

Report of Investigation
into the Collision between
China Registered
Bulk Carrier *Yao Hai* and
Ukraine Registered
Supply Tug *Neftegaz-67*
in position 22° 20.7'N, 114° 00.1'E
at 2113 on 22 March 2008



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

Purpose of Investigation

This incident is investigated, and published in accordance with the IMO Code for the Investigation of Marine Casualties and Incidents promulgated under IMO Assembly Resolution A.849(20). The purpose of this investigation conducted by the Marine Accident Investigation and Shipping Security Policy Branch (MAISSPB) of Marine Department is to determine the circumstances and the causes of the incident with the aim of improving the safety of life at sea and avoiding similar incident in future.

The conclusions drawn in this report aim to identify the different factors contributing to the incident. They are not intended to apportion blame or liability towards any particular organization or individual except so far as necessary to achieve the said purpose.

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

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Glossary of Terms and Abbreviations

AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid
COLREGS	International Regulations for Preventing Collisions at Sea 1972
CPA	Closest Point of Approach
FSD	Fire Services Department
GPS	Global Positioning System
kW	kilowatt
n.m.	nautical mile
RPM	Revolutions Per Minute
SAR	Search and Rescue
STCW	Seafarer's Training, Certification and Watchkeeping
S-VDR	Simplified Voyage Data Recorder
TCPA	Time of Closest Point of Approach
VHF	Very High Frequency
VTC	Vessel Traffic Centre
VTR	Vessel Traffic Regulator
VTs	Vessel Traffic Services

Time Notation in 24 hours

e.g. 1234 12- hour 34- minute

 123456 12 -hour 34- minute 56-second

1. Summary

- 1.1 At about 2113 local time on 22 March 2008, the China registered bulk carrier *Yao Hai* collided with the Ukraine registered supply tug *Neftegaz-67* in Hong Kong waters in position 22° 20.7'N 114° 00.1'E. At the time of the accident, the weather condition was cloudy with light rain. There was a westerly light breeze and a smooth sea with a moderate visibility of about 2 nautical miles (n.m.). *Yao Hai* sustained damages to the stem and bulbous bow while *Neftegaz-67* sustained damages to the starboard side shell and starboard shaft tunnel. *Neftegaz-67* listed to starboard and sank shortly after the collision. Six crew members and a Chinese interpreter of *Neftegaz-67* were rescued and the remaining eighteen crew members were drowned inside the vessel.
- 1.2 The investigation revealed the following probable causes of the collision:
 - 1.2.1 *Yao Hai* which was a give-way vessel to *Neftegaz-67* appeared to have failed to comply with the following International Regulations for Preventing Collisions at Sea 1972 (COLREGS) :
 - (a) Rule 16 (Action by give-way vessel) – *Yao Hai* did not take early and substantial action to keep well clear of *Neftegaz-67*.
 - (b) Rule 6 (Safe Speed) - *Yao Hai* did not proceed at a safe speed before the collision.
 - (c) Rule 8 (Action to avoid collision) - Avoiding action taken by *Yao Hai* was not positive, not made in ample time and was not large enough to be readily apparent to *Neftegaz-67*. Before collision, *Yao Hai* had not reduced, stopped or reversed engine to avoid collision or allow more time to assess the situation.
 - 1.2.2 *Neftegaz-67*, being a stand-on vessel in a crossing situation, appeared to have failed to comply with Rule 17 (Action by stand-on vessel) of the COLREGS by altering course to port for *Yao Hai* on her own port side in a crossing situation.
- 1.3 Although *Neftegaz-67* was well designed and constructed to withstand the damages imposed on it in the collision, the opening of three watertight doors in the transverse bulkheads below deck caused progressive flooding of the compartments and eventual capsizing and sinking of the vessel.
- 1.4 *Yao Hai* should consider to pass northwards of CP1 light buoy to keep clear of *Neftegaz-67* when there was a risk of collision with the latter vessel.

2. Description of the vessels

2.1 *YAO HAI*

2.1.1 Particulars

Port of Registry	:	Wuhan, China
IMO No.	:	8515697
Call sign	:	BUWP
Type	:	Bulk Carrier
Year Built	:	1986
Gross Tonnage	:	36,544
Net Tonnage	:	23,020
Length Overall	:	225 metres
Breadth	:	32.2 metres
Summer Draft	:	13.257 metres
Summer Deadweight	:	69,497 tonnes
Main Engine	:	DIESEL MITRUI B&W 5L70MC
Engine Power	:	8,355 kW
Number of cargo holds	:	7
Speed	:	12.5 knots
Class	:	China Classification Society (CCS)



Figure 1- *Yao Hai*

- 2.1.2 *Yao Hai* was a bulk carrier classed with China Classification Society. It had 7 cargo holds with a grain capacity of 81,803 cubic metres. The accommodation and the main machinery space were situated aft. The navigational equipment consisted of two sets of radar with an Automatic Radar Plotting Aid (ARPA), two sets of Very High Frequency (VHF) radiotelephone, two sets of Global Positioning System (GPS) Navigator, a gyro compass, a magnetic compass, an echo sounder, an Automatic Identification System (AIS) and a simplified voyage data recorder (S-VDR).
- 2.1.3 The vessel was manned by a Master, three deck officers, four engineers, an electrical officer and sixteen ratings. All crew members were Chinese nationals.
- 2.1.4 *Yao Hai* was engaged in trading between the ports in China.

2.2 NEFTEGAZ-67

2.2.1 Particulars

Port of Registry	:	Chernomorsk, Ukraine
IMO No.	:	8418576
Call sign	:	EMHO
Type	:	Supply Tug
Year Built	:	1990
Gross Tonnage	:	2,723
Net Tonnage	:	817
Length Overall	:	81.37 metres
Breadth	:	16.30 metres
Summer Draft	:	4.90 metres
Summer Deadweight	:	1,393 tonnes
Main Engine	:	DIESEL 6ZL 40/48 6 ZL 40/48 x 2
Engine Power	:	2,650 kW x 2
Speed	:	15.3 knots
Class	:	Russian Register of Shipping



Figure 2- *Neftegaz-67*

- 2.2.2 *Neftegaz-67* was a supply tug classed with Russian Register of Shipping. The accommodation was situated forward and the main machinery space was situated almost amidship. The navigational equipment consisted of two sets of radar with an Automatic Radar Plotting Aid (ARPA), two sets of Very High Frequency (VHF) radiotelephone, one set of Global Positioning System (GPS) Navigator, a gyro compass, a magnetic compass, an echo sounder and an Automatic Identification System (AIS).
- 2.2.3 The vessel was manned by a Master, three deck officers, four engineers, a radio officer, an electrical engineer and fourteen ratings. All crew members were Ukrainian nationals. A Chinese interpreter was also on board the vessel at the time of collision.
- 2.2.4 *Neftegaz-67* was engaged in trading between Chiwan, China and an oilfield about 47 n.m. south of Waglan Island of Hong Kong.

3. Sources of Evidence

- 3.1 Statements from the Master, Third Officer, Duty Quartermaster, Chief Engineer, Third Engineer, Pilot and Co-pilot of *Yao Hai*;
- 3.2 Data retrieved from simplified voyage data recorder (S-VDR) of *Yao Hai*;
- 3.3 Statements from the Master and Third Officer of *Neftegaz-67*;
- 3.4 Operator of *Neftegaz-67*;
- 3.5 The Hong Kong Marine Department; and
- 3.6 The Hong Kong Observatory.

4. Outline of Events

4.1 Account of *Yao Hai*

- 4.1.1 At 0448 on 18 March 2008 *Yao Hai* departed from Dalian for Shekou and the vessel was loaded with 57,842 tonnes of a cargo of maize. At 2000 on 22 March 2008 the vessel arrived at Hong Kong Ngan Chau Pilot Station with a forward draft of 11.48 metres and an after draft of 12.01 metres. A Hong Kong Pilot and a Co-pilot boarded *Yao Hai* to pilot the vessel to transit Hong Kong waters from East Lamma Channel to Urmston Road. The bridge team consisted of the Master, the duty officer i.e. 3rd Officer, the helmsman i.e. duty Quartermaster, the Pilot and Co-pilot. According to the statements of the Master and the Pilot, the Pilot did not take the con of the vessel and the Master remains in overall command at all times. The Pilot was a Class 1 pilot who was responsible for advising the Master on the navigation of the vessel and the Co-pilot was a Class 2C pilot whose job was to monitor the passage and communicate with various parties.
- 4.1.2 After boarding *Yao Hai*, Co-pilot advised the Vessel Traffic Centre (VTC) of Marine Department that he and the Pilot had boarded *Yao Hai* which would proceed inbound towards Urmston Road. After exchange of information with the Master, the Pilot gave an order to increase the engine speed from slow ahead to full ahead. A few minutes later, Pilot ordered to further increase the engine to 75 RPM (Revolutions per minute) which would give a speed of about 12 knots. At about 2055, *Yao Hai* passed under the Tsing Ma Bridge. At about 2100 *Yao Hai* had negotiated a turn to port and positioned the vessel in the center of the fairway north of the northwest point of Ma Wan.
- 4.1.3 When Ma Wan was at a range of just less than 2 cables to port, *Yao Hai* was steadied on a course of about 250°T to head for the entrance to the deep water buoyed channel north of Siu Mo To and when Kap Shui Mun opened to the south, *Yao Hai* altered course to starboard to about 252°T towards the deep water buoyed channel by following the contour of the northern shore.
- 4.1.4 At about 2109 the Co-pilot reported to the Pilot that he had observed on the port radar a target bearing about 1 point i.e. 11.25° on the starboard bow and was at a range of about 2.5 n.m. The target was on a course of about 090°T and was making a speed of about 10 knots and it was later identified to be *Neftegaz-67*. At this juncture, *Yao Hai* was heading about 257°T and was making a speed of about 12 knots.

- 4.1.5 At about 2109 *Yao Hai* adjusted her course to starboard and was steadied on 260°T. The Pilot observed both from the radar and visually that *Neftegaz-67* was fine on the starboard bow and at a range of about 2 n.m.. *Neftegaz-67* showed two masthead lights which were slightly open and a red sidelight. The Co-pilot tried to attract the attention of *Neftegaz-67* by flashing the Aldis lamp towards *Neftegaz-67*. At about 2110 *Yao Hai* passed to the north of Cheung Sok. CP1 buoy was fine on the starboard side and at a range of about 0.9 n.m. while *Neftegaz-67* was very fine on the starboard bow and at a range of about 1.6 n.m. showing a red sidelight. The Pilot expected *Neftegaz-67* to alter course to starboard but *Neftegaz-67* maintained her course and speed.
- 4.1.6 Shortly after 2111 the Pilot asked the Co-pilot to contact Vessel Traffic Centre (VTC) of Marine Department on the VHF. VTC was requested to provide information on the target i.e. *Neftegaz-67* and to advise *Neftegaz-67* on the VHF that the two vessels should pass port to port to avoid collision. In response to the request from *Yao Hai*, VTC called *Neftegaz-67* and instructed the vessel to take action to avoid collision. *Neftegaz-67* responded on the VHF but her response could not be comprehended. At 2112 the Pilot instructed the helmsman to alter course slowly to starboard to 265°T in order that *Yao Hai* could enter the deep water buoyed channel with CP1 buoy close on the starboard side.
- 4.1.7 At about 2113 *Neftegaz-67* was very fine on the port bow and at a range of about 0.5 n.m. The Pilot gave a helm order of starboard 10 with a view to keeping *Neftegaz-67* on the port bow and giving *Neftegaz-67* as much room as possible to pass on the port side. One short blast on the whistle was given by the Co-pilot. Within seconds *Neftegaz-67* was observed to alter course to port rapidly. The Pilot ordered the helmsman to put the wheel to starboard 20 and then followed by hard to starboard. 5 short and rapid blasts on the whistle were sounded by the Co-pilot. As *Neftegaz-67* continued to alter her course to port and her masthead lights opened more widely, 5 short and rapid blasts on the whistle were again sounded by the Co-pilot. The Pilot then gave a helm order of port 10 in order to reduce rate of turn of *Yao Hai* to starboard and to allow *Neftegaz-67* to pass clear ahead. Later, a helm order of starboard 10 was given by the Pilot. *Yao Hai* did not hear any sound signal from *Neftegaz-67*. Despite the above avoiding actions, the bow of *Yao Hai* struck the starboard quarter of *Neftegaz-67* at about right angle shortly before 2114. The collision impact was heavy and *Yao Hai* vibrated violently. The Pilot ordered to stop the engine.

4.1.8 At the time of collision, the visibility was about 2 nautical miles and there was a light drizzle. The tide was setting in a westerly direction at a rate of about 1.5 knots. After collision, the Co-pilot informed VTC on VHF about the collision and that *Yao Hai* would go to drop anchor. Due to the reasons that the forepeak was flooded by seawater and the vessel was at a risk of running aground,. *Yao Hai* could not provide assistance to *Neftegaz-67*. *Yao Hai* dropped anchor at about 2120 with CP1 buoy bearing 150°T at a range of 0.5 n.m..

4.1.9 Due to flooding of fore peak, it was suspected that *Yao Hai* had run aground forward when the forward draft read 12.1 metres. At about 2130, another pilot boarded *Yao Hai* and took the vessel to anchor with the assistance of two tugs. At about 2254 *Yao Hai* was anchored off Sunny Bay.

4.2 Account of *Neftegaz-67*

4.2.1 *Neftegaz-67* departed from Chiwan at about 2000 on 22 March 2008 and transited Hong Kong to an oil rig located 47 nautical miles south of Waglan Island of Hong Kong. The forward draft was 4.4 metres and the after draft was 4.8 metres. The vessel was loaded with a cargo of 8 containers and 4 baskets with pipes and other items. After leaving Chiwan, *Neftegaz-67* followed various courses and entered Hong Kong waters. The bridge team consisted of the Master, duty officer i.e. Third Officer and the duty Quartermaster.

4.2.2 At about 2100 the Master of *Neftegaz-67* observed a target which was later identified to be *Yao Hai* by radar bearing 077°T and was at a range of 5.5 n.m.. *Neftegaz-67* was steering on a course of 092°T with a speed of about 10 knots. The target was turning round Ma Wan and was later steadied on a course of 250°T with a speed of about 14 knots. As *Neftegaz-67* and *Yao Hai* approached CP1 light buoy, the latter vessel was observed to have altered course about 5° to port showing green sidelight.

4.2.3 At about 2109, *Yao Hai* contacted VTC on VHF channel 67 to request information on the name of *Neftegaz-67* and at about 2111 VTC called *Neftegaz-67* by VHF on channel 67 to advise the vessel to keep a safe distance from *Yao Hai*. At about 2113 *Neftegaz-67* took avoiding action by altering course hard to port and increasing speed in order to increase the rate of turn. Five short blasts on the whistle and five short light flashes were given by *Neftegaz-67*. *Yao Hai* gave a long blast on the whistle and was heard by *Neftegaz-67*. Despite the above avoiding actions, the starboard quarter of *Neftegaz-67* was struck by *Yao Hai* at an angle of about 90°.

4.2.4 After the collision, the engine of *Neftegaz-67* stopped immediately and the vessel lost power and lights. *Neftegaz-67* informed VTC by VHF that the vessel had a collision and it was sinking. As the vessel's general alarm could not be activated, the Master instructed the Quartermaster to go down to warn the other crew members to abandon ship. After collision, the vessel developed a heavy list to starboard and when the sea water reached the bridge, the Master and Third Officer left the bridge and slid into the sea.

4.2.5 Five other crew members also escaped from the sinking vessel and were floating on the sea surface. After about 25 to 30 minutes later, a helicopter and some vessels were conducting search in the area and totally seven crew members were rescued from the sea.

4.3 Vessel Traffic Centre (VTC)

Introduction

4.3.1 The Vessel Traffic Centre (VTC) is located at the outer island of the Hong Kong Macau Ferry Terminal in Central. It was set up in 1989 to provide the Vessel Traffic Services (VTS) to vessels to facilitate their arrivals, berthing/unberthing and departures as safely and expeditiously as possible. It was a monitoring and regulating system for vessels navigating in the waters of Hong Kong. Vessels participating in the VTS would receive navigational information and advice from the VTC through the Very High Frequency (VHF) radio network. Twelve radars are employed in the system to provide radar surveillance coverage of the Hong Kong navigable waters. To ensure effective vessel monitoring, the waters of Hong Kong are divided into three sectors, namely Eastern Approach, Harbour and Western Approach. A VHF channel is assigned to each sector to facilitate communication with vessels. Sector consoles are manned by Vessel Traffic Regulators (VTRs).

Account of Vessel Traffic Regulator (VTR) at Western Approach workstation

4.3.2 At about 2105 on 22 March 2008, the Vessel Traffic Regulator (VTR) at Western Approach workstation observed on the radar screen *Neftegaz-67* was coming down from the UR2 light buoy and sailing eastwards between CP1 light buoy and CP2 light buoy. At about 2110 a potential collision red alert was displayed on *Neftegaz-67* and another vessel *Yao Hai* which was observed sailing westwards. The VTR kept a close monitor on the movement of *Neftegaz-67* to see whether it had any intention of course alteration.

4.3.3 At about 2111, the VTR received a call from the Pilot of *Yao Hai* on the VHF channel 67 requesting details of *Neftegaz-67* and the VTR gave the name of *Neftegaz-67* to the Pilot. The VTR then asked *Neftegaz-67* about its intention and noticing that *Neftegaz-67* had not taken any action, he issued a warning to the vessel at about 2112. A second warning to *Neftegaz-67* was issued when the two vessels were observed moving closer to each other. At about 2113, a third warning was issued by the VTR to *Neftegaz-67* after he observed that although there was a change in the courses of the two vessels to northwards, the risk of collision still existed.

4.3.4 At about 2116, the Pilot of *Yao Hai* informed VTC that his vessel had collided with an ocean tug. At about 2119, the VTR tried to contact *Neftegaz-67* by VHF but there was no response. A few seconds later, *Neftegaz-67* responded to VTC's call but the message could not be understood due to lots of interference. At about 2120, *Neftegaz-67* called VTC but the message could not be understood.

Account of Vessel Traffic Regulator (VTR) at Harbour workstation

4.3.5 At about 2112, the Vessel Traffic Regulator (VTR) at Harbour workstation had observed that a potential collision red alert was displayed on *Neftegaz-67* and *Yao Hai*, he issued a warning on VHF channel 14 to *Yao Hai* requesting the vessel to take avoiding action but there was no reply from the vessel. The VTR at Harbour workstation drew the attention of VTR at Western Approach workstation about the situation as *Neftegaz-67* was in the western sector.

4.3.6 At about 2114, radar echoes of *Neftegaz-67* and *Yao Hai* were observed very close to each other. The VTR then alerted the pilot of CMA CGM BERLIOZ which followed *Yao Hai* and he tried to contact *Yao Hai* but there was no response. At about 2120, *Neftegaz-67* reported to VTC on VHF channel 14 that the vessel was sinking and in danger. VTC tried to call *Neftegaz-67* but there was no response.

4.3.7 At about 2122, a passing high-speed craft *Hai Yang* reported to VTC that a large vessel was sighted sinking in a position approximately 200 metres west of CP1 light buoy.

4.4 Search and Rescue (SAR) Operations

- 4.4.1 There were twenty-five crew members on board *Neftegaz-67*. Seven of the crew members were rescued without injury from the water by a Marine Police launch at 2134 on 22 March 2008. Remaining eighteen crew members were found missing. A sea surface search operation was conducted shortly by 1 Government Flying Service (GFS) helicopter, 14 Marine Police launches, 7 fireboats and 4 Marine Department launches. At 2345 on 22 March 2008 underwater search and rescue operation was carried out by the divers of Fire Services Department (FSD). Marine Department hydrographic survey boat *Hydro 2* was also summoned to scene to locate the exact position of the sunken *Neftegaz-67*. There was no result after conducting both surface and underwater searches on 23 March 2008.
- 4.4.2 Guangzhou Salvage Bureau was requested to arrange a heavy lift crane barge to assist in SAR operations. Heavy lift crane *Nan Tian Ma* arrived at scene at about 1315 on 23 March 2008 with deep sea divers on board to help stabilizing and preparing for the salvage of the sunken *Neftegaz-67*. Despite underwater searches at the wreck conducted by divers during slack waters on 25 March 2008, no crew members were found. Bodies of one of the motormen and one of the able seamen were located by the divers of FSD inside the cabins of the wreck at 0059 and 0220 respectively on 26 March 2008.
- 4.4.3 There was no result of underwater search conducted during slack waters on 27 March 2008. On the next day, body of the Chief Engineer was located by the diver at the main deck portside alleyway at 1420. The underwater search operation was suspended at 0200 on 29 March 2008 and the surface search was also suspended at 1200 on the same day. Operation then proceeded from the SAR phase to the salvage phase.
- 4.4.4 Heavy lift crane *Hua Tian Long* of Guangzhou Salvage Bureau was engaged in the salvage operation. At 1615 on 27 April 2008 *Neftegaz-67* was lifted above the sea level by *Hua Tian Long* (Figure 3). A joint search operation was conducted by Marine Police and FSD officers inside the accommodation of the wreck at about 2330 and searching operation was completed at about 1430 on 29 April 2008. A total of 15 bodies of all the remaining missing crew members were located inside the accommodation and most bodies were found on the main deck.



Figure 3 – Wreck of *Neftegaz 67* was lifted up by *Hua Tian Long*

5. Analysis of Evidence

5.1 Certification and Experience of Personnel

5.1.1 *Yao Hai*

5.1.1.1 The Master of *Yao Hai* was a holder of a valid Certificate of Competency as Master issued by the Maritime Safety Administration of China for vessels of or over 3000 gross tons on 23 August 2004. He has been serving as Master for about 3 years and he joined *Yao Hai* on 21 November 2007.

5.1.1.2 The Third Officer of *Yao Hai* was a holder of a valid Certificate of Competency as Third Mate issued by the Maritime Safety Administration of China for vessels of or over 3,000 gross tons on 4 September 2007. He has been serving as Third Officer for about 6 months and he joined *Yao Hai* on 27 September 2007.

5.1.1.3 The Hong Kong Pilot on board *Yao Hai* started his apprenticeship with the Hong Kong Pilots Association in December 1993 and obtained his Class 1 Pilot Licence in June 1997. A Class 1 pilot is qualified to pilot any vessel without restriction within Hong Kong waters. He has conducted pilotage on a large number of vessels after his apprenticeship and had a record of a very minor contact accident before the collision.

5.1.1.4 The Hong Kong Co-pilot on board *Yao Hai* started his apprenticeship with the Hong Kong Pilots Association in June 2006 and obtained his Class 2C Pilot Licence in December 2007. A Class 2C pilot is qualified to pilot vessels of up to 165 metres in length within Hong Kong waters. He has conducted pilotage on various vessels after his apprenticeship and had no record of any accident before the collision.

5.1.2 *Neftegaz-67*

5.1.2.1 The Master of *Neftegaz-67* is a holder of a valid Certificate of Competency as Master issued by the Maritime Administration of Ukraine for vessels of or over 500 gross tons on 24 June 2003. He has served as Master on board *Neftegaz-67* for about 4 years and 8 months.

5.1.2.2 The Third Officer of *Neftegaz-67* is a holder of a valid Certificate of Competency as Officer in charge of a navigational watch by the Maritime Administration of Ukraine for vessels of or over 500 gross tons on 11 May 2006. He has been serving as Third Officer for about 2 years and he joined *Neftegaz-67* on 6 January 2008.

5.2 Certification of the vessels in collision

5.2.1 The statutory trading certificates of both vessels were valid and in order.

5.3 Weather, visibility and tidal stream conditions

5.3.1 The weather was reported to be cloudy with a light rain and a westerly light breeze. The tidal stream was about 1.5 knots setting in a westerly direction. The sea was smooth and the visibility was about 2 n.m. The weather conditions are not considered to have any bearing on the occurrence of the accident.

5.4 Actions taken by *Yao Hai* (Figure 6)

5.4.1 After taking the pilots at about 2000 at the pilot station, *Yao Hai* proceeded northwards along East Lamma Channel, Western Fairway, Ma Wan Fairway and passed under Ma Wan Bridge at about 2055. The engine was ordered by the Pilot to increase to harbour full speed at 2003 and subsequently further increased to give a speed of about 12 knots at 2006. After turning round Ma Wan, *Yao Hai* altered course to port to about 252°T at about 2057.

5.4.2 At about 2109 the Pilot on board *Yao Hai* observed visually the red sidelight and two masthead lights of *Neftegaz-67*. According to VTC radar plot, *Yao Hai* was on a course of 258°T and distance of *Neftegaz-67* was at a range of 1.9 n.m.. As the visibility was about 2 n.m., both vessels should be able to observe visually the navigation lights of each other at this juncture. According to the statement of the Master of *Neftegaz-67*, he observed visually the green starboard sidelight of *Yao Hai* when *Yao Hai* was first sighted. According to VTC radar plot, *Neftegaz-67* was on a course of 092°T at 2109. Under the above circumstances, *Yao Hai* and *Neftegaz-67* were in a crossing situation when they were in sight of one another and Rule 15 of COLREGS would apply.

5.4.3 In accordance with Rule 15 of COLREGS, 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. Under Rule 16 of COLREGS, 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.

5.4.4 According to the above evidence, *Yao Hai* was the give-way vessel and *Neftegaz-67* was the stand-on vessel in this case. According to VTC radar record, *Yao Hai* was steadied on a course of about 260°T with a speed of about 13.5 knots since 2109. *Yao Hai* was observed to alter course to starboard at 2113 and was on a course of 287°T when colliding with *Neftegaz-67* at 211341. Before the collision, *Yao Hai* maintained a speed of about 13.5 knots. S-VDR record of *Yao Hai* indicated that the following helm orders were given by the Pilot before collision:

<u>Time</u>	<u>Ship's Heading of <i>Yao Hai</i></u>	<u>Helm order given</u>
211112	260°T	261°T
211140	260.6°T	263°T
211226	262.5°T	Starboard Ten
211233	262.5°T	Starboard Twenty
211244	263.5°T	Hard-a-starboard
211305	269.8°T	Port Ten
211315	274.7°T	Starboard Ten
211325	279.6°T	Midship

It can be derived from the above S-VDR record that being a give-way vessel *Yao Hai* had failed to comply with Rule 16 of COLREGS by not taking early and substantial action to keep well clear of *Neftegaz-67*. When the helm order of Starboard Ten was given at 211226, the distance between *Yao Hai* and *Neftegaz-67* was only about 0.49 n.m. According to the manoeuvring characteristics of *Yao Hai*, the vessel will have traversed 2.16 n.m. and will have taken about 15.8 minutes to stop from full sea speed after engaging the engine from full sea speed ahead to full astern. The vessel will have taken 2.3 minutes to travel a distance of about 0.4 n.m. before ship's heading could change 90° to starboard when the vessel is travelling at full sea speed after the helm has been put hard to starboard (Figure 4). Taking into account of the above manoeuvring characteristics of *Yao Hai*, the vessel should have taken early avoiding actions to keep well clear of *Neftegaz-67* well before the contact of VTC at 211156 and giving a helm order of Starboard Ten at 211226. The helm orders given by the Pilot of *Yao Hai* were also not substantial as helm orders of starboard Ten and Starboard Twenty were given at the early stage of course alteration. A helm order of Hard-a-starboard should be given when avoiding action was taken. From S-VDR record, the heading of *Yao Hai* had only changed 10° to starboard from 211111 to 211305. The above small course alterations to starboard would not be apparent to *Neftegaz-67* which altered course to port and collided with the former vessel. Under the above circumstances, *Yao Hai* failed to comply with Rule 8 by making a succession of small alteration of course to starboard which was not large enough to be readily apparent to *Neftegaz-67*.

- 5.4.5 Rule 8 of the COLREGS also requires that 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. From the time of observing *Neftegaz-67* visually at 2109 to the time of collision, *Yao Hai* maintained a speed of 13.5 knots without any reduction of speed. The movement of *Neftegaz-67* had raised the concern of the Pilot of *Yao Hai* who instructed the Co-pilot to contact VTC at 2112 on VHF channel 67 asking for the information of the former vessel and made proposal for the two vessels to pass port to port. Despite the above actions, *Yao Hai* had failed to slacken her speed to allow more time to assess the situation as required by the COLREGS.
- 5.4.6 Rule 6 of the COLREGS requires that every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed, the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions and the draught in relation to the available depth of water are among the factors that should be taken into account. Being a laden Panamax bulk carrier and was drawing a maximum draught of 12.01 metres, *Yao Hai* will according to her manoeuvring characteristics take about 15.8 minutes to stop after travelling a distance of about 2.16 n.m. when the engine is engaged from full sea speed i.e. 14 knots ahead to full astern. However, when *Yao Hai* reduces her speed to a slow speed of about 6.9 knots, her stopping distance will be greatly reduced to 0.46 n.m. and the time taken will be reduced to 7.6 minutes. VTC radar record indicates that *Yao Hai* maintained a speed of about 13.5 knots before collision. It is considered that the vessel did not proceed at a safe speed as required by the COLREGS. *Yao Hai* should have proceeded at a much slower speed so that the vessel could take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

MANOEUVRING CHARACTERISTICS

M.V. YAO HAI

MINIMUM STEERING SPEED

NORMAL LOADED CONDITION	1.5	KNOTS
NORMAL BALLAST CONDITION	1.0	KNOTS

MAXIMUM AVAILABLE RUDDER ANGLE

HARD RIGHT OR STARBOARD	35	DEGREES
HARD LEFT OR PORT	35	DEGREES

ENGINE ORDER /RPM (PROPELLER PITCH) / SPEED TABLE

MANOEUVRING SPEEDS	ENGINE ORDER	RPM (PROPELLER PITCH)	SPEED LOADED CONDITION	SPEED BALLAST CONDITION
	FULL SEA AHEAD	83.4	14.0	14.5
	FULL AHEAD	65	11.0	11.7
	HALF AHEAD	50	8.6	9.2
	SLOW AHEAD	40	6.9	7.4
	DEAD SLOW AHEAD	33	5.7	6.1
	DEAD SLOW ASTERN	33		
	SLOW ASTERN	40		
	HALF ASTERN	50		
	FULL ASTERN	60		

TIME AND DISTANCE TO STOP

(NOTE: USING ENGINES FULL ASTERN AND WITH MINIMUM APPLICATION OF RUDDER)

MANOEUVRING SPEEDS	NORMAL LOADED CONDITION		NORMAL BALLAST CONDITION	
	TIME	DISTANCE	TIME	DISTANCE
	FULL SEA SPEED	15.8 MINUTES 2.16 MILES	7.1 MINUTES 1.00 MILES	
	FULL SPEED	11.5 MINUTES 1.28 MILES	5.2 MINUTES 0.62 MILES	
	HALF SPEED	9.2 MINUTES 0.75 MILES	4.2 MINUTES 0.36 MILES	
	SLOW SPEED	7.6 MINUTES 0.46 MILES	3.4 MINUTES 0.23 MILES	

TURNING CIRCLE DIAGRAMS

NORMAL LOADED CONDITION

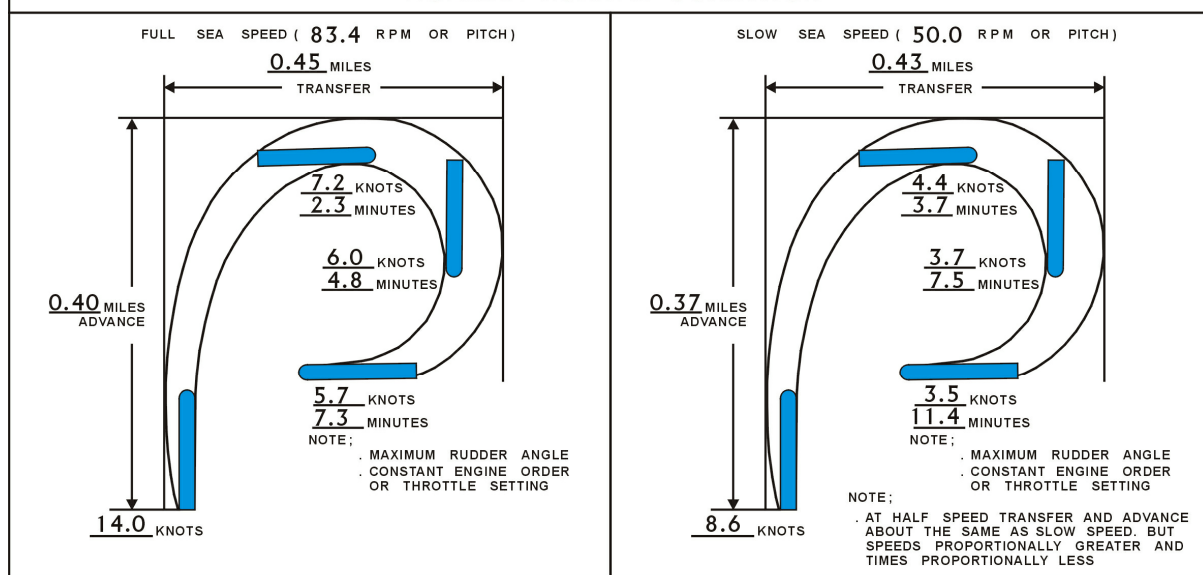


Figure 4 – Manoeuvring data of Yao Hai

VHF Communication

- 5.4.7 At 211140 the Pilot of *Yao Hai* instructed the Co-pilot to contact VTC to obtain the name and intention of the vessel navigating between CP1 and CP2 light buoys i.e. *Neftegaz-67* and proposing the two vessels should pass red to red and the Co-pilot called VTC on VHF channel 67 as instructed at 211202.
- 5.4.8 At 211222 VTC called *Neftegaz-67* on VHF channel 67 enquiring about her intention and advising *Neftegaz-67* to keep a safe distance from the head-on vessel i.e. *Yao Hai*. *Neftegaz-67* requested VTC to repeat the message.
- 5.4.9 When the instruction to call VTC was given by the Pilot to the Co-pilot at 211140, the distance between *Yao Hai* and *Neftegaz-67* was about 0.78 n.m. and when VTC called *Neftegaz-67* on VHF channel 67 at 211222, the distance between the two vessels was reduced to 0.51 n.m..
- 5.4.10 Use of VHF is a common practice for inter-ship communication when both vessels are engaged with local pilots. It aims to collect advance information about the traffic movement and would be appropriate when it is carried out at an early stage where no risk of collision is developing and that the vessels are far apart. It is considered that in this situation where close-quarters situation or risk of collision between the two vessels was developing, the Pilot of *Yao Hai* should waste no time to communicate with VTC or the other vessel on the VHF but to take early action to avoid collision in compliance with the COLREGS.
- 5.4.11 In this particular case, the distance between *Yao Hai* and *Neftegaz-67* was only about 0.78 n.m. at 211140 and the collision would take place after about 2 minutes if no avoiding actions were taken by either vessels. Under the above circumstances, the time used for trying to establish VHF communication with VTC by *Yao Hai* would only reduce the time to allow early action to be taken to avoid collision.

Bridge team on board *Yao Hai*

- 5.4.12 The Master of a vessel remains to be in overall command even with the assistance of the pilot and he has the ultimate responsibility to the safety of the vessel at all times. It is stipulated in Section A-VIII/2 of Seafarer's Training, Certification and Watchkeeping (STCW) Code that despite the duties and obligations of pilots, their presence on board does not relieve the master or officer in charge of navigational watch from their duties and obligations for the safety of the ship. The master and/or the officer shall co-operate closely with the pilot and maintain an accurate check on the ship's position and movement.

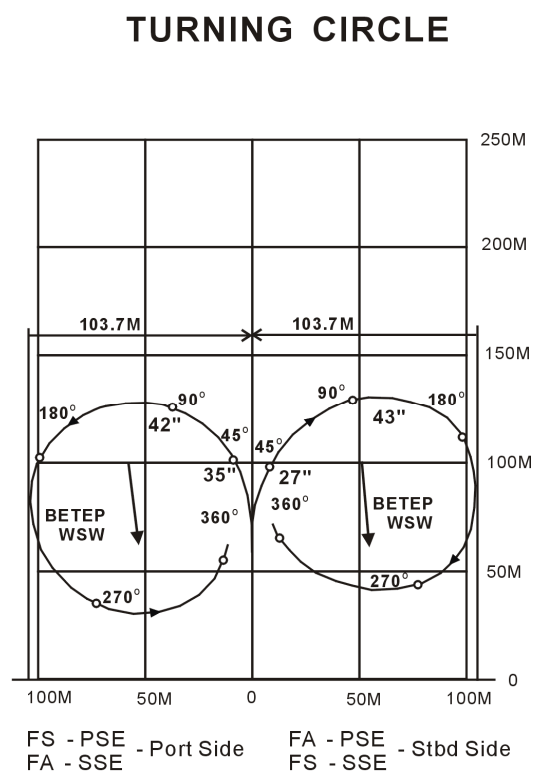
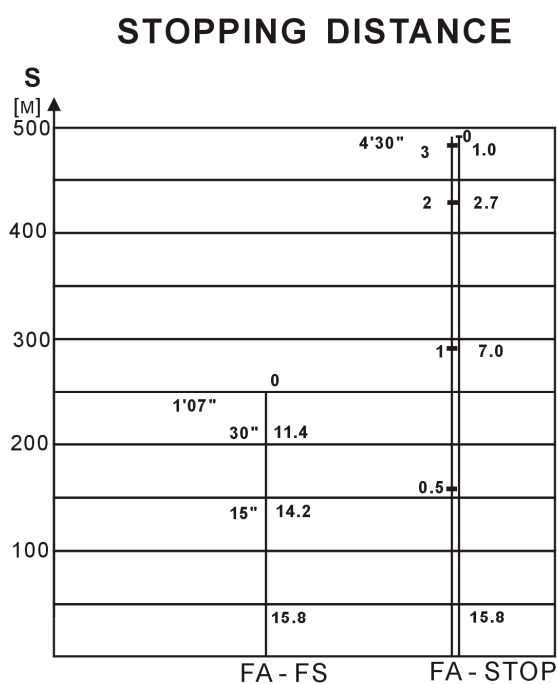
- 5.4.13 The Master of *Yao Hai* appeared to have delegated the navigation completely to the two pilots on board the vessel. In the incident there was no indication that the Master had taken any initiatives or intervention to ensure the safety of his vessel. He had neither given nor advised the Pilot to give any helm or engine orders to avoid collision with *Neftegaz-67* prior to developing into a close-quarters situation but just totally relied on the Pilot to take avoiding actions.

5.5 Actions taken by *Neftegaz-67* (Figure 6)

- 5.5.1 According to VTC radar plot, *Neftegaz-67* departed from Chiwan at about 1950 on 22 March 2008 and followed various courses to sail southwards towards Hong Kong. After turning round the Black Point and Tap Shek Kok i.e. western corners of the New Territories of Hong Kong, *Neftegaz-67* passed between CP4 and CP5 light buoys at 2100 and set a course of about 092°T at 2101. Her speed was about 10 knots. *Neftegaz-67* maintained the above course and speed until 211305. According to AIS information, *Neftegaz-67* commenced altering course to port at 211305 and was on a heading of 036°T just before the collision took place at 211341.
- 5.5.2 Rule 17 of the COLREGS stipulates that a power-driven stand-on vessel which takes action in a crossing situation shall, if the circumstances of the case permit, not alter course to port for a vessel on her own port side. Being the stand-on vessel in this crossing situation, *Neftegaz-67* had contravened this rule by altering course to port at 211305 and her sudden alteration of course to port was one of contributory factors to the accident.
- 5.5.3 The distance between the two vessels was about 0.23 n.m. i.e. 387 metres when *Neftegaz-67* altered course to port at 211305. According to the manoeuvring characteristics of *Neftegaz-67* (Figure 5), in order to alter course 90° to starboard, the vessel would have travelled a distance of about 130 metres only if her starboard engine was put on full astern and her port engine was put on full ahead. In this connection, the collision could have been avoided if *Neftegaz-67* altered course to starboard instead of to port by using both engines.

MANOEUVRING ELEMENTS OF NEFTEGAZ-67

CIRCULATION DIAGRAM AT STEERING WHEEL DEVIATION 35° TO PORT SIDE, OR STARBOARD SIDE



MAIN DIMENSIONS

FORE DRAFT	4.00 M
AFT DRAFT	4.50 M
LENGTH OVER ALL	81.37 M
BEAM	15.96 M
DISPLACEMENT	33124 T

ABBREVIATIONS

PSE	Port Side Engine
SSE	Starboard Side Engine
FA	Full Ahead
FS	Full Astern
M	Metre
T	Tonne

Figure 5 – Manoeuvring data of *Neftegaz 67*

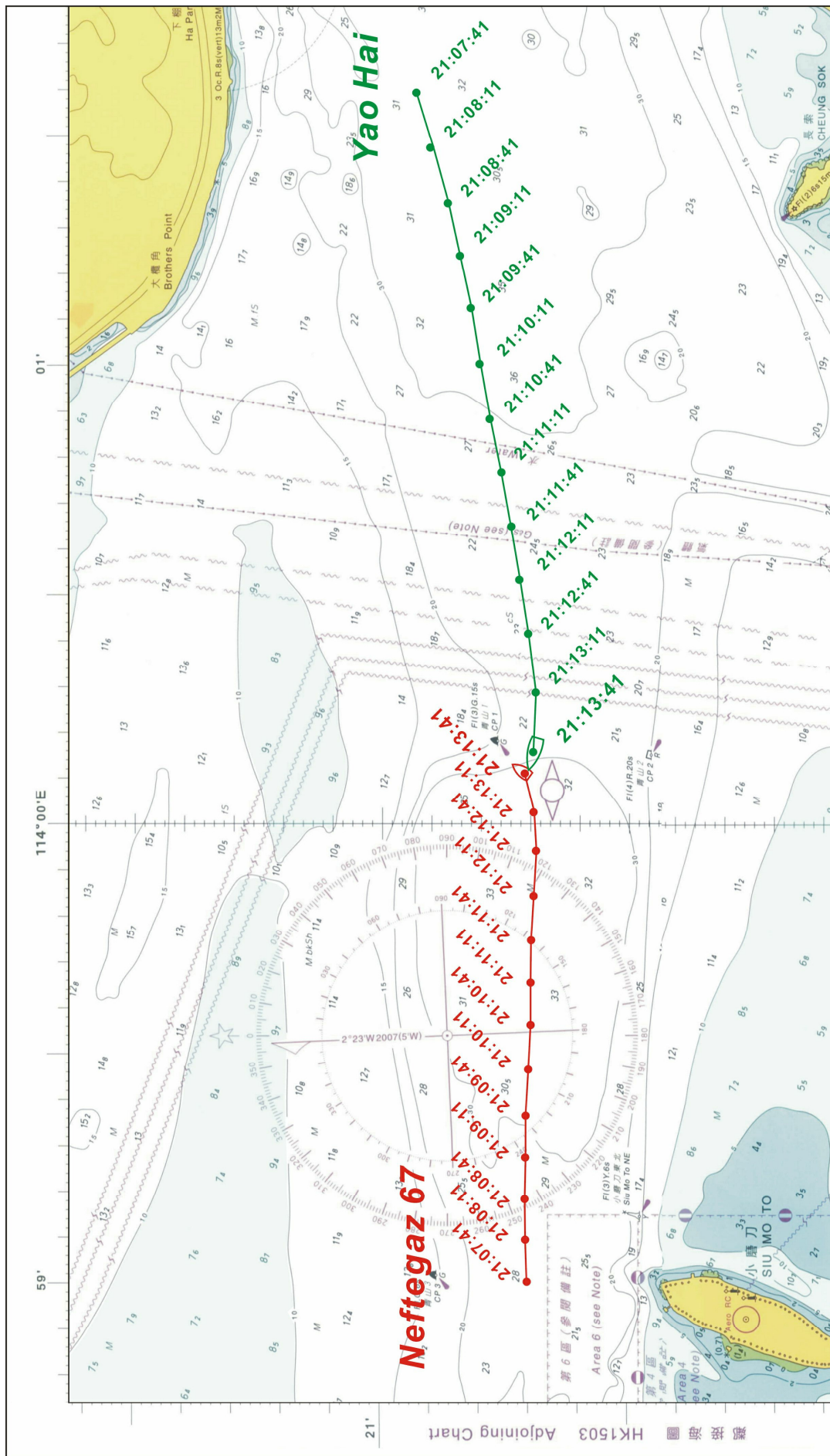


Figure 6 - Radar Plot showing the Collision Tracks of Yao Hai and Neftegaz 67

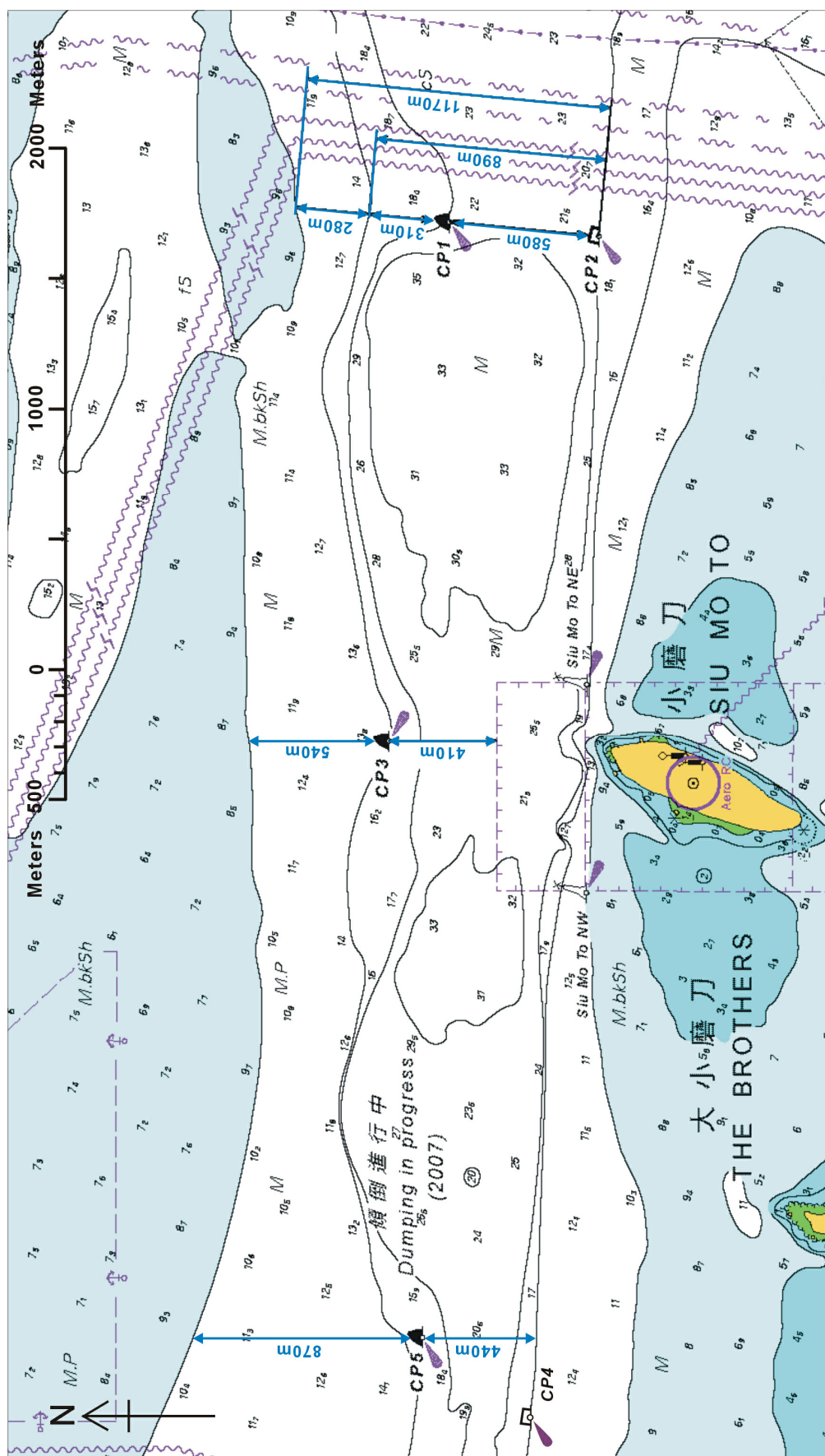
5.6 Actions taken by Vessel Traffic Centre (VTC)

- 5.6.1 Both *Yao Hai* and *Neftegaz-67* were VTS participating vessels. Before collision, the movement of *Yao Hai* was monitored by the VTR at the Harbour workstation while the VTR at the Western Approach workstation monitored the movement of *Neftegaz-67*.
- 5.6.2 When potential collision red alert was displayed on both vessels at 211052 on the radar of VTC, the distance between the two vessels was 1.096 n.m.. The potential collision red alert has been set to be triggered off when the closest point of approach (CPA) between two vessels falls below 90 metres and the time of CPA (TCPA) is within 3 minutes. The VTRs maintained monitoring the movements of the two vessels. At the same time, the VTR at the Harbour Workstation was engaged in communications with an ocean-going vessel on anchorage assignment while the VTR at the West Approach workstation was communicating with a river-trade vessel about her departure.
- 5.6.3 At 211156, *Yao Hai* called VTC on VHF channel 67 asking for details of *Neftegaz-67* and proposing to pass red to red. At 211222 VTR at Western Approach workstation contacted *Neftegaz-67* on VHF channel 67. *Neftegaz-67* was enquired about her intention and she was warned about the risk of collision with *Yao Hai* and to take avoiding action. At 211223, VTR at Harbour workstation contacted *Yao Hai* on VHF channel 14. *Yao Hai* was warned about the risk of collision with *Neftegaz-67* on her starboard bow and to take avoiding action. But there was no response from *Yao Hai*. The range between *Neftegaz-67* and *Yao Hai* was 0.506 n.m. i.e. 938 metres. If no action was taken by both vessels, collision would take place after 1 minute 17.5 seconds. Further warnings were given to *Yao Hai* by VTC on VHF channel 14 at 211233 and 211252 but there was no response. At 211239 *Neftegaz-67* called VTC on VHF channel 67 but the message could not be comprehended. Further warnings were given to *Neftegaz-67* by VTC on VHF channel 67 at 211244 and 211327 but there was no response.
- 5.6.4 VTC has a VTR intervention policy that VTRs shall not navigate vessels from the VTC i.e. the VTRs will not give specific instructions on helm or engine orders to the vessels. The application of the VTS (Vessel Traffic Services) will never infringe upon the authority of the master, who shall continue to be solely responsible for the safe navigation of his vessel. The warnings were given when the vessels were 0.506 n.m.

apart and would collide after 1 minute 17.5 seconds if no actions were taken by both vessels.

5.7 Buoyage system in the subject area (Figure 7)

- 5.7.1 The CP1 green and CP2 red light buoys were lateral marks laid on two 20-metre contour lines north and south with a distance of about 580 metres apart. The intention of these two buoys is to demarcate a safe route for deep-draft bulk carriers drawing a draft of 16.8 metres to proceed to berth and discharge coal at Tap Shek Kok Power Station or large container vessels transiting Hong Kong to Shekou.
- 5.7.2 *Yao Hai* was drawing a maximum draught of 12.01 metres and instead of passing between the CP1 and CP2 light buoys, the vessel should have taken avoiding action by passing northwards of CP1 light buoy to keep clear of *Neftegaz-67*. CP1 light buoy was situated about 310 metres southwards from the 15-metre contour line and *Yao Hai* could have passed northwards of the CP1 light buoy without any danger.
- 5.7.3 Lateral marks are generally used for well defined channels and they indicate the port and starboard hand sides of the route to be followed by vessels. Although the information on placement and intention of the CP light buoys is not found on the Chart No. HK1502, Section 9.142 (Ma Wan to Urmston Road) of the Admiralty Sailing Directions – China Sea Pilot Volume I (NP 30) indicates that CP1 and CP2 light buoys and further light buoys i.e. CP3, CP4 etc. mark the deep water route in the subject area. As the purpose of the CP light buoys is to delineate the deep water route for deep draft vessels, consideration may be given to examine the most appropriate way to mark this deep water route without restricting other vessels to navigate within the route.



5.8 Damages sustained to *Yao Hai* and *Neftegaz-67*

- 5.8.1 *Yao Hai* sustained hull damages to the upper part of its stem and to the top side of its bulbous bow below water.



Figure 8- Damage on the stem of *Yao Hai*



Figure 9- Damage on the bulbous bow of *Yao Hai*

- 5.8.2 *Neftegaz-67* sustained hull damages to starboard side shell aft of amidships near frame no. 25 and to the hull bottom in way of the starboard sterntube.



Figure 10-Damage on the starboard side shell of *Neftegaz-67*

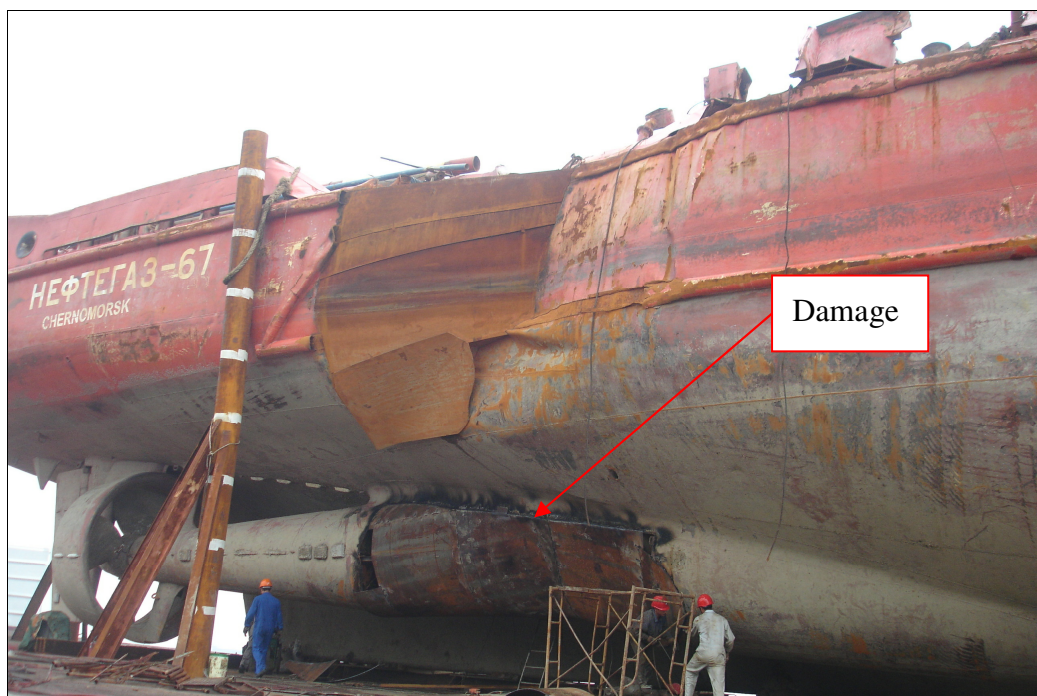


Figure 11-Damage on the starboard sterntube of *Neftegaz-67*

5.8.3 A detailed description of damages on both vessels can be found in the Appendix II of the report.

5.9 Listing, capsizing and sinking of *Neftegaz-67*

- 5.9.1 The Master of *Neftegaz-67* stated that four of the watertight doors below deck were opened 10 minutes before the collision by a motorman for hourly inspection of the engine room, generator room and steering gear room. The watertight door below deck between the engine room and the compartment forward of the engine room was closed by a crew member immediately after the collision.
- 5.9.2 After collision *Neftegaz-67* developed a starboard list which was most probably due to its starboard sterntube hit by the bulbous bow of *Yao Hai*. As the upper part of its side shell was holed by the stem of *Yao Hai*, large amount of seawater accumulated into the starboard side of the store compartment momentarily. Also, when seawater entered the cement tank compartment, the cement storage tanks at the centerline blocked the flow of seawater to port side and would have caused *Neftegaz-67* to list further to starboard.
- 5.9.3 *Neftegaz-67* capsized after listing to starboard. The capsizing was due to free surface effects caused by ingress of seawater into the compartments together with the loss of waterplane area in way of the damaged store compartment. Capsizing would have been prevented if all the watertight doors below deck were closed before the collision.
- 5.9.4 *Neftegaz-67* in its intact condition had a substantial reserve buoyancy. If all watertight doors below deck were closed, seawater could only get into the store compartment and the ingress of seawater would be limited by the internal tanks. Under the above circumstances, *Neftegaz-67* would not sink by foundering. Even when the store compartment and cement tank compartment were both flooded, *Neftegaz-67* would not sink by foundering as the floodable volume of the cement tank compartment was also greatly reduced by its internal tanks. The sinking of *Neftegaz-67* was caused by capsizing as seawater could get into the vessel much more quickly once it had capsized.
- 5.9.5 Appendix I illustrates the sequence of happenings after the first impact of the collision.

5.9.6 In order to find out the reasons behind why so many seafarers were trapped inside *Neftegaz-67*, a detailed analysis of listing, capsizing and sinking of *Neftegaz-67* was attached as Appendix II of this report.

5.10 Equipment and engine failure

5.10.1 The condition of the equipment and the navigational aids, including the propulsion engine of *Yao Hai*, was reported after the incident to be in good working order. There was also no evidence to indicate that there was any malfunctioning of equipment in relation to the incident.

5.10.2 As *Neftegaz-67* had sunk in the incident, the condition of the navigational equipment on board the vessel before collision could not be verified. The only information concerning the condition of the navigational equipment of *Neftegaz-67* before collision was obtained from the Master and Third Officer who stated that the navigational equipment was in normal working order.

5.10.3 The personnel on both vessels stated that they had observed the navigational lights i.e. masthead lights and/or sidelight of the other vessel. It is considered that navigational lights were displayed in normal order and did not contribute to the cause of this incident.

5.11 Alcohol and Drug

5.11.1 Officers and pilots on both vessels did not admit that they had been affected by alcohol or drug.

5.12 Fatigue

5.12.1 Navigational watches on board *Yao Hai* and *Neftegaz-67* were on traditional four-on eight-off basis. The Third Officer and a duty Quartermaster kept the Third Watch i.e. 0800-1200 hours and 2000-0000 hours on each vessel. The Master did not take any watch but he was required to be on the bridge any time when the situation needed e.g. when the vessel is in congested waters and/or when pilot is on board, etc.

- 5.12.2 According to the watch arrangement stated in paragraph 5.12.1, there was no evidence to suggest that the Masters and duty crew members of *Yao Hai* and *Neftegaz-67* had suffered from fatigue in the incident.
- 5.12.3 According to the Pilots Job Assignment Summary Reports submitted by Hong Kong Pilots Association, Pilot of *Yao Hai* was off duty on 20 March 2008. He started his duty at 0820 on 21 March 2008 and had taken 5 assignments with three long breaks i.e. 7.37 hours, 6.33 hours and 6.97 hours prior to piloting *Yao Hai* from 1920 on 22 March 2008. In the case of Co-pilot, he was off duty on 19 March 2008. Prior to taking up duty on board *Yao Hai*, he had taken 8 assignments with six breaks i.e. 12.35 hours, 4.62 hours, 7.7 hours, 7.78 hours, 0.55 hour and 4.08 hours commencing from 0745 on 20 March 2008.
- 5.12.4 Based upon the above information on the job assignments of the two pilots on board *Yao Hai*, it appears that they had not suffered from fatigue.

6. Conclusions

- 6.1 At about 2113 local time on 22 March 2008, the China registered bulk carrier *Yao Hai* collided with the Ukraine registered supply tug *Neftegaz-67* in Hong Kong waters in position 22° 20.7'N 114° 00.1'E.
- 6.2 At the time of the accident, the weather condition was cloudy with light rain. There was a westerly light breeze and a smooth sea with a moderate visibility of about 2 nautical miles (n.m.). The current was setting in a westerly direction at the rate of about 1.5 knot.
- 6.3 *Neftegaz-67* listed to starboard and sank shortly after the collision. Seven crew members of *Neftegaz-67* were rescued and eighteen crew members were drowned inside the vessel.
- 6.4 *Yao Hai* sustained damages to the stem and bulbous bow while *Neftegaz-67* sustained damages to the starboard side shell and starboard shaft tunnel.
- 6.5 The investigation revealed the following probable causes of the collision:

- 6.5.1 *Yao Hai* which was a give-way vessel to *Neftegaz-67* appeared to have failed to comply with Rule 16 (Action by give-way vessel) of the Collision Regulations (COLREGS) by not taking early and substantial action to keep well clear of *Neftegaz-67*. *Yao Hai* did not proceed at a safe speed as required by Rule 6 (Safe Speed) before the collision. *Yao Hai* also failed to comply with Rule 8 (Action to avoid collision) as her avoiding action was not positive, not made in ample time and was not large enough to be readily apparent to *Neftegaz-67*. Before collision, *Yao Hai* had not reduced, stopped or reversed engine to avoid collision or allow more time to assess the situation.
- 6.5.2 *Neftegaz-67*, being a stand-on vessel in a crossing situation, appeared to have failed to comply with Rule 17 (Action by stand-on vessel) of the COLREGS by altering course to port for *Yao Hai* on her own port side in a crossing situation.
- 6.6 Although *Neftegaz-67* was well designed and constructed to withstand the damages imposed on it in the collision, the opening of three watertight doors in the transverse bulkheads below deck caused progressive flooding of the compartments and eventual capsizing and sinking of the vessel.
- 6.7 Instead of passing between CP1 and CP2 light buoys, the Pilot of *Yao Hai* should consider to navigate the vessel to pass northwards of CP1 light buoy to keep clear of *Neftegaz-67*.

7. Recommendations

- 7.1 A copy of the report should be sent to the Maritime Administration of Ukraine and the shipping company of *Neftegaz-67* which should issue a notice to draw the attention of their masters and officers working on supply tugs to the findings of this report. They should be reminded to comply with COLREGS at all times whilst navigating within Hong Kong waters and the importance of keeping all the watertight doors in the transverse bulkheads below deck closed at all times.
- 7.2 A copy of the report should be sent to the Maritime Safety Administration of People's Republic of China and the shipping company of *Yao Hai* which should issue a notice to draw the attention of their masters and officers to the findings of this report. They should be reminded to comply with COLREGS at all times whilst navigating within Hong Kong waters under pilotage. They should also be reminded to follow Section A-VIII/2 of STCW Code that the presence of pilot on board does not relieve the duties and obligations of the master or officer in charge of the navigational watch for the safety of the vessel.

- 7.3 The Marine Department should conduct a review on the buoyage system in the subject area, taking into consideration that the current disposition of the CP light buoys will have an effect to allure vessels that could safely navigate outside the deep water route to navigate through it.

8. Submissions

- 8.1 In the event that the conduct of any person or organization is commented in an accident investigation report, it is the policy of the Marine Department to send a copy of the draft report to that person or organization for their comments.

- 8.2 The relevant parts of the final draft of the report were sent to the following parties:

Master, Third Officer, Pilot, Co-pilot, owner of *Yao Hai*

Master, Third Officer, owner of *Neftegaz-67*

Maritime Safety Administration of People's Republic of China

Shipping Safety Inspectorate of Ukraine, Ministry of Transport of Ukraine

Hong Kong Pilots Association, Ltd.

Assistant Director/Port Control Division of Marine Department, Hong Kong

- 8.3 Submissions were received from the following parties:

Owners of both vessels

Maritime Safety Administration of People's Republic of China

Shipping Safety Inspectorate of Ukraine, Ministry of Transport of Ukraine

Hong Kong Pilots Association, Ltd.

Assistant Director/Port Control Division of Marine Department, Hong Kong

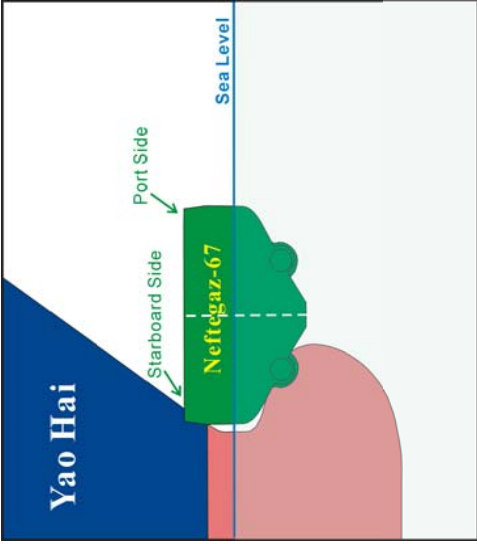
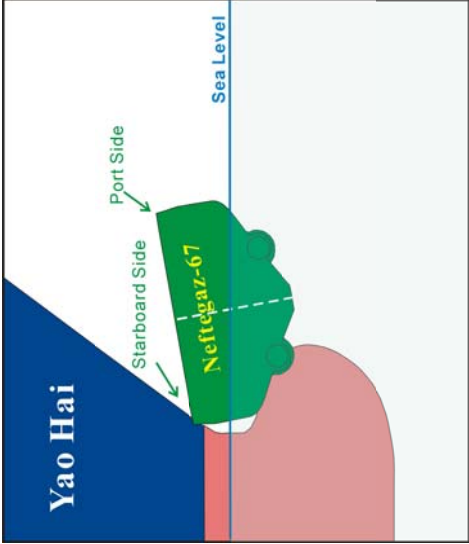
The draft investigation report was amended as appropriate according to their submissions.

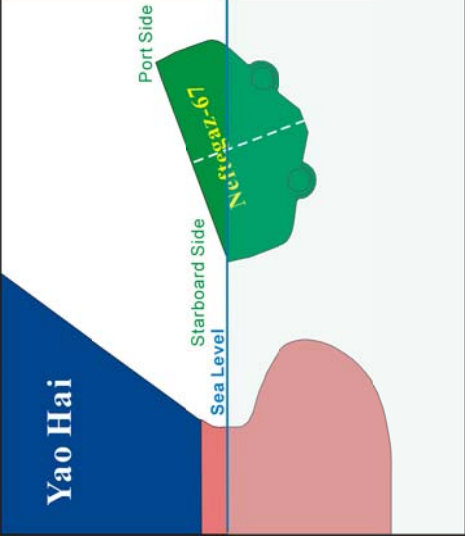
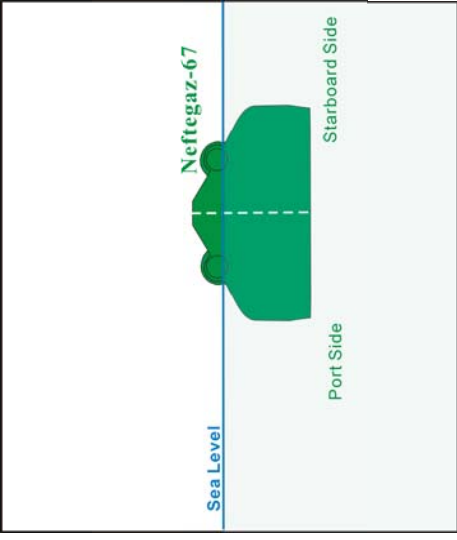
- 8.4 The Master and the two pilots on board *Yao Hai* refrained from making submissions until upon conclusion of all disciplinary or judicial proceedings.

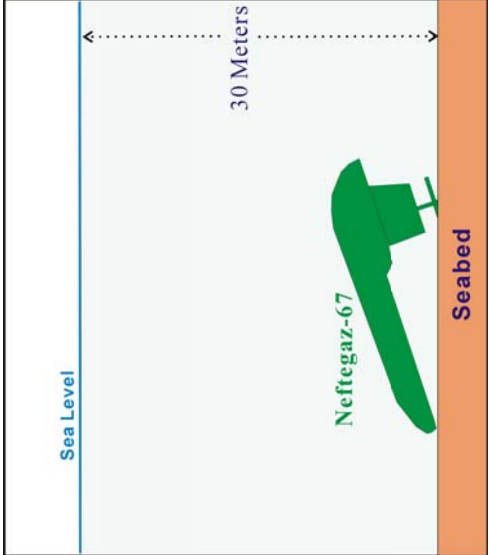
Appendix I –

Sequence of happenings
after the first impact of the
collision

Time-line on Stability of *Neftegaz 67* after the Impact (based on the Report on Capsize and Sinking of *Neftegaz 67* by Mr. Ronnie Law)

Time Scale	Sketch	Remark
Time of Collision i.e. 211341		<i>Yao Hai</i> hit <i>Neftegaz 67</i> at near frame no. 25 (Store compartment) at a relative angle of about 40° at 211341. <i>Yao Hai</i> was going at over 13 knots and <i>Neftegaz 67</i> was travelling at 9.5 knots.
0-20 seconds		<i>Neftegaz 67</i> listed to starboard immediately. The tug was holed in way of her starboard sterntube by the bulbous bow of <i>Yao Hai</i> and was also holed in way of her starboard side near frame no. 25 (Store compartment) by the stem of <i>Yao Hai</i>. <i>Neftegaz 67</i> was locked onto and being pushed by <i>Yao Hai</i> sideway as well as in the astern direction at about 13 knots causing a quick surge of seawater ingress in the Store compartment. Seawater was later forced into the Cement Tank compartment through the opened watertight door between Store compartment and Cement Tank compartment.

21 seconds – 7 minutes 33 seconds	 The diagram shows the Neftegaz-67 vessel tilted to its starboard side. A horizontal line represents the 'Sea Level'. The vessel's hull is green, and its name 'Neftegaz-67' is written in yellow. The 'Starboard Side' is labeled on the left, and the 'Port Side' is labeled on the right. The vessel is partially submerged in a red area representing water.	The two vessels parted at about 211401 i.e. 20 seconds after first impact. At this moment, Seawater might /might not have entered into the Engine Room compartment through the opened watertight door between Cement Tank compartment and Engine Room compartment. <i>Neftegaz 67</i> would still be stable if only a nominal amount of seawater had entered the Store compartment and the Cement Tank compartment. The tug later became unstable after substantial amount of seawater had entered the Engine Room compartment. At 212114 the last words were recorded by VTC from the crew that they abandoned the tug.
7 minutes 33 seconds – 10 minutes 33 seconds	 The diagram shows the Neftegaz-67 vessel upright. A horizontal line represents the 'Sea Level'. The vessel's hull is green, and its name 'Neftegaz-67' is written in yellow. The 'Port Side' is labeled on the left, and the 'Starboard Side' is labeled on the right.	<i>Neftegaz 67</i> had capsized and it was still seen afloat upside down by a passing vessel at 212414 . The tug was probably taking in seawater quickly.

After 10 minutes 33 seconds	 The diagram illustrates the vessel's position. A horizontal blue line at the top is labeled 'Sea Level'. Below it, a green silhouette of the vessel 'Neftegaz-67' is shown resting on an orange horizontal bar labeled 'Seabed'. A vertical dashed line with arrows at both ends spans the distance between the sea level line and the seabed, and is labeled '30 Meters'.	Neftegaz 67 had sunk and disappeared from sea surface as reported by a passing vessel at 212727. The salvage team found that the tug had rested in inverted position on the seabed about 30 metres below sea level.
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Appendix II –

Report on the capsizing and
sinking of M.V. Neftegaz-67

Report

The capsizing and sinking of M.V. Neftegaz-67

Prepared for: MAISSP Branch, Marine Department

**Prepared by: Mr. Ronnie Law
Senior Surveyor of Ships
Hong Kong Marine Department**

Date: 10 September 2008

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I. Summary

1. At the request of the MAISSP Branch, I examined the physical elements that caused M.V. Neftegaz-67 (the Tug) to capsize and sink. The examination considered the intact and damaged stability of the Tug especially when the Tug was undergoing partial and progressive flooding of the compartments. The examination concluded that the Tug was well designed and constructed to withstand the damages imposed on it in the collision, and that it would not capsize or sink if all the watertight doors below deck were closed before the collision. It was discovered that the inboard penetration of the impact was only one metre deep at weather deck level despite the massive collision force. This was due to the Tug being free to be pushed around by the large bulk carrier. Most of the tanks in the compartments flooded therefore remained intact and they helped to reduce the amount of ingressed seawater and free surface effects. In my opinion, if those watertight doors were closed the people onboard would survive in the collision.

II. Purpose

2. This investigation report is prepared at the request of the MAISSP Branch of the Hong Kong Marine Department. The purpose of this investigation is to establish the physical elements that led to the capsize and sinking of the tug “Neftegaz-67” after it was hit by a much larger bulk carrier “YAO HAI”.

This investigation will not address navigational or human elements (including any human errors) that led to the collision. This report merely looks into what had happened to the tug “Neftegaz-67” physically during the collision.

III. Background

3. On 22 March 2008, M.S. “Neftegaz-67” (the Tug) was hit by a much larger bulk carrier, M.V. “YAO HAI” (the Ship). According to the statements from the master of the Tug, the Tug capsized very soon after first impact. A number of crew died in the incident as they were not able to escape in time. The master of the Tug and a few other persons survived. According to the information given to me by the master of the Tug, the survivors included the Chinese translator who called for help on the VHF and one crew member who went down to the engine room from his cabin to close the watertight door in the engine room forward transverse watertight bulkhead, before he returned to main deck and escaped in time before the Tug turned over.
4. I visited the Tug after it was salvaged from seabed in Hong Kong. I visited it again after it was placed on top of a barge in dry condition in Panyu, China. For safety reasons, I was not able to enter the deckhouse and went below the main deck during my visits. Therefore I was only able to see the damaged parts of the hull and deck from outside.
5. The master of the Tug confirmed in his statements that four of the watertight doors below deck were opened before the collision. He also stated that immediately after the collision, the below deck watertight door between the engine room and the compartment forward of the engine room was closed by a member of the crew. However, the other three watertight doors were left opened.
6. As the watertight door that led to the Aft Peak Store compartment was at tweendeck level, the other three compartments would be flooded first during the collision. Since these three compartments covered over half of the total length of the Tug and their total floodable volume was over 50% of the total below deck volume, once they were totally flooded, there would be no doubt that the Tug would capsize and sink. However, in this collision, most of the internal tanks in the compartments were not damaged. The floodable volume was much reduced. Hence it was necessary to examine in details what exactly caused the capsize and sinking. Therefore the investigations had looked into:
 - (1) The reasons for the Tug to heel to starboard before it capsized.
 - (2) Whether the weight of ingressed seawater could accumulating on one side of the Tug and, if so, whether it would cause the Tug to turnover.
 - (3) The primary physical cause for the capsize and whether the capsize could be prevented.
 - (4) The cause for the sinking of the Tug.

IV. Difficulties of the investigation

7. The main difficulty in the investigation was that the operators or the owner of the Tug was not able to provide clear, accurate and drawn to scale geometrical hull drawings (the Lines Plan, Offset Table, and the Body Section Plan) and the internal arrangement (including tank drawings) of the Tug. In particular, they were not able to provide precise and comprehensive data and information regarding the loading and the centre of gravity of all the onboard stores, fuel, water, cargoes and any other loadings of the Tug at the time of collision. Without these information, input data for computer calculations would be incorrect and the computer calculations would be meaningless, for it would produced incorrect and often misleading results. In computing terminology, this is known as a “garbage-in-garbage-out” situation.

V. Overcoming difficulties and the methodology used

8. The above mentioned difficulties were however overcome by employing a rational naval architectural approach using simple calculations based on first principle. The volume, centre of gravity and free surface of ingressed seawater were carefully estimated based on reasonable assumptions. In the calculations the estimated value of volume, weight and free surface areas had always been carefully determined to represent a “conservative” value such that the calculation results would be much more reliable to be used for drawing a conclusion. For example, when it was concluded that the Tug would not sink when the floodable spaces of the Store compartment and the Cement Tank compartments were flooded, a permeability factor of 1 was used to demonstrate the weight of ingressed seawater would not exceed the reserved buoyancy.

In fact this approach would be more useful to lead to conclusions because the flooding of the compartments in this collision was progressive and not total flooding due to the tanks in the compartments remained intact. That means the compartments other than the one damaged with large holes were flooded progressive through the opened watertight doors or through any damaged parts of the transverse watertight bulkhead. Consequently, the stability information sheets of the Tug provided by the operators of the Tug were only of limited use in the calculations.

VI. Material evidence used for the investigation

9. The investigation was therefore carried out based on the following information:
 - (a) The radar course tracking plot of both vessels provided by the Vessel Traffic Control (VTC) office of the Hong Kong Marine Department. In these plots, the global position, speed, and heading of each vessel were recorded once in every three second intervals. The voice communication recordings between the Tug and VTC were also provided by VTC. In this report, the VTC radar tracking plots were used to identify the time a event took place. That is, the exact time recorded by the radar was used, but not the time reported to VTC by the vessels. Also, the headings of vessels and the relative positions of the two vessels recorded by radar were used. In particular, the voice recordings between the vessels and VTC were used to identify the exact time when the last conversation between the Tug and VTC ended.
 - (b) Information (written and verbal) obtained from the master of the Tug during an interview with him on 29 April 2008, in Marine Department.
 - (c) Statements provided by the master of the Tug and the master of the Ship to Marine Department and Hong Kong Police Force.
 - (d) Pictures, plans, drawings and information provided by the operators of the Tug, which was handed to Marine Department by the Ukrainian authorities on 18 July 2008.
 - (e) Pictures of the Tug and its damaged parts taken after the Tug was salvaged in Hong Kong waters, and when the Tug was placed on top of a barge in Panyu, China.
 - (f) Information about the Ship given in the PRC Certificate of Vessel's Nationality.
 - (g) Pictures of the damaged stem and its bulbous bow and the profile drawing of the stem of the Ship, provided by a Mr. J.D. Wort who was an advisor to the operators of the Ship.

VII. The Investigation

(a) Particulars of the vessels

10. The main particulars of the two vessels were:

“Neftegaz-67” (the Tug)

Ship name:	M.V. Neftegaz-67
Ship type:	Offshore supply vessel, also as a seagoing tug for pulling and towing duties.
Area of trading permitted:	No limit
Construction:	Steel. Designed and constructed for navigating in ice conditions, with double hull skins at hull side for 3 watertight compartments at amidships.
Watertight subdivisions:	Divided into 8 damage subdivision zones, separated by transverse watertight bulkheads at frame nos. 7, 26, 45, 66, 82, 97, and 110 (collision bulkhead). Each zone represented a compartment below the tweendeck. There was a watertight door in each transverse watertight bulkheads at frames no. 7, 26, 45 and 66. There were double bottom tanks throughout the ship length.
Maximum Speed:	15 knots
Length overall:	81.37 metres (As indicated in the stability information sheet)
Length between perpendiculars:	71.45 metres (As indicated in the stability information sheet)

Breadth:	15.96 metres (As indicated in the stability information sheet)
Hull depth	7.20 metres (Measured from the bottom of keel to main deck, as indicated in the stability information sheet)

The freeboard of 2.3 metres together with a ship length and breadth of 71 metres and 15.96 metres respectively would mean a reserved buoyancy of well over 2000 tonnes.

“YAO HAI” (the Ship)

Ship name:	M.V. YAO HAI (IMO no. 8515697)
Ship type:	Bulk carrier
Construction:	Steel
Speed:	12.5 knots (as designed)
Length overall:	225 metres
Length between perpendiculars:	215.98 metres
Breadth (moulded):	32.2 metres
Hull depth (moulded):	18.3 metres
Draft:	13.533 metres (Tropical Loadline) 13.257 metres (Summer Loadline) 12.981 metres (Winter Loadline)
Displacement:	9823 tonnes (light ship) 81133 tonnes (Tropical Loadline) 79320 tonnes (Summer Loadline) 77512 tonnes (Winter Loadline)
Bulbous bow:	Protruding bulb at bow underwater.

(b) Weather

11. The collision took place shortly after nine o'clock in the evening on 22 March 2008. The sea condition and weather was reported as good. Hence the motion and movement of both vessels during collision should not have been much affected by sea and weather.

(c) Damages to both vessels

The Tug

12. As indicated in VTC radar plots the Tug was travelling at 9.5 knots and the Ship was travelling at 13.5 knots when they collided at an angle. (See [Figure 1](#)) The Tug was hit by the Ship on the starboard side aft of amidships, at near frame no. 25. Frame no. 25 was one frame spacing aft of the transverse watertight bulkhead between the Store compartment and the Cement Tank compartment.

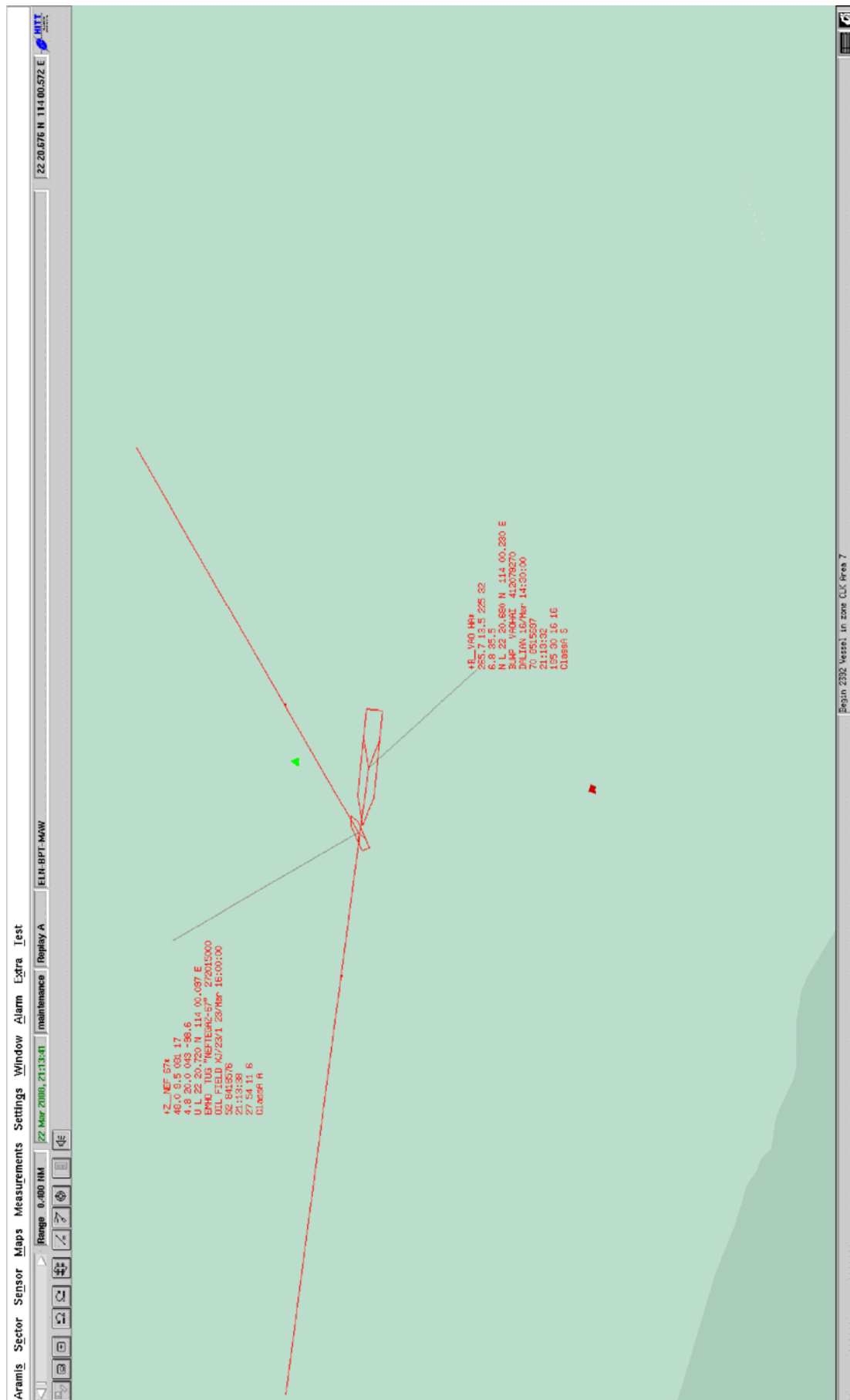


Figure 1 - Vessel Traffic Centre (VTC) Radar Plot of Collision

13. The damage to the Tug on its starboard side shell resulted a large hole, measuring approximately 2.5 to 3 metres in width and extending downward by 3.2 to 4 metres. (See Figures 2A, 2B and 2C) The maximum inboard collision penetration at the open weather deck (measured by me during my visit to the Tug at Panyu) was about 1 metre. (See Figure 3) The large hole had a truncated end at aft. At the fore end of the hole the hull side shell plating was pressed inboard. The shape of this hole and the configuration of the pressed in part of the side shell at deck level matched well with the position of the damaged scratch marks and the damaged hole at the bow of the Ship. It was not known whether the transverse watertight bulkhead at frame no. 26 was damaged to become leaking because for safety reasons I was not able to go below deck during my visits to the Tug. Nevertheless with such a severe impact force and that the Tug's hull side was badly pressed in, it would be reasonable to assume damages had been caused to this bulkhead, especially at nearer to the hull side shell plating.



Figure 2A – Damage on starboard side of Neftegaz 67



Figure 2B – Damage on starboard side of Neftegaz-67



Figure 2C – Damage on starboard side of Neftegaz-67



Figure 3 – Maximum inboard collision penetration as measured at open weather deck was about 1 metre

14. The starboard side of the hull immediately beneath the above described hole at the upper hull side of the Tug, however, remained intact (See [Figure 4](#)). There was an undamaged area of hull shell plating, about 2 metres in height, between above described hole and a hole at the hull bottom below that was caused by the hit of the bulbous bow of the Ship. The starboard sterntube and the propellar shaft of the Tug was totally destroyed during first impact. The sterntube was damaged so badly that it was pressed to become closely folded, which indicated the extremely large impact force. The hull bottom at the inboard side of the sterntube was also holed, leaving a large hole at hull bottom on both sides of, and in way of the starboard sterntube. The overall dimensions of the hull bottom hole was as large as 6 m in length and 1.5 m in width.



Figure 4 – Damages on starboard side and starboard sterntube of Neftegaz-67

15. Apparently, the other parts of the hull of the Tug was not damaged. Some of the damages to the crane and upperdeck fittings and structures, were probably damages done to the Tug when it landed on seabed and during salvage operation. The size of the damaged holes compared with the overall size of the Tug were, despite the striking impression of the photographs taken, not that large. (See [Figure 5](#))

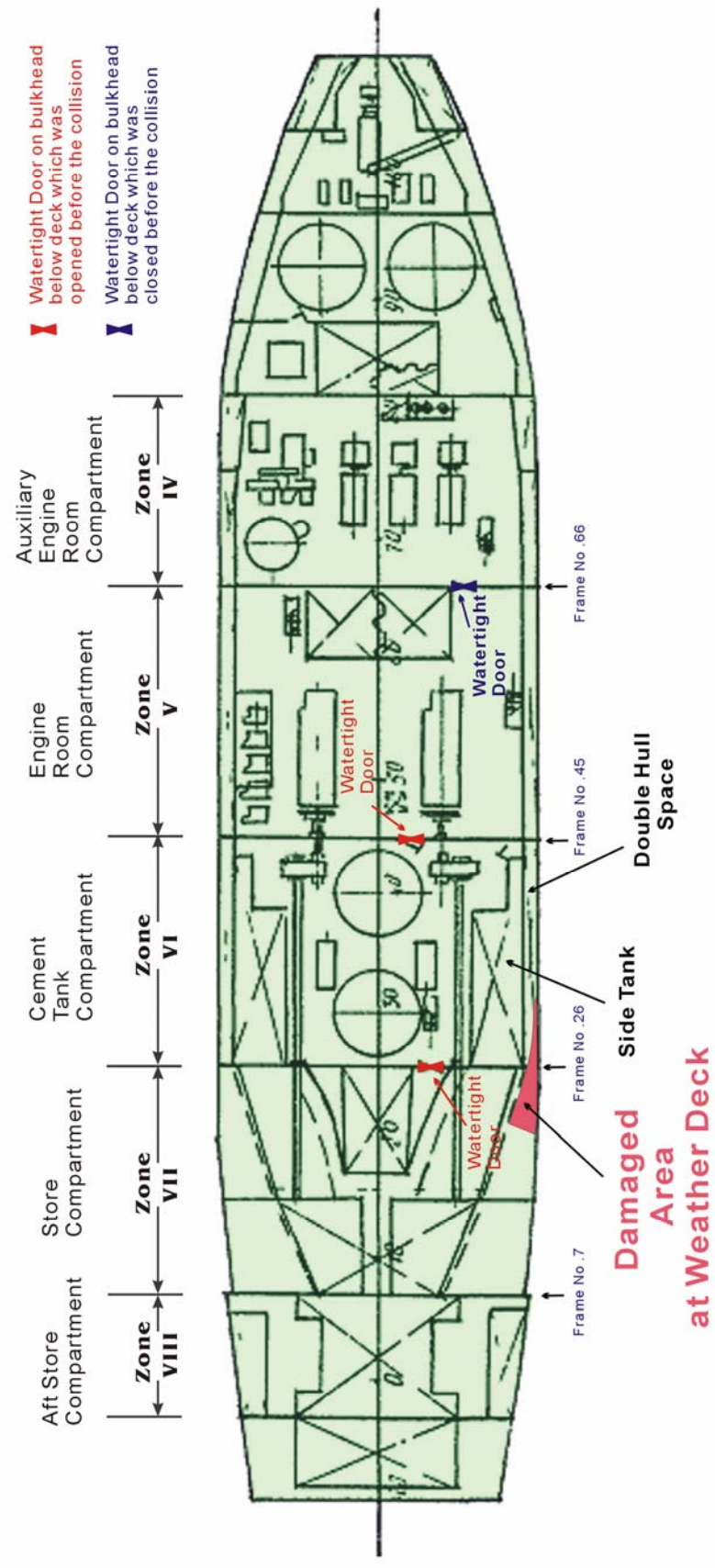


Figure 5 - Plan view of Neftegaz-67 between the double bottom deck and the tween deck

The Ship

16. The Ship was holed at its fore end in two areas, one at the upper part of its stem and the other at the top side of its bulb below water at bow. The impact resulted a large hole in the stem. (See Figures 6A, and 6B) This hole was of an eye shape parallel to the waterline. It was at a height of about 14 m from hull bottom. (See Figure 7) This hole appeared to be caused by the main deck edge of the Tug cutting into the Ship's stem at first impact. There were dents and scratch marks within the vicinity of this upper damaged hole. The height and shape of the scratch marks as seen on photographs agreed well with the corresponding profile of the damaged part of the hull of the Tug where its side shell was pressed in. The protruding bulb of the bow (bulbous bow) was badly holed at its top near the tip. It was a large hole with badly folded metal at its aft edge, exposing its internal steel structures. One of the flanges of the Tug's propeller shaft coupling was left embedded in this hole. (See Figure 8). The hole at the upper part of the stem was about 6 metres above the damage hole at the top of the bulb. (See Figure 7) This height agreed well with the vertical distance between the damaged hull bottom of the Tug and the damaged part of main deck edge of the Tug. The transverse view of the Ship and the Tug in the collision is shown in Figure 7. It can be seen that the Ship was much larger and taller than the Tug that in the collision, the Tug could be push around by the Ship easily.



Figure 6A – Damage on stem of Yao Hai

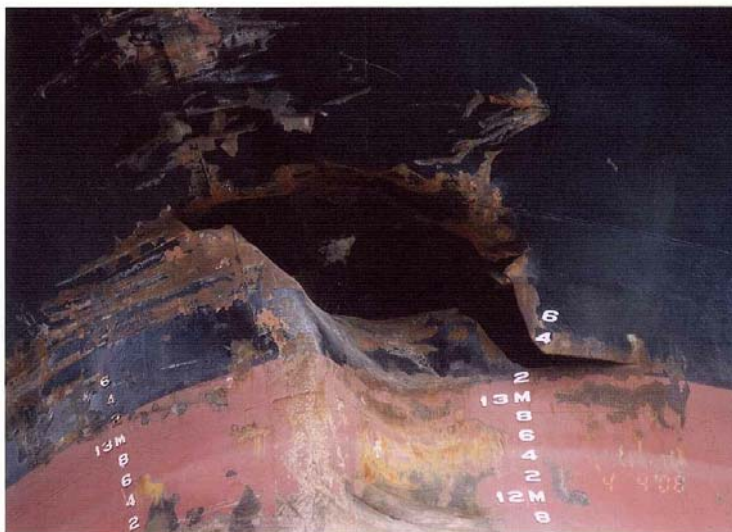


Figure 6B – Damage on stem of Yao Hai

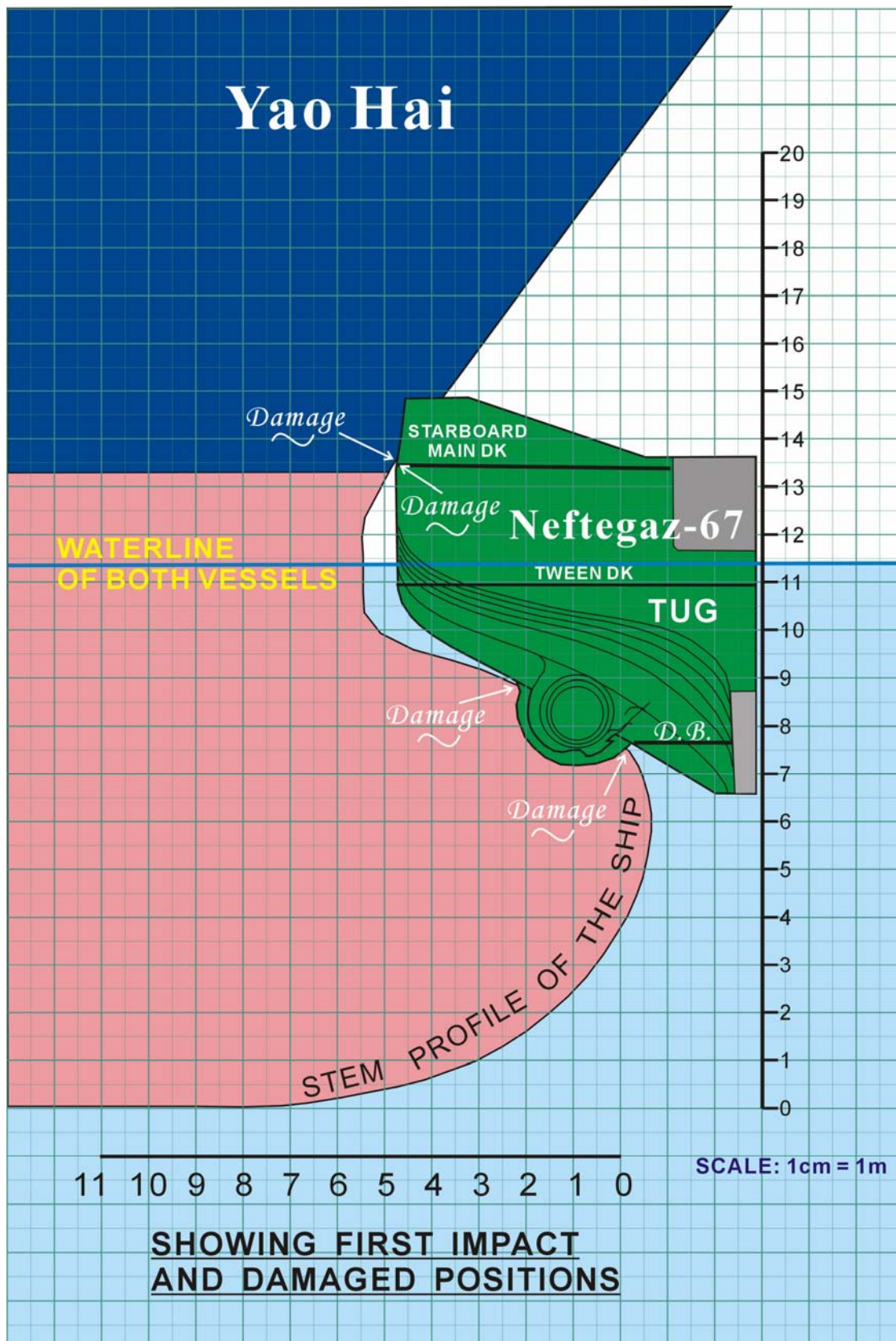


Figure 7 –The transverse view of “Yao Hai” and “Neftegaz-67” in the collision

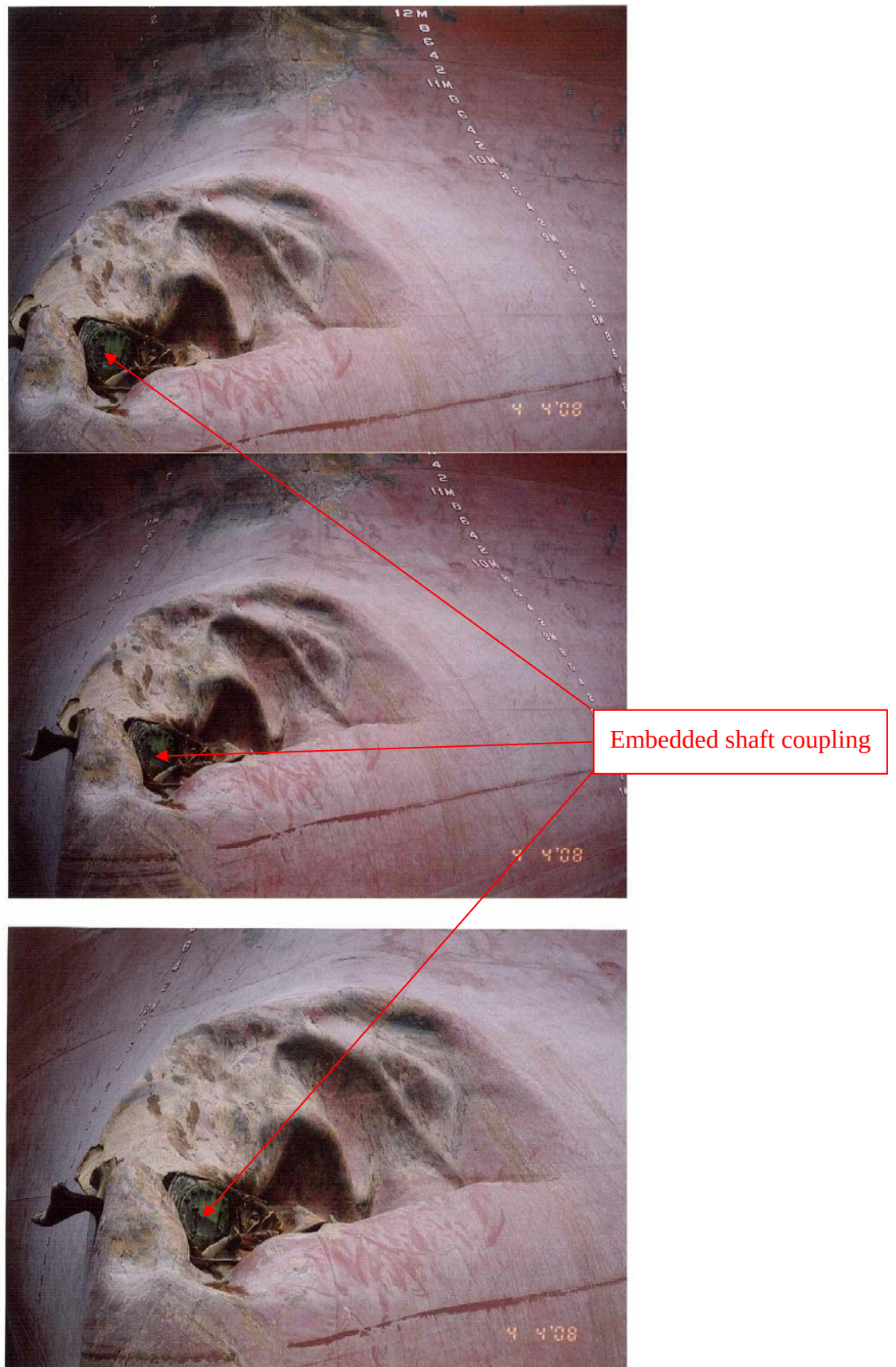


Figure 8 – Damage on bulbous bow of Yao Hai

(d) The collision

17. A description of the sequence of happenings after the first impact of the collision is given below:

- (1) The Ship hit at the Tug at near frame no. 25 (Store compartment) at an relative angle of about 40 degrees, at 21:13:41 hour. The Ship was going at over 13 knots and the Tug was travelling at 9.5 knots.
- (2) The Tug listed to starboard immediately as it was hit by the bulb below water. The Tug had a large hole below water in way of its starboard sterntube, caused by the hit from the below water bulb of the Ship. The starboard propeller shaft of the Tug jammed onto the damaged hole in the bulb of the Ship. The port propeller, however, should still be turning at this moment, probably resulting a clockwise turn of the Tug when the upper part of the side shell of the Tug was hit by the stem of the Ship, resulting another large hole above the double bottom deck. The double bottom deck plate remained undamaged. The Ship and the Tug then stuck together.
- (3) During first impact, and within the next 20 seconds, the Tug was locked onto and being pushed by the Ship sideway as well as in the astern direction at about 13 knots. This resulted a quick surge of seawater ingress in the Store compartment.
- (4) Due to blockage of flow because of the large internal tanks in the Store compartment, and that the Tug was being pushed in the astern direction at about 13 knots, water level at starboard side of the Store compartment rose quickly, and seawater was forced into the Cement Tank compartment through the opened watertight door. If the transverse watertight bulkhead was also damaged at near the starboard side shell, it was possible for seawater to get into the double hull spacing and probably also entered the starboard side tank in the Cement Tank compartment.
- (5) The volume (or amount) of seawater ingress in the Cement Tank compartment was also reduced because of the large side tanks and the two large cement storage tanks placed in the Cement Tank compartment. Since the Tug was already listing to starboard and locked onto the Ship, seawater in the Cement Tank compartment also accumulated at starboard. The cement storage tanks and its supporting girders and frames at centreline also helped to prevent the flow of seawater to port side, momentarily.
- (6) The two vessels parted at about 21:14:01 hour, i.e., 20 seconds after first

impact. At this moment, it was not known by this time whether seawater would have already, or just beginning to, enter the Engine Room compartment through the opened watertight door. According to the calculations (See Appendix I) in the investigation, the Tug would still be stable if only a nominal amount of seawater had entered the Store Compartment and the Cement Tank Compartment, before substantial amount of seawater had entered the Engine Room compartment. However, the surviving crew members only abandoned the Tug about 8 minutes later, after first impact. Note that when the Tug was listing to starboard and it would take longer time for seawater in the Cement Tank compartment to rise to reach the lower edge of the opened watertight door between the Cement Tank compartment and the Engine Room compartment. That is, it would take slightly longer time to capsize.

- (7) At 21:21:14 hour the last words were recorded by VTC from the crew. By this time, crew abandoned the Tug. Three minute later, at 21:24:14 hour, the Tug was still seen by a by-passing vessel as afloat upside down, with the bow high above sea surface. By this time, the Tug was probably taking into seawater quickly.
- (8) At 21:27:27 hour, i.e. about 4 minutes later, the Tug disappeared from sea surface, as reported by a by-passing vessel.

(e) Calculations

- 18. The breach of hull watertight integrity of the Tug and the flooding of its internal compartments, tanks and spaces would change the weight and buoyancy distribution of the Tug. Such changes are time dependent and their instantaneous values depend on the quantity (hence the weight) of ingressed seawater and the location of the spaces or compartments flooded. The speed of flooding can affect the instantaneous stability of the Tug. The stability of the Tug and its responding motions could be very different if the spaces are flooded slowly (known as progressive flooding), compared with a situation where the spaces are totally flooded immediately (known as immediate total flooding). In practice, progressive flood usually makes a vessel more vulnerable in stability compared with an immediate total flooding situation.
- 19. The examination of progressive flooding should best be performed by means of analytical calculations using a suitable ship stability calculation computer program, However such detailed calculations were not carried out for this report because of the gross lack of available and reliable detailed information of the compartmentation, space details and the loading conditions of the Tug. Nevertheless, it was able to examine and to establish possible scenarios based on a rational approach taking into account of the estimated loss of buoyancy and waterplane areas, and the added weights and free surface effects of

ingressed seawater.

20. Initial stability data (as taken from the stability information sheet provided by the operators of the Tug) were:

Displacement (tonnes)	Forward Draft (m)	Aft Draft (m)	Trim (degree °)	Transverse metacentric height (GM) (m)	Freeboard (m)
2617	3.5	3.5	0	0.86	3.7
3087	4.0	4.0	0	0.85	3.2
3598	4.5	4.5	0	1.1	2.7
4028	4.9	4.9	0	1.34	2.3

21. According to the information provided by the Ukrainian Authority, the Tug was drawing 4.4 metres forward and 4.8 metres aft. Therefore it would have a displacement of about 3598 tonnes. For the sake of convenience the figure 3598 tonnes was used in the calculations. Calculations using other displacement figures were also carried out to gauge the sensitivity of the results towards displacement variables.
22. The heeling of the Tug caused by sequential flooding of Zone VII, VI and V was examined. In the examination, the permeability of the flooded spaces were estimated. The weight of ingressed seawater was compared with the data given in the stability information sheets, as a check of confidence level.
23. Note that the calculated heel angles and the stability of the Tug were for the Tug as a free floating body. In the incident, however, the Tug was restricted in its movements, as it was dominated by the Ship holding onto it. Nevertheless, the Tug became a free floating body after 20 seconds, when it separated from the Ship. The investigation in this report showed the Tug capsized due to free surface effects.
24. The combination of progressive flooding and sequential flooding consists of a sizable matrix of events to be examined. This incurred a large number of ship motion response calculations in order to come up with the more probable scenarios. For easy reading this report does not include the large amount of calculations that had been done but only the more illustrative ones.

(f) Starboard list

25. The reason for the Tug to acquire a starboard list was most probably due to it being hit by the bulbous bow of the Ship at the sterntube area during the first moment of ship-to-ship body contact. That is, the Tug immediately listed to starboard just before the lower part of the hull of the Tug was holed. Another explanation would be that, as the upper part of the Tug's side shell was holed, large amount of seawater accumulated onto the starboard side of the Store compartment momentarily. Also, when seawater entered the Cement Tank compartment the cement storage tanks at centreline blocking the flow of seawater to port side would cause the Tug that was already listing to starboard to list further to starboard.
26. As a consequence of one of the above reasons, or a combination of these two reasons, when the Tug parted with the Ship, the Tug would have an initial starboard list as well as a strong tendency to list heavily to starboard due to the accumulation of seawater at starboard. However, the calculations showed that the Tug did not turned over due to the weight of ingressed seawater accumulating at starboard, but capsized due to free surface effects before the weight of ingressed seawater could turnover the Tug. (See Appendix II)

(g) The cause of capsize

27. The cause of capsize for the Tug in the collision was due to free surface effects of ingressed seawater together with the loss of waterplane area in way of the damaged Store compartment. Capsize would have been prevented if all the watertight doors below deck were closed. If only the Store compartment was flooded, the Tug would not capsize (See Appendix III). The calculations (See Appendix IV) revealed that if the watertight door between the Cement Tank compartment and the Engine Room compartment was closed (i.e. even with only the watertight door between the Store compartment and the Cement Tank compartment was left open) although the free surface effects would not unstabilise the Tug (because of the reduced floodable volumes), the Tug would still capsize because it would have a large trim by its stern with the aft end of its open deck immersed under water. That would result a substantial loss of waterplane area (and reduced stability), and would allow large amount of seawater entering the most aft store compartment (Zone VIII).

(h) Sinking

28. The calculations showed that the tug in its intact condition had a substantially large reserved buoyancy. With the amount of seawater ingress limited by the internal tanks the Tug would not sink by foundering if all watertight doors below deck were closed as seawater could only get into the Store compartment. As the floodable volume of the Cement Tank compartment was also greatly

reduced by its internal tanks the Tug would not sink by foundering even when the Store compartment and the Cement Tank compartments were both flooded.

The fact that the Tug did capsize before it sank (in about 4 to 5 minutes after it capsized) indicated that the sinking of the Tug was either as a result of, or that the sinking was quickened by, the capsize. This was because seawater could get into the vessel much more quickly once it capsized.

VIII. Conclusion

29. The study concluded that the Tug was well designed and constructed to withstand the damages imposed on it in the collision, and it would not capsize or sink if all the watertight doors below deck were closed before the collision.
30. Eliminating all possibilities that would suggest otherwise, the following definitive statements can be made:
 - (1) Due to the shallow (only about 1 metre as measured at weather deck level) transverse penetration of the hit it was likely that many (if not all) of the internal tanks remained undamaged. The weight of ingressed seawater and the associated free surface effects were therefore much reduced.
 - (2) The Tug would not capsize if all the below deck watertight doors in the transverse bulkheads were closed.
 - (3) The fast sinking of the Tug was due to its capsize because the capsize quicken seawater ingress.
 - (4) The Tug capsized due to free surface effects of ingressed seawater. In particular, once Engine Room compartment was flooded to produce a free surface across the Engine Room, the total free surface effects of seawater in the Cement Tank compartment and the Engine Room compartment, together with the loss of waterplane area in the Store compartment, would definitely capsize the Tug.
 - (5) The Tug took over 8 minutes, or more, after first impact before it turnover to its side (starboard).

IX. Appendix

Appendix I:

Examination of substantial flooding of the Store Compartment

+ Cement Tank Compartment

(Calculation by added weight method)

Purpose: To show the Tug would still be stable if only nominal amount of seawater entered Zone VII and Zone VI but not Zone V (Engine Room)

Appendix II:

Examination of ingressed seawater on one side of the Tug, i.e., flooding of the

Store Compartment + Cement Tank Compartment + Engine Room

(Calculation by added weight method)

Purpose: To show the Tug in this flooding condition would not sink by foundering and would not turnover because of seawater accumulating at starboard, but capsized and sank due to free surface effects.

Appendix III:

Examination of substantial flooding of the Store Compartment

(Calculation by added weight method)

Purpose: To show the Tug would not sink or capsize if only the Store Compartment was flooded.

Appendix IV:

Examination of substantial flooding of the Store Compartment

+ Cement Tank Compartment

(Calculation by added weight method)

Purpose: To show the Tug in this flooding condition would turnover due to substantial trim at aft.

Appendix V:

VTC voice recording details.

Examination of substantial flooding of the Store Compartment
+ Cement Tank Compartment
(Calculation by added weight method)

Purpose: To show yhe tug would still be stable if only norminal amount of seawater entered Zone VII and Zone VI but not Zone V (Engine Room)

Assumed flooding condition

- (I) Store Compartment:
- (1) Double bottom - 100% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboard - 80% flooded
 - port - 40% flooded
- (II) Cement Tank compartment:
- (1) Double bottom - 0% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboad - 70% flooded
 - port - 20% flooded
 - (3) Double hull spacing - 0% flooded
 - (4) Starboard side tank - 0% flooded

According to master of the Tug:

Initial forward draft = 4.4 m

Initial aft draft = 4.8 m

Hence, mean freeboard = 2.7 m

Displacement = 3598 tonnes (approx.)

Reserved buoyancy > 2000 tonnes

Total ingressed seawater weight + loss of buoyancy in store compartment = 199 tonnes

Sink by stern = 2,31 m

Rise by bow = 2.96 m

Heel = 3.87 degree

Loss in GM = 0.767 m

Initial GM = 1.1 m

Resultant GM = 0.33 m

Hence, the Tug will NOT sink.

Hence, the resultant GM is positive and the Tug is stable.

FREE SURFACE EFFECTS CALCULATION

Flooding of Store Compartment + Cement Tank Compartment

Disp	3598 tonnes		
GM intact	1.1 metres		
Flood	Frame nos.	#7	#45
SEAWATER	1,025 tonnes/cu.m	=	34.84 cu.ft/ton
Conversion facto	1000 kg	=	2205 lbs

STORE COMPARTMENT

Free surf: length 5.77 metres X width 15.96 metres

Total free surface length **5.77**metres X width **15.96**metres

Free surface moment of inertia = 226526.0487 ft^2 . ft^2

CEMENT TANK COMPARTMENT

Free surf: length 10.56 metres X width 9.38 metres

Total free surface length **10.56**metres X width **9.38**metres

Free surface moment of inertia = 84162.01191 ft² . ft²

ENGINE ROOM COMPARTMENT

Free surf: length 0 metres X width 0 metres

Total free surface length metres X width metres

Free surface moment of inertia	0	ft ² . ft ²
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TOTAL Free Surface Moment of Inertia	310688.0606	ft^2 . ft^2
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TOTAL added weight of the flooded compartments	199.067
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Factor 34.84 x Disp x 2205 / 2240 = 123395.6588 ft^3

Loss in GM	2.517820025	ft
	0.767394095	metres

Resultant GM	0.332605905	metres
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Flooding of Store Compartment + Cement Tank Compartment

- A.** Added weight method is used in the calculation
- B.** The volume of the Compartments excluding all the internal tanks are used in the calculation.
- C.** The volume are separated into 2 parts, i.e. port and starboard.
- D.** Seawater level is assumed filled up to the tweendeck level.

Seawater ingress in	Zone VII above DB	Stb 100%
Seawater mass from centerline	3.99	meter
Seawater mass from LCF	15.02	meter
Width of volume	6.57	meter
Length of volume	5.87	meter
Depth of volume	3.05	meter
Block coefficient*fullness	0.36	
Seawater density	1.025	
		tonne/cu.m.
Weight of seawater	43.40399216	
		Mmt longn 651.928
		Mmt transverse 173.1819

Seawater ingress in	Zone VII above DB	port 100%
Seawater mass from centerline	-3.99	meter
Seawater mass from LCF	15.02	meter
Width of volume	6.57	meter
Length of volume	5.87	meter
Depth of volume	3.05	meter
Block coefficient*fullness	0.18	
Seawater density	1.025	
		tonne/cu.m.
Weight of seawater	21.70199608	
		Mmt longn 325.964
		Mmt transverse -86.591

Seawater ingress in	Zone VI dbl hull	100%
Seawater mass from centerline	7.28	meter
Seawater mass from LCF	7.745	meter
Width of volume	0.7	meter
Length of volume	10.56	meter
Depth of volume	3.29	meter
Block coefficient*fullness	0	
Seawater density	1.025	
Weight of seawater	0	

Block coeff	Fullness
0.9	0

Mmt long	0
Mnt transverse	0

tonne/cu.m.

tonnes

Seawater ingress in	Zone VI stb	100%				
Seawater mass from centerline	2.35	meter				
Seawater mass from LCF	<u>7</u>	meter				
Width of volume	4.69	meter				
Length of volume	10.56	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0.56	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0.7</td></tr></table>	Block coeff	Fullness	0.8	0.7
Block coeff	Fullness					
0.8	0.7					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	93.52862534	<table><tr><td>Mmt longn</td><td>6547004</td></tr><tr><td>Mmt transverse</td><td>219.7923</td></tr></table>	Mmt longn	6547004	Mmt transverse	219.7923
Mmt longn	6547004					
Mmt transverse	219.7923					

Seawater ingress in Zone VI port		100%					
Seawater mass from centerline	2.35	meter					
Seawater mass from LCF	<u>7</u>	meter					
Width of volume	4.69	meter					
Length of volume	10.56	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0.16						
Seawater density	1.025						
		tonne/cu.m.					
Weight of seawater	26.72246438	tonnes					
			<table border="1"> <tr> <td>Mmt longn</td> <td> 187.0573 </td> </tr> <tr> <td>Mmt transverse</td> <td> -62.7978 </td> </tr> </table>	Mmt longn	187.0573	Mmt transverse	-62.7978
Mmt longn	187.0573						
Mmt transverse	-62.7978						

Seawater ingress in Zone VI side tank		0%					
Seawater mass from centerline	5.87	meter					
Seawater mass from LCF	<u>7.85</u>	meter					
Width of volume	2.35	meter					
Length of volume	7.51	meter					
Depth of volume	3.286	meter					
Block coefficient*fullness	0						
Seawater density	1.025						
		tonne/cu.m.					
Weight of seawater	0	tonnes					
			<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0						
Mmt transverse	0						

Seawater ingress in Zone V Stb		0%					
Seawater mass from centerline	4.69	meter					
Seawater mass from LCF	<u>-3.3</u>	meter					
Width of volume	7.04	meter					
Length of volume	11.74	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0						
Seawater density	1.025						
		tonne/cu.m.					
Weight of seawater	0	tonnes					
			<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0						
Mmt transverse	0						

Seawater ingress in **Zone V port** **0%**

Seawater mass from centerline-4.69meter

Seawater mass from LCF-3.3meter

Width of volume7.04meter

Length of volume11.74meter

Depth of volume3.29meter

Block coefficient*fullness0

Seawater density1.025

Block coeff	Fullness
0.8	0

tonne/cu.m.

Weight of seawater0

tonnes

Mmt longn0

Mnt transverse0

Seawater ingress in **Zone V DBL Hull** **0%**

Seawater mass from centerline7.28meter

Seawater mass from LCF-5meter

Width of volume0.7meter

Length of volume11.74meter

Depth of volume3.29meter

Block coefficient*fullness0

Seawater density1.025

Block coeff	Fullness
0.9	0

tonne/cu.m.

Weight of seawater0

tonnes

Mmt longn0

Mnt transverse0

LCF at frame 48	Moment to change trim by 1 metre	262.00	tonne-M
	Trim		
	Distance of added weight CG from LCF	5.27	metres
	Trim	2.31	6.94 metres
	Trim	2.96	AFT (sink)
Total added weight			FWD (rise)
	199.067		
Total moment	243.585	Transverse	1381 Longn

Initial Displ (tonnes)	Final displ (tonnes)	W*D	Tan Theta	Heel (deg.)
3087	3087.00	243.59	0.079	4.51
3598	3598.00	243.59	0.068	3.87
3758	3758.00	243.59	0.065	3.71
4028	4028.00	243.59	0.060	3.46

Zone VII stb 0.80
 port 0.40
 below DB 1.00

Zone VI dbl hell 0.00
 stb 0.70
 port 0.20
 side tank 0.00

Zone V stb 0.00
 port 0.00
 dbl hull 0.00

Appendix II

Examination of ingressed seawater on one side of the Tug, i.e. flooding of the Store Compartment + Cement Tank Compartment + Engine Room (Calculation by added weight method)

Purpose: To show the Tug in this flooding condition would not sink by foundering and would not turnover because of seawater accumulating at starboard, but capsized and sank due to free surface effects.

Assumed flooding condition

- (I) Store Compartment:
 - (1) Double bottom - 100% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboard - 60% flooded
 - port - 15% flooded
- (II) Cement Tank compartment:
 - (1) Double bottom - 0% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboard - 60% flooded
 - port - 15% flooded
 - (3) Double hull spacing - 60% flooded
 - (4) Side tank - 60% flooded
- (III) Engine Room compartment from double bottom top upto beneath tweendeck
 - (1) Starboard - 25% flooded
 - (2) Port - 15%
 - (3) Double hull spacing - 0% flooded

According to master of the Tug:

Initial forward draft = 4.4 m

Initial aft draft = 4.8 m

Hence, mean freeboard = 2.7 m

Displacement = 3598 tonnes (approx.)

Reserved buoyancy > 2000 tonnes

Total increased seawater weight + loss of buoyancy in Store compartment = 289.36 tonnes

Sink by stern = 1.72 m

Rise by bow = 2.20 m

Heel = 9.93 degrees

Loss in GM = 1.36 m

Initial GM = 1.1 m

Resultant GM = 0.26 m

Hence, the Tug will NOT sink, and the weight of ingressed seawater on one side would not turnover the Tug. However, the Tug would capsize due to free surface effects.

FREE SURFACE EFFECTS CALCULATION

Flooding of Store Compartment + Cement Tank Compartment + Engine Room

Disp	3598 tonnes		
GM intact	1.1 metres		
Flood	Frame nos.	#7	#66
SEAWATER	1,025 tonnes/cu.m	=	34.84 cu.ft/ton
Conversion facto	1000 kg	=	2205 lbs

STORE COMPARTMENT

Free surf:	length	5.77 metres	X	width	15.96 metres
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Total free surface	length	5.77 metres	X	width	15.96 metres
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Free surface moment of inert	=	226526.0487	ft ² . ft ²
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CEMENT TANK COMPARTMENT

Free surf:	length	10.56 metres	X	width	9.38 metres
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Total free surface	length	10.56 metres	X	width	9.38 metres
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Free surface moment of inert	=	84162.01191	ft ² . ft ²
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ENGINE ROOM COMPARTMENT

Free surf:	length	8.4 metres	X	width	14.36 metres
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Total free surface	length	8.4 metres	X	width	14.36 metres
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Free surface moment of inert	=	240207.344	ft ² . ft ²
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TOTAL Free Surface Moment of Inertia	550895.4047	ft ² . ft ²
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TOTAL added weight of the flooded compartments	289.36	tonnes
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Factor 34.84 x Disp x 2205 / 2240 =	123395.6588	ft ³
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Loss in GM	4.46446342	ft
	1.360702048	metres

Resultant GM	-0.260702048	metres
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Flooding of Store Compartment + Cement Tank Compartment + Engine Room

- A.** Added weight method is used in the calculation.
- B.** The volume are separated into 2 parts, i.e. port and starboard.
- C.** Depth of space is up to tweendeck level.

Seawater ingress in	Zone VII above DB	Stb 60%				
Seawater mass from centerline	3.99	meter				
Seawater mass from LCF	15.02	meter				
Width of volume	6.57	meter				
Length of volume	5.87	meter				
Depth of volume	3.05	meter				
Block coefficient*fullness	0.27	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.45</td><td>0.8</td></tr></table>	Block coeff	Fullness	0.45	0.8
Block coeff	Fullness					
0.45	0.8					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	32.55299412	<table><tr><td>Mmt longn</td><td>488.946</td></tr><tr><td>Mmt transverse</td><td>129.8864</td></tr></table>	Mmt longn	488.946	Mmt transverse	129.8864
Mmt longn	488.946					
Mmt transverse	129.8864					

Seawater ingress in		Zone VII above DB	port 15%				
Seawater mass from centerline	-3.99		meter				
Seawater mass from LCF	15.02		meter				
Width of volume	6.57		meter				
Length of volume	5.87		meter				
Depth of volume	3.05		meter				
Block coefficient*fullness	0.0675	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.45</td><td>0.15</td></tr></table>	Block coeff	Fullness	0.45	0.15	
Block coeff	Fullness						
0.45	0.15						
Seawater density	1.025		tonne/cu.m.				
Weight of seawater	8.138248529		<table><tr><td>Mmt longn</td><td>122.2365</td></tr><tr><td>Mmt transverse</td><td>-32.4716</td></tr></table>	Mmt longn	122.2365	Mmt transverse	-32.4716
Mmt longn	122.2365						
Mmt transverse	-32.4716						

Seawater ingress in Zone VII below DB		100%				
Seawater mass from centerline	0	meter				
Seawater mass from LCF	15.73	meter				
Width of volume	5.16	meter				
Length of volume	6.33	meter				
Depth of volume	1.17	meter				
Block coefficient*fullness	0.35	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.35</td><td>1</td></tr></table>	Block coeff	Fullness	0.35	1
Block coeff	Fullness					
0.35	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	13.70980202	<table><tr><td>Mmt longn</td><td>215.6552</td></tr><tr><td>Mmt transverse</td><td>0</td></tr></table>	Mmt longn	215.6552	Mmt transverse	0
Mmt longn	215.6552					
Mmt transverse	0					

Seawater ingress in Zone VI dbl hull		60%	
Seawater mass from centerline	7.28	meter	
Seawater mass from LCF	7.745	meter	
Width of volume	0.7	meter	
Length of volume	10.56	meter	
Depth of volume	3.29	meter	
Block coefficient*fullness	0.54		
Seawater density	1.025	tonne/cu.m.	
Weight of seawater			
13.46094288			

Seawater ingress in Zone VI stb		60%					
Seawater mass from centerline	2.35	meter					
Seawater mass from LCF	7	meter					
Width of volume	4.69	meter					
Length of volume	10.56	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0.48	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0.6</td></tr></table>	Block coeff	Fullness	0.8	0.6	
Block coeff	Fullness						
0.8	0.6						
Seawater density	1.025	tonne/cu.m.					
Weight of seawater	80.16739315	tonnes	<table><tr><td>Mmt longn</td><td>561.1718</td></tr><tr><td>Mnt transverse</td><td>188.3934</td></tr></table>	Mmt longn	561.1718	Mnt transverse	188.3934
Mmt longn	561.1718						
Mnt transverse	188.3934						

Seawater ingress in Zone VI port		15%					
Seawater mass from centerline	-2.35	meter					
Seawater mass from LCF	7	meter					
Width of volume	4.69	meter					
Length of volume	10.56	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0.12	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0.15</td></tr></table>	Block coeff	Fullness	0.8	0.15	
Block coeff	Fullness						
0.8	0.15						
Seawater density	1.025	tonne/cu.m.					
Weight of seawater	20.04184829	tonnes	<table><tr><td>Mmt longn</td><td>140.2929</td></tr><tr><td>Mmt transverse</td><td> -47.0983 </td></tr></table>	Mmt longn	140.2929	Mmt transverse	-47.0983
Mmt longn	140.2929						
Mmt transverse	-47.0983						

Seawater ingress in Zone VI side tank		60%	
Seawater mass from centerline	5.87	meter	
Seawater mass from LCF	<u>7.85</u>	meter	
Width of volume	2.35	meter	
Length of volume	7.51	meter	
Depth of volume	3.286	meter	
Block coefficient*fullness	0.54		
Seawater density	1.025		
		tonne/cu.m.	
			Mmt longn251.978 Mnt transverse188.4218
Weight of seawater	32.09910945	tonnes	

Seawater ingress in Zone V Stb		25%					
Seawater mass from centerline	4.69	meter					
Seawater mass from LCF	-3.3	meter					
Width of volume	7.04	meter					
Length of volume	11.74	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0.2	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0</td></tr></table>	Block coeff	Fullness	0.8	0	
Block coeff	Fullness						
0.8	0						
Seawater density	1.025	tonne/cu.m.					
Weight of seawater	55.74302272	tonnes	<table><tr><td>Mmt longn</td><td>-183.952</td></tr><tr><td>Mmt transverse</td><td>261.4348</td></tr></table>	Mmt longn	-183.952	Mmt transverse	261.4348
Mmt longn	-183.952						
Mmt transverse	261.4348						

Seawater ingress in Zone V port		15%					
Seawater mass from centerline	-4.69	meter					
Seawater mass from LCF	-3.3	meter					
Width of volume	7.04	meter					
Length of volume	11.74	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	0.12	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0.15</td></tr></table>		Block coeff	Fullness	0.8	0.15
Block coeff	Fullness						
0.8	0.15						
Seawater density	1.025	tonne/cu.m.					
Weight of seawater	33.44581363	tonnes	Mmt longn -110.371				
			Mmt transverse -156.861				

Seawater ingress in		Zone V DBL Hull	0%					
Seawater mass from centerline	7.28		meter					
Seawater mass from LCF	-5		meter					
Width of volume	0.7		meter					
Length of volume	11.74		meter					
Depth of volume	3.29		meter					
Block coefficient*fullness	0		<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.9</td><td>0</td></tr></table>	Block coeff	Fullness	0.9	0	
Block coeff	Fullness							
0.9	0							
Seawater density	1.025		tonne/cu.m.					
Weight of seawater	0	tonnes	Mmt longn	0				
			Mmt transverse	0				

LCF at frame 48	Moment to change trim by 1 metre	262.00	tonne-M
	Trim	3.93	metres
	Distance of added weight CG from LCF	3.56	metres
	Trim	1.72	metres
	Trim	2.20	metres
Total added weight	289.359		
Total moment	629.701	Transverse	1029 Longn

Initial Displ (tonnes)	Final displ (tonnes)	W*D	Tan Theta	Heel (deg.)
3087	3087.00	629.7	0.204	11.53
3598	3598.00	629.7	0.175	9.93
3758	3758.00	629.7	0.168	9.51
4028	4028.00	629.7	0.156	8.89

Zone VII	stb	0.60
	port	0.15
	below DB	1.00

Zone VI	dbl hell	0.60
	stb	0.60
	port	0.15
	side tank	0.60

Zone V	stb	0.25
	port	0.15
	dbl hull	0.00

Appendix III

Examination of substantial flooding of the Store Compartment

(Calculation by added weight method)

Purpose: To show the Tug would not sink or capsize if only the Store Compartment was flooded

Assumed flooding condition

Store Compartment :

- (1) Double bottom - 100% flooded
- (2) Double bottom top upto beneath tweendeck
starboard - 100% flooded
port - 100% flooded

According to master of the Tug:

Initial forward draft = 4.4 m

Initial aft draft = 4.8 m

Hence, mean freeboard = 2.7 m

Displacement = 3598 tonnes (approx.)

Reserved buoyancy > 2000 tonnes

Total increased seawater weight + loss of buoyancy in Store compartment = 122.2 tonnes

Sink by stern = 3.09 m

Rise by bow = 3.95 m

Heel = 0 degrees

Loss in GM = 0.54 m

Initial GM = 1.1 m

Resultant GM = 0.56 m

Hence, the Tug will NOT sink.

Hence, the Tug will not capsize.

FREE SURFACE EFFECTS CALCULATION

Flooding of Store Compartment

Disp 3598 tonnes

GM intact 1.1 metres

Flood VII Frame nos. #7 #45

SEAWATER 1.025 tonnes/cu.m = 34.84 cu.ft/ton

Conversion facto 1000 kg = 2205 lbs

Flooded upto underneath tween deck

Free surf: length 5.77 metres X **width** 15.96 metres

Added weight 122.22 tonnes

Total free surface length 5.77 metres X **width** 15.96 metres

Free surface moment of inertia = 226526 ft² . ft²

Factor 34.84 x Disp x 2205 / 2240 = 127587.3000 ft³

Loss in GM 1.77546 ft

0.541134 metres

Resultant GM 0.558866 metres

Flooding of Store Compartment

- A.** Added weight method is used in the calculation.
- B.** The volume of the Store Compartment excluding all the internal tanks are used in the calculation
- C.** The volume are separated into 2 parts, I.e. port and starboard.
- D.** Seawater level is assumed filled up to the tweendeck level.

Seawater ingress in	Zone VII above DB	Stb 100%				
Seawater mass from centerline	3.99	meter				
Seawater mass from LCF	15.02	meter				
Width of volume	6.57	meter				
Length of volume	5.87	meter				
Depth of volume	3.05	meter				
Block coefficient*fullness	0.45	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.45</td><td>1</td></tr></table>	Block coeff	Fullness	0.45	1
Block coeff	Fullness					
0.45	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	54.25499019	<table><tr><td>Mmt longn</td><td>814.91</td></tr><tr><td>Mmt transverse</td><td>216.4774</td></tr></table>	Mmt longn	814.91	Mmt transverse	216.4774
Mmt longn	814.91					
Mmt transverse	216.4774					

Seawater ingress in	Zone VII above DB	port 100%				
Seawater mass from centerline	-3.99	meter				
Seawater mass from LCF	15.02					
Width of volume	6.57	meter				
Length of volume	5.87	meter				
Depth of volume	3.05	meter				
Block coefficient*fullness	0.45	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.45</td><td>1</td></tr></table>	Block coeff	Fullness	0.45	1
Block coeff	Fullness					
0.45	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	54.25499019	<table><tr><td>Mmt longn</td><td>814.91</td></tr><tr><td>Mmt transverse</td><td>-216.477</td></tr></table>	Mmt longn	814.91	Mmt transverse	-216.477
Mmt longn	814.91					
Mmt transverse	-216.477					

Seawater ingress in		Zone VII below DB	100%				
Seawater mass from centerline	0	meter					
Seawater mass from LCF	<u>15.73</u>	meter					
Width of volume	5.16	meter					
Length of volume	6.33	meter					
Depth of volume	1.17	meter					
Block coefficient*fullness	<u>0.35</u>						
Seawater density	1.025	tonne/cu.m.					
		<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.35</td> <td>1</td> </tr> </table>	Block coeff	Fullness	0.35	1	
Block coeff	Fullness						
0.35	1						
Weight of seawater	<u>13.70980202</u>	tonnes	<table border="1"> <tr> <td>Mmt longn</td> <td>215.6552</td> </tr> <tr> <td>Mmt transverse</td> <td>0</td> </tr> </table>	Mmt longn	215.6552	Mmt transverse	0
Mmt longn	215.6552						
Mmt transverse	0						

Seawater ingress in		Zone VI dbl hull	0%				
Seawater mass from centerline	7.28	meter					
Seawater mass from LCF	<u>7.745</u>	meter					
Width of volume	0.7	meter					
Length of volume	10.56	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	<u>0</u>						
Seawater density	1.025	tonne/cu.m.					
		<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.9</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.9	0	
Block coeff	Fullness						
0.9	0						
Weight of seawater	<u>0</u>	tonnes	<table border="1"> <tr> <td>Mmt longn</td> <td>0</td> </tr> <tr> <td>Mmt transverse</td> <td>0</td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0						
Mmt transverse	0						

Seawater ingress in		Zone VI stb	0%				
Seawater mass from centerline	2.35	meter					
Seawater mass from LCF	7	meter					
Width of volume	4.69	meter					
Length of volume	10.56	meter					
Depth of volume	3.29	meter					
Block coefficient*fullness	<u>0</u>						
Seawater density	1.025	tonne/cu.m.					
		<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.8</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.8	0	
Block coeff	Fullness						
0.8	0						
Weight of seawater	<u>0</u>	tonnes	<table border="1"> <tr> <td>Mmt longn</td> <td>0</td> </tr> <tr> <td>Mmt transverse</td> <td>0</td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0						
Mmt transverse	0						

Seawater ingress in	Zone VI port	0%
Seawater mass from centerline	-2.35	meter
Seawater mass from LCF	7	meter
Width of volume	4.69	meter
Length of volume	10.56	meter
Depth of volume	3.29	meter
Block coefficient*fullness	0	
Seawater density	1.025	tonne/cu.m.
Weight of seawater	0	tonnes
		Mmt longn 0
		Mmt transverse 0

Seawater ingress in	Zone VI side tank	0%
Seawater mass from centerline	5.87	meter
Seawater mass from LCF	7.85	meter
Width of volume	2.35	meter
Length of volume	7.51	meter
Depth of volume	3.286	meter
Block coefficient*fullness	0	
Seawater density	1.025	tonne/cu.m.
Weight of seawater	0	tonnes
		Mmt longn 0
		Mmt transverse 0

Seawater ingress in	Zone V Stb	0%
Seawater mass from centerline	4.69	meter
Seawater mass from LCF	-3.3	meter
Width of volume	7.04	meter
Length of volume	11.74	meter
Depth of volume	3.29	meter
Block coefficient*fullness	0	
Seawater density	1.025	tonne/cu.m.
Weight of seawater	0	tonnes
		Mmt longn 0
		Mmt transverse 0

Seawater ingress in	Zone V port	0%				
Seawater mass from centerline	-4.69	meter				
Seawater mass from LCF	-3.3	meter				
Width of volume	7.04	meter				
Length of volume	11.74	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0	<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.8</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.8	0
Block coeff	Fullness					
0.8	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	0	tonnes				
		<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0					
Mmt transverse	0					

Seawater ingress in	Zone V DBL Hull	0%				
Seawater mass from centerline	7.28	meter				
Seawater mass from LCF	-5	meter				
Width of volume	0.7	meter				
Length of volume	11.74	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0	<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.9</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.9	0
Block coeff	Fullness					
0.9	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	0	tonnes				
		<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0					
Mmt transverse	0					

LCF at frame 48

Moment to change trim by 1 metre **262.00 tonne-M**

Trim **7.04 metres**

Distance of added weight CG from LCF **15.1 metres**

Trim **3.09 metres** **AFT (sink)**

Trim **3.95 metres** **FWD (rise)**

Total added weight **122.22**

Total moment **0** **Transverse** **1845 Longn**

Initial Displ (tonnes)	Final displ (tonnes)	W*D	Tan Theta	Heel (deg.)
3087	3087.00	0	0	0.00
3598	3598.00	0	0	0.00
3758	3758.00	0	0	0.00
4028	4028.00	0	0	0.00

Zone VII	stb	1.00
	port	1.00
	below DB	1.00
Zone VI	dbl hell	0.60
	stb	0.60
	port	0.15
	side tank	0.60
Zone V	stb	0.25
	port	0.15
	dbl hull	0.00

Appendix IV

Examination of substantial flooding of the Store Compartment + Cement Tank Compartment

(Calculation by added weight method)

Purpose: To show the Tug in this flooding condition would turnover due to substantial trim at aft.

Assumed flooding condition

- (I) Store Compartment :
 - (1) Double bottom - 100% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboard - 100% flooded
 - port - 100% flooded
- (II) Cement Tank compartment :
 - (1) Double bottom - 0% flooded
 - (2) Double bottom top upto beneath tweendeck
 - starboard - 100% flooded
 - port - 100% flooded
 - (3) Double hull spacing - 0% flooded
 - (4) Starboard side tank - 0% flooded

According to master of the Tug:

Initial forward draft = 4.4 m

Initial aft draft = 4.8 m

Hence, mean freeboard = 2.7 m

Displacement = 3598 tonnes (approx.)

Reserved buoyancy > 2000 tonnes

Total increased seawater weight + loss of buoyancy in Store compartment = 389.44 tonnes

Sink by stern = 4.66 m

Rise by bow = 5.96 m

Heel = 0 degrees

Loss in GM = 0.767 m

Initial GM = 1.1 m

Resultant GM = 0.33 m

Hence, the Tug will NOT sink.

Hence, the resultant GM is positive. But this is an illusion because the Tug is experiencing a substantial trim aft with its aft open deck immersed in water. There would result a substantial loss of waterplane area. The Tug therefore could become unstable. (Bearing in mind that as the aft end of the open deck submerged, seawater could also get into the most aft store compartment. That would add weight to the Tug and increase free surface effects.

FREE SURFACE EFFECTS CALCULATION

Flooding of Store Compartment+Cement Tank Compartment

Disp 3598 tonnes
GM intact 1.1 metres
Flood Frame nos. #7 #45

SEAWATER 1.025 tonnes/cu.m = 34.84 cu.ft/ton
Conversion facto 1000 kg = 2205 lbs

STORE COMPARTMENT

Free surf: length 5.77 metres X **width** 15.96 metres

Total free surface length 5.77metres X **width** 15.96metres

Free surface moment of inertia = 226526.0487 ft² . ft²

CEMENT TANK COMPARTMENT

Free surf: length 10.56 metres X **width** 9.38metres

Total free surface length 10.56metres X **width** 9.38metres

Free surface moment of inertia = 84162.01191 ft² . ft²

ENGINE ROOM COMPARTMENT

Free surf: length 0 metres X **width** 0metres

Total free surface length 0metres X **width** 0metres

Free surface moment of inertia = 0 ft² . ft²

TOTAL Free Surface Moment of Inertia

TOTAL added weight of the flooded compartments

Factor $34.84 \times \text{Disp} \times 2205 / 2240$ = 123395.6588 ft³

Loss in GM = 2.517820025 ft
0.767394095 metres

Resultant GM = 0.332605905 metres

Flooding of Store Compartment + Cement Tank Compartment

- A.** Added weight method is used in the calculation.
- B.** The volume of the Store Compartments excluding all the internal tanks are used in the calculation.
- C.** The volume are separated into 2 parts, i.e. port and starboard.
- D.** Seawater level is assumed filled up to the tweendeck level.

Seawater ingress in	Zone VII above DB	Stb 100%				
Seawater mass from centerline	3.99	meter				
Seawater mass from LCF	15.02	meter				
Width of volume	6.57	meter				
Length of volume	5.87	meter				
Depth of volume	3.05	meter				
Block coefficient*fullness	0.45	<table><tr><th>Block coeff</th><th>Fullness</th></tr><tr><td>0.45</td><td>1</td></tr></table>	Block coeff	Fullness	0.45	1
Block coeff	Fullness					
0.45	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	54.25499019	<table><tr><td>Mmt longn</td><td>814.91</td></tr><tr><td>tonnes</td><td>Mnt transverse 216.4774</td></tr></table>	Mmt longn	814.91	tonnes	Mnt transverse 216.4774
Mmt longn	814.91					
tonnes	Mnt transverse 216.4774					

Seawater ingress in	Zone VII above DB	port 100%				
Seawater mass from centerline	-3.99	meter				
Seawater mass from LCF	15.02					
Width of volume	6.57	meter				
Length of volume	5.87	meter				
Depth of volume	3.05	meter				
Block coefficient*fullness	0.45	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.45</td><td>1</td></tr></table>	Block coeff	Fullness	0.45	1
Block coeff	Fullness					
0.45	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	54.25499019	<table><tr><td>Mmt longn</td><td>814.91</td></tr><tr><td>Mnt transverse</td><td>-216.477</td></tr></table>	Mmt longn	814.91	Mnt transverse	-216.477
Mmt longn	814.91					
Mnt transverse	-216.477					

Seawater ingress in	Zone VII below DB	100%				
Seawater mass from centerline	0	meter				
Seawater mass from LCF	15.73	meter				
Width of volume	5.16	meter				
Length of volume	6.33	meter				
Depth of volume	1.17	meter				
Block coefficient*fullness	0.35	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.35</td><td>1</td></tr></table>	Block coeff	Fullness	0.35	1
Block coeff	Fullness					
0.35	1					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	13.70980202	tonnes				
		<table><tr><td>Mmt longn</td><td>215.6552</td></tr><tr><td>Mnt transverse</td><td>0</td></tr></table>	Mmt longn	215.6552	Mnt transverse	0
Mmt longn	215.6552					
Mnt transverse	0					

Seawater ingress in	Zone VI dbl hull	0%				
Seawater mass from centerline	7.28	meter				
Seawater mass from LCF	7.745	meter				
Width of volume	0.7	meter				
Length of volume	10.56	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.9</td><td>0</td></tr></table>	Block coeff	Fullness	0.9	0
Block coeff	Fullness					
0.9	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	0	tonnes				
		<table><tr><td>Mmt longn</td><td>0</td></tr><tr><td>Mnt transverse</td><td>0</td></tr></table>	Mmt longn	0	Mnt transverse	0
Mmt longn	0					
Mnt transverse	0					

Seawater ingress in	Zone VI stb	100%				
Seawater mass from centerline	2.35	meter				
Seawater mass from LCF	7	meter				
Width of volume	4.69	meter				
Length of volume	10.56	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0.8	<table><tr><td>Block coeff</td><td>Fullness</td></tr><tr><td>0.8</td><td>0</td></tr></table>	Block coeff	Fullness	0.8	0
Block coeff	Fullness					
0.8	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	133.6123219	tonnes				
		<table><tr><td>Mmt longn</td><td>935.2863</td></tr><tr><td>Mnt transverse</td><td>313.989</td></tr></table>	Mmt longn	935.2863	Mnt transverse	313.989
Mmt longn	935.2863					
Mnt transverse	313.989					

Seawater ingress in

Zone VI port

100%

Seawater mass from centerline

-2.35

meter

Seawater mass from LCF

7

meter

Width of volume

4.69

meter

Length of volume

10.56

meter

Depth of volume

3.29

meter

Block coefficient*fullnes

0.8

Seawater density

1.025

tonne/cu.m.

Block coeff

Fullness

0.8

0

Weight of seawater

133.6123219

tonnes

Mmt longn

935.2863

Mnt transverse

-313.989

Seawater ingress in

Zone VI side tank

0%

Seawater mass from centerline

5.87

meter

Seawater mass from LCF

7.85

meter

Width of volume

2.35

meter

Length of volume

7.51

meter

Depth of volume

3.286

meter

Block coefficient*fullnes

0

Seawater density

1.025

tonne/cu.m.

Block coeff

Fullness

0.9

0

Weight of seawater

0

tonnes

Mmt longn

0

Mnt transverse

0

Seawater ingress in

Zone V Stb

0%

Seawater mass from centerline

4.69

meter

Seawater mass from LCF

-3.3

meter

Width of volume

7.04

meter

Length of volume

11.74

meter

Depth of volume

3.29

meter

Block coefficient*fullnes

0

Seawater density

1.025

tonne/cu.m.

Block coeff

Fullness

0.8

0

Weight of seawater

0

tonnes

Mmt longn

0

Mnt transverse

0

Seawater ingress in	Zone V port	0%				
Seawater mass from centerline	-4.69	meter				
Seawater mass from LCF	-3.3	meter				
Width of volume	7.04	meter				
Length of volume	11.74	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0	<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.8</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.8	0
Block coeff	Fullness					
0.8	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	0	tonnes				
		<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0					
Mmt transverse	0					

Seawater ingress in	Zone V DBL Hull	0%				
Seawater mass from centerline	7.28	meter				
Seawater mass from LCF	-5	meter				
Width of volume	0.7	meter				
Length of volume	11.74	meter				
Depth of volume	3.29	meter				
Block coefficient*fullness	0	<table border="1"> <tr> <td>Block coeff</td> <td>Fullness</td> </tr> <tr> <td>0.9</td> <td>0</td> </tr> </table>	Block coeff	Fullness	0.9	0
Block coeff	Fullness					
0.9	0					
Seawater density	1.025	tonne/cu.m.				
Weight of seawater	0	tonnes				
		<table border="1"> <tr> <td>Mmt longn</td> <td> 0 </td> </tr> <tr> <td>Mmt transverse</td> <td> 0 </td> </tr> </table>	Mmt longn	0	Mmt transverse	0
Mmt longn	0					
Mmt transverse	0					

LCF at frame 48

	Moment to change trim by 1 metre	262.00 tonne-M
	Trim	10.61 metres
	Distance of added weight CG from LCF	7.14 metres
	Trim	<u>4.66 metres</u> AFT (sink)
	Trim	<u>5.96 metres</u> FWD (rise)
Total added weight	389.444	
Total moment	0	Transverse 2781 Longn

Initial Displ (tonnes)	Final displ (tonnes)	W*D	Tan Theta	Heel (deg.)
3087	3087.00	0	0	0.00
3598	3598.00	0	0	0.00
3758	3758.00	0	0	0.00
4028	4028.00	0	0	0.00

Zone VII	stb	1.00
	port	1.00
	below DB	1.00
Zone VI	dbl hell	0.00
	stb	1.00
	port	1.00
	side tank	0.00
Zone V	stb	0.00
	port	0.00
	dbl hull	0.00

Appendix V - Vessel Traffic Centre (VTC) voice recording details on VHF channel 14

Time	From	Content	Translation
21:12:23	Mardep	Yao Hai Yao Hai Mardep calling over	Yao Hai Yao Hai Hong Kong Mardep, Mardep is calling, Yao Hai
	Mardep	Yao Hai Yao Hai 香港海事, Mardep 叫, Yao Hai Yao Hai, Mardep calling, you have risk of collision with a vessel on your starboard bow,the in bound vessel. Take action to avoid collision at once.	Yao Hai, Mardep calling, you have risk of collision with a vessel on your starboard bow,the inbvound vessel. Take action to avoid collision at once.
21:12:33	Mardep	Yao Hai Yao Hai Mardep calling, warning, you have risk of collision with the east bound vessel on your starboard bow,take action to avoid collision at once over.	
21:12:52	Mardep	Yao Hai Yao Hai, take action to avoid collision at once over.	
21:13:35	Mardep	Yao Hai Yao Hai Mardep calling.	
21:14:44	Mardep	CMA CGM Berlios, Mardep calling.	
21:15:25	Mardep	CMA CGM...	
21:16:17	Mardep	Mardep Mardep CMA CGM Berlios, we will keep clear about the Lu Hai (Yao Hai) now.	
21:16:23	Berlios	Understand, you are passing CP1 pay attention the vessel Yao Hai ahead of you got the Yao Hai, Mardep did not know what is the intention of that vessel, keep caution.	
21:16:31	Mardep		
	CMA CGM	OK over	
21:16:47	Berlios		
	Mardep	and also the tug boat onyour port bow called the Neftgaz67 and pay attention take caution.	
21:16:48	Mardep		
	CMACGM	OK over	
21:17:00	Berlios		
21:17:57	Mardep	欲海 欲海 海事叫 欲海 欲海 海事.	Yuk Hai Yuk Hai, Mardep calling. Yuk Hai Yuk Hai, Mardep.
21:20:12	Mardep	耀海 Mardep 耀海 耀海, Mardep go ahead.	Yiu Hai Mardep, Yiu Hai Yiu Hai, Mardep go ahead.
21:20:45	Neftgaz67	香港海事 香港海事 Neftgaz67.	Hong Kong Mardep, Hong Kong Mardep, Neftgaz67.
21:20:50	Mardep	甚麼船叫	What vessel is calling?
21:20:52	Neftgaz67	Neftgaz67 海事 我在下沉, 我在下沉	Neftgaz67, Mardep, I am sinking, I am sinking.
21:20:57	Mardep	你在下沉, 你在邊條船下沉呀.	You are sinking, which ship are you in sinking?
21:21:00	Neftgaz67	海事 我在下沉 海事 我在下沉	Mardep I am sinking, Mardep I am sinking.
21:21:02	Mardep	你這條船是不是下沉?	Is your ship sinking?
21:21:04	Neftgaz67	剛才在沉, 剛才在沉, 在沉.	Just sinking, just sinking, sinking.
	Mardep	我知道剛剛跟那條船既撞,現在你這條船情況怎麼樣?	I understand the vessel just collided, what is the condition of your vessel?
21:21:07	Mardep		
21:21:14	Neftgaz67	在下沉, 非常危險, 非常危險.	(it is) sinking, very dangerous, very dangerous.
21:21:17	Mardep	好的, 你等候, 你在這.....	OK you wait, here you...
21:21:20	Neftgaz67	海事 海事	Mardep Mardep
	Mardep	Neftgaz67 Mardep you have to take all the precaution , all the precaution to avoid...	
21:21:34	Mardep	Neftgaz67 Neftgaz六十七 香港海事叫	Neftgaz67, Neftgaz67, Hong Kong Mardep calling.
21:21:54	Mardep	Neftgaz67 香港海事叫	Neftgaz67, Hong Kong Mardep calling.
21:22:08	Mardep		
	海洋	海事 海事 海事 我係高速客船calling, 海洋號 calling.	Mardep, Mardep, Mardep, I am the high speed passenger ferry calling, Hai Yang(海洋) calling.
21:22:15	Mardep	海洋,你乜野船,重覆一次	Hai Yang, what ship you are? Repeat again.
21:22:23	Mardep	乜野船叫海事, 重覆, 乜野船叫海事, 請講.	Whish vessel is calling Mardep? Repeat. Which vessel is calling Mardep? Please go ahead.
21:22:36	Mardep		
	海洋	海洋, 我經過 CP1 浮, 有隻沉船, 有隻大沉船, 就係 CP1 浮 over.	Hai Yang, I am passing CP1 buoy, a sinking vessel, a big sinking vessel, at CP1 buoy over.
21:22:41	Mardep	收到呀, 你睇唔睇到個船名.	Received, Can you see the vessel's name?
21:22:48	Mardep		
	海洋	海洋號向你報告, 架係珠海高速客輪,開往港澳碼頭. Over.	Hai Yang report to you, (I am) the Zhuhai high speed passenger ferry, bounding for Kong O Terminal (Hong Kong and Maucau Ferry Terminal).
21:22:53	Mardep		
21:23:02	Mardep	好呀, 收到, 你睇唔睇到個位置係邊度呀?	OK, received, can you see where the position is?
21:23:07	海洋	個位置就係 CP1, CP1 浮 偏西便小小. 200 咪都未夠.	The position is at CP1, little bit to the west of CP1, less than 200 metres.
21:23:17	Mardep	係大船定係沉..., 海洋, 收到呀. 係咪個隻67 呀, Neftgaz67 呀!	Is it a big ship or sink... , Hai Yang, received, is it that 67, Neftgaz 67.

21:23:25	海洋	唔知呀,睇唔到呀,黑麻麻.	(I) don't know, can't see, it is very dark.
21:23:28	Mardep	收到,係唔係 CP1 既西南面,大約係咪四個cable呀?	Received, is it about 4 cables to the west of CP1? 0.4 nm.
21:23:44	海洋	差唔多啦,大概係 0.2 cable 度啦.	Its about it. Its about 0.2 cables
21:23:49	Mardep	係乜野方向呀?	In what direction?
21:23:51	海洋	但係成一... 航道上面,高出水面有10 公尺度,高出水面有 10 公尺度呀.沉係水底,有部份成拾咪度露出水面,over.	it is... in the fairway, about 10 metres above sea surface, about 10 metres above sea surface, sink below water.
21:24:09	Mardep	收到 收到,你睇唔睇到情況係點呀,而家?	Received, received, can you see what is the condition now?
	海洋	成隻船沉低係航道中間架.我地就偏離佐,睇到,睇唔清楚,晚刻,就開始以為係無燈既船,後來呀,睇清就係沉船,咁既情況. Over.	The whole vessel sank in the middle of the fairway. We are away from the fairway, cannot see it clearly, it is at night. In the beginnning, it was reckoned as a vessel without light, then when (I) see it more clearly, it was a sinking vessel, that was the situation.
21:24:14			
21:24:31	Mardep	好呀,收到,我地會通知有關方面架啦.唔該晒你先.	OK, received, we shall inform the concerned parties, thank you.
21:24:35	海洋	海洋號向你報告結束 thank you out.	Hai Yang Ho finished reporting to you, thank you, out.
21:24:59	Mardep	All station, stand by, 等候,等候. Neftgaz67 67, Mardep calling.	All station, stand by, Wait, wait, Neftgaz67, 67, Mardep calling.
21:26:39	Mardep	所有船等候, 等候, Neftgaz67 Neftgaz67, Mardep calling, 香港海事叫. Huatai Huatai 香港海事叫.	All vessels wait, wait, Neftgaz67, Neftgaz67, Mardep calling, Hong Kong Mardep calling. Huatai, Huatai, Hong Kong Mardep calling.
21:27:01	Huatai	Mardep Huatai.	
	Mardep	Huatai, Mardep. Captain, can you see the sinking vessel on southof your present position, what is the condition now.	
21:27:03			
21:27:11	Huatai	My position now passing CP1 over.	
	Mardep	Understand, captain can you see the sinking vessel Neftgaz67 near the southwest, southwest of the CP1, can you see? What is the condition.	
21:27:15			
21:27:27	Huatai	I cannot see, I cannot see the sinking vessel.	
21:27:31	Mardep	You can't see the sinking vessel, OK. Thank you, call Mardep northwest Mawan.	
21:27:37	Huatai	Yes sir, I did not see the sinking vessel over.	
21:27:43	HuaHai	Mardep Mardep HuaHai passing Tsing Ma.	
21:27:48	Mardep	HuaHai, call Mardep again passing CP1.	
21:27:50	HuaHai	Roger, Roger, Mardep would we assist to the vessel atCP1?	
21:27:57	Mardep	The Neftgaz67 report is sinking.	
	HuaHai	Roger, Roger, so we vessel at our maximum speed and try to get around there as quickly as possible and give you some information.	
21:28:04			
21:28:13	Mardep	You call Mardep again when passing CP1, thank you.	
21:28:17	HuaHai	Roger, Roger sir.	

