

Final Report

COLLISION BETWEEN OIL TANKER KARTIKA SEGARA AND SUCTION HOPPER DREDGER JBB DE RONG 19 IN SINGAPORE STRAIT ON 13 SEPTEMBER 2017

MIB/MAI/CAS.025

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

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The Transport Safety Investigation Bureau

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SYNOPSIS

In the early hours of 13 September 2017, at about 0038H, an Indonesian registered oil tanker Kartika Segara (KS) collided with a Dominica registered suction hopper dredger JBB De Rong 19 (JDR 19) in the Precautionary Area of the Singapore Strait.

KS was laden and departing the port of Singapore, while JDR 19 was transiting in the westbound lane of the Singapore Strait Traffic Separation Scheme.

The collision caused JDR 19 to capsize, and resulted in the loss of five out of 12 dredger's crew. KS sustained structural damage to its bow.

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

The investigation found that the JDR 19 was manned by uncertificated personnel who were unqualified for purpose in the capacity that they were engaged. There were also inadequacies in the Safety Management System of JDR 19's ISM Manager for ensuring safety at sea and prevention of loss of life.

The investigation also determined that both vessels did not maintain a proper lookout and did not assess the risk of collision. The bridge team of JDR 19 did not take appropriate collision avoidance actions. In addition, KS' bridge team lacked situational awareness for their intended transit out of Singapore despite timely advice being provided by Singapore Vessel Traffic Information Service (VTIS) on the traffic conditions in the Strait, and did not apply the principles of Bridge Resource Management effectively.

DETAILS OF VESSELS INVOLVED

Name	Kartika Segara	JBB De Rong 19
IMO number	9156345	9828649
Flag	Indonesia	Dominica
Classification society ¹	Nippon Kaiji Kyokai (ClassNK)	Sing-Lloyd ²
ISM ³ RO (as applicable)	Flag Administration	Sing-Lloyd
Ship type	Oil tanker	Cargo ship - Suction hopper dredger
Construction	Steel	Steel
Year of built	August 1998	Feb 2017
Registered owner	PT Pelayaran United Maritime Jaya	Benchmark Development (M) SDN BHD
Manager	PT Kelola Armada Samudera	LK Global Shipping (M) SDN BHD
Gross tonnage	22,809	4,965
Length overall	173.21m	108.00m ⁴
Moulded breadth	31.00m	18.20m
Moulded depth	15.60m	7.60m
Design Draught	9.00m	5.30m
Main engine(s)	Marine diesel engine x 1	Marine diesel engine x 2
Total power	One unit x 6,767kW	Two units x 1103kW at 428 RPM
Propeller and rudder	Single fixed right-hand propeller and semi- balanced	Two fixed propellers, and two rudders
Voyage Data Recorder (VDR)	S-VDR ⁵ (JCY 1850 – JRC)	Not fitted
Speed (loaded)	14.3 knots (kts) ⁶	Unknown
Speed (ballast)	14.0kts	Unknown

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 Flag Administration's approved RO. Sing-Lloyd is not a member of the International Association of Classification Societies (IACS) at the time of accident.

³ International Management Code for the Safe Operation of Ships and for Pollution Prevention.

⁴ Does not include the length of conveyor belt (about eight metres) extended from the ship's bow.

⁵ S-VDR – Simplified-VDR complying as required by SOLAS 74 V/20.2, as amended, and complying with Performance Standards MSC. 163(78). S-VDR is not required to record rudder and engine order response. The S-VDR was fitted on-board in August 2008. The Last Annual Performance Test was done on 14 April 2016 with an expiry on 13 July 2017. The SEQ certificate annotated that the vessel was fitted with a VDR and not S-VDR.

⁶ Knot (kt) is a unit of speed equal to one nautical mile (1.852km) per hour.



Figure 1: Kartika Segara – Photograph after collision showing damaged bow



Figure 2: JBB De Rong 19 – Photograph after collision showing capsized and partially submerged in water
(Source: Maritime and Port Authority of Singapore)

1 FACTUAL INFORMATION

All times used in this report are Singapore local time, eight hours ahead of the UTC⁷. Ships mean time on JBB De Rong 19 (JDR 19) and Kartika Segara (KS) were same as local time.

1.1 Sequence of events

- 1.1.1 On 12 September 2017, at 1042H, the Indonesian registered oil tanker KS completed its cargo loading of about 21700 metric tonnes of unleaded gasoline, at an oil terminal in Singapore. The cargo was meant for subsequent discharge in Baubau⁸, Indonesia.
- 1.1.2 At 1436H, KS was shifted to the Western Holding Anchorage with assistance of a harbour Pilot⁹, for the purpose of bunkering. She anchored by about 1618H.
- 1.1.3 On the same day, the Dominica registered dredger JDR 19, was transiting through the westbound lane of Singapore Strait Traffic Separation Scheme (TSS) bound for Malaysia.
- 1.1.4 During JDR 19's transit, the Chief Officer 1¹⁰ (CO1) and Radio Man¹¹ were on the bridge. CO1 was steering the vessel and the Radio Man was reportedly performing the role of a lookout. Additionally, when passing from one vessel traffic information service (VTIS) sector¹² to another, the Radio Man would report JDR 19's position to the VTIS by the Very High Frequency (VHF) radio.
- 1.1.5 By 1915H, KS had completed its bunkering operation, and the harbour Pilot was booked at 2330H for her departure out of the anchorage.
- 1.1.6 Between 2236H and 2312H, the Third Officer of KS carried out pre-departure tests and checks for all bridge navigational equipment in accordance with the company's procedures. The tests included a steering system function and main engine ahead and astern movements using the engine telegraph. All equipment was found to be in working condition, and the test results were logged accordingly.
- 1.1.7 On JDR 19, at about 2300H, the Chief Officer 2 (CO2) took over con of the JDR 19 from CO1 and continued hand steering the vessel, while the Radio

⁷ UTC – Coordinated Universal Time, is the primary time standard by which the world regulates clocks and time.

⁸ An Indonesian port, is located on the Southern part of Southeast Sulawesi region.

⁹ Pilotage is compulsory within Singapore port waters unless exempted. Pilotage services for arrival, intra-port shifting and departure ships are provided by the PSA Marine (Pte) Ltd.

¹⁰ At the time of occurrence, there were two Chief Officers on JDR 19. Both rotated to keep navigational sea watch.

¹¹ Likely engaged by the company primarily to facilitate communications in the local language Bahasa Melayu with Malaysian port authorities. It was also made known that he would do all the communication between JDR 19 and shore authorities in English.

¹² A designated reporting point when ships cross over into another VTIS station monitoring area under STRAITREP.

Man remained on bridge, standing at the forward part of the bridge near the VHF radio on the starboard side.

- 1.1.8 At about 2336H, the harbour Pilot boarded KS as scheduled, and carried out a Master-Pilot information exchange on the departure plan out of the anchorage to the pilot disembarkation ground (DG7)¹³. The Pilot reported KS' readiness for departure to the Singapore West Control Operator¹⁴ on VHF radio channel 68, and requested permission to depart the anchorage.
- 1.1.9 At about 2358H, after receiving permission to depart the anchorage, KS departed the anchorage under Pilot's advice and Master's orders, initially at Dead Slow Ahead (approximate speed of 7kts) and then gradually moving the engine telegraph to Full Ahead (approximate speed of 12kts). The bridge was manned by the Master, the Second Officer, the Third Officer, and an Able Seafarer Deck (ASD) as the Helmsman.
- 1.1.10 By about 0017H, on 13 September 2017, KS was about 1.8nm from DG7, when as a routine practice, the Pilot informed West Control of his intention to disembark and provided information about KS being outbound towards the TSS as well as the intention to switch the VHF radio to channel 14¹⁵ for subsequent communication with VTIS Central. Pilot's call was acknowledged by West Control and the Pilot reported KS' position to VTIS Central. The Pilot also sought traffic information and advice from VTIS Central, which the KS' bridge team would use for crossing the westbound lane of the TSS towards the eastbound lane through the Precautionary Area in the TSS after he disembarked.
- 1.1.11 Then, KS was displaying three all-round green lights¹⁶. VTIS Central operator provided navigational advice to the Pilot on the heavy traffic expected from the East between Sisters Islands (South of) to Tembakul light, five vessels¹⁷ (see **Figure 3**). The Pilot acknowledged by responding¹⁸, "Five, Sisters, Westbound, thank you".

¹³ DG7 – Located near the Southern Boarding Ground for designated Pilot disembarkation. Also marks the end of Singapore port limit.

¹⁴ A Watch Operator who holds IALA Model Course V-103/1 (VTS Operator competency certificate), oversees a sector defined as per the MPA Port Marine Circular no. 4 of 2009 dated 11 March 2009.

¹⁵ Channel monitored by VTIS Central

¹⁶ The IMO's Maritime Safety Committee, 88th Session, adopted the recommendatory measure for vessels crossing the TSS and Precautionary Areas in the Singapore Strait to display the night signals consisting of three all-round green lights in a vertical line. The measure was implemented on 1 July 2011. The MPA issued a Port Marine Circular No. 4 of 2013 to reproduce the requirement.

¹⁷ Based on the VTIS replay, the AIS tracks were of five vessels: Bina Marine 61, Kyauk Phyu Star, Unity Discovery, Gaschem Nordsee and JBB De Rong 19.

¹⁸ Pilots acknowledging VTIS's information provided in a short form, which is a practice used to reduce VHF radio conversation airtime by replying in key words.

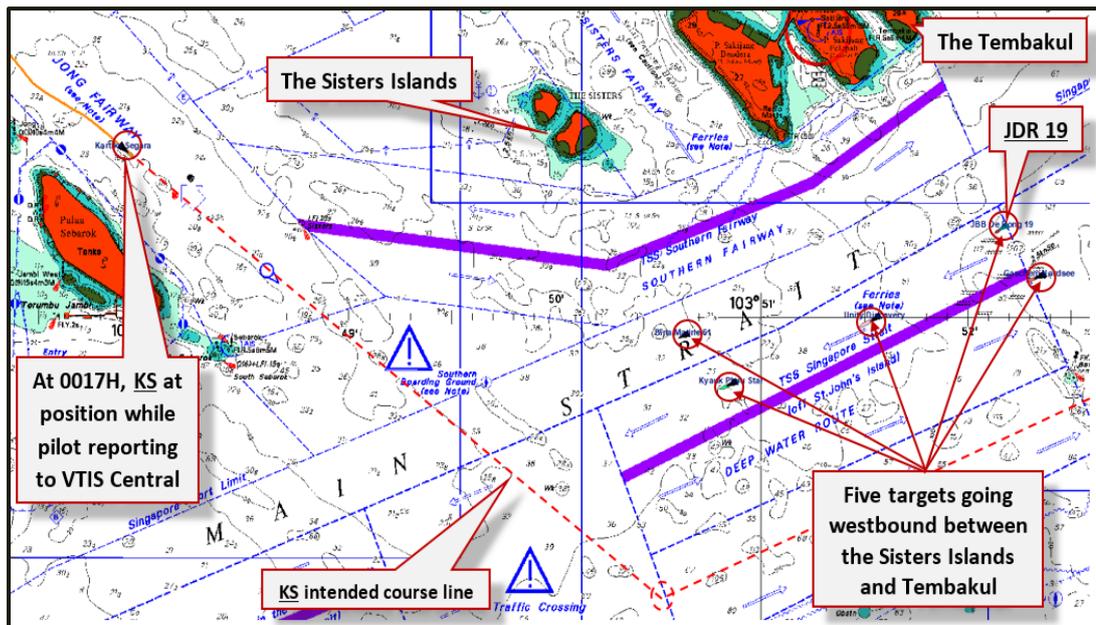


Figure 3 – Positions of five targets highlighted by the VTIS Central for illustration

- 1.1.12 The Pilot briefed the Master of KS on traffic information in KS' immediate vicinity as well as those expected to be encountered in the Strait and tidal conditions. The Master acknowledged the information, and at 0017H moved the engine telegraph of KS to Slow Ahead and then to Dead Slow Ahead. When the Pilot disembarked at a time recorded as 0018H, KS was doing a speed of about 8kts.
- 1.1.13 At 0019H when KS had its engine telegraph at Dead Slow Ahead, JDR 19 was passing South of Tembukul light, in the westbound lane of Singapore Strait at a speed of about 7.5kts. KS and JDR 19 were about 3.3nm from each other.
- 1.1.14 At about 0027H, KS' engine telegraph was moved to Slow Ahead with an intention to cross the westbound lane, and then to Half Ahead. Her speed over ground (SOG) was about 7kts at this time, and she began to make good a course of 128°(T) while on a heading 130°(T). About this time, a target AIS-14 (later identified to be the JDR 19) was acquired on the X-band radar by the Second Officer, as were two other targets in the westbound lane ahead of AIS-14 (see **Figure 4**).

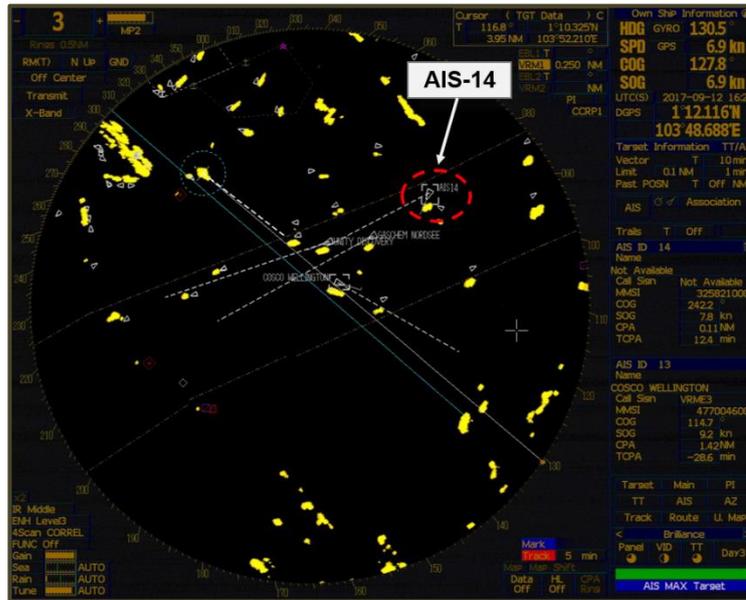


Figure 4 – JDR 19 (annotated with red circle) acquired on radar

- 1.1.15 As KS left the shelter of Sebarok island, the current was setting KS to the East.
- 1.1.16 At 0028H, when KS was about 1.2 nm from the edge of the TSS, VTIS Central's Watch Manager (WM) called KS to advise about the heavy traffic from the East and to find out KS' intentions. The Second Officer responded (as advised by the Master) that KS was eastbound and their intention was to cross the westbound lane. The WM highlighted to KS the traffic and asked again if KS still intended to cross the TSS. No response was received from KS.
- 1.1.17 At about 0029H, noting that there was no change to KS' speed or heading, and she was continuing towards the TSS, the WM again called KS to ask of her intentions. KS responded that her intention was to cross the westbound lane. The WM advised her to slow down the ship's speed and wait for the traffic in the TSS to pass clear before attempting to cross and head towards the eastbound lane. KS acknowledged the message and responded that she would watch out for the traffic. Engine telegraph was moved to Dead Slow Ahead at about 0030H, as recorded in the logbook. At about this time, WM advised KS against attempting to cross. This time the Second Officer of KS responded that they would stop KS.
- 1.1.18 Soon after, WM also alerted KS of a nearby tug boat, the westbound Bina Marine 61(BM 61)¹⁹, which was about 9 cables²⁰ on KS' port bow, and for KS to keep lookout for her (see **Figure 5**). KS acknowledged the message and noting BM 61 was on KS' port side, decided to pass ahead of her. VTIS Central was informed, who then called BM 61 and informed her of KS'

¹⁹ BM 61, a Singapore registered tug, Gross Tonnage at 149, Length overall at 23.5 metres.

²⁰ About 1666 metres away. 1nm equals to 10 cables.

intention to pass ahead. BM 61 acknowledged the information and subsequently altered her course to starboard side to increase the passing distance between her and KS.

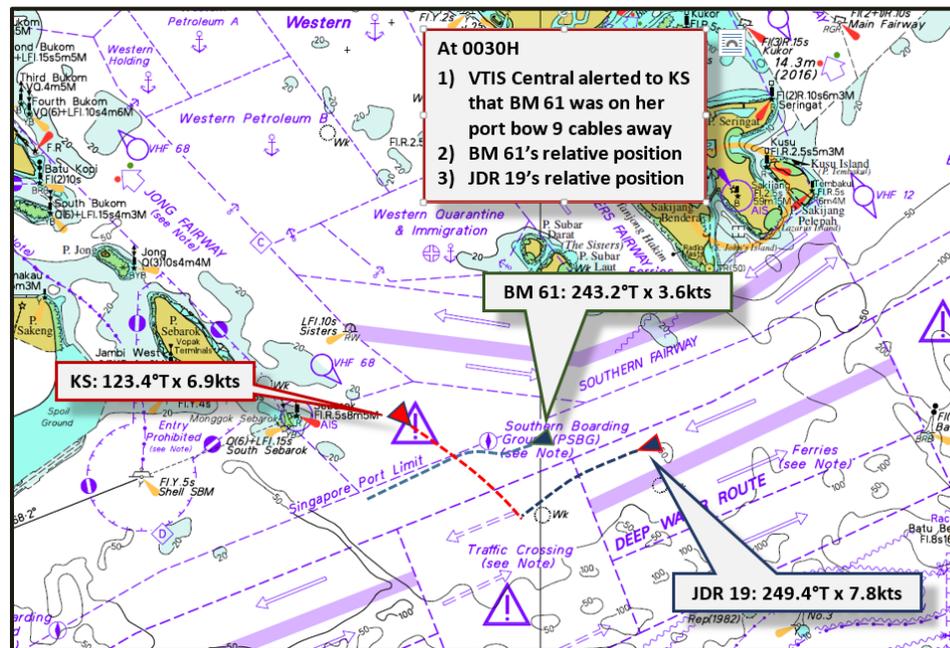


Figure 5 – Relative position of BM 61 and JDR 19 to KS, at 0030H

- 1.1.19 By about this time, JDR 19 was about 1.4nm away from KS which was proceeding steadily at a speed of about 6.9kts towards the TSS. JDR 19 meanwhile, continued travelling at a speed of about 7.8kts in the westbound lane.
- 1.1.20 Noting KS' continued approach towards the TSS, at about 0032H, the WM called JDR 19 on VHF radio channel 14, and advised her to look out for the departing KS which was about 1nm on JDR 19's starboard side and that she intended to cross JDR 19's bow and join the eastbound lane. This message was acknowledged by JDR 19's Radio Man. According to KS' logbook, her engines were stopped at 0032H. VDR data at this time indicated KS' SOG of about 7kts.
- 1.1.21 While earlier VTIS Central advised KS against crossing the TSS, recognising that the two vessels were going to end up in a close quarter situation, the VTIS Central Co-Watch Manager (CWM) advised KS to cross the TSS at right angles²¹ with a view to increase the passing distance between her and JDR 19 by altering her course to starboard as well as by increasing her speed. KS acknowledged this message (coming from the VTIS Central) and stated that she had started to alter her course to starboard. According to KS' logbook, Dead Slow Astern propulsion was operated at 0033H. VDR data at this time indicated KS' SOG of about 7kts. The WM also advised JDR 19 to comply

²¹ COLREGs Rule 10(c) – A vessel shall, so far as practicable, avoid crossing traffic lanes but if obliged to do so shall cross on a heading as nearly as practicable at right angles to the general direction of traffic flow.

with COLREGs²² and to give way²³ to KS. JDR 19 acknowledged this message with an “OK”.

- 1.1.22 At about 0034H, KS called JDR 19 on VHF radio channel 14, informing JDR 19 of KS’ intention to alter course to starboard and thus requesting JDR 19 to pass KS’ stern, but no response was received from JDR 19. At around this time, JDR 19’s course changed to Port from 246° (T) to 237° (T). According to KS’ logbook, engine orders on KS were given as Full Astern progressively till about 0034H. VDR data at this time indicated KS’ SOG of about 7kts.
- 1.1.23 At about 0035H, the CWM called JDR 19, urging her to take immediate action sensing the proximity between the two vessels. In quick succession, the WM reminded JDR 19 twice to take immediate action as the give-way vessel by slowing down. JDR 19 acknowledged²⁴ CWM’s call.
- 1.1.24 By about 0036H, KS was heading 137° (T) and making good a course of 126° (T). This difference had steadily increased from 2° at 0027H.
- 1.1.25 At about 0037H, communications from KS on VHF radio channel 14 mentioned “*This BB still is dangerous over*”. KS could be heard on the VHF radio stating that she was now altering her course to port (hard over) and already had her engines on Full Astern. KS also gave rapid light flashes using the signaling lamp querying JDR 19’s intentions.
- 1.1.26 At about 0038H, KS and JDR 19 collided with each other in approximate position Latitude 01°11.11’N and Longitude 103°49.87’E, Precautionary Area²⁵ of the Singapore Strait TSS, about 1.7nm Southwest of the Sisters Islands within Singapore territorial waters (see **Figure 6**). There were no sound or other light signals²⁶ made or heard prior to the collision by either of the ships involved.

²² The International Regulations for Preventing Collisions at Sea 1972, and its amendment. It is published by the IMO.

²³ COLREGs – Rule 15 – When two power driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel. Rule 16 - Every vessel which is directed to keep out of the way of another vessel shall, so far as possible, take early and substantial action to keep well clear.

²⁴ Voice recording indicate that the response of “OK Sir” from JDR 19 was from the Radio Man

²⁵ Precautionary Area is defined by IMO as a routeing measure comprising an area within defined limits where ships must navigate with particular caution.

²⁶ COLREGs Rule 34 – Manoeuvring and warning signals – For e.g. two short blasts supplemented by two flashes by light to indicate alteration of course to port.

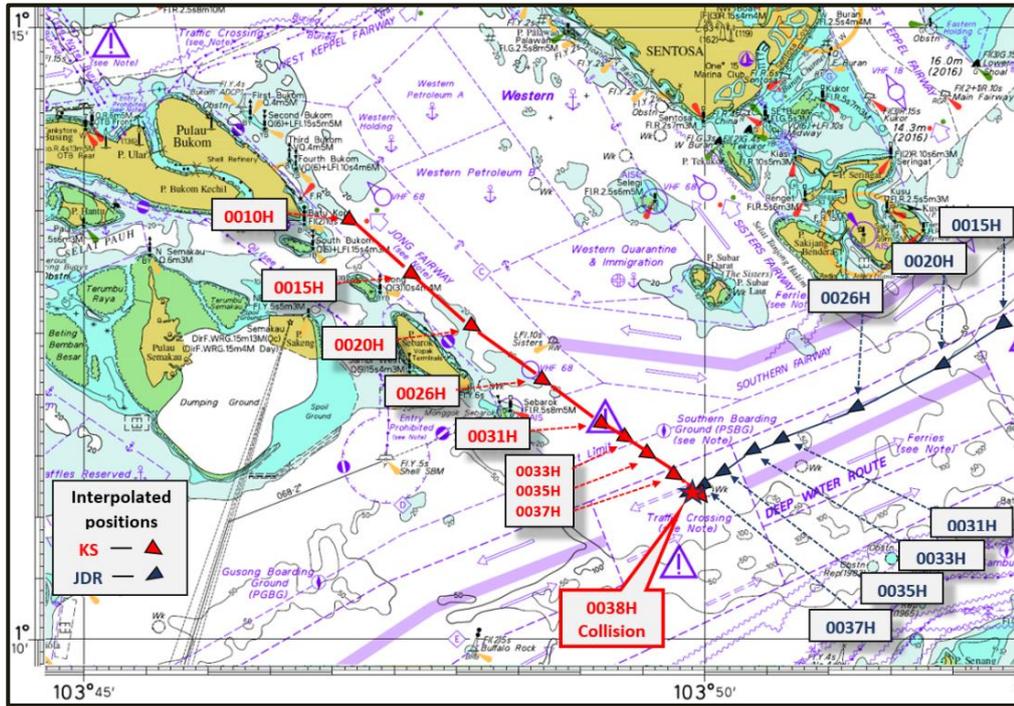


Figure 6 – Navigational data of KS and JDR 19

1.1.27 Illustrated in **Figure 7** below is the relative distance between KS and JDR 19, and their respective course and speed at various stages prior to the collision.

Time	Course (COG) ²⁷ and Speed (SOG)		Relative distance between KS and JDR 19
	KS	JDR 19	Approx.
0015H	119.1° x 7.8 kts	233.3° x 7.5 kts	4.0nm
0018H	KS' Pilot disembarked		
0020H	129.9° x 7.8 kts	238.2° x 7.6 kts	3.1nm
0026H	127.9° x 6.9 kts	242.0° x 7.8 kts	2.1nm
0031H	123.3° x 7.0 kts	249.9° x 7.6 kts	1.2nm
0033H	122.8° x 7.1 kts	245.8° x 7.7 kts	0.8nm
0035H	127.9° x 7.4 kts	236.7° x 7.6 kts	0.5nm
0037H	128.5° x 7.5 kts	238.9° x 5.9kts	0.2nm
0038H	120.1° x 5.3 kts	267.1° x 5.0 kts	Collision

Figure 7 - Courses and Speeds prior to the collision
(Source: Maritime and Port Authority of Singapore)

1.1.28 Almost immediately KS informed VTIS Central of the collision and that JDR 19 had capsized²⁸ (and was in danger of sinking) as a result. VTIS Central

²⁷ Course and Speed Over Ground.

²⁸ According to the crew of JDR 19, after the collision, the vessel heeled to the port side and then to starboard before capsizing. The crew jumped into the water because their vessel capsized very quickly. Rapid progressive flooding in other areas of the vessel cannot be ruled out as a possible consequence of compromised hull integrity.

alerted all passing vessels to keep clear of the collision location as well as to report any sighting of survivors to VTIS Central. Search and Rescue (SAR) efforts were launched soon after with assistance of assets from Singapore Police Coast Guard (PCG) and the Republic of Singapore Navy.

- 1.1.29 Of the 12 crew on-board JDR 19, seven were rescued soon after the collision from the water by PCG and conveyed to hospital for medical assessment²⁹. Five persons were unaccounted for.
- 1.1.30 Continuous navigational safety broadcasts were made by the Port Operation Control Centre³⁰ of the Maritime and Port Authority of Singapore (MPA), to inform ships in the vicinity to report any sighting of the missing crew members, as the SAR operations continued with the additional assistance by the Republic of Indonesia.
- 1.1.31 Although KS suffered structural damage to her bow, she remained seaworthy as assessed by the Master. None of KS' crew were injured and no pollution was reported. She remained on-site to standby for SAR assistance.
- 1.1.32 At about 0155H, KS was requested by VTIS Central, to drop anchor at the Eastern Holding Bravo anchorage (AEHB) for an investigation. With the assistance of a Pilot, KS was safely anchored at AEHB by about 0300H. The Master did not save the VDR data³¹ as per manufacturer's instructions until about 15 hours after the collision. As such, the voice data was overwritten and only the log data and visual data were available.
- 1.1.33 At about 0806H, the partially submerged JDR 19 was towed by four tugs (see **Figure 8**) and beached³² off Pulau Senang about 5nm away at the Southern edge of Raffles Reserved Anchorage to facilitate diving operations to search for the missing crew members.



Figure 8 - Capsized and partially submerged JDR 19 was towed by four tugs
(Source: Maritime and Port Authority of Singapore)

²⁹ CO2 sustained rib injuries while six others sustained minor injuries.

³⁰ The centre monitors vessel movements in its port waters and the Singapore Strait, it is equipped with an integrated state-of-the-art marine surveillance, communication and information system.

³¹ The audio of the VDR was recorded only for the last 12.5 hours and would be overwritten after that, while the log data and visual data were recorded for 34 and 55 hours respectively.

³² To ground deliberately in shallow water to prevent it from sinking in deep water.

- 1.1.34 By about 1226H, divers recovered two bodies. The Radio Man, a Malaysian national, age 26 was found in the bridge, while a Chinese national crewmember³³, age 46, was found in the accommodation.
- 1.1.35 On 16 September 2017, a body was found at South of Raffles Lighthouse³⁴ in Singapore waters, and identified as the missing Able Seafarer (Deck) a Chinese national, age 55.
- 1.1.36 On 17 September 2017, another body was found 1.9nm Northwest of Tanjung Sengkuang³⁵ off Batam in Indonesian waters, identified as another missing Able Seafarer (Deck), a Chinese national, age 50.
- 1.1.37 The MPA continued to issue safety broadcasts on SafetyNET³⁶ and NAVTEX³⁷ to ships in the area to keep a lookout for the remaining one missing crew member.
- 1.1.38 On 5 November 2017, divers recovered another body from the accommodation structure, later identified as the missing Cook, a Chinese National, age 60.
- 1.1.39 JDR 19 was declared as a constructive total loss and the wreck was removed by cutting it into sections (see **Figure 9**).



Figure 9 - The starboard quarter of JDR 19 being lifted out of water showing the angle and location of impact from KS's bow.

³³ Engaged on board by the ship's manager to supervise administrative work on board such as crew discipline and other non-work related matters. He was not a trained seaman according to information provided by the Master and Chief Officers.

³⁴ About 6 nm West of the collision site.

³⁵ About 3.6 nm East of the collision site.

³⁶ SafetyNET is the international service for the broadcast and automatic reception of maritime safety information and search and rescue related information via Inmarsat EGC system.

³⁷ NAVTEX is another mode of delivery of navigational and urgent maritime safety information to ships. It's a major element of the Global Maritime Distress Safety System (GMDSS).

1.2 Damage

1.2.1 Kartika Segara

- 1.2.1.1 The internal structural members of the bulbous bow were buckled (see **Figure 10**). Additional damages were noted on the ship's bow and starboard side bulwark at the forecastle deck and a slight indentation to the starboard side shell plate at the area of no. 3 water ballast tank.



Figure 10 – Damage at ship bow areas after the collision
(Source: the ship's manager)

- 1.2.1.2 Surveyors from ClassNK surveyed the vessel and issued a condition of class³⁸ for permanent repairs to be done no later than the next docking survey. Having done the temporary repairs, KS subsequently resumed her voyage to discharge her cargo at the next discharging port of Baubau, Indonesia.

1.2.2 JBB De Rong 19

- 1.2.2.1 The damage to JDR 19 was mainly on its starboard side which included tearing of ship's side shell plating at the starboard quarter in way of the starboard auxiliary tank³⁹ below the steering gear compartment, bending of all the four blades of the starboard propeller and misalignment of the starboard rudder (see **Figure 11**). JDR 19 capsized soon after the impact.

³⁸ Areas of temporary repairs were to be inspected during an occasional survey every 3 months till permanent repairs are carried out.

³⁹ JDR 19 designed having two auxiliary tanks located port and starboard.

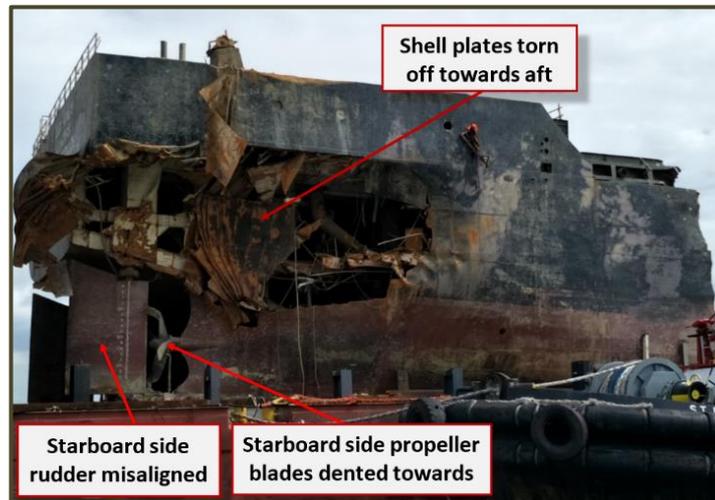


Figure 11 – Aft section of JDR 19 after being salvaged

1.3 Kartika Segara

1.3.1 The vessel

- 1.3.1.1 KS had six cargo oil tanks (see **Figure 12**), and was certified to carry oil cargo with flash point below 60° C. Her trading areas were between Indonesia and other Asian ports, including Singapore.

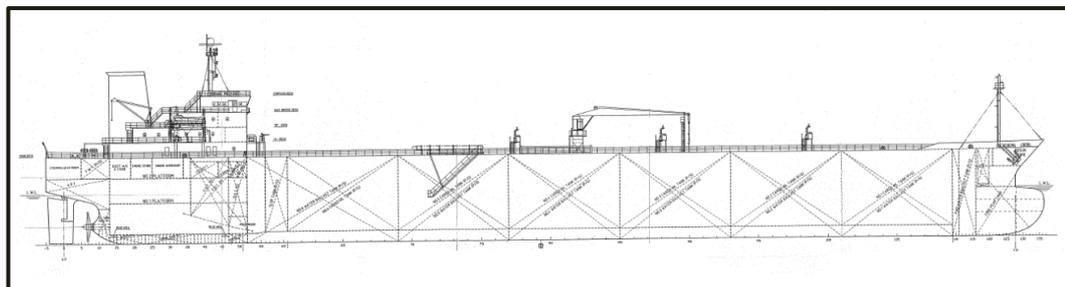


Figure 12 – General Arrangement (GA) Plan of KS
(Source: the ship's ISM manager)

- 1.3.1.2 KS was manned by all-Indonesian crew, the official language being both English and Bahasa Indonesia as stated in the company's Safety Management System (SMS) manual. Communication amongst officers and crew was predominantly in Bahasa, Indonesia.
- 1.3.1.3 Full term statutory certificates issued by ClassNK were valid at the time of the collision.
- 1.3.1.4 KS was inspected by its Flag State Control (FSC) on 23 August 2017, about a month before the accident and nil deficiencies were recorded. KS' last Port State Control (PSC) inspection was conducted in the port of Singapore on 12

February 2016. Seven non-detainable deficiencies were recorded⁴⁰ and rectified accordingly.

1.3.1.5 The SMS (version A-001/KAS/2017) scoped out the shipboard operations and procedures and was last revised in April 2017. The SMS required the Master to conduct navigation audits every three months⁴¹ covering various elements of navigation such as preparation, approval of and adherence to passage plans. Annual navigational audits by company superintendent was required to cover among other things, bridge team management.

1.3.1.6 The SMS contained instructions to bridge watchkeepers relating to Navigation Policy, posted on the bridge, extracted and summarized as follows –

- *A proper lookout shall be maintained at all times by sight and hearing and if necessary by Radar or other to detect at a good time risk of collision;*
- *Lookout shall be well instructed in the duties and not engaged in working with other duties that may impeded the lookout;*
- *For anti-collision measures, always use Radar and check in good time approaching vessels by repeated observations (radar and compass bearings)*
- *Effect of actions by give way vessel shall be checked until the other vessel is finally past and clear. If other vessel does not take proper actions, to use sound/light signals and VHF to call for her attention*
- *Determine Risk of close quarter situation by plotting or other systematic observation and use all Radars*
- *Do not make manoeuvres based on scanty information*
- *Before the Pilot leaves, information regarding other vessels movements, and currents shall be obtained from him.*

1.3.2 The Master and bridge team

1.3.2.1 The bridge was manned by the Master, the Second Officer, the Third Officer and a Helmsman at the time of collision.

1.3.2.2 The Master, age 57, held a Certificate of Competency (COC) Class 1 (Deck) issued by the Head of Sub Directorate of Seafarer Department, Indonesia and valid oil tanker endorsements. He had an in-rank experience of about 10 years and had joined KS a month ago. During this 10-year period he had been to other ports including Singapore, but this time was the first time on KS. He could not recall when he came to Singapore last. The Master was positioned in the forward part of the bridge and was not actively using the navigational equipment such as radars for navigating his vessel out of Singapore

1.3.2.3 The Second Officer, age 39, joined KS on 27 May 2017, and held a COC Class 2⁴² (Deck) issued by the Head of Sub Directorate of Seafarer Department, Indonesia and valid oil tanker endorsements. He kept the 12-4

⁴⁰ None of the deficiencies related to Navigation related matters

⁴¹ Master's Audit was conducted on 12 September 2017. No significant findings on passage planning. The audit noted that VDR maker's instructions were complied with and that vessel is fitted with a type-approved ECDIS and that ECDIS was for reference only.

⁴² COC Class 2 (deck) - the certificate qualifies person to be a Chief Officer on a merchant ship in Indonesia.

watch⁴³, came up on the bridge at midnight, and was assisting the Master for navigation, as well as in communicating with external parties using VHF radio, including VTIS and JDR 19.

- 1.3.2.4 The Third Officer, age 33, joined KS on 4 September 2017, about a week prior to the collision. He held a COC Class 2 (Deck) issued by the Head of Sub Directorate of Seafarer Department, Indonesia and valid oil tanker endorsements. He kept the 8-12 watch, and had completed his watch at midnight. As the vessel was departing Singapore and expected to cross the TSS, the Master instructed him to stay on the bridge to assist the bridge team. He was supposed to perform the role of a lookout and to plot the ship's position.
- 1.3.2.5 The Helmsman, age 54, held appropriate qualifications for ratings forming a part of navigational watch and was steering the vessel since departing the anchorage and had been on the helm for about an hour prior to the collision.
- 1.3.2.6 Records of hours of rest and work documented as per company's SMS indicated that the bridge team's rest hours were in compliance with 'Hours of rest' requirements⁴⁴. There was no evidence to suggest that alcohol was consumed on board the vessel.
- 1.3.2.7 The bridge team had certificates to indicate that they had undergone training on bridge resource management from Indonesia. The Master had attended a revalidation course in July 2016, while the Second Officer and Third Officer attended this course in March 2015 and May 2015 respectively. This training requirement was documented in the company's SMS manual under the Navigation Safety section.
- 1.3.2.8 This section also scoped out Master's responsibility to organize and lead an effective Bridge Management Team, including verification that all the members of the team use the company's checklists and that the voyage plans are adhered to. A standard matrix as per company SMS, regarding bridge watch conditions, was required to be posted on the bridge and implemented. The vessel was in compliance with the watch conditions for this transit.

1.3.3 **Bridge equipment**⁴⁵

- 1.3.3.1 According to the Safety Equipment Certificate (SEQ) ⁴⁶ KS was fitted with two radars, both Automatic Radar Plotting Aids (ARPA), namely S-band and X-

⁴³ Arrangement on KS, the Second Officer keeps sea watch for periods of 0001H-0400H and 1200H to 1600H. The Third Officer keeps sea watch for periods of 0800H-1200H and 2000H-2400H.

⁴⁴ Maritime Labour Convention (MLC) 2006 provides guidelines on minimum number of hours of rest required for seafarers on merchant ships. Same establishment of rest periods for watchkeeping personnel contained in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW Convention).

⁴⁵ Pre-departure check conducted by the Third Officer was documented as working with no defects.

⁴⁶ The Cargo Ship Safety Equipment Certificate was issued to KS by the Flag Administration on 29 May 2017, and listed details of navigational system and other equipment on KS. The last annual survey was carried out on 29 May 2017.

band type. At the time of the collision, both radars were in operation. The Automatic Identification System (AIS) for identification of vessels was available and reported to be in working condition. At the time of the collision, positions were being plotted on the paper charts and ECDIS was being used for reference as the crew thought ECDIS was not the primary means⁴⁷ of navigation. KS' primary means of navigation stated on the SEQ certificate was ECDIS with nautical charts as the backup.

1.3.3.2 The rudder and rate of turn indicators were available in working condition, for the steering AB to take reference from when steering the vessel by hand. According to the Master, there were no abnormalities observed in KS' maneuverability since departing the anchorage.

1.3.3.3 Four sets of the VHF radio were fitted on the bridge, two of which were sited on the port and starboard side in the front part of the bridge, while the other two sets were spares and not in use at the time (see **Figure 13**). The VHF radio on the port side was used by the Second Officer on channel 14 for communicating with VTIS Central.



Figure 13 – Bridge equipment locations on KS

1.3.3.4 Manufacturer's instructions on how to save the VDR data⁴⁸ were available on the bridge next to the equipment, which was also verified during the last satisfactory Annual Performance Test (APT) by the attending Radio Surveyor.

1.3.3.5 Prior to the Pilot's disembarkation, the X-band radar's range scale was changed from 1.5 nm (off centered giving effective range of about 2.3 nm) to 3 nm. The radar displays also showed that the SOG and course over ground (COG) were in use at the time of the collision (see **Figure 14**).

⁴⁷ Electronic Chart Display and Information System (ECDIS). Tankers of 3000 gross tonnage and upwards constructed before 1 July 2012, not later than first survey after 1 July 2015 are required to be provided with an ECDIS. KS was required by regulation to comply with ECDIS carriage requirements.

⁴⁸ MSC/Circ.1024 – IMO adopted guidelines on Voyage Data Records (VDR) ownership and recovery.

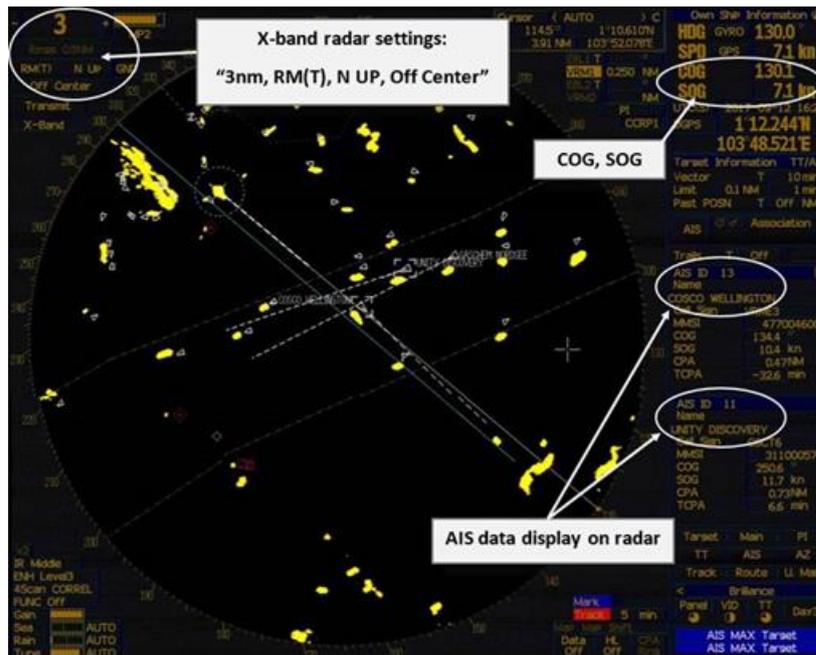


Figure 14 – X-band ARPA display setting on KS before crossing the TSS

1.3.3.6 Both radars were used with AIS integration function by the bridge team. During the interviews, the investigation team learned that it was a practice on-board to overlay the AIS data on the radar and rely on the AIS information for collision avoidance rather than ARPA target acquisition functions.

1.3.3.7 The S-band radar located on the starboard side of the bridge was set at 3nm range scale. Since it was not linked to the ship's VDR, data from this radar could not be verified.

1.4 JBB De Rong 19

1.4.1 The Vessel

1.4.1.1 JDR 19 was a dredger, constructed with four cargo holds, each hold was in a single V-shape design. She had a single hull and double bottom. (see **Figure 15**).

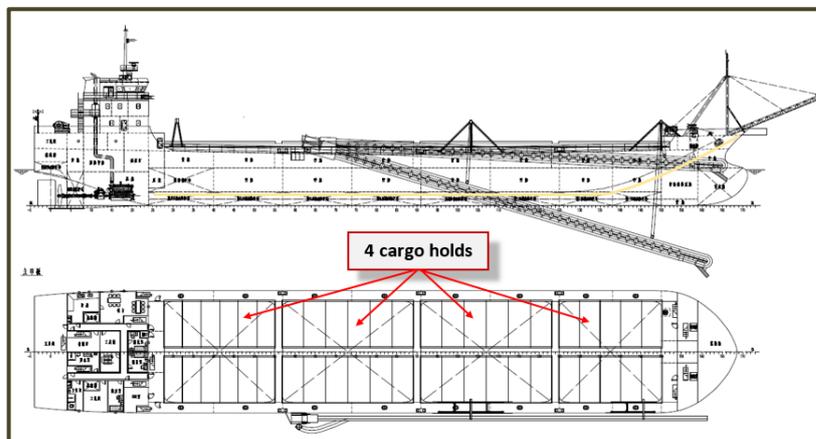


Figure 15 – GA Plan of JDR 19 (Source: the ISM Manager)

- 1.4.1.2 Benzmark Development (M) SDN BHD, based in Malaysia, owned and operated JDR 19 (the Owner). The company also owned and operated two sister ships, on a similar trading route, namely JBB De Rong 16 and JBB De Rong 18.
- 1.4.1.3 LK Global Shipping (M) SDN BHD was the ISM Manager (the company) of JDR 19 and operated out of the same office as the Owner. The company managed a fleet of 38 vessels including JDR 19, using an approved SMS. Of these, 37 were suction hopper dredger type while one was just a sand carrier. All of them are like the JDR 19, traded along the same route.
- 1.4.1.4 According to the Designated Person Ashore (DPA), on 5 November 2017, a suction hopper dredger namely JBB Yu Hang 258, managed by them, capsized and sank about seven nautical miles off waters of Parit Jawa, Muar, Malaysia. All 14 crew members were rescued. News reports cited that in March 2018, a dredger, JBB Rong Chang 8, capsized and sank off Muar, Malaysia, resulting in the loss of 13 persons. This dredger too, like the JBB Yu Hang 258, was managed by the same company. The DPA⁴⁹ of the company could not provide a copy of relevant training records for his role.
- 1.4.1.5 JDR 19 was classed with the Sing-Lloyd, a classification society approved by JDR 19's Flag Administration. An Interim Certificate of Classification was issued to her, which was valid for five months after an initial survey in May 2017. Interim statutory certificates were also issued and were valid at the time of the collision.
- 1.4.1.6 As required by Flag Administration⁵⁰, a crew list and documentary evidence to demonstrate provision of qualified crew for JDR 19 were submitted by the ISM Manager. On receipt of the application for a Certificate of Endorsement (COE) in May 2017 for recognition of certificates held by the officers and crew, the Flag Administration issued a Certificate of Receipt of Application (CRA) for relevant officers and crew to be engaged on-board JDR 19. The same crew list was verified during the shipboard audit in Malaysia on 3 May 2017 by the ISM auditor prior to issuance of an interim Safe Management Certificate (SMC).
- 1.4.1.7 In July 2017, there was a change in JDR 19's crew prior to her being deployed on an international voyage. At the time of the accident, the Flag Administration did not receive a notification of crew change or any other documents associated with it.
- 1.4.1.8 According to the ISM Manager, JDR 19 had completed more than 20 voyages transiting through Singapore Strait prior to the collision.

⁴⁹ DPA – Person in the ISM Manager (company) having direct access to the highest level of management ashore, so as to ensure safe operation of each ship, including responsibility and authority for monitoring the safety and pollution prevention aspects of the ship.

⁵⁰ Flag Administration of the Commonwealth of Dominica requires that for all vessels applying for registration under Dominica flag, a crew list must be submitted in addition to other documents by the vessel's Owner/operator. All Dominica vessels are also required to submit monthly reports on the disembarkation of their crewmembers and embarkation of new personnel.

1.4.1.9 As a new build, the vessel's Pre-Registration Inspection was waived by the Flag Administration and initial Flag State Inspection was planned around the registration's anniversary date⁵¹. The vessel had not been inspected by any Port State Control authority since being deployed on international voyages.

1.4.2 The bridge team and the SMS

1.4.2.1 JDR 19 was issued with a Provisional Minimum Safe Manning Certificate (PMSMC) (see **Figure 16**) under STCW requirements⁵² on 27 April 2017 by the Flag Administration, for her trading areas of Singapore and Malaysia.

Capacity	Certificate (STCW Regulations)	Number of Persons
Master	II/2	1
Chief Mate	II/2	1
Rating Forming part of Navigational Watch	II/4	3
Chief Engineer	III/3	1
Officer in Charge of Engine Watch	III/1	1
Rating Forming part of Engine Watch	III/4	1

Figure 16 – Minimum manning listed on the PMSMC

1.4.2.2 At the time of the collision, JDR 19 was manned by 12 persons, of which 11 were from China while one was from Malaysia, a Malay crew who was the Radio Man.

1.4.2.3 The person engaged as the Master on the crew list, was 47 years old and had joined the vessel at Shanghai in China on 16 July 2017. According to China MSA⁵³, he held a Chief Officer's certificate issued by them, with limitations to sail on domestic trade in China on ships of less than 500 GT. This certificate was valid till 31 December 2016 and had since not been revalidated.

1.4.2.4 The person engaged as CO1 on the crew list, was 56 years old and held a certificate for a rating as a part of navigation watch. He had handed over the navigation watch to a person engaged as CO2 at about 2300H on 12 September 2017.

⁵¹ Source - Flag Administration dated 20 September 2017.

⁵² 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.

⁵³ MSA – Maritime Safety Administration of the People's Republic of China, is a government agency which administers all matters related to maritime and shipping safety, the Seafarer Certificate Department in MSA who examines and issues competency certificates to seafarers.

- 1.4.2.5 The person engaged as CO2 on the crew list, was 52 years old and was the Officer in-charge of navigation watch at the time of collision. China MSA was unable to trace any certification issued to him. During the interviews, he could not provide any indications of when he obtained his maritime related qualifications. Subsequent queries posed to him indicated that his knowledge of navigation and COLREGs was poor⁵⁴. He could only speak Chinese (Mandarin) and not converse in English.
- 1.4.2.6 It was made known to the investigation team, that the person engaged as the Radio Man on the crew list, could not converse in Chinese (Mandarin). According to Malaysia Marine Department (MMD), he had not been issued with any Certificate of Competency or rating forming a part of a navigation watch under the STCW convention by Malaysian authorities. However, according to MMD, he held the following certificates issued by institutions approved by them:
- Basic Oil Training and Chemical Tanker
 - Basic Training
 - Security Awareness
- 1.4.2.7 It was also made known to the investigation team that communications between the Chinese crew and the Radio Man on-board JDR 19 was typically by sign and body language. VHF radio records indicate that communications between JDR 19 and VTIS Central took place in English.
- 1.4.2.8 The company could not provide the investigation team with evidence of qualifications for the remaining crew. The company indicated that JDR 19's crew was sourced through a manning agency in China. Details of this manning agency were not made available to the investigation team.
- 1.4.2.9 The company provided the investigation team with a copy of the SMS manual (version 1.0) developed in 2013. The company's SMS further stated that the working language used on-board was Chinese and/or English. The SMS contained lengthy procedures for navigation management, audits and checklists, amongst others⁵⁵. The Marine department⁵⁶ of the company was required to provide navigational support as per the SMS.

⁵⁴ He opined that a vessel which had departed a Port and was approaching from his starboard side, he would alter his vessel's course more to port side and keep clear of her. He further added that he had used a portable hand torch to attract KS' attention prior to the collision instead of using the daylight signalling lamp, which is required to be on the bridge for providing signals to attract attention as per COLREGs.

⁵⁵ The SMS was observed to contain lengthy details such as Unattended Machinery Space (UMS) Operation, hold washing for different types of cargo to be loaded into the cargo holds, hatch cover checklists, handling procedures for dangerous cargo, which was not applicable to JDR 19 or the type of ships managed by the company.

⁵⁶ The investigation team could not verify any details about any shore staff other than the DPA. The DPA did not have any seagoing experience. Evidence of DPA training was not provided to the investigation team.

1.4.2.10 The SMS contained a section on crew qualifications:

“1. General Requirements

1.1 Holding all required Crew certificates as required in STCW 78/95 and all the valid period should be 3 months longer than crew’s service period on board; holding a professional training certificate according to Industry specifically requested.

...

1.5 Having the required language communicating ability for performing his duties.

...

6.5 SMS Information and Communication Language

6.5.1 By developing the specific requirements on collecting, forwarding and using the SMS information, including the best practices, the Company ensures all staff ashore and afloat can receive all the relevant SMS information;

6.5.2 The Company stipulates both the Chinese and English are working language ashore and aboard ship; the variety written information regarding to the SMS running should be in English and Chinese, when needed may be in Chinese for supplement;

6.5.3 By the Crew Management Procedure, the Company employs the qualified crew who can use English and/or Chinese from the crew company, so as to ensure all crew can communicate effectively when they performance their duties;

...”

1.4.3 Bridge equipment

1.4.3.1 An Interim Cargo Ship Safety Equipment Certificate was issued to JDR 19 Sing-Lloyd on 3 May 2017 with a five-month validity. The certificate indicated that JDR 19 was provided with two radars⁵⁷, both X-band radars, an AIS, a rudder indicator. The primary means of navigation was paper charts, although the crew confirmed an electronic chart also on the bridge. The vessel was provided with a magnetic compass instead of a gyro compass⁵⁸ and was not fitted with a VDR⁵⁹ which is a requirement for its size.

1.4.3.2 The vessel was provided with two sets of VHF radio located one each at the port and starboard side on the bridge. The Radio Man was reportedly using the starboard side VHF radio set for communicating with VTIS Central.

1.4.3.3 JDR 19’s initial class survey for registration of Sing-Lloyd classification was done on 3 May 2017. The Classification Society had not submitted exemption applications to the ship’s Flag Administration⁶⁰ for JDR 19’s equipment such as gyro compass, ARPA, VDR and BNWAS⁶¹ system. According to the Flag Administration, JDR 19 had not been issued with any exemptions at the time of the collision.

⁵⁷ At the time of the collision, both were in operation, one at 1.5nm and one at 3nm range scale.

⁵⁸ Due to the trading area, Classification Society had waived these requirements subject to certain conditions.

⁵⁹ SOLAS 74 V/20.1.4, as amended – To assist in casualty investigations, ships when engaged in international voyages, ships, other than passenger ships, of 3000 gross tonnage and upwards constructed on or after 1 July 2002, shall be fitted with a VDR, which may be S-VDR (SOLAS 74 V/20.2.1, as amended).

⁶⁰ The Flag Administration confirmed that exemption applications had not been issued for JDR 19 and that the Classification Society was not authorised to waive any requirements without the Flag Administration’s authorisation.

⁶¹ Bridge navigational watch alarm system.

1.4.4 Steering and engine information

- 1.4.4.1 JDR 19 did not have auto-steering capabilities and had to be steered manually. The engine telegraph was next to the steering console. CO2 had reportedly been steering the ship since taking over watch from CO1 at 2300H.
- 1.4.4.2 According to the Master and both Chief Officers, the vessel did not have any maneuvering difficulties and responded well to helm orders from the bridge.
- 1.4.4.3 A post salvage assessment of the wreck showed that the rudder position was at about 17° to port (see **Figure 17**). This was confirmed as being the helm order given⁶² by the CO2 prior to the collision.

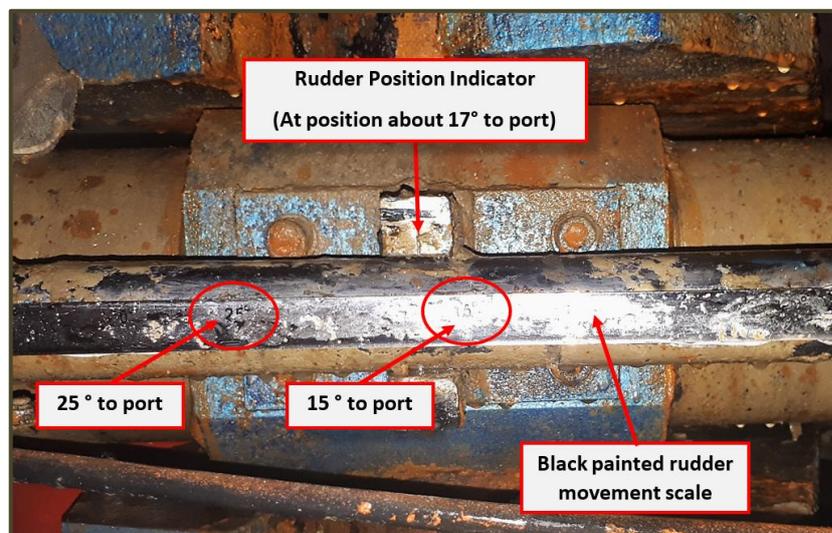


Figure 17 – Physical rudder position indicator at steering gear room on JDR 19

- 1.4.4.4 According to CO2, he slowed the engine telegraph to “minimum” ahead prior to the collision.
- 1.4.4.5 The physical inspection of the wreck showed that JDR 19’s local engine lever at a position⁶³ between Dead Slow Ahead and Stop (see **Figure 18**).

⁶² VDR data of the KS indicated that JDR 19’s heading began to change to port about four minutes prior to the collision.

⁶³ CO 2 had confirmed that he had reduced JDR 19’s engine speed about 2 minutes prior to the collision.

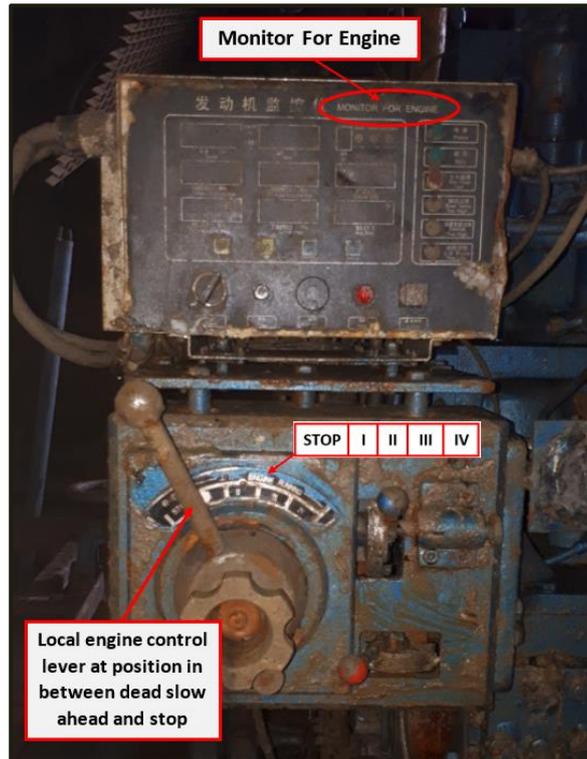


Figure 18 – Engine local control lever at position between Dead Slow Ahead and Stop, photo taken in the engine room after vessel was salvaged

1.4.4.6 In the absence of audio recordings forming a part of the VDR, the investigation team was not able to verify, if any conversation took place on JDR 19 amongst the bridge team, to assess the actions on the bridge prior to the collision.

1.5 The location of collision

1.5.1 The collision occurred within the Precautionary Area of the TSS in the Singapore Strait which was about 1.7nm South-West of Sisters Islands (see **Figure 19**) within Singapore territorial waters.

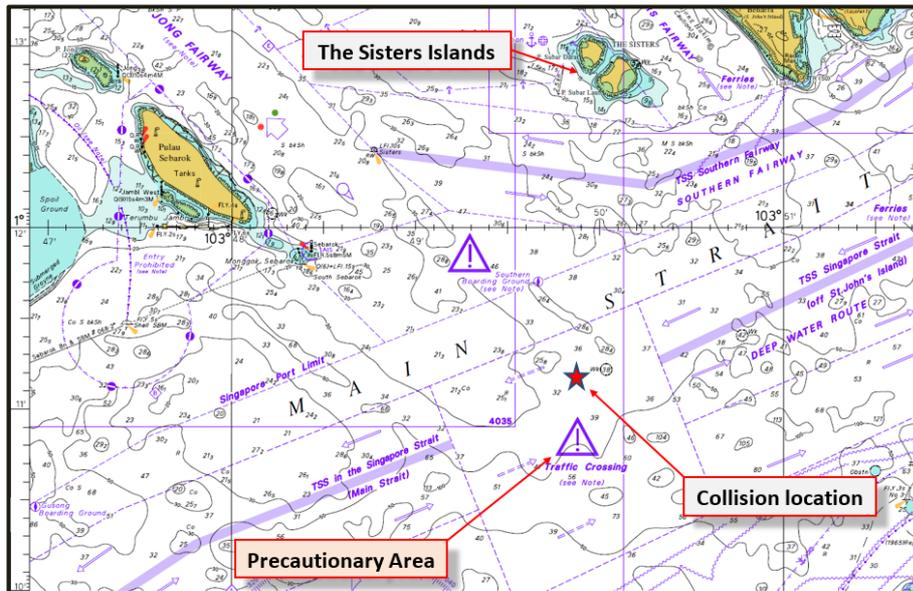


Figure 19 – Collision occurred at the Precautionary Area of the Singapore Strait TSS, about 1.7nm South-West of Sisters Islands

- 1.5.2 The location was within the mandatory ship reporting systems stated in the International Maritime Organization (IMO) published Ships' Routing⁶⁴.
- 1.5.3 To enhance navigational safety, MPA had in 2013 recommended vessels crossing the TSS and Precautionary Areas⁶⁵ in the Singapore Strait during the hours of darkness⁶⁶ to display three all-round green lights in a vertical line. This recommendation did not relieve crossing vessels from their obligation to comply with Rule 10 (Traffic Separation Scheme) of COLREGs. KS Master was aware of this requirement.
- 1.5.4 On the nautical charts⁶⁷ used by KS, the Precautionary Area was printed with the recommended direction of traffic flow (see **Figure 20**). In some parts of the world, Precautionary Areas are not considered⁶⁸ as a part of the TSS and COLREGs Rule 10 is not generally applicable, however, ships should navigate with particular caution within such areas⁶⁹.

⁶⁴ 2015 edition (at the time of collision occurred), Ships' routing systems contribute to safety of life at sea, safety and efficiency of navigation, and/or protection of the marine environment, its general provisions are established pursuant to regulation V/10 of the SOLAS Convention.

⁶⁵ A routing measure comprising an area within defined limits where ships must navigate with particular caution and within which the direction of traffic flow may be recommended – Source IMO Ship's Routing (edition 2017).

⁶⁶ PMC No. 4 of 2013 – Recommendatory measure for vessels crossing the traffic separation scheme (TSS) and precautionary areas in the Singapore Strait during the hours of darkness. IMO's Maritime Safety Committee was adopted as an interim recommendatory measure at its eighty-eighth session.

⁶⁷ Dual badge chart BA4041 Ed. 27 Aug 2015 published by Singapore and UK.

⁶⁸ MGN 364 (M+F) Application of Rule 10 and Navigation in the Dover Strait – Source UK Maritime and Coastguard Agency.

⁶⁹ MPA's requires that vessels crossing the TSS and Precautionary Areas in the Singapore Strait to proceed to or from ports or anchorages should when intending to cross the eastbound or westbound traffic lanes in the TSS or precautionary areas respectively should cross the traffic lane on a heading

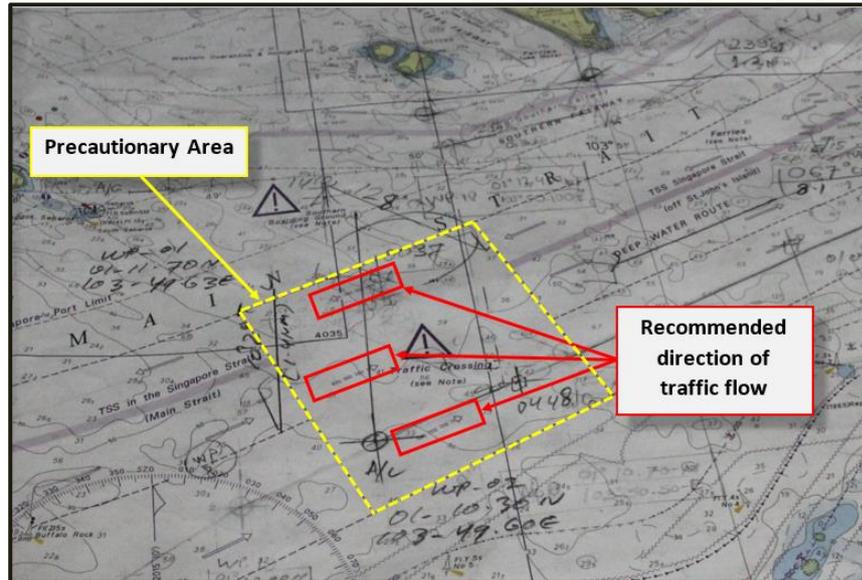


Figure 20 – BA 4041 used by KS overlaid with annotations indicating recommended direction of traffic flow within the Precautionary Area

1.6 Singapore Vessel Traffic Information System (VTIS)

- 1.6.1 MPA operates the VTIS from the Port Operations Control Centre (POCC), which integrates data from various sources including radars, the AIS, Closed Circuit Television System, Very High Frequency Communications System and vessel databases, to provide an accurate and comprehensive understanding of the traffic in the Singapore Strait and Singapore port waters. The VTIS enables MPA to provide timely information and advice to help vessels transit safely through the Singapore Strait, as well as manage traffic within Singapore port waters.
- 1.6.2 For managing traffic within Singapore port waters, in addition to traffic advice for the Strait, various sub-sectors exist (see **Figure 21**) which have their own dedicated VHF radio channels for communication and the stations are manned by duly qualified operators. Prior to the collision, KS was departing the Western sector which was monitored on VHF radio channel 68.

as nearly practicable at right angles to the general direction of traffic flow – Source MPA Port Marine Circular No. 4 of 2013.

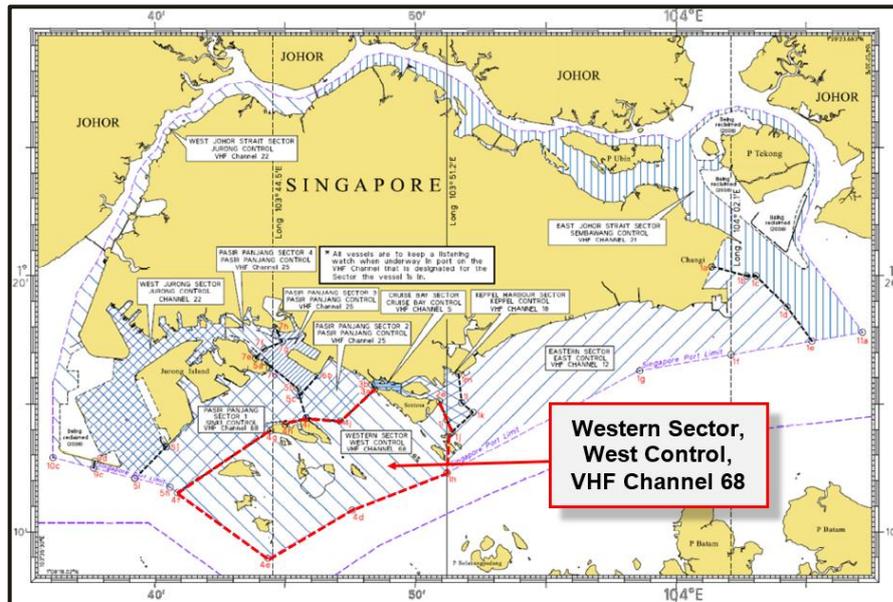


Figure 21 – Reporting sectors in Singapore port
(Source: MPA Port Marine Circular no. 4 of 2009)

1.7 VTIS personnel

1.7.1 The TSS area where KS and JDR 19 were navigating in was managed by a VTIS operator⁷⁰ who held relevant training⁷¹ as per model courses by International Association of Marine Aids and Lighthouse Authorities (IALA). In addition⁷² to the operator, a WM and a CWM were also assisting in de-conflicting the two vessels prior to the collision. The operator had been performing his role in VTIS for more than 15 years while both the WM and CWM had been performing their roles for about 1.5 years and 3 years respectively.

1.8 Environmental conditions

1.8.1 The night visibility was reported as good of more than 5nm. The sea was calm, clear skies and a flood tide⁷³ at approximate of 1 to 2kts. 5kts wind was reported from South-East.

⁷⁰ IALA Model Course V-103/1 VTIS Operator's Certification.

⁷¹ MPA's internal competency requirements in compliance with IALA requirements.

⁷² The WM and CWM were Master Mariners who held Certificate of Competency Class 1 (Deck) and IALA Model Course V-103/2 VTS Supervisor Certification (The watch manager is overall in-charge of a shift and oversees the operators under his shift).

⁷³ The predicted tidal stream at that time was slack water with the "Ebb tide" changing to the "Flood tide" at 0001H. The ebb tide was in the direction of towards in 064° which may have been prevalent just prior to the collision setting KS to the East.

2 ANALYSIS

2.1 Actions by KS in crossing the TSS

- 2.1.1 Despite being made aware earlier by the Pilot that heavy traffic would be encountered from the East in the westbound lane, the Master of KS continued on his vessel's planned course and increased the vessel's engine telegraph progressively with the three all-round green lights displayed⁷⁴ on the main mast. On receiving the initial advice from VTIS against crossing the TSS, considering the heavy traffic from the East, KS' initial response indicated that the team had not understood VTIS' advice.
- 2.1.2 Only upon subsequent reaffirmation, in which KS responded with an "OK", suggested that she had agreed to stop the vessel while waiting for the traffic from the East to clear.
- 2.1.3 Despite ECDIS being KS' primary means of navigation, the Master's navigational audit stated that ECDIS was for reference. With none of the officers using the ECDIS as an important navigational aid to monitor their vessel's position in real-time, it is possible that the bridge team had not recognised KS' position with reference to the TSS and the transit traffic. The Master from where he was positioned (see **Figure 22**) throughout the transit, was likely to have been over reliant on visual cues to navigate his vessel out of Singapore. The Master could have consulted the other available navigational equipment such as the ARPA and ECDIS to have a better situational awareness.

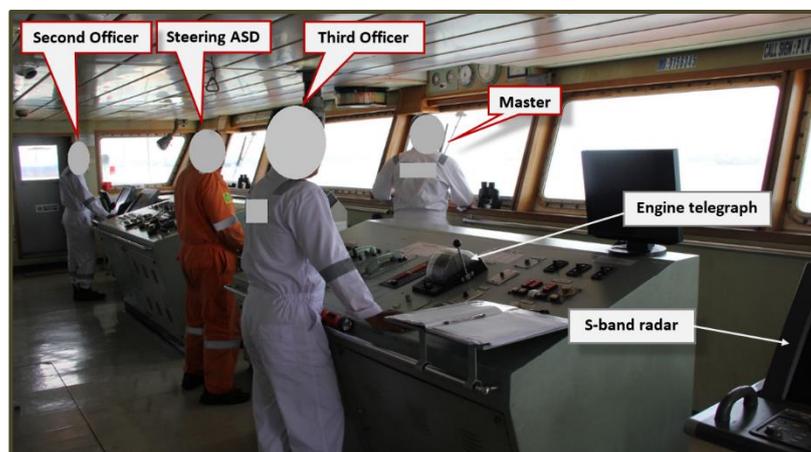


Figure 22 – Illustration of approximate position of the bridge team members prior to the collision

- 2.1.4 Although KS responded that they would stop the vessel, as advised by VTIS (see paragraph 1.1.17), and the records in the logbook indicated that KS' engine telegraph was stopped at 0032H and full astern propulsion at 0034H, KS was still making good a speed of about 7kts about 3 minutes prior to the

⁷⁴ The investigation team became aware during the interview of KS' Master that his assessment was that once he had displayed the three all-round green lights, other vessels in the TSS were to watch out for his vessel as she was going to cross the TSS.

collision. It is possible that the bridge team had either delayed its response, or did not take sufficient action, to stop the vessel's headway, which resulted in a close quarter situation with JDR 19.

- 2.1.5 KS' charted course as per the passage plan for departing Singapore and to join the eastbound lane was 128°(T), which was not a heading nearly as practicable at right angles to the direction of traffic flow, which was 067° (T) (see **Figure 3**). Although KS was expected by way of a recommendation to cross the Precautionary Area and TSS as nearly as practicable at right angles to the general direction of traffic flow, this may not have contributed to the collision.

2.2 Crew competency of JDR 19

- 2.2.1 Despite several requests made to the company, the Flag Administration and the State's regulatory authority, the investigation team was not able to obtain Certificate of Competency of the JDR 19's crew. The investigation team has reason to believe that the person engaged on-board JDR 19 as CO2 was not qualified as officer in-charge of a navigational watch under STCW II/1. There was also no evidence to confirm that the Radio Man held any qualification under STCW II/4 for a rating forming a part of a navigation watch that would have enabled him to provide lookout duties effectively.
- 2.2.2 Additionally, the persons engaged on-board JDR 19 as the Master and CO1 were unqualified.
- 2.2.3 Details of the manning agency used by the ISM Manager could not be obtained. It is likely that the ISM Manager of JDR 19 had been provided with unqualified crew by the manning agency to operate their ships and there was no process in place for the ISM Manager to verify the crew's qualification to ensure that the ship was manned with qualified and certificated seafarers⁷⁵.
- 2.2.4 Without the relevant qualifications, it is likely that the CO2 and Radio Man (crew in the bridge at time of collision) were not familiar and cognisant with the COLREGs and were not aware that JDR19 was a give-way vessel for KS when KS was approaching from the Precautionary Area attempting to cross the TSS.

2.3 Maintaining a lookout on-board JDR 19 and KS

- 2.3.1 On JDR 19, both CO2 and Radio Man first became aware of KS' presence when VTIS Central called JDR 19 advising them to keep a lookout for the departing tanker.
- 2.3.2 JDR 19 was manually being steered by CO2 when transiting the westbound lane of the TSS. According to CO2, the radars were in operation at a range of 1.5nm and 3nm. However, because CO2 was steering the vessel and the Radio Man was standing next to the VHF radio keeping a listening watch on

⁷⁵ ISM Code Element 6.2.

the starboard side at the forward part of the bridge and occasionally looking out of the bridge windows, the radars were not being used by either of them to monitor and track the vessels in the vicinity. As such, it is likely that JDR 19 did not maintain a proper lookout⁷⁶ during its transit preceding the collision.

- 2.3.3 On KS' bridge, three of the five targets, including JDR 19⁷⁷ in the TSS were acquired⁷⁸ by the Second Officer using the ARPA function of the X-band radar on a 3nm range. Although the Master visually saw JDR 19's (aspect) green sidelight and other navigation lights prior to the collision, it could not be established what time he had noticed these navigation lights. Although the Master expected his officers to advise him of the status of traffic in the vicinity, the Master could not explain why he did not specifically ask for JDR 19's target data from the Second Officer for his assessment. The Second Officer being the same person who was communicating to VTIS indicating KS' intention to cross the TSS, also did not provide any input to the Master how JDR 19's presence was going to affect KS' intended crossing of the TSS.

2.4 Assessment of risk of collision and situational awareness

- 2.4.1 JDR 19's crew became aware of KS' presence only when VTIS called JDR 19. The level of competence of JDR 19's crew as highlighted in Para 2.2 is indicative of them lacking situational awareness during the transit prior to the collision and inadequate knowledge of COLREGs.
- 2.4.2 Since the CO2 was steering the vessel from a position that was away from the radars or the compass, and the Radio Man was not using them either, the bridge team of JDR 19 did not determine if a risk of collision existed⁷⁹ and did not realise its obligation as the give-way vessel for KS (see **Figure 23**).
- 2.4.3 As stated in Para 1.1.24, KS was on a heading of 137° (T) and making good a course of 126° (T) (that is, a difference of 11° between heading and course). This suggests that the KS' bridge team did not recognise the current acting on KS from the West and did not take action to correct the difference. KS' crew also did not pay particular attention to the almost constant compass bearing of the approaching JDR 19. JDR 19's nearly constant Closest Point of Approach (CPA) range (between 0.1nm-0.02nm) and steadily reducing time to CPA (TCPA), after several minutes of being acquired by the KS' Second Officer, are vital indicators of a potential close quarter situation between the two vessels as they approached each other. These indicators should have alerted the KS' crew of an imminent collision. All these would

⁷⁶ COLREGS Rule 5 - Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

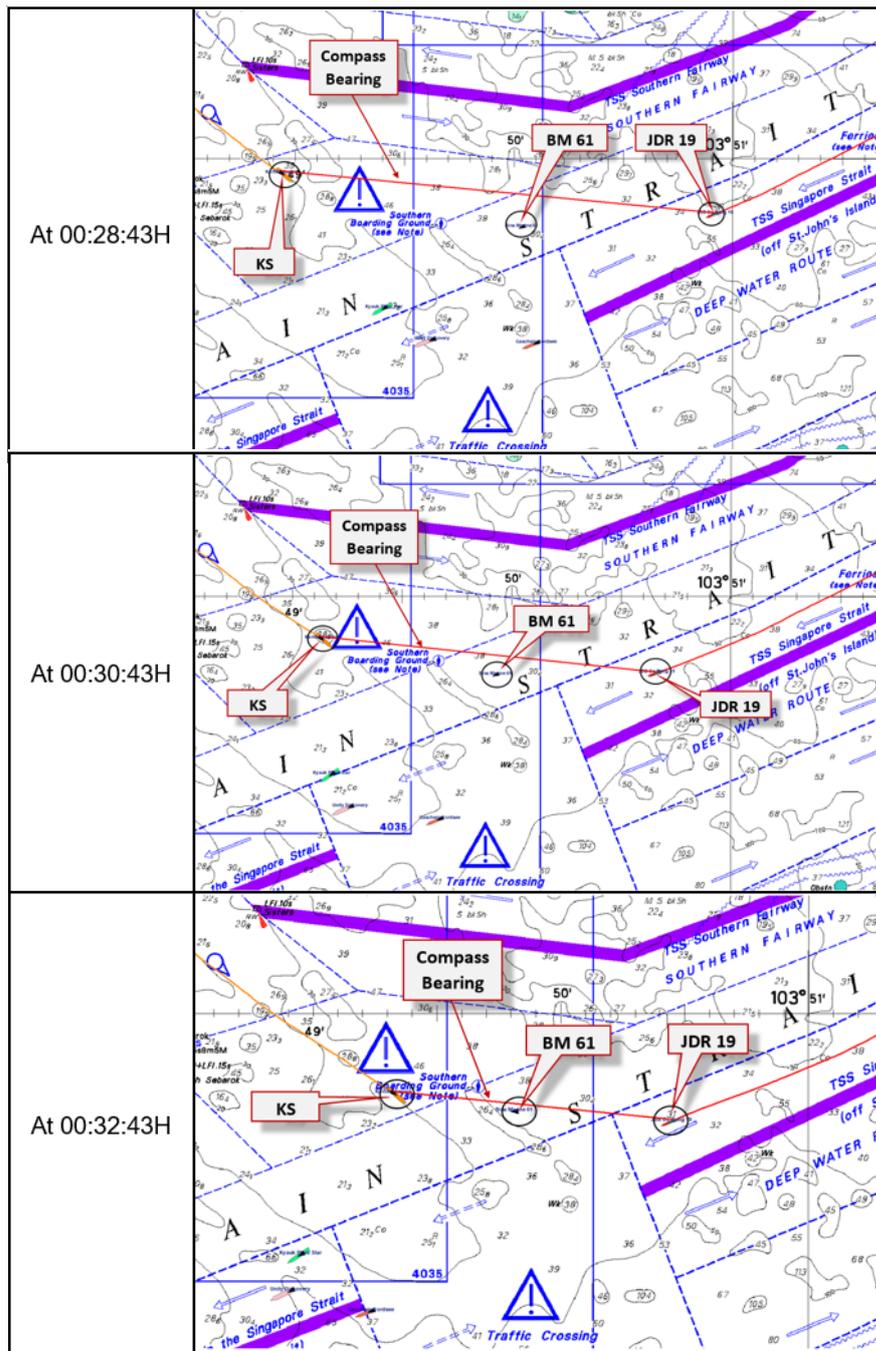
⁷⁷ JDR 19 CPA and TCPA – 0.11nm and 12 min.

⁷⁸ COLREGs Rule 7(b) – Proper use shall be made of radar equipment if fitted and operational including long-range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects. Although the Second Officer acquired JDR 19, he did not inform the Master of JDR 19's data.

⁷⁹ COLREGs – Rule 7(d) (i) – In determining if a risk of collision exists the following considerations shall be among those taken into account – such risk shall be deemed to exist if the compass bearing of an approaching vessel does not appreciably change.

suggest that there was also a lack of situational awareness on the KS' bridge team.

Time (HH:MM:SS)	Distance (n.m.)	Compass True Bearing (from KS/from JDR 19)
00:28:43	1.98	095.5° / 275.5°
00:30:43	1.55	096.0° / 276°
00:32:43	1.13	095.8° / 275.8°
00:34:43	0.74	096.7° / 276.7°



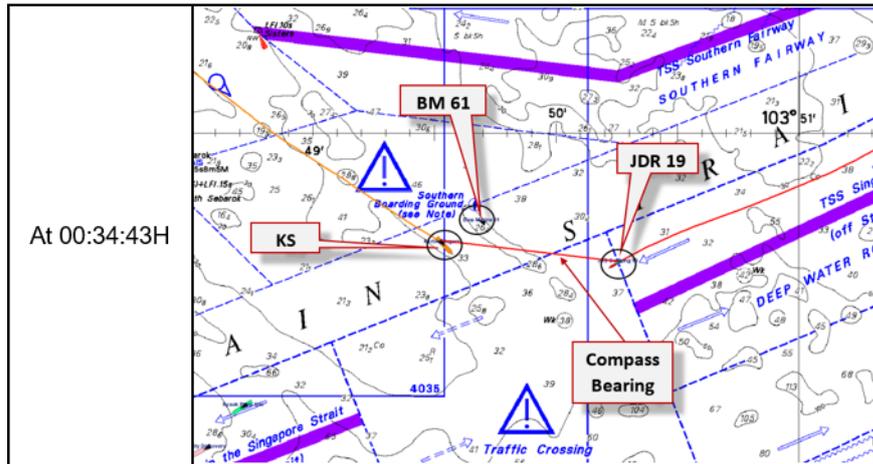


Figure 23 – Illustration of compass bearing between KS and JDR 19

2.5 Actions to avoid the collision

- 2.5.1 When CO2 of JDR 19 became aware of KS' presence, a helm to port was applied by him, which was consistent with JDR 19's heading change to port prior to the collision as noted on KS' VDR data as well as the post salvage inspection which had the rudders indicated at about port 17. This helm order was based on CO2's understanding of collision avoidance action, but was not in accordance with COLREGs. Had JDR 19 altered its course to starboard in accordance with COLREGs when the bridge team became first aware of KS' presence, the consequence may have been different.
- 2.5.2 At about 0036H, observing that KS was nearly at the edge of the Precautionary Area, VTIS informed KS of available sea-room on its starboard side and for her to alter course to avoid the imminent collision. Though the Master initially gave helm orders to alter his vessel's course to the starboard side while making headway (and operating astern propulsion), considering his own vessel's safety⁸⁰, he amended that helm order to the port side. Helm orders on KS could not be verified from the VDR data and hence it could not be established whether the helm orders were indeed ordered and executed promptly as required by the Master. This order of port helm was not in accordance with COLREGs Rule 17 (c)⁸¹.
- 2.5.3 Although prior to the collision, the KS gave rapid light flashes as per COLREGs querying JDR 19's intentions, KS should have also indicated her

⁸⁰ KS was loaded with a cargo of gasoline and an impact from the JDR 19's bow to KS' midship may have resulted in a fire / explosion putting both vessels at risk. According to the Master, his decision to amend his order was also influenced by his visual assessment of JDR 19's relative position to his vessel, and an assessment that altering to port may also have a higher chance of avoiding the collision or minimising its impact.

⁸¹ A power-driven vessel which takes action in a crossing situation in accordance with subparagraph (a) (ii) of this Rule to avoid collision with another power-driven vessel shall, if the circumstances of the case admit, not alter course to port for a vessel on her own port side.

manoeuvre of astern propulsion⁸² on the whistle (three short blasts) supplemented by light signal (three flashes) as required by COLREGs. This was especially when JDR 19 did not respond to the VHF radio call by KS exclaiming the dangerous situation.

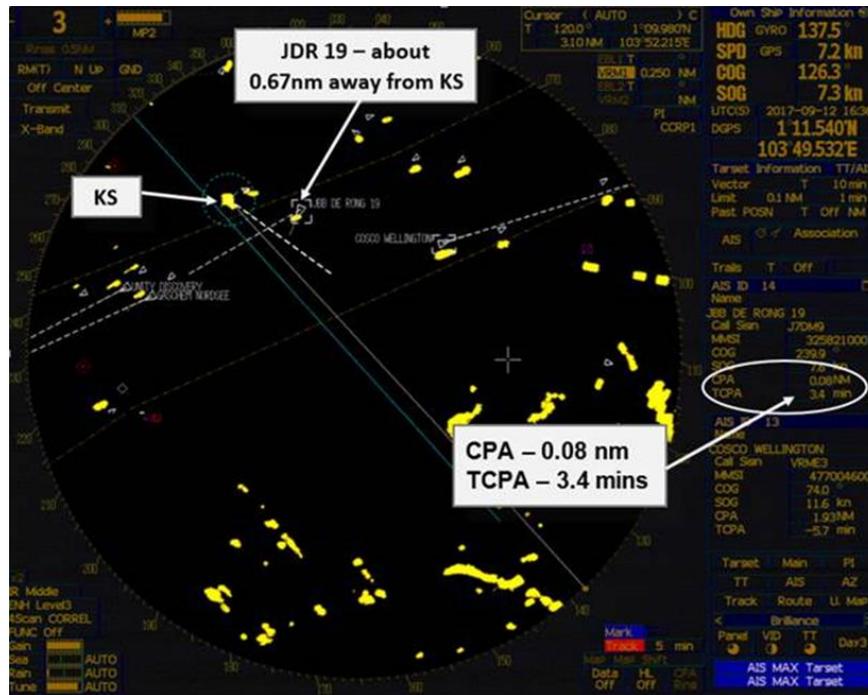


Figure 24 – At 0036H, JDR 19 relative position on KS' radar display

2.5.4 Notwithstanding the above, had KS observed timely that JDR 19 was not taking actions to avoid collision as expected of a give-way vessel, KS could have taken early actions to avoid collision.

2.5.5 Both vessels should have used appropriate light and sound signals timely to attract each other's attention and to indicate their respective actions.

2.6 Bridge Resource Management

2.6.1 The four persons of the bridge team of KS, including the Master, had undergone Bridge Resource Management (BRM) courses which included a refresher course as a part of their STCW training. Despite this, for the fact that the Master was over relying on his visual assessment and did not receive inputs on ARPA and ECDIS from his crew, it was evident that the principles of BRM were not practiced on-board KS, with each member performing their own individually assigned/ undertaken tasks. According to the Master, he was expecting traffic related information from the Second Officer who was communicating with VTIS, as well as the Third Officer, who was, instead of performing the role of a lookout, manning the telegraph and making logbook entries.

⁸² COLREGs – Rule 34 (a) and (b) – Power driven vessels shall indicate their manoeuvre, when in sight of one another, and manoeuvring as authorised or required by these Rules.

- 2.6.2 The bridge of JDR 19 during its transit, was manned by two persons, the CO2 (on the helm) and the Radio Man (VTIS communication) who did not have a common communication language amongst them and relied on hand signals and gestures to communicate, the former a native Chinese speaker, and the latter was a Malay and unable to understand Chinese.
- 2.6.3 As JDR 19 progressed on her transit in the westbound lane, the Radio Man responded to VTIS' call for JDR 19 to lookout for the KS. According to CO2, when the Radio Man gesticulated to him about the target KS intending to cross JDR 19's bow, CO2 strongly urged (also using hand gestures) to ask KS to pass JDR 19's stern. Ineffective communication amongst the two members of the bridge team which resulted in confusion on the course of actions to be taken could be a reason why the Radio Man did not communicate with VTIS on JDR 19's assessment.

2.7 Role of VTIS

- 2.7.1 VTIS Central in its advisory capacity, had provided early and sufficient information to KS about traffic in the Strait. As KS approached the TSS, VTIS Central cautioned KS to refrain from crossing the Strait due to the heavy traffic, which was acknowledged by KS. Observing that KS' speed had not changed, VTIS Central suspected that KS had either not understood the previously given advice or had changed her mind to cross the TSS, and further noting that KS was coming close the edge of the Precautionary Area, VTIS Central advised JDR 19 to lookout for the departing KS.
- 2.7.2 KS' master may have misinterpreted this conversation as a permission for KS to cross the TSS, which was not the case. i.e. vessels should at all times make a full appraisal of the situation using all available means appropriate in the prevailing circumstances in addition to information provided by VTIS.
- 2.7.3 Recognising his vessel's status as the Stand-on vessel, it is likely that the bridge team on KS expected JDR 19 to give-way and hence did not pay particular attention on its CPA and TCPA, as they approached each other, or positively identified whether a risk of collision existed. A well-trained crew should be cognisant to observe such pre-cursors so as to timely assess risk of collision and to take avoidance actions.
- 2.7.4 Just prior to the collision, VTIS Central tried to avert the collision by advising KS to alter course more to starboard to increase the CPA with JDR 19 and by increasing her speed.

2.8 Safety Management System (SMS)

- 2.8.1 A DPA is responsible for the monitoring of the safety and pollution prevention aspects of the operations of the ship and hence should have the relevant knowledge of marine operations. The DPA for JDR 19 although claimed to have undergone relevant training to perform his role, based on the investigation team's interactions with him, it seems that he had little knowledge of marine operations and he was not able to provide a copy of

relevant qualifications and training records⁸³ that would have allowed him to effectively monitor and verify the implementation of the SMS in compliance with the ISM Code.

- 2.8.2 The SMS of ISM Manager for JDR 19's was unable to ensure that the personnel engaged were properly qualified or were able to communicate effectively in the execution of their duties related to the SMS. The SMS also did not ensure that Flag requirements for crew-change were timely reported. It was evident that the SMS was not in compliance with elements of the ISM Code, such as 1.4.2, 6.1, 6.2 and 6.7, thus casting doubt on the effectiveness of verification and control as required by SOLAS 74 IX/6, as amended, by the Flag Administration's recognised organisation. It was further evident that this SMS was not adequately implemented as required by SOLAS 74 IX/5, as amended.
- 2.8.3 KS' SMS did not contain a clear procedure to ensure that the VDR data was to be saved after an accident, defeating the intent of SOLAS 74 V/20, as amended and IMO's associated guidelines for VDR ownership and recovery.
- 2.8.4 KS' SMS although contained a Navigation Policy for ensuring navigation safety, the bridge team had not complied with provisions on maintaining an effective lookout and had not practiced effective Bridge Resource Management.

2.9 Incidental observations

- 2.9.1 JDR 19 had not been exempted from carriage of navigation equipment by the Flag Administration, and was not fitted with navigational equipment such as gyro compass, ARPA or VDR. The Classification Society, approved by the Flag Administration, had waived certain SOLAS requirements without the Flag Administration's concurrence or approval.
- 2.9.2 Even though the Second Officer had acquired the JDR 19, the bridge team of KS relied on AIS data of target ships more than the ARPA function of the radar. The latter could have given a better representation of JDR 19 as it provides details of range, bearing, bow crossing range of the targets based on speed through water.
- 2.9.3 The SMS on Navigation Policy for KS was silent on the use of Speed through Water for collision avoidance. This could have led to a practice on-board KS for the bridge team to use Speed over Ground. Using Speed through Water could have allowed the bridge team of KS to correlate the aspect (visual representation) of JDR 19 so as to make a full appraisal of the situation.
- 2.9.4 The SEQ certificate stated that KS was provided with a VDR, however the vessel was fitted with S-VDR which did not record the engine and rudder parameters.

⁸³ As set out in MSC-MEPC.7/Circ.6.

3 CONCLUSIONS

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

- 3.1 KS and JDR 19 collided in Singapore Strait TSS under calm weather conditions and good visibility, as a result of both vessels not maintaining a proper lookout.
- 3.2 The bridge team on-board KS did not make a full appraisal of the situation when advised by VTIS to refrain from crossing the TSS due to the traffic expected to be encountered during its intended crossing. The team lacked situational awareness for their intended transit out of Singapore, with the Master over reliant on visual cues for navigation.
- 3.3 The bridge team on-board KS did not apply principles of effective BRM, as evident from each member performing their own individually assigned/undertaken tasks, despite having undergone a BRM refresher training course.
- 3.4 The bridge team of JDR 19 did not take appropriate collision avoidance actions. JDR 19 was being navigated by uncertificated persons who were not qualified for the post that they were engaged on-board for and the task they performed. They had no knowledge of COLREGs to ensure safety of navigation by determining the risk of collision and taking appropriate actions to avoid collision.
- 3.5 The bridge team on-board JDR 19 was unable to effectively communicate with each other. Although the company's SMS included both Chinese and English as the working language on-board, neither of the persons on the bridge understood each other's language.
- 3.6 JDR 19's ISM Manager had not ensured that JDR 19 was provided with qualified and duly certificated crew fit for purpose for the safe operation of ships and pollution prevention, by the manning agency.
- 3.7 JDR 19 had not been exempted from carriage of navigation equipment by the Flag Administration, and was not fitted with equipment such as gyro compass, ARPA or VDR. Flag Administration's approved Classification Society had waived certain SOLAS requirements without the Flag Administration's concurrence or approval.
- 3.8 KS' ISM Manager had not ensured that VDR data is saved timely after a marine casualty and the SMS was silent on appropriate speed input for collision avoidance.

4 SAFETY ACTIONS

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

- 4.1 Actions taken by the (new)⁸⁴ ISM Manager of JDR 19.
 - 4.1.1 Recruited two ex-Master Mariners as the DPA and Deputy DPA on 26 February 2018, so as to have better understanding and appropriate knowledge background to review and implement the Safety Management System for their fleet.
 - 4.1.2 An in-house crewing executive was engaged to verify the qualification and certification of officers and crew before being engaged on their vessels.
- 4.2 Actions taken by the Flag Administration of JDR 19.
 - 4.2.1 An increase in oversight of all vessels operated by the new ISM Manager.
 - 4.2.2 All these vessels are also undergoing a Change-of-Class procedure for Hull and Machinery for which the Administration would conduct statutory surveys and certification directly to ensure full compliance with Flag State Inspection program.
 - 4.2.3 Considering Sing-Lloyd's issuance of exemption certificates without due process a non-compliance of Dominica's requirements, Administration would amend its procedure to include verification of Exemption Certificates during its audit of the RO, where the Exemption Certificates are issued on behalf of the Administration.

⁸⁴ After the collision, LK Global Shipping (M) SDN BHD closed down its operations as an ISM Manager and the persons from this company transferred to the Owner of JDR 19 operating the same ships under a new DOC.

5 SAFETY RECOMMENDATIONS

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

- 5.1 For the Owner of JBB De Rong 19
 - 5.1.1 To ensure that the ISM Manager of JBB De Rong 19 review the SMS procedures for recruiting and engaging appropriately certificated personnel. **[TSIB-RM-2018-024]**
 - 5.1.2 To ensure ISM Manager's SMS procedures on the use of appropriate working language on-board for effective communication, taking into account the operational needs of vessels and the nationality of the personnel engaged, are complied with. **[TSIB-RM-2018-025]**
- 5.2 For the Classification Society of JBB De Rong 19
 - 5.2.1 To review its processes for survey and certification of ships on behalf of the Flag Administration to ensure proper exemption from carriage of navigation equipment are granted by the Flag Administration. **[TSIB-RM-2018-026]**
- 5.3 For Dominica Flag Administration of JBB De Rong 19
 - 5.3.1 To verify that its approved Classification Societies have appropriate processes in place for granting exemptions on behalf of the Flag Administration. **[TSIB-RM-2018-027]**
- 5.4 For the ISM Manager of Kartika Segara
 - 5.4.1 To review its crew training process for ensuring the effective use of Bridge Resource Management principles and techniques. **[TSIB-RM-2018-028]**
 - 5.4.2 To improve the existing process for conducting periodic verification on effective Bridge Resource Management. **[TSIB-RM-2018-029]**
- 5.5 For Indonesia Flag Administration of Kartika Segara
 - 5.5.1 To remind owners and operators of Indonesia Flagged vessels to ensure that VDR data is saved and secured timely after a marine casualty so that it can assist in casualty investigations, taking into account guidance provided by IMO. **[TSIB-RM-2018-030]**

End of Report