FINAL REPORT

SAFETY INVESTIGATION INTO
COLLISION BETWEEN ALNIC MC AND THE USS JOHN S MCCAIN
IN SINGAPORE TERRITORIAL WATERS
ON 21 AUGUST 2017

MIB/MAI/CAS.021

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

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SYNOPSIS

In the pre-dawn hours of 21 August 2017, the Liberian-registered Alnic MC and the US Naval vessel USS John S McCain collided in the westbound lane of the Singapore Strait, in Singapore territorial waters about 4.6 nautical miles (nm) from Horsburgh Lighthouse. The collision resulted in 10 fatalities on the USS John S McCain.

The safety investigation determined that the USS John S McCain made a sudden turn to Port (left) into the path of Alnic MC because of a series of missteps that took place after propulsion controls were transferred.

When the Bridge team of Alnic MC saw the USS John S McCain turning, it presumed that the USS John S McCain would be able to safely pass ahead. The collision happened within three minutes of the USS John S McCain turning to Port, and the actions taken by Alnic MC were insufficient to avoid the collision.

1 FACTUAL INFORMATION

All times used in this report are Singapore local time, eight hours ahead of the UTC[1]. Ships mean times on Alnic MC and the USS John S McCain (JSM) were the same as Singapore local time.

1.1 Alnic MC[2]

1.1.1 Alnic MC (AM) is a 30,040 GT Steel Construction, 2008 South Korean built typical oil tanker, with its Bridge and accommodation block aft. She was provisionally registered[3] under the Republic of Liberia on 13 April 2017. AM was on a routine loaded voyage from Mai Liao, Taiwan, bound for the Port of Singapore, and was drawing a mean draught of about 8.65 metres when she was involved in a collision with JSM, a US Naval vessel in the pre-dawn morning of 21 August 2017, about 4.6 nm NNE of Horsburgh Lighthouse, in Singapore territorial waters.

Figure 1 - ALNIC MC at Singapore anchorage after the collision

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

[2] Previous known names: Tandara Spirit -> Naviga8 Stealth –> Helcion

[3] AM was provisionally registered under the Liberian Flag Administration and her rights and privileges as a Liberian-registered vessel were valid till 12 October 2017.

1.1.2 AM had on board about 12,000 MT of Pyrolisis Fuel Oil (FO) loaded from Mai Liao, Taiwan, in four cargo tanks. There were two slop tanks with some slop water, and eight empty tanks. The cargo of FO was destined for discharge in Singapore.

1.1.3 AM's navigation Bridge was constructed to fulfil SOLAS[4] requirements of Bridge design. The chart room was separated by curtains which were drawn at night / hours of darkness during navigation.

1.1.4 AM's navigation related equipment was that of a typical modern merchant vessel, comprising amongst others, two Automatic Radar Plotting Aids (ARPA), Electronic Chart Display Information System (ECDIS)[5], typical radio equipment forming a part of the Global Maritime Distress and Safety System (GMDSS), and a steering stand console with Auto-Pilot steering and manual steering change-over capabilities.

Figure 2 – AM's Bridge layout, indicating the X-Band ARPA (left), ECDIS (center) and S-Band ARPA (right)

1.1.5 AM has a Length overall (LoA) of 183 metres and breadth of 32.2 metres, and is powered by one diesel MAN B&W engine 6550MC-C capable 10965BHP at 120.3 RPM.

1.1.6 She has one fixed-pitch 4-blade propeller and a semi-balanced rudder capable of turning hard over to hard over in 25 seconds with one steering motor and 15 seconds with two steering motors.

[4] SOLAS Convention – Regulation 15 – Principles relating to Bridge design, design and arrangement of navigational systems and equipment and Bridge procedures

[5] ECDIS was not the primary means of navigation. Cargo Ship Safety Equipment Certificate – Paper charts were the primary means of navigation. ECDIS had an interface from the ARPA and displayed tracked dangerous targets if they meet the pre-set settings.

1.1.7 She is owned by Energetic Tank Inc. and the International Safety Management (ISM) manager is Stealth Maritime Corporation S.A.[6] registered in Greece. The vessel was operated with a Safety Management System (SMS) which complies with the requirements of the ISM Code[7] with English as the working language. She was provisionally classed[8] under Bureau Veritas (BV) for statutory certification. In addition, the SMS catered for the Company's, Master's and third party's Navigational Audits. No non-conformities were raised during these audits (sampled in the previous year) prior to the collision.

1.2 AInic MC's Voyage

1.2.1 AM's Estimated Time of Arrival (ETA) to Eastern Boarding Ground "C" Pilot Station was 0830H. She was scheduled to pick up pilot on arrival, and was bound for anchorage to await berthing instructions for discharge.

1.2.2 AM's passage through the South China Sea was uneventful. On 20 August, the Master left routine night orders on the Bridge for AM's arrival at the Port of Singapore, including giving four hours' notice to Singapore Pilots for arrival.

1.2.3 According to deck logbook entries made during the Second Officer's watch, the Master came up on the Bridge at about 0300H on 21 August. The logbook also stated that with the Master conning[9], steering was switched to manual. At 0400H, the 12-4 watch Bridge watch was handed over by the Second Officer to the Chief Officer who was on 4-8 watch. Both officers were on a typical 4 On-8 Off watch routine at sea. The Second Officer continued to remain on the Bridge in the Chartroom, which was separated by curtains, to perform some pre-arrival Port document formalities, but was not a part of the Bridge team. The Master took over con from the Chief Officer at about 0405H.

1.2.4 The Master was using the S-Band radar (ARPA)[10] which was located on the Port side of the Bridge away from the telegraph controls. The S-Band radar did not have any blind sector, while the X-Band radar (also ARPA), also located on the Port side of the Bridge, had a non-significant blind sector of 2° right astern (179° ~ 181°).

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[6] The ISM manager, Stealth Maritime Corporation S.A., is also known as the Company. The Document of Compliance, which was valid till 7 Aug 2021, was issued by Lloyds Register on behalf of the Republic of Liberia, for the operation of Bulk Carriers, Oil tankers and Gas Carriers under the ISM Code.

[7] ISM Code for the safe operation of ships and for pollution prevention – Element 1.4

[8] The Provisional Certificate of Classification was issued in Qingdao, China and was valid till 14 October 2017.

[9] Conning means taking over control of the vessel's navigation from another officer. In the initial interview, the Master indicated that he had con of the vessel since 0300H. In the 2nd interview, he stated that he took the con of the vessel at 0405H. An addendum to the entry in the deck logbook was made to reflect that the Master was on the Bridge at 0405H and the entry for manual steering was struck off.

[10] ARPA – Automatic Radar Plotting Aid

1.2.5 The X-Band radar was connected to the ship's Voyage Data Recorder (VDR). It was located further to Port on the Bridge and was separated from the S-band radar by the ECDIS. At the time of the collision, the ARPA was in a North-Up, relative motion and off-centre mode at a range of three miles. It was set to give an alarm to the user if an acquired target came within a CPA[11] of three nm and TCPA of 12 minutes. The auto-acquisition function of the radar was on Manual mode. The Chief Officer reportedly acquired targets manually.

1.2.6 AM was heading 231° True (T) and on a speed of 9.5 knots. The Master noted the presence of routine busy traffic, as was to be expected in the Singapore Strait based on his past experience.

1.2.7 The other vessels were also heading South-westerly entering the west bound lane of the Traffic Separation Scheme (TSS). AM was amongst the slowest of the lot. Other vessels had either overtaken or were in the process of overtaking AM, and there was nothing of significant or immediate concern.

1.2.8 On the Bridge, as part of the Bridge team, in accordance with the pre-planned passage plan, were an Ordinary Seaman (OS) (who was assigned as the lookout) and an Able Seafarer Deck (ASD) (who was assigned as Helmsman of the watch). According to the Master, as per previously executed transits, AM was navigated at Bridge category or level II[12], i.e. with the Master, one Licensed Officer, one duty watch ASD and 1 extra OS on the Bridge.

1.2.9 In accordance with the Company's SMS procedures, the Bridge team and the Master had completed and documented risk assessments for pre-arrival and the passage, in addition to completing the pre-arrival checklists. Amongst these checks were the confirmation of all working status of navigation equipment and engine availability.

1.2.10 Two very high frequency (VHF) channels were monitored at the time – VHF Ch 20 for Singapore Pilots and Ch 16, which was the international channel for distress and calling.

1.2.11 Both steering motors were running, and the main engines were available for manoeuvring. In addition, the engine room was manned in accordance with the Company's procedures in preparation for arrival into port. The weather was noted as calm seas with good visibility of more than five nm.

1.2.13 Although AM was not required to call the Singapore Pilots until 0630H based on AM's ETA, the Chief Officer, on the Master's instructions, tried to call them at

[11] CPA – Closest Point of Approach; TCPA – Time to CPA

[12] The Company's SMS – BML II required a Master, one Licensed Officer of watch, one duty watch ASD, and one extra OS [four persons]. When transiting the Singapore Strait, the vessel was to be on manual steering and the SMS BML III (which required an additional Licenced Officer).

about 0442H on Ch 20 to confirm that they had received the four hours' notice for AM's ETA to Pilot boarding ground which the Master had sent[13].

1.2.14 Around 0500H, the Master overheard the Singapore Pilots calling a US naval vessel a few times. It was at this time that the Master became aware of the presence of a naval vessel in his vessel's vicinity. He briefly went to the Bridge wings to obtain a visual on a naval vessel but could not sight any.

1.2.15 At about 0515H, AM was on a South-westerly course over ground about 227° (T) and at 9.2 knots was approaching the eastern limit of the TSS. AM's engines were at Full Ahead i.e. about 90-95 rpm. At that time, another vessel, Team Oslo (TO), which was on a similar heading, overtook AM's Starboard beam at a speed of about 10.8 knots. JSM could be seen on AM's radar, astern of TO and nearly abeam of another vessel Long Hu San (LHS).

1.2.16 At about 0519H, AM, which was still on a South-westerly heading and at a speed of about 9.4 knots, entered the eastern limit of the Singapore Strait TSS. The Master used a binoculars to scan the surroundings and observed TO, which was ahead and in close vicinity, having overtaken AM a few minutes earlier.

1.2.17 At about 0520H, the OS, who was assigned as the lookout, did not feel well and obtained the Chief Officer's permission to go down to his cabin to relieve himself. He did not carry any handheld radio with him. The Master was aware that the ASD, who was assigned as Helmsman of the watch (although the helm remained on automatic mode), was now performing the role of lookout. At this time, the Bridge team comprised three persons[14].

1.2.18 Looking astern, the Master further noticed three vessels. The first, Guang Zhou Wan (GZW) at about five cables[15], was coming up from right astern and was deemed to be overtaking AM's Starboard beam. The second, later identified as the naval vessel JSM, at about five cables, was reportedly coming up fast from AM's Starboard quarter. The third, Hyundai Global (HG), was about a mile away and overtaking from AM's Port side.

1.2.19 The Master noted that the Automatic Identification System (AIS) was not showing JSM's information. He visually sighted JSM from the Bridge wing and returned to the Bridge. No additional person was assigned to maintain a visual on JSM. He then attempted to acquire the target on the S-Band ARPA, but could not do so. Referring to GZW's speed (and associated trails) of 11.4 knots, and correlating the trails of the moving (JSM's) target, the Master estimated JSM's speed to be in excess of 12 knots. He deemed his vessel to be as a vessel being

[13] As per PSA Marine's (PSAM's) requirements, the Master of the vessel is required to contact the Singapore Pilots, via phone, fax or email, four hours before confirmed service time (CST), in order for the Singapore Pilots to track the Arrival of Vessel at Boarding Ground at CST. The Master had sent an email notification to the Singapore Pilots at about 0430H. The subsequent confirmation to the Singapore Pilots is required two hours before CST.

[14] This is one person less than what BML II required and two persons less than what BML III required.

[15] 1 cable = 1/10 of a nautical mile or 0.1 nm

overtaken by the other vessels, in accordance with COLREGs[16], and decided to keep his course and speed.

1.2.20 The Chief Officer attempted to call the Singapore Pilots again on VHF Ch 20 at around 0520H. From the VDR records, the Master attempted to call JSM at about 0521H but did not receive a response.

1.2.21 At around the same time, JSM passed AM's Starboard beam at a distance of about 0.3 nm. The Master visually observed that JSM was displaying the usual navigation lights for a power driven vessel underway (aspect seen as red sidelight and masthead light).

1.2.22 At that time, GZW, which was travelling at 11.4 knots, was coming up close from AM's Starboard quarter and thereafter, was noted as overtaking on AM's Starboard beam away from JSM. At about the same time, on AM's Port quarter, HG, which was travelling at 15.2 knots, was coming up steadily to overtake on AM's Port beam.

1.2.23 Shortly after JSM had come up to forward of AM's Starboard beam, JSM appeared to the Master to be drawing in closer to AM's path at an acute angle. At this time, the Master, referring to JSM, remarked to his Bridge team in native language Tagalog – *"Good crossing action, in the middle of a channel (sarcastically)?"* The Master continued to navigate AM on Auto-Pilot at this time.

1.2.24 The Master then noticed that JSM had displayed some red lights on her mast. The ASD positioned himself near the vessel's steering console in anticipation of change of steering command by the Master from Auto-Pilot to manual steering.

1.2.25 According to the Master, when he perceived that JSM was likely to collide with AM, and with two other vessels (GZW and HG) overtaking AM on its Starboard and Port side respectively, he went to the engine telegraph with the intent to bring the lever down from Full Ahead to STOP. However, AM's telegraph was not moved to STOP until 40 seconds after the collision.

1.2.26 AM did not make any sound or light signals to attract JSM's attention prior to the collision[17].

1.2.27 Just before 0524H, AM's bow collided with JSM's Port side, slightly abaft the latter's beam in approximate position 01° 24.158'N 104° 26.326'E (see **Figure 11** in paragraph 1.8.1).

1.2.28 According to the Master, except for the red-over-red lights, he did not recall seeing any other lights or hearing sound signals made by JSM. But the Bridge

[16] COLREGs – Convention on the International Regulations for preventing collisions at Sea, 1972. The regulations apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.

[17] COLREGs – Rule 34(d) – When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or actions of the other, or is in doubt whether sufficient action is being taken to avoid a collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. Such a signal may be supplemented by a light signal or at least five short and rapid flashes.

team recalled that some alarms on the Bridge of AM went off about two minutes before the collision.

1.2.29 After the collision, AM continued moving forward under its momentum at about 10 knots, and pushed JSM across AM's bow from Starboard to Port. In the process, AM's speed dropped to about 4 knots.

1.2.30 JSM came on to a nearly reciprocal heading with AM after the first impact, and was seen briefly scraping along AM's Port side, from forward to the gangway area, where both vessels finally separated and stopped. The Master raised the ship's General Alarm to muster his crew for a damage assessment.

1.2.31 All crew on board AM were safely accounted for and the vessel drifted. A Breathalyzer test was carried out on all crew, including the Master, at about 0600H in accordance with the company's procedures, and the negative results were documented.

1.2.32 The Master heard JSM's call to the Singapore Pilots to inform them of the collision and to request for assistance.

1.2.33 The Master informed his Company representatives, and subsequently Singapore Vessel Traffic Information System (VTIS) East, of the collision. AM then awaited instructions and permission from VTIS to enter Port of Singapore, as advised by the Company.

1.2.34 AM entered Port of Singapore at about 0900H and anchored at Singapore's Eastern special purpose anchorage.

1.3 Alnic MC's Key Personnel

1.3.1 AM was manned by 24 crew from the Philippines, and was mostly trading between the South Asian / Southeast Asian region, in the Ports of Japan, South Korea, China, Malaysia and Singapore, amongst others, since coming under the management of the present ISM Manager. Her last call to Singapore prior to the collision was in May 2017.

1.3.2 The Master, who had the con of AM at the time of the collision, held STCW[18] II/2 (Master Mariner) qualifications issued by the Republic of the Philippines, and Flag State Endorsements. He had been on board AM for about five months. This was his first contract with the current company. He had a command experience of about four years and was well experienced in navigating in areas of high vessel traffic density, including the Singapore Strait.

1.3.3 The Chief Officer, who was on the Bridge as Officer of the Watch (OOW) at the time of the collision, also held STCW II/2 (Master Mariner) qualifications issued by the Republic of the Philippines and Flag State Endorsements. He had been

[18] STCW – The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers

on board AM for about five months. This was his first contract with the current company. He had been a Chief Officer for about two years.

1.3.4 The ASD – Helmsman, who was on the Bridge as lookout at the time of the collision, held appropriate qualifications under STCW 78 (2010 Manila amendments) for Ratings forming a part of the Navigational Watch issued by the Republic of the Philippines.

1.3.5 The OS, who was not on the Bridge at the time of the collision, held qualifications under STCW 78 (2010 Manila amendments) for Ratings forming a part of the Navigational Watch issued by the Republic of the Philippines.

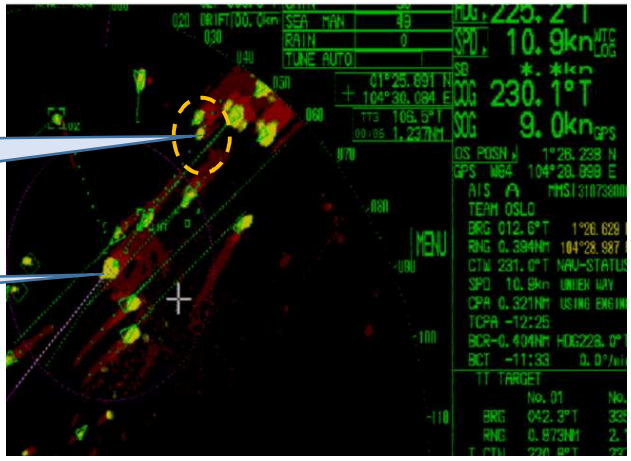
1.3.6 The Second Officer, the previous OOW, who was in the chart room handling documentation for Port arrival, held STCW II/2 – Chief Mate qualifications issued by the Republic of the Philippines and Flag State Endorsements.

1.3.7 All key personnel had duly recorded their hours of rest on a computerised form, which documented hours of work and rest in a 24-hour period, and calculated their hours of rest in any 24-hour and 7-day period. This form was a part of the Company's SMS.

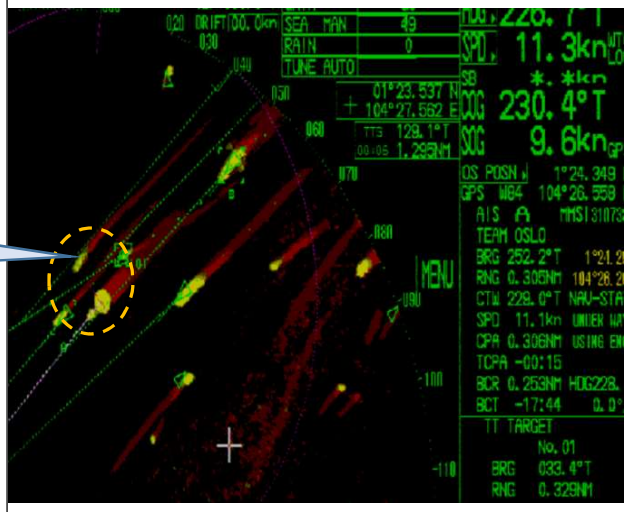
1.4 Alnic MC's VDR Data

1.4.1 Information extracted from the ARPA (X-Band) and ECDIS[19] playback from AM is reproduced below:

Local time	Event	Remarks
5:02:27	JSM's blip appears to separate from a cluster of ships about 2.3 nm astern of AM.	JSM's blip not acquired on ARPA. Other targets displayed on ARPA data screen were TO, LHS, and two others.
5:05:37	AM heard the Singapore Pilots calling JSM.	JSM approximately 1.8 nm on Starboard quarter of AM. Not acquired on ARPA. Master remarks – *"undecipherable……US warship!"*
5:12	ARPA range changed to 3 nm.	
5:13	TO overtaking AM at a range of 0.19 nm on a course of 226° (T) and 10.8 knots.	JSM approximately 1.4 nm Starboard quarter of AM. Not acquired on ARPA.
5:17	TO forward of AM's beam on a course of 229° (T) and speed of about 11 knots.	JSM approximately 0.80 nm Starboard quarter of AM. Not acquired on ARPA. AM's position – 1° 24.83'N 104° 27.142' E



[19] According to the ECDIS manufacturer, ECDIS does not acquire targets, and only receives tracked targets (TT) from the Radar. Targets must be auto or manual (from operator) acquired from Radar in order to be transferred and displayed on the ECDIS. The Master was reportedly manually acquiring targets on the S-Band radar.

5:21:17	Master attempts to call JSM on Ch 20. No response recorded.	
5:22:04	JSM abeam of AM at a range of 0.27 nm showing a slight turn to Port. JSM abeam of AM showing a slight turn to Port	AM's position – 1° 24.349'N 104° 26.558'E Course 230° (T) Speed 9.6 knots JSM not acquired on ARPA. 
5:22:44	Based on ECDIS data, AM's Position – 01° 24.283'N 104° 26.474'E JSM's blip appears as TT 01: COG[20] 215.8° (T) SOG[21] 21.6 knots CPA 0.27nm TCPA: 0.06 JSM's blip flashes on ECDIS screen.	
5:22:46	Some alarms heard on Bridge of AM.	JSM not acquired on ARPA.
5:23:09	Based on ECDIS data, JSM's blip indicates data as COG 198.7° (T) SOG 19.0 knots CPA: 0.21nm TCPA: 00.18	
5:23:31	Based on ECDIS data, JSM blip appears as COG 197.7° (T) SOG 15.8 knots CPA: 0.19nm TCPA: 00.18	
5:23:44	AM's engine ordered to Half Ahead.	75 RPM (Rated) / 73.4 RPM (Recorded)
5:23:50	N/A	AM's position 1° 24.168'N, 104 °26.342'E

[20] COG – Course Over Ground

[21] SOG – Speed Over Ground

5:23:53	Based on ECDIS data, JSM blip appears as COG 199.3° (T), SOG 14.6 knots CPA: 0.18 nm TCPA: 00.24	
5:23:56	JSM blip disappears from ECDIS screen - AM's Position 1°24.158'N 104° 26.326'E	
5:23:58	Impact sound recorded on AM's VDR.	**Likely to be the time of impact.**
5:24:05	AM's speed starts to drop and heading changed.	1° 24.144'N, 104 °26.310'E (distance travelled within 15 seconds was about 70 m)
5:24:00	AM's engine at 75.7 RPM (Recorded).	
5:24:16	AM's Master calls JSM on Ch 20.	
5:24:31	AM's engine at 66.9 RPM (Recorded).	Slow Ahead.
5:24:40	**AM's engine stopped.**	
5:25:21	Call on VHF 16.	JSM calling Singapore Pilots seeking Pilot and tug assistance.
5:25:50	AM's VDR recording stopped.	Master saves VDR data.

1.5 USS John S McCain[22]

1.5.1 JSM, a 1994 built 8300 GT Arleigh Burke-class destroyer, belongs to the 7th fleet of the United States Navy. Her LoA is about 154m, and her breadth is about 20m. She draws a typical draught of about 9.4m.

Figure 4 – USS John S McCain (source: Wikipedia)

1.5.2 She is powered by four General Electric LM2500-30 gas turbines, two shafts, and is capable of producing 100,000 total shaft power and speeds in excess of 30 knots.

1.5.3 She is typically staffed with over 270 personnel[23], has automatic radar tracking capabilities with two radars which can be operated from two locations (the Bridge and the Combat Information Centre (CIC)), an integrated Bridge and Navigation System, and an AIS. The Bridge contains the ship's navigation equipment, steering and propulsion equipment. She has a Voyage Management

[22] Information obtained from the US Navy and redacted statements provided by the US Coast Guard. Only relevant details concerning the collision have been included in this report. Details on the vessel are obtained from open source.

[23] Documenting the details of manning of a naval vessel is out of the scope of this report. However it was reported by the US Navy that several sailors had been on a temporary assignment from another US Navy vessel with different steering control systems.

System (VMS), which is an electronic navigation system that incorporates nautical charts with inputs from GPS, radars and sensors to fix the ship's position. Both these systems give the navigating team an overview of the surroundings, including surface targets. Night vision goggles are provided but not routinely utilised.

1.5.4 JSM has a Steering and Propulsion and Control System (SPCS) commissioned in 2016 which provides for propulsion and steering controls. She is capable of being steered from five different locations – the "Helm" station, "Lee Helm" station, (see **Figure 5**), Helm forward station, the Bridge Command and Control station, and "Aft Steering" [24] Unit.

1.5.5 During routine operations, the "Helm" station on the Bridge is used to steer the ship in computer assisted manual mode[25] or backup manual mode[26], as well as to control the propulsion. During special-evolutions, such as Sea and Anchor detail or when directed by the Commanding Officer, the "Lee Helm" station will assume propulsion control while the "Helm" maintains the steering control. It is physically possible, although rarely exercised, for the "Lee Helm" station to assume both steering and propulsion control duties. When propulsion is "active" on a particular position, the "throttles" are ganged, i.e. moving either throttle (Port or Starboard) causes a simultaneous change to both Port and Starboard propulsion units.

1.5.6 The number of steps and permissions required to transfer steering and/or propulsion control are dependent on the "mode" of operation. For example, when the ship is operating in backup manual mode, any station (by design) can take control of steering or propulsion without permission or acknowledgement from the original controlling station. When directed, "Aft Steering" can independently assume steering control by depressing the "Emergency Override to Manual" push button. Active steering control from "Aft Steering" is typically reserved for emergency situations.

[24] Auxiliary station that has the ability to take control of steering in the event of a problem or casualty to the ship's primary control stations.

[25] In this mode, steering orders are generated from the helm wheel at the "Helm" station or the "Aft Steering" station or using the computer screens. This is the most frequently used steering mode to control the rudder.

[26] In this mode, steering orders are generated from the helm wheel at the "Helm" station or the "Aft Steering" station. Operation in this mode is based on analog circuitry rather than using the steering computer.

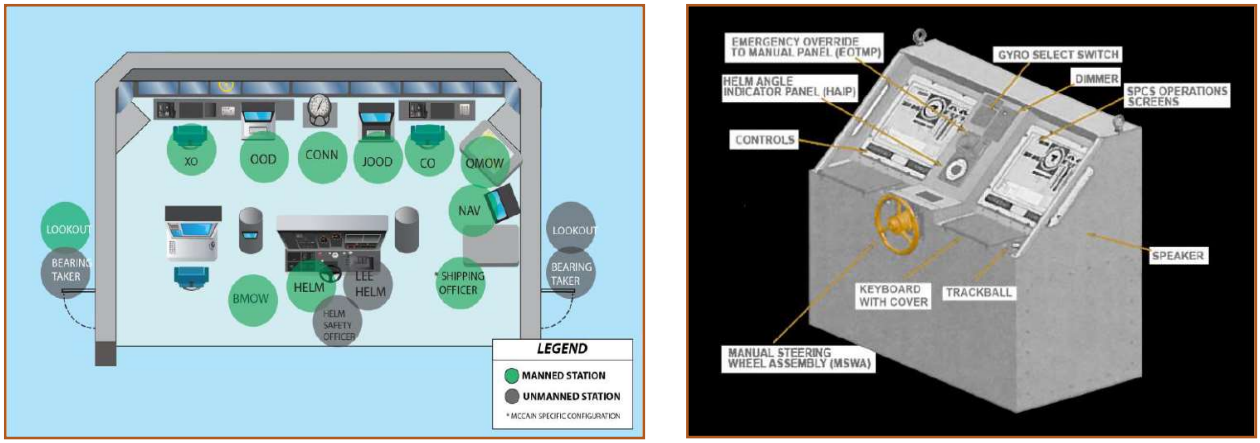


Figure 5 – JSM's Steering and Propulsion Control System (source: the US Navy's report)

1.6 JSM's Voyage

1.6.1 JSM departed its homeport of Yokosuka, Japan, on 26 May 2017 for a scheduled six-month deployment in the Western Pacific.

1.6.2 On the morning of 21 August, JSM was about 50 nm east of Singapore, approaching the Singapore Strait, to a scheduled call at Changi Naval Base, Singapore.

1.6.3 Seas were calm, with one to three foot swells reported. All navigation and propulsion equipment were operating properly. At about 0115H the Commanding Officer (CO)[27] was on the Bridge.

1.6.4 At 0418H, JSM transitioned to a Modified Navigation Detail[28] approached within 10 nm from shoal water.

1.6.5 The executive officer[29] (XO) had been on the Bridge since 0430H to provide additional supervision and oversight when JSM was entering port. At about 0436H, the CO ordered steering modes shifted from automatic control to backup manual, and she was being steered from the "Helm" station at the Steering Control Console (SCC) on the Bridge. At this point, the Helmsman at the "Helm"

[27] Commands the ship. Also – Captain or Overall in charge or somewhat equivalent post on a merchant vessel.

[28] Modified navigation detail is used by the US Navy when in proximity of water too shallow to safely navigate e.g. when entering port. This detail supplemented the on watch team with a Navigation Evaluator and Shipping Officer, providing additional personnel and resources to perform navigation duties and manage the ship's position relative to other vessels.

[29] 2nd in command to the Commanding Officer

station, who was steering and maintaining JSM's course, was also operating the propulsion throttles.

1.6.6 At about 0457H, JSM was at a speed of 17 knots. About two minutes later, the speed was reduced to about 16 knots[30]. At about 0500H, an announcement was made to inform the crew that JSM was entering areas of limited waters. Between 0500H and 0518H, JSM overtook several vessels outside of the eastern entrance of the Singapore Strait TSS. The CPA of JSM with these vessels was about 0.3 nm.

1.6.7 All doors inside the vessel, and all hatches at the main deck and below were shut to help secure the boundaries between different areas of the vessel in case of flooding or fire. Watertight scuttles on the hatches (smaller circular openings that can be opened or closed independently of the hatch) were left open in order to allow easy transit between spaces[31]. By about 0515H her speed was ordered to be 20 knots, equating to about 89 ~ 90 shaft revolutions per minute (SRPM). The CO noticed the Helmsman at the "Helm" station struggling to maintain course while simultaneously adjusting throttles to keep the speed. The CO then ordered a separation of these duties[32]. The "Lee Helm" station was given orders to take over the propulsion from the "Helm" station, while steering was expected to be continued by the "Helm" station.

1.6.8 At about 0518H, JSM was on a course of 230° (T) and navigating at a speed of about 20 knots. Rudder (to Starboard) was being applied to compensate for the current from the bow. At 0520H a transfer of propulsion control from the "Helm" station to "Lee Helm" station began.

1.6.9 The Sea and Anchor detail[33] was not scheduled until 0600H, approximately 40 minutes after JSM entered the middle channel of the Singapore Strait at about 0520H.

1.6.10 The Helmsman at the "Helm" station reported loss of steering at about 0521H. This was conveyed to the Officer of the Deck (OOD)[34]. JSM was by now on a course of 228° (T), a speed of about 20 knots (making good 18.6 knots over ground) and turning to Port at 0.26° / second. AM at this time was less than 0.3 nm on JSM's Port side and bearing 164° (T) from JSM. Loss of steering was announced on the general announcement system, and the steering was shifted to "Aft Steering".

[30] To implement the speed reduction, the Helmsman has to input entries according to pre-set values.

[31] Termed by the US Navy as Modified Zebra condition.

[32] This change-over of duties was not a part of navigation brief and not discussed prior amongst the Bridge team.

[33] A team that the US Navy uses for transiting narrower channels to enter port. It provides additional personnel with specialised navigation and ship-handling qualifications.

[34] Officer in-charge of ship safety and navigation

1.6.11 JSM was on course 216° (T) and at a speed of 18.6 knots by about 0522H, and was turning to Port at a rate of approximately 0.2° / second. The vessel's navigation lights configuration was changed from *Power driven vessel underway* to *Vessel Not Under Command (NUC)*[35].

1.6.12 A reduction in speed of JSM was ordered by CO to 10 knots. JSM, on course 204° (T) and at a speed of 16.6 knots, was now turning to Port at a rate of approximately 0.4° / second. About 15 seconds before 0523H, on being advised by the XO, CO ordered a further reduction of speed to 5 knots.

1.6.13 At about 0523H, JSM, on course 194° (T) and a speed of 15.8 knots, was 0.18 nm away from AM, which was bearing 097° (T), on a course of 230° (T) and speed of 9.6 knots. "Aft Steering" had control of the vessel at around this time. JSM was on course 192° (T) and a speed of 15.6 knots and turning to Port at a rate (increased) of 0.5° / second. The lookout posted on the Bridge reported to CIC on JSM's rate of approach and her being drawn towards AM. CIC acknowledged and relayed the same back to the Bridge.

1.6.14 About 15 seconds after 0523H, Helmsman took over control of steering at the "Helm" station on the Bridge in backup manual mode. Ten seconds later, JSM was on course 183° (T) and a speed of 13.8 knots and turning to Port at a rate of 0.54° / second. Soon after, "Aft Steering" station had control of the steering in backup manual mode, and a positive steering test was conducted by turning the rudder to Port 33°. Then steering control was switched to the computer assisted manual mode.

1.6.15 About 15 seconds later, JSM was on course 177° (T) and a speed of 11.8 knots. Starboard rudder was applied to check the vessel's Port swing and she was nearly on a constant heading, when AM's bow struck her at about two seconds before 0524H, where her berthing quarters were located below the waterline.

1.6.16 JSM's engines were stopped as she was on a course of 139° (T) and a speed of nearly 6 knots and turning to Port at a rate of 1.4° / second.

1.6.17 JSM did not make any light or sound signals to attract AM's attention prior to the collision[36]. JSM's voyage data recorder did not identify her as an acquired target at any time[37].

1.6.18 Damage control efforts were initiated at about 0526H. Based on AM's VDR records, JSM initiated radio calls to the Singapore Pilots on Ch 16[38], about one

[35] COLREGs – *Not Under Command* means a vessel which through some exceptional circumstance is unable to manoeuver as required by these Rules and is therefore unable to keep out of the way of another vessel. Rule 27 (a) (i) – A vessel not under command shall exhibit two all-round red lights in a vertical line where they can best be seen.

[36] COLREGs – Rule 36 – If necessary to attract the attention of another vessel any vessel may make light or sound signals that cannot be mistaken for any signal authorised elsewhere in these Rules, or may direct the beam of her searchlight in the direction of the danger, in such a away as not to embarrass any vessel. Any light to attract the attention of another vessel shall be such that it cannot be mistaken for any aid to navigation.

[37] Source – US Navy through US Coast Guard

[38] Singapore Pilots monitor Ch 20 for pilot deployment.

minute after the collision, requesting for pilot and tug assistance. At about 0530H JSM called Singapore VTIS on Ch 10 to inform of the collision and request for tug and pilot assistance. Singapore VTIS responded to JSM's call and requested for further information.

1.7 JSM's Electronic Data

1.7.1 The path of JSM was plotted relative to the other vessels based on JSM's GPS data and shipboard electronic data on propulsion and steering.

1.7.2 At 0521H, JSM was on a course of 227.8° (T) and engines were full ahead for 20 knots. At 0522H, JSM was making 18.4 knots. About five seconds later, the CO ordered a speed of 10 knots. At 15 seconds prior to 0523H, the CO further ordered a speed of 5 knots. About 15 seconds before the collision, JSM had slowed to 11.8 knots.

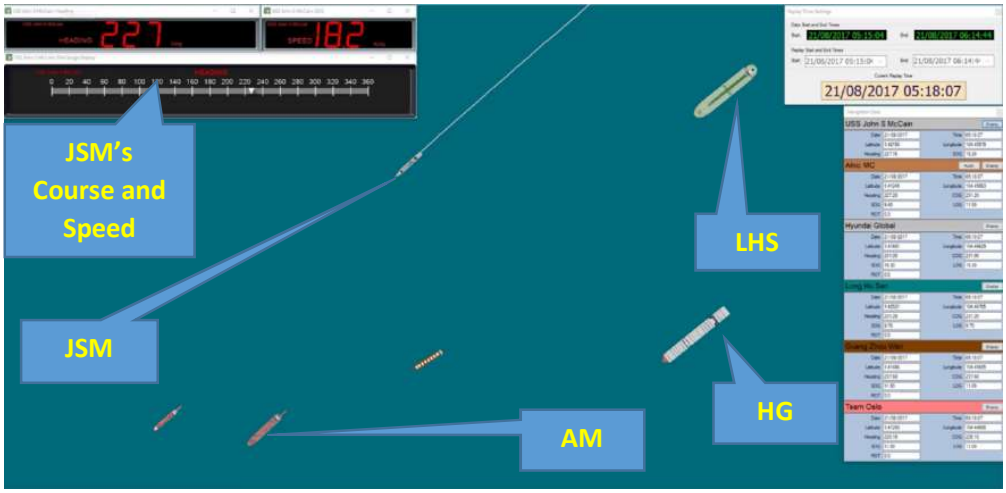


Figure 6 - Graphical representation of position of AM in relation to JSM at about 0518H

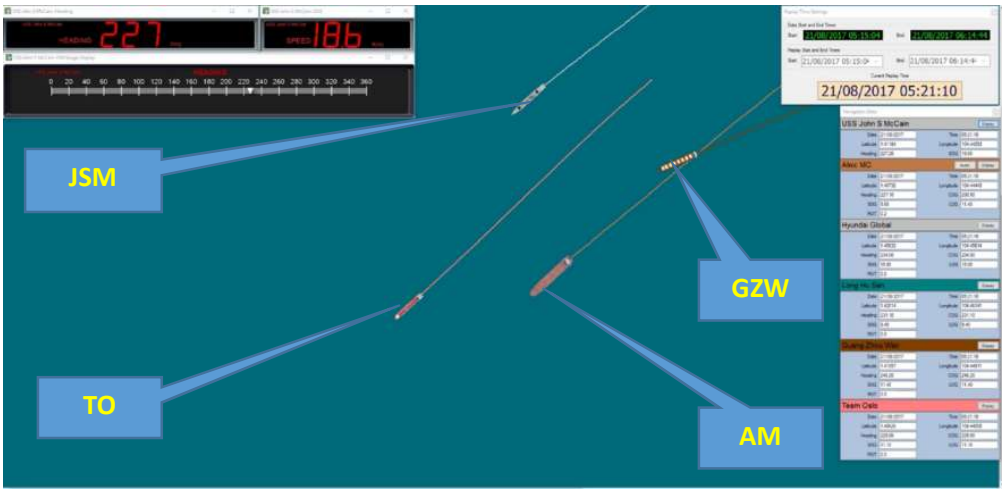


Figure 7 - Graphical representation of position of AM in relation to JSM at about 0521H

1.7.3 Logged data indicates that the first reduction of propulsion took place at about two minutes before the collision. The operating revolutions[39] at this time for Port engine and Starboard engine were 66 SRPM and 90 SRPM respectively. Both engines were operating with 100% pitch[40].

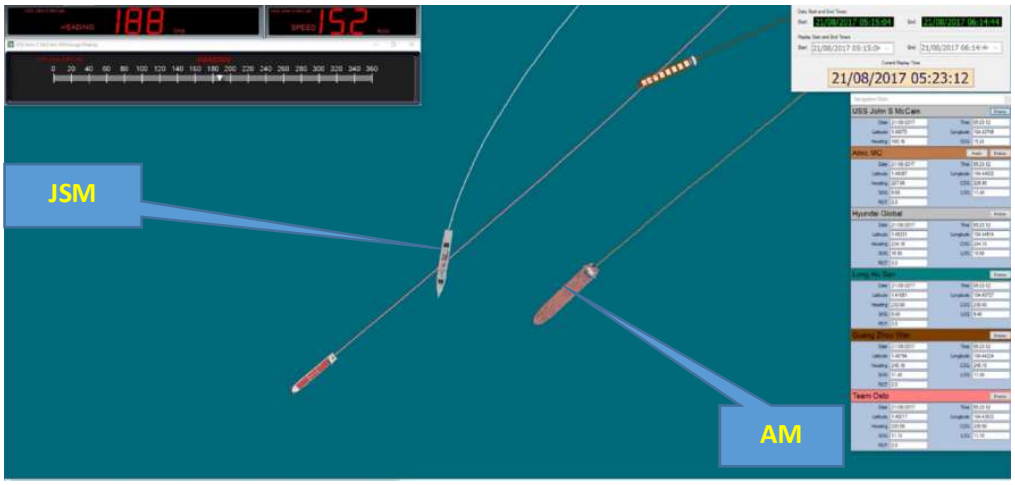


Figure 8 - Graphical representation of position of AM in relation to JSM at about 0523H

[39] Command revolutions for the engines were Port – 44 SRPM / Starboard – 87 SRPM – Source: US Coast Guard

[40] The pitch is the angle of the blade relative to the shaft. By changing the pitch, the (amount of) thrust can be controlled.

1.7.4 Thereafter, command revolutions[41] for the engines were 32 SRPM[42] with 87% pitch followed by an order of 38 SRPM with 48% pitch on both engines[43].

Figure 9 - Graphical representation of position of AM in relation to JSM at about 0523H

1.7.5 Prior to the collision the command revolutions remained as 36 SRPM with 59% pitch and the operating revolutions were at 63 SRPM with 60% pitch on the Port engine, and 64 SRPM with 59% pitch on the Starboard engine.

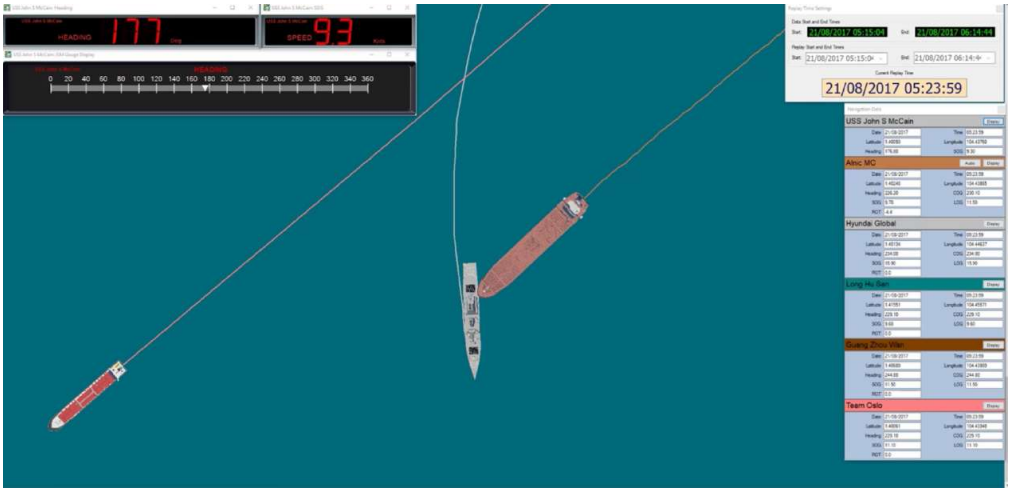


Figure 10 - Graphical representation of collision between AM and JSM at about 0524H

[41] Command revolutions for the engines were Port – 44 SRPM / Starboard – 87 SRPM – Source: US Coast Guard

[42] Starboard engine command revolutions remained at 87 SRPM and 100% pitch.

[43] Operating revolutions of Port engine is 85 SRPM with 49% pitch and Starboard engine is 95 SRPM with 47% pitch.

1.8 Location of Collision

1.8.1 The collision occurred in the westbound lane of the Singapore Strait TSS adopted by the IMO, in Singapore territorial waters in position Lat: 1° 24.158'N Long: 104 °26.326'E, at about 4.6 nm NNE of Horsburgh Lighthouse (Pedra Branca).

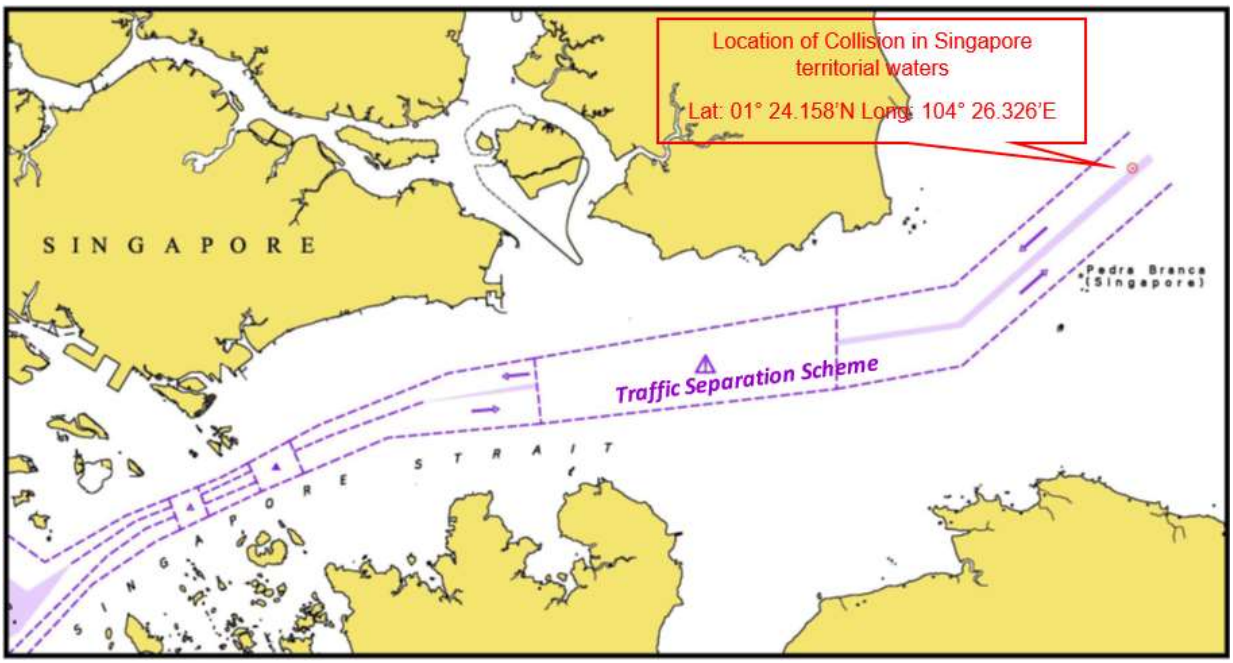


Figure 11 – Collision location (source: Maritime and Port Authority of Singapore)

1.9 Consequence of Collision

1.9.1 The bow of AM collided with the Port aft of midship section of JSM, impacting her berthing 3 and 5 below the waterline (see **Figure 12**).

1.9.2 As a result of the collision, AM sustained damages on its Starboard bow (holed about two to three meters long and about seven meters above water level) and some indentation along the Port side. There was no reports of pollution from AM.

1.9.3 10 sailors from JSM were reported to be unaccounted for, and five sailors sustained injuries that required medical attention. Search and rescue (SAR) efforts and MEDEVAC procedures were initiated.

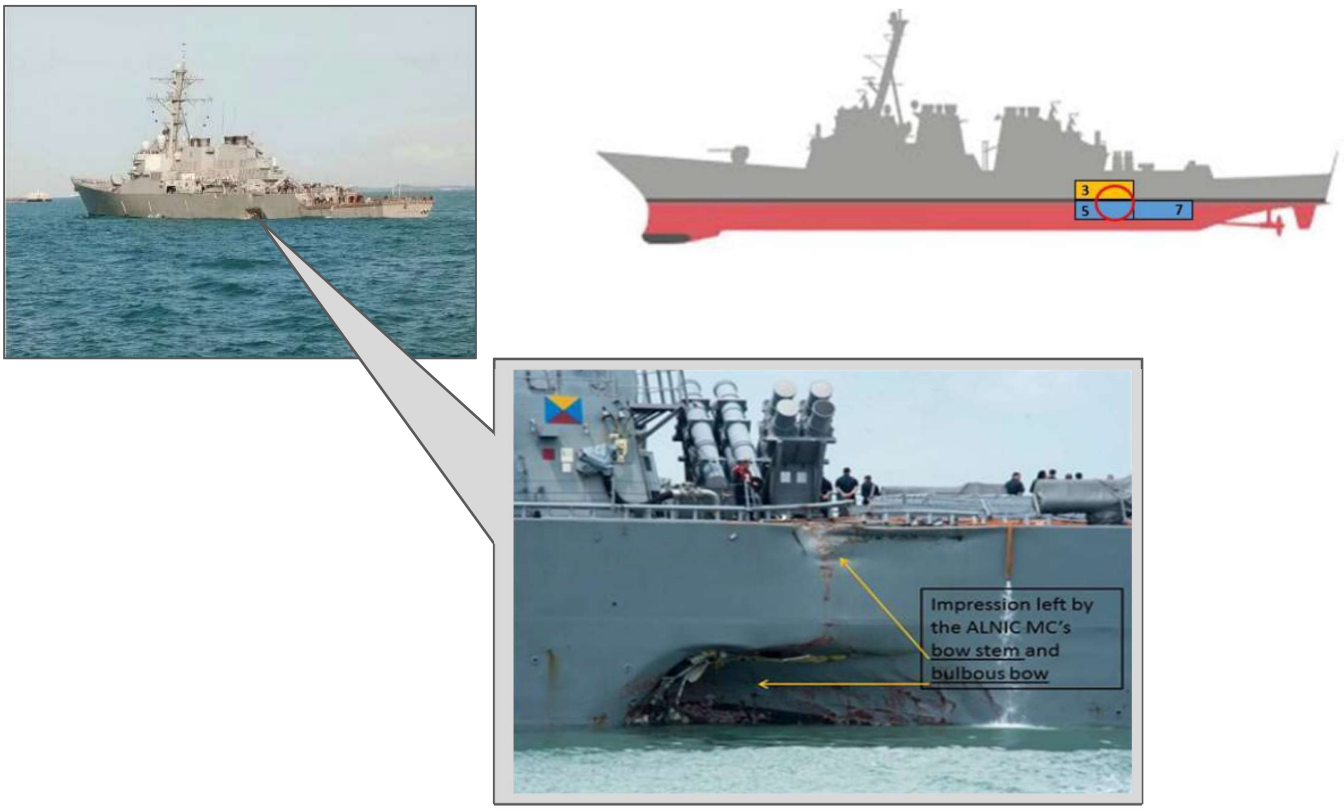


Figure 12 – Source: US Navy

1.10 Search and Rescue Operations

1.10.1 The incident occurred within Singapore territorial waters. As the agency responsible for coordinating maritime SAR operations within Singapore's Maritime Search and Rescue Region (MSRR), the Maritime and Port Authority (MPA) of Singapore led the multi-agency[44] SAR efforts.

1.10.2 The SAR operations covered an area of 5524 km^2 over the next 4 days.[45] Helicopters from the Republic of Singapore Air Force (RSAF) transferred the injured personnel from JSM to Singapore hospitals for medical attention. MPA issued hourly navigational broadcasts and NAVTEX messages to advise passing vessels of the incident and requested them to keep a lookout for any persons in the water. In addition, Singapore's VTIS polled vessels transiting the area to lookout for any persons in the water.

1.10.3 The US Navy and Marine Corps divers eventually located remains of JSM's sailors when they accessed sealed compartments in the damaged parts of the vessel during their search operations. After that, focus was shifted from rescue to recovery of bodies from within JSM.

1.11 Singapore Vessel Traffic Information System (VTIS)

1.11.1 MPA operates the VTIS, 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.

[44] The US, Indonesia, Malaysia and Australia participated in the SAR efforts which Singapore coordinated.

[45] More than 300 personnel from Singapore were deployed for this operation. The Singapore Armed Forces (SAF) deployed four patrol vessels, three fast craft, one frigate, three Super Pumas, two Chinooks, two C-130 and three Fokker 50, while the Police Coast Guard (PCG) deployed four patrol craft. MPA deployed two craft, three tugboats and a team of divers.

1.12 VTIS Playback

1.12.1 Playback of VTIS data indicates that the VTIS held AM and JSM on MPA's radar. VTIS data also showed that AM was transmitting AIS signals while JSM was not.

1.12.2 AM was on a nearly steady course of about 231° (T) and nearly constant speed of about 9.5 knots from 0450H, having commenced a slight reduction from 10.8 knots at about 0430H. AM's speed registered a significant drop to about 3.5 knots about two seconds before 0525H and her course changed to about 191° (T).

1.13 VTIS Operator

1.13.1 A VTIS Senior Vessel Traffic Officer (SVTO) responded to a voice call at about 0531H from JSM on VHF Ch 10 requesting tugs and pilot assistance due to a collision.

1.13.2 The SVTO informed his Watch Manager (WM) and subsequent correspondence between VTIS East and JSM took place between 0532H and 0549H. Information was sought by VTIS on status of JSM's condition including any injuries to personnel and pollution from the vessel in accordance with VTIS' standard operating procedure.

1.13.3 The SVTO responded to a voice call from AM at about 0551H on VHF Ch 10 regarding the collision, and a series of VHF communications from VTIS East were initiated to both JSM and AM, which continued till about 0627H, seeking additional information and arrangement for pilots.

1.13.4 The SVTO and the WM had undergone training[46] as per relevant model courses by International Association of Marine Aids and Lighthouse Authorities (IALA). They had been performing their roles in VTIS for 20 years and 15 years respectively.

1.14 Additional Information from Other Vessels in the Vicinity

1.14.1 According to the Master of LHS, his vessel was on a course of 231° (T) and on a speed of 9.5 knots and bound for the Port of Singapore. VHF Ch 16 and 10 were being monitored. At about 0517H, he observed a naval vessel overtaking

[46] IALA Model Course V-103/1 – VTIS Vessel Traffic Officer's Certification and IALA Model Course V-103/2 – VTIS Watch Manager's Certification.

his own vessel at a speed of about 19 knots on the Starboard side. At this time, the LHS was astern of AM at a distance of about 1.3 nm.

1.14.2 He observed AM stopped in the water at about 0524H, and her deck lights were turned on. He altered LHS' course away from AM recognizing some trouble with AM.

1.14.3 The Master heard a PAN-PAN notification from JSM at about 0525H, that she had collided with another vessel and requesting all vessels to keep clear of her position.

1.14.4 According to the OOW of another vessel, the GZW, the Bridge team visually observed one speed target displaying normal navigation lights for power driven vessel underway, later identified as JSM, on GZW's Starboard quarter.

1.14.5 JSM overtook GZW at about 0519H at a speed of about 22 knots and on a course of 230° (T). At this time, GZW was on a course of 229° (T) and a speed of about 10.8 knots.

1.14.6 According to the Master of another vessel HG, at about 0520H, his vessel was entering the westbound lane of the Singapore Strait TSS, while overtaking three vessels including AM. JSM was not observed on HG's radar or AIS. A set of lights was noticed behind AM's hull which were later identified to possibly belong to JSM.

1.14.7 AM was observed to be turning to Port at about 0525H, after HG had overtaken her.

1.14.8 Prior to the collision, HG did not hear any sound signals from either JSM or AM.

1.15 Conduct of Full Mission Handling Substitution Test

1.15.1 A substitution test was conducted at Singapore Maritime Academy's Integrated Simulation Centre (ISC) to assess whether another individual would respond differently to how the events unfolded.

1.16 Weather Conditions

1.16.1 The incident occurred in the pre-dawn hours. The weather at the time of the collision was calm. Visibility was more than 10 nautical miles and partly cloudy skies. Wind was blowing from the South (BF Scale 3) and the current was 056° (T) at about 1.5 knots.

2 ANALYSIS

2.1 Actions of ALNIC MC

2.1.1 The Master had conducted risk assessments for the pre-planned passage to Singapore, and the vessel was navigating with her engine and steering system ready for immediate use. The Bridge team was well rested prior to the occurrence.

2.1.2 There was nothing contentious or of concern, and everything appeared normal. Having transited the Singapore Strait on previous occasions, the Master did not deem this situation of having three or four vessels in the vicinity to be a problem. The Master's assessment that his vessel was the vessel being overtaken by JSM and decision to keep his vessel's course and speed was appropriate[47].

2.1.3 Although JSM originally came up from abaft AM's beam on a nearly parallel course the Master believed after JSM's course began to change that she was actually attempting to cross his vessel's bow and in between his vessel and the TO, which was ahead. This assessment was based on visual cues. He attempted to call JSM at this time but no response from JSM was recorded on the VDR. It would have been prudent for the Master to give warning signals in accordance with COLREGs[48].

2.1.4 The ARPA was not used to acquire JSM[49]. The ARPA collision warnings for CPA and TCPA were only triggered when JSM came closer to AM within the pre-set values. These warnings appeared as JSM became a tracked target (TT) on the ARPA at about 0522H, i.e. less than two minutes before collision. JSM also showed up on the ECDIS, which was capable of displaying TT's. The Bridge team could not recall if it had noted these warnings before the collision.

2.1.5 The Master attempted to reduce his vessel's headway, instead of altering his vessel's course, considering that his vessel would not be able to turn quickly enough and that there were other vessels in the vicinity which might have created another close quarter situation. He felt that a reduction in speed was a more effective course of action[50], as he considered that JSM, being a naval

[47] COLREGs – Rule 17 - Action by Stand on vessel – (a) (i) Where one of two vessels is to keep out of the way of the other shall keep her course and speed.

[48] COLREGs – Rule 34 – Manoeuvring and Warning Signals – (d) When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or actions of the other, or is in doubt whether sufficient action is being taken by the other to avoid collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. Such signals may be supplemented by a light signal of at least five short and rapid flashes.

[49] COLREGs – Rule 7 – Risk of collision – (a) Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.

[50] COLREGs – Rule 17 – Action by Stand on vessel – (b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take action as will best aid to avoid collision.

vessel, had speed capabilities that would allow her to safely pass ahead of his vessel. As the Master had seen JSM's NUC lights before the collision, his assumption of JSM being NUC[51] and still having manoeuvring capabilities was inappropriate. However, it should be noted that he could not recall the exact time he saw the NUC lights.

2.1.6 VDR data revealed that the engine reduction from Full Ahead to Half Ahead was done just moments before the collision and finally to STOP after the collision. If the Master had taken all way off[52], it would have given him more time to assess the situation, and could have enabled him to take action to avoid the collision or minimise the impact of the collision.

2.1.7 The vessel was not being navigated in accordance with the Company's SMS. The Bridge team initially comprised four persons, as required by the SMS for a Bridge watch Level II. However, the SMS required that for a transit through the Singapore Strait, the Bridge was to be manned by an additional person, i.e. a total of five persons. After the OS went down to his cabin, the active Bridge team then comprised three persons. The Second Officer was performing paperwork in the chart room and was not involved in the navigation or providing assistance to the Bridge team. It is not clear why the company's internal audits and the Master's navigational audits prior to the collision did not reveal a non-compliance with the SMS on Bridge watch levels, especially since the Master claimed this particular transit was no different from his past transits.

2.1.8 Although the radar signal kept dropping as the Master attempted to acquire JSM, he did not convey any concerns of being unable to acquire the target[53] to the Chief Officer, who was the OOW, and asked him to attempt to acquire JSM on the other ARPA. The Master could also have allocated this task to the Second officer if it was considered urgent. No specific instructions were provided to the Helmsman performing the role of a lookout to visually observe JSM. The Chief Officer could not provide any reasons for not attempting to acquire the fast moving target on his own accord. While these were not the main causal factors of the collision, they contributed to the Bridge team not having an enhanced situational awareness.

2.1.9 AM was on schedule to arrive at the Port of Singapore at 0830H and the Master had already sent the 4-hour notification by email to Singapore Pilots. Although the next notification to the Singapore Pilots was due at about 0630H, for some unexplained reason, the Master still instructed the Chief Officer to call the Singapore Pilots on VHF Ch 20. This instruction was not necessary, as it took

[51] COLREGs – Rule 18 – Responsibilities between vessels – Except where Rules, 9, 10 and 13 otherwise require, a power driven vessel underway shall keep out of the way of a vessel not under command. A not under command vessel is one which due to some exceptional circumstance, is unable to manoeuvre as required by COLREGs and thus unable to keep out of the way of another vessel.

[52] COLREGs – Rule 8 – Action to avoid collision – (e) If necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.

[53] The Master could have provided explicit instructions to the Chief Officer to track JSM, if he was concerned that he was not able to track her on his ARPA. Similarly, the Master could have instructed the Chief Officer to use sound or light signals to attract JSM's attention to understand the latter's intentions.

the Chief Officer away from his primary responsibility, as a key member of the Bridge Team, of supporting the Master in the vessel's navigation. As a result, the Chief Officer was focused on calling Singapore Pilots to confirm AM's ETA to pilot boarding ground rather than providing the Master with support for navigation.

2.1.10 It was evident that the Master did not have full support on the Bridge. He also did not utilise his team effectively.

2.2 Actions of JSM

2.2.1 JSM was on a routine call to Singapore, and had transited the Singapore Strait on numerous occasions. The crew including the Bridge team had been made aware by the CO of the busy traffic that was expected during the transit.

2.2.2 Because steering control was in backup manual at the "Helm" station, all other stations were capable of taking over steering control. The system was designed such that any of these stations could have taken control of steering in backup manual without the "Helm" station's acceptance of the request.

2.2.3 JSM's difficulties began with the transfer of propulsion control from the "Helm" station to "Lee Helm" station. Until then the "Helm" station had been controlling the steering of the vessel and concurrently handling the propulsion of the vessel. When the CO noted the Helmsman struggling to perform both tasks, he ordered the propulsion to be taken over from him. While this unplanned shift was not abnormal, it was not properly executed, and resulted in the transfer of steering control from the "Helm" station to the "Lee Helm" station[54].

2.2.4 In areas of higher vessel traffic density such as the Singapore Strait, it was considered normal for a CO to order a Helmsman (responsible for steering) and Lee Helmsman (responsible for propulsion) to perform separate tasks, as maximum concentration and preparation was required to manage emergencies such as a steering or propulsion casualty.

2.2.5 During the transfer of propulsion control from the "Helm" station to "Lee Helm" station, steering control was inadvertently also transferred from the "Helm" station to "Lee Helm" station. When the Helmsman was not able to steer the ship from his steering console, he did not recognise that steering control had been transferred to the "Lee Helm" station, and mistakenly believed the vessel had a loss of steering control. His prompt report of a "Loss of Steering" then resulted in a standard operating procedure for loss of steering to be initiated on the Bridge of JSM, i.e. announcements were made for the emergency steering to be activated at the "Aft Steering".

[54] Onboard data recorded shows that Steering control was at "Lee Helm" Station about 20 seconds before 0521H. Source – US Coast Guard.

2.2.6 The “Aft Steering” took over the controls from the “Helm” station twice at about 0523H within a span of 17 seconds. During the second takeover, the rudder position was at Port 33° as a result of the conduct of a positive steering test at the “Aft Steering” station. The rudder was not returned to zero prior to the change from backup manual mode to computer assisted manual mode at the “Aft Steering” station. This caused an increase in JSM’s rate of turn to Port.

2.2.7 As JSM continued to turn to Port towards AM, there were no light or sound signals made to attract the attention of other ships in the vicinity. The steering controls were changed between the “Aft Steering” station and the Bridge multiple times. This was likely to have added confusion on the Bridge as to which station had steering control at any given time, despite communications using the headsets between stations.

2.2.8 Meanwhile a speed reduction was ordered[55] on the Bridge. When propulsion controls were transferred from the “Helm” station to “Lee Helm” station, the system caused the “ganged” throttle positions to be disengaged from the “gang” and they had to be ganged manually again by the user of the taking-over station. When “Lee Helm” took over the propulsion, he did not recognise that the throttles had disengaged from the “gang”. A speed reduction initiated on the screen using the slider bar would have caused only one of the engines (the Port engine throttle in this case) to be reduced, while the Starboard engine throttle remained at its original position, exacerbating JSM’s turn to Port. It is not clear at what stage the throttles on JSM were “re-ganged” before the collision.

2.2.9 It was apparent that despite JSM transiting a known area of high vessel traffic density, her Bridge team had not anticipated an emergency situation. The decision to set the Sea and Anchor detail earlier as suggested[56] by the Bridge team members might have been better able to handle an emergency situation such as steering problem or the perception of “Loss of Steering”. The lack of experienced personnel handling critical equipment like steering and propulsion indicated lack of a robust risk assessment on considering the “what-if” scenario so that appropriate risk mitigating measures could be taken timely.

2.2.10 While there was no evidence of a panic on the Bridge of JSM, it is likely that there was a lack of a comprehensive situational awareness amongst the team on what was to come.

2.2.11 Although the recognition of unavailability of steering was promptly reported by the Helmsman, no person on the Bridge of JSM verified whether it was a steering failure.

[55] COLREGs – Rule 8 – Action to avoid collision – (e) If necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion.

[56] It was expected that a Master Helmsman and a qualified Engineering “Lee Helm” were to be on watch for this transit with a significantly congested area. Source: US Navy

2.2.12 Several sailors on watch during the collision with control over steering were temporarily assigned from another US naval vessel which had steering control systems that were significantly different[57] from JSM's. These differences were not compensated for. Inadequacies in training and familiarisation before task allocation may have contributed to the actions on JSM.

2.2.13 Naval vessels are likely to operate under strict protocol and reporting lines. The crew are thus likely to be focused on individually assigned tasks. In addition, when the authority gradient is too high, team decision making is affected, and there is less opportunity for interventions. This emphasises the importance of Bridge Resource Management[58] as an effective tool for ensuring safety of navigation.

2.3 Substitution Test

2.3.1 The substitution test conducted at Singapore Maritime Academy's ISC established that the "role-play" Master reacted in a similar manner as the Master of AM, by reducing speed instead of altering course. But unlike the Master of AM, the "role-play" Master ordered engines to full Astern, as opposed to Half Ahead as was done by the Master of AM.

[57] Crew had been on another US destroyer which had different steering systems than JSM. The crew were on a temporary assignment and had not undergone ship specific training. Multiple Bridge watch standers lacked a basic level of knowledge on the steering control system, in particular the transfer of steering and thrust control between stations. Additionally, personnel assigned to ensure these watch standers were trained had an insufficient level of knowledge to effectively maintain appropriate rigor in the qualification program. The senior most officer responsible for these training standards lacked a general understanding of the procedure for transferring steering control between consoles. Source: US Navy

[58] Bridge Resource Management training is a mandatory requirement under the STCW convention. An effective Bridge Team will manage efficiently all the resources that are available and promote good communication and teamwork.

3 CONCLUSIONS

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

3.1 The collision between JSM and AM as they were transiting through the Singapore Strait happened because of a sudden turn to Port by JSM, which caused it to head into the path of AM.

3.2 JSM's sudden turn to Port was due to a series of missteps that took place after a transfer of propulsion controls, which led to a confusion as to which station had steering control, and an unintentional reduction of the Port engine throttle which increased the rate of JSM's turn to Port.

3.3 JSM's crew did not recognise the processes involved in the transfer of propulsion and steering control. The crew were likely to have lacked the requisite knowledge of the steering control system due to inadequacies in training and familiarisation.

3.4 When AM's Bridge team saw JSM turning, it presumed that JSM would be able to safely pass ahead. The collision happened within three minutes of JSM turning to Port, and the actions taken by AM were insufficient to avoid the collision. AM's Bridge team was not manned in accordance with the Company's SMS, and the Master did not have full support on the Bridge.

4 SAFETY ACTIONS

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

4.1 Stealth Maritime Corporation S.A.

4.1.1 The Company has increased its oversight of its managed ships and is considering implementing remote VDR-auditing to assess the effectiveness of its SMS on board ships.

4.1.2 The Company has reviewed its SMS to ensure prescribed requirements for safety of navigation are adhered to, and taken measures to ensure effective Bridge Team Management on board its vessels.

4.2 US Navy[59]

4.2.1 Following the collision, the US Navy issued a directive to all their assets to switch on the AIS, particularly in areas of high vessel traffic density, to enable their ships to be identified by merchant vessels and VTIS authorities.

4.2.2 Reportedly concerned about the workload of crew on naval vessels, the US Navy would be looking into increasing the manning levels, in addition to instituting circadian rhythm-based watch schedules in lieu of traditional five-on-ten-off watch schedules to address matters relating to fatigue.

4.2.3 To improve situational awareness capabilities, the US Navy is looking to re-introduce manoeuvring boards or manual acquisition of all surface contacts with an initial CPA of 5000 yards or less, and to put crew through a Bridge Resource Management course.

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.

In view of the safety actions taken by relevant stakeholders, no safety recommendations have been issued.

End of Report

[59] Source – US Navy and open source