Panama Maritime Authority
Directorate General of Merchant Marine
Maritime Affairs Investigation Department

M/V "NEW DIAMOND"
IMO No. 9191424
R-023-2021-DIAM
CASUALTY DATE: September 3rd, 2020

INVESTIGATION REPORT

M.T. NEW DIAMOND

IMO NO. 9191424

"EXPLOSION IN ENGINE ROOM"

SEPTEMBER 3rd 2020

SOUTH EAST OF SRI LANKA

In accordance to Resolution No. 106-135-DGMM of September 9th, 2013 from the Merchant Marine General Directorate of the Panama Maritime Authority, on its second article stipulates; "Similarly investigations are not designed to exert actions criminal, civil or administrative, at which they will be subject only to the purposes stated in the Code for the Investigation of Marine Casualties and Incidents adopted by the International Maritime Organization (IMO)

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REFERENCE

FOREWARD

The Marine Affairs Investigation Board of Panama Maritime Authority (PMA) received information on 03 September 2020 about major explosion and fire in engine room on board MT "NEW DIAMOND" registered with Panama Flag while the vessel was passing South East Coast of Sri Lanka.

PMA communicated with the Ship's Owner, Manager and Operator for detailed information to conduct casualty investigation.

Flag State Administration acted in accordance with the IMO resolution A.849 (20) and accident investigation code 2010. Subsequently, Capt.C.D.Mathur was appointed as Principal Investigator on behalf of flag state of vessel.

Due to COVID-19 Pandemic quarantine protocol of Sri Lanka, the investigation could only be commenced from 22nd September through video conferencing with Master and ship crew stationed onshore.
In last week of October after returning back to their country, Master and 4 crew members of Greek nationality were also interviewed in the office of Hellenic Bureau of Marine Casualty Investigation, Piraeus.

The on-site investigation and evidence collection for Flag state nominated investigator was permitted after discharge of her cargo at Kalba Anchorage, UAE on 31st January 2021 (nearly 5 months after initial incident). The visit of flag state investigator to ship was limited to only an hour which on special request extended for 5 hours with restricted entry in engine room only. However, no record of whatsoever nature was available on board.

SUMMARY

M.T. New Diamond had loaded 277,145MT of Kuwait export crude oil at Mina Al Ahmadi, Kuwait and sailed on 23 August 2020 towards discharge port Paradip, India.

On 3rd September 2020 around 0730 hrs (Ship Time, UTC+4.5) there was a very severe explosion in the engine room while she was off South East Coast of Sri Lanka.

Extremely severe jolt was felt on board with lots of smoke, fumes, grey coloured dust and massive sound of explosion, shaking up of entire accommodation superstructure with simultaneous sounds of various alarms followed with blackout. Some parts of vessel's fittings were blown off including the piece of Main Engine exhaust pipe which flew from funnel top to all the way forward of accommodation on starboard side no.5 COT. Engine Room skylight was also blown off from its frame with fire seen through it. Emergency generator did start on auto but was not on load with no electric supply. Initial major explosion was followed after few minutes by a second explosion at no. 1 port side FO tank, blowing off its manhole cover. Couple of more explosions also took place in way of FO & DO tanks both sides, blowing off port side life boat, it's davit, rupturing port side shell in way of slop tank, flames rising to 10-20 meters heights from port side no.1 FO tank, smoke followed with flames from funnel exhaust and causing various damages.

On realizing the severity of the explosions, non-availability of Main Engine, black out on ship followed up with fire, the Master decided to request for assistance and the distress message was transmitted.

Ship crew mustered, starboard side lifeboat was prepared for lowering. During muster it was found that Duty Oiler no. 3 was missing being on watch inside Engine Room at the time of explosion. Another crew member missing was the middle watch (00-04 watch) Third Engineer, inside his cabin at the time of explosion. He suffered major injuries due to falling of his cabin deck head panels. He was moved out by other Third Engineer to the adjacent port side open deck. Attempt to fight the fire and locate missing oiler in the Engine room by Second Engineer and team was not feasible because the entrances to engine room were badly damaged with broken stairways, holed platforms, parted decks, and machinery and auxiliaries being on fire.

Abandon ship by Master was called for. By 0830 hours 19 crew in lifeboat had cast off and waited away from the ship. 4 persons including Master, Pump man, injured 3E and the

Oiler were left on board.

M/T HELEN M was first merchant vessel to reply to distress call of the ship and approached for assistance. Sri Lanka Navy vessel also approached for assistance and to rescue injured 3E.

Merchant vessel M/T HELEN M arrived for rescue of ship's crew and all 19 crew from Lifeboat safely boarded the rescue ship around 1000hrs.

Injured 3E was also evacuated around 1100hrs by Sri Lanka Navy and taken ashore for medical assistance. At this time Master and Pump man stayed on board.

Later Sri Lankan Navy ship approached to rescue Master and Pump man from M/T New Diamond.

Other vessels from Indian Coast Guard and Navy also arrived including couple of firefighting vessels and started to douse the massive fire on board which was engulfed in flames following multiple explosions.

The fire fighting continued from 3rd September till 9th September.

A physical inspection for severity and extent of the damages was conducted by SMIT SALVAGE, it reported fuel oil and diesel oil tanks deck plates were blown off with water and oil level ullage same as in engine room. Based on similar ullage value it was considered these tanks were ruptured inside the engine room. Severe damages to cargo pump room, accommodation, engine room casing and surrounded deck fittings were also reported.

Vessel was handed over to SMIT SALVAGE for the safety of her cargo and environmental protection.

After necessary seaworthiness and stability checks she was towed from Sri Lanka coast to Kalba Anchorage, North of Fujairah for discharging her crude oil cargo through STS operation.

Master did share most information of post-accident scenario. However, none of the ship staff had any clue of such intense and sudden explosion in Engine room.

The missing crew who was in engine room on duty at the time of explosion was declared dead.

The on sight devastating scene of engine room during the investigation could be visualised and compared with blast of a small boiler water reactor causing such shattering damages to most engine room machineries with fire spreading to fuel oil tanks, lubricants, chemicals and inflammable material in and around the engine room as well in crew accommodation.

Majority of engine room machineries, auxiliaries, fittings, stairways, trunks, decks had turned into debris, gutted down in fire and being beyond recognition. Due to no stairways and lighting in place except one emergency access through steering gear compartment it was a very difficult task for any individual to go around, inspect and recognise the damaged machineries inside the engine room.

The root cause analysis findings point towards multiple safety failures in engine room causing fire in exhaust gas economiser, leading to pressure surge in auxiliary boiler steam-water drum which resulted to such severe explosion and fire.

BRIEF DETAILS OF ACCIDENT

Time and Date	0730hrs 03rd September 2020
Location of Accident	South East of Sri Lanka, Lat 07° 06' N, Long 082°29' E
Crew on board	23 crew including Master
Type of Accident	Explosion, fire & crew casualty
Injuries / Fatalities	One Engineer injured / One Oiler dead

ABBREVIATIONS

AB	Able Bodied Seamen
BA	British Admiralty
CDC	Continuous Discharge Certificate
C/E, 2/E, 3/E	Chief Engineer, 2nd Engineer & 3rd Engineer
C/O, 2/O, 3/O	Chief Officer, 2nd Officer, 3rd Officer
COC	Certificate of Competency
COE	Certificate of Endorsement
COSP	Commencement of sea passage
DPA	Designated Person Ashore
DO/ FO	Diesel Oil / Fuel Oil
ECR	Engine Control Room
ECDIS	Electronic Chart Display and Information System
GPS	Global Positioning System
GMDSS	Global Maritime Distress and Safety System
IMO	International Maritime Organization
ISM	International Safety Management
LOF	Lloyd's Open Form
MLC	Maritime Labour Convention
MF/HF/VHF	Medium/High/Very High Frequency
MT	Metric Ton
NM	Nautical Mile
NKK	Nippon Kaiji Kyokai
NUC	Not Under Command
OLB	Official Log Book
OOW	Officer of watch
PIC	Person- in-charge
PMA	Panama Maritime Authority
PPE	Personal Protective Equipment
SMS	Safety Management System
SOLAS	Safety of Life at Sea
STCW	Standards of Training, Certification and Watch keeping
UTC/ LT/hrs	Universal Time Coordinate/ Local Time/24 hours

1. FACTUALS

1.1 THE SHIP

Image 1: M.T. NEW DIAMOND – Forward View

Image 2: M.T. NEW DIAMOND – Port Side Aft View

M.T. "NEW DIAMOND"

1.1.1 SHIP'S PARTICULARS

IMO number	9191424
Call Sign	3EWG
Official No.	45172-13-B
MMSI	351247000
Type	CRUDE OIL TANKER
Nationality	Panama
Keel laid/ Delivery	Dec-1999/Nov-2000
Builder	Mitsui Engineering and Shipbuilding Company
GRT/NRT	160,079 / 92,207
Length overall	330.00 M
Length (BP)	318.00 M
Breadth Moulded	60.00 M
Depth Moulded	30.33 M
Summer Draft	20.09 M
Freeboard Summer / Tropical	9,144 mm / 8,702 mm
Classification	NKK (Nippon Kaiji Kyokai)
Owner	Porto Emporius Shipping INC 57A, Poseidonos Avenue, Moschato, 18344 Piraeus, Greece
Ship Manager/Operator	NEW SHIPPING LIMITED 57A, Poseidonos Avenue, Moschato, 18344 Piraeus, Greece

Engine Room Machinery Specification,

1. Main Engine

Type	8S80MC
No. of Set	1
Out put	MCR: 25080kw @ 68 rpm
	NSR: (85%) 21320 kw @ 64.4 rpm
F.O. Type /Rate	HFO NSR: 120 g/kw-h
Turbo Charger	No. of Set: 2
	Model: MET66SE
	Maker: Mitsubishi

2. Electric Generator, Diesel Generators

Engine	Model: 6N260L-UN
	No. of Set: 3
	Maker: Yanmar
	Output: 1455 PS X 720 rpm
	Kind of F.O: D.O & H.F.O
	Output: 1000 kw, 60Hz

3. Steam Generating Plant, Auxiliary Boiler

Type	Two-Drum, Water Tube
No. of Set	1
Model	MAC-80B
Maker	Mitsubishi
Evaporation	Max: 75000 kg/h
Steam Condition	Press: 20 kg/cm2, Temp: Saturated
Feed Condition	Temp: 60°C
Burner	Type: SFVFTR-500 * 2 sets Maker: Volcano
Level Control	Type: Air Operated Valve, Madic system Maker: Mitsubishi
Soot Blower	Type: Manual, Steam Jet 1 set.
Kind of F.O	D.O & H.F.O

4. Exhaust Gas Economizer

Type	Finned Tube
No. of Set	1

Maker	Mitsubishi
Evaporation	1500 kg/h (At 85% MCR Main Eng. Output)
Steam Condition	Press: 7 kg/cm2g, Temp: Saturated
Feed Condition	Temp: 60°C
Exh. Gas Condition (at 85% MCR)	Flow: 188640 kg/s Inlet Temp: 229°C Outlet Temp: 207°C
Heating Surface	Evaporator: 559 m2
Exh. Gas By-Pass	NA
Soot Blower	Type: Manual, Rotary, Steam Jet 2 set.
Water Washing Nozzle	Manual 4 sets

5. Electric Motor Driven Centrifugal Pump

ITEM	NO	TYPE	MAKER/ MODEL	CAP X HEAD (SUC) M3/h X mwc (mwc)	MOTOR Kw X rpm
Main Feed Pump	2	Cent. El. Hor.	Shinko DK100-4M0	100 X 270 (NPSH 5.5m)	132 X 3600
Aux. Feed Pump	2	Cent. El.Hor.	Shinko SK40M	4 X 250 (NPSH 1m)	18.5 X 3600
Blr W.Circ. Pump	2	Cent. El.Hor.	Shinko BT70-5	15 X 30 (22k)	5.5 X 3600

1.1.2 STATUS OF STATUTORY CERTIFICATES

Sr. no	Certificate	Date of Issue	Date of Expiry	Issued By
1	Certificate of Registry	04.10.2019	07.10.2024	PMA
2	Radio Station License	04.10.2019	03.10.2024	PMA
3	Continuous Synopsis Records	03.02.2015	-	PMA
4	Minimum Safe Manning	28.04.2014	-	PMA
5	Civil Liability for bunker oil pollution damage	20.02.2020	20.02.2021	PMA
6	Certificate of Classification	24.04.2019	23.04.2024	NKK
7	Document of Compliance	14.10.2015	22.11.2022	ABS
8	Safety Management Certificate	03.08.2019	02.10.2024	NKK
9	Maritime Labour Convention	04.08.2019	02.10.2024	NKK
10	International Load line Certificate	24.04.2019	23.04.2024	NKK
11	International Tonnage Certificate	28.03.2013	Until Revoked	NKK
12	International Ship Security Certificate	24.12.2019	02.10.2024	PMA
13	Cargo Ship Safety Construction	24.04.2019	23.04.2024	NKK
14	Cargo Ship Safety Equipment	24.04.2019	23.04.2024	NKK
15	Cargo Ship Safety Radio Certificate	24.04.2019	23.04.2024	NKK
16	International Oil Pollution Prevention	24.04.2019	23.04.2024	NKK
17	International Air Pollution Prevention	24.04.2019	23.04.2024	NKK
18	International Sewage Pollution Prevention	24.04.2019	23.04.2024	NKK

19	P & I Club	20.02.2020	20.02.2021	WEST OF ENGLAND

1.1.3 NAVIGATION AND COMMUNICATION EQUIPMENTS STATUS

SR.NO.	EQUIPMENT	REMARKS
1	A.I.S.	1Set, Model No.Furuno-FA-100
2	ECHO SOUNDER	1Set, Model No.Furuno-FE-6801/1(8680-4382)
	ECDIS	1Set, Model No.JRC-NDC-2000-M2
3	EPIRB	1 Set, Model No. Serpe-Iesm/Kannad 406 WH
4	SART	2 Sets, Model No. Taiyo-TBR-600
5	GMDSS Walkie Talkies	3 Sets, Model No.Furuno-FM-8800
6	PUBLIC ADDRESS SYSTEM	1Set, Model No. Furuno-FS-40
7	GPS	2 Sets, Model No. Furuno-GP-80
8	GYRO	2 Set, Model No.Tokimec-TG-6000-62232/62273
9	INMARSAT C	1 Sets, Model No. Furuno-Felcom 12
10	MAGNETIC COMPASS	1 Set, Model No.Tokimec-SH-165A/6090
11	MF/HF	1Sets, Model No.Furuno-FS-5000
12	NAVTEX RECEIVER	1Set, Model No. Furuno-NX-500
13	RADAR	2Set, Model No. Furuno-FAR-2825
14	ARPA	2Set, Model No. Furuno-FAR-2835S
15	SSAS	1Set, Model No. Thrane & Thrane- Sailor 3027SSA

16	VDR	1Set, Model No. Furuno-VR-3000S

1.1.4 DATE, TIME AND OTHER PARAMETERS

Date and time

Date and time mentioned in report is local time in hrs (ship time) referring to ZD +4.5.

Time in HH:MM:SS notation is UTC

Location of vessel

Ship's position indicated in latitude and longitude derived from GPS system was plotted on BA Chart 1583 and ECDIS Charts.

Speed

Speed over ground is determined from GPS. At the time of the incident MT "NEW DIAMOND" was on her passage from Mina Al Ahmadi (Kuwait) to Paradip (India) and she was steaming at speed of about 10 knots.

Heading

As indicated by the ship's compass, at the time of the incident, the vessel was on a course 017º (T).

Radar data

Radar Data is indicated by electronic signal information from ship's radar installations. This includes range rings, bearing markers, electronic plotting symbols. At the time of the incident both radars were in operation and in good working order.

Main alarms

This includes all mandatory alarms on the bridge and E/R as per SOLAS requirement.

Wind speed, direction and weather reports

Wind speed and direction are taken by visual observations. Weather conditions were received through.

LOCATION OF VESSEL DURING EXPLOSION & FIRE FIGHTING

FLEET OF VESSELS ASSISTING IN FIRE FIGHTING

INFORMATION ON WEATHER CONDITION DURING FIRE FIGHTING

Date	Time	Wind Direction/ Speed (Knots)		Sea & Swell	Temp
		Beaufort Scale			
03/09/2020	0000-1200	4	SW 11-16 Knots	Moderate Sea	26.6°C
	1200-2400	3	SWS 7-10 Knots	Moderate Sea	26.7°C
04/09/2020	0000-1200	3	W'LY 7-10 Knots	Slight Sea	26.5°C
	1200-2400	1	NWN 1-3 Knots	Calm Sea	26.5°C
05/09/2020	0000-1200	2	N 4-6 Knots	Smooth Sea	27.7°C
	1200-2400	1	NE 1-3 Knots	Smooth Sea	27°C
06/09/2020	0000-1200	2	E'LY 4-6 Knots	Calm Sea	26.8°C
	1200-2400	2	E'LY 4-6 Knots	Smooth Sea	26.7°C
07/09/2020	0000-1200	3	SE 7-10 Knots	Slight Sea	26.9°C
	1200-2400	2	E'LY 4-6 Knots	Smooth Sea	27°C
08/09/2020	0000-1200	3	SE 7-10 Knots	Slight Sea	27.2°C
	1200-2400	3	SE 7-10 Knots	Slight Sea	27.5°C
09/09/2020	0000-1200	1	W'LY 1-3 Knots	Calm Sea	27.3°C
	1200-2400	2	NW 4-6 Knots	Smooth Sea	27.1°C
10/09/2020	0000-1200	1	N 1-3 Knots	Calm Sea	26.8°C
	1200-2400	2	NE 4-6 Knots	Smooth Sea	26.5°C

1.1.5 CARGO, FUEL AND STABILITY DATA

On departure from port Mina Al Ahmadi (Kuwait), the vessel was in laden condition. The following were remaining on board:

Cargo 277,144.92 MT

Fuel as per 2nd September noon report

Fuel Oil	1363.3MTS
D.O	142.6MTS

Stability data

Dead weight	307,777 MT
Displacement	346,741 MT
TPC	176 MT
GM	3.93 M

Vessel satisfied all intact stability criteria and SF / BM were within permissible limits.

1.1.6 INFORMATION OF ON-BOARD CREW

MASTER
The Master, Greek nationality of 59 years of age joined the vessel on 17 August 2020 at Fujairah, UAE. He completed almost 17 days on the day of accident. He had experience of about 34 years in the capacity of Master. He obtained his National COC of Master in the year 1986. He had Panama COE. He was first time with present company.

CHIEF OFFICER - Duty Officer (0400 to 0800 & 1600 to 2000)
The Chief Officer, Greek nationality of 37yrs of age, joined the vessel on 17 August 2020 at Fujairah, UAE. He had been only 17 days on board before the date of accident. He was first time in the capacity of Chief Officer. He obtained his COC as Chief Mate in the year 2016 from Greece and had Panama COE. He was on employment contract of 6 months and had completed 6yrs with present company.

SECOND OFFICER- (0001 to 0400 & 1200 to 1600)
The Second Officer, Filipino nationality of 36yrs of age, joined the vessel on 03 August 2019 at Fujairah, UAE. He had completed 13 months 01 days onboard till the day of accident. He had experience of about 3yrs in the capacity of Second Officer. He obtained his National COC as Second Mate in the year 2016 from Republic of the Philippines and had Panama COE. He had completed 3 years with present company was on employment contract of 6-7 months.

SECOND OFFICER- (0800 to 1200 & 2000 to 2400)
The Second Officer, Greek nationality and 68yrs of age, joined the vessel on 17 August 2020 at Fujairah, UAE. He completed almost 17 days on the day of accident. He had experience of about 3yrs in the capacity of Second Officer. He obtained his COC as Second Mate from Republic of Cyprus and had Panama COE. He had completed 3years with the company and was on employment contract of 6 months.

CHIEF ENGINEER
The Chief Engineer, Greek national, 62yrs of age, joined the vessel on 17 August 2020 at Fujairah, UAE. He completed almost 17 days on the day of accident. He had experience of about 2yrs in the capacity of Chief Engineer. He obtained his national COC in 2018 and had Panama COE as Chief Engineer. He was 1st time with this company on an employment contract of 6 months.

SECOND ENGINEER - Duty Engineer (0400 to 0800 & 1600 to 2000)
The Second Engineer, Filipino, 58yrs of age, joined the vessel on 23 November 2019 at Fujairah, UAE. He had completed 9 months & 11 days onboard on the day of accident. He obtained National COC in 2012 and had Panama COE. He was on employment contract of 6-7 months and had completed 3 contracts with present company.

THIRD ENGINEER - (0800 to 1200 & 2000 to 2400)
The Third Engineer, Filipino, 58yrs of age, joined the vessel on 09 September 2019 at Kuala Lumpur, Malaysia. He had completed 11 months and 25 days onboard before the day of accident. He had experience of about 9yrs in the capacity of Third Engineer. He obtained his National COC in the year 2011 and had Panama COE. He was on employment contract of 6-7 months and had completed 3 contracts with present company.

THIRD ENGINEER (Injured Engineer) - (0001 to 0400 & 1200 to 1600)
The Third Engineer, Filipino, 57yrs of age, joined the vessel on 23 February 2020 at Fujairah, UAE. He had completed 6 months 11 days onboard till the day of accident. He had experience in the capacity of Third Engineer. He obtained his National COC in the year 2019 and had Panama COE. He was on employment contract of 6 months and had completed 7yrs with present company.

PUMP MAN
The Pump man, Greek nationality, 52yrs of age, joined the vessel on 17 August 2020 at Fujairah, UAE. He completed almost 17 days on the day of accident. He had experience in the capacity of Pump man. He was on employment contract of 9 months and had completed 3 contracts with present company.

BOATSWAIN
The Boatswain, Filipino, 46yrs of age, joined the vessel on 12 November 2019 at Fujairah, UAE. He had completed 9 months 22 days onboard till the day of accident. He had experience of about 18 months in the capacity of Boatswain. He was on employment contract of 9 months and had completed 3yrs with present company.

ABLE-BODIED SEAMAN - (0000 to 0400 – 1200 to 1600)
The Able-Bodied Seaman, Filipino, 33yrs of age, joined the vessel on 12 November 2019 at Fujairah, UAE. He had completed 9 months 22 days onboard till the day of accident. He had experience of about 4yrs in the capacity of Able-Bodied Seaman. He was on employment contract of 9 months and had completed 4yrs with present company.

ORDINARY SEAMAN no.2 – On Look Out Duty (0400 to 0800 & 1600 to 2000)
The Ordinary Seaman, Filipino, 25yrs of age, joined the vessel on 12 November 2019 at Fujairah, UAE. He had completed 9 months 22 days onboard till the day of accident. He had experience of about 4yrs in the capacity of Ordinary Seaman. He was on employment contract of 9 months and had completed 4yrs with present company. He held certificate of rating keeping navigation watch also the certificate of flag state endorsement for the same.

OILER no3. On Engine room duty-Missing &declared dead (0400 to 0800 & 1600 to 2000)
The Oiler, Filipino, 25yrs of age, joined the vessel on 12 November 2019 at Fujairah, UAE. He had completed 9 months 22 days onboard till the day of accident and he was the missing oiler.

OILER no.2- (0800 to 1200 & 2000 to 2400)
The Oiler, Filipino, 32yrs of age, joined the vessel on 23 February 2020 at Fujairah, UAE. He had completed 6 months 11 days onboard till the day of accident. He got onboard promotion as oiler. He was on employment contract of 9 months and had completed 2 contracts with present company.

FITTER
The Fitter, Filipino, 56yrs of age, joined the vessel on 09 September 2019 at Kuala Lumpur, Malaysia. He had completed 11 months 25 days onboard till the day of accident. He was on employment contract of 9 months and had completed 8yrs with present company.

Sr.no.	Rank	Time		At the Time of Incident
1	Chief Officer	0400	0800	Duty Officer On Bridge Watch
2	Ordinary Seaman no. 2			Duty OS On Bridge Watch Look Out Duty
3	Second Engineer	0400	0800	Duty Engineer On Engine Room Watch at ECR on bridge
4	Oiler no.3			Duty Oiler – **Deceased Crew** On Engine Room Watch

1.1.7 NAVIGATION & ENGINE ROOM WATCH KEEPING SCHEDULE

1.1.8 STATEMENT & INTERVIEW OF MASTER AND SHIP'S CREW

Master and Ship crew members were subjected to verbal interview using video recorded platform of Zoom meeting and their statements were noted down to retain the same meaning as intended. Key persons connected to incident were put through additional questions. The recorded interviews from Master, C/O, 2/O, C/E, 2E, 3/Es, Boatswain, Duty OS 2, Oiler 2, Fitter and Pump man are part of this investigation report.

Statements/Questionnaire - Answers of Master & crew form part of investigation as per attached list of folders.

1.2 DETAILS OF DECEASED CREW – OILER No.3 – ON ENGINE ROOM DUTY

He was Filipino, born on 05 December 1994. At the time of explosion, he was on 04-08, morning watch in engine room.

He had valid STCW certificates and qualification for the capacity he was serving on board as an Oiler.

His seafarer's identity document no PO316224 was issued by Government of Philippines, valid until 19 June 2023. He possessed passport No.C1277016.

1.3 NARRATIVE

1.3.1 SITUATION PRIOR INCIDENT

M.T. New Diamond called at Mina Al Ahmadi, Kuwait from Fujairah port where Master, Chief Officer, one Second Officer, Chief Engineer the Pump Man had joined on 17 August. Vessel loaded 270,000MT of crude oil at Mina Al Ahmadi on 23rd August 2020 and sailed towards her discharge port Paradip, India.

While steaming at sea, engine room was manned with duty engineer maintaining watch in ECR located at port side aft wheelhouse and duty oiler on watch keeping duty in engine room.

Vessel propelled through Arabian Gulf and while in transit Arabian Sea on 31st August a routine safety meeting was held on board.

She continued her voyage towards discharge port passing South of Sri Lanka on 2nd September 2020.

On 3rd September she was passing South East Coast of Sri Lanka, normal handing and taking over of midnight and morning watch was carried out. Chief Officer took over watch from 2nd Officer with one lookout man (OS) on duty.

2nd Eng prior to taking over watch at 0400hrs took rounds in the engine room and left Oiler no.3 to continue watch in Engine Room and then went to take over watch from 3rd Engineer in engine control room.

Vessel was steaming at slow speed for commercial purpose and exhaust gas economiser was in use with auxiliary boiler standby for auto start.

Between 0630hrs to 0730hrs, Boatswain and Pump man reported to Chief Officer for day's work. During this time Master and Chief Engineer were also in wheel house, however CE went back to his cabin. Most of the other ship's crew were having the breakfast while other off watch keepers were resting in their cabins.

Though the vessel was UMS class but as per managers decision engine room was not in UMS mode and engine room watches were maintained.

1.3.2 INCIDENT

At 0730 hrs a very severe explosion was heard from the port side of engine room with lots of

dust, fumes, black carbon air and gas like sand or powder and damages seen in wheel house, accommodation and around engine room casing. Chief Officer went out of wheel house to check what has happened. Master activated the emergency alarm. Explosion also resulted in stoppage of Main engine combined with loss of Electrical Power. Emergency Generator did start but there was no emergency electric power supply from it. Emergency fire pump was also started but there was no water.

Other crew who were in their cabins getting ready for day's work or taking rest or in messroom having breakfast, were shaken up and sustained some injuries due to severe damages of deckhead and bulkhead panels. Maximum damage was on Port Side of C, D and wheel house Deck. Intensity of explosion was so severe that cabin and toilet deckheads and other associated panels, stiffeners etc., collapsed. The exhaust pipe piece of main engine exhaust flew away and landed on starboard side no. 5 cargo oil tank. Sky light from its fittings also flew off. At this time Third Engineer of middle watch was in cabin, he suffered multiple injuries with profuse bleeding and shouting for help. Other 3E from adjacent cabin helped him and shifted him out of the alleyways of 'C' deck.

CO, on the advice of Master, transmitted distress message by DSC on MF/HF and Sat C and 2O broadcast the distress message on VHF by voice.

By 0740 hrs all ship crew excluding CE, injured 3rd Engineer and missing duty Oiler mustered on starboard side. Soon CE who had fallen down and fainted for a short while inside his cabin recovered and came out to muster station. 3E who suffered severe injuries was somehow brought outside on port side up to "B' deck with the help of other 3rd Engineer. Nobody was aware of exact location of duty oiler in Engine Room.

One team with 2E, Boatswain and Oiler no.1 wore fireman's outfit to search missing oiler in engine room who was on duty. They tried to get access in engine room from accommodation port side upper deck entry but saw no stairways, decks with most passage blocked with mingled pipes and some debris. They returned back and tried to make entry in engine room from steering compartment through aft engine room emergency exit trunk.

0740: 2nd explosion took place at port side fuel oil tank no.1 and blew off its manhole covers on main deck. Hearing this explosion all crew ran toward main deck starboard side. Fire flames of about 10-20 meter-high were seen from no.1port side fuel oil tank.

0750: One merchant vessel 'HELEN M' responded to distress call of the vessel to render assistance. Ships rescue team of 2E, Boatswain and Oiler tried to enter in engine room from steering gear room on 4th deck and found floor plates badly damaged, pipes broken and plenty of debris. It was almost impossible to safely move in side Engine Room due to severe damages by explosion.

0755: Chief Officer asked all rescue team members to return back on deck.

0757: Master informed crew that a vessel M/T HELEN M was approaching for their rescue.

0800: Master ordered to abandon ship and prepare launching of starboard side lifeboat and liferafts.

0815: M/T HELEN M informed that she was approaching soonest possible.

0825: All crew moved inside starboard lifeboat except Master, injured 3E, missing Oiler and Pump man who stayed back to support the Master in rescue operation.

0830: Lifeboat was lowered and cleared of own vessel.

0900: Sri Lanka Navy boarded the vessel with stretcher and shifted injured 3E into the vessel's lifeboat.

0934: M/T HELEN M approached about a mile from NEW DIAMOND and was stand by for rescue operation.

1013: Lifeboat was alongside M/T HELEN M and the crew started to board the rescue vessel.

1045: All 19 crew were rescued from lifeboat.

1050: Injured 3E was transferred from SRI LANKAN navy vessel to the ambulance to be taken shore for medical assistance.

1200: Rescue vessel M/T HELEN M drifting 5 miles off NEW DIAMOND.

1300: 3rd explosion near port slop tank shipside plate 1m above seawater level.

1310: 4th explosion on port side diesel oil tanks and blew off the lifeboat and the davit.

1500: Master and Pump man disembarked from NEW DIAMOND and boarded Sri Lanka Navy Vessel.

2100: Rescue vessel disembarked 19 crew of NEW DIAMOND at Trincomalee. Pump man was also sent ashore while Master did not leave charge of his ship and continued offshore to supervise the fire-fighting operation

1.3.3 ACTION AFTER INCIDENT

Firefighting with joint efforts of Indian Coast Guard vessels, Indian Navy vessels, Sri Lanka Navy Vessels, Offshore Tug APL Winger continued. Master of New Diamond stayed on scene to supervise the fire-fighting and safe guard the vessel from to oil cargo tanks or any sort of oil pollution.
Later on, 4th September 2 more tugs from Hambantota port were deployed for firefighting. By noon vessel drifted about 20 nm and was 25 nm away from SW Sri Lanka coast. Fire on portside of vessel's superstructure appeared contained and under control. Cargo tanks of vessel were intact.
It was advised by the coast Guard to tow away the vessel from Sri Lanka Coast.
At 1820hrs, Tug ALP Winger secured the tow line and commenced to tow her away from coast in Easterly direction.

On 5th September around 1400hrs it was reported that fire was under control but the white-grey smoke from superstructure was seen, indicating inflammables including fuel was doused or burned out.

On 6th September around 1100hrs Fire again appeared reignited and fire fighting continued. Vessel was slowly towed away from coast. Dry Chemical powder was dropped in to engine room by helicopters. At 1330hrs no visible flames and fire seems to be doused.

On 7th September around 1700hrs it was known through media news that there was fire in aft section and superstructure reignited again due to bunker fuel in tanks around the engine room area. At 1800hrs media news relayed stating fire is extinguished, all ships engaged in firefighting remained standby.

On 8th September it was reported by media that some fire is not doused and fire fighting continues.

On 9th September the media news stated that fire is under control and tanker is under tow towards seaward direction. On board seaworthiness and stability condition inspection was conducted.

On 10th September the press release of Sri Lanka Navy declared that fire on New Diamond is finally extinguished and there was no risk of reignition. One crew, the missing Oiler was declared dead on board.

On 12th September vessel believed to have been offered on LOF to SMIT SALVAGE.

On 13 September, Indian Navy, Sri Lanka and Salvor Diving team from SMIT SALVAGE completed under water inspection in AM hours. Salvage team undertaken blanking of shipside opening, de-ballasting from engine room to ballast tanks and sealing all leaks on hull.

At 1400hrs, Tug BOKA EXPEDITION took over MT NEW DIAMOND and Salvors preparing on safety and seaworthiness of vessel for towing to safe port to discharge her cargo, probably to port of Fujairah, UAE.

From 14th September onward, no media report was received about vessel condition or readiness for towing to another port.

On 1st October 2020, it was known through ASI data that Tug Boka Expedition crossing Sri Lanka South Coast at speed of 4 knots in position Lat 07°43.9'N, Long 082°51.3'E.

On 6th October, tracking of ASI data revealed that Tug Boka Expedition was heading towards Arabian Sea at speed of 4 knots in position Lat: 02°56.2'N, Long: 078°41.3'E.

On 9th October ASI data shown Tug Boka Expedition advanced her position towards Lakshadweep Sea in position Lat 07°42.53'N, Long 075°10.78'E.

On 12th October the Tug Boka Expedition further advanced her position at 4 Knots almost middle of Arabian Sea in Lat 10°48.2'N, Long 071°10.47'E.

On 15th October the Tug Boka Expedition as per ASI data was found moving at 3 Knots in position Lat 14°24.16'N, Long 068°06.15'E.

On 25th October the Tug Boka Expedition was transiting Gulf of Oman at 2.3 knots in position Lat 20°44.8'N, Long 063°39.0'E.

On 8th November 2010 it was known that vessel had arrived at Kalba Anchorage, north of Fujairah Port in UAE waters.

From 12th November 2010 it was known that vessel had made preparation for STS operation for discharging her Crude Oil Cargo.
On 12 December it was advised that STS operation was almost complete and stripping of cargo tanks was in progress.

On 31st January On-site investigation was permitted by Owners and Salvors of vessel for Flag State Safety Investigation on Engine Room Explosion, Fire and Crew Casualty which was restricted with limited access to engine room for 5 hours only.

Fire detectors on board
Bridge and engine room was provided with smoke detectors.
The smoke detector functioned and fire alarm was activated.

INJURIES/FATALITY: There was one 3E injured seriously and one deceased crew, Oiler on engine room watch.

POLLUTION: There was no pollution reported.

TIME SHEET (SHIP TIME, UTC+4.5)

21-08-2020

2209 HRS: VESSEL MT. NEW DIAMOND ARRIVED PORT MINA AL AHMADI, KUWAIT.

23-08-2020

0800 HRS: VESSEL DEPARTED FROM PORT MINA AL AHMADI, BOUND FOR PARADIP PORT, INDIA LOADED WITH ABOUT 277,000 MT OF KUWAIT EXPORT CRUDE OIL.

31-08-2020

1700 HRS: SAFETY MEETING WAS CARRIED OUT.

03-09-2020

0630 HRS: BOATSWAIN REPORTED TO CHIEF OFFICER FOR DAILY WORK.
0645 HRS: C/E CAME TO BRIDGE FOR 5-10 MINUTES.
0700 HRS: PUMP MAN REPORTED TO CHIEF OFFICER FOR DAILY WORK.
0705 HRS: SHIPS CREW WERE HAVING THEIR BREAKFAST.
0730 HRS: FIRST EXPLOSION TOOK PLACE IN ENGINE ROOM.
0733 HRS: C/O WENT OUT TO CHECK WHAT HAPPENED.
0734 HRS: BOATSWAIN FOUND 2/O COUGHING HEAVILY, HE TOOK HIM FROM STBD SIDE C-DECK to MUSTER STATION.
0735 HRS: MASTER ACTIVATED ALARM MANUALLY.
0736 HRS: 3/E (DOMINADOR JR MALLARI QUIAMBAO) HEARED VOICE OF OTHER 3/E (ELMO DELA CRUZ), HE WENT TO CHECK, HE FOUND 3/E (ELMO DELA CRUZ) WITH BIG WOUND & SHOUTING FOR HELP. 3/E (DOMINADOR JR MALLARI QUIAMBAO) TOOK 3/E (ELMO DELA CRUZ) FROM PORT SIDE & TRIED TO GO B-DECK BUT IT WAS SO FAR FROM C-DECK. THEY PUT 3/E IN PALLET & TRIED TO PUT HIM DOWN TO UPPER DECK, BUT IT WAS DIFFICULT. THEY SAID TO 3/E TO STAY ON B-DECK & 2/E INFORM MASTER ABOUT HIS INJURY.
0737 HRS: ON VHF MASTER INFORMED HELICOPTER IS COMING & THEY PUT SOME TOWEL TO THE INJURED PART.
0738 HRS: THEY LEFT INJURED 3/E IN B-DECK & WENT FOR MUSTER STATION.
0739 HRS: MASTER ASKED TO BROAD CAST DISTRESS SIGNAL.
0740 HRS: 2ND EXPLOSION ON PORT SIDE FO TANK
ALL SHIPS CREW MUSTER EXCLUDING 3/E, OILER AND C/E.
0741 HRS: AFTER MUSTERING 3/E CAME BACK TO SEE INJURED 3/E, HE WAS HAVING DIFFICULTIES IN BREATHING. THEY PROVIDED EMERGENCY OXYGEN TO INJURED 3/E.

0742 HRS: C/E ALSO REPORTED TO MUSTER STATION PORT SIDE.
0743 HRS: CREW WENT TO HEAD QUARTER STATION & TOOK BA & FIRE MAN OUTFITS.
0745 HRS: 2/E & BOATSWAIN STARTED TO WEAR FIRE MAN OUTFIT, THEN 2ND EXPLOSION TOOK PLACE NEAR TO PORT SIDE FUEL TANK & THE MANHOLE OF FUEL OIL TANK BLOWS OFF IN AIR & ALL CREW RUN TO STBD SIDE MAIN DECK.
0749 HRS: STARTED SEARCH & RESCUE OPERATION WITH ONE LIFE LINE AND ONE PORTABLE FIRE EXTINGUISHER, IN LEAD WITH 2/E.
0750 HRS: MT HELEN M RESPONDED TO DISTRESS ALERT AND DEVIATED FOR THE RESCUE OPERATION.
0752 HRS: ENTERED 4TH DECK IN E/R SAW LOTS OF SMOKE, FLOORS HAVE HOLES, MOST OF THE PIPES BROKEN & PLENTY OF DEBRIS.
0753 HRS: INFORMED C/O THAT PLATFORMS OF 4TH DECK WAS DAMAGED.
0754 HRS: BOATSWAIN INFORMED ABOUT HIS OXYGEN BOTTLE ALARMING.
0755 HRS: C/O TOLD TO COME BACK.
0757 HRS: MASTER INFORMED CREW ABOUT RESCUE IS COMING.
0800 HRS: MASTER ORDERED FOR ABONDONED SHIP.
0805 HRS: STARTED PREPARING LIFE BOAT AND LIFE RAFT.
0810 HRS: L/B WAS READY TO LAUNCH AWAITED MASTER ORDER.
0815 HRS: MT HELEN M CALL NEW DIAMOND THAT THEY ARE REACHING AS SOON AS POSSIBLE.
0820 HRS: MASTER ORDERED FOR ABONDONED SHIP.
0825 HRS: ALL CREW WERE IN L/B ACCEPT MASTER, PUMP MAN, 3/E & MISSING OILER.
0830 HRS: L/B WAS LOWERED IN WATER & CLEAR AWAY FROM VESSEL.
0900 HRS: SRILANKAN NAVY BOARDED THE VESSEL WITH ONE STRETCHER TO TAKE INJURED 3/E. THEY PUT 3/E IN STRETCHER & LOWERED TO BOAT.
0934 HRS: OWN VESSEL POSITION 1 NM FROM NEW DIAMOND AND STAND BY FOR THE RESCUE OPERATION. ALL ARRANGEMENTS ONBOARD READY FOR THE RESCUE OPERATION.
1013 HRS: LIFEBOAT ALONGSIDE OWN SHIP. AND VESSEL STARTED PICKING UP THE PERSONS FROM LIFEBOAT.
1042 HRS: ALL 19 CREW RESCUED FROM THE LIFEBOAT AND ONBOARD OWN SHIP. VESSEL PROVIDED THEM ALL ASSISTANCE, HOSPITALITY, FOOD, WATER AND CLOTHING.
1045 HRS: VESSEL INFORMED MRCC THAT RESCUE IS COMPLETED AND VESSEL PROCEEDING TO A SAFER DISTANCE FROM THE DISTRESS SHIP AND AWAITING FURTHER INSTRUCTIONS FROM THEM. MRCC ACKNOWLEDGED SAME.
1050 HRS: INJURED 3/E TRANSFER FROM BOAT TO SHORE AND FROM SHORE TO AMBULANCE.

1200 HRS: VESSEL DRIFTING 5 NM FROM THE DISTRESS SHIP AND AWAITING INSTRUCTIONS FROM THE MRCC. POSN: 07 12.4 N 082 26.24 E. 1300: 3RD EXPLOSION ON SLOP TANK PORT SIDE SHELL PLATE. 1305 HRS: VESSEL RECVD INSTRUCTIONS FROM MRCC COLOMBO TO PROCEED TO OPL TRINCOMALLE FOR DISEMBARKATION OF PERSONS WHICH IS ON THE WAY TO KAKINADA.1310: 4TH EXPLOSION ON NO.2 DO TANK PORT SIDE LIFEBOAT DAVIT.

1315 HRS: RESCUE VESSEL RESUMED HER VOYAGE.

1500 HRS: MASTER DISEMBARK FROM MT NEW DIAMOND AS PER INSTRUCTION FROM SRI LANKAN NAVY.

2100 HRS: VESSEL STOPPED OF OPL TRINCOMALLE FOR DISEMBARKATION OF 19 CREW.

2200 HRS: VESSEL COMPLETED DISEMBARKATION OPERATION AND RESUME HER PASSAGE TOWARDS DISPORT KAKINADA POSN: 08 28.06 N 081 32.79 E.

04-09-2020

0400 UTC: FIRE FIGHTING CONTINUES, CARRIED OUT, UNDERSTOOD, BY JOINT EFFORTS OF INDIAN, SRI LANKAN AND RUSSIAN NAVY AND CG SHIPS, OFFSHORE TUG APL WINGER (IMO 9367504), BUT RUSSIAN SHIPS HAD ALREADY LEFT THE SCENE. AT LEAST 2 TUGS FROM HAMBANTOTA PORT ARE ALSO DEPLOYED. MASTER OF NEW DIAMOND IS ON BOARD OF ONE OF THE SHIPS, ASSISTING IN FIRE FIGHTING. FROM THE LOOKS OF LATEST PHOTOS, FIRE IS CONTAINED AROUND PORT SIDE SUPER STRUCTURE, TANKER DEVELOPED SLIGHT PORT SIDE LIST, NOTHING UNUSUAL IN MAJOR FIRE ACCIDENTS. TANKER DRIFTED SOME 20 NM SW, CLOSER TO SRI LANKA COAST, NOW SHE'S SOME 25 NM OFF COAST LINE WITH IN OPERATIVE AIS.
MY INITIAL ASSUMPTION, THAT THE MAJORITY OF ND CREW WERE PICKED UP BY MT HELEN M (IMO 9308223), WAS CORRECT, LATER THEY'VE BEEN TRANSFERRED TO ONE OF SLN SHIPS AND… ISOLATED ON "PANDEMIC" FEARS AND PROTOCOLS. INJURED 3RD ENGINEER IS OK, NOTHING LIFE-THREATENING. MISSING SEAMAN IS OF FILIPINO NATIONALITY. CARGO TANKS AS OF MORNING SEP 4, WERE INTACT.

1615 UTC: ACCORDING TO INDIAN COAST GUARD, FIRE IS UNDER CONTROL, AND IT LOOKS LIKE UNDER CONTROL ON LATEST PHOTOS. TANKER IS READY TO BE TOWED EITHER OFF TO OCEAN AWAY FROM SRI LANKAN COAST, OR IF/WHEN FIRE IS EXTINGUISHED, TO NEAREST MOST SUITABLE PORT. BUT AS OF 1615 UTC, TOWAGE DIDN'T YET COMMENCE. ANYWAY, GREAT NEWS ON FIRE BEING TAKEN UNDER CONTROL

1820 UTC: OFFSHORE TUG ALP WINGER (IMO 9367504) TOOK NEW DIAMOND ON TOW, TOWAGE COMMENCED AT AROUND1620 UTC, IN EASTERN DIRECTION, AT SOME 2 KNOTS SPEED, BUT CARAVAN IS GATHERING WAY.

05-09-2020

0910 UTC: FIRE SEEMINGLY, UNDER CONTROL, THE SMOKE STILL BILLOWING FROM SUPER STRUCTURE IS OF WHITE-GREY COLOR, MEANING THAT INFLAMMABLES, INCLUDING PROBABLY FUEL, WERE DOUSED OR BURNED OUT. TANKER IS UNDER TOW OF OFFSHORE TUG ALPWINGER, SLOWLY MOVING IN NORTHERN DIRECTION, WITH OUT IT SEEMS, ANY DESTINATION IN MIND, WAITING UNTIL FIRE IS EXTINGUISHED, AND TANKER IS SAFE TO BE TOWED TO PORT. REPORTEDLY, OWNER ASSIGNED SALVAGE COMPANY, NAME UNKNOWN.

06-09-2020

0600 UTC: LOOKS LIKE FIRE REIGNITED, MOST PROBABLY TANKER'S BUNKER FUEL. TANKER IS SLOWLY TOWED AROUND, WHILE FIRE FIGHTING CONTINUES. NEW DIAMOND APPOINTED SMIT SALVAGE AS SALVAGE COMPANY, BRITISH AND DUTCH JOINT TEAM TO ARRIVE TO SRI LANKA SOON.

1330 UTC: ACCORDING TO LATEST ICG REPORT, FIRE SEEMS TO BE DOUSED, NO VISIBLE FLAMES ANYMORE

07-09-2020

1230 UTC: FIRE IN THE AFT SECTION AND SUPERSTRUCTURE REIGNITED AGAIN, SAID INDIAN CG IN LATEST TWEETS. SEEMS LIKE THE WHOLESTRUCTURE IN AFT SECTION IS OVERHEATED, AND THERE IS SUBSTANTIAL QUANTITY OF BUNKER FUEL LEFT, WHICH DIDN'T BURN OUT, AND THATLEADS TO REPEATED REIGNITIONS.

1315 UTC: FIRE IS EXTINGUISHED, ACCORDING TO OFFICIAL STATEMENTS OF BOTH SRI LANKAN AND INDIAN CG AND NAVY, AND LATESTPHOTOS. TANKER AND ALL SHIPS DEPLOYED IN FIRE FIGHTING/SALVAGE REMAIN ALMOST STATIONARY, FINAL TOWAGE DIDN'T YET COMMENCE, TOO EARLY FOR THAT. TEMPERATURE INSIDE SUPER STRUCTURE, HULL AND ENGINE ROOM MUST RETURN TO NORMAL, SALVAGE PROFESSIONALS MUST ASSESS TANKER'S STATUS AND DAMAGES, AND AFTER THAT, SHE'LL BE TOWED TO SAFETY, PROBABLY TO PORT OF DESTINATION, TO OFF LOAD CRUDE. SHE LOOKS LIKE SHE WON'T NEED REPAIRS AFTER COMPLETING VOYAGE AND OFF LOADING CARGO. HIGHLY LIKELY SHE'LL BE SOLD FOR SCRAP.

08-09-2020

0900 UTC: UNDERSTOOD FIRE FIGHTING CONTINUES, AND OPEN FIRE ISN'T YET DOUSED. NO UPDATES FROM INDIAN/SRI LANKAN NAVY/CG DURING LAST 7 HOURS.

09-09-2020: ACCORDING TO LATEST SLN STATEMENT DATED MORNING SEP 9, FIRE IS UNDER CONTROL OR EXTINGUISHED, NO FLAMES, NO SMOKE VISIBLE.HOPEFULLY, THIS TIME IT'S THE END OF THE STORY, AND THERE WON'T BE ANY NEW REIGNITION. TANKER IS SAID TO BE UNDER TOW INSEAWARD DIRECTION.

10-09-2020: THE FIRE, FINALLY, IS EXTINGUISHED, ACCORDING TO SEP 9 EVENING PRESS-RELEASES AND PHOTOS. SALVAGE TEAM OR TEAMS REPORTEDLY, ALREADY BOARDED TANKER. THEY'LL WAIT AND CHECK UNTIL THEY'LL BE SURE THERE'S NOTHING SMOLDERING LEFT, NO RISK OF REIGNITION.AFTER THAT OR PARALLEL WITH COOLING, CHECKING AND ASSESSING SHIP'S CONDITION, TOWAGE TO PORT WILL COMMENCE OR ALREADYCOMMENCED, BECAUSE TANKER AND ALL DEPLOYED IN SALVAGE SHIPS ARE ALREADY MOVING NORTHWARD. HOPEFULLY, IT'S THE END, MORE OR LESS HAPPY END, THOUGH REGRETFULLY, ONE CREW DIED.

13-09-2020: INDIAN NAVY, SRI LANKAN NAVY AND SALVORDIVING TEAM COMPLETED UNDER WATER INSPECTION AT AM HOURS AND SALVORS UNDERTAKING DEBALLAST & BLANKING OF UNDER WATER NON RETURN VALVE SALVORS UNDERTOOK DEBALLASTING FROM ENGINE ROOM TO BALLAST TANK AND ALL LEAKS ON HULL SEALED.

1400 HRS: TUG BOKA EXPEDITION TOOK OVER MT. NEW DIAMOND

01-10-2020:

1130 UTC: TUG BOKA EXPEDITION CROSSING SRI LANKA SOUTH COAST AT THE SPEED OF 4 KNOTS & POSITION LAT: 07°43.9'N, LONG: 082°51.3'E.

06-10-2020:

0510 UTC: TUG BOKA EXPEDITION PASSING THE INDIAN OCEAN AT THE SPEED OF 4 KNOTS & POSITION LAT: 02°56.2'N, LONG: 078°41.3'E.

09-10-2020:

0930 UTC: TUG BOKA EXPEDITION PASSING THE LAKSHADWEEP SEA AT THE SPEED OF 5 KNOTS & POSITION LAT: 07°42.53'N, LONG: 075°10.78'E.

12-10-2020:

0930 UTC: TUG BOKA EXPEDITION PASSING THE ARABIAN SEA AT THE SPEED OF 4 KNOTS & POSITION LAT: 10°48.2'N, LONG: 071°10.47'E.

15-10-2020:

0930 UTC: TUG BOKA EXPEDITION PASSING THE ARABIAN SEA AT THE SPEED OF 3 KNOTS & POSITION LAT: 14°24.16'N, LONG: 068°06.15'E.

25-10-2020:

2030 UTC: TUG BOKA EXPEDITION PASSING THE GULF OF OMAN AT THE SPEED OF 2.3 KNOTS & POSITION LAT: 20°44.8'N, LONG: 063°39.0'E.

08-11-2020:

AM HOURS: THE VESSEL ARRIVING AT ANCHORING IN FUJAIRAH ON SUNDAY MORNING.

12-11-2020: VESSEL ARRIVED IN FUJAIRAH WITH PREPARATION BEING MADE FOR THE STS OPERATION.

23-12-2020: STS OPERATION ALMOST COMPLETED WITH THE STRIPPING OF CARGO TANK.

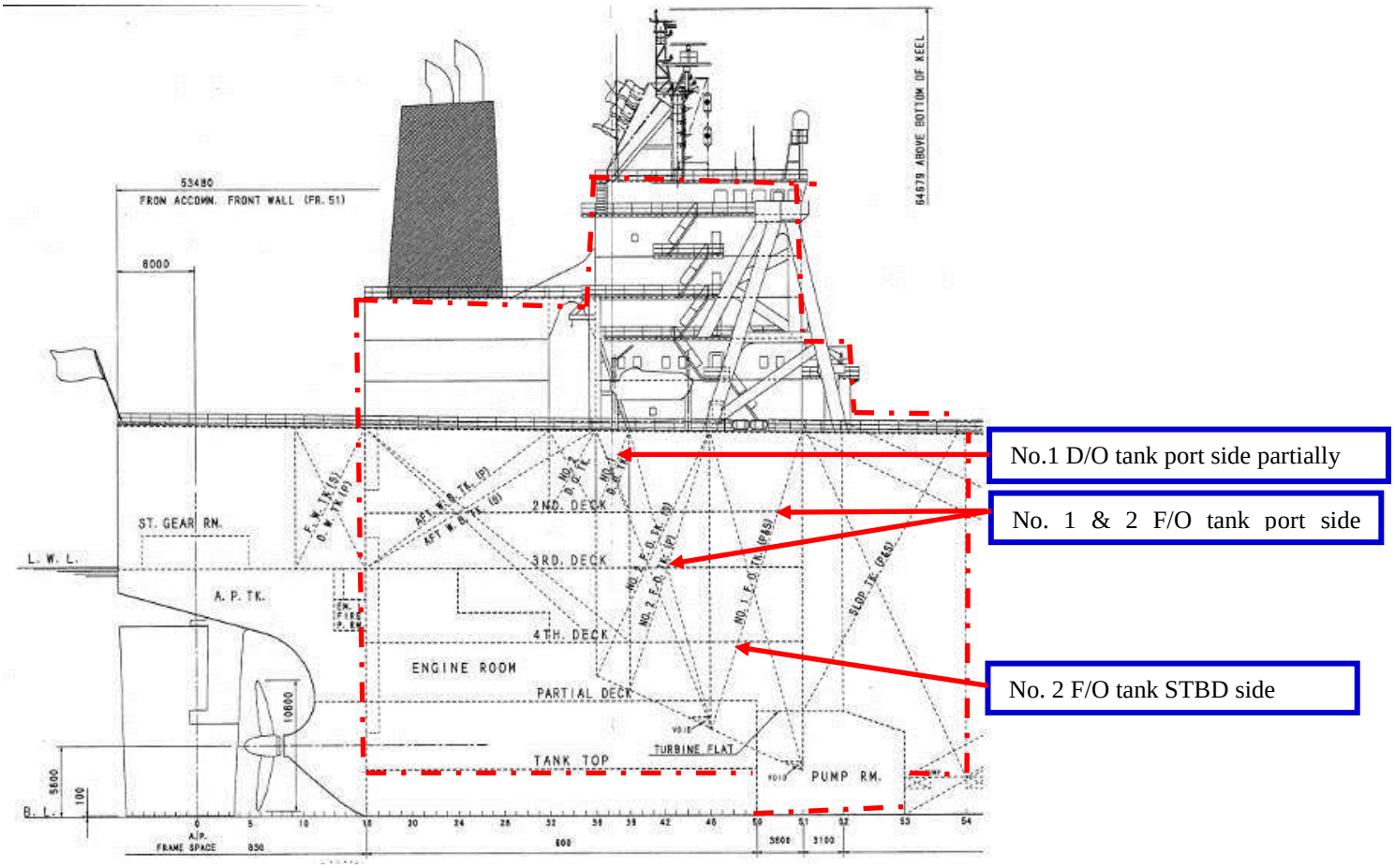
31-01-2021: FLAG STATE INVESTIGATOR BOARDED THE VESSEL.

1.3.4 DAMAGES

Following damages were observed on visual inspection in engine room after the incident of fire:

1. Severe damages inside engine room around auxiliary boiler, exhaust gas economizer area, other machinery, auxiliaries, stores and fittings on 2nd, 3rd, 4th, partial and floor plate area.
2. Skylight blown off and damages to overhead crane between engine room and aft of accommodation superstructure.
3. Various engine room pump motors switch panels damaged beyond recognition along with floor plates, railings, pipes etc. with major machineries, auxiliaries turned into debris.
4. Damages inside entire accommodation but mostly on Port side and on C Deck level extending to D and wheel house caused due to tremors of explosion travelling through the adjoining plates between engine room casing and accommodation structure. Also, the exploded steam turned into smoke with severe pressure travelled through the elevator trunk.
5. Subsequent damages on Upper deck and side shell etc. due to subsequent explosions of fuel tanks, pump room and slop tank having adjoining bulkhead boundaries.

GENERAL PROFILE OF VESSEL's DAMAGED AREA SHOWN WITH RED DOTTED LINE



Photographs taken after the fire was extinguished on 9 Sept'20

Port Quarter View

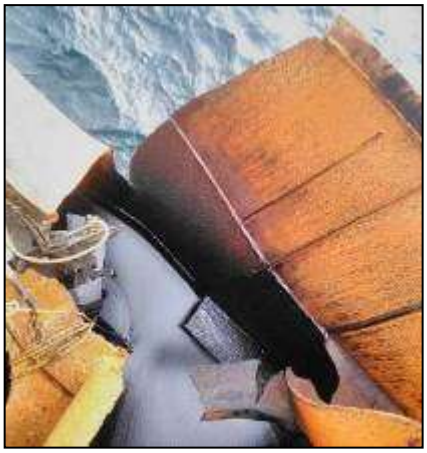
Port side F/O no 1, 2 and D/O tank plates blown off

Port Side F/O service & settling tank in E/R

Port side slop tank ship shell view from aft looking forward

Aft of D/O tank no. 2 deck and in way of aft WB tank appears intact

STBD side F/O tank blown off



STBD side shell ribbed from the deck down at the forward edge of STBD tank no 2

Area between engine room and accommodation aft

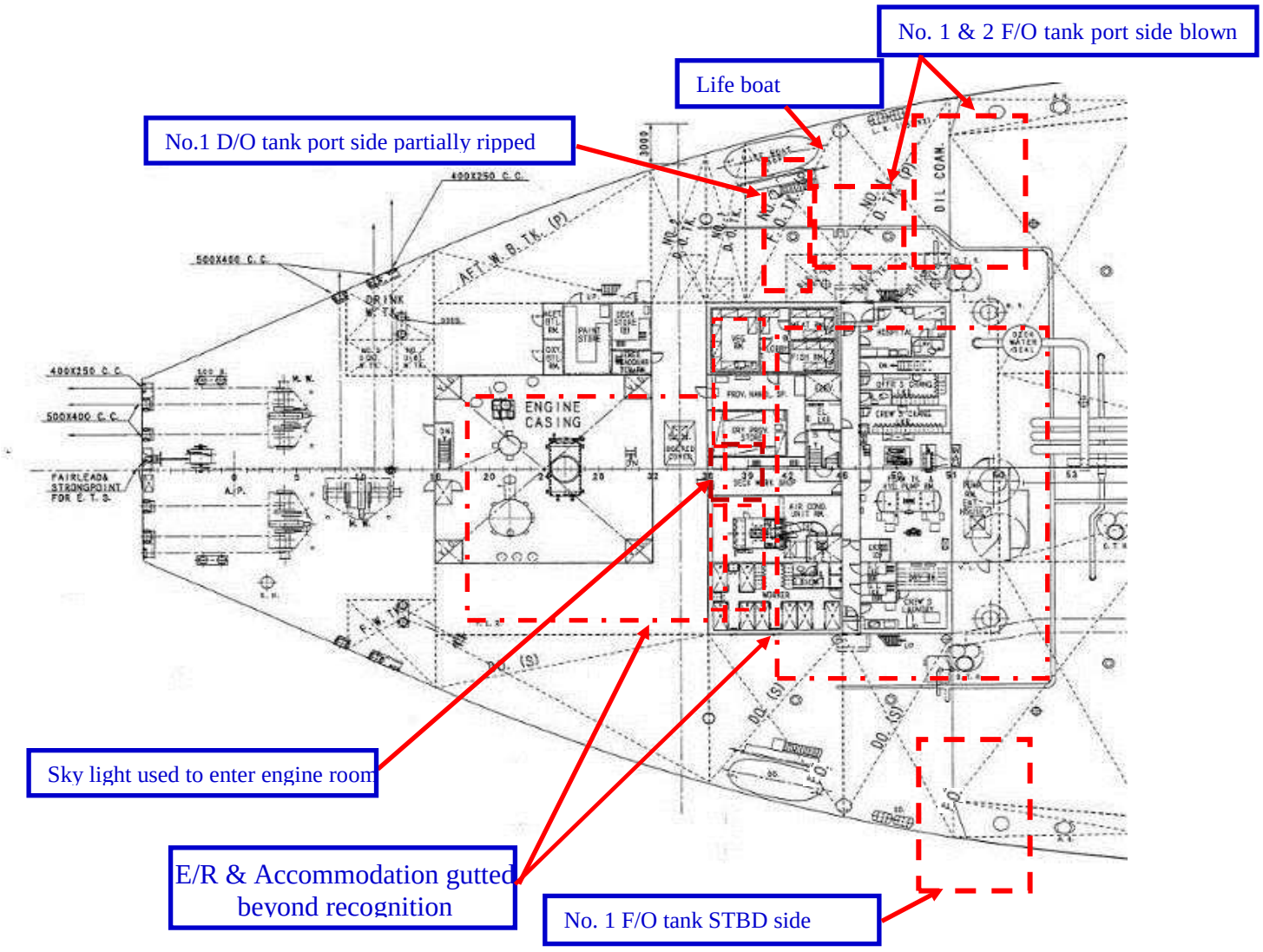
STBD side Pump Room entrance

Port side Pump Room entrance

Between Engine room and accommodation

Closer view of sky light which was later used to rig scaffolding stage for access into engine room

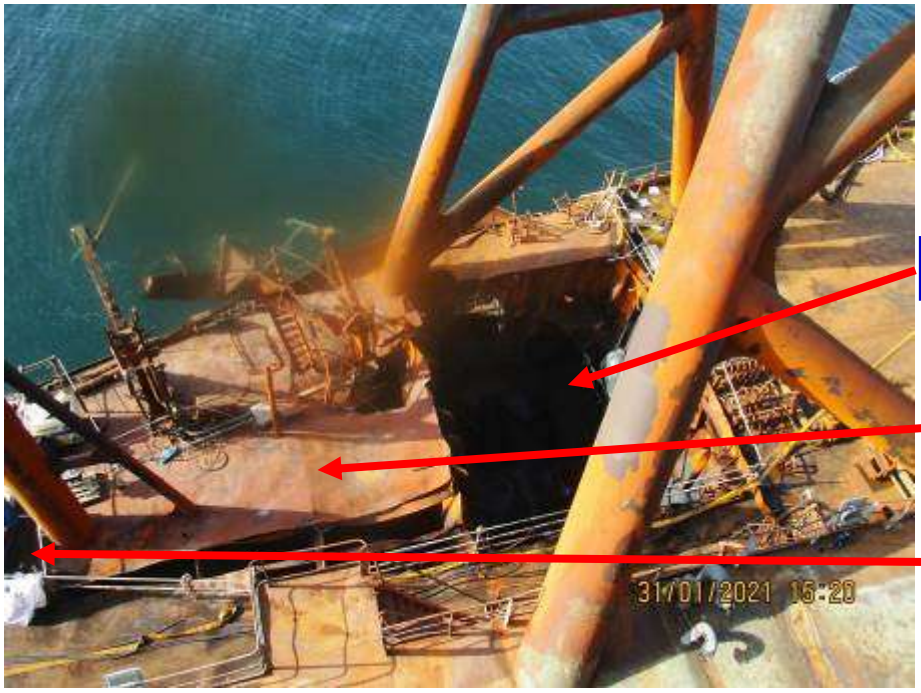
UPPER DECK LAYOUT



showing damages

PHOTOS TAKEN DURING ON SITE INVESTIGATION

View from Port Side – F/O tanks

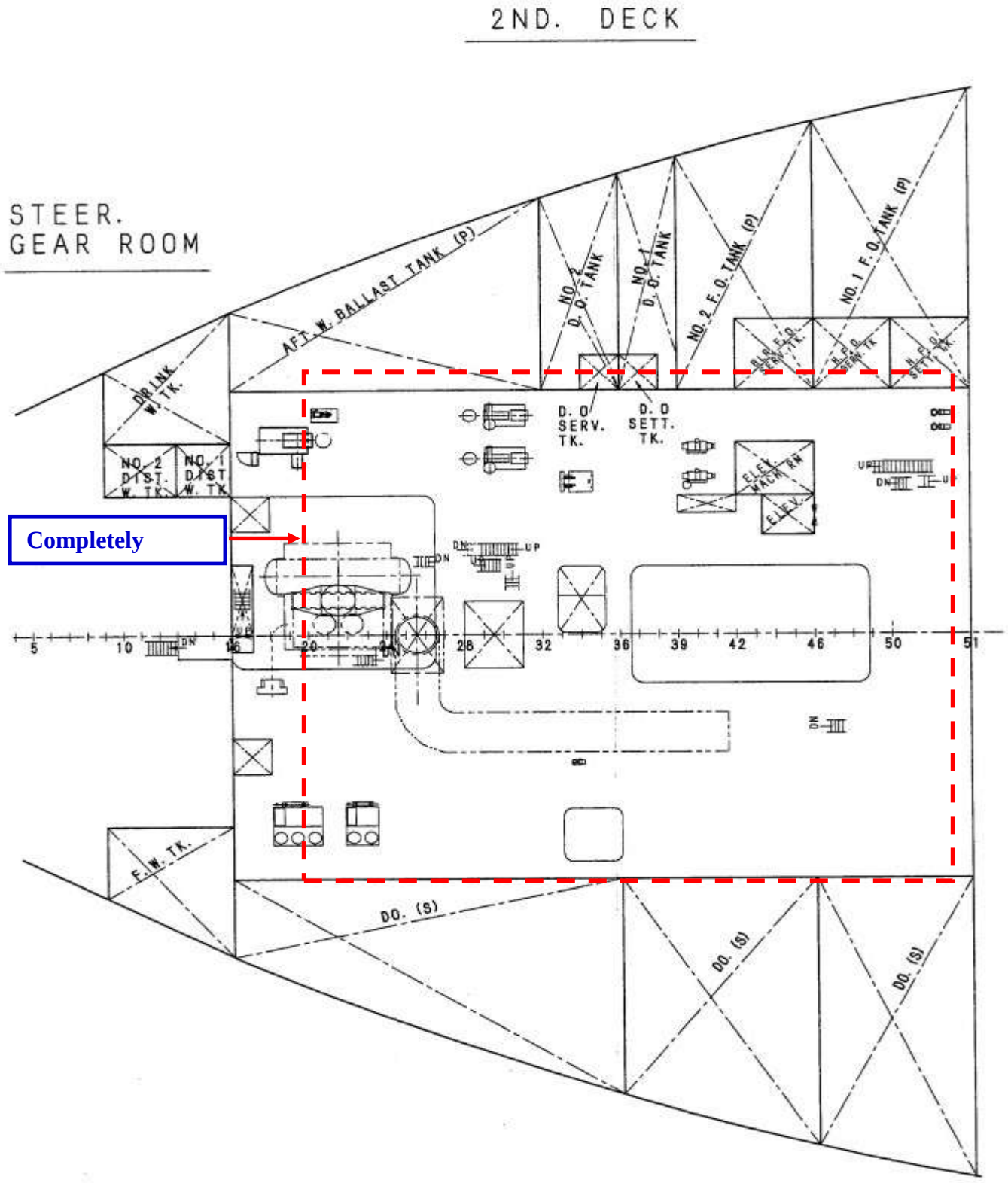


View from port side bridge wing

Bulged & deformed engine room casing bulkhead and upper deck

Broken and burnt out port holes on accommodation aft bulkhead and area around gantry crane above E/R sky light

Scaffolding was rigged for access into engine room.
Investigation team tentered E/R from skylight


2ND. DECK
STEER. GEAR ROOM
AFT W. BALLAST TANK (P)
NO. 2 D. O. TANK
NO. 1 D. O. TANK
NO. 2 F. O. TANK (P)
NO. 1 F. O. TANK (P)
DRINK W. TK.
NO. 2 DIST. W. TK.
NO. 1 DIST. W. TK.
D. O SERV. TK.
D. O SETT. TK.
ELEK. MACH. RM
ELEV.
Completely
F. W. TK.
DO. (S)
DO. (S)
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5
10
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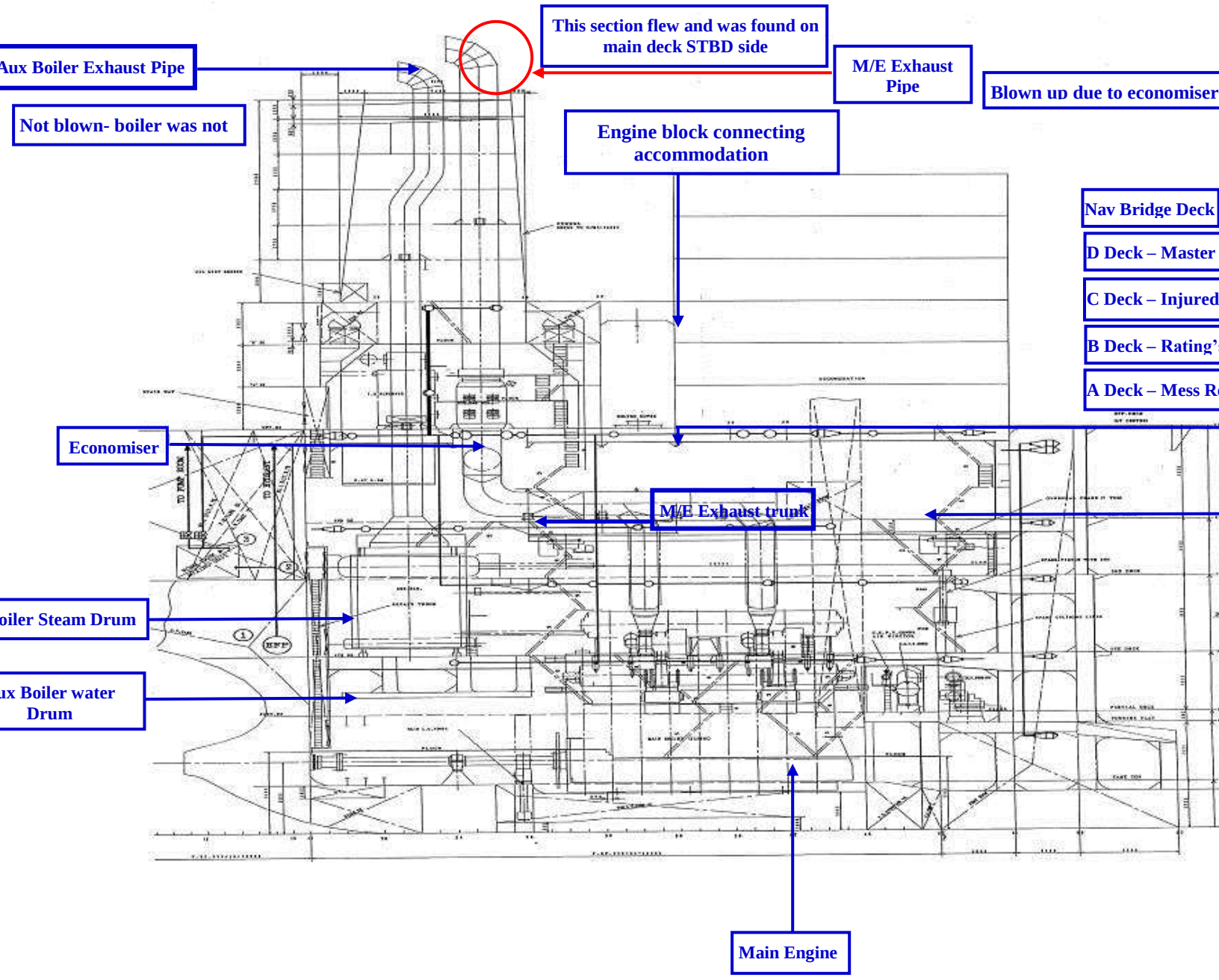

This section flew and was found on main deck STBD side
Aux Boiler Exhaust Pipe
M/E Exhaust Pipe
Blown up due to economiser
Not blown- boiler was not
Engine block connecting accommodation
Nav Bridge Deck
D Deck – Master
C Deck – Injured
B Deck – Rating'
A Deck – Mess R
Economiser
M/E Exhaust trunk
oiler Steam Drum
ux Boiler water Drum
Main Engine

PICTURES OF ENGINE ROOM DAMAGES BY EXPLOSION AND SUBSEQUESNT FIRE

ENGINE ROOM 2ND DECK

Page 43 to 46 – Photos of debris and gutted down E/R machineries taken from staging rigged inside E/R in way of skylight


31/01/2021 10:48

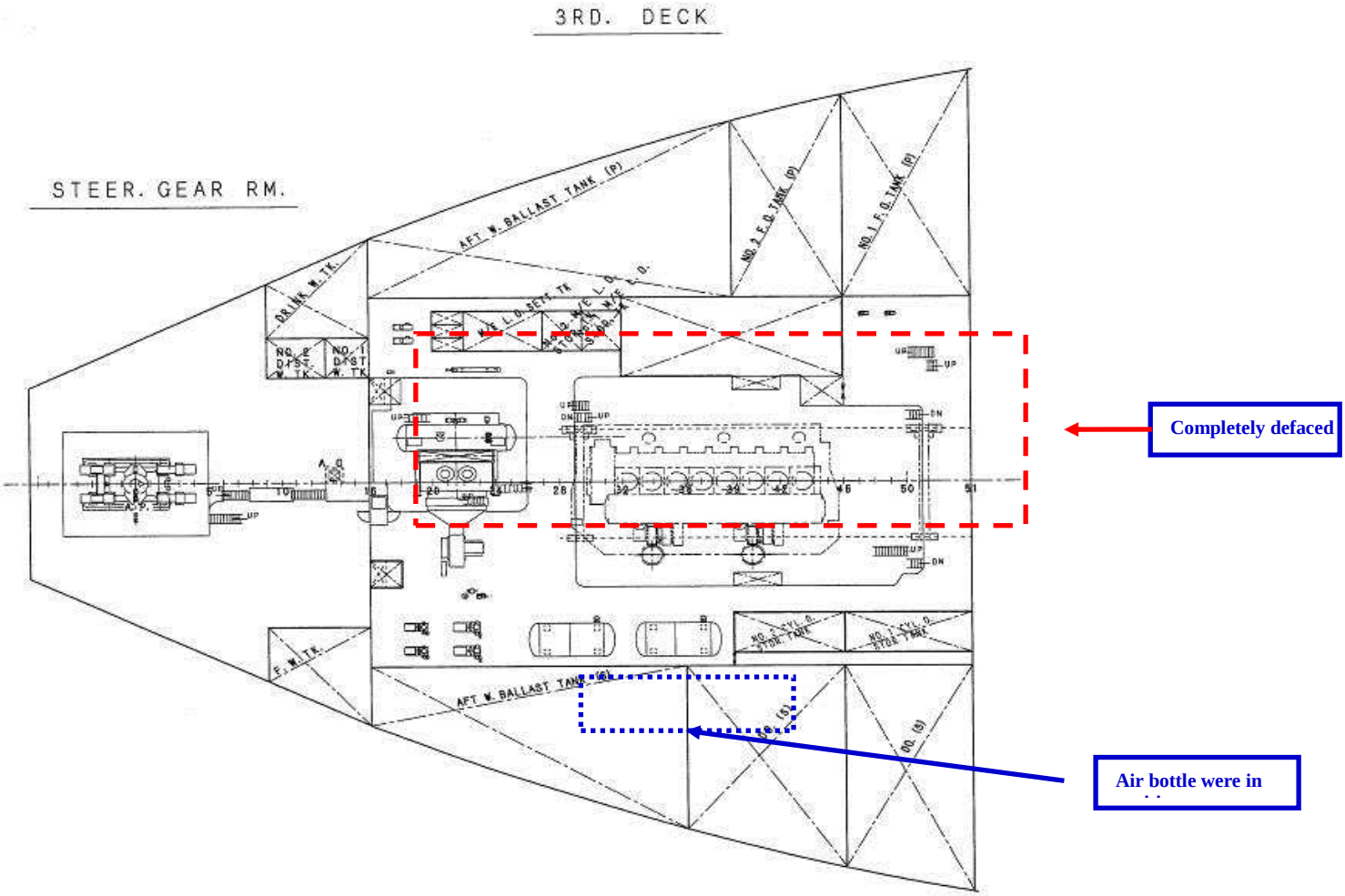

31/01/2021 10:49


31/01/2021 10:49


31/01/2021 10:45


31/01/2021 10:49


31/01/2021 10:52


3RD. DECK
STEER. GEAR RM.
AFT W. BALLAST TANK (P)
NO. 2 F.O. TANK (P)
NO. 1 F.O. TANK (P)
DRINK W. TK.
NO. 2 DIST. W. TK.
NO. 1 DIST. W. TK.
F. W. TK.
AFT W. BALLAST TANK (S)
Completely defaced
Air bottle were in

Entry to 3rd Deck from Steering Compartment

STERRING COMPARTMENT


31/01/2021 11:32

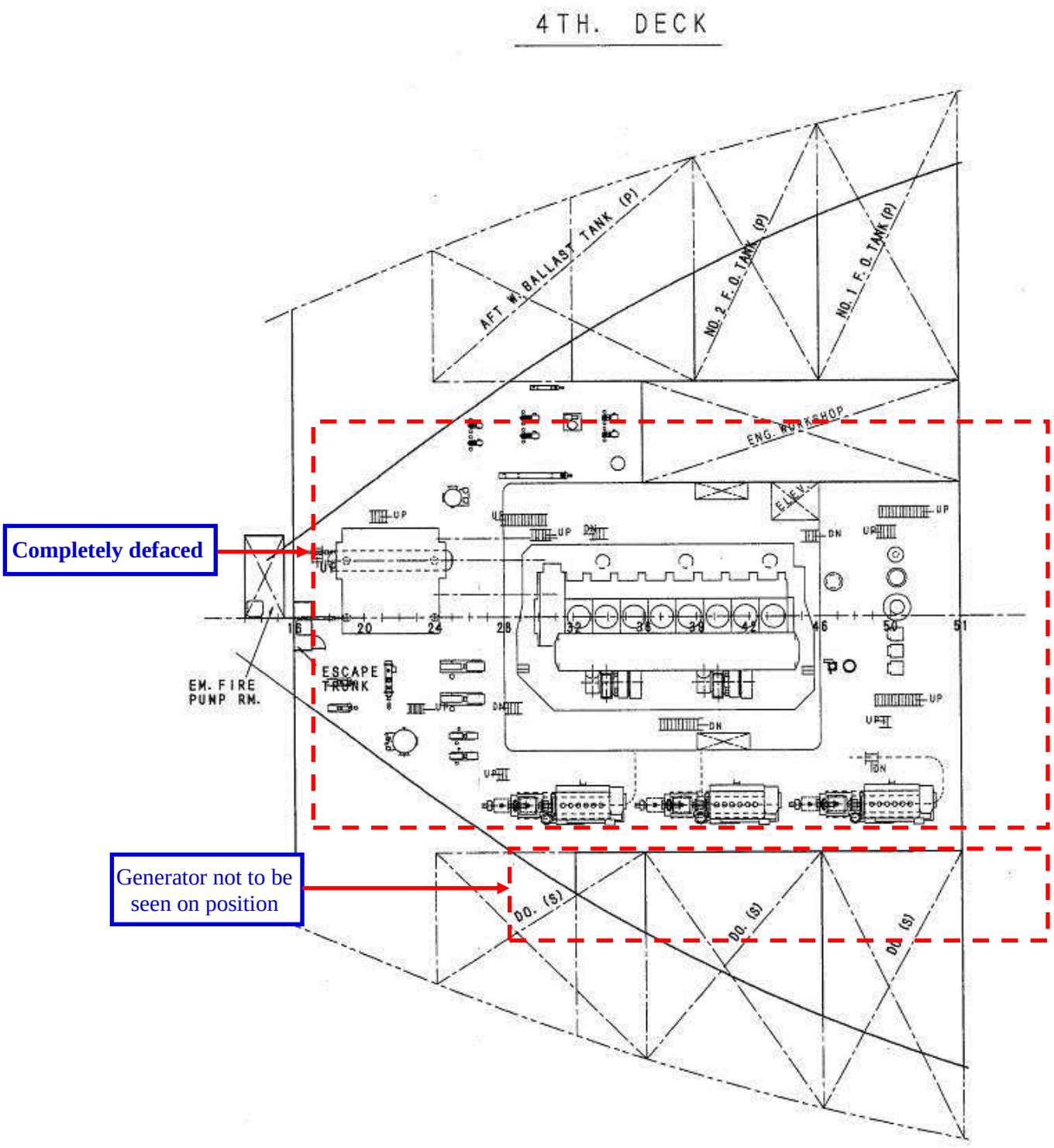

31/01/2021

Engine room 3rd deck view from steering compartment

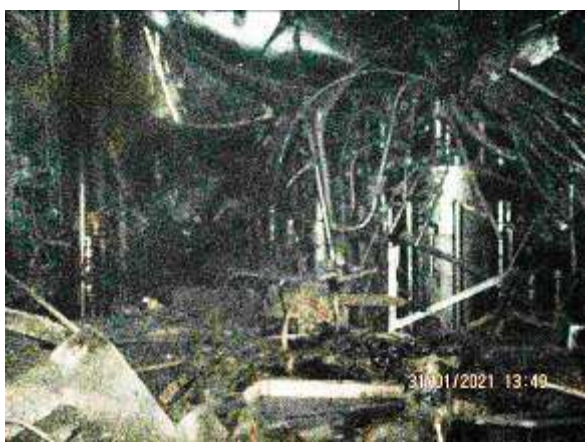

31/01/2021 11:36


31/01/2021 14:27

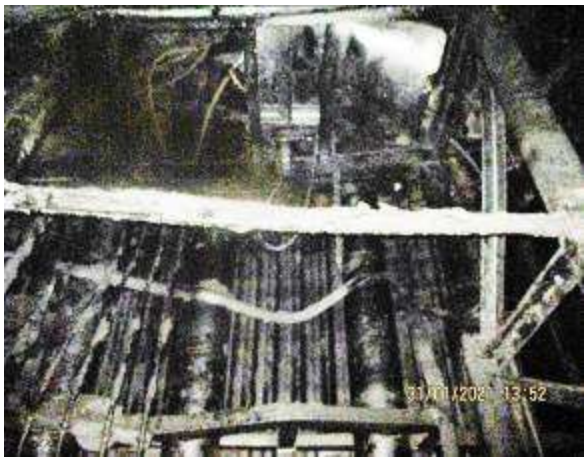

31/01/2021 14:28


4TH. DECK
AFT W.BALLAST TANK (P)
NO.2 F.O.TANK (P)
NO.1 F.O.TANK (P)
ENG. WORKSHOP
F.L.EV.
ESCAPE TRUNK
EM. FIRE PUMP RM.
Completely defaced
Generator not to be seen on position


31/01/2021 13:49


31/01/2021 13:49


31/01/2021 13:51

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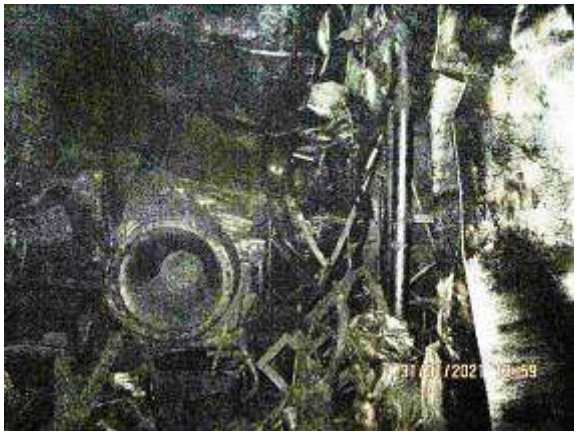


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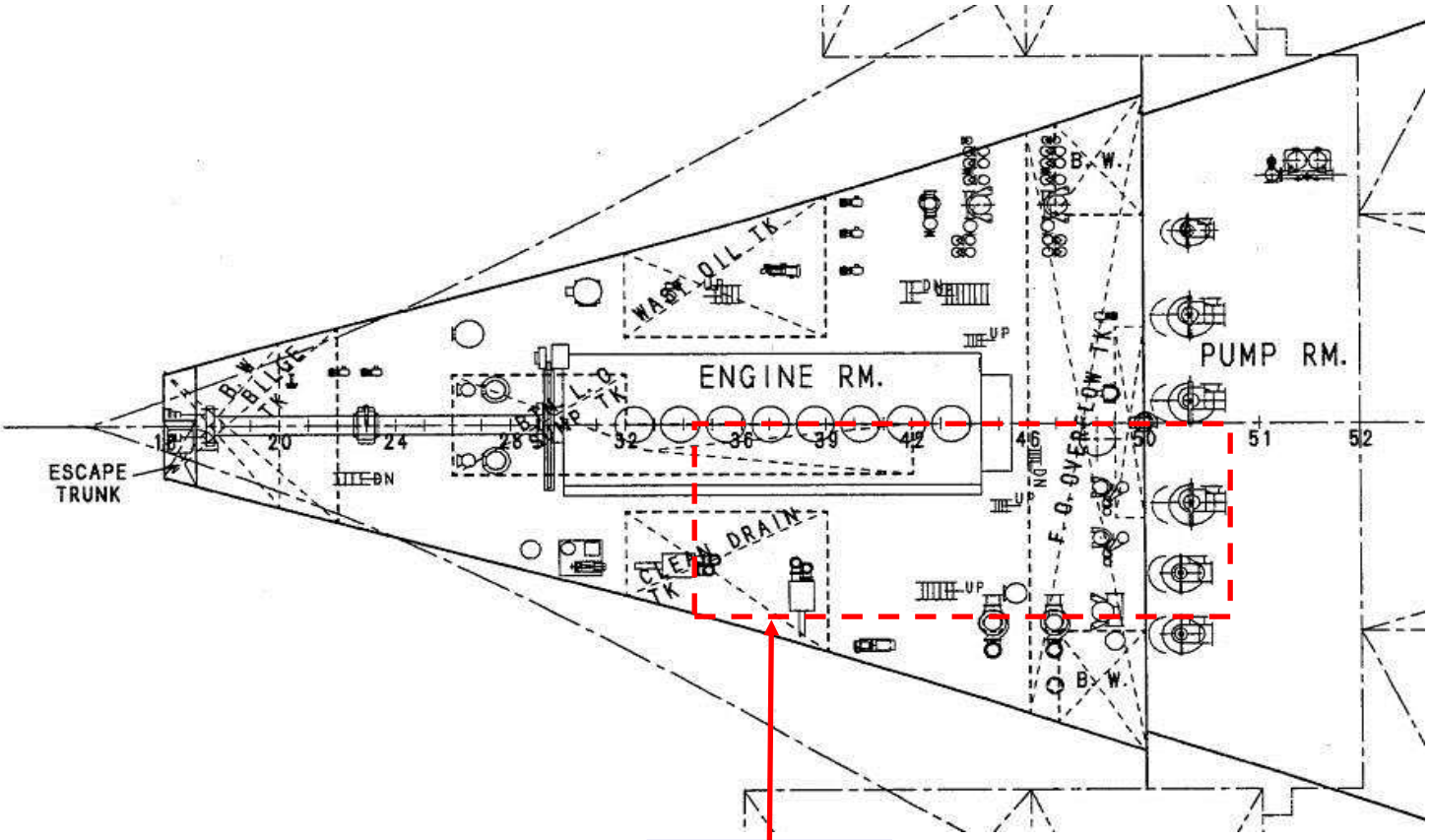
FLOOR PLAN



Partially defaced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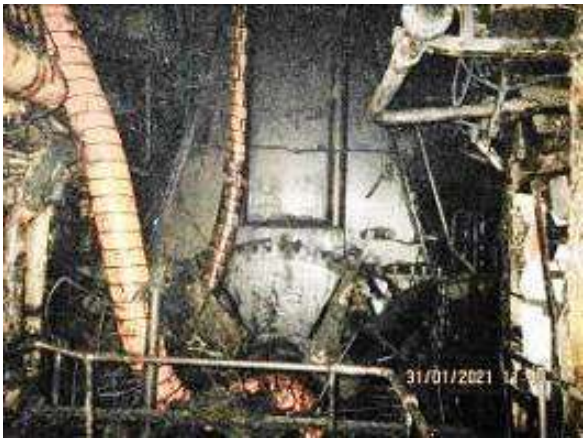


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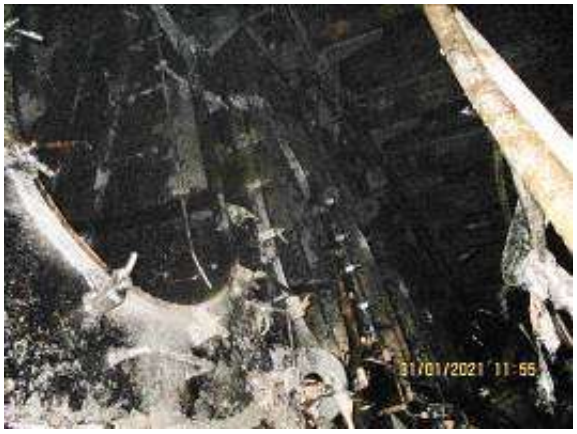
M/E crankcase and area around it

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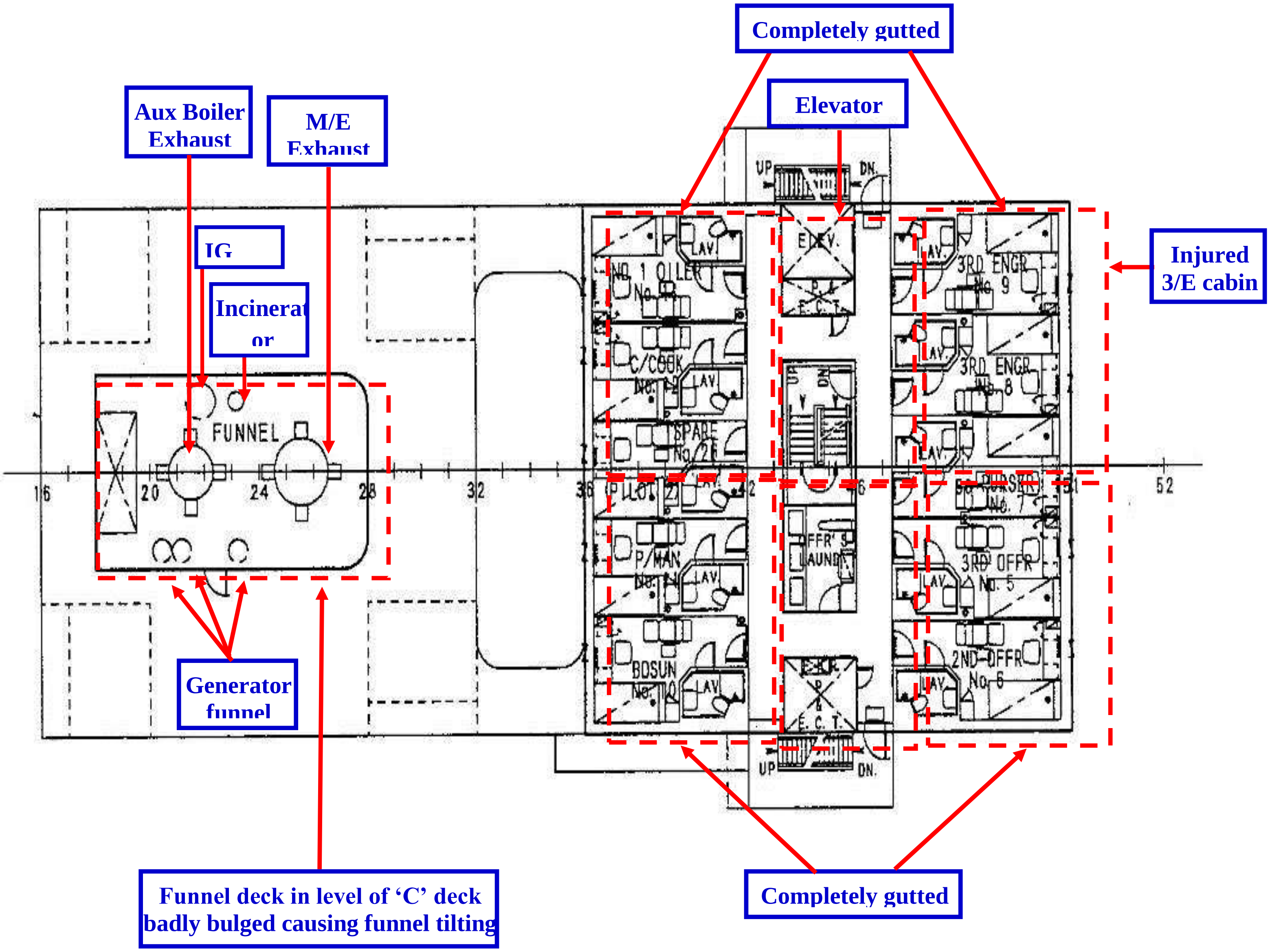
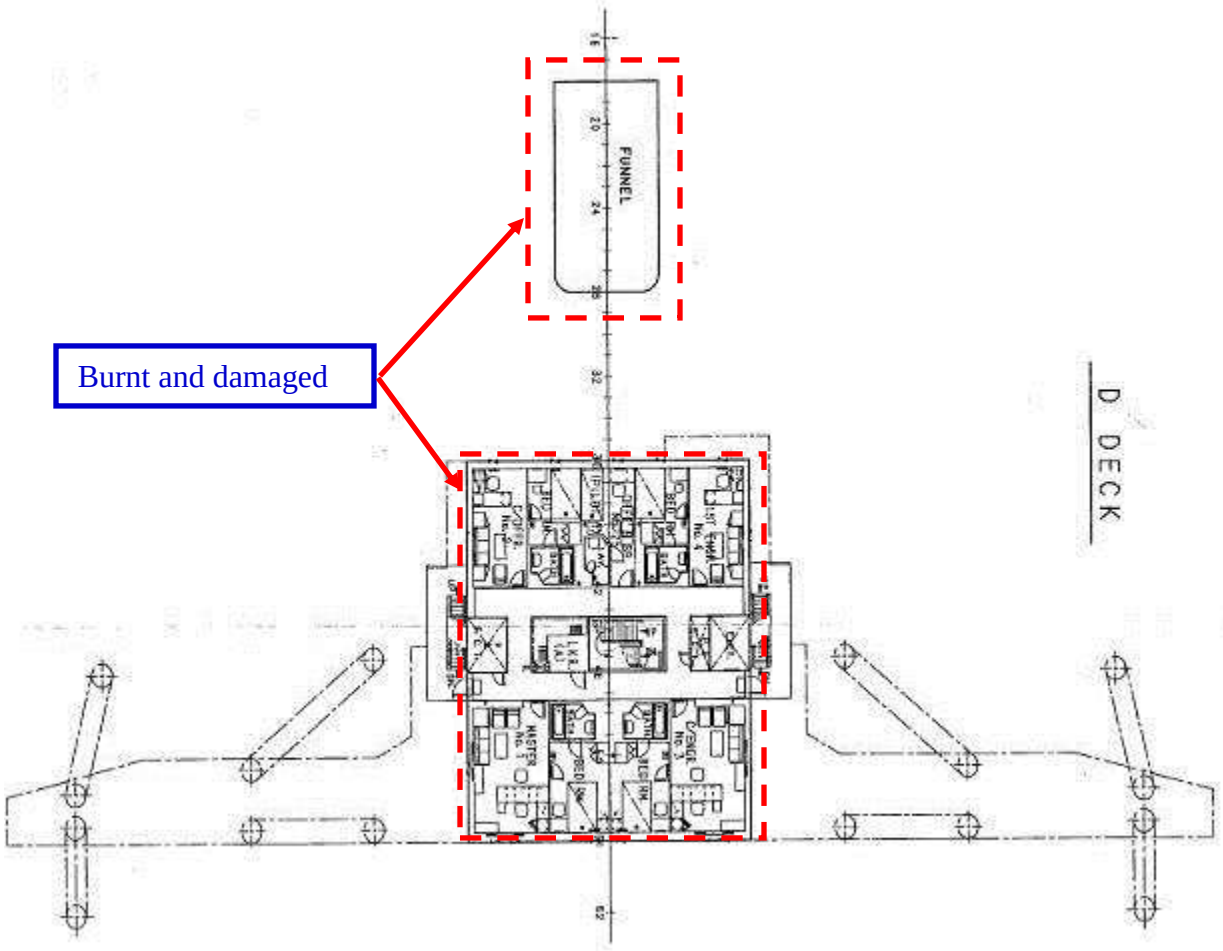
C DECK

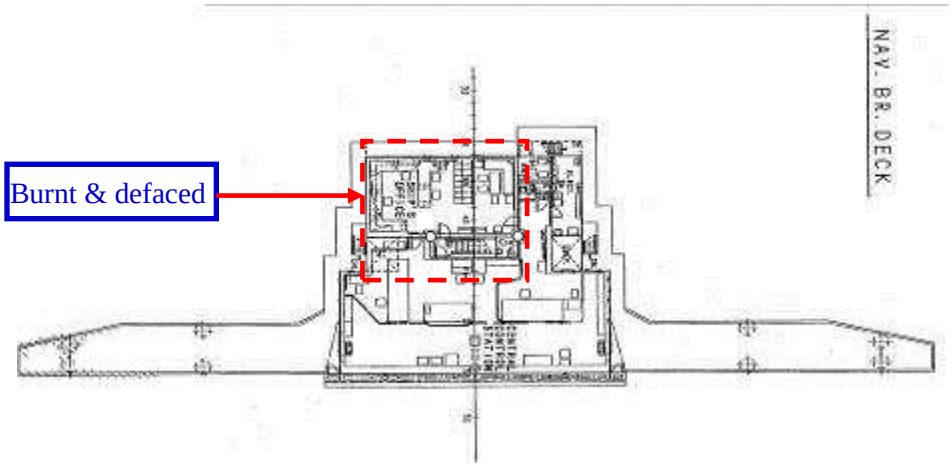

Completely gutted
Elevator
Aux Boiler Exhaust
M/E Exhaust
IG
Incinerator
Injured 3/E cabin
FUNNEL
Generator funnel
Funnel deck in level of 'C' deck badly bulged causing funnel tilting
Completely gutted
3RD ENGR No. 9
3RD ENGR No. 8
3RD OFFR No. 5
2ND OFFR No. 6
C/COOK
SPARE
P/MAN
BOSUN
LAV.
UP
DN.

C Deck

Engine room casing and funnel deck badly buckled, tilted forward due to fire heat


Burnt and damaged
FUNNEL
D DECK

NAVIGATION DECK



View from STBD to Port
CCR Panel on aft STBD side in wheel house

View from Port to STBD side
Maneuvering console with burnt out control and engine telegraph

ECR Console of aft port wheel house

STBD side Bridge Wing

2 ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 PRIMARY CAUSE OF THE ENGINE ROOM EXPLOSION & FIRE

Based on the available information it seems that the cause behind such catastrophic explosion is starting of a soot fire in Main Engine Exhaust gas trunk around economizer region which got aggravated to Hydrogen fire and resulted in rupture of large sized steam-water drum of auxiliary boiler having large amount of steam and water at high pressure. This probably happened due to rupture of some economizer tubes at soot fire stage or presence of water vapors due to improper combustion along with soot fire. The soot fire aggravated to Hydrogen /Iron fire which caused sudden and uncontrolled rise of pressure inside steam header which is connected to Auxiliary Boiler Steam-water drum via economizer steam outlet pipe. Therefore, pressure surged inside Auxiliary Boiler Steam-water drum which was the common drum for steam generated by Auxiliary Boiler as well as Exhaust gas economizer. Boiler drum pressure in this situation would have risen very rapidly beyond the drum design pressure of 22 Kg/Cm2 and beyond capacity of Safety valves.

On this vessel, Main Engine exhaust gases pass through exhaust gas economizer which has finned tubes having water inside and hot exhaust gases outside, see Illustration no.1. Hence large amount of carbon or soot gets deposited on the fins and tubes over a period of time. If the combustion is not proper, amount of unburnt carbon or soot generation increases. These deposits are supposed to be removed regularly by soot blowing for which arrangements are available on the vessel but apparently not being done based on investigation.

Normally dry soot deposits have a high ignition temperature. But when the soot gets wet with hydrocarbon vapors due to improper combustion or otherwise, their ignition temperature may come down to around 150 degree Celsius. This may result in boiler soot fire or boiler uptake fire. Even dry soot can catch fire if exhaust gas temperatures are high due to poor combustion and excessive deposit of soot.

However, during interviews engineers and engine ratings could not provide firm information about soot blowing practice being followed on the vessel. This raises serious doubts, whether proper soot blowing was being carried out at all on this vessel. Main engine running on low power could have increased chances of incomplete combustion also.

This would have helped to create the conditions needed for a soot fire as all three elements of fire triangle are present inside a typical exhaust trunking as below

- Inside an economizer, heat is already present due to passing of main engine exhaust.
- Air is available as excess unburnt component of scavenging air depending on combustion quality.
- Deposit of unburnt fuel, carbon residue (soot) are also present and stick at the outside surface of economizer tubes and fins which spread to large heating surface area of 559 sqm.
- Excess soot is also formed from incomplete combustion and use of low-grade fuel.
- If the ignition temperature of soot comes down or exhaust temperature increases, there are chances of soot fire.

For a better understanding of Soot Fire, it is helpful to understand its three stages as below

Stage 1: Normal Soot fire

Stage 2: Hydrogen Fire

Stage 3: Iron Fire

Stage 1: Normal Soot Fire:

Wet soot can catch fire at a low temperature of around 150 degree Centigrade. But even dry soot can catch fire if lot of soot is accumulated in the presence of excess oxygen and higher temperature of around 300-350 Degree Centigrade which may be present in uptake if combustion is not proper due to effects of late injection/after burning.

Normally above soot fires even if it takes place are small in nature because the heat energy is conducted away by the circulating boiler water and steam and reducing the temperature of soot deposit. Also, the sparks remain inside the funnel or diminish while passing through the flame arrestor in the funnel top. If the cooling management by failure of circulating pump failure takes place then the temperature can further shoot up to the range of 800-1000 deg C.

Stage 2: Hydrogen Fire

Hydrogen fire in an EGE occurs when the chemical reaction of dissociation of water takes place at a temperature above 1000 deg. C. This leads to the formation of Hydrogen (H2) and Carbon mono-oxide (CO) which are both combustible in nature.

$2H_2O = 2H_2 + O_2$ (Dissociation of water Leading to formation of hydrogen-H2)

$H_2O + C = H_2 + CO$ (Reaction of water with carbon deposit leading to formation of carbon monoxide-CO)

Rupture of any tube at the time of soot fire may make large quantity of Steam available for

above reaction.

This not only provides the fire with fuel due to Hydrogen, but also the oxygen needed for it to burn as per above chemical equation and the fire can become self-sustaining. At temperatures above 1100°C, the iron in the tube materials can be oxidised in a reaction that produces heat, it may also react with steam in a different process which also generates heat. Collectively, these two reactions are known as iron fires. Such self-sustaining fires can only be extinguished by applying copious amounts of water to cool the fire below 1000°C. A lesser amount of water, which allows the temperature to be sustained, may provide additional fuel for the fire.

Stage 3: Iron Fire

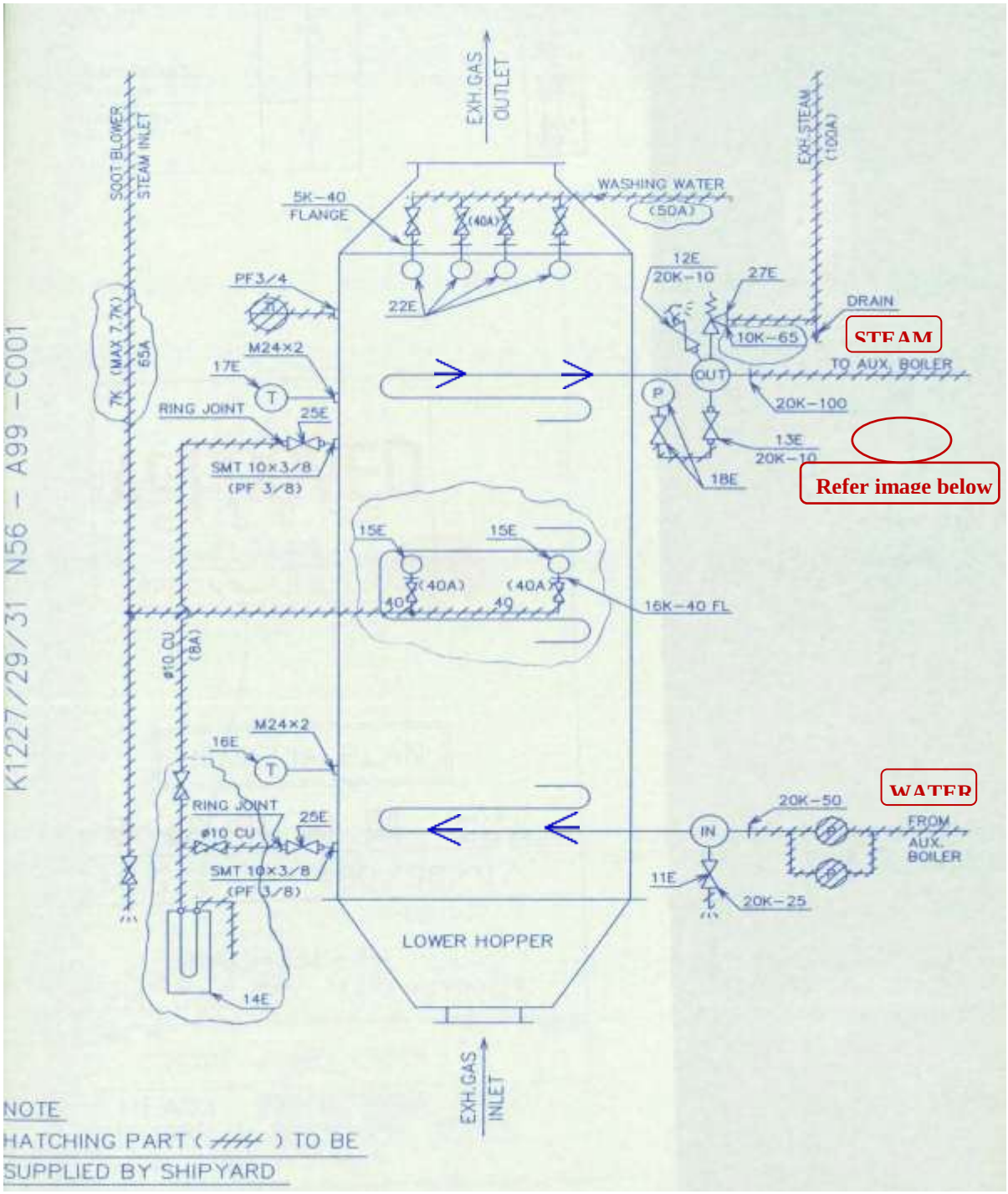
At this stage, the chain reaction of oxidation of iron metal starts at a high temperature of 1100 deg. C which means at such high temperature the tube will start burning itself, leading to complete meltdown of tube stacks.

$2Fe + O2 = 2FeO+$ heat (Exothermic Reaction)

It is strictly advised not to use water or steam at this stage to fight the fire because the overheated iron will react with water to continue this reaction.

$Fe + H2O = FeO+ H2 +$ heat

ILLUSTRATION NO 01 – STEAM OUTLET CONNECTION FROM ECONOMIZER TO AUX BOILER



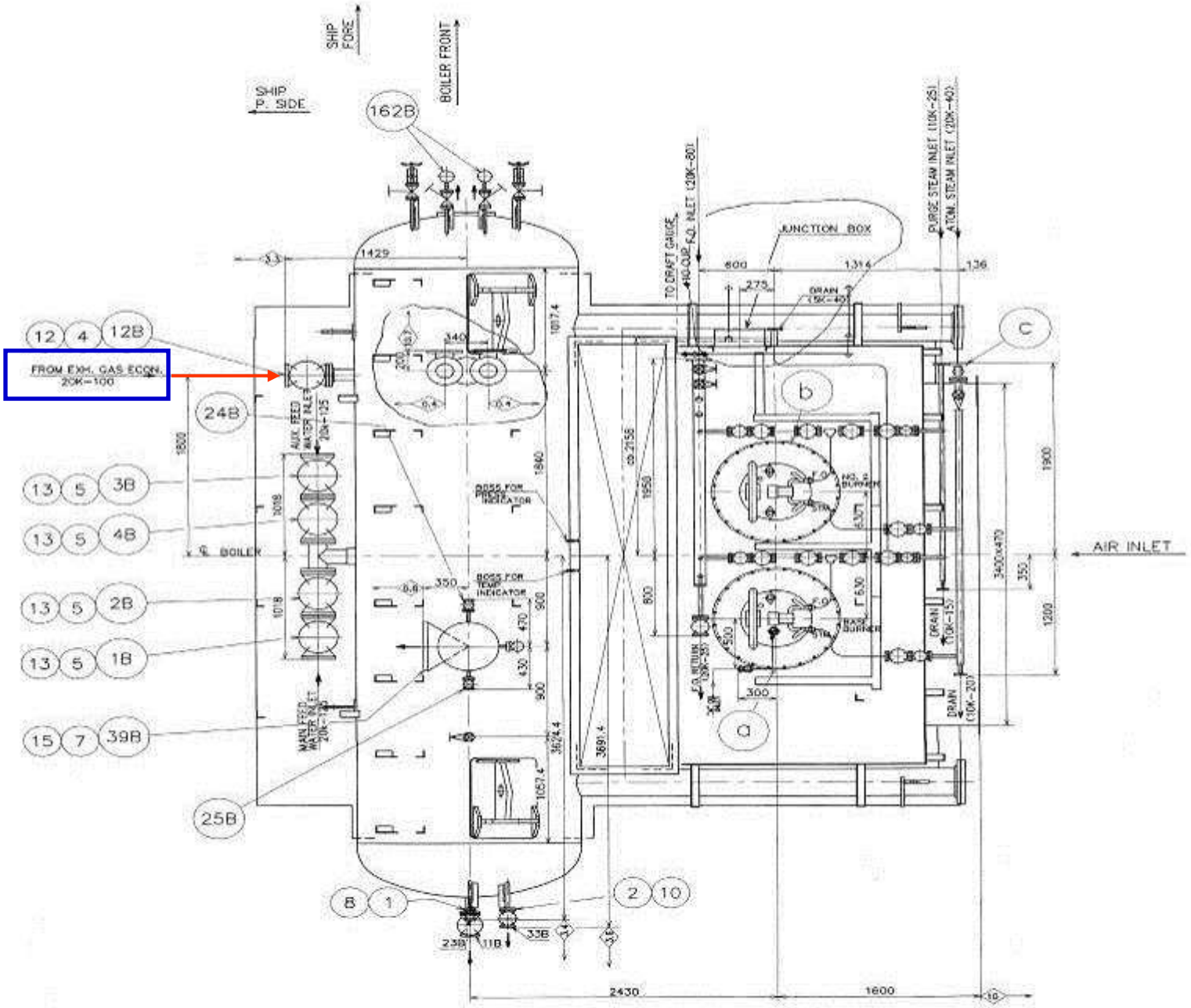


ILLUSTRATION NO 02 – STEAM INLET CONNECTION FROM ECONOMIZER TO AUX BOILER

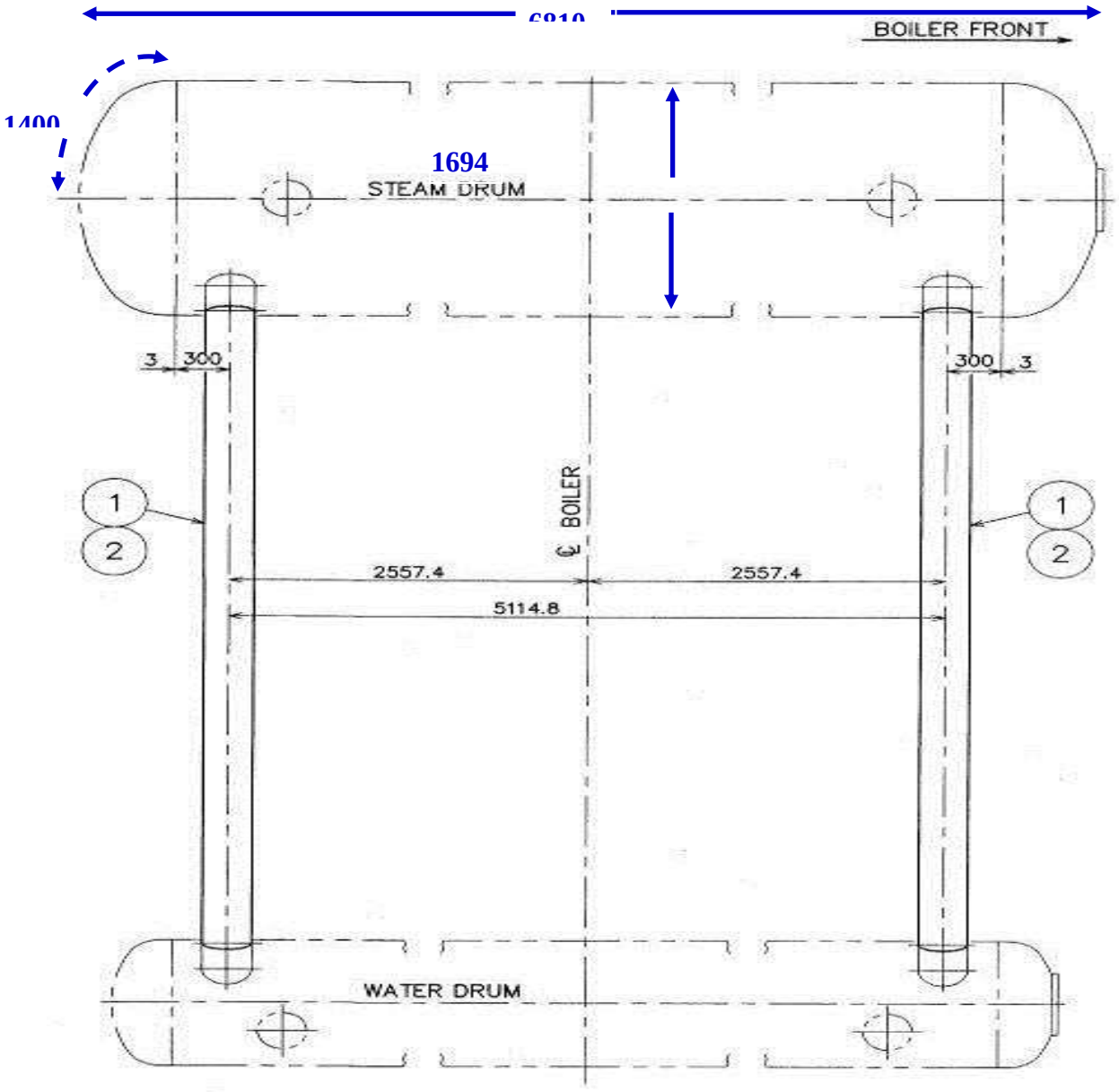
2.3 ROOT CAUSE

2.3.1 INTERNAL CAUSE
FAILURE OF ESSENTIAL AUXILIARY MACHINERY

- The primary reason behind such massive damage appears to be sudden explosion and rupture of Auxiliary Boiler Steam-water Drum. This conclusion is based on following findings:
  Boiler drum was having large amount of water at high temperature and pressure and as a result high amount of energy capable of causing such massive damages. Being a large tanker, the Boiler was relatively very big in size. It was a cylindrical steam drum with hemispherical ends - 6810 mm length and 1694 mm radius (refer Sketch). Boiler Design Pressure is 22 kgf/cm2, Working pressure 20 kgf/cm2 and designed evaporation rate of 75000 kg/hr. The Super-heated water from economizer turns into steam with sudden pressure increase in steam-water drum which could not hold surge in pressure, leading to explosion of drum with its metal pieces flying in all direction and emitting massive energy. The amount of energy which would develop inside steam-water drum of volume 60 cu meter at working temperature of 70 degree C for steam of specific heat value 1.85Kj/Kg K will be about 11.6GJ. This amount of energy within the steam water drum would explode with its particle and debris shooting at a speed of 116 meter/second. This energy and speed of particle can be compared with explosion effect of a small bomb which can destroy the multi storied building in few minutes. The similar damages were witnessed and reported by ship staff
- Eye witnesses indicated, large amount of steam coupled with smoke and insulation particles inside the accommodation. This was through the elevator trunks which runs all the way from 4th deck in engine room to navigation bridge deck, traversing the draft of heat of explosion with smoke, dust and fumes from engine room to various decks in accommodation up to wheel house.
- Also, the ripples of force generating during explosion travelled through metal structure of engine room casing connected to crew accommodation superstructure at "C" deck level. For this reason, impact of the explosion was maximum on this deck also near to Third Engineer's Cabin as elevator trunk also passes near to his cabin. The impact relatively reduced gradually on other decks. However, impact of damage was right up to Bridge Deck level and bridge door had collapsed.
- Damage was concentrated more on Port Side and branching of exhaust uptake for IG line /Deck seal etc. is also on Port side.
- Since the original damage was relatively less on lower decks of accommodation (many crew members were in mess room area located on A and B deck at the time of explosion and fortunately didn't suffer much injury) crankcase explosion is less likely as primary source of explosion was against Boiler explosion.
- Subsequently after the entire engine room was engulfed in fire and after many other explosions including that of Port side Fuel oil tank no 1 & 2, it is quite possible that crankcase also caught fire subsequently. Evidence of fire was clearly visible inside crankcase, but it was not localized near any particular unit which normally happens in a crank case explosion. Also, there was no melting of handrails, support handles and components inside crank case unlike areas near Boiler where most structure is totally melted

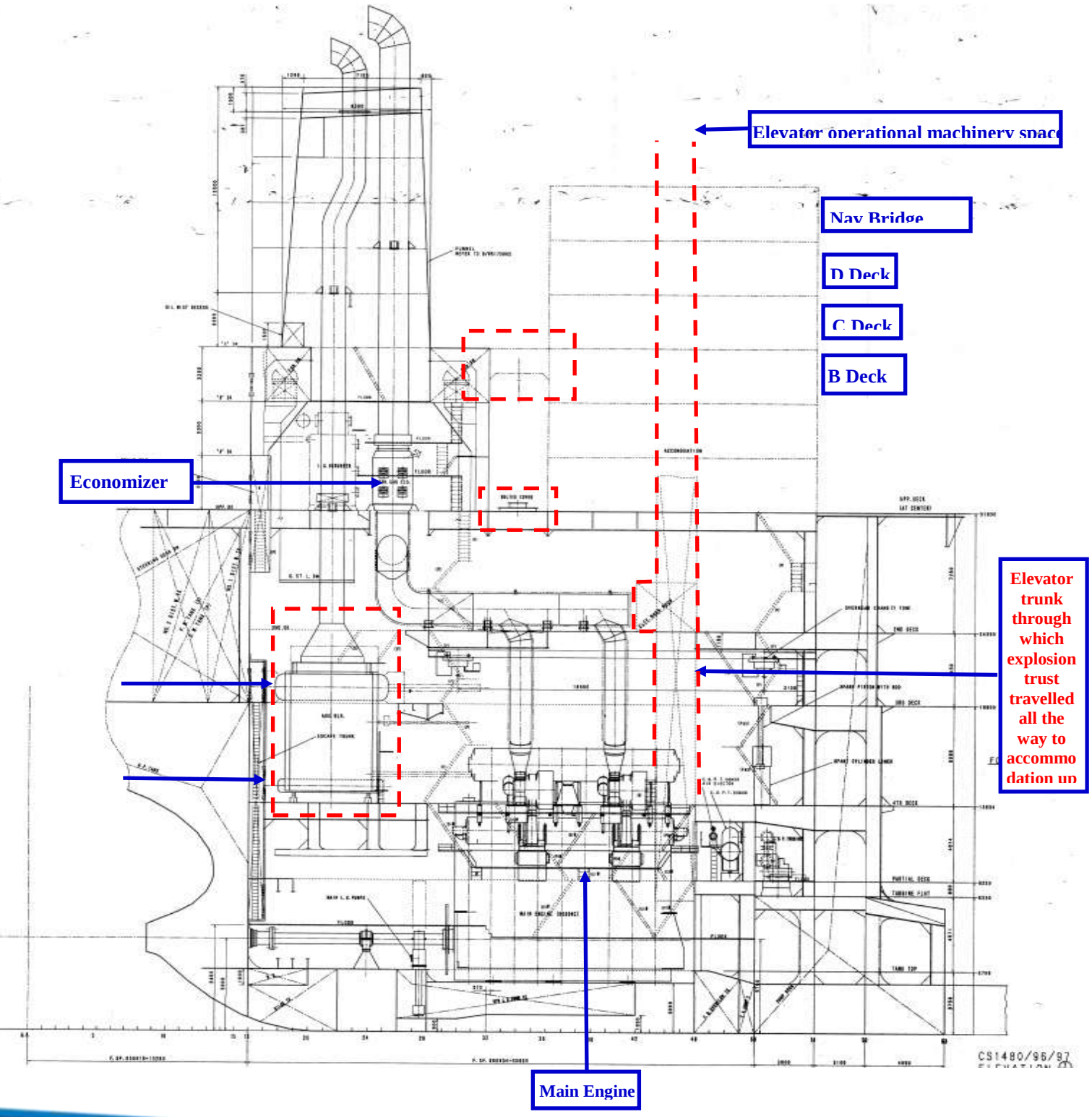
and deformed. This indicates that original explosion is from the Boiler steam-water drum.

- Engine room skylight was also badly damaged which indicates massive sudden explosion with significant energy near boiler platform.
- Fuel Tank no. 1 Port with its major boundaries inside the engine room exploded soon afterwards and its manhole on main deck port side flew off. This may be possible due to large amount of heat generation near the Fuel Tank after boiler drum explosion.



ILLUSTRAION NO 3

RED DOTTED LINES SURROUNDING THE PATH OF EXPLOSION ENERGY



2.3.2 **CONTIBUTORY CAUSES**

In addition to above causes, one or more of below stated causes would also aggravate the situation:

High exhaust temperature
Absence of lifting of safety valve of boiler.
Overlooking local fire alarm
Un-noticed spark from funnel

2.3.3 EXTERNAL CAUSES

HUMAN VIOLATION & ERROR
INCORRECT OPERATION OF CONTROL & EQUIPMENTS

- During interview with the engineering team, evidence of proper and effective soot blowing could not be established even though vessel is quite old. Engineering staff was not consistent in their response about when and how soot blowing was being carried out. Most of the engineers appeared unaware about any soot blowing being carried out if at all.

- Chances of IG line catching fire appears remote as master during his interview said that he himself had taken round on the deck and found no abnormality on deck IG Line or deck seal etc.
- A big portion of exhaust funnel uptake had blown out, which indicates sudden and massive buildup of pressure inside Exhaust gas uptake after soot fire.
- Chances of Boiler drum explosion due to auxiliary boiler burner backfire is ruled out as boiler was not being fired and instead exhaust gas economizer was in use.

FORGETTING TO REPORT INFORMATION

VDR data being important for investigation of such severe accident was not shared promptly with the flag state and investigating team directly from the ship or the owner vessel.
Vital part of VDR sound recordings made available to investigating team around the time of explosion at 0730hrs as missing. This is a bit strange and investigating sent the recording for forensic check. Surprisingly as per forensic report VDR recording is allegedly tampered. Refer supporting folders.

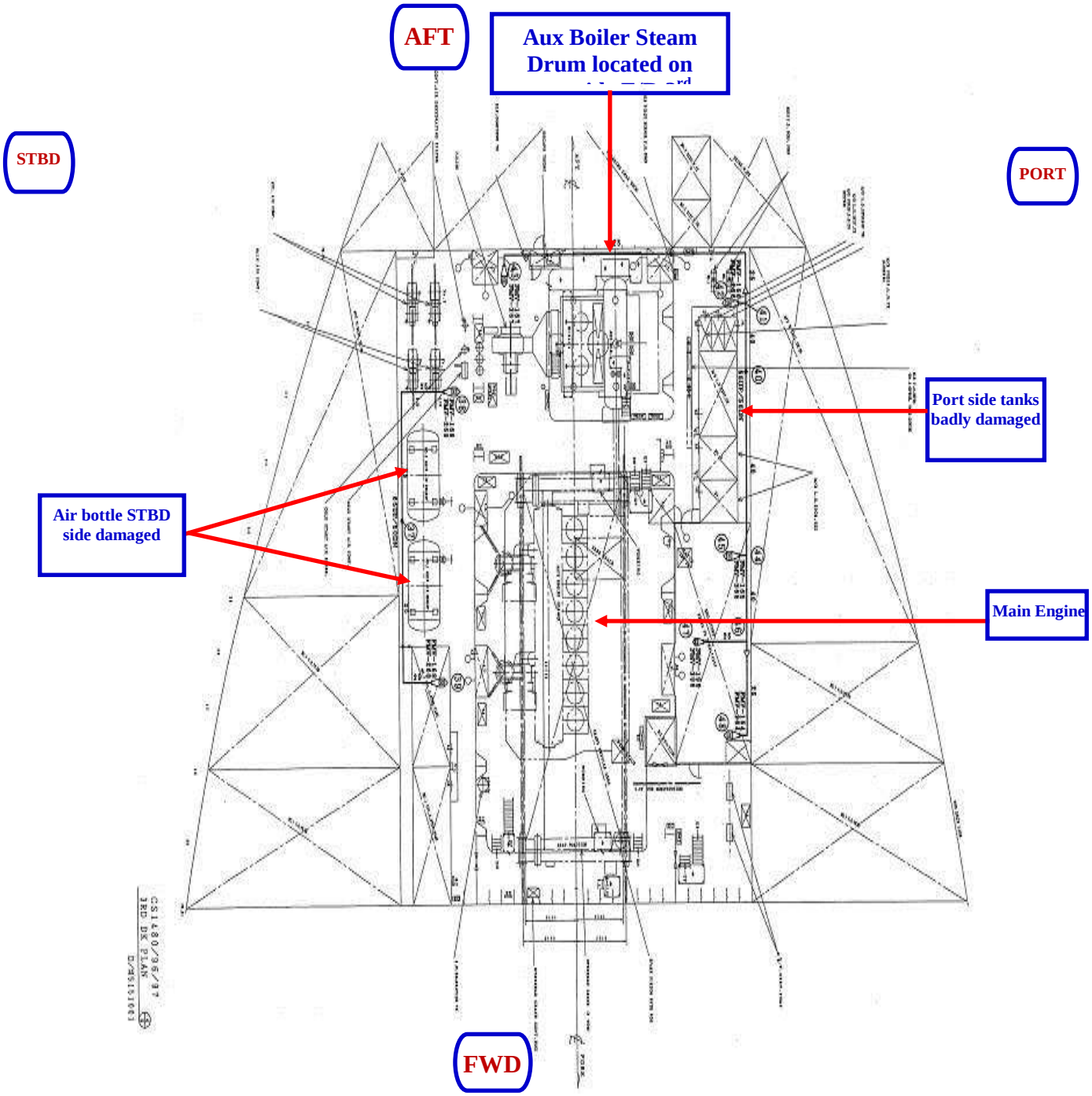
2.4 CONSTRAINTS IN ROOT CAUSE ANALYSIS

The investigation in this particular instance was significantly hampered due to the following constraints.

1. Investigating team was not able to visit on board vessel for about five months after the incident due to emergency situation on board and vessel being under supervision of Salvage Company apart from other logical constraints including COVID Pandemic related

constraints.

2. Incident took place on 3rd September 2020 in Sri Lankan waters and investigating team could visit vessel only on 30th January 2021at Kalba anchorage after vessel was towed to Dubai and discharge of cargo. Even after boarding vessel, most areas of engine room including areas near Boiler were inaccessible due to total collapse and melt down of Engine room stairways, hand railings and floor plates etc. Many machinery parts and other structures were melted down due to tremendous generation of heat and multiple explosions as a result of long duration of fire lasting over many days. Permission to visit Pump room was specifically denied to Investigating team during their visit as it was reportedly not gas free.
3. Ship staff, particularly engineers also could not go to engine room for investigation after the explosion and all of them were evacuated from vessel and sent ashore in Sri Lanka and thereafter sent home.
4. The only person present in the engine room at the time of explosion was oiler. Unfortunately, he became a casualty himself.
5. Engineer on duty was Second Engineer who was on Bridge deck where ECR was also located. He advised the investigating team that he had no idea about the reasons behind this accident. As per him all machineries were operating normal till the time of explosion and explosion was sudden.
6. Chief Engineer during interview stated that he himself fell down and fainted due to serious impact of explosion while he was in his cabin. He also mentioned that he has no idea why this explosion took place and as per him also all parameters were normal when he visited Engine control room short while before the explosion.
7. Third Engineer in charge of previous 0001-0400 watch was inside his cabin. He was badly injured and fainted due to sudden falling of deckhead ceiling inside his cabin. He was also unable to think of any reason behind such massive explosion.
8. No other ship staff during interview had any clue as to why this explosion took place when asked by the investigating team.
9. Relevant Records on board including Engine log book were burnt and could not be accessed.
10. Vessel had many CCTV cameras covering Engine Room, but only one was working.
11. Records of Alarm at the time of accident were not available to the investigating team which could have helped, all such records were gutted in fire. It is very strange that duty engineer did not mention about a single alarm related to poor combustion,


AFT
Aux Boiler Steam Drum located on
STBD
PORT
Port side tanks badly damaged
Air bottle STBD side damaged
Main Engine
FWD

2.5 HUMAN FACTORS

2.5.1 LIVE WARE

Standard of Competence, lack of familiarity & leadership – 3 out 0f 4 senior management officers including Master had joined about a fortnight before the accident. They had only 4-5 hours of taking over time from their predecessors. These new joiners were 1st time sailing on this 20years old ship with ECR on bridge in manned engine room as per manager's decision though the vessel continued to have UMS class certification.
It was established on the basis of interviews that regular Soot Blowing was not being undertaken on the vessel. Engineers and engine room ratings gave contradictory statements and even Chief Engineer was not sure about soot blowing being undertaken.

The question regarding the soot blowing of exhaust gas economizer was asked to all engine room staff and their answers were contradictory, state below:
Quote
CE: Not aware who is doing soot blowing
2E: It is done 08-12 watch.
3E: Soot blowing alternate date
3E Junior: My Oiler does soot blowing 08-12 watch
Oiler 08-12 watch: No soot blowing in my watch
Unquote

Lack of regular and effective soot blowing lead to excessive soot built up and a source of fire.

CE in his questionnaires answered that he is not aware, who maintains the PMS on board.
CE also stated that there is no IG Generator on board ship.
2E in particular was found during interview lacking in ship specific knowledge in spite of being on board vessel for almost nine months.
2E was more than 9 months on board but not aware who was DPA and CSO for the vessel.
2O: SOLAS guidelines requires VDR data to be saved for every serious accident but it was not done.

CE & 2E answered to many important technical questions that they did not know or they did not remember which shows they were inattentive, forgetful and lacking leadership quality which is not expected out of a management level officer on a VLCC.

Failure to respond appropriately – Even though it was known to ship staff that fire has taken place in Engine Room and at the same time Duty Oiler is also not traceable, two separate teams were not made – one for firefighting and other for Search and rescue of duty oiler. Muster list requirement was also not followed for firefighting and rescue operations.

Lack of Managerial Responsibility – Managers of vessel did not notify the Classification society of vessel, NK while opting to operate manned engine room while continuing with certificate of Unmanned Machinery Spaces.
Technical management did not brief before joining of the ship that she maintains the UMS certification while in practice operating manned engine room.

Communication – Most of the senior officers were of Greek nationality and other ship staff was of Filipino nationality. It was observed that Greek Chief Engineer was having significant difficulty in expressing himself in English. Even during interview, Chief Engineer needed help of a translator while talking to investigating team in English.

Thus, there seems to be lack of common language on board which is a requirement of ISM code. Further the owners/managers or Master of vessel delayed in providing relevant information as per IMO requirements to flag state for investigation of this accident in spite of many reminders.

Fatigue – Some management, operation and support level on board ship had completed their employment contract period and had served more than 2 months extra which would also lead to mental fatigue and lack of interest affecting professional performance.

2.5.2 HARDWARE

Maintenance and Repair – Master during his interview had reported that Following were non-operational:
One feed water pump for auxiliary boiler not working with it's automation completely off.
Many CCTV cameras of Engine Room were not working due to which complete view of Engine Room was not available to Engineers on watch.
However senior engineers, had no idea since when this deficiency is continuing. Also, they could not advice about any plan or proposal for their repairs.
This is more important in a situation where Duty Engineer is not in the Engine Room and most of the time present on Bridge. Only one oiler was generally keeping watch alone.

During on-site investigation it was also found that fitting out site the engine room had material loss wherein sub-standard repairs being undertaken on board such as airpipe and main engine starboard side exhaust trunk.

2.5.3 SOFT WARE

Less than adequate operating procedures & instructions

Vessel was maintaining certification of Class with UMS notation. However, it was reported that as per instructions of managers engine room was to be manned with duty engineer attending to ECR in wheel house and duty rating keeping watch in engine room. There was no reason given for this by Chief or Second Engineer. Master had mentioned that this practice was followed due to age of ship being more than 15 years.
While opting to maintain the engine room watches with UMS certification no Risk Assessment was recorded.
Also there was no Risk Assessment recorded for malfunctioning of CCTV cameras in engine room.

Management & Supervision
2/E at times gave contradictory statements during interview. Chief Engineer also could not provide satisfactory answer to many vital questions e.g. who was in charge of soot blowing, how often it was being undertaken, action plan to repair CCTV cameras etc.

There was lack of leadership and team work in organizing the search of missing crew.

2.5.4 ENVIRONMENT

Primarily this accident did not have any environmental effects accept in the afternoons while firefighting wind conditions were not favorable for a short duration in any day from 3rd to 9th September 2020.

3 CONCLUSIONS

Based on the limited information available with Investigating team following conclusion has been arrived at. These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular organization or individual.

- The reason behind such massive damage appears to be sudden explosion and rupture of Auxiliary Boiler steam-water Drum. Fire seems to have started as a relatively low-grade Soot Fire but got aggravated to Hydrogen fire and possibly Iron Fire. This resulted in collapse of tube stack and sudden and tremendous rise of pressure inside steam and water drum which exploded, releasing very large amount of energy along with large amount of steam, exhaust gases, soot and insulation material. Engine casing is connected with accommodation block on C Deck and explosion tremors and gases travelled inside accommodation. Third Engineers cabin was on C Deck Port side and suffered maximum damage. Elevator is also located there itself next to third engineer's cabin and via elevator hollow shaft. Explosion particles travelled up to Bridge deck through this shaft and along with connecting stairways passage. Such tremendous release of heat energy in large quantity could have brought entire engine room under fire and soon bunker tanks situated in engine room caught fire and exploded. Subsequently crank case also caught fire and resulted in the lifting of all relief valves.

- Vessel was certified UMS, but not running as UMS and no reason was given for the same even by Senior Engineers.
- Ship staff was unable to advice whether Soot blowing was being undertaken regularly and who was in-charge of the same and frequency of the same.
- Many CCTV cameras were not operational but no action plan regarding same advised by Chief Engineer.
- Even senior Engineers expressed total ignorance about any possible cause behind the incident apart from saying everything was alright in the Engine Room.
- Communication also seemed an issue There was no common language where all crew were able to make effective communication.

4 RECOMMENDATIONS

Basis available information, interviews with crew and review of all available documents and records, the recommendations to prevent similar incidents in future are summarized below.

For Ship staff

- Soot should not be allowed to accumulate as it may catch fire. Therefore, regular soot blowing is recommended with installed soot blowing arrangements.
- Periodic inspection of soot accumulation to be undertaken from inspection windows of economizer and water washing to be carried out periodically.
- Main engine combustion to be monitored with particular focus on exhaust temperatures.
- Fuel quality, combustion parameters to be maintained to reduce soot build up.
- All crew must be trained on proper, safe and quick evacuation from E/R in case the fire is out of control. The crew must be familiar with use of emergency escapes and other spaces with escape routes. The fixed firefighting installation should only be used after everyone on board is accounted for. Delay in escape means spread of fire beyond control and risk to life.
- SOLAS CH II–2, Regulation 15–2.2.2 "Training in use of EEBD shall be considered as part of training".
- All crew members to be familiarized properly soon after joining and before assigning them significant duties. More attention to be given to familiarization of safety aspects and senior staff to ensure that familiarization is effective.

For Shore Management

If a vessel is designed for UMS operation, it should be ensured that it operates in UMS mode and any deficiencies or shortcomings to be rectified on a priority basis.

- It is even more important in this type of vessel where ECR is located on the bridge and only oiler remains in the engine room alone most of the time. CCTV monitors should be in good working condition at all times so that duty engineer can have a good view of engine room.
- CCTV to be fully equipped with recording devices also so as to retrieve the information for investigation if required. This will also discourage the crew from indulging in unsafe practices on board and prevent casualties.
- Flag State guidelines must be followed in submitting preliminary report within 72 hours of very serious nature accidents such as fire and crew casualty.
- VDR recordings are an important tool in investigations. They must be promptly retrieved and saved as per instructions and ensured no tampering takes place.
- The technical managers must brief the joining officers and engineers particularly the management level staff with on board operational conditions of the vessel. Proper record and notes must be shared while there is short time is spent on board for handing over-taking over charge for each rank.

REFERENCE

Following supporting documents were used as evidence of incidence and were compiled for the record of Accident Investigation.

SR. NO	FOLDERS	CONTENTS
1	FOLDER A	• LIST OF DOCUMENTS REQUESTED • LIST OF DOCUMENTS NOT RECEIVED • SHIP PARTICULARS • SHIPS CERTIFICATES • DECLARATION OF COMPANY, DPA & CSO • COMMUNICATION & NAVIGATION EQUIPMENT • PMA CREW LIST • CREW CERTIFICATE
2	FOLDER B	• MASTER & CREW INTERVIEW • STATEMENTS OF FACT
3	FOLDER C	• VDR ANALYSIS REPORT
4	FOLDER D	• FLAG STATE INSPECTION REPORT • PSC REPORT • CLASS SURVEY STATUS REPORT • INTERNAL & EXTERNAL AUDIT REPORT • CRITICAL EQUIPMENT RECORD • DEFECT LIST • NOON REPORT • REQUISITION LIST • WATCHKEEPING PROCEDURES
5	FOLDER D1	• PARTICULARS OF MACHINERY • MONTHLY MAIN ENGINE & AUXILIARY ENGINES RUNNING HOURS REPORT • MAIN ENGINE & DIESEL GENERATOR CALIBRATION SHEET • MAINTENANCE REPORT FOR AUX.EXH. GAS BOILER MOUNTINGS- FIRE SIDE WATER WASH • MONTHLY INSPECTION REPORT FOR AUTOMATION-ELECTRICAL-ELECTRONIC SYSTEMS

6	FOLDER E	• GA PLAN- DRAWING NO. 1100081 • CAPACITY PLAN- DRAWING NO. 1102061 • ARRANGEMENT OF ENGINE ROOM- DRAWING NO. 5151001, PAGES 1 OF 12 • BOILER PLAN- VARIOUS DRAWINGS, PAGES 1 OF 94 • ARRANGEMENT OF EXHAUST GAS ECONOMIZER- DRAWING NO. N56-A99-A001 • EXH. GAS ECONOMIZER -HEADER, EVAPORATING TUBE & TUBE SUPPORTER- DRAWING NO. N56-H99-A010
7	FOLDER F	• LSA & FFA RECORDS • FIRE CONTROL AND SAFETY PLAN- DRAWING NO.4119001, PAGES 1 OF 15 • FIXED HIGH EXPANSION FOAM SYSTEM- DRAWING NO.HDZ -7693, PAGES 1 OF 68
8	FOLDER G	• VDR DATA
9	FOLDER H	• VIDEO CONFERENCING RECORDING OF INTERVIEW