FINAL REPORT

CREW FATALITY
ON BOARD GENERAL CARGO SHIP
KOTA BAKAT AT
SAO TOME AND PRINCIPE ANCHORAGE
ON 25 JUNE 2018

MIB/MAI/CAS.046

Transport Safety Investigation Bureau
Ministry of Transport
Singapore

13 December 2019

The Transport Safety Investigation Bureau of Singapore

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).

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SYNOPSIS

On 25 June 2018, the Singapore registered general cargo ship, Kota Bakat, was discharging containers at Sao Tome and Principe anchorage onto a lighter barge using the ship's cargo crane. A fully automatic twistlock was stuck in between a 20-foot (20') container and a 40-foot (40') container on deck. The Bosun was performing a gas-cutting task on the stuck twistlock to free it.

In attempting to free up the stuck twistlock, the 20' container swung out and hit an unsuspecting Able Seafarer Deck (ASD) who was in the vicinity, causing fatal injuries. The 20' container was connected to the 40' container above which was attached to taut lifting chains of the cargo crane at the time of the occurrence.

The Transport Safety Investigation Bureau classified the occurrence as Very Serious Marine Casualty and launched a marine safety investigation.

The investigation revealed that the lifting force acting on the containers had compromised the integrity of the corroded locking edges resulting in the 20' container to break away. There was a lack of task planning and risk assessment to free up the stuck twistlock by the ship's crew. There was also a lack of effective communication between the ship's and shore personnel.

The investigation also revealed that there was lack of clear guidance in the company's safety management system for senior officers to prepare ship and operation specific standing instructions relating to cargo operations.

DETAILS OF THE SHIP

Name	Kota Bakat
IMO Number	9593684
Flag	Singapore
Classification society	Lloyds Register (LR) / Nippon Kaiji Kyokai (ClassNK)[1]
Ship type	General cargo ship (multi-purpose carrier)
Hull	Steel
Delivery	2012
Owners	PSI (2) Pte Ltd
Operators / ISM[2] Managers	Pacific International Lines (Pte) Limited
Charterers	Niledutch Belgium
Gross tonnage	18,189
Length overall	161.33m
Moulded breadth	27.40m
Moulded depth	13.50m
Summer draft	9.815m
Cargo onboard	General cargo in bulk and in containers

Kota Bakat
(*Photo source*: Shipspotting.com)

[1] ClassNK was for carrying out ISM audit and issuance of ISM related certificates.
[2] International management code for the safe operation of ships and for pollution prevention.

1 FACTUAL INFORMATION

All times used in this report are ship's time, which was one hour ahead of the UTC (UTC + 1H), unless otherwise stated.

1.1 Sequence of events

1.1.1 On 22 June 2018, at about 0630H, the Singapore registered general cargo ship, Kota Bakat (KB), arrived at Sao Tome and Principe anchorage[3] (see **Figure 1**) for a routine discharge of containers. She was riding to her port anchor with 9-shackles[4] in the water. The ship was exposed to the sea conditions and cargo discharge operations took place at the anchorage with lighter barges tied up alongside KB.

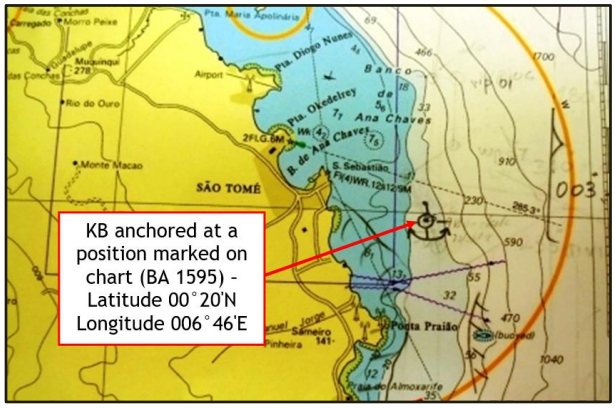

Figure 1 - KB's anchored position marked on chart in use by the ship (*photo source*: the ISM Manager)

1.1.2 On 25 June 2018, the cargo was being discharged to a lighter barge which had been moored to KB's port side. KB's no.3 cargo crane was in use and being operated by a shore stevedore with the assistance of several stevedores and a shore foreman who was signalling for the discharging operations.

1.1.3 At about 1000H, when discharging the containers at bay 34, one of four fully automatic twistlocks used to lock the containers[5] got stuck and could not be removed (see Paragraph 1.5 on the description of automatic and manual

[3] The anchorage is within the port area used for cargo loading/discharging by lighters.

[4] The anchor cable was at about 250m in length in the water.

[5] The twistlock was a part of container lashing system, and the stuck one was used to lock two containers one above another at positions of 34 00 84 and 33 00 82. The 40' container (34 00 84) was loaded at a port in Europe, and had a cargo weight of 8.1 metric tonnes (mt). The 20' container underneath was also a laden container, secured with two manual twistlocks on the hatch cover and had a weight of about 9mt.

twistlocks). The three remaining fully automatic twistlocks could be unlocked and removed. The crane operator (stevedore) tried to lift up the 40' container (position of 34 00 84[6]) located on the second tier a few times, using the ship's cargo crane in an attempt to free up the stuck twistlock, but was unsuccessful. The duty watchkeeping officer (Third Officer[7]) noticed that the crane operator had some difficulty in discharging the container at that bay, and proceeded to the location from a nearby bay to find out what had happened.

1.1.4 The Third Officer noted that a twistlock was stuck between the containers, and sought the assistance of an Able Seafarer Deck[8] (ASD1), who was on duty with him to clear the stuck twistlock. The discharge of cargo was suspended temporarily.

1.1.5 The ASD1 brought a set of tools[9] and a portable ladder to the cross deck between bay 30 and bay 34. The ladder was placed against the top frame edge of the first tier 20' container (33 01 82) just beside the stuck twistlock. The crane's hook held the container lifting chains (four chains) attached to the 40' container in a taut condition while ASD1 tried to free up the stuck twistlock several times using the set of tools. The Chief Officer and Master were not made aware[10] of the problem with the stuck twistlock and the suspension of the cargo operations.

1.1.6 By about 1130H, another Able Seafarer Deck[11] (ASD2, the deceased) had come on deck for his watch (due to start at 1200H) and to relieve ASD1. ASD1 handed over to ASD2 and informed the Bosun[12] about the stuck twistlock. The Bosun went on deck and also tried using the same tools to free up the twistlock.

1.1.7 At about 1200H, the Second Officer[13] came on deck to relieve the Third Officer for cargo watch duty. The Third Officer handed over his watch to the Second Officer and explained to him about the stuck twistlock at bay 34.

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[6] The 6-digit number is used for identifying a container stowage location: 34 - bay, 00 - row, 84 - tier.

[7] He kept 0600H-1200H & 1800H-2400H cargo watches in port.

[8] He kept the 0600-1200H and 1800-2400H cargo watches in port.

[9] He was asked to bring a crowbar, a hammer, a chisel and a spike.

[10] Chief Officer's night orders signed by all deck officers amongst other things, stated *"any doubts regarding the operation shall be brought to the attention of the Chief Officer and Master immediately"*. The night orders required officers to observe Master's and Chief Officer's standing orders for cargo operations and port watch. While the Chief Officer's standing was not available, the Master's standing orders were generic and did not contain specific circumstances under which the Chief Officer was to be called.

[11] The deceased, he kept the 1200-1800H and 0000-0600H cargo watches in port.

[12] He was a day worker, had no watchkeeping duties.

[13] He kept 1200H-1800H & 0000H-0600H cargo watches in port.

1.1.8 At about 1205H, the Third Officer went for lunch and met the Chief Officer[14] in the mess room. He informed the Chief Officer about the problem regarding the stuck twistlock and that the cargo discharge had been temporarily suspended.

1.1.9 The Chief Officer went on deck immediately and enquired about the use of 'emergency tool'[15] for clearing the stuck twistlock. The Bosun subsequently brought the emergency tool (see Paragraph 1.5.6 and Figure 9) to bay 34 and inserted it into the corner casting eye of the 20' container (33 00 82) where the stuck twistlock was located.

1.1.10 The Chief Officer instructed the shore foreman and the shore cargo supervisor to secure (lock) the forward port side of the 40' container with one twistlock (manual locking type[16]) which was locked to 20' container (33 00 82), and similarly to secure the aft of the same container with two twistlocks for both port and starboard side[17] which were locked to another 20' container (35 00 82) (see **Figure 2**). Once satisfied that the three twistlocks had been manually locked in place, the Second Officer was instructed to inform the shore foreman to lift up the 40' container to check if the stuck twistlock had been freed up.

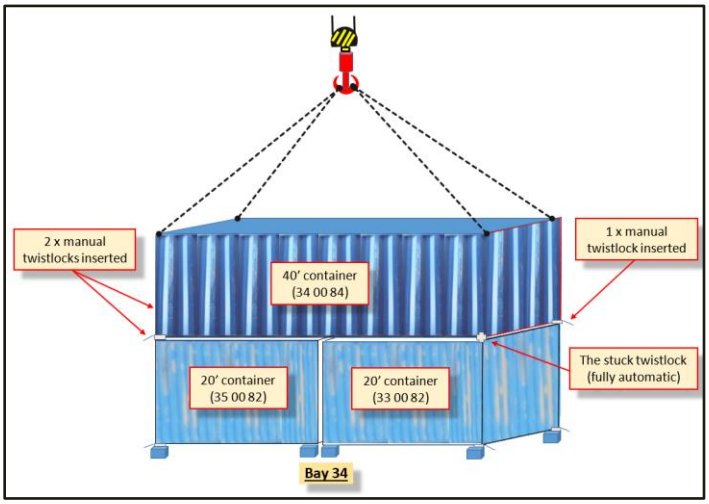

Figure 2 - Illustration of the twistlocks used before gas-cutting

[14] Responsible to the Master for the effective administration and supervision of the work, duties and responsibilities of the deck officers and deck crew. He was also responsible for cargo handling operations onboard and other duties such as taking measures against occurrence of cargo accidents (stated in the company's procedures Chapter 14.2 and Chapter 3.8). He kept 0400H-0800H & 1600H-2000H watch at sea and was being a day worker in port.

[15] A special tool designed by the manufacturer of the twistlock for manually unlocking the twistlock if its internal parts get stuck.

[16] This type of twistlock was used at first tier on deck to manually lock the container onto the hatch cover or ship's raised structure.

[17] To prevent accidental lifting of the 40' container while the stuck twistlock was being freed.

1.1.11 While attempting to free up the stuck twistlock, the emergency tool was continuously being adjusted to find the right position for unlocking, to no avail.

1.1.12 After a brief discussion with the ship's crew at the site. the Chief Officer then made a decision to use gas cutting equipment to free the stuck twistlock. The Bosun was tasked to prepare the gas cutting equipment and was assisted by ASD2. The Chief Officer instructed the Second Officer to check the loading bay plan for the surrounding areas and whether there was any dangerous cargo loaded. All combustible materials were also instructed to be cleared away. An Ordinary Seaman[18] (OS) was tasked to bring a water hose and a bucket of water to the working site in case of fire breakout.

1.1.13 While preparations were being done for the hot work to commence, the Chief Officer informed the shore foreman not to lift up the 40' container until further clearance from himself or his duty officer. The lifting chains were still kept taut.

1.1.14 At about 1245H, the Bosun took the gas cutting torch and went up the portable ladder (three to four steps) next to the stuck twistlock, and started to cut the inner latch of the twistlock (see **Figure 3**).

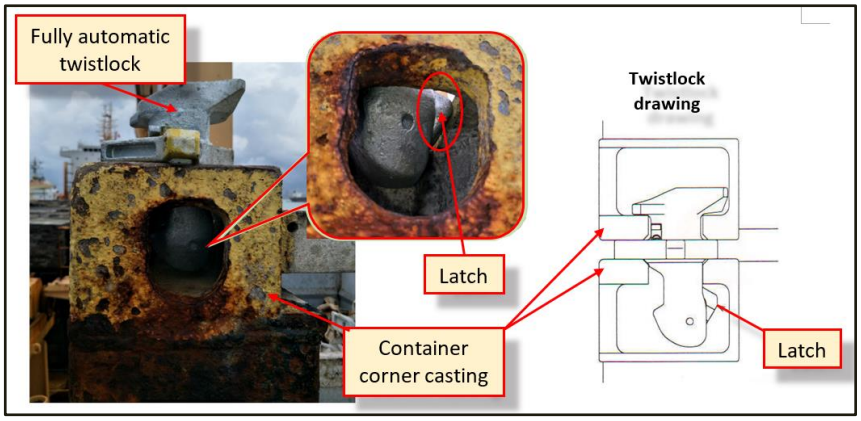

Figure 3 – Illustration of the twistlock and part to be cut off with the gas torch
(Photo taken on a sister ship "Kota Bakti")

1.1.15 ASD2 was assisting the Bosun and was last seen standing at the cross deck on the port side about 5m away from the Bosun. The Second Officer was standing on top of the first tier container at bay 30 (forward of the Bosun) and was monitoring the cutting progress. Few stevedores and the shore foreman were also in the vicinity (see **Figure 4A** and **4B**). The Chief Officer was with the shore cargo supervisor and stood at the aft of bay 34.

[18] He kept 1200H-1800H & 0000H-0600H watches in port.

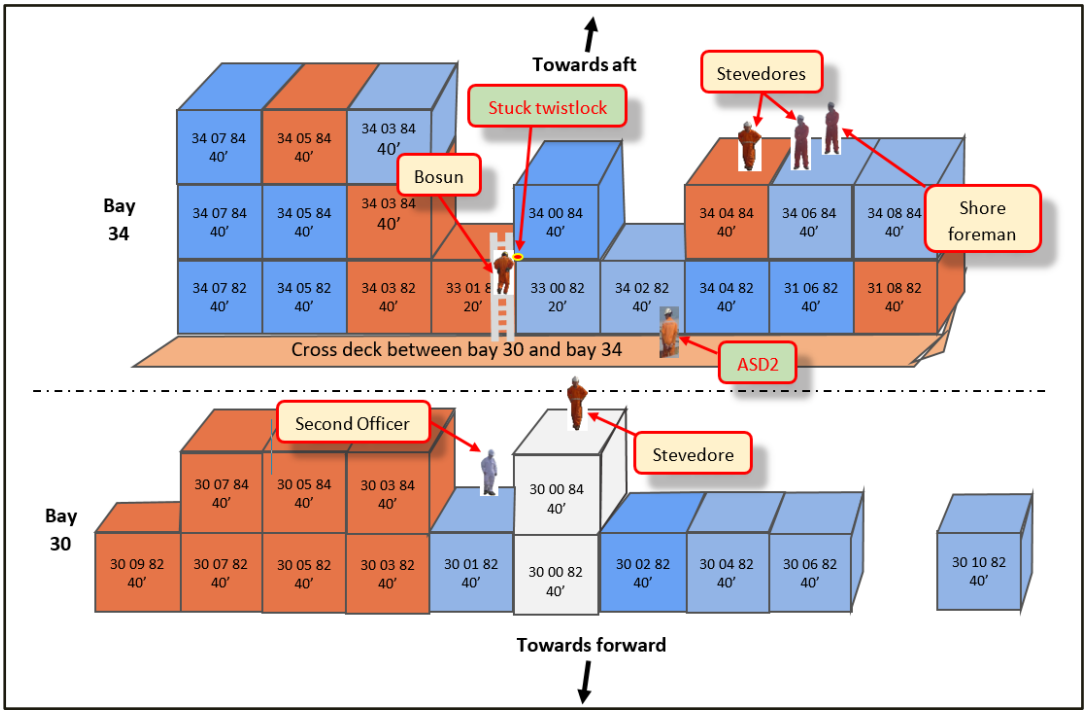

Figure 4A – Positions of relevant personnel prior to the accident
(not to scale, side view for illustration purpose)

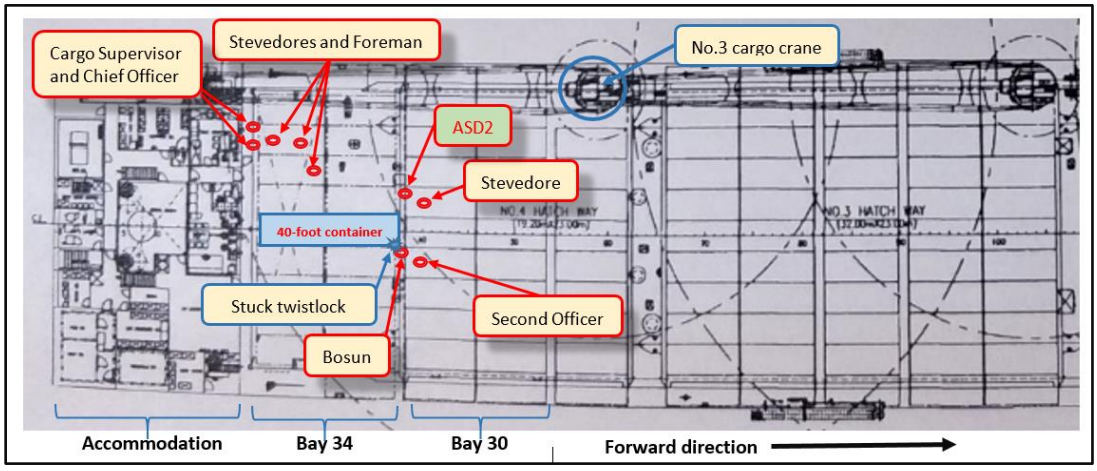

Figure 4B – Plan view of positions of relevant personnel
(not to scale, for illustration purpose)

1.1.16 While the Bosun was cutting the stuck twistlock, the Chief Officer received a call from the Master on the walkie-talkie, asking his whereabouts.

1.1.17 The Chief Officer responded that he was at bay 34 on deck to clear a stuck twistlock. The Master asked him to go to the ship's office for a discussion on ballast water operation. The Chief Officer recalled reminding the shore cargo supervisor (standing next to him) and the shore foreman (standing on the

second tier container at the bay 34 on the port side) not to lift up the container without permission from himself or his duty officer. He then went back into the ship's office inside accommodation. There was no other discussion between Chief Officer and the Second Officer. The Second Officer was not actively involved in directing the crew and stevedores.

1.1.18 At about 1300H, according to the Bosun he was almost at the end of finishing the cutting of the stuck twistlock. All of a sudden, the 40' container (34 00 84) jerked and came out of the stowed position together with the forward 20' container (33 00 82)[19]. The Bosun instantly jumped off the ladder and suffered some minor injuries to his left elbow.

1.1.19 The 20' container hit the unsuspecting ASD2 (who was in the vicinity) and crushed his upper body against the port side frame of another 40' container (30 00 82) located one bay forward (see **Figure 5**).

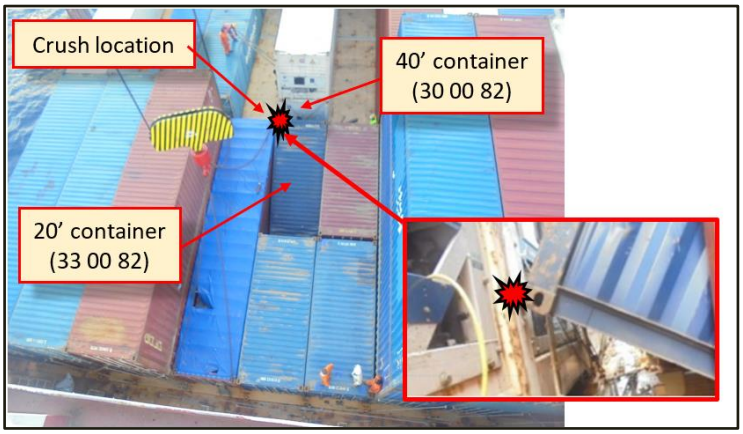

Figure 5 – Top view of accident site after removal of the 40' container (34 00 84). Inset shows the location where the ASD2 was crushed.
(*Photo source:* the ISM Manager)

1.1.20 The crew on-site saw that the frame of the 20' container struck ASD2 in the upper part of the torso and the head. An immediate assessment by the ship's crew showed ASD2 had passed away on the spot.

1.2 The ship

1.2.1 KB was a double hull multi-purpose carrier for the carriage of a wide range of

[19] Almost at the same time, the two manual twistlocks at the bottom of the 20' container (33 00 82) came out from the locking slots of the hatch cover, causing the 20' container to swing in the forward direction.

cargo such as containers[20] and general solid bulk cargo and was capable of loading and discharging containers and other type of heavy lift cargo, on deck and under deck. At the time of arrival at Sao Tome and Principe anchorage, she was loaded with 131 TEU[21] containers, about 1200mt of general cargo and 8500mt of malting barley bulk cargo.

1.2.2 She was constructed with four cargo holds, and fitted with three cargo cranes installed on the deck edge at the port side. At the time of accident, only no.3 cargo crane was in use.

1.2.3 Apart from the cargo holds, the ship was fitted with structural posts (see **Figure 6**) athwartship on deck after the last cargo hold to create an additional container bay for additional loading capacity. This would allow stowing of 20' containers as bay 33 and bay 35 or 40' containers as bay 34.

Figure 6 - View of the structural posts and the incident 20' container
(*Photo source:* the ISM Manager)

1.2.4 The 20' container (33 00 82) that struck the ASD2 was stowed at bay 33, and was secured with two manual locking twistlocks at the forward end at the bottom onto the hatch cover. Due to the limited space available for access, twistlocks for securing that container at the aft end were available but did not lock the container. The stuck twistlock preventing the discharge of the 40' container was above the 20' container at bay 34.

[20] Due to the nature of the trade and port of calls for KB, containers would be carried together with other general cargoes at the same time. At other times, the vessel would carry only general cargo without any containers.
[21] Twenty-foot equivalent unit.

1.3 The crew

1.3.1 At the time of the accident, 21 crew of different nationalities employed by the company (ship's Operator / ISM Manager) were on board. All crew held valid STCW[22] competency certificates required for their respective positions held on board. The working language on board was English.

1.3.2 The qualification and experience of the Master, relevant officers and crew members are tabulated below:

Designation onboard	Nationality	Age	Qualification	Duration onboard (month)	Experience on this type of ship (month)	In rank service (month)	Service in company (Year)
Master	Bangladeshi	57	COC – Master	3.5	35.4	145.3	34.3
Chief Officer	Chinese	32	COC – Chief Officer	1.5	8.3	1.5	3.6
Second Officer	Srilankan	40	COC – Chief Officer	0.8	5.8	41.5	5.1
Third Officer	Chinese	26	COC – Second Officer	3.5	12.5	31.1	4.8
Bosun	Srilankan	34	Deck Rating per STCW	5.0	17.0	68.2	13.6
ASD1	Srilankan	43		9.2	9.2	64.8	5.4
ASD2	**Myanmar**	**30**		**3.5**	**10.2**	**42.9**	**3.6**
OS	Myanmar	34		< 1	< 1	< 1	< 1

1.3.3 The Master had been with this company since 1984 when he joined as a deck cadet. He sailed on KB once, which was a year ago in 2017.

1.3.4 The Chief Officer joined the company as Second Officer in 2014. He had served once on a similar type of ship in the company. KB was his first ship as Chief Officer after his promotion.

1.3.5 KB was the Second Officer's fourth contract in the company, and this was the second time he had served on this type of ship.

1.3.6 The Third Officer, having mostly sailed on container ships had once worked on a similar type of ship as KB.

1.3.7 The Bosun had, prior to KB, sailed on three ships of the same type. He had an in-service experience in performing gas-cutting and welding jobs on board. He

[22] 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.

had undergone STCW training for his position[23]. The company had scheduled some of the crew to undergo formal training in batches so that hot work could be performed by deck crew as the need arose. The Bosun was scheduled to attend a course on gas-cutting and welding after his contract on KB. At the time of occurrence, KB had qualified[24] crew in the engine room for performing gas-cutting and welding tasks, but they had not been called on that day for doing this task.

1.3.8 The ASD2's (deceased) medical records indicated all check-ups including eye sight and hearing test were normal. Assessment of fitness for service at sea indicated that he was fit for deck service without any restriction and he had not been prescribed any medication. His medical certificate for service at sea was issued on 31 January 2018 and had a 2-year validity.

1.3.9 Based on the company's training record, ASD2 had been through various training between December 2016 and January 2018, such as risk assessment and management, crane simulator training, personal safety onboard, use of personal protective equipment, permit to work system and behaviour based safety.

1.3.10 ASD2 was wearing his personal protective equipment while he was on duty which comprised of safety helmet and shoes. Prior to the accident, there was no communication between him and other persons (ship's crew and shore workers) at the site, when the Bosun started cutting of the stuck twistlock till the accident occurred.

1.3.11 The OS was not at the scene as he was tasked to take a freshwater hose and to bring a bucket of water for the hot work involved in the cutting of the stuck twistlock.

1.3.12 According to KB's records, all officers and crew met the STCW and MLC[25] requirements concerning the hours of work and rest. The investigation team was also not made aware of any fatigue related issues on board, i.e. all ship's personnel had adequate rest in the period preceding the accident.

[23] The STCW allows deck ratings at support level (same qualification held by the Bosun) to perform a task on board using general hand and power tools like wrench, chisel brush, electric tools like drilling and bench grinding machine, portable electric tool like air driven type of needle hammer and grinder, and additional tools like centre punch and cutting disk *(Source: IMO model course 7.10 function 4 – Maintenance and repair at support level)*.

[24] STCW convention, Chapter II, Table A-II/5, function of maintenance and repair at the support level.

[25] MLC - the Maritime Labour Convention, 2006.

1.4 The midstream cargo operation

1.4.1 Due to the water depth limitation at the berth, the discharging of cargo was facilitated by the provision of a lighter barge which would come alongside the mother ship (KB in this case) at the outer anchorage within port waters. The lighter barges would then carry the lightered cargo to the berth for further delivery. This was a routine operation at this berth. KB had been to this port many times in the past and had been through this type of operation for the past few days.

1.4.2 Operation of the ship's cargo crane[26] was usually performed by the port stevedores customarily arranged by the ship's charterers through a local stevedoring company. A shore foreman acted as the signalling man and several stevedores on deck would typically assist the crane operator for hooking and unhooking of the containers and other cargo matters.

1.4.3 The communication between the crane operator and the signalling man (i.e. the shore foreman in this case) was using hand signals, and there was no portable radio being used at the time of accident. There was no particular control[27] of communication for discharging operation amongst the stevedores, i.e. apart from the foreman, other stevedores would also communicate with each other and the crane operator using hand signals.

1.5 The cargo securing devices on board

1.5.1 According to the approved cargo securing manual, there were two types of twistlocks on KB for securing the containers loaded on deck.

1.5.2 One of them was the manual locking twistlock, which was fixed by sliding it into a welded track on the hatch cover or on the raised structural posts. This type of twistlock was for securing the first tier containers onto the ship's hatch cover or the ship's raised structural post. Sliding the handle manually to either side would lock or unlock the twistlock (see **Figure 7**). The breaking load of this type of twistlock was 50 ton (tension).

[26] Unlike a lifting by a gantry crane, the limitations of using a ship's crane would be that the cargo operations need to be carried out with extra care to ensure the lifting up of the container is done vertically and not at an angle.

[27] The crew commented that as the visual view of the signalling man would occasionally be blocked by the ship's structure or cargo, stevedores in the vicinity would voluntarily provide hand signals and shout loudly in their own native language to the crane operator, and the crane operator would act upon those signals accordingly.

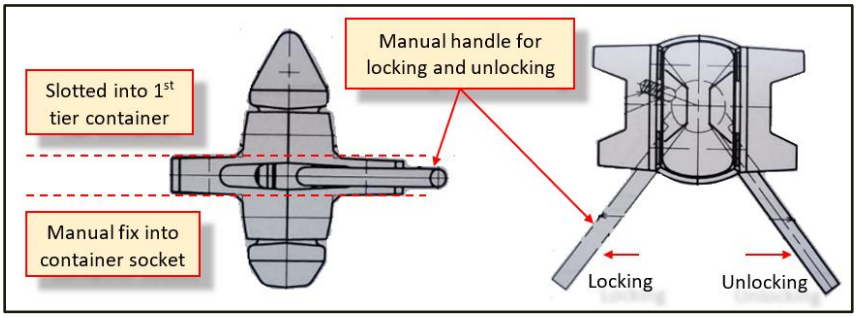

Figure 7 – drawing of the manual twistlock

1.5.3 The second type (the same type as the one that was stuck) was the fully automatic twistlock (see **Figure 8**) for securing of the containers on the second tier and above on deck. Before a container was loaded onto the ship, the twistlock would be inserted in the container, prior to it leaving the jetty by the crane. Once lifted on board the ship, the container would be slotted on to the corner casting eye of the lower container. Once slotted, a spring loaded latch would automatically lock and secure both containers together.

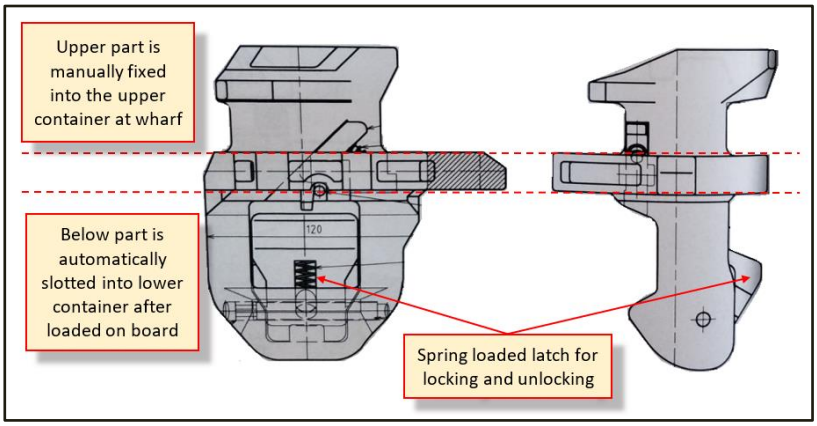

Figure 8 – Drawing of the fully automatic twistlock

1.5.4 As with most fully automatic type of twistlock, there was no handle fixed to give a visual indication externally if the twistlock was locked. The limitation of such a twistlock without handle was that it would not be able to assess whether a twistlock had some internal fault, after exercising it.

1.5.5 The fully automatic twistlock was designed to unlock itself when the container was lifted in upward motion and thus separating it from the container below to facilitate discharge. This type also had the same breaking load as that of the manual twistlock.

1.5.6 The ship was also provided with three sets of emergency tool (see **Figure 9**) which could be used to manually unlock stuck twistlock. The design of the tool

was simple and was meant to be operated[28] by a single person. The investigation team became aware that emergency tool was kept in the ship's store room. There was no record of any training session for the use of emergency tool conducted on board prior to the accident.

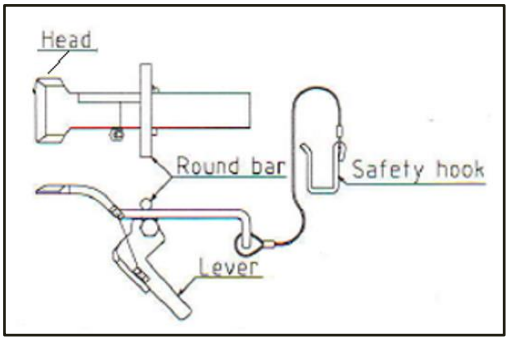

Figure 9 – Drawing of the emergency tool

1.5.7 An inventory (lashing gear inventory) was maintained on board, as with all ships that carry containers, which included the two types of twistlocks. A bi-monthly[29] inspection was carried out by the ship's crew. It was a requirement within the company's processes for damaged twistlocks to be segregated and kept away in a store room preventing them from use[30]. The mechanical components of fully automatic twistlock would be lubricated by grease or lubricating oil to keep the parts moving freely. At the time of accident, a total about 70 to 80 pieces of damaged or in bad condition twistlocks had been collected in the store.

1.5.8 There was no record of replenishment of new or serviced twistlocks on KB in the six months preceding the accident. The investigation team was apprised that there was no feedback of shortage of the twistlocks in the past few voyages.

1.5.9 The investigation team's visit on the sister ship Kota Bakti indicated that some welded tracks for sliding the manual twistlocks on the hatch covers were found to be in poor condition due to corrosion. The locking edges (see **Figure 10**) of the welded tracks had become thinner over a period of time due to wear and tear. Information obtained by the investigation team revealed that on KB the locking edges of the welded tracks on the hatch cover that the two manual twistlocks of the 20' container (33 00 82) were attached to was found sheared-off after the accident.

[28] By inserting the head part of the tool, the spring of the twistlock could be adjusted.
[29] Once every two months – the last inspection was done in April 2018
[30] The damaged twistlocks would normally be arranged by the company to be replaced at a convenient port where it was economical to do the replacement.

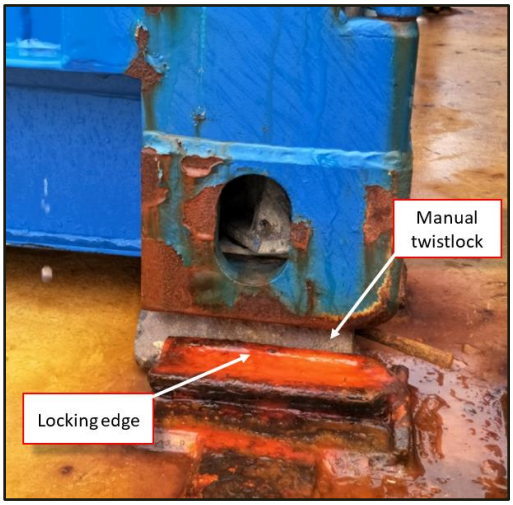

Figure 10 - Condition of welded tracks on hatch cover with a manual twistlock slid in *(Photo taken on a sister ship "Kota Bakti")*

1.5.10 Inspection of the stuck twistlock revealed that the spring and other components had been bent and also showed signs of being cut by a gas-cutting torch.

1.6 The company's safety management system (SMS)

1.6.1 The ISM Manager managed a fleet of container, bulk carrier and general cargo ships.

1.6.2 The Document of Compliance certificate was issued to the ISM Manager by ClassNK on 29 August 2016[31] and it was valid until 18 May 2019. The last annual (third) verification was carried out on 31 July 2017.

1.6.3 The Safety Management certificate (SMC) was issued to KB on 18 August 2017 and was valid until 24 September 2022. A renewal SMC audit was carried out at Buenos Aires port on 18 August 2017, an observation was issued relating to the navigational checklist not being used at the time of arriving port.

1.6.4 An ISM internal audit to the safety management system (SMS) on board KB was carried out by a marine safety superintendent from the company on 3 April 2018. There were four observations raised during the audit. Out of the four, two were related to lifesaving appliances, while one was related to housekeeping matters and another was related to a sludge disposal checklist not being used for the operation at a port.

1.6.5 Prior to the accident, the last Port State Control inspection was carried out at

[31] This certificate was rewritten due to amendments to the company's particulars.

Port-Gentil in Gabon on 9 April 2018, there was no deficiency issued. There was no record of Flag State Control inspection in the past two years.

1.7 The SMS procedures

1.7.1 The company's SMS manual[32] with the latest revision dated 31 December 2016, provided for a strict drug and alcohol policy on its fleet of ships. At the time of accident, there was no evidence to suggest that any crew members consumed alcohol prior to their duties.

1.7.2 The SMS did not specify or provide specific guidance for the ship's officer and crew to follow, in the event a container could not be discharged due to a stuck twistlock. There was no prohibition for shore personnel to use the ship's crane and cargo operations were left to the ship's crew to assess on a case by case basis, especially if the charter requirements stated so.

1.7.3 On the provision for container loading/discharging procedures, the SMS procedures stated that, the Chief Officer was responsible to review standing instructions before commencement of cargo operations to ensure the instructions covers all aspects for the forthcoming operation and to avoid misunderstanding of what would be required during the cargo work. The same procedures required the officer of the watch to ensure lashings (including twistlocks) of the containers were checked during cargo operations and being lashed in accordance with the cargo securing manual[33].

1.7.4 The SMS had a specific section on hot work procedures, stating that a permit was required to be issued before commencing hot work and that the Master was to pay attention to the type of hot work required before issuing that permit. Gas-cutting fell into the category of hot work in the fleet.

1.7.5 The same procedures stated that, after safety checks were carried out by the Chief Officer and a hot work checklist permit form was duly completed, the hot work then could be carried out once an approval was obtained from the Master. Records provided to the investigation team indicated that a hot work permit had been issued after the conduct of a risk assessment and that the Master had granted for the hot work to proceed for freeing up the stuck twistlock.

[32] Named as Safety Management Procedure Manual (SMPM).

[33] A manual is approved by the ship's Flag Administration or its Recognised Organisations, requires to be carried on all types of ships engaged in the carriage of all cargo other than solid and liquid bulk cargo, it provides guidelines on how the cargo to be lashed and what lashing equipment is required.

1.8 Relevant safe working practice

1.8.1 The COSWP[34], 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.

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 19.21.10, emphasized the importance of communication involving a lifting operation. An effective means of communication to the authorising officer and between those involved should be established and maintained to avoid misunderstandings. This might be by telephone, portable hand-held radio or a person-to-person chain. Action should be taken as a result of the positive receipt of confirmation that the message is understood.

1.9 Autopsy report

1.9.1 After the occurrence, an autopsy report was issued by the Health Authority, Democratic Republic of Sao Tome Principe on 27 June 2018. The report revealed that the cause of death for the ASD2 were haemorrhagic shock and multiple fractures to the upper thorax and skull.

[34] Though not a mandatory publication for carriage on Singapore registered ships, the company's SMS had incorporated the Code of Safe Working Practices for Merchant Seafarers (COSWP) as the part of procedures for reference. The COSWP, edition 2015, published by the UK Maritime and Coastguard Agency (MCA), provides best practice guidance for improving health and safety on board ships. A copy of COSWP was on board at the time of the accident.

1.9.2 The Autopsy was conducted at 1100H on 27 June 2018 stated the time of death as 1250H[35] on 25 June 2018.

1.10 Environmental condition

1.10.1 The accident occurred in daylight hours. The weather was partly cloudy with south-westerly moderate breeze[36] (see **Figure 11**) and good visibility. The sea was moderate[37] at the anchorage.

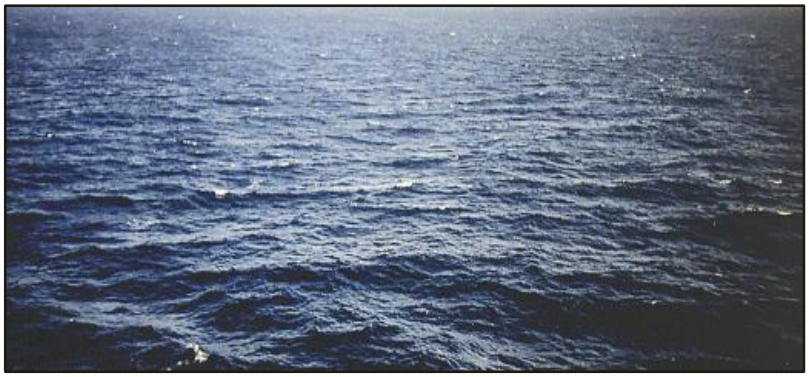

Figure 11 - Illustration of sea state at Beaufort scale (BF-4) of wind force (*Sour*ce: The Mariner's Handbook, NP100)

1.10.2 According to the ship's crew involved in the operation, the ship was not experiencing any list and excessive trim which could have affected the container lifting or the twistlock at the time of accident.

[35] The reason for the 10mins discrepancy of the time of the death as stated in the autopsy report and what was recorded on the ship could not be validated.

[36] Beaufort scale of wind force 4 at about 11-16 knots.

[37] Approximate height of the sea was about 1.2m to 2.4m.

2 ANALYSIS

2.1 The occurrence

2.1.1 ASD2 was hit by the 20’ container (33 00 82) connected to the 40’ container above it, which had a stuck twistlock and three manual twistlocks. The 40’ container was attached to four taut lifting chains of the ship’s cargo crane which was at an angle to the containers (crane jib head not vertically above the containers). While attempting to free the stuck twistlock by cutting it with a gas-cutting torch, the resultant forces (in an upward direction at an angle towards ASD2) of the taut lifting chains had likely caused the two manual twistlocks securing the 20’ container to the hatch cover to shear off the worn locking edges of the welded tracks and came loose.

2.1.2 The sudden jerking out the 40’ and 20’ containers at the end of gas-cutting when the stuck twistlock was freed, indicated that there had been upward forces acting on the 40’ container by the taut lifting chains. With the resultant forces acting on the two containers and the twistlock serving as a pivot, in all probability, resulted in the 20’ container (33 00 82) being lifted up from the hatch cover and swung in the direction of the unsuspecting ASD2 (see **Figure 12**).

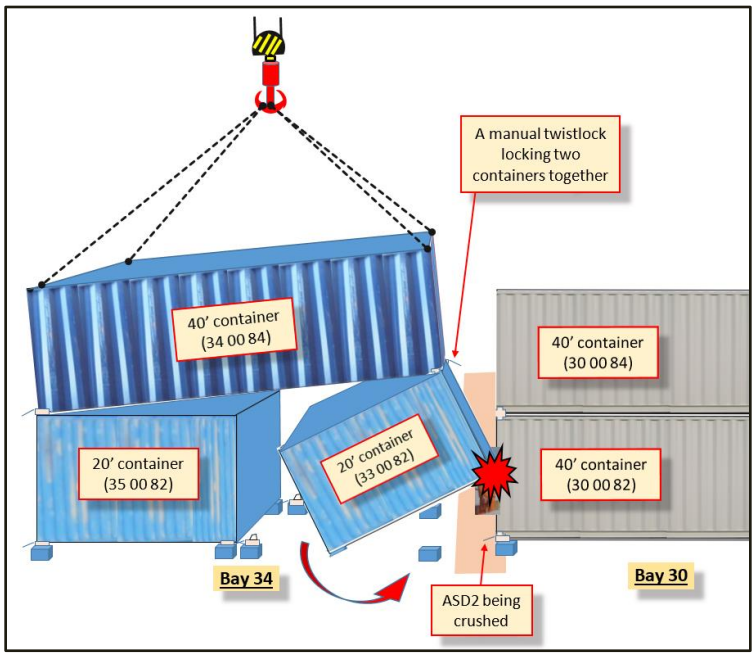

Figure 12 - Illustration of containers’ most likely movement at the time of accident (not to scale)

2.1.3 Being an assistant to the Bosun, the ASD2 had probably moved closer to him to see if he could help and did not communicate his intention to others in the

vicinity. As everyone was focusing on getting the stuck twistlock to be freed up, no one noticed that ASD2 had come closer to the gas-cutting location from where he stood earlier.

2.1.4 While the Chief Officer might have reminded the shore cargo supervisor and foreman not to lift up the container without his or his duty officer's permission (see paragraph 1.1.17), it is unclear if this had been communicated clearly to the crane operator.

2.1.5 This occurrence highlighted the importance of slackening of the lifting chains to minimise or eliminate the inadvertent lifting of the containers by the crane while trying to free up the stuck twistlock. While it is understandable that lifting of the 40' container would be needed as a means to check if the stuck twistlock was freed up, the lifting action should have been coordinated in a controlled manner, and this task should have taken the safety of personnel involved in the vicinity into consideration.

2.2 Detachment of 20' container from its secured position

2.2.1 While a lifting force was applied unknowingly by the crane operator when keeping the lifting chains taut, it was not possible to ascertain the magnitude of this lifting force. Based on the evidence available, the lifting force did not reach the breaking load of the manual twistlocks.

2.2.2 The Chief Officer asked for the 40' container to be secured with the 20' container (33 00 82) with three manual twistlcoks to avoid inadvertent lifting of the 40' container to free the stuck twistlock (see paragraph 1.1.10). When using the emergency tool to free the stuck twistlock, the 40' container was lifted. This lifting force could have transferred to the manual twistlocks securing the 20' container compromising the integrity of the locking edges on the hatch cover.

2.2.3 As there were only two twistlocks securing the 20' container at the forward end (see paragraph 1.2.4), when additional lifting force was applied during the gas-cutting of the stuck twistlock, the 20' container eventually broke away from the locking edges (which may have been corroded and worn out) of the hatch cover.

2.3 The cause of twistlock stuck

2.3.1 The investigation team attempted to ascertain the cause of the fully automatic twistlock getting stuck between the containers. The following were considered as likely to be the contributing factors:

a) The fully automatic twistlock was already in a poor or damaged status, and it had not been identified to be unfit for use (and thus not segregated from the last inventory check). As a result, the stevedores at the loading port, inserted it into the 40' container before it was loaded on board. Although the duty watchkeeping officer at the loading port would routinely check the fitting of the twistlock, because the twistlock did not have a handle fixed, knowing the internal condition would be difficult to ascertain visually after it was loaded on board above the first tier together with the container (34 00 84); or

b) The fully automatic twistlock was in a working condition, but it got stuck due to improper discharging of the 40' container at Sao Tome and Principe. The container could have been lifted up at an angle as a result of the crane jib head not being vertically above the container.

2.3.2 Considering the possibility of a twistlock getting damaged either as a result of infrequent use due to the trading pattern, and thus getting rusty internally, or as a result of frequent use and getting damaged internally, requires a calibrated and comprehensive inspection process, which should be taken into account within the company's SMS, in addition to the lashing gear inventory.

2.3.3 Assuming that the twistlock was not faulty, monitoring of the cargo operation by the officer of the watch was needed to be done appropriately so as to ensure that the incorrect lifting of the container did not bring about a damage to the twistlock (see footnote 26). A lack of supervision during the discharging process may have contributed to the twistlock getting stuck.

2.3.4 The use of inappropriate tools such as crowbar, chisel, and spike to forcefully knock the internal parts of the twistlock could have further deteriorated the condition of the stuck twistlock, as the spring and other parts may have prevented the latch to move freely or being unlocked with the emergency tool. The importance of using tools which are fit for purpose cannot be emphasised enough and appropriate measures must be in place within the company's SMS.

2.4 Task planning and risk assessment

2.4.1 After becoming aware of a stuck twistlock, the Third Officer did not consider informing the Chief Officer and Master, or using the emergency tool and allowed the crew to use inappropriate tools for freeing up the twistlock. The officers and crew of the taking over watch continued to use these tools until the Chief Officer was advised, who then instructed for the emergency tool to be brought on deck. It was likely that a lack of clarity on what circumstances required the Chief Officer to be notified may have contributed.

2.4.2 There was a lack of communication between the shore workers and ship's crew. When the Chief Officer was notified about two hours later on the stuck twistlock, he conducted a brief discussion with the ship's crew on deck which did not involve the shore foreman, the shore cargo supervisor or the stevedores. Instructions were then given to each individual ship's crew directly to commence gas-cutting operation.

2.4.3 The following actions took place on board KB suggested that there were lack of task planning and risk assessment in the attempt to free up the stuck twistlock:

- The Chief Officer's plan was to prevent accidental lifting of the 40' container by securing it to the two 20' containers below. There was no evidence to suggest whether the condition of the locking edges of the welded tracks was checked which may have worn over a period of time;

- Although the Chief Officer had instructed the shore cargo supervisor and shore foreman not to lift up the 40' container without his or the duty officer's permission, the lifting chains were kept taut. With taut chain lifting chains, it was not possible to ascertain how much lifting force was exerted.

- There was a lack of risk assessment in the upward force exerted by the taut lifting chains. Instead of having the lifting chains kept taut all the times, the lifting chains should have been slacken while gas-cutting was in progress. When there was a need to check if the stuck twistlock was freed, the lifting of the containers should have been done in a better coordinated manner by ensuring no one was in the vicinity.

- Though a work permit and checklist for gas-cutting work was prepared, which was subsequently approved by the Master, the working area was not assessed for risks that could develop in the course of gas cutting,

such as the identification of danger zones.

- The Second Officer had not been instructed by the Chief Officer to take over the supervisory role when the Chief Officer went to the accommodation. Hence, it is likely that no one was paying an active role to the safety of the crew in the vicinity and the actions of the stevedores after the Chief Officer left.

2.4.4 It would have been desirable for the Chief Officer to have a tool-box meeting and carry out a detailed risk assessment before communicating the course of actions to be taken by the ship's crew and to the shore workers, in order to have a coordinated action plan, for e.g. ship's crane to be operated by ship's crew, removing non-essential personnel from the scene, etc. so that everyone shared the same mental model.

2.5 The SMS procedures

2.5.1 As indicated earlier, the company's SMS procedures, though comprehensive, did not anticipate situations such as a stuck twistlock and how to deal with such a scenario. While it is understandable that not all situations can be managed by an SMS procedure, clear and specific standing instructions are desirable. In this particular case, despite the company's SMS requirement (see paragraph 1.7.3), the Chief Officer's standing instructions were not available, and Master's standing instructions were generic. Thus, the peculiarities associated with cargo discharging operation in this port had not been anticipated.

2.5.2 As a result, when the fully automatic twistlock got stuck in between containers during the midstream discharge operation, without appropriate guidance or instructions on how to solve the problem, the ship's crew resorted to methods based on their own assessment.

2.5.3 It would have been desirable for the company's SMS procedures to provide clear guidance for senior officers to prepare ship and operation specific standing instructions, so that such guidance could be used to supplement the assessment of the ship's crew.

2.5.4 The cargo securing manual which contained details of how to use the emergency tool (designed for the purpose and recommended by the twistlock manufacturer), was not linked to any section within the SMS. As a result, there was no requirement within the SMS to ensure that the crew are trained on its use. Had the emergency tool's importance been recognised as the primary

solution for freeing up a stuck twistlock, the crew would have likely used it in the beginning after encountering the problem.

2.6 Incidental observation

2.6.1 The investigation team notes that the company had scheduled the Bosun to attend a training course on gas-cutting and welding after his contract on KB. If indeed, the gas-cutting was needed, the Bosun was not the appropriate person to perform that task. It is extremely important to ensure that allocation of roles and responsibilities on board is relevant to the qualification and training of personnel to minimise the risk of accidents.

2.6.2 Although a hot work permit was obtained from the Master of KB and a hot work checklist form was duly completed in accordance with the company's SMS procedures, the Bosun commenced the gas-cutting task before the water hose was rigged and ready for use. The control measures within the permit were not implemented for accident prevention.

3 CONCLUSION

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 While freeing up the stuck twistlock, the 20’ container became loose and swung toward the ASD2 and resulted in his death.

3.2 The lifting of the 40’ container together with the 20’ container compromised the integrity of the locking edges which may have corroded and worn out resulting in the 20’ container to break away and swing in the direction of unsuspecting ASD2.

3.3 There was lack of task planning and risk assessment in the attempt to free up the stuck twistlock. There was also a lack of effective communication between the ship’s and shore personnel.

3.4 The cause of the fully automatic twistlock getting stuck could not be established. An unfit for purpose (poor condition or damaged twistlock) being used, or an improper discharging of the container resulting in it getting stuck could not be ruled out.

3.5 There was a lack of clear guidance in the company’s SMS for senior officers on board to prepare ship and operation specific standing instructions.

3.6 There was no mention within the company’s SMS of the importance on the use of the emergency tool as the primary solution for freeing up a stuck twistlock.

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 In September 2018, the company issued a fleet circular to its fleet of ships, sharing the findings and the lessons learnt from this accident. The corrective and preventive actions highlighted were as follows:

a) require ship's staff to report to the ship's Master on problems encountered during cargo operations, without undue delay;

b) require all ships to carry out effective inspection and maintenance periodically on ship's cargo securing devices as prescribed per the Planned Maintenance Schedule (PMS) system. Effective from first quarter of 2020, the findings of such inspection and maintenance for each individual ship are to be reported on monthly basis for the company to monitor ashore;

c) to plan shipboard operations in a safe, effective and efficient way. Proper and effective supervision is to be maintained throughout the operation;

d) to conduct a comprehensive risk assessment, identify all possible hazards, and ensure safety and mitigating measures are put in place before commencement of an operation;

e) to establish a mode of communication used in an operation, which is clearly understood and accepted by all parties involved including shore workers before commencement of each cargo operation; and

f) to motivate ship's crew to maintain a good safety culture on board ships, take safety seriously, remain watchful and avoid compromises.

4.1.2 The company requires all ships to allocate half a day to conduct a "Stop for Safety Day" program twice a year (as decided by the head office) so that safety concerns, lessons learnt from other ships and reported near misses, can be shared widely so as to take appropriate actions for safety of all personnel on board.

4.1.3 As a part of crew awareness and training, the company had incorporated an item related to the use of Twist Lock Emergency Tool Handling in the Shipboard

Operational Training Plan from January 2019, which will be conducted quarterly on board ships.

5 SAFETY RECOMMENDATION

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

5.1 Pacific International Lines (Pte) Limited (the Operators / ISM Managers)

5.1.1 To review its SMS procedures for cargo operations by providing clear guidance for senior officers on board to prepare ship and operation specific standing instructions. **[TSIB-RM-2019-019]**

- **End of Report** -