Report of investigation into the fatal accident on board the Hong Kong registered general dry cargo ship "*CSC Rui Hai*" at Changshu, China on 21 September 2020

The Hong Kong Special Administrative Region
Marine Department
Marine Accident Investigation Section

04 January 2022

Purpose of Investigation

The purpose of this investigation, conducted by the Marine Accident Investigation Branch (MAIB) of Marine Department, is to determine the circumstances and the causes of the incident with the aim of enhancing the safety of life at sea and avoiding similar incidents in future.

It is not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAIB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.

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Summary

On 18 September 2020, the Hong Kong registered general dry cargo ship "*CSC Rui Hai*" (*the vessel*) berthed at Changshu, China for cargo discharge and other miscellaneous tasks, including crew change, and repair work of the crane and derrick.

The contractor for repair work (the contractor) of the No. 3 crane (the crane) and the No. 1 derrick (the derrick) boarded *the vessel* at around 1835 hours on 20 September 2020. At 0130 hours on 21 September 2020, the duty watch officer noticed and reported to the Chief Officer (C/O) and Bosun that the contractor was testing the derrick without informing any crew on board. The Bosun then summoned four able seafarers (AB1, AB2, AB3 and the AB) and a deck cadet (D/C) (*the testing crew*) to assist the testing of the derrick. The tween deck pontoon cover (pontoon) in the No. 1 cargo hold (C/H) was used as a proof load to test the loading limit of the derrick. Two pontoons were stacked up, and two wire ropes were used at each of the four corners to lift the stack of pontoons. Without removing the existing pontoon special lifting accessory gears (*the gears*) on the wire ropes, crew members jointed the two wire ropes with a large shackle and connected the shackle to each corner of the bottom pontoon by a lug.

When the wire slings were about to lift the stack of pontoons, the C/O and Bosun realised that *the gears* would obstruct the lifting operation. As such, they instructed *the testing crew* to pull *the gears* along with the wire slings to the large shackles. While the AB standing at the starboard forward corner of the stack of pontoons pulled *the gears* up, he lost his balance and fell onto the C/H bottom through the tween deck opening next to him. The Bosun immediately informed the bridge and Master. The AB was sent to a local hospital, but was later declared dead on the same day.

The investigation identified that the management company did not ensure safe testing of the derrick; the contractor was not competent enough in testing the derrick; crew members failed to prepare for the testing; toolbox talk was not carried out thoroughly, and an in-depth pre-work inspection was not carried out. Eventually, the site supervision to *the testing crew* was inadequate to prevent the fatal accident from happening.

1. Description of the vessel

Ship name	:	*CSC Rui Hai* (Figure 1)
Flag	:	Hong Kong, China
Port of registry	:	Hong Kong
IMO number	:	9602851
Type	:	General dry cargo ship
Year built, shipyard	:	2012, CSC Yichang Shipyard
Gross tonnage	:	10,817
Net tonnage	:	3,527
Summer deadweight	:	12,496.8 tonnes
Length overall	:	125 metres
Breadth	:	22 metres
Engine power, type	:	4,413 kW, DAIHATSU 8DKM-36
Classification society	:	China Classification Society
Registered owner	:	CSC Ruihai Co., Limited
Management company	:	Yangtze Navigation (Hong Kong) Co., Ltd

Figure 1 *The vessel*

2. Sources of evidence

2.1 Statements of the crew of *the vessel*.

2.2 Information provided by the management company of *the vessel*.

3. Outline of events

(All times were local time UTC + 8 hours.)

3.1 On 30 August 2020, *the vessel* was loaded with 11,200 tonnes of wood pulp and departed Futong, Indonesia for three discharge ports in China. The second discharge port was at Changshu, China and the cargo was stowed in the Nos. 1 and 2 C/Hs.

3.2 At 1342 hours on 18 September 2020, *the vessel* berthed at Changshu for cargo discharge. Crew change was arranged at 1600 hours. There were 6 on-signers who were the Master, C/O, Third Officer, AB1, AB2 and AB3. On the same day, one able seafarer deck who worked on board for about three months was promoted to the rank of Bosun.

3.3 Prior to arriving at Changshu, the management company had arranged a contractor to board *the vessel* to repair the crane and the derrick. On 18 September 2020, the contractor commenced the crane repair work, but the work was not completed in time and obstructed the progress of cargo discharge. Since another vessel was waiting for the berth, *the vessel* shifted to the anchorage nearby at 1200 hours on 19 September 2020, to continue the crane repair work.

3.4 At 1810 hours on 20 September 2020, the crane repair work was completed, and *the vessel* berthed alongside again to continue the cargo discharge.

3.5 At around 1835 hours, four workers of the contractor boarded *the vessel* to repair the derrick. The repair work continued until 2200 hours. The contractor requested the Bosun and *the testing crew* to assist in testing the derrick. However, the testing failed. The Bosun relieved *the testing crew* to take rest, and told them that they would be called for testing the derrick again when required.

3.6 At 0130 hours on 21 September 2020, the Second Officer as the duty watch officer informed the C/O and the Bosun that the testing of the derrick commenced. The C/O later found that in order to avoid disturbing crew members from taking rest, the contractor tried testing

the derrick by themselves. During the process of testing, they used a combination of webbing sling and wire rope to lift two tween deck pontoon covers of No. 1 C/H, but the webbing sling on the port side of the pontoons had broken apart.

3.7 The Bosun entered the No. 1 C/H and saw that the Nos. 2 and 3 pontoons counting from forward were stacked up and placed on top of the No. 4 pontoon. Since the pontoons were not placed in parallel to port-starboard direction, only a limited area was left at the starboard forward corner for personnel movement (Figure 2). At around 0200 hours, the C/O, the Bosun and *the testing crew* gathered on deck for a toolbox meeting. The C/O briefed the Bosun and *the testing crew* that the two stacked up pontoons should be lifted together by the derrick. The AB3 was assigned to operate the derrick.

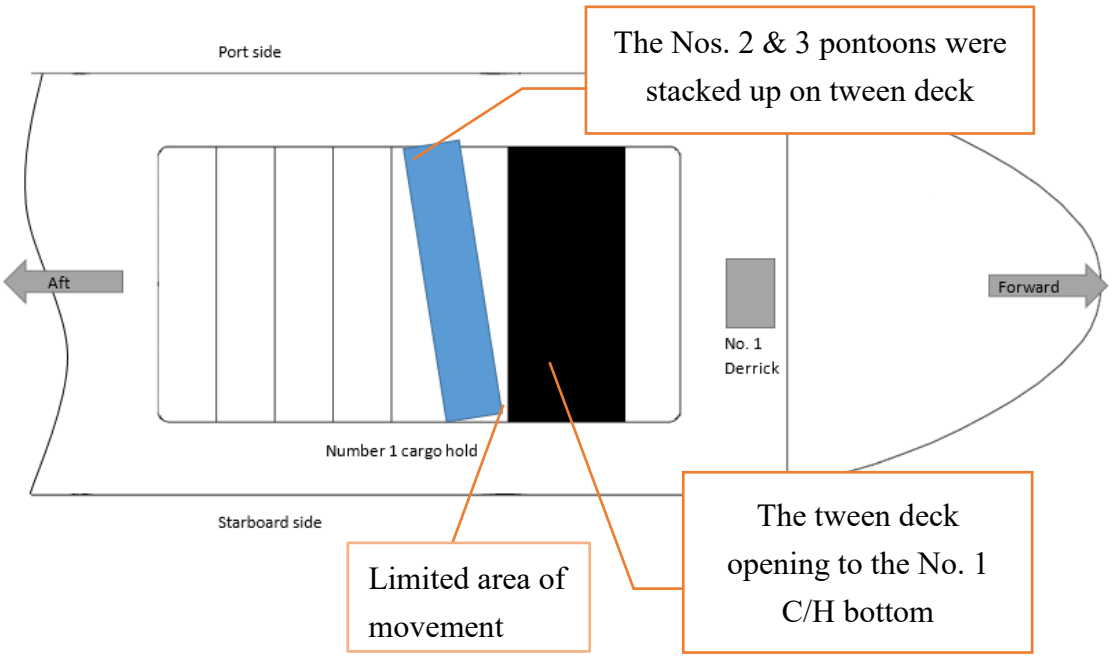

Figure 2 Layout of the pontoons on tween deck in the No. 1 C/H

3.8 Since *the vessel* was scheduled to depart at 0800 hours on the same day, the C/O did not want to spend extra time to search for wire ropes of larger diameter thus delaying the testing and the departure time. The C/O therefore instructed *the testing crew* to take the wire ropes (Figure 3) specially fabricated for *the gears* from the No. 2 C/H to replace the broken webbing sling.

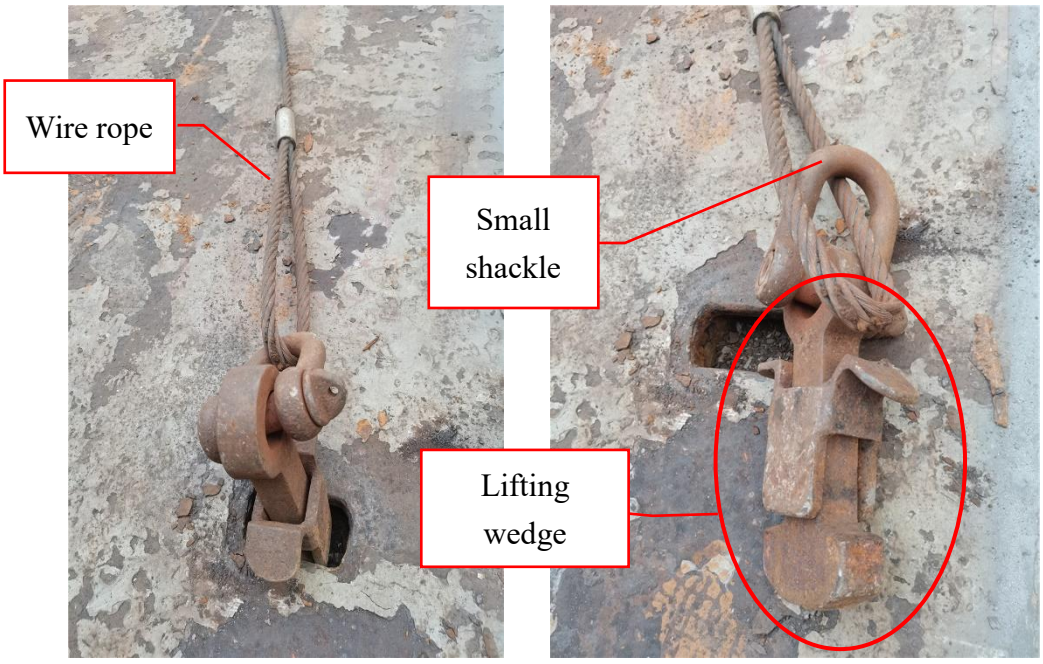

Figure 3 *The gears* of the pontoon

3.9 After gathering the required wire ropes, the AB1 and D/C went to the port side of the hold. The C/O together with the AB2 and the AB went to the starboard side of the hold to secure the wire ropes on the pontoons. The Bosun stood on top of the stack of pontoons to overlook the entire securing arrangement (Figure 4).

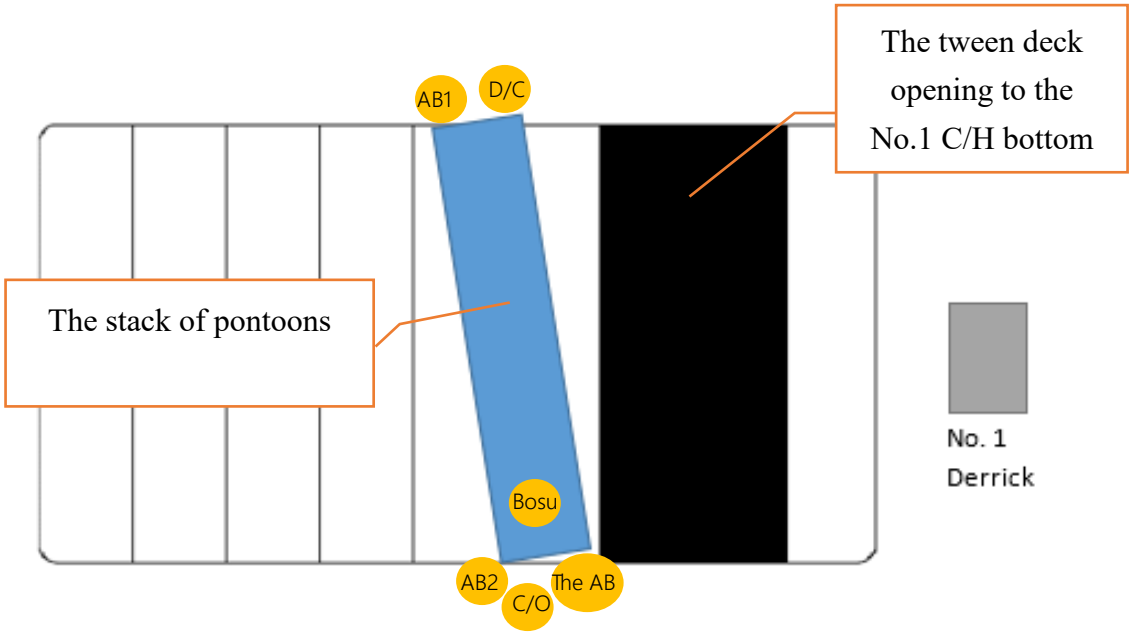

Figure 4 Standing position of *the testing crew*, the Bosun and the C/O

3.10 Each pontoon by itself was designed to be lifted by four wire ropes attached to its four corners. In order to lift the stack of two pontoons together, two wire ropes were required at each corner of the bottom pontoon of the stack. *The testing crew* used a large shackle to secure each corner of the bottom pontoon of the stack, and connected the two wire ropes to the large shackle at each corner. However, *the gears* that were not applicable to the testing, was not removed from each of the wire ropes before linking to the large shackle (Figure 5).

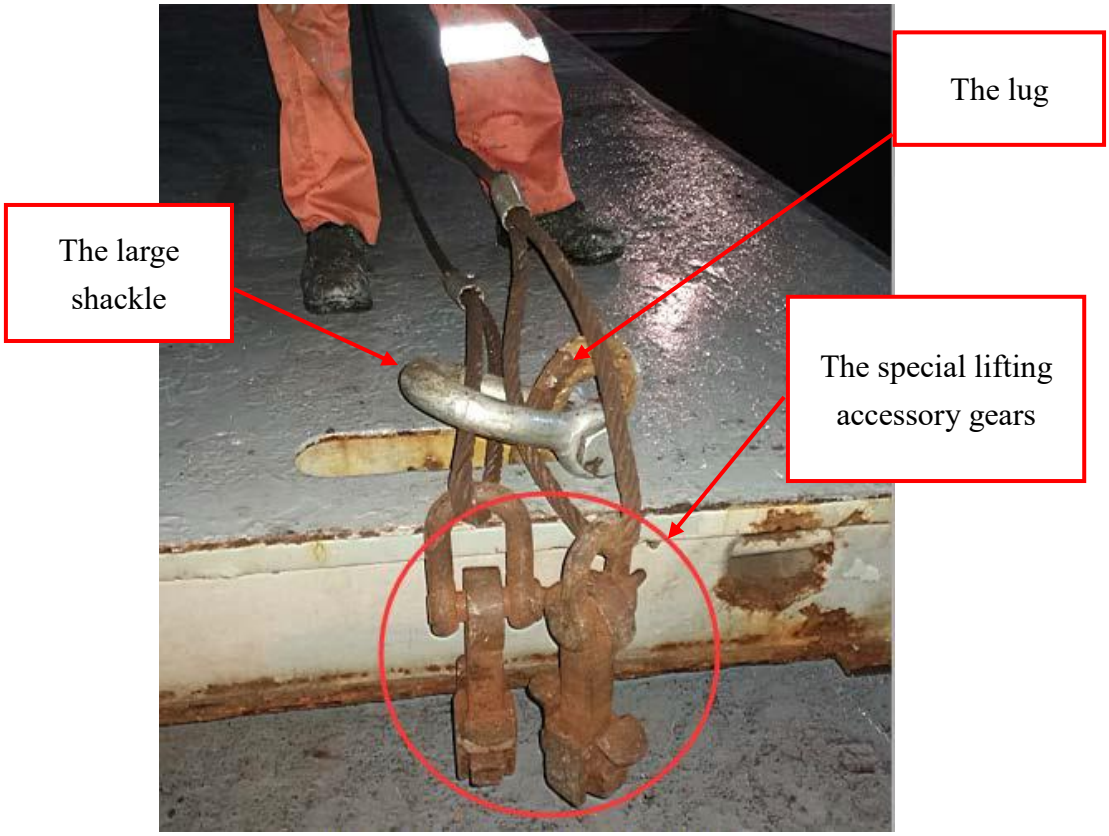

Figure 5 Two wire ropes connected by one large shackle

3.11 The earlier broken pieces of webbing sling were used as a protection pad to protect the wire ropes from pressing hard against the edge of the top pontoon of the stack. At the four corners of the stack of pontoons, protection pads were put in place by *the testing crew* (Figure 6). The C/O and Bosun assisted in positioning the protection pads at the starboard side of the stack.

3.12 After protection pads were in place, it was found that *the gears* would

obstruct the lifting of the stack of pontoons. Therefore, it was decided amongst crew members that *the gears* should be pulled up and placed above the large shackles.

3.13 At around 0218 hours, the AB standing at the starboard forward corner (Figure 6), tried to lift *the gears* and placed them on the large shackle. When he was lifting *the gears*, he lost his balance and fell onto the bottom of the No. 1 C/H through the tween deck opening next to him (Figure 7). The vertical distance was about 7.3 metres between the tween deck and the bottom of the C/H.

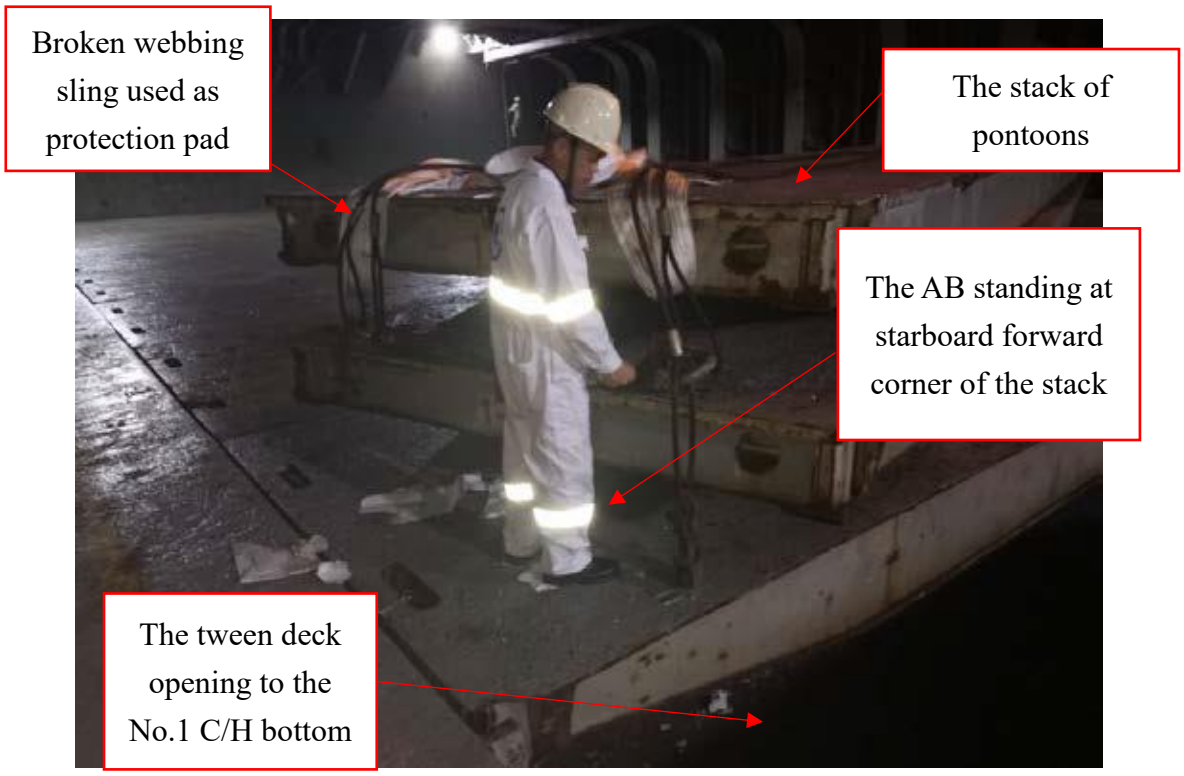

Figure 6 Indicative standing position of *the AB*

Figure 7 The AB fell from tween deck to the No.1 C/H bottom

3.14 The C/O, Bosun and AB2 immediately rushed to the No.1 C/H bottom for rescue. They saw the AB lying on his side and was trying to sit up straight. The C/O stopped him and assisted him to lie down. The AB was still conscious with eyes opened, breathing and coughing occasionally. No blood was seen, but he could not talk while waiting for medical treatment. The Bosun informed the bridge and Master through portable radio.

3.15 At 0245 hours, the agent and an ambulance arrived. The AB was sent ashore for emergency medical treatment.

3.16 However, at 1336 hours on the same day, the AB was declared dead at a local hospital.

4. Analysis

Certification and experience of the crew

4.1 *The vessel* was normally manned by 21 crew members. At the time of the accident, *the vessel* was manned by 24 crew members from China and Bangladesh. There were 3 Bangladesh crew members scheduled to sign off at the next port. There was no shortage of crew on board.

4.2 The Master had served in the current rank for 25 months. He held a Class 1 Certificate of Competency (Deck Officer) issued by China and a Class 1 License of the Deck Officer issued by the Hong Kong Marine Department (HKMD) valid until 25 July 2021. He signed on *the vessel* as a master for 3 days prior to the accident.

4.3 The C/O had served in the current rank for about 24 months. He held a valid Class 2 Certificate of Competency (Deck Officer) issued by China and a valid Class 2 License of the Deck Officer issued by the HKMD valid until 23 December 2021. He signed on *the vessel* as a chief officer for 3 days prior to the accident.

4.4 The Bosun was recently promoted to the current rank on 18 September 2020. He held a valid Certificate of Proficiency for Able Seafarers issued by China on 31 October 2016 valid until 2 July 2057. He signed on *the vessel* as an able seafarer (deck) about 3 months before the accident.

4.5 The AB joined *the vessel* 3 days before the accident. He had experience of working on general cargo ship for 20 days and on container ship for about 6 months as a trainee. *The vessel* was the first ship that he served for the management company and he was the first time working as an able seafarer deck. He held a valid Certificate of Proficiency for Able Seafarers issued by China on 20 July 2020, valid until 12 November 2066.

4.6 There were no abnormalities noted with regard to the certification and experience of the crew concerned.

Fatigue, alcohol and drugs abuse

4.7 There was no evidence showing that the crew members of *the vessel* suffered from either fatigue at work or abuse of alcohol and drugs.

Weather and sea conditions

4.8 At the time of the accident, *the vessel* was at berth, and the weather was gentle breeze with calm sea condition. Weather and sea conditions should not be the contributory factors to the accident.

Repairing and testing the derrick

4.9 On *the vessel*, there were 4 main cargo lifting appliances including two derricks and two cranes. The derrick was located at the forward of *the vessel* (Figure 8), with a safe working load (SWL) of 25 tonnes. The "Certificate of Test and Thorough Examination of Lifting Appliances" was issued by China Classification Society (*the Class*) on 28 February 2017. After the last annual thorough examination of all the cargo lifting appliances on board was done on 7 March 2020 by *the Class*, however, it was found that the derrick could only work with a maximum load of 15 tonnes. After about 6 months later, the management company arranged the contractor to repair the derrick by which the accident happened.

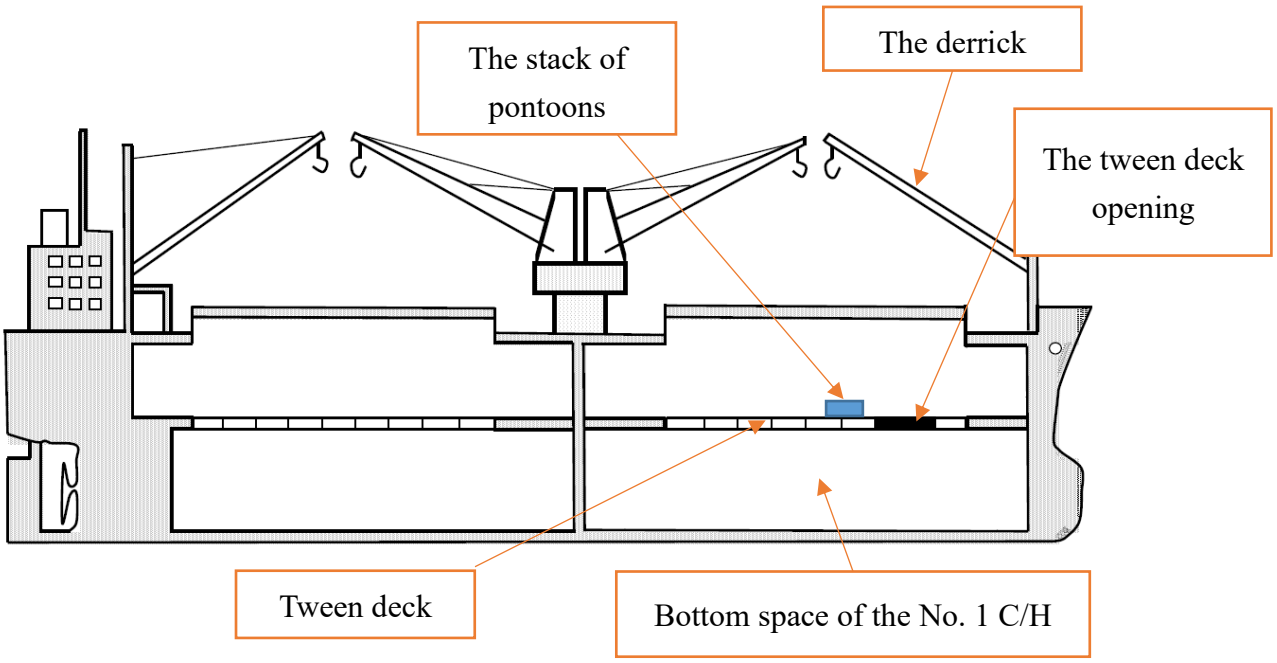

Figure 8 Location of the derrick and the No. 1 C/H

4.10 After substantial repair, the derrick should not be taken into use if it had not been duly tested and examined, which should include retesting by lifting a proof load of about 30 tonnes for SWL of 25 tonnes, according to the following:

(a) "Rules for lifting appliances of ships and offshore installations" published by *the Class*, specified that for the derrick with SWL of 25 tonnes, the proof load should be 29.9 tonnes[1].

(b) Annex 1 of Hong Kong Merchant Shipping Information Note No. 94/2012, specified that for a lifting appliance with SWL of 25 tonnes, the proof load to be used should be at least 30 tonnes.

(c) The maker's manual of the derrick suggested performing retesting by 1.25 times of SWL, which would be 31.25 tonnes.

(d) Chapter 19.5 of the Code of Safe Working Practices for Merchant Seafarers[2] (COP) specified that retesting a lifting appliance with

[1] Paragraph 7.4.1.1 specified the proof load requirement for derricks.

[2] "Code of Safe Working Practices for Merchant Seafarers" is a publication required to be carried on board Hong Kong ships pursuant to the Merchant Shipping (Seafarers) (Code of Safe Working Practices) Regulation (Cap. 478M).

SWL of 25 tonnes should be conducted by using a proof load of 30 tonnes.

4.11 From the above requirements, the contractor using two pontoons of total weight only up to 19 tonnes as a proof load for retesting the derrick was not considered as appropriate since the SWL of the derrick was 25 tonnes.

The company to ensure safe operation of the vessel

4.12 The investigation revealed that the management company had not ensured the safe operation of the derrick for the following findings:

(a) after knowing the working load of the derrick failed to reach the SWL, the management company did not instruct the crew members to stop using the derrick;

(b) upon knowing the problem of the *derrick*, the management company did not communicate effectively with *the Class* and the maker to prepare retesting procedures. As a result, the retesting carried out by the contractor and crew members was in an unplanned manner causing the accident; and

(c) the management company accepted to retest the repaired derrick by weight of less than the proof load of 30 tonnes.

Competence of the contractor to test the derrick

4.13 The investigation revealed also that the contractor was not competent enough to carry out retesting of the derrick for the following findings:

(a) the contractor should be familiar with the maker's manual and instructions to repair and retest the derrick. However, after the repair of the derrick, the contractor used the pontoons as a proof load for retesting. The contractor planned to lift the stack of two pontoons with only about 19 tonnes as the proof load for retesting. The proof load was far less than 30 tonnesas required. Normally a dynamometer could be used to conduct a static test instead of using pontoons. However, dynamometer was not

available in the test which probably indicated that the contractor was not competent enough to carry out the derrick load test;

(b) before summoning the crew members for assistance, the contractor tried to lift the stack of pontoons by using the webbing sling and wire sling but the webbing sling parted leading to a near miss accident. The intention of using incompatible sling to lift the pontoons showing that the contractor was not competent enough on the job; and

(c) after attending on board for the repair, the contractor failed to discuss and agree on a work plan with the crew members for the repair and testing of the derrick. Hence, the ship was unable to arrange crew members with experience of the derrick retesting work (e.g. the officers from the engine department) and gather proper lifting tools for the contractor. If the contractor had sufficient experience to ensure the retesting was well planned for *the testing crew* to follow, the accident would have been avoided.

Preparation for retesting the derrick by the crew members

4.14 The investigation revealed that crew members did not well prepare to assist the contractor in repairing and retesting the derrick thus leading to the accident in view of the following findings:

(a) the contractor commenced to repair the lifting appliances on board since 18 September 2020, but the crew members failed to ensure the establishment of a safe work plan and procedure to facilitate the repair and retesting;

(b) the toolbox talk was not carried out thoroughly to ensure any work plan, safety precautions and hazards involved had been clearly addressed and understood by *the testing crew* with the following evidence:

(i) the toolbox talk was only carried out by the C/O in a rush at 0200 hours on 21 September 2020 to brief *the testing crew* about the job to be performed shortly before the work;

(ii) the contractor used pontoons as the proof load for retesting the derrick. The C/O, the Bosun and *the testing crew* just cooperated on the request and did not ensure that there were established task-based risk assessments for safety before the work. Hence, the associated hazards were not identified and a safe working procedure was not drawn up in the toolbox talk. Eventually, the AB did not receive safety advice on the fatal falling hazard and failed to receive the required personal protective equipment, e.g. safety harness, before staying nearby the tween deck opening ; and

(iii) during the toolbox talk, *the testing crew* did not discuss and prepare the work according to the SMS. The SMS document, QSEP-7.2-ISQ 04 "Instruction for working at height" (*the instruction*), had stated the situation of the work site in the accident as "working on edge" since the pontoons were stacked up creating a tween deck opening in the hold forward. *The instruction* specified that fences or railings should be set up to prevent people from falling into the cargo hold bottom while working in tween deck areas. *The instruction* also stated that a safety harness should be donned and secured at a strong point when required.

At the work site, no fences or railings were set up at the tween deck opening, and none of *the testing crew* had donned a safety harness, i.e. *the instruction* was not followed. Had *the instruction* been discussed and followed accordingly, the accident would have been avoided.

(c) an in-depth pre-work inspection was probably not carried out satisfactorily at the work site before commencing the work. The inability of *the gears*, which was a combination of a small shackle and a lifting wedge, in gripping the stack should be identified before commencing the work (Figure 9). As a substitution, large shackles with lugs were used to grip the pontoon at the bottom of the stack.

The gears had been attached to the wire slings connected to the bottom pontoon through the large shackles and lugs before commencing the lifting. As a result, the wire slings were later

entangled by *the gears* affecting the balance of weight at the four corners of the stack of *pontoons* in lifting. Had an in-depth pre-work inspection been carried out, the hazard of the wire slings being entangled by *the gears* would have been identified. Furthermore, the AB would not have gone close to the tween deck opening to release the entanglement of the wire sling by pulling up *the gears* above the large shackle; and

(d) site supervision to *the testing crew* was inadequate, eventually leading to the accident, as follows:

(i) the C/O was the responsible officer, while the Bosun was the safety supervisor for retesting. However, they were all actively involved in positioning the protection pads for the wire slings. No one was overseeing the entire work; and

(ii) the accident happened at the moment when the AB was standing nearby the un-fenced tween deck opening trying to pull *the gears* above the large shackle to set free the wire sling. Had site supervision been implemented sufficiently, the AB would have been stopped to stand in hazardous location.

Figure 9 *The gears* at each corner of the pontoon

5. Conclusions

5.1 At around 0218 hours on 21 September 2020, a fatal accident happened on board *the vessel* at the port of Changshu, China. The AB fell through the tween deck opening at a height of about 7.3 metres to the bottom of the No.1 C/H. He was sent to a local hospital for medical treatment, but was later declared dead on the same day.

5.2 The investigation identified the following contributory factors:

(a) the management company had not ensured safe operation of *the vessel* by failing to establish a retesting procedure of the derrick identifying safety precautions and duties of the testing team comprising *the contractor* and crew members;

(b) the contractor was not competent enough to retest the derrick;

(c) the crew members did not well prepare to assist the contractor for the repair and retesting of the derrick resulting in the work being carried out in an unplanned manner;

(d) the toolbox talk was not carried out thoroughly to ensure the retesting work plan, safety precautions and the hazards involved being clearly understood by *the testing crew*;

(e) the in-depth pre-work inspection was probably not done satisfactorily at the work site before commencing the work; and

(f) site supervision was inadequate.

6. Recommendations

6.1 The management company should:

(a) review the existing SMS procedures and ensure that standard retesting procedure of lifting appliances was available on board for the crew to follow;

(b) review the existing SMS to ensure the competence of the contractor for the work on board; and

(c) conduct internal audits on *the vessel* to confirm compliance with the SMS requirements in performing key operations including lifting, and working at height.

6.2 The management company should also issue circulars informing all masters, officers and crew members of its fleet of the findings of the investigation, and the lessons learnt from this accident and instruct them to:

(a) accomplish preparation work including the assurance of the establishment of a safe work plan and procedure, the availability of special tools and acceptance standards for the job going to be done by contractors;

(b) carry out a cautious pre-work inspection for identifications and evaluation of the risks inherent particularly in the environment of non-routine work and take effective control measures;

(c) ensure that work plan, safety precautions and hazards involved were fully understood by crew members in toolbox talk before commencing work;

(d) carry out site supervision of all key operations by experienced officers; and

(e) monitor working at height to be carried out strictly according to the SMS.

6.3 A Hong Kong Merchant Shipping Information Note should be issued to promulgate the lessons learnt from this accident.

7. Submission

7.1 The draft investigation report, in its entirety, was sent to the management company and the Master of *the vessel* as well as the Quality Assurance Section of Marine Department for their comments.

7.2 By the end of the consultation, there was no comment received from the above-mentioned parties.