FINAL REPORT

CAPSIZE AND SINKING OF THE AGGREGATES CARRIER CAI JUN 3 IN SINGAPORE TERRITORIAL WATERS ON 13 MARCH 2017

MIB/MAI/CAS.015

Transport Safety Investigation Bureau
Ministry of Transport
Singapore

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The Transport Safety Investigation Bureau

The Transport Safety Investigation Bureau (TSIB) is the air and marine accidents and incidents investigation authority in Singapore. Its mission is to promote aviation and marine safety through the conduct of independent investigations into air and marine accidents and incidents.

TSIB conducts marine safety investigations in accordance with the Casualty Investigation Code under SOLAS Regulation XI-1/6 adopted by the International Maritime Organization (IMO) Resolution MSC 255(84).

The sole objective of TSIB's safety investigations is the prevention of marine accidents and incidents. The safety investigations do not seek to apportion blame or liability. Accordingly, TSIB reports should not be used to assign blame or determine liability.

CONTENTS

SYNOPSIS

On 13 March 2017, Cai Jun 3 (CJ3), a Panama registered aggregates carrier, on completion of her dredging operations, reported to the Singapore Vessel Traffic Information Service (VTIS) of heavy listing to her starboard and requested for assistance. The crew reported that the heavy listing was caused by her suction pipe dropping into the water.

All crew managed to abandon the carrier using a work boat that was installed on-board, and were later rescued. CJ3 subsequently capsized and sank in Singapore Territorial Waters.

The Transport Safety Investigation Bureau (TSIB) classified the occurrence as a Very Serious Marine Casualty.

The investigation revealed that CJ3 was likely making way at a speed of between 4 and 5 knots with her suction pipe not secured in stowed position. The suction pipe was likely to have impacted the shallow sea bed, resulting in an external heeling force that caused CJ3 to heel to starboard. CJ3's subsequent listing was due to a shift of her cargo, which caused progressive flooding of compartments below the waterline as her deck-edge immersed in water.

CJ3 did not observe any speed restriction when the suction pipe was not stowed and secured. In addition, there were indications of an unsafe culture on-board ships operated by the company.

DETAILS OF THE SHIP

Name	Cai Jun 3
IMO number	8667309
Flag	Panama
Classification society[1]	Isthmus Bureau of Shipping[2] (ClassIBS)
ISM[3] RO	Overseas Maritime Certification Services (OMCS)
Ship type	General Cargo Ship - Aggregates Carrier
Construction	Steel
Keel Laid	28 September 2010
Delivery	25 March 2012
Modification	In 2016 (date unknown)
Registered Owner	Boxing Investment Co. Limited
ISM Manager (The Company)	East Sunrise Ship Management Limited
Gross tonnage	9,994
Length overall	139.80m
Moulded beam	22.00m
Moulded depth	10.50m
Draught designed	7.80m
Main engine(s)	Marine Diesel Engine
Total power	Two units x 1617 KW at 825 RPM
Propeller and rudder	Two fixed propellers, and two rudders
Service speed	8 knots[4] in loaded and 10 knots in ballast condition

[1] Also referred to as a Recognised Organisation (RO), which means an organisation that has been assessed by a flag State and has the delegation of authority to perform statutory certification and services on behalf of the flag State.
[2] The International Association of Classification Societies (IACS) consists of twelve marine classification societies headquartered in London. It promotes the safety of life, property and the environment primarily through the establishment and verification of compliance with technical and engineering standards for the design, construction and life-cycle maintenance of ships, offshore units and other marine-related facilities. The class of Isthmus Bureau of Shipping is not an IACS member at the time of the occurrence.
[3] International Management Code for the Safe Operation of Ships and for Pollution Prevention.
[4] The knot is a unit of speed equal to one nautical mile (1.852km) per hour.

1 FACTUAL INFORMATION

All times recorded in this report are in Singapore local time, eight hours ahead of Coordinated Universal Time (UTC). Ship's mean time of Cai Jun 3 (CJ3) was the same as the Singapore local time.

1.1 Sequence of events

1.1.1 At about 1910H on 12 March 2017, CJ3 departed the port of Singapore, bound for Pasir Gudang Port, Malaysia[5]. The ship was owned by Boxing Investment Co. Limited, which had appointed East Sunrise Ship Management Limited (ESSML) as the ISM Manager (the company) to manage[6] its ships, including CJ3.

1.1.2 At about 0243H, on 13 March 2017, CJ3 cleared the Singapore Strait at a speed of about 9.3 knots.

1.1.3 At 0313H, Singapore Vessel Traffic Information Service's (VTIS) AIS track plot showed CJ3 to be in position B (see **Figure 1**) and moving at less than 5 knots. Between 0321H and 0432H, she was moving at about 1 knot in approximate position Latitude 01°25.670' N and Longitude 104°24.519' E (between positions B and C as shown in Figure 1). Thereafter, at about 0452H, she moved further north-east at about 9 knots to positions C, D and E as shown in Figure 1. Her last AIS[7] transmission was at 0524H.

[5] Based on declaration by ship's agent for port clearance.
[6] ESSML assumed the responsibility for operation of the ship from the owner and agreed to take over all duties and responsibilities under the ISM Code in March 2014.
[7] AIS is an automatic tracking system used on ships and by vessel traffic services. AIS is intended to assist a vessel's watch-standing officers and allow maritime authorities to track and monitor vessel movements.

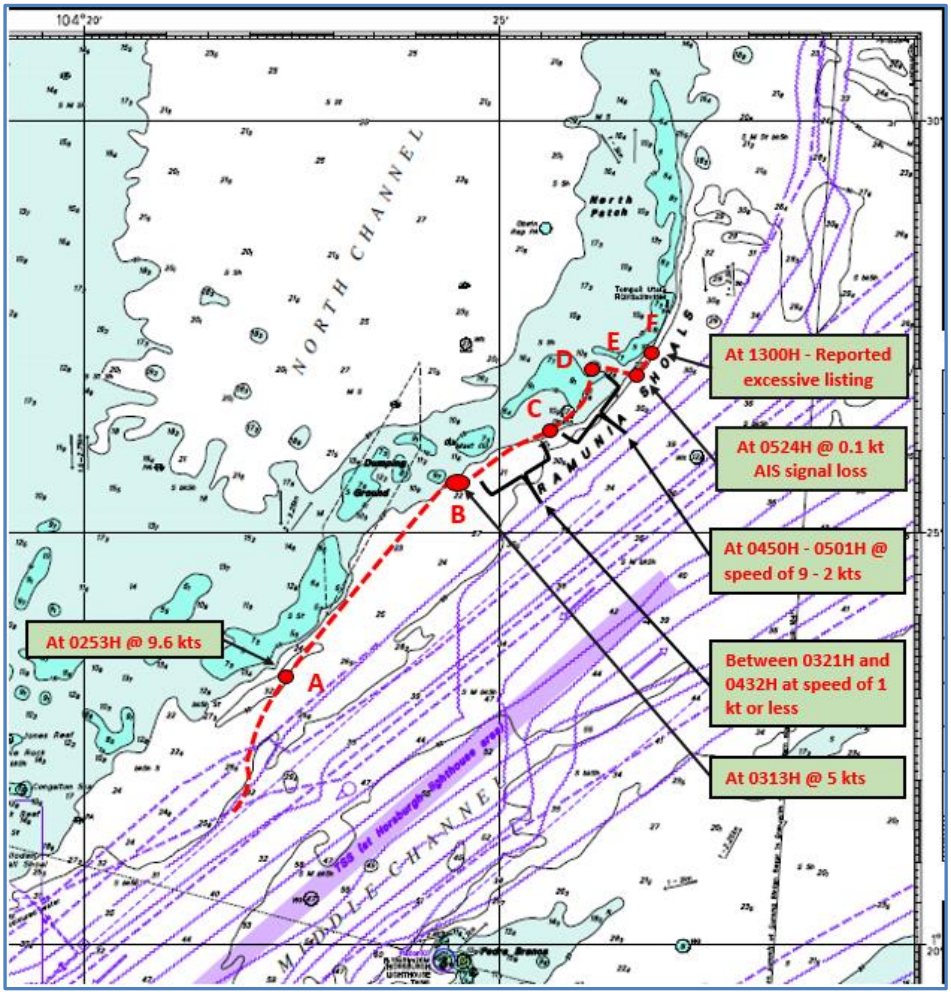

Figure 1 – BA (Dual badge) Chart 503 Ed. 5 annotated to indicate CJ3's passage prior to capsize
(Source: Maritime and Port Authority of Singapore)

1.1.4 According to the Master, around 1200H, CJ3 in loaded condition was moving at about 4 knots with the Master conning[8] the ship and the Second Officer at the helm[9].

1.1.5 The Master said that the suction pipe had suddenly dropped from the main deck into the water. This caused the ship's speed to decrease. The ship rapidly developed a heel[10] of about 40° to the starboard side. The Master fell on the bridge and suffered minor injuries. The Second Officer noted from his position at the helm that the sand cargo had shifted to the starboard side, and the starboard side of the main deck had partially immersed in water.

[8] Conning means taking over control of the vessel's navigation from another officer.
[9] The Master instructed the Second Officer to take helm till a Helmsman came to the bridge.
[10] Heel – The transverse inclination of the ship caused by external forces.

1.1.6 At about 1252H, VTIS (East) received a radio call from CJ3 via VHF channel 10 that she was experiencing excessive list[11] within Singapore Territorial Waters and needed assistance.

1.1.7 At about this time, Cai Jun 2 (CJ2), a sister ship of CJ3, was transiting the Singapore Strait when she heard CJ3's call for assistance. CJ2 informed VTIS on VHF channel 10 of her intention to assist the stricken CJ3, which was about few nautical miles (nm) away from her. VTIS accepted CJ2's offer to assist. CJ2 located CJ3 and relayed CJ3's position to VTIS. VTIS issued navigational safety broadcast for vessels in the vicinity and at the same time informed Singapore's Police Coast Guard (PCG) and the Republic of Singapore Navy.

1.1.8 At about 1337H, CJ2 contacted CJ3 on VHF channel 10 as she was heading towards CJ3's location. CJ3 responded[12] to CJ2 and requested for CJ2 to expedite to where it was, with full speed.

1.1.9 Meanwhile, CJ3's starboard list briefly reduced to about 25°-30°, before increasing again. The Master, in anticipation of worsened conditions, and fearing for his crew's safety, raised the emergency alarm and ordered for CJ3 to be abandoned. The crew panicked on hearing the alarm and went towards the work boat which was initially stowed on CJ3's starboard side at the aft part of the ship, but had slipped off its stowed location into the water. Some of the crew started boarding the work boat directly, while a few others, including the Second Officer, jumped into the sea before boarding the work boat. The Master was the last person to abandon CJ3. He also jumped into the sea before boarding the work boat.

Figure 2 – CJ3 listing on 13 March 2017

(Source: Maritime and Port Authority of Singapore)

[11] List – The transverse inclination caused by unequal distribution of weights on either side of the centre line of the ship.

[12] Communications translated from Chinese, as spoken at that time between the two ships.

1.1.10 All 17 crew members successfully abandoned the ship and boarded the work boat. However, the work boat's engines could not be started and she drifted in the vicinity of CJ3. There was no distress call sent out from CJ3. At about 1345H, a patrol craft from PCG arrived at the incident location to render assistance to CJ3.

1.1.11 Around 1352H, a passing container vessel CMA CGM ZHENG HE sighted CJ3 being aware of VTIS' navigational safety broadcast. CMA CGM ZHENG HE informed VTIS that CJ3 was not at anchor, that she was heavily listing to her starboard side, and that her starboard deck was immersed in water.

1.1.12 At about 1405H, i.e. about one hour from the time of initial listing, CJ3 was seen floating with her bottom hull visible above the water surface (see **Figure 3**) within Singapore Territorial Waters. The suction pipe was seen extending downward at an angle and resting on the ship's bottom. There appeared to be no signs of hull failure.

Figure 3 – Capsized CJ3 on 13 March 2017
(Source: Maritime and Port Authority of Singapore)

1.1.13 By about 1410H, CJ2 arrived near CJ3. The work boat from CJ3 with the 17 crew on-board was side towed by a PCG craft to CJ2 and the 17 crew members boarded CJ2 safely by about 1415H.

1.1.14 At about 1730H, CJ2, with the CJ3 crew on-board, started sailing to the port of Pengerang in Johor, Malaysia, as instructed by the ship's agent in Malaysia. CJ2 reached Pengerang safely at about 2005H.

1.1.15 The CJ3 crew did not return to Singapore to make themselves available for interview by the TSIB investigation team. The ISM Manager did not provide TSIB with access to the CJ3 crew despite repeated requests. The crew also did not provide any statements to the investigation team. The Master, Chief Mate, Second Officer and an Able-bodied Seaman who reportedly assisted the Chief Mate in securing the suction pipe did however, provide their

statements to Protection & Indemnity surveyors and a copy of these statements were shared with the investigation team.

1.1.16 On the next day, 14 March 2017, the capsized CJ3 was still free floating with a small portion of the bottom hull visible above the water surface (see **Figure 4**).

Figure 4 – Capsized CJ3 on 14 March 2017
(Source: Maritime and Port Authority of Singapore)

1.1.17 By about 1155H on 15 March 2017, the capsized CJ3 had sunk, at approximate location Latitude 01°25.915' N and Longitude 104°27.389' E, about 7.8nm NNE of Horsburgh Lighthouse in Singapore Territorial Waters.

1.1.18 The Maritime and Port Authority of Singapore (MPA) installed an Isolated Danger Mark[13] for the safety of navigation. MPA also issued notices on the sunken CJ3 for safety of navigation (see **Figure 5**).

[13] Isolated Danger Mark is a sea mark used to indicate a hazard to shipping, recognisable by its black and red bands and top-mark of two black balls and its distinctive sequence of flashing white light (two quick flashes at an interval of five seconds).

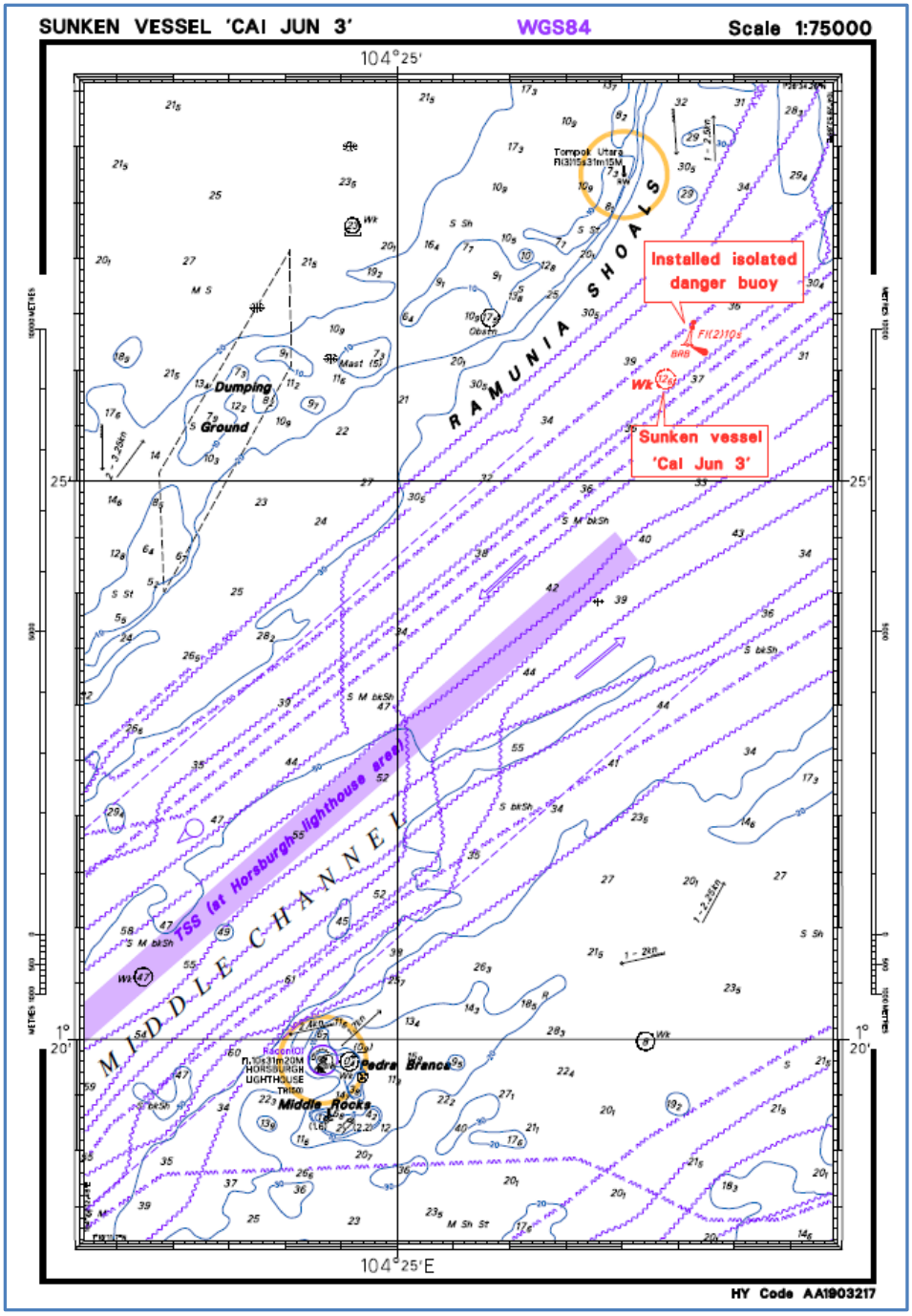

Figure 5 – Sunken CJ3, as marked on Singapore Notices to Mariners, Edition No. 3B/2017 (Source: MPA Hydrographic Department, Singapore)

1.1.19 Underwater survey photographs showed the sunken CJ3 lying on its port side on the sea bed in depth of about 38 metres. The vessel's hull and structure appeared intact.

1.1.20 CJ3 was subsequently declared a total loss by its owner. Her wreck was removed from the site on 11 January 2018.

1.2 CJ3's history

1.2.1 CJ3 was previously called Wan Xiang 799. It was built at Chaohu Yingjiang Shipbuilding in China, and was delivered in March 2012 to its then-owner Boyu Investment Co. Limited. She had three cargo holds and was designed and fitted with a conveyor belt system, giving her the capability to self-discharge sand cargo from the three cargo holds. She had a double bottom hull below the cargo holds, and 12 ballast tanks equally distributed on both sides (see **Figure 6**).

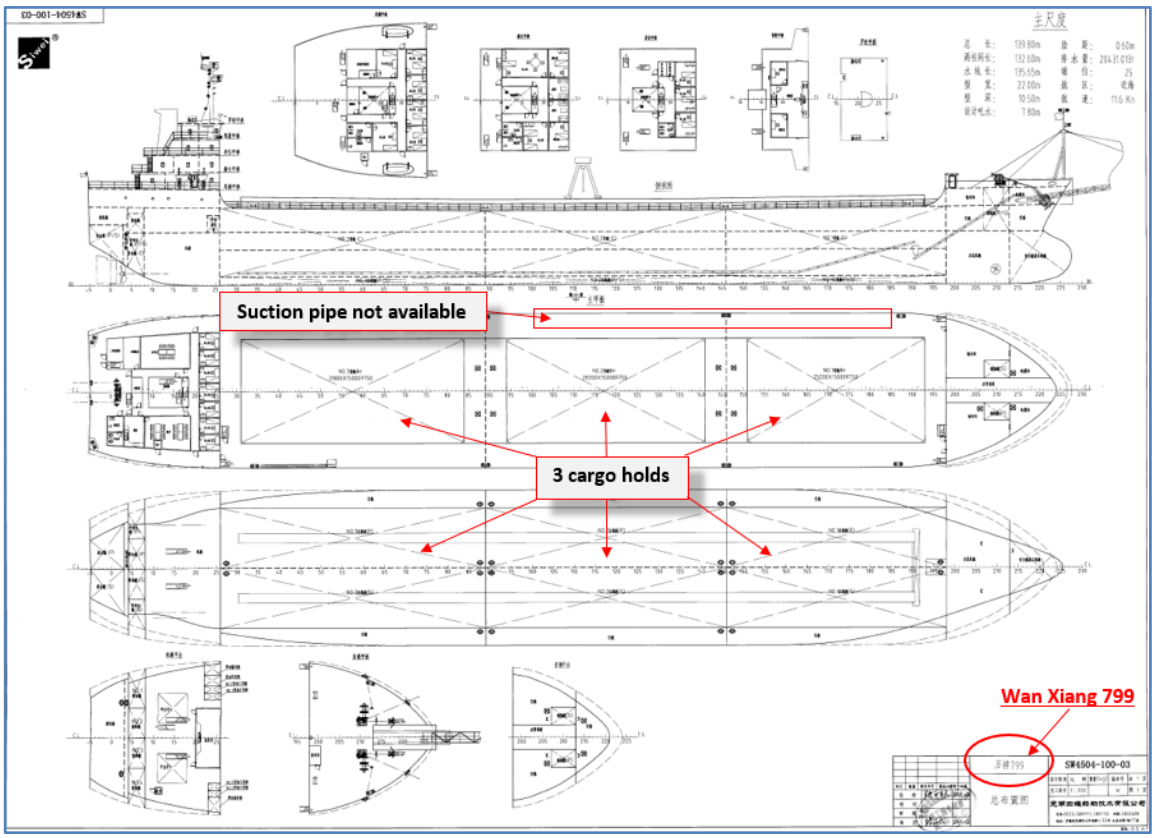

Figure 6 – Plans of Wan Xiang 799
(Source: The ISM Manager)

1.2.2 In 2014, CJ3 was bought over by the current owner, Boxing Investment Co. Limited. She was registered under Panama flag on 13 February 2014 as Cai Jun 3.

1.2.3 CJ3 was initially classed under Overseas Maritime Certification Services (OMCS) for statutory certification matters. Full-term statutory certificates issued by OMCS on 28 September 2015 were valid till 26 May 2020.

1.2.4 CJ3 was to be deployed on international voyages and needed some modifications to be done to the ship to provide her with self-dredging capabilities.

1.2.5 In addition, No. 1 and No. 3 cargo holds were further partitioned by adding a transverse bulkhead in each of them, thus making a total of five cargo holds.

1.2.6 The ISM Manager was unable to provide information of the actual modification[14] date. The ISM Manager could only indicate that CJ3 had undergone modifications at a shipyard in China in 2016 and that the modifications included the installation of a suction pipe on the vessel's port side at the main deck level, davit-like supports and sheaves fitted with steel wires connected to winches to facilitate lifting and lowering of the pipe, and 14 pumps connected to the suction pipe with a capacity of 22 KW each. The pipe was installed at Frames 82 to 203, and was about 72 metres in length with an approximate weight of about 100 metric tonnes (see **Figure 7**). According to the Designated Person Ashore (DPA), the chain links and shackles were new, having been renewed in the last quarter of 2016.

Figure 7 – CJ3's suction pipe, two davit supports and winch wires
(Source: ISM Manager)

1.2.7 According to the Master, the last abandon ship drill[15] was held on 6 March 2017 after a major crew-change had taken place. On his part, the Chief Mate could not recall any abandon ship drill having been conducted since his time on-board. Records of the abandon ship drills, if any had been held, were lost when the ship sank.

[14] This was despite repeated requests to the ISM Manager and the owner to provide the information.
[15] Abandon ship drills were required to be carried out monthly or if a crew-change involving more than 25% of the crew had taken place within 24 hours of leaving port.

1.2.8 In the meantime, there was a change of class from OMCS to ClassIBS. ClassIBS conducted an initial hull and change-of-class survey[16] on 6 February 2017 and, based on Statutory Certificates issued by OMCS, issued CJ3 with interim[17] certificates, valid till 5 July 2017.

1.2.9 During its survey on 6 February 2017, ClassIBS noted that CJ3 had been issued with stability/loading information in the form of a ship stability booklet[18] at the time of the vessel's delivery. ClassIBS was not aware that CJ3 had undergone modification in 2016[19]. The owner had submitted plans and drawings of Cai Jun 5 (CJ5), another sister ship of CJ3, which had five cargo holds, for ClassIBS' reference (see **Figure 8**). However, ClassIBS did not notice that CJ3 stability booklet showed only three cargo holds. ClassIBS issued the interim certificates based on the owner's information that CJ3 and CJ5 had the same plans with regard to cargo holds.

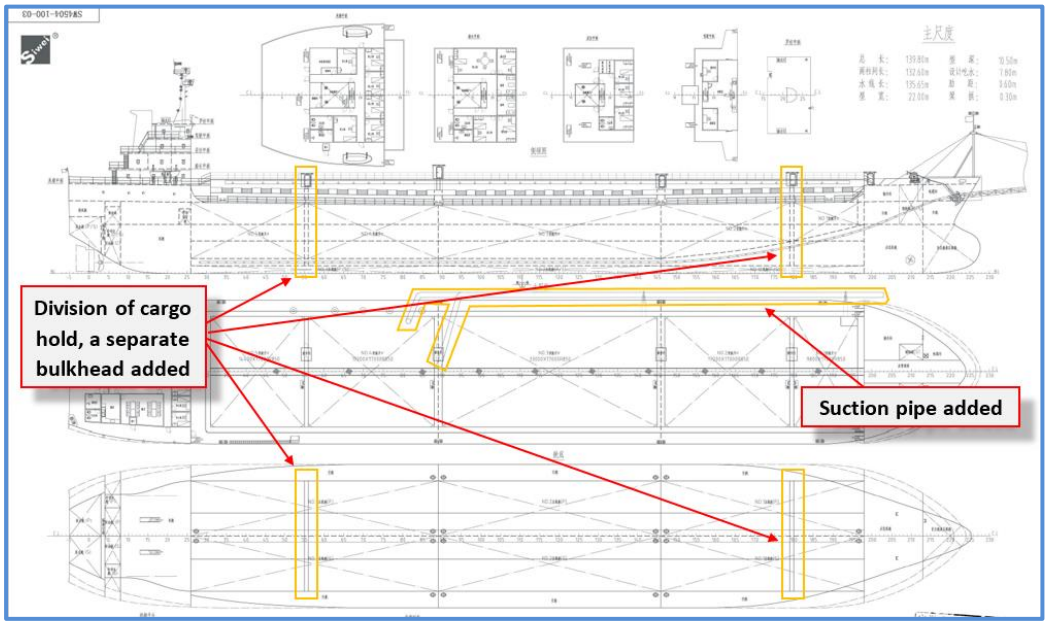

Figure 8 – Plans of CJ3 showing modifications
(Source: ISM Manager)

1.2.10 In early March 2017, the owner deployed CJ3 from home-trade service in China to international voyage.

[16] A Docking Survey Report on the ship's Tail Shaft and Steering Gear Maintenance and Measurement was issued to CJ3 on 10 September 2016.
[17] Short term certificates issued by on-site surveyor pending issuance of full-term certificates by head office. ClassIBS issued Interim certificates such as Loadline certificate, Cargo Ship Safety Construction, Safety Equipment and Safety Radio certificates.
[18] SOLAS II-1 / Reg. 5-1 – Stability information to be supplied to the Master.
[19] Annual Hull Survey Checklist - "1.1 Confirm that no modifications have been made to the ship which would affect the class (any modifications are to be reported overleaf)".

1.3 Statutory certification, navigation and lifesaving equipment

1.3.1 In order to issue full-term certificates, ClassIBS had requested for the ship's owner to submit relevant documents pertaining to CJ3, including the ship's plans and drawings, for verification. At the time of the occurrence, ClassIBS had not received the requested documents.

1.3.2 The ISM Manager, through ClassIBS, had also applied to the Flag Administration for an exemption[20] from SOLAS requirements (see table below), as the vessel was trading in Sea Area A1[21]. At the time of the occurrence, no exemption had yet been granted by the Flag Administration.

S. No	Exemption certificates applied for and pending approval by the Flag Administration
1	SOLAS Reg II-2/.9.2.3.3.1 (Method of protection in accommodation area)
2	SOLAS.Reg.II-2/10.5.1.1 (Fire extinguishing arrangement in machinery space)
3	SOLAS Reg.II-2/10.7.1.1(Fire-extinguishing system for cargo spaces)
4	SOLAS Reg. III./31.1.1.1 (Survival craft - totally enclosed lifeboats complying with requirement 4.6)
5	SOLAS Reg. III/32.3.2.3 (Immersion Suits).
6	SOLAS Reg V/19.2.2.3 & 19.2.3.4 (Bridge navigation watch alarm system BNWAS)
7	SOLAS Reg V/19.2.5.1 (gyro compass)
8	SOLAS V Reg. 20.1 (Voyage Data Recorded VDR).

1.3.3 At the time of the occurrence, the vessel did not have on-board any of the equipment for which exemption was applied. According to ClassIBS, additional measures were taken on board for proceeding on voyages without the relevant equipment, pending the issuance of exemption

[20] SOLAS I / Reg. 4(b) – The *(Flag)* Administration may exempt any ship which embodies features of a novel kind from any of the provisions of chapters II-1, II-2, III and IV of these regulations the application of which might seriously impeded research into the development of such features and their incorporation in ships engaged on international voyages.
SOLAS V / Reg. 3 – The Administration may grant to individual ships exemptions or equivalents of a partial or conditional nature, when any such ship is engaged on a voyage where the maximum distance of the ship from the shore, the length and nature of the voyage, the absence of general navigational hazards, and other conditions affecting safety are such as to render the full application of this chapter unreasonable or unnecessary, provided the Administration has taken into account the effect of such exemptions and equivalents may have upon the safety of all other ships.
[21] Sea Area A1 means an area within the radiotelephone coverage of at least one VHF coast station and in which continuous digital selective calling alerting is available.

certificates by the Flag Administration. However, ClassIBS was unable to make available to the investigation team documentary evidence that would show that these additional measures were implemented.

1.3.4 CJ3's primary means of navigation was through the use of paper charts, as stated on Form 'E' of the interim Safety Equipment Certificate[22]. Paper charts were reportedly provided on-board for passage planning and navigation. According to the ISM Manager, there was an electronic chart on-board which had not been approved for navigation.

1.3.5 An echo sounding device was fitted on-board for measuring the depth of water. A VHF was installed on CJ3 in addition to three two-way VHF radiotelephony portable apparatus.

1.3.6 CJ3 was fitted with an AIS equipment[23] . At the time of the occurrence there was no AIS signal being transmitted from CJ3. According to the ISM manager it was a common practice on-board their dredgers to switch off the AIS[24].

1.3.7 Form 'E' annotated that CJ3 had two open type lifeboats located on each side of the accommodation block, each with a 17-person capacity. The lifeboat on the starboard side was the designated rescue boat. CJ3 was also fitted with two liferafts of 20-person capacity on each side of the ship near to the port and starboard side lifeboat stations. One of them was fitted with davit launching capability. In addition, there was a liferaft of 6-person capacity located at the forward part of the ship. The investigation team was not able to establish the condition of the lifeboats and liferafts at the time of the occurrence[25].

[22] Issued by ClassIBS dated 6 February 2017 and valid till 5 July 2017.
[23] SOLAS V / Reg. 19.2.4.7 – Ships of 300GT and above engaged in international voyages and ships of 500GT and above, even if not engaged in international voyages, shall be fitted with an AIS, which shall be operated taking into account the guidelines adopted by the International Maritime Organisation. Ships fitted with AIS shall maintain AIS in operation at all times except where international agreements, rules or standards provide for the protection of navigational information.
[24] IMO Res. A.917(22) – Guidelines for the on-board operational use of AIS – AIS should always be in operation when the ships are underway or at anchor. If a Master believes that the continual operation of AIS might compromise the safety or security of his/her ship, then AIS may be switched off. However, such action should be recorded in the logbook, together with the reason for doing so.
[25] The crew did not use the lifeboats or liferafts when they abandoned ship. Instead they used an open type work boat. Such a work boat was installed at the shipyard but was not a part of the ship's approved survival craft equipment. According to the ISM Manager, the work boat was used for performing general work, such as checking draught and maintenance work.

1.3.8 CJ3 had not been inspected by any Port State Control authority since being deployed on international voyages. Records of Flag State Control Inspection in the last three years were not available.

1.4 Safety management certification

1.4.1 The ISM Manager was issued with a Document of Compliance (DOC) on 3 March 2014 by OMCS with a validity till 21 October 2018 to operate bulk carriers and other cargo ships. Three annual verification audits had been conducted by OMCS in Guangzhou, China on 2 January 2015, 2 January 2016 and 24 December 2016.

1.4.2 A Safety Management Certificate (SMC) was issued to CJ3 on 25 April 2016 by OMCS with a validity till 25 November 2020.

1.5 CJ3's manning

1.5.1 CJ3 was manned by 17 persons of Chinese nationality at the time of the occurrence. The 17 persons comprised the Master, Chief Mate, Second Officer, Chief Engineer, Able-bodied Seamen (9), Electricians (2), Oiler and Cook.

1.5.2 The Minimum Safe Manning Certificate (MSMC) for worldwide trade issued by the Flag Administration to CJ3 on 28 May 2014 stated the following manning requirements:

Grade/Capacity	Certificate (STCW[26] regulation)	Number of Persons
Master	II/2	One (1)
Chief Mate	II/2	One (1)
Deck Officer	II/1	One (1)
Able-bodied Seamen	II/4	Three (3)
Ordinary Seamen	VI/1	One (1)
Chief Engineer	III/2	One (1)
Second Engineer	III/2	One (1)
Engine Officer	III/1	One (1)
Oiler(s)/Motorman	III/4	Three (3)

[26] 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 sea-going merchant ships.

1.5.3 The Master, age 33, indicated that he had graduated from a maritime college in China in 2005. He had served on CJ5, as Chief Mate for about four months, and signed off in November 2016. He had about 25 months of experience as Chief Mate before he joined CJ5. He joined CJ3 in January 2017 as Master. He had about two months' experience as Master at the time of the accident.

1.5.4 The Chief Mate, age 46, indicated that he had obtained his Chief Mate's Certificate of Competency in 1999 from the Maritime Safety Administration of the People's Republic of China (China MSA)[27]. He joined the current owner in 2012 as Chief Mate. His primary responsibility was to oversee the dredging, loading and discharging operations. He was not on any roster to keep navigational watch but he could be called upon to occasionally relieve the Master or the Second Officer when the ship was navigating. He indicated that he did not know how to perform cargo calculations in respect of free surface effect or metacentric height[28] (GM). He was also not aware of the location of the stability booklet, or his muster station duties as per SOLAS requirements[29].

1.5.5 The Second Officer, age 34, indicated that he had graduated from Dalian Maritime University in China in 2009 and had served about 13 months on ships prior to obtaining his first Certificate of Competency. After serving 19 months as Third Officer, he qualified to serve as Second Officer in 2016. He served in this rank for about nine months on other ships of the same owner. He joined CJ3 on 5 March 2017, about two weeks before the occurrence. His role on CJ3 included maintaining operational condition of the navigational equipment, telecommunication between the ship and the ISM Manager for matters relating to the ship's bunker and store supply, keeping navigational watch and carrying out chart corrections and voyage planning.

1.5.6 The Able-bodied Seaman (AB) who indicated that he had assisted the Chief Mate to secure the suction pipe prior to the accident, age 53, was a fisherman for about 30 years prior to joining merchant vessels at the age of 46. He served mainly on coastal sand dredgers for about seven years and joined CJ3 on 6 March 2017, less than two weeks before the accident.

[27] China MSA is a Chinese Government Authority which administers all matters related to maritime and shipping safety.

[28] GM is a measurement of the initial static stability of a ship. It is calculated as the distance between the centre of gravity of a ship and its metacentre. A larger GM implies greater initial stability against overturning.

[29] SOLAS III / Reg. 8 - Life-saving appliances and arrangements, Regulation 8 - Muster list and emergency instructions.

1.5.7 According to the Flag Administration, none of the crew members including the Master on CJ3 held any certificates[30] or GMDSS[31] licenses issued by them.

1.6 Limited information pertaining to CJ3

1.6.1 An incident report submitted[32] by the Charterer, two days after the capsize, stated that the suction pipe on-board CJ3 had suddenly dropped and fell into the water causing a sudden brake to the vessel and the CJ3 listed to the starboard side; water flowed into the engine room and sand accumulated on the starboard side causing imbalance to the vessel. The report stated that the root cause was identified as poor maintenance of the suction pipe winch and also stated that direct cause was insufficient maintenance, lack of routine inspection and inadequate control and supervision. Evidence to support this report was not made available to the investigation team.

1.6.2 The investigation team attempted to verify the qualifications and experience of the Master, Chief Mate, Second Officer and the AB with China MSA by providing the passport numbers of these seafarers to China MSA. However, China MSA's records could only be retrieved using a seafarer's national identity number. The investigation team was unable to obtain the seafarer's national identity number of the crew from the ISM Manager.

1.6.3 Repeated requests to the ISM Manager, directly and through the Flag Administration, to facilitate interview of CJ3's crew were to no avail. Subsequent reminders sent by the Flag Administration to them were also to no avail. Requests for copies of the company's Safety Management System (SMS) manual for ship operations were also to no avail.

1.6.4 CJ3 sank with the documents and certificates that were on-board, including crew certificates. Despite repeated requests to ISM Manager and the owner, copies of these documents and certificates were not provided to the investigation team.

[30] STCW 95, with amendments – Article 6 – Certificates and Chapter I, Regulation 10 – Recognition of Certificates.

[31] GMDSS - the global maritime distress and safety system. The STCW Convention Chapter IV, Regulation IV/2, provides the mandatory minimum requirements for certification of GMDSS radio operators

[32] There was no incident report from the Owner and ISM Manager.

1.6.5 The investigation team however boarded CJ2[33], a sister ship of CJ3, which was being operated and managed by the ISM Manager. The visit allowed the investigation team to observe CJ2's operational practices, from which CJ3's operational practices could be inferred (see paragraph 1.7). The investigation team was aware that CJ2 had three cargo holds whereas CJ3 initially had three cargo holds but was later modified to contain five cargo holds (see paragraph 1.2.5).

1.6.6 The investigation team was handicapped by a lack of access to information, as well as by incomplete and, at times, limited information provided by the ISM Manager and owners.

1.7 Operations on CJ3

1.7.1 Dredging operation

1.7.1.1 Typically for dredging, the suction pipe would be lowered into the sea using the winches. As the pipe's end neared the sea bed, a pump (capable of being started remotely or locally) would pump seawater through the suction pipe, thus causing the sand and water mixture from the sea bed to be sucked in due to the vacuum[34] created at the end of the pipe (see **Figure 9**).

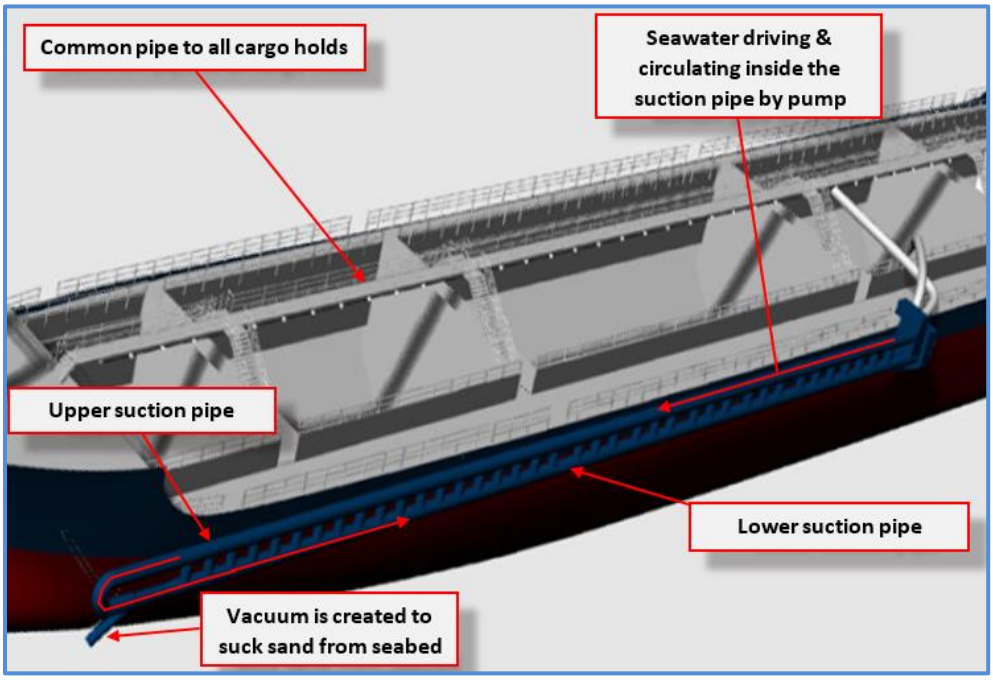

Figure 9 – Illustration of CJ3's suction pipe's working – annotated by TSIB

[33] CJ2 was built at the same shipyard in China as CJ3, and was delivered at the same time as CJ3 to Boyu Investment Co. Limited. She was also bought over by Boxing Investment Co. Limited and was registered under Panama flag and classed under OMCS.
[34] Eductor principle using Venturi effect.

(Source: Brand Marine Consultants)

1.7.1.2 The sand and water mixture would be fed into a common and large-diameter pipe running above and along the length of all cargo holds (see **Figure 10**). The common pipe had distributing header disc valves to discharge the sand and water mixture into the cargo holds.

Figure 10 – Layout of suction system on CJ2 (CJ3's was similar)

1.7.1.3 The deck crew would use these manually operated distributing header disc valves to control the amount of sand and water mixture to be discharged. They would monitor the operation and would open or shut them based on instructions from the Chief Mate. The ship would be considered fully loaded when all cargo holds were almost full and when water flowed out from the overflowing ports[35] (see **Figure 11**) at the main deck level.

[35] CJ2 was provided with eight overflowing ports for each cargo hold which, like the distributing headers, were manually operated disc valves. The ports were located at the main deck and about 1.5 metres below the coaming of the cargo hold.

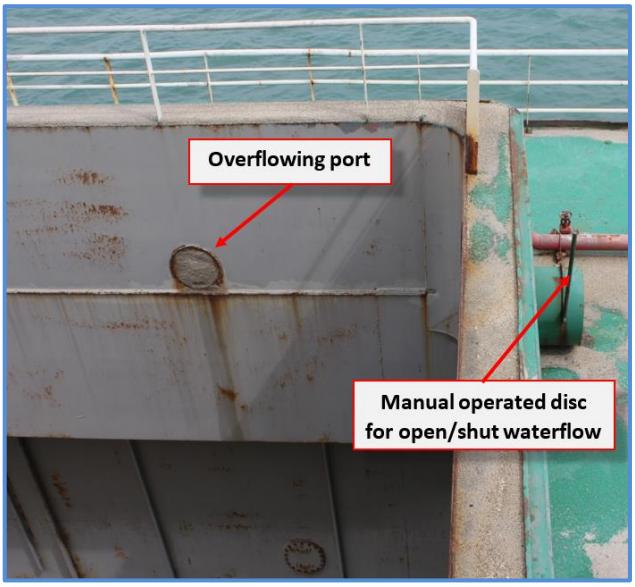

Figure 11 – Overflowing port on CJ2 seen from inside and outside the hold

1.7.1.4 While sand was being loaded into the cargo holds during the dredging operation, the ballast tanks would be emptied of water progressively.

1.7.1.5 CJ3's Master claimed that the ship's stability had been assessed for the previous voyage which was on 10 March 2017. There were usually no cargo quantity measurements or draught surveys done until before discharging the sand. The Master claimed that the ship had a high GM[36] but he could not recall the GM figure. The Master also claimed that there was no need to recalculate the GM as the type and quantity of the cargo did not change.

1.7.1.6 The Chief Mate had the responsibility[37] of performing the stability calculation but had not carried out any stability calculation before. He had assumed that the ship was designed to be able to accept a full load of sand cargo without any stability issues. As mentioned in para 1.5.4, the Chief Mate had not seen any stability booklet on-board CJ3.

1.7.1.7 As also practised on CJ3's sister ships, for dredging, CJ3's Master would navigate the ship and advise the depth of the water to the Chief Mate. Once the ship had slowed down to about 1 knot, the Chief Mate would order the suction pipe to be lowered onto the sea bed. The main deck would typically be between 20-40 metres above the sea bed (depending on the depth of

[36] GM – Metacentric height, is a measurement of the initial static stability of a ship. It is calculated as the distance between the centre of gravity of a ship and its metacentre. A larger GM implies greater initial stability against overturning.
[37] The ISM Manager was not able to provide any documentary evidence in the company's SMS as regards the roles and responsibilities of the key personnel.

water) and the suction pipe, pointing forward, would typically make an angle of 20°-30° with the water surface.

1.7.1.8 After the start of the dredging, the Chief Mate would monitor the status of the dredging by observing the mixture of the sand and water filling up the cargo holds, and instruct the crew to close the distributing header disc valves. He would also advise the Master to adjust the position of the ship if sand could not be sucked up anymore. The ship would typically drift or move at a slow speed of 1 knot or less during the dredging.

1.7.2 Securing of suction pipe

1.7.2.1 Once the dredging operation was completed, the suction pipe would be heaved up by winches and brought up to the deck level. Winch brakes would be applied and a chain link with a D-shackle would be secured to a pad-eye on the suction pipe and connected to the main deck (see **Figure 12**).

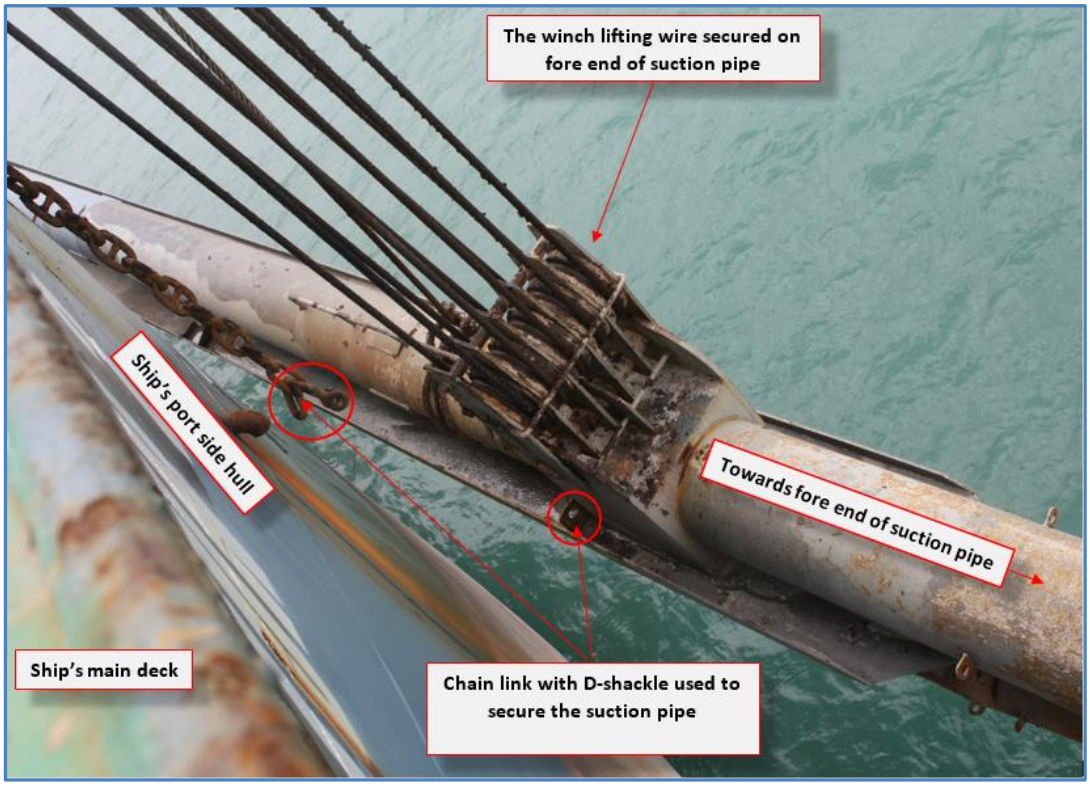

Figure 12 - Suction pipe securing arrangement on CJ2
(CJ2 had one lifting davit support whereas CJ3 had two as seen in Figure 7)

1.7.2.2 The Chief Mate of CJ3 claimed that on the day of the occurrence, he had secured the suction pipe with the assistance of the AB by bringing it up to

deck level and securing it with the chain link and D-shackle. Power to the winches was switched off [38] after securing.

1.7.3 Observed practices on CJ2

1.7.3.1 Although CJ2 carried paper charts on-board for statutory compliance, the ship was fitted with an electronic chart. The electronic chart was used for navigation and passage planning. There was no documentary evidence to indicate that the electronic chart was approved by the Flag Administration.

1.7.3.2 All manual disc valves (see **Figure 13**) on CJ2's main deck was observed to be seized in the shut position preventing water from the cargo holds to drain out. It could not be established since when these valves had been in this condition.

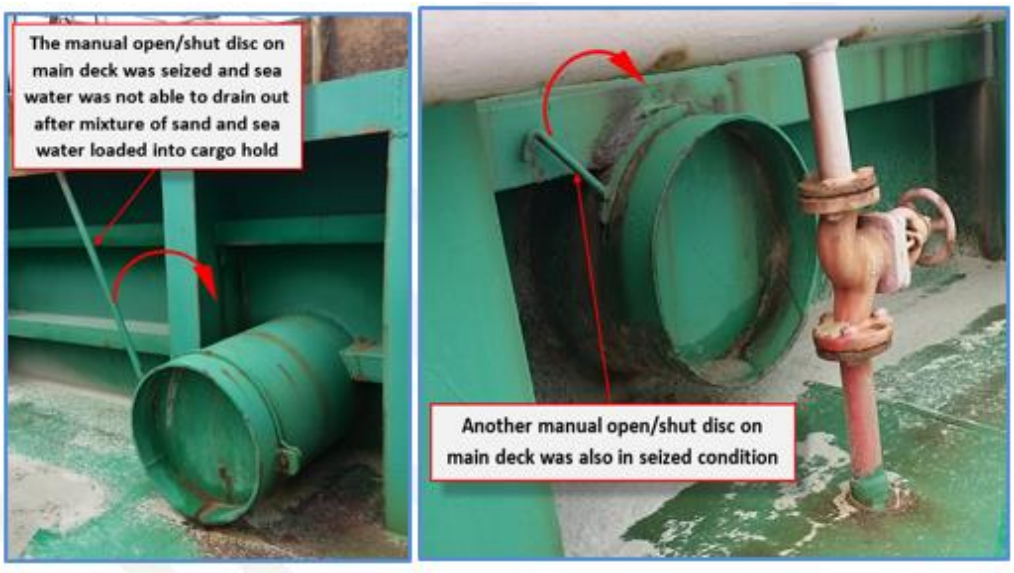

Figure 13 – Manual disc valves on main deck level

1.7.3.3 There were cut-outs observed in the hatch coaming about one metre above CJ2's main deck near the edge of the coaming (see **Figure 14**). These were reportedly to facilitate draining of water from the cargo holds, which would have normally been from the manual disc valves shown in Figure 13. It could not be established when these cut-outs were made.

[38] Winches on-board CJ3, like those on CJ2 had spring loaded brakes as a failsafe. When power to the winches was switched off, the springs would keep the brake pads applied on the brake drum. When power was on, hydraulic pressure would work against the springs to release the brake pad from the drum.

Figure 14 – Manual cut-outs on hatch coaming on all sides

1.7.3.4 The securing chain and shackle for CJ2's suction pipe was rusted (see **Figure 15**). The bolt was engaged to the nut by two to three turns of the bolt thread.

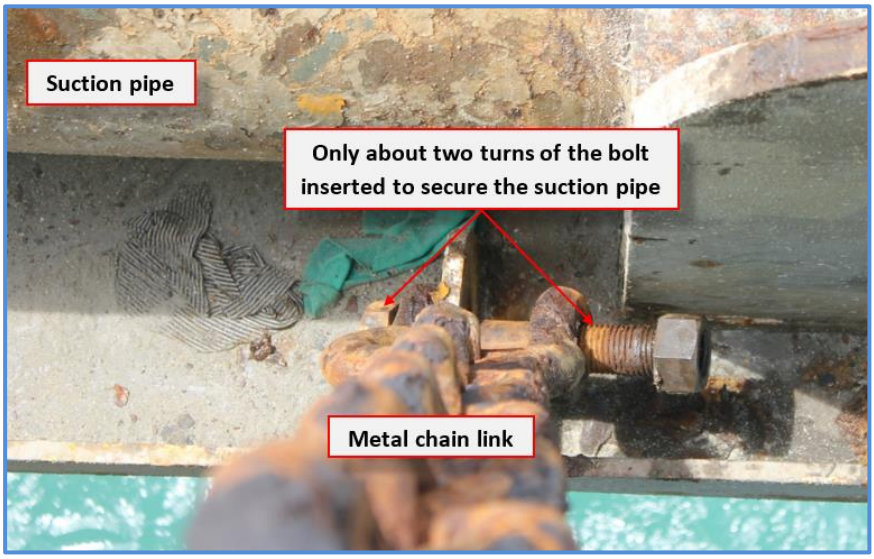

Figure 15 – Chain link from main deck to suction pipe

1.7.3.5 According to its crew, the door for the forecastle store on CJ2 was always lashed in the open position. The door led directly to the forward access to the pumps and hydraulic control space[39], where the hydraulic system for controlling the slats of the conveyor belt system was located (see **Figure 16**). Similarly, the weather tight door at the aft main deck leading to the aft

[39] The pumps and hydraulic control space were below the cargo holds.

access to the pumps and hydraulic systems space was lashed in the open position. Transverse bulkhead doors underneath the cargo holds (below the waterline) were also lashed in the open position.

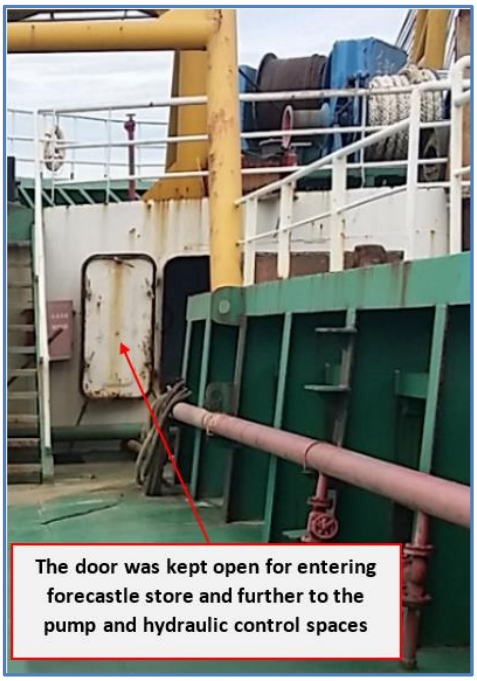

Figure 16 – Weather tight door accessing to forecastle store

1.7.3.6 Both lifeboats on CJ2 were in poor condition (see **Figure 17**). Water was trapped inside. Life vests (non-SOLAS type) were lying around loose. The lifeboats' engines appeared rusty and inoperable. The lifeboat davit hook and boat falls' block were rusty. The port side lifeboat was partially cracked.

Figure 17 – General condition of CJ2's lifeboats

1.7.3.7 CJ2's Chief Mate was not familiar with the dredging operations or ship's stability calculations.

1.7.3.8 CJ2's Chief Engineer did not conduct any atmosphere checks before entering enclosed spaces. Basic personal protective equipment (PPE) such as protective coveralls, safety goggles, safety helmet, safety shoes, safety gloves were not provided to any crew on-board. All crew were seen wearing flip-flop slippers.

1.7.3.9 The bridge was left unattended by the Officer of the Watch while CJ2 was at anchor. It was learnt that this was a normal practice, as was sleeping on the bridge[40] when the ship was at anchor.

1.8 Strength and stability calculations

1.8.1 In the absence of information on the amount of cargo of sand and water on-board CJ3, the investigation team wished to assess whether CJ3 could, with a full cargo, heel and capsize by itself or when subject to an external force. For this purpose, the investigation team engaged Lloyds Register Consultancy Services (LRCS) to carry out calculations to help in the analysis as detailed in paragraph 2.2.

1.8.2 It was also noted that the suction pipe was heavily deformed (see **Figure 18**). This suggested that it had been subjected to substantial loads. Calculations by LRCS suggested that the impact force along the longitudinal axis of the suction pipe was of the order of 10000-32000 kN[41].

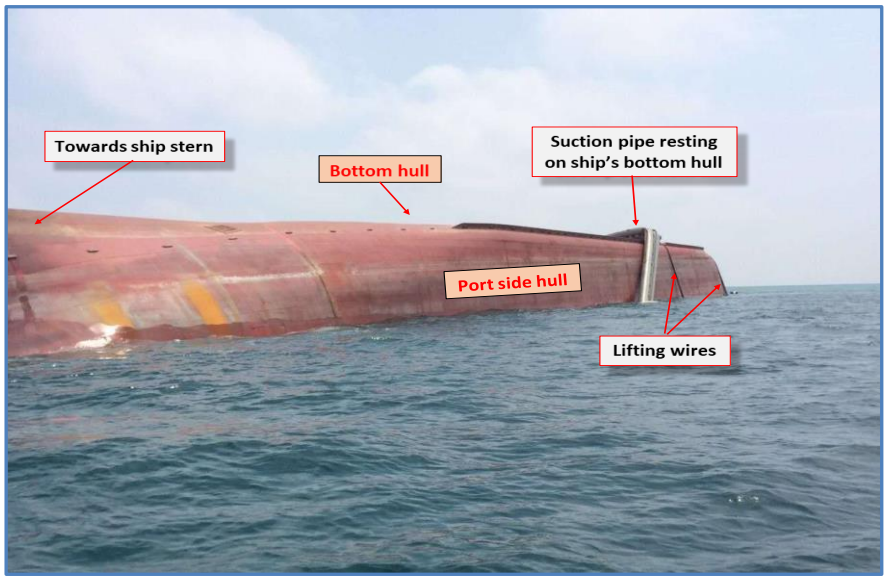

Figure 18 – Close-up photograph annotated by TSIB indicating bent suction pipe (Source: Maritime and Port Authority of Singapore)

[40] A straw mat and blanket were seen on the bridge.
[41] LRCS' impact force calculations assumed the following:

- A forward momentum after the impact, as the ship was still being propelled by its propeller
- Ship's speed of 4-5 knots (Master's statement mentioned that CJ3 was about 4 knots prior to the incident)
- The suction pipe contacting the sea bed at a dredging angle of 20-30°
- A stopping distance of 2-4 metres

1.9 Environmental condition

1.9.1 At the time of the accident, the weather was fair, visibility was good, and the sky partly cloudy. The wind was light and the sea was calm.

1.9.2 The area (circled **in Figure 19**) where CJ3 heeled had depth contours of 30 metres, 20 metres and 10 metres. Shallow patches existed in the area within the 10 metre contour. The shallowest being about 8 metres.

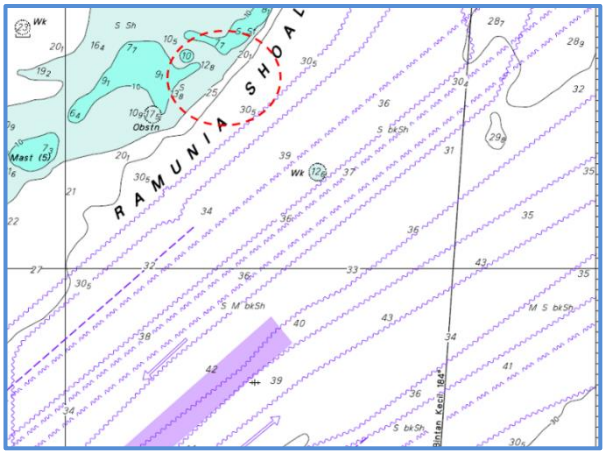

Figure 19 – BA (Dual badge) Chart 502 Ed. 5,
Red dash circled to indicate possible location of heel and capsize
(Source: Maritime and Port Authority of Singapore)

2 ANALYSIS

The analysis addresses the following aspects:

(a) Securing of the suction pipe
(b) The listing and capsize
(c) CJ3's manning and competency
(d) Abandoning of ship
(e) Effectiveness of surveys and Flag State inspections
(f) Safety culture on sister ship CJ2

2.1 Securing of the suction pipe

2.1.1 The Chief Mate and AB claimed that the suction pipe had been secured (see paragraph 1.7.2.2) and power to the winch switched off. The Master and Charterer claimed that the suction pipe had suddenly dropped from the main deck into the water (see paragraph 1.1.5 and 1.6.1). The Charterer further attributed the cause of this to be insufficient maintenance of the wires and winch.

2.1.2 The suction pipe was to be secured by a system of chain links and shackles (see paragraph 1.7.2). These chains and shackles were renewed recently. In order for a secured (if secured) suction pipe to drop, the following failure(s) would have to take place:

- Failure of the chain links
- Failure of the shackles
- Failure of the winch wires
- Failure of the winch brakes (which could lead to a slackening of winch wires, as the wires would be unevenly tensioned)

2.1.3 If the power to the winches was turned off, then the hydraulic pressure acting on the drum, as a failsafe (see 1.7.2.2), would not allow the winches to turn causing slackening of the wires and lowering of the pipe if it was not secured with the shackles. The wires suspending the suction pipe from the winch appeared intact and taut when the vessel was seen in the heeled position (see **Figure 20**).

Figure 20 – CJ3 listing to her starboard side
(Source: Maritime and Port Authority of Singapore)

2.1.4 Securing the suction pipe for sea is a critical operation and it is expected to be executed properly under the supervision of an appropriate officer. However, the ISM Manager was not able to provide evidence of clear procedures from their SMS as to how the securing task was to be executed and supervised, to ensure that the suction pipe was secured when the ship was making way. It was also not clear whether the ISM Manager had any speed restrictions for the ship while the suction pipe was not stowed and secured.

2.1.5 The investigation team did not receive evidence to suggest or support that the wires used for supporting the suction pipe had failed, causing it to drop into the water suddenly. As such, the suction pipe was unlikely to be secured in stowed position, contrary to what was claimed by the Master, Charterer and the crew.

2.2 The listing and capsize

2.2.1 Given that it was highly unlikely that the suction pipe had dropped suddenly into the water, the investigation team investigated on the belief that the ship was travelling, possibly between 4-5 knots, with the suction pipe not in its stowed position.

2.2.2 The investigation team explored a hypothesis concerning the listing and capsizing of CJ3 with the following sequence:

(a) The ship was moving in a shallow area and the suction pipe hit the sea bed at an angle of about 20°-30°. The length of the suction pipe was about 72 metres. At an angle of 20°-30°, the vertical height of the pipe would be roughly between 24 metres and 36 metres. Deducting the freeboard[42] from this height, the vertical height of the pipe below water would be about 21-33 metres. The area where CJ3 likely was could be as shallow as 8 metres (see paragraph1.9.2). Therefore, it is probable that the suction pipe, could have hit the sea bed (see **Figure 21**) at this depth. A contributing factor could be that the Master did not have the assistance of other officers in checking the paper charts or to advise him on the status of the ship with respect to the surrounding waters, considering that he was probably navigating the ship with limited resources.

(b) The suction pipe's impact with the sea bed likely resulted in forces acting in an upward direction resulting in a "grounding effect[43]", causing a disruption to the original hydrostatic equilibrium and initiating a heel to starboard. Although a righting moment would allow the ship to return to its upright position, the ship did not return freely to an upright position due to the pipe being "grounded".

[42] Based on CJ3's particulars and an almost full load condition, it is estimated that her freeboard would be about 3 metres.

[43] The ship, with the suction pipe, was in effect grounded. A grounded ship does not float freely by her own buoyancy. In this case, part of the ship's weight is supported by the suction pipe and part by sea water.

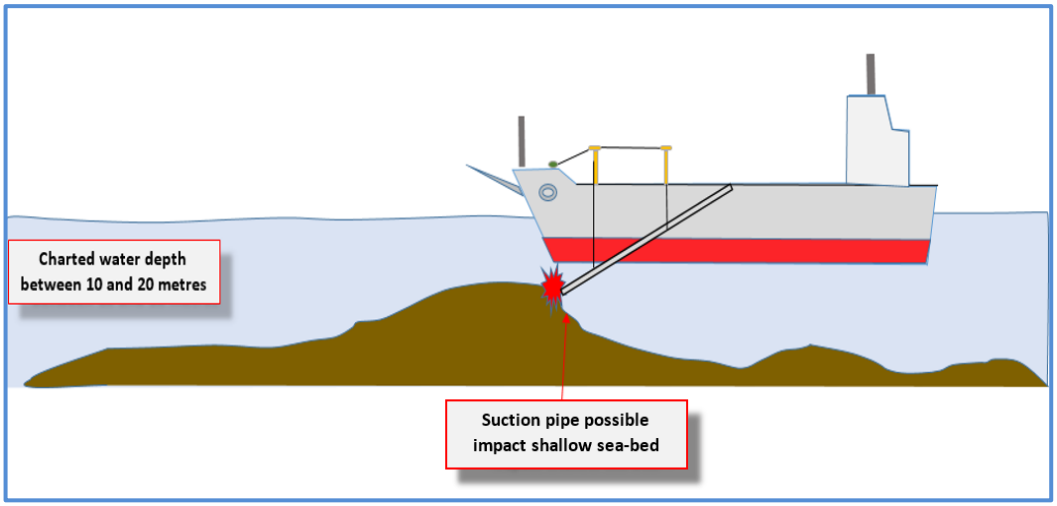

Figure 21 – Illustration of the suction pipe contacting the sea bed
(Not to scale)

(c) The impact force on the suction pipe was substantial (see paragraph 1.8.2). This force would cause the ship to swerve towards the port side. The swerving to the port side would result in a centrifugal force due to the turning about the pipe and cause a rolling motion to the starboard (see **Figure 22**). This rolling to the starboard would in turn induce the cargo of sand and water to shift in the same direction and aggravate further heeling to starboard.

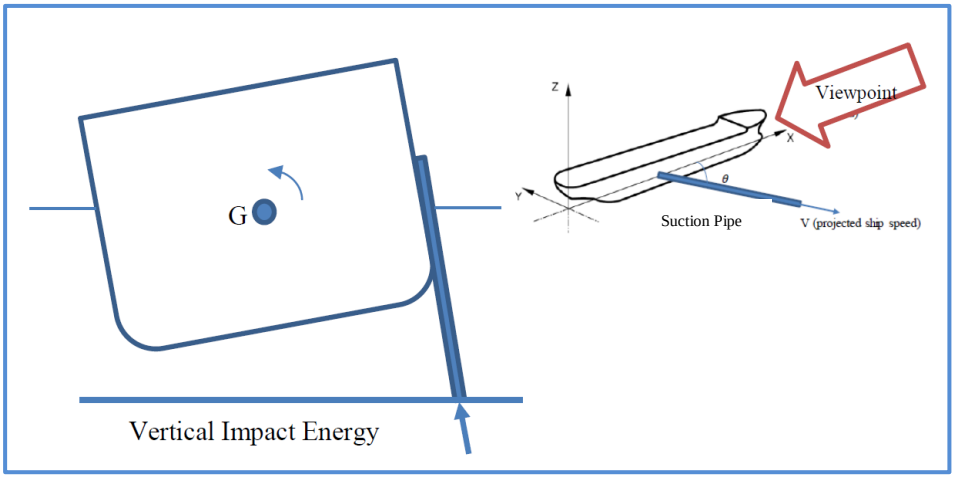

Figure 22 – Schematic illustration of heeling moment
(Source: Lloyds Register Consultancy Services)

(d) Cargo shifting could be dangerous at large angles as it may induce further cargo shifts in combination with possible flooding of openings at the reduced freeboard height on the listed side[44].

[44] LRCS' calculations showed that the shifting of the cargo (sand and water mixture) alone would not have resulted in the heeling of the ship and would have to be occasioned by an external force.

2.2.3 Based on CJ3's particulars and an almost full load condition, it is estimated that her freeboard would be about 3 metres and the deck would start to become wet at a list angle of about 14°. Seawater would reach openings that are 1 metre above the deck level at a heel angle of 20°. This would result in ingress of seawater in the compartments if the doors to these compartments were not closed.

2.2.4 The ship had reportedly tilted rapidly to 40° to the starboard side at the time of the occurrence. Judging by the operational practices on CJ2, the investigation team also has reason to believe that CJ3's doors, at least those to the forecastle store and pump space, were not closed. It is therefore probable that seawater had entered the ship to cause progressive flooding prior to the 40° heel. Again, judging by the operational practices on CJ2, doors in the cargo holds in the transverse bulkheads spaces below the water line were likely to have been open, which could contribute to the flooding of the spaces below the water line and further affect the ship's stability.

2.2.5 Thus, the discussion in paragraph 2.2.3 supports the hypothesis with regard to the sequence of CJ3's heavy listing and capsize as outlined in paragraph 2.2.2.

2.2.6 Nevertheless, the investigation team also examined the following possibilities but considered them unlikely to cause such heavy list to her starboard side and subsequently capsized:

(a) Hard over helm with full vessel's speed and in nearly fully loaded condition – the crew statements related to CJ3's passage did not indicate a situation where a hard over helm was needed or executed prior to its capsize.
(b) Uncontrolled de-ballasting from one side – the crew statements did not indicate any activity on concurrent de-ballasting which could have affected CJ3's stability at the time of the incident.
(c) Loss of engine power while hard over helm to starboard side - the crew statements did not indicate a situation where a loss of engine could have occurred.
(d) Steering failure – there was no indication of steering failure or difficulties by the crew prior to the incident.
(e) Suction pipe dropping and hanging vertically without touching the sea bed while vessel was making way – with the suction pipe hanging vertically, during an impact with seabed or obstacle underwater, the sand pipe would have been moved backwards while the ship was making way. In addition, the hypothesis of stability calculation did not establish a force large enough to heel the ship to 40° in such a situation.

2.3 CJ3's manning and competency

2.3.1 Based on CJ3's crew list dated 12 March 2017, the number of crew on-board were as required by the Minimum Safe Manning document issued to CJ3 by the Flag Administration on 26 May 2016. It is likely that CJ3's officers and crew were not properly certificated for the positions that they were engaged on-board.

2.3.2 The Chief Mate was in charge of the sand dredging and discharging operation and had sailed on aggregates carriers for a period of about 5 years as a Chief Mate. The Chief Mate had also admitted that he did not possess basic knowledge about a ship's stability or know how to ensure the ship met its stability requirements. The Chief Mate, responsible for the stability of CJ3, did not know the location of the stability booklet and hence was not able to know if the stability booklet had been updated to reflect the actual cargo hold configuration. Without such knowledge, it was unlikely that the Chief Mate could provide the Master with the stability information of CJ3.

2.3.3 The crew likely knew that the electronic chart on-board was not an approved equipment for navigation. Their reliance on an unapproved equipment reflected a disregard for the ship's safety[45].

2.3.4 Although guidelines by IMO recognise that the Master can exercise his discretion to turn off the AIS if its continued transmission impacts the safety/security of his ship, there was no evidence to suggest that the circumstances[46] in this occurrence required the AIS to be turned off. CJ3's logbook could not be sighted[47] to verify the reasons for switching off the AIS. However, it is noted that turning off the AIS did not contribute to the occurrence.

2.4 Abandoning ship

2.4.1 After the Master sounded the emergency alarm signal and ordered to abandon ship, the ship's crew panicked and abandoned CJ3 by boarding a non-approved work boat without donning any lifejackets. The work boat's engine could not be started.

[45] Using unapproved electronic chart is a hazard to safe navigation as the chart might not have been systematically updated. It could not be established whether the electronic chart in use reflected the shallow depth of 8 metres where CJ 3 was navigating with its suction pipe down.
[46] The ISM Manager could not also provide a valid safety /security reason for the AIS to be turned off on their fleet of vessels.
[47] The sister vessel CJ2 was also not able to present any supporting documentary evidence when their AIS had been switched off.

2.4.2 The Master claimed that the last abandon ship drill was held on 6 March 2017, when a major crew change had taken place. The Chief Mate, however, claimed that no such drill had been conducted. It was likely that the crew of CJ3 were not familiar with the assigned emergency duties as required for by the SOLAS III/Reg. 19, provisions of ISM Code Chapter 6 regarding familiarisation of duties.

2.4.3 Due to the lack of information regarding the ISM Manager's SMS, it could not be established if the SMS catered for emergency response procedures, as required by ISM Code.

2.5 Effectiveness of surveys and Flag State inspections

2.5.1 At the time of the occurrence, CJ3 was in possession of a Navigation Provisional Registry Certificate issued by the Flag Administration which was valid till 31 December 2017.

2.5.2 CJ3 was classed under ClassIBS and held interim (short term) statutory certificates issued on 6 February 2017, which were based on previous certificates by OMCS. Full term statutory certificate issuance on behalf of the Flag Administration was pending and subject to additional documentation submission by the ship owner.

2.5.3 During the change-of-class survey, the ship owner submitted to ClassIBS the plans of a sister ship (CJ5), which had reportedly the same layout as CJ3. ClassIBS was not aware during the initial hull survey of any modifications that CJ3 had undergone. Tonnage Certificate issued by OMCS and Interim Loadline Certificate by ClassIBS indicated that the ship had three cargo holds, but this was missed by ClassIBS.

2.5.4 It was likely that ClassIBS had not cross-checked [48] the submitted plans of CJ5 with the previous certificates issued for CJ3. ClassIBS was waiting for CJ3's plans to be submitted for the purpose of issuing full term certificates and the vessel was allowed to trade in the interim period.

2.5.5 This occurrence revealed gaps in ClassIBS' processes, although these did not directly contribute to the accident. The Flag Administration would need to review ClassIBS' processes with a view of ensuring that the approval process for a ship to change class to ClassIBS and ClassIBS' subsequent

[48] This discrepancy of three cargo holds could have been picked up by the ClassIBS surveyor during the initial hull survey. The attending surveyor claimed that there was no indication of ship structure modifications on CJ3 at the time of survey request made by ship owner.

issuance of certification on behalf of the Flag Administration would not rely heavily on the ship owner's self-declarations[49].

2.6 Safety culture on sister ship CJ2

2.6.1 The undesired operational practices observed on-board CJ2 (see paragraph 1.7.3) could be prevalent on CJ3 and other aggregates carriers in the owner's fleet. Lapses such as leaving doors lashed in the open position and poor maintenance could well have been present on CJ3, and could have contributed to the ingress of seawater when CJ3 was heeled.

2.6.2 Attempts to understand how the SMS catered for various elements of the ISM Code, such as the following, were to no avail due to lack of information:

(a) ensuring that qualified personnel operate the ships in accordance with national and international requirements, procedures, plans and instructions for key shipboard operations;
(b) definition of tasks qualified personnel; and
(c) maintenance of the ship and equipment.

2.6.3 While it is understandable that SMS auditing is often performed on a sampling basis, this occurrence nevertheless showed up gaps and inadequacies in the ISM Manager's SMS.

[49] Cross checking of the ship's actual condition with the certificates issued, interviewing the Master, reviewing the ship's Stability Calculation Booklet, International Tonnage Certificate issued by the OMCS.

3 CONCLUSIONS

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

3.1 CJ3 was likely making way at a speed of between 4 and 5 knots with her suction pipe not secured in stowed position.

3.2 CJ3 developed a heavy heeling likely as a result of her suction pipe impacting the sea bed.

3.3 The force acting on CJ3 as a result of the suction pipe impacting the sea bed was likely to have caused the cargo of sand and water on-board to shift in the same direction of the heeling and aggravated further listing to the starboard.

3.4 The heeling of CJ3, with a likely full load condition and a low freeboard, could have also resulted in the ingress of seawater and resulted in the flooding of compartments if the doors to these compartments were not closed, as found in the sister ship CJ2. The flooding of compartments could have further aggravated the listing of CJ3.

3.5 There appeared to be no speed restriction when the vessel was making way with the suction pipe not stowed and secured. In addition, the Master could have been navigating CJ3 with limited resources, as he was not advised on the status of the ship with respect to the surrounding waters, which was as shallow as 8m.

3.6 It is likely that CJ3's officers and crew were not properly certificated for the positions that they were engaged on-board.

3.7 Although not directly contributing to the capsize of CJ3, the investigation revealed some findings that reflected the ineffective implementation of the Safety Management System:

(a) The stability booklet on CJ3 was likely an outdated version which did not take into account the modification of cargo holds from three to five. The master was likely not provided with stability information[50] on the actual cargo hold configuration to the satisfaction of the Flag Administration. This information would have enabled him to obtain

[50] SOLAS 74 II/5.1, as amended – Stability information to be supplied to the Master.

accurate guidance on the stability of the ship under varying conditions of service.

(b) The company was not able to provide documentary evidence to support that CJ3 was manned by qualified persons.

(c) Based on the observation of CJ2, there could have been issues with the safety culture on-board the ships operated by the company.

3.8 An additional finding which did not contribute to the occurrence:

(a) The Flag Administration's approved Recognised Organisation likely did not conduct thorough checks on the plans and documents submitted by the ship owner prior to issuing the interim statutory certificates.

4 SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety action was initiated by the ISM Manager.

4.1 Following the accident, the ISM Manager implemented the following preventive measures:

(a) Details about the accident were shared with other aggregates carriers of its fleet.

(b) All sister ships of CJ3 were instructed to fully secure the suction pipe to the stowage position with additional chain and D-shackle.

5 SAFETY RECOMMENDATIONS

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

5.1 For East Sunrise Ship Management Limited (ISM Manager of CJ3):

5.1.1 To establish clear procedures in the SMS for ensuring that the suction pipe is properly secured when ships are making way. **[TSIB-RM-2018-13]**

5.1.2 To review the SMS to impose speed restrictions for ships when suction pipe is not in a stowed position. **[TSIB-RM-2018-14]**

5.1.3 To review the SMS to ensure effective monitoring of the implementation of SMS as per ISM Code. **[TSIB-RM-2018-15]**

5.2 For Recognised Organisation

5.2.1 Class IBS as the RO, to review its internal processes for change-of-class to ensure that plans and documents submitted by ships that have been surveyed are thoroughly checked before issuance of certificates on behalf of the Flag Administration **[TSIB-RM-2018-16]**

5.3 For the Flag Administration:

5.3.1 To require the ISM Manager to review its SMS to ensure clear procedures for ensuring that the suction pipe is properly secured and speed restrictions are imposed when pipe is not stowed or secured**. [TSIB-RM-2018-17]**

5.3.2 To require the ISM Manager to review its SMS to ensure effective monitoring of the implementation of SMS as per ISM Code. **[TSIB-RM-2018-18]**

5.3.3 To require the ISM Manager to ensure that qualified and certified crew are engaged on its flagged ships. **[TSIB-RM-2018-19]**

5.3.4 To require ClassIBS, as the RO, to review its internal processes for change-of-class to ensure that plans and documents submitted by ships that have been surveyed are thoroughly checked before the issuance of certificates on behalf of the Flag Administration. **[TSIB-RM-2018-20]**

- End of Report -