in various areas, such as missing ship's continuous synopsis records, lacking of information on route passage planning, firefighting equipment maintenance and under keel clearance policy for navigation, most of them were rectified before the ship's departure.

²⁸ These rules were applied to heavy lifting and pontoon operation. To keep airwaves free as much as possible, the rules discouraged other involved persons repeating orders over radios if the lift supervisor (in this case refers to signalling man) gave orders, unless it was requested by the supervisor.

²⁹ The supervisor would order for an emergency stop or make corrections if he noticed any unexpected crane movement due to misunderstanding of his orders by the crane operator.

- 1.7.5 If the crane operator heard the word “STOP” over the radio or the crane operator saw a STOP signal by hands, the crane operator would be required to stop the operation and resume only when the situation had been clarified.
- 1.7.6 Under the section on pontoon operation in the SMS, all personnel were required to keep clear of a swinging pontoon and were prohibited from stepping on the pontoon when swinging. Riding on top of a pontoon while it was being shifted was prohibited by the SMS.
- 1.7.7 A risk assessment was required to be carried out for critical operation on board such as opening/closing and shifting of hatch covers and pontoons, and it was to be recorded in the company’s form (HAN-SM-5-22) as per the SMS.
- 1.7.8 As a part of a toolbox meeting, the risk assessment³⁰ that was conducted on 19 October 2017 before commencement of the cargo discharging operation at this port, i.e. two days before the occurrence, was discussed. The risk factor derived from the likelihood and severity of harm was recorded as “Very Low” in the risk assessment form. The form was signed by the Chief Officer with a “GO” (proceed with the operation) and endorsed by the Master.

1.8 Relevant safe working practice

- 1.8.1 The COSWP³¹, was incorporated into the company’s SMS procedures and to be carried on board its fleet of ships.
- 1.8.2 Chapter 1.2.4 of COSWP - Managing Occupational Health and Safety - Planning of work is essential in ensuring occupational health and safety at work. Adequate control of risks can only be achieved by ensuring that all involved are aware, activities are coordinated and good communication is maintained by all involved.
- 1.8.3 While planning the task, consideration of what actions are necessary, how these will be carried out and what effect they may have on seafarers’ safety at work, taking into account that there may be consequences that are indirect and unintended.

³⁰ The hazards identified were, amongst others, personal injuries or death due to crew in critical or awkward position or use of inexperienced crew. The measures to control the hazards were to confirm that no one was at critical position and not to be on top of hatch covers/pontoons, the crew handling the opening or closing of hatch covers/pontoons were required to be the most experienced crew with sufficient knowledge of such an operation.

³¹ The Code of safe working practices for merchant seafarers (COSWP), edition 2015, published by the UK Maritime and Coastguard Agency (MCA), provides best practice guidance for improving health and safety on board ships. The company’s SMS had incorporated the COSWP as the part of procedures for reference.

- 1.8.4 Chapter 1.2.5 on risk awareness, highlights that seafarer's knowledge about risk can be attained through a combination of conducting risk assessment, theoretical training, practical application, information sharing, personal experience, as well as clear instructions and supervision by supervisors.
- 1.8.5 Chapter 19, highlighted that every lifting operation must be subject to a risk assessment, be properly planned, appropriately supervised and be carried out in a safe manner.

1.9 Bosun's fitness for service at sea

- 1.9.1 The Bosun's pre-joining 'Medical Certificate for Service at Sea', issued to him on 26 April 2017 (valid for 1 year³² for medical surveillance) indicated that he had a history of high blood pressure and that had been prescribed medication for it.
- 1.9.2 Based on the 'Medical Examination Report for Seafarers', which contained the Bosun's self-declaration, indicated that he did not have any hearing disorders. However, the initial audiometry examination results documented in this report indicated that the Bosun was having severe hearing loss for both ears.
- 1.9.3 Ancillary examination results recorded in the same report were revised (downgraded) to moderately severe hearing loss for both ears.
- 1.9.4 At the end of the medical report, an Ear, Nose, Throat (ENT) clearance³³ was then granted in the summary, and the Bosun was certified fit without restriction for look-out duty and for deck service.
- 1.9.5 It was also noted that this medical report did not indicate the audiometry test results as per Annex of STCW.7/Circ.19³⁴, (Appendices B, F and G), i.e. threshold values in decibel. The investigation team thus sought additional clarification from the medical centre which issued the medical report through the maritime regulator of the Philippines. According to the information provided by MARINA³⁵, the medical centre's whereabouts could not be documented as the said medical centre ceased its operation since February 2018 without notifying the Philippines Department of Health (DoH).

³² Typically, medical examination for seafarers are valid for two years.

³³ The typical process of hearing test according to one of the Singapore medical clinic for seafarers is to carry out whisper speech test, followed by an audiometry and ENC specialist examination if at any stage failed to pass the test.

³⁴ This circular provides details of what tests are to be conducted and suggests format of items to be recorded for assessment of this examination.

³⁵ Maritime Industry Authority, the Philippines, is the authority for development, promotion and regulation of the Maritime Industry in the country.

- 1.9.6 A check with Singapore based medical clinic that conducts medical examination for seafarers indicated that a typical process to assess a seafarer's hearing ability is to first conduct a whisper test (at a distance of three metres). If the test is unsatisfactory then the seafarer is sent to an approved hearing test centre for an audiometry test. A further examination with an ENT specialist may then be done, depending on the results of the audiometry test. The doctor would then make an assessment whether the person is fit for service at sea, with or without restrictions. According to the medical clinic, results of audiometry tests and related graphs of threshold values are included in the medical examination report, in accordance with STCW requirements.
- 1.9.7 The investigation team did not have any information from the crew on board or the company to suggest that the Bosun had any hearing problems.
- 1.9.8 After the occurrence, there was no autopsy examination conducted to determine the cause of death. The local hospital's report at Sohar revealed that the deceased body had a contusion at his right chest. No other external injuries were noted.
- 1.10 Environmental condition**
- 1.10.1 The accident occurred in daylight hours. The weather was partly cloudy with light north-easterly wind and good visibility. The sea was considerably calm at the berth. The ship was upright and did not experience a list which could affect the movement of the pontoon.

2 ANALYSIS

2.1 The occurrence

2.1.1 While the Bosun had attended the pre-joining ship briefing and shipboard training of opening/closing pontoon operation, as this was his first time in this company, it is likely that he was still observing various operational practices from the others on board.

2.1.2 Before the accident, the ASD2 was inside the access space at the aft bulkhead together with the Bosun. From this location both could visually see the available clearance of the lower opening, as the pontoon got closer to the aft bulkhead.

2.1.3 It is likely that ASD2 had anticipated that once no.8 pontoon was stacked as the third tier, the remaining clearance at the lower opening would be too narrow to enter the cargo hold and hence opted to enter the cargo hold before it was stacked. When ASD2 informed ASD1(crane operator) to stop the movement of the pontoon, there was no evidence to suggest that ASD2 communicated his intention (of climbing onto the pontoon) to the Bosun. Despite being as a part of the same team, to unhook the wire slings from the pontoon, there appeared to be a lack of coordination between the ASD2 and the Bosun.

2.1.4 Being new to the company, the Bosun had likely by instinct, followed the actions of ASD2. However, the Bosun did not communicate his intention using his radio or exercised the 'STOP' rule so that the situation could be better assessed.

2.1.5 When the Bosun attempted to climb onto the pontoon and was seen to lose his footing, despite ASD1's attempt to stop the pontoon's movement, it was too late to stop the accident from happening due to the momentum of the pontoon, as the distance of the pontoon was only about 1m from the aft bulkhead.

2.1.6 This incident highlighted the importance of having good coordination, team work and communication among the crew members when pontoon shifting operation is being performed.

2.2 Limitations of cargo hold access design

2.2.1 Han Zhi was designed with four access points for entering the cargo hold, which were located at forward and aft part of the ship.

2.2.2 The limitations of the cargo hold access space, especially when it gets blocked by pontoons, should have been carefully assessed. Such limitations should have been taken into account during the risk assessment stage, when positioning crew in an access space for unhooking the lifting wire slings from a stacked pontoon to avoid crew being trapped within the space under such a scenario.

2.2.3 In the event that the access space is blocked, a proper method would have been for the crew to exit the space from the main deck, re-enter the cargo hold from the forward access space and use a portable ladder to access the stacked pontoon for unhooking the lifting wire slings.

2.3 Risk assessment on pontoon shifting operation

2.3.1 The Chief Officer had conducted a briefing prior to the pontoon shifting operation. However, considering the risks involved posed by the design of the access space and associated openings, it would have been prudent for the toolbox meeting and this briefing to be more detailed to include risk assessments on:

- a) where the two crew members (ASD2 and Bosun) were supposed to be positioned during various stages of the pontoon shifting operation;
- b) if there was a need to station the crew at the access space, to assess whether the opening(s) would be blocked by the pontoons and; and
- c) identify the alternate ways of entering the cargo hold should the openings be blocked, etc. Such details in the risk assessment would have been useful in providing clear guidance to the crew members on the possible hazards that they would likely face and to mitigate them accordingly.

2.3.2 In the absence of properly identified risks, the ASD2 and Bosun chose an unsafe method to enter the cargo hold from the aft access space when the pontoons have been stacked at the aft bulkhead.

2.4 The safety management system

2.4.1 The company's SMS required an experienced crew member to be assigned to monitor and supervise the entire pontoon operation. During the briefing conducted by the Chief Officer, there was no clear assignment on who would perform the monitoring and supervision role. Though the Chief Officer was initially supervising the pontoon shifting operation, when he started to prepare the cargoes in the tween deck by removing the lashing, there was

no supervision and the crew members were left to perform the pontoon shifting operation by themselves.

- 2.4.2 The company's SMS on heavy-lift operation contained radio SILENCE and STOP rules, which also applied to pontoon shifting operation. The margin of error in heavy-lift operation can be extremely little and thus observing such rules are critical. The investigation team is of the view that these rules are of equal importance whenever cranes are used in order to minimise risks.
- 2.4.3 Despite these rules in the SMS, none of the crew members (including the Chief Officer) sought to stop the crane operator from moving the pontoon when ASD2 first climbed onto and travelled with the pontoon (see paragraph 1.6.4). Similarly, the STOP rule was not exercised by the Bosun when he intended to enter the cargo hold as the pontoon closed in on him.
- 2.4.4 The company's SMS also prohibited personnel to ride on the pontoon when it was being moved or swung. However, it appeared that on board Han Zhi, this procedure was not followed especially when cargoes were of uneven height. It was reportedly a common practice to travel on the pontoon during pontoon shifting operation, as in this case by the ASD2 and attempted by the Bosun. Such practice was likely for the sake of convenience to avoid having to climb up and down in the cargo hold to access the pontoon after it had been stacked. Such routine non-compliance of procedures had traded safety for convenience.
- 2.4.5 The procedures not being followed demonstrated that the company's SMS was not effectively implemented on board the ship. It would be desirable for the company to review its existing procedures so that any gaps in the SMS can be identified and addressed accordingly.
- 2.4.6 The company did not scrutinise the medical examination report in detail, as the Bosun was granted ENT clearance and certified fit for sea service without restrictions (see paragraph 1.9.4). The company relied on the manning agent's processes when deploying seafarers. It would have been desirable for the company to have a better oversight in scrutinising a medical examination report for the seafarer and take appropriate actions, such as alerting the Master for ensuring the safety of the person and the ship.
- 2.4.7 It must be recognised that even though certified fit for sea service, seafarers should also bring to the attention of the Master and superiors of any medical conditions that may affect their work on board.

2.5 Human behavioural and medical considerations

2.5.1 In analysing this occurrence, the investigation team attempted to establish certain human behaviours and medical considerations which may have played a contributory role.

2.5.2 The Bosun's decision to enter the cargo hold from the aft access space when the pontoon was about 1m away could have been influenced by a combination of one or more of the following factors:

- a) As a member of the team of unhooking the lifting wire slings assigned by the Chief Officer, he had likely thought to stay with the ASD2 to perform the task together;
- b) The ASD2 safely positioning himself on no.8 pontoon may have given the Bosun the perception that the Bosun too could climb onto the pontoon in a similar manner, albeit on a slow moving pontoon;
- c) The Bosun had likely assessed that after no.8 pontoon was stacked, he had limited space to enter the cargo hold from the lower opening (refer to paragraph 1.3.2).

2.5.3 The Bosun was certified medically fit for sea service. Though, he had a history of high blood pressure and had been prescribed medication, there were no indications of him being unwell prior to the occurrence.

2.5.4 The medical examination report, initially stated that the Bosun had severe hearing loss, which was then downgraded to moderately severe hearing loss and eventually granted ENT clearance. The report did not indicate any details of how these changes (in hearing) evolved over the course of the examination. The investigation team was not able to conclude if the Bosun's hearing was impaired at the time of the occurrence (see paragraph 1.9.7). Likewise, the investigation team could not establish whether the Bosun had heard the ASD2's shout advising him to stay inside the access space (see paragraph 1.10).

2.6 Incidental observations on medical examinations

2.6.1 The medical examination report for the Bosun and the fitness for sea service was in all likelihood done as per requirements of STCW. However, it would have been desirable for results of the audiometry tests to have been documented clearly in the report, including the threshold values instead of textual results such as "severe to moderate hearing loss" which could be perceived as subjective.

3 CONCLUSIONS

From the information gathered, the following findings, which should not be read as apportioning blame or determining liability to any particular organisation or individual, are made.

- 3.1 The lack of team work and coordination between the ASD2 had led to the Bosun entering the cargo hold without considering that the moving pontoon.
- 3.2 The Bosun didn't communicate to any of the other crew using his radio of his intention to enter the cargo hold from the lower opening of the aft access space. In attempting to climb onto the pontoon he lost his balance and got crushed by the moving pontoon. It could not be established if the Bosun's hearing was impaired at the time of the occurrence or he had heard ASD2's shout advising him to stay inside the access space.
- 3.3 The design of the cargo hold and related openings were likely not taken into consideration when planning for and conducting the briefing of the crew prior to commencement of pontoon shifting operation.
- 3.4 Although a risk assessment was carried out as per the company's SMS procedures, it did not cover the proper positioning of personnel involved during pontoon shifting operation especially in situations where the openings are blocked by stacked pontoons and the alternate ways of entering cargo hold.
- 3.5 Despite the company's SMS procedures, such as prohibiting from standing a moving pontoon, conduct of risk assessments, ensuring supervision of cargo related operations, it is likely that there was ineffective implementation of the company's SMS requirements.
- 3.6 The company's SMS also lacked verification method / screening process to scrutinise joining seafarers' medical examination reports and take appropriate actions, such as alerting ship's Master for ensuring the safety of the person and the ship.

4 SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the company.

4.1 Actions taken by the ISM Managers

4.1.1 On 2 November 2017, the company issued a fleet circular to its fleet sharing the findings and the lessons learnt from this accident. The corrective and preventive actions were highlighted as follows:

- Review relevant sections of the SMS, HAN-MN-07-06 (Provision for Cargo Handling) on safety precautions to be observed during tween deck pontoon operation;
- Review risk assessment, HAN-SM-5-35, Open/closing hatch cover and pontoons, specify the risk/hazard during the hatch cover and pontoon operation;
- Seek manufacturer's guidance on safe pontoon operation, precautions to be taken by ship's crew;
- Require all crew on board to study and discuss the accident during the shipboard safety meeting, and to enhance crew safety awareness on such operation;
- Require ship's masters to conduct training to ensure crew familiarise the company's SMS, maker's specific operating instructions;
- Ensure the effectiveness of training on board, improvement of crew's safe working behaviour;
- Motivate crew to report non-conformity, near-miss on board to the ship's masters and the company.

4.1.2 On 5 November 2017, the instructions on pontoon shifting operation in the company's procedures had been amended. The new instruction requires proper supervision of the operation and for it to be done by at least four crew members.

5 SAFETY RECOMMENDATIONS

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

5.1 Han Ship Management Pte Ltd (the Operators / ISM Managers)

5.1.1 To ensure its SMS is effectively implemented on board its fleet of ships.
[TSIB-RM-2019-011]

5.1.2 To consider implementing a verification process to scrutinise seafarers' medical examination reports and to advise the ship's Master accordingly for better deployment of the crew. **[TSIB-RM-2019-012]**

- End of Report -