



**REPUBLIC OF CYPRUS
MARINE ACCIDENT AND INCIDENT
INVESTIGATION COMMITTEE**

Investigation Report No 201A/2018

Very Serious Marine Casualty

**Fire, Explosion and Stranding of the Oil / Chemical Tanker
“ATHLOS” on 29/12/2018 off the Southern Coast of Cyprus**



A horizontal banner with a blue background featuring a wavy, water-like texture. The text is white and positioned on the left side of the banner.

MAIC

Marine Accident and Incident Investigation Committee
Cyprus

Foreword

The sole objective of the safety investigation under the Marine Accidents and Incidents Investigation Law N. 94 (I)/2012, in investigating an accident, is to determine its causes and circumstances, with the aim of improving the safety of life at sea and the avoidance of accidents in the future.

It is not the purpose to apportion blame or liability.

Under Section 17-(2) of the Law N. 94 (I)/2012 a person is required to provide witness to investigators truthfully. If the contents of this statement were subsequently submitted as evidence in court proceedings, then this would contradict the principle that a person cannot be required to give evidence against themselves.

Therefore, the Marine Accidents and Incidents Investigation Committee, makes this report available to interested parties, on the strict understanding that, it will not be used in any court proceedings anywhere in the world.

This investigation was carried out with the cooperation of the Malta Marine Safety Investigation Unit (MSIU) and the Hellenic Bureau of Marine Casualties Investigation (HBMCi).

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List of Acronyms and Abbreviations

AB	Able Seaman
BAC	Blood Alcohol Content
CCR	Cargo Control Room
CCTV	Closed Circuit Television Cameras
C/E	Chief Engineer
C/O	Chief Officer
CoC	Certificate of Competency
COT	Cargo Oil Tank
DPA	Designated Person Ashore
ERT	Emergency Response Team
FFLB	Free-Fall Life Boat
GA	General Alarm
IFO	Intermediate Fuel Oil
ISM Code	International Management Code for the Safe Operation of Ships
Knots	Speed in nautical miles per hour
Lat.	Latitude
Long.	Longitude
LFL	Lower Flammable Limit
l.t.	Local Time
m	Meter
MC	Management Company
JRCC	Joint Rescue Coordination Centre
MT	Metric Ton
ME	Main Engine
MDO	Marine Diesel Oil
MPX	Master-Pilot Exchange
POB	Pilot On Board
PSN	Position
RPM	Revolutions per Minute
SAR	Search And Rescue
2/O	Second Officer
SMC	ISM Safety Management Certificate
SMM	Safety Management Manual
SMS	Safety Management System
SOLAS	Safety of Life At Sea Convention
STCW95	International Convention on Standards of Training, Certification and Watch keeping for Seafarers 1978, as amended
S-VDR	Simplified -Voyage Data Recorder
3/O	Third Officer
VTS	Vessel Traffic Services
UTC	Universal Time Coordinated
VHF	Very High Frequency Radio
ZT	Zone Time

1. Summary

In conducting its investigation, the Marine Accident Investigation Committee (MAIC), visited the vessel several times at the grounding position and in the repair yard at Limassol port and taken interviews from crew witnesses, collected material and documentary evidence and reviewed documents provided by the Master and the Management Company. A detailed fact finding and incident review was performed to identify all factors that might have played a role in the series of events that culminated in the ultimate accident - the tanks' explosion.

Accident Description

Oil / Chemical Tanker "ATHLOS", under Malta flag, operated by Management Company "Enea Management Inc, Greece", suffered explosion, in the morning of Saturday 29 December 2018 at 09:27 l.t., shortly after leaving Larnaca. The fire was extinguished while vessel turned to coast and finally ran aground off Zygi (fishing village on the south coast of Cyprus), 200 metres from the coast.

As a result of the explosion and the fire, the vessel sustained severe structural damage, in way of No. 4,5,6, cargo oil tanks, adjacent ballast tanks and main deck. There was no indication of fire in the accommodation and the engine room.

Five crew members of the total crew of seventeen, jumped overboard, all five were rescued, two of them suffering serious burns of 35 per cent and 7 per cent respectively. All five were taken to hospital. Three of them were later released, but the two suffering serious burns remained for treatment, one of whom died 30 days later, in Nicosia General Hospital.

The Larnaca Joint Rescue Coordination Centre (JRCC), coordinated the rescue operation, as part of the Cyprus national rescue scheme "Nearchos".

Members of the Cyprus Fire Service rushed to the scene, though the fire had already been extinguished by the crew members.

Deployment of Cyprus Port and Marine Police, the Catastrophe Response Special Unit, as well as local boaters, with the aim of rescuing crew members.

A helicopter of the Cyprus Police Aviation Unit was deployed to provide imagery in case of an oil leak in the sea.

The Cyprus Fisheries Department activated the "Orpheus" Marine Pollution Emergency Plan and took preventative measures in view of a potential oil leak and staff was stationed on the scene. Nevertheless, no marine pollution was caused.

Although the source of ignition was not determined, there is evidence that the initial fire was developed in an open plastic bucket which was being used to contain minor spills, rubbish, rugs, as well as, droplets from a Vacuum Ejector's two small de-aeration pipes, during stripping of cargo tanks.

When sea water was sprayed to extinguish the fire in the plastic bucket, the flames splashed out from the plastic bucket, propagated due to the existence of hydrocarbon gasses on the deck area and through an open port, entered into a non-inerted cargo tank, causing the explosion as well as, fire on main deck.

2. Factual Information



2.1.1. Ship Particulars

Name of ship: **ATHLOS**

IMO number: **9539858**

Call sign: **9HA2125**

MMSI number: **248011000**

Flag State: **MALTA**

Type of ship: **CHEMICAL /OIL PRODUCT TANKER**

Gross tonnage: **4908**

Length overall: **109.92m**

Breadth overall: **17.20m**

Classification society: **BV**

Registered shipowner: **ATHLOS MARITIME CO LTD, VALETTA MALTA-IMO 5893387**

Ship's company: **ENEA MANAGEMENT INC., GREECE**

Year of build: **2010**

Deadweight: **6995**

Hull material: **STEEL**

Hull construction: **DOUBLE HULL**

Propulsion type: **ICE**

Type of bunkers: **IFO, MDO**

Number of crew on ship's certificate: **11**

2.1.2. Voyage Particulars

Port of departure: **LARNACA**
Port of call: **ASPROPYRGOS**
Type of voyage: **INTERNATIONAL**
Cargo information: **BALLAST**
Manning: **17**
Number of passengers: **0**

2.1.3 Marine Casualty or Incident Information

Type of marine casualty/incident:	Very Serious Marine Casualty
Date/Time:	29/12/2018 @ 09:20 Hours LT
Location:	
Position (Latitude/Longitude):	Lat.: 34° 40.29'N / Long.: 033°23.38'E
External and Internal Environment:	Sea State: Slight-NW/3, Wind: Gentle Breeze-NW/3, Daylight, Cloudy Sky, Visibility good.
Ship operation and Voyage segment:	Voyage - Displacement
Human Factors:	Yes
Consequences:	Damage to ship, Serious Injuries (Burns)

2.1.4. Shore authority involvement and emergency response

On 29/12/2018 at 09:27 l.t., M/T "ATHLOS", sustained sequential explosions which caused the collapse of No. 4,5,6, cargo oil tanks and ballast tanks bulkheads, resulting in list to stbd due to ingress of ballast water into affected cargo tanks.

"ATHLOS" transmitted distress call (fire and explosion) 3.5 miles off the village of Zygi (a fishing village on the south coast of Cyprus).

At 09:29 l.t., the Larnaca Joint Rescue Coordination Centre (Larnaca JRCC) received the distress call from "ATHLOS".

Immediately the Larnaca was mobilized. The Larnaca JRCC coordinated the rescue operation, as part of the Cyprus National Rescue Scheme "Nearchos". Deployment of Port and Marine Police, the Catastrophe Response Special Unit, as well as local boaters with the aim of rescuing crew members.

A helicopter of the Cyprus Police Aviation Unit was deployed to provide imagery in case of an oil leak in the sea. Members of the Cyprus Fire Service rushed to the scene, though the fire had already been extinguished by the crew members.

Master decided to beach the vessel and altered course towards the shore. Ordered abandon ship. Two Life-Rafts were thrown from the ship into the sea.

The fire was extinguished before stranding.

Five crew members jumped overboard.

Five crew members were rescued from the water by local fishermen and taken to the Limassol Hospital.

The vessel was beached 200m from the shore near Zygi. The list altered from stbd to port abt 5°.

Three of the five crew members were later released from Hospital. Two remained for treatment of serious burns 35% and 7% respectively.

The Department of Fisheries activated the "Orpheus" Marine Pollution Emergency Plan at Level 1 and sent personnel and vessels to assess the situation. Department of Fisheries staff was in the area and the situation was under constant monitoring.

The shipowning company "Enea Management Inc. Shipping Company", via its agent in Cyprus, "Lavar Shipping Co Ltd.", instructed Vasiliko Terminal Services (VTS) to take measures to address issues related to the protection of the marine environment. VTS placed a floating barrier around the ship.



Vessel stranded 200m from shore, with 5 degrees list to port. Two Life-Rafts were thrown into the sea. An Oil-Collection Boom and a Tug-Boat standing by to contain potential pollution.

3. Narrative



“ATHLOS” track from Larnaca gulf to beaching position

At 07:42 l.t.: Full Away (FA) on passage. Destination Aspropyrgos (Greece).

At 07:54l.t. at position Lat.: 34° 57' 80N - Long.: 033° 40' 70E altered course (a/c) to Way Point (WP) 3. Set course 205° true.

At 08:21 l.t. at position Lat.: 34° 46' 61N – Long.: 033° 37' 71E a/c to WP4. Set course 243° true.

The Master consulted the ECDIS to find a suitable coast for beaching the vessel. He identified a stretch of coast with suitable seabed, mud-sand, and directed the ship to this point. He took the wheel and turned the ship to the shore.

At 09:55 l.t., as the vessel approached full speed ahead to the point of deliberate grounding, the Master reduced speed with the telegraph and pressed the ME emergency stop button.

At 10:00 l.t., at position Lat.: 34° 43' 77N - 033° 21' 73E, the ship with the minimum speed that had, touched the seabed smoothly, without violent shudder.



“ATHLOS” proceeding towards the shore for beaching.



“ATHLOS” stranded 200m from the shore, with 5 degrees list to port.

3.1. Sequence of Events

1. **On 27/12/2018** the M/T “ATHLOS” arrived at Larnaca roads, with 17 crew members comprising of 7 Greeks, 9 Indians and 1 Georgian.
At 1900 l.t.: End of sea passage (EOSP). Notice of readiness (NOR) tendered. Draft Fwd=6.95m - Draft Aft=7.00m. Liquids on board: IFO=106.29MT, MDO=34.54MT, LO=8320 Litres, FW=34.5MT. Cargo on board, four parcels of Oil Cargo: **UNLD 95, UNLD 98, ULSD 10PPM and GAS OIL.**
2. At 19:18 l.t.: Dropped port anchor 6 shackles in the water at position Lat.: 34° 56N - Long.: 033° 40E. At 19:24 l.t.: Finish with engine (FWE). At 20:00 l.t.: Free Pratique granted.
3. On 27/12/2018 at 24:00 l.t.: At anchor. VHF watch on Ch.14&16.
4. **On 28/12/2018** at 06:48 l.t.: SBE.
5. At 07:00 l.t.: Commenced heaving-up anchor.
6. At 07:12 l.t.: Anchor up. At 07:30 l.t.: Pilot on board (POB). Master – Pilot Exchange (MPX). At 08:18 l.t.: Tug made fast aft.
7. At 08:28 l.t.: Dropped port & stbd anchors.
8. At 08:36 l.t.: First line on mooring buoy.
9. At 08:54 l.t.: All fast. Pilot disembarked. Tug cast off. FWE.
10. At 10:54 l.t.: Commenced discharging cargo Unleaded 95.
11. At 14:00 l.t.: Commenced ballasting.
12. At 20:42 l.t.: Completed discharging cargo Unleaded 95.
13. At 20:48 l.t.: Commenced discharging cargo Unleaded 98.
14. At 21:48 l.t.: Completed ballasting.
15. At 23:12 l.t.: Completed discharging cargo Unleaded 98.
16. At 23:24 l.t.: Cargo hose disconnected from Unleaded 98 line and connected to ballast manifold for flushing.
17. At 23:30 l.t.: Commenced flushing shore line with sea water.
18. At 23:36 l.t.: Completed flushing shore line with sea water.
19. At 23:48 l.t.: Unleaded 98 hose disconnected.
20. At 23:48 l.t.: Commenced discharging cargo Gas Oil.

21. **On 29/12/2018** at 00:54: Completed discharging cargo Gas Oil.
22. At 01:00 l.t.: cargo hose disconnected from Gas Oil line and connected to ULSD 10PPM line.
23. At 01:06 l.t.: Commenced discharging cargo ULSD 10PPM.
24. At 06:06 l.t.: Completed discharging cargo ULSD 10PPM.
25. At 06:06 l.t.: Commenced cargo tanks inspection.
26. At 06:18 l.t.: Completed cargo tanks inspection. **Empty Tanks Report was issued.**
27. At 06:42 l.t.: Cargo hose disconnected from ULSD 10PPM line.

Departure from Larnaca SBM

28. At 06:54 l.t.: Stand-by-engine (SBE) for departure.
29. 07:00 l.t.: POB. MPX. Commenced unmooring.
30. At 07:12 l.t.: All lines on board.
31. At 07:30 l.t.: Anchor aweigh. Pilot disembarked. Vessel proceeding with various courses along the southern coast of Cyprus.
32. The Bosun with the Chief Officer (C/O) who were at the forward mooring station, secured the anchors. While they were taking the anchors up, the C/O said to Bosun to prepare everything for washing. Then, the CO went in the cargo control room (CCR) where he arranged the cargo documents which were on the table.
33. The ABs who were at the aft mooring station, collected the mooring ropes. The Bosun went aft and checked that the ABs secured the ropes properly. After, the Bosun together with the ABs went on the main deck, and took the pilot ladder up.
34. At 07:42 l.t.: Full Away (FA) on passage. Destination Aspropyrgos (Greece). On the Nav Bridge were the Master, the two Second Officers and the AB of watch (4-8). The Second Officers were preparing messages and the Master was navigating the vessel.
35. At 07:54 l.t. at position Lat.: 34° 57'80N - Long.: 033° 40' 70E vessel altered course to Way Point (WP) 3. Set course 205° true.
36. At 08:21 l.t. at position Lat.: 34° 46' 61N – Long.: 033° 37' 71E vessel altered course to WP4. Set course 243° true.
37. Between 08:20 – 08:35 l.t., the C/O left from CCR and had a short meeting on main deck with the Bosun and the three (2) ABs. He told them that will wash No. 2 Port & Stbd and 5P and 6P Cargo Oil Tanks (COT).

38. He told them to prepare the tank cleaning hoses and the flexible hose for the blower. Also, after finishing tank cleaning preparation, to secure the deck for sailing. Then to have breakfast. After lunch to start the tank cleaning job.
39. At 08:42 l.t. at position Lat.: 34° 44' 57N – Long.: 033 ° 32' 79E the Main Engine's (ME) fuel was changed over from marine diesel oil (MDO) to intermediate fuel oil (IFO).
40. When the navigational situation was clear, the Master went in his cabin. At around 09:00 l.t., he was filling in documents on the computer.
41. At around 09:00 l.t., the C/O went inside the accommodation, had breakfast and then went in his cabin. Before going to his cabin, the C/O called the Engine Control Room (ECR), and spoke with the Chief Engineer (C/E). Then, he passed from Master's cabin and informed him that he will start washing cargo tanks later at about 12:00 and that he was going for rest.
42. Some minutes after the Master left, the 2/O (12-4) also left from the Nav Bridge. On the Nav Bridge remained the 2/O of the watch (8-12). There was no AB. The 2/O of the watch (8-12) was alone on the Nav Bridge. He was navigating with ECDIS. He was standing at the port side ECDIS (the vessel has two ECDIS).

On the Main Deck

43. A fixed gas freeing fan and venting line is fitted on main deck. A flexible tube was connected to the venting line and its other end, was placed near No.6(P) hatch coaming. No.5 (P) and No.6(P) hatch coamings, as well as the respective sounding/sighting ports, were open. The ventilation was not in operation. Then, the two ABs (as instructed by the C/O), were preparing the water supply flexible black hoses for the washing of No.2(P) and No.2(stbd) cargo tanks. The Indian AB was giving to the Greek AB the water supply flexible black hoses (from their storage place above the main deck), while the Greek AB was on the main deck, in order to connect them to the "Butterworth" tank cleaning machines. The C/O would then send water through Butterworth to wash the cargo tanks. When the Greek AB finished connecting the No.2(P) hose and walked to go to the No.2(stbd), he saw smoke near the cargo pump of the No. 6(P) cargo tank. Then, both ABs run aft, through the hoisted deck-way, towards the No.6(P) cargo tank area, where the fire was sighted.
44. At the same time, the Bosun who was standing at the manifolds port side, saw smoke near No.6 (P) cargo tank. He also run aft and saw the fire in a plastic bucket located aft of the Vacuum Ejector. (The open plastic bucket was used to contain minor spills, rubbish, rugs, as well as, droplets from the Vacuum Ejector's two small pipes during stripping /draining of cargo tanks). The two ABs started preparing the Fire-Hose. The Bosun shouted fire-fire-fire, and went in the Cargo Control Room (CCR). According to his statement, he started the Fire Pump and the Foam Pump from the CCR. The 2 ABs were keeping the fire hose and nozzle, awaiting the water to come. The Bosun returned from the CCR, went close to them and untied the hose because it was twisted. The ABs directed the nozzle to the fire in the plastic bucket and water came out with pressure. After sprayed water for 5-6 seconds the fire spread. Its size, from half a meter became 2-3 meters. The plastic bucket melted. Some remaining liquid in the plastic container, splashed on the deck and got fire.

The fire spread around 3-4m. When the Greek AB saw the fire intensifying, shouted at the Bosun and the Indian AB to leave. He let the hose down and ran forward.

45. **At 09:27 l.t.**, after the fire spread out of the plastic bucket, at position Lat.: 34° 40' 29N – Long.: 033° 23' 38E 3.5 miles off the village of Zygi, an explosion occurred inside the cargo tanks and a fire broke out on the main deck. Sequential explosions in cargo and ballast tanks from No.2 to No.6 caused the collapse of the cargo and ballast tanks bulkheads, resulting in list to stbd.

(The flames have most probably propagated through the flammable gasses getting out from the open No.6(P) sounding / sighting port over the main deck and then entered through the same port in No.6(P) cargo tank).

46. The explosion threw the Greek AB at the base of the deck crane. The other two were behind him. He got up and continued to run forward. So, did they. The Greek AB saw that Bosun had trauma on his head.

The bosun fell down on the pipe lines, in close proximity to No. 5 (stbd) cargo tank. Moreover, his overall caught fire. He was unconscious for some time but he regained it. Soon after was able to run away from the area, taking off his burning overall. As soon as he took off his overall, the fire on him stopped. He had burns on his foot, hands and trauma to his head. He run forward, to be stand-by there, because the vessel listed. Three people were there, the Bosun and the two ABs.

The Bosun saw at aft stbd side the 2/O and the Oiler jumping into the sea. The list was very big. They jumped from 4-5m height. After he saw them, he jumped into the sea from forward stbd side. The other AB who got burns, jumped also into the sea. The Greek AB didn't jump and went aft.

On the Nav Bridge & Accommodation

47. The 2/O on the Nav Bridge, heard the explosion and within seconds there was smoke and fire. Simultaneously the front glass of the Nav Bridge broke. At about the same time, the Master got up from the computer and headed to the cabin's bedroom. While entering the bedroom, heard silent noise and at the same time humming and jerking repeatedly. He turned his head to the front window and saw a flame at the height of the window. He approached the window and saw smoke and fire on the deck. He shouted "fire - fire – fire" and run towards the Nav Bridge. By the time the Master went out of his cabin, heard the fire alarm. He went up to the Nav Bridge, where he found the 2/O who was shocked. The front window of the Nav Bridge was crushed and smoke entered inside.

48. The C/O who was in his cabin washing his teeth, heard a big sound. As soon as he got out of his cabin, heard the fire alarm.

49. The Cook was drinking coffee. He noticed a repeated "boom-boom-boom", at least three times. He went to the kitchen and closed the oven and the ventilation. From the windows he saw smoke and heard the fire alarm as well as "fire-fire-fire" shouting. He thought something had happened to the ship's engine.

50. The 2/O as instructed by the Master, called on the public address (P.A.) System and said "Attention all crew. Please go at Master Station". He sent distress call MAYDAY on Ch. 16: "This is M/T ATHLOS 9HA2125 at position Lat.: 34° 40' 29N – Long.: 033° 23' 38E and gave the nature of the distress – Fire/Explosion. We need assistance". He pressed the

general alarm (GA) button. Pressed distress button of MF/HF, VHF Ch.70 and INMARSAT-C.

51. At 09:29 l.t., the Larnaca Joint Rescue Coordination Centre (Larnaca JRCC) received the distress call from "ATHLOS".
52. At about 0932 l.t., as the vessel was continuously listing to stbd side, the Master gave orders to abandon the ship.

In the Engine Room (ER)

53. All engine crew was in the ER except Oiler No.3 (12-4) who was sleeping.

At 09:27 l.t., the Oiler No.1 heard “boom-boom-boom” while he was heading to the door of the Engine Control Room (ECR) and assumed that the vessel grounded. He looked at the main engine (ME) and it was working normally. The Third Engineer (3/O) and Oiler No.2 were cleaning the De-Laval for the diesel oil. At the time of the “boom-boom-boom” they immediately got out of the workshop and saw the Main Engine (ME) from above. The Oiler No.2 thought that something had happened with the ME. After realizing that the ME was working properly, entered in the ECR together with Oiler No.1 and from the closed-circuit television cameras (CCTV), saw the fire. The fire along with black smoke was on the port side, at the manifolds. Immediately Oiler No.1 pressed the Fire Alarm button. Then Oiler No.1 and No.2 proceeded from the ER to the accommodation where met the Master, who told them to start the fire pump. They returned in the ECR and started the fire pump. Then they got out from the ER and went in the accommodation.

The C/E was in the ER. The C/E thought that it was the engine's turbine. He went to the turbine, and realised that it wasn't and then proceeded inside the ER towards the Boiler when he heard the Fire Alarm. The C/E left the Boiler and went to ECR, where was the 3/E and told him to put the Electrical Generator on the network. Then he proceeded from the ER to the accommodation.

Outside of the Cargo Control Room (CCR), the C/E met the C/O who told him that the Master said to start the Foam Pump. The 2/E and 3/E went to the Air-condition Room where the Foam system is in and started the Foam Pump. The C/E opened the Main Valve on the Foam system. The two deck aft cannons were directed towards the fire. When they put them on, locked them with lever and then went at the aft poop deck stbd side.

On the Nav Bridge&Accommodation

54. The No1 and No.2 Oilers, went in the alleyway, where met the 2/O (12-4). Then, they met the C/O outside CCR who said “abandon-abandon ship”. The C/O proceeded up via the external stairs to the Free-Fall Life Boat (FFLB). He was followed by the 2/O (12-4), the three Oilers and other crew members. They removed the FFLB battery charging cable. Then opened the FFLB door. The C/O told them to get into the FFLB. No.1 Oiler told him that it was very high and showed him the Life-Rafts (LR). Also, the vessel had developed excessive list. Then they saw a speed-boat near the vessel and shouted "help-help". Some crew members descended from the external stbd stairs to the Poop Deck stbd side.

55. At the same time, the 2/O collected the EPIRB, SART, GMDSS VHF. He passed them to crew who were at the Poop deck.
56. After that, the C/O left from the FFLB area and went in the Nav Bridge. Then, with the 2/O went to the poop deck and deployed the LR. Then he went in the CCR. The Master brought the crew's certificates, seaman books on the Nav Bridge and the 2/O put them in a bag. The 2/O went to the CCR and gave the bag to the C/O. Then, the C/O started de-ballasting the stbd side tanks to correct the stbd list. The C/O remained in CCR and the 2/O returned on the Nav Bridge.
57. In the meantime, the Master checked with ECDIS the ship's position and the area the ship was at that time. It was close to the southern coast of Cyprus, on the course of the ship, 3-4 NM from the shores. Thinking that the ship with the gradient he had picked up could be overturned, he decided to be as close as possible to rescue services from land. He looked in ECDIS to find a suitable coast for beaching the vessel. He found a coast with a suitable seabed, (mud-sand) and directed the ship to that point. He took the wheel and turned the ship to the shore.

Beaching and Rescue Operations

58. The ME continued operating and the foam monitor guns continued to spray foam.
59. At about 09:40 l.t., a speed-boat arrived close to the vessel for granting help. The No.1 and No.2 Oilers and the 2/O who were wearing life-jackets, jumped into the sea. They boarded on the speed-boat.
60. Then, they saw the Bosun in the water wearing a Life-Buoy and told the fisherman to direct the speed-boat to him. When the No.1 Oiler grabbed him by the arms to pull him into the speed-boat, his skin was leaving.
61. As the speed-boat was proceeding towards the shore, they saw the other AB who jumped. He was not wearing a life-jacket, nor swimming, but was simply floating on the water. The Oiler and the fisherman pulled the AB onto the speed-boat. The Bosun and the AB were wearing only their underwear. They had their body, face and hair burned.
62. The speed-boat took the 5 crew members to Zygi Fishery Shelter. The Marine Police was there. After about 5 minutes arrived Ambulance and took the Bosun and the AB to the Limassol Hospital. Another Ambulance brought the two Oilers and the 2/O to the Limasol Hospital.
63. At about 09:50 l.t., the fire was extinguished by the foam monitor guns. Therefore, the Master gave orders to cancel the abandonment.
64. Contact was established with Larnaca JRCC on VHF Ch. 16/06. The C/E was speaking on the VHF saying what the Master was telling him, while the Master still keeping the wheel. It was given the ship's position, the kind of danger "Explosion-Fire- Big List" and that is proceeding for beaching.

65. At 09:55 l.t., as the vessel approached full speed ahead to the point of deliberate grounding, the Master reduced speed with the telegraph and pressed the ME emergency stop button. At 10:00 l.t., at position Lat.: 34° 43 77N - 033° 21 73E, the ship with the minimum speed that had, touched the seabed smoothly, without violent shudder.
66. At 10:04 l.t., the Master contacted on mobile phone the Management Company (MC), and informed about the situation.
67. At 10:05 l.t., Larnaca JRCC informed the Master, that 5 crew members were rescued.
68. The vessel after beaching listed from stbd to port side.
69. At 10:10 l.t., the Master called the crew on the Bridge and counted them and found that 5 were missing.
70. At 10:12 l.t., the C/O and 2/O went on deck for taking soundings of Ballast Tanks and depths around the vessel.
71. At 10:41 hrs, the Master contacted Management Company's (MC) Emergency Response Team (ERT) and agents and requested them to assist in the necessary actions and measures for the potential prevention in case of oil spill.
72. At about 16:00 l.t., an underwater inspection from a local diving Company was carried out.
73. Soon after, the Local Authorities, Insurance Representatives, Class Surveyor and MC's Technical Personnel, attended the vessel.
74. On 30 December 2018 at 18:45l.t., after completion of inspection and preparatory works, the vessel re-floated with the use of tug boats. Vessel was towed to Vassiliko anchorage.
75. At 19:52 l.t., vessel anchored at Vassiliko anchorage.
76. On January 01 2019, vessel shifted to the port of Limassol, for repairs.
77. On January 29th, 2019, the AB2, after being treated for 30 days in the Intensive Care Unit of the Nicosia General Hospital, passed away. According to the Post Mortem Examination Report issued by the Coroner Service of the Republic of Cyprus, the cause of death was "Acute bronchopneumonia in the field of burning disease".



Hull Occasional Survey (Afloat and In-Water-Survey by Approved Divers), was carried out by Classification Society Bureau Veritas (BV), for the issue of a Certificate of Survey for a voyage in ballast to a repair facility at Limassol.

Preliminary damage findings, were summarized as below:

-Cargo oil tank No. 5 port/stbd side and adjacent Tanks 4 and 6 were damaged with corrugated bulkheads to have been severely damaged/partly collapsed.

-Double hull external plating had no visible damages.

-Double bottom (ballast) tanks were externally examined by diver as far as possible and appeared to be in sound condition. Double bottom tank tops were not accessible.

-Cargo oil tanks 4,5,6 were not accessible and not gas free for inspection.

-Main deck plating, in way of cargo holds 4- 6 port and stbd was severely damaged with holes and openings in various positions. Pippings, deck fittings and equipment also deformed and damaged. Main deck plating and transverse frames in way of tanks 5 and 6 stbd visibly buckled upwards.

-Deck longitudinals and transverse beams in way of Cargo oil tanks 4-5-6 port and stbd, were damaged, bend, partly detached and deformed, in various positions throughout the affected cargo tank top plating.

A further overall inspection in way of Cargo Tanks No. 4-6 port and stbd was carried out at Limassol port on 03/1/2019 and 04/01/2019 with following damages recorded:

-Center Line bulkhead detached/damaged fr. No. 41-73

-Transverse bulkheads 5 aft port/stbd and 5 forward port collapsed

-Tank-top where the corrugate was resting torn out

-Main deck torn out

-Side longitudinal bulkheads in sound condition

4. Analysis

(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).

The following analysis is based on interviews taken on board from several crew witnesses, material and documentary evidence collected from the ship and documents provided to the investigator by the Master and the Management Company.

4.1. The Crew

Certification

The Master, officers and crew of the “ATHLOS”, held STCW certificates of competency (endorsed by flag state) and all other STCW required trainings, appropriate for the type of the vessel.

A lack of certification was not a contributory factor to the accident.

Manning

At the time of the incident, the vessel was crewed by 17 seafarers, including 7 Greeks, 9 Indians and 1 Georgian. The vessel was manned well in excess of the vessel’s Minimum Safe Manning Document (MSMD). She had a crew of 17, although her MSMD provides for 11.

A lack of manpower was not a contributory factor to the accident.

Working and Living Conditions

At the time of the incident, the “ATHLOS”, had a valid Maritime Labour Compliance Certificate (MLC) along with a Declaration of Maritime Labour Compliance (DMLC) issued by the flag state.

There was no evidence to suggest that, the working and living conditions was a contributory factor to the accident.

Fatigue

According to the documents provided by the Management Company (MC) to the investigator: Prior and on the day of the accident, the recorded hours of rest of all crew members, within the last 24 hours, were more than 10 hours and more than 77 hours in any seven-day period. They were in accordance with the requirements of MLC, 2006 and STCW 78 as amended.

According to the SMSM “Procedures for the preparation of plans and instructions for shipboard operations” - Chapter 7.5.1:

Quote

The C/O must always be present in the following operations:

- commencement of loading / discharging / ballasting operations;
- completion of loading / discharging / ballasting operations; and
- during any critical part of operation.

Unquote

In order to implement the above requirement of the SMS, the C/O should have been working:

At 10:54 l.t.: Commenced discharging cargo Unleaded 95.

At 14:00 l.t.: Commenced ballasting.

Nevertheless, in his Record of Hours of Work it is shown that on the 28/12/2018, he was not working from 10:00 until 19:30. Either the SMS requirement was not implemented, or the Record of Hours of Work was inaccurate.

Also, the C/O stated that, on the 28/12/2018 during discharging in Larnaca, for crucial part of the cargo operation he should be in the CCR and that he was in the CCR during discharging.

He performed his first cargo discharging operation which should have been very stressful and exhausting. Been exhausted and possibly sleepless due to overnight cargo operations, was eager to rest. He left without supervision the Bosun, to make preparation for tank cleaning and went to rest.

There was no evidence to suggest that the Chief Officer was fatigued.

Physiological, Psychological, Psychosocial Condition#

All crew members were holders of medical certificate for service at sea issued in compliance with the STCW and MLC, 2006 Conventions as amended. They were certificated as fit for sea duty without restrictions and not suffering from any medical condition likely to be aggravated by service at sea or to render the seafarer unfit for such service or to endanger the health of other persons on board.

There was no evidence to suggest physical, physiological, psychological, or psychosocial condition of the crew, was such that could have contributed to the accident.

Experience and familiarization

The Master

The Master, held a Hellenic Master's Certificate of Competency, STCW'95 II/2, STCW Basic Safety Training, Proficiency in survival craft and rescue boat, GO-GMDSS, Medical Care, Advanced firefighting, BRM, SSO and Advanced oil tanker operation. He had 25 years seagoing experience, 10 years in command. He signed-on, on 15/09/2018, i.e., he was on board for 3 ½ months. He is considered as experienced Master and having about 3 ½ months on board he knew the ship.

The Chief Officer

The C/O, held a UK Chief Officer's Certificate of Competency, STCW'95 II/2, STCW Proficiency in survival craft and rescue boat, GO-GMDSS, Medical care, Advanced fire-fighting, BRM, SSO and Advanced oil tanker operation. He had 18 years seagoing experience. It was his first time as C/O. He signed-on, on 12/11/2018, i.e., he was on board for 1 ½ months as Second Officer and only 3 days as Chief Officer. He is not considered as experienced Chief Officer, especially serving on a demanding chemical/product tanker.

The Chief Engineer

The C/E was holder of a Hellenic Certificate of Competency STCW 95 III/2, STCW Basic Safety Training, Proficiency in survival craft and rescue boat, Medical first aid, Advanced fire-fighting, Advanced oil tanker operation and ERM. He had 30 years seagoing experience, 6 years in as Chief

Engineer. He joined the vessel on 08/12/2018. On the date of the accident he was on board for 3 weeks. His time on vessel although short, is considered adequate to familiarize himself due to short voyages and repetitive operations. He is considered as experienced C/E.

The Bosun

The Bosun was holder of a Certificate STCW II/4 (Rating forming part of a navigational watch), STCW Basic Safety Training, Proficiency in survival craft and rescue boat and General tanker familiarization. issued by the India. He had 25 years' experience at sea, all of which on tankers.

He was on board about 8 months. He was for first time as Bosun. He stated that during discharging he was doing the work of the Pumpman. The duties of the Pumpman are very specialized especially on a chemical / product tanker and experience is required.

Although he was a new Bosun, in addition, was assigned the demanding duties of the Pumpman. He is not considered experienced in performing the duties of the Pumpman.

The Management Company failed to provide adequate crewing resources. The crew placement was inadequate for chemical/product tanker demands.

4.2 The Ship

The Oil/Chemical Tanker "ATHLOS" was built in 2010 at Argem Shipyard Tuzla - Turkey by Argem Tersanecilik Turizm Sanayi LTD and is operated by "ENEAM MANAGEMENT INC" 2, Leosthenous Str. - 185 36 Piraeus – Greece.

The ship has overall length of 109.92m, length between perpendiculars of 103.20m, breadth 17.20 m, moulded depth: 8.80m, maximum summer draft 7.15m, summer freeboard: 1782 mm. The Lightship is 2811MT, the Summer Displacement is 9806 MT and the Deadweight is 6,995 MT. The gross tonnage is 4908 GRT and the net tonnage is 2229 NRT.

The vessel is of double hull construction with accommodation and machinery spaces aft. She has 12 cargo tanks numbered 1 through 6 (port and starboard) from forward. (Cargo Capacity 98%: 7830.42 M3) and 2 slop tanks (260.77 M3). She has 12 ballast tanks numbered 1 through 6 (port and starboard) from forward. Ballast Capacity 100 %: 2684.19 M3.

F.O. Capacity 100 %: 492.023M3 - G.O. Capacity 100 %: 91.505M3.

Propulsion is provided by Main Engine:

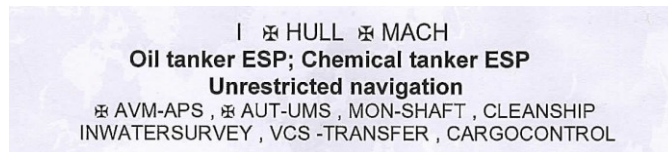
MAN B&W Marine Diesel Engine - Type 7L 32/40 with 3500 KW/4755HP AT 750 RPM
BV classed ICE 1C - 50HZ – each 1900KW@1000RPM.

The propelling system consists of 1 Screw Controllable Pitch Propeller Left Hand, LB (oil closed). Propeller immersion: 4.6 m. The service speed is 13,5 knots.

The vessel is fitted with a bow thruster. Bow-thruster: SCHOTTEL/STT 330 T-LK /450 KW 600 (BHP). Bow Thruster immersion: 1.8 m.

The Electrical installation consists of 3x Diesel Generators: 775 KVA-620KW/842 HP, 60Hz
The vessel is fitted with a Shaft Generator 1265 kVA-1150kW, 60 Hz.

Class Notation:



Inert Gas System: Nitrogen

The cargo handling equipment consists of Cargo Pumps:

12 x 2003/hr (Main Cargo Pumps- Marflex)

2 x 60 m³/hr (Slop Pumps-Marflex)

1 x 70 m³/hr (Em. Portable Pump)

The “ATHLOS” at the time of the accident, had valid certificates including an ISM, ISPS and MLC certificates. The maintenance records indicated that it was maintained in accordance with existing regulations and approved procedures.

4.3 The Environment

External environment:

The Larnaca Oil and Gas Tanker berths are situated at Larnaca roads at the southern coast - central part of Cyprus. Oil and Gas Tankers, berth there to discharge products for the terminals situated just opposite ashore.

Mooring on buoys (Single-Buoy Mooring -SBM). Position of buoys: 34° 54.75N - 33° 39 E. Limiting conditions: Controlling depth 12.70m, Max. L.O.A. 215m, Max draft 12.70m. Mean tidal levels 0.30m. Abnormal levels 0.60m. Density of water 1,025. Max. size of vessel handled 215m.

The Fire-Explosion accident occurred on 29/12/2018 at 09:27 Hrs LT, in position Lat.: 34° 40.29'N - Long.: 033°23.38'E, about two hours after departure from the Larnaca roads.

In the morning of 29/12/2018 at the southern shores of Cyprus, the weather conditions were: Sea State: Slight-NW/3, Wind: Gentle Breeze-NW/3, it was Daylight, Cloudy Sky and the Visibility was good.

There is no evidence that physical environmental factors, such as weather, climate, etc., have been a contributing factor to the incident.

4.4 Safety Management

4.4.1 Safety Management System - Tank Cleaning Procedure

According to the Safety Management System Manual (SMSM)- Procedures for the preparation of plans and instructions for shipboard operations / Chapter 7 VI. Planning of tank cleaning:

Quote

Before commencing tank cleaning operations, a meeting of the Safety Committee should be held with the following individuals attending it: Master, C/E, C/O, 2nd Engineer and Pumpman. The meeting shall deal with all matters associated with tank cleaning and a decision shall be made about the manner in which operation is to proceed. The meeting shall in particular:

- a. Study available instructions from the Company or the Charterers.
- b. Ensure that all equipment necessary for tank cleaning is in order.
- c. **Prepare the tank cleaning procedure on the basis of the last cargo discharged and the ship's next employment.**
- d. Estimate time at disposal-expected duration of tank cleaning.
- e. Fix the time to start preparation of boilers, pumps, etc. and, where necessary, of tank cleaning preheater.
- f. Prepare a detailed plan of the tank cleaning, including hours of operation, manpower required, change of ballast, need for gas freeing, treatment/storage of slops and bunker consumption. When planning tank cleaning a careful estimate, having regard to the operation of the ship in light ballast condition, the efficiency of tank cleaning and the time available on the ballast voyage, shall be made as to whether round the clock work will be required or whether the work, in order to avoid or reduce overtime, can be carried out within normal working hours. When planning the number of working hours required it is important to note that work, in connection with starting up boilers each day and also fuel consumption during periods when no work is carried out, is included in the calculations so that all expenses associated with the tank cleaning are allowed for and so that the resources in the form of manpower and fuel oil are utilized in the most profitable way.

Unquote

Comment: The C/O stated that, between 08:20 – 08:35 l.t., left from CCR and had a short meeting on main deck with the Bosun and the three (3) ABs. He told them that will wash No. 2 Port & Stbd and 5(P) and 6(P) Cargo Oil Tanks (COT). At around 09:00 l.t., the C/O went inside the accommodation, had breakfast and then went in his cabin. Before going to his cabin, the C/O called the ECR and spoke with the C/E. Then, he passed from Master's cabin and informed him that he will start washing cargo tanks later at about 12:00 and that he was going for rest.

No meeting before commencing tank cleaning operations was held in the presence of the Master, C/E, C/O, 2nd Engineer and Pumpman, to deal with all matters associated with tank cleaning. No detailed plan was prepared of the tank cleaning, including hours of operation, manpower required, change of ballast, need for gas freeing, treatment/storage of slops and bunker consumption

The SMS procedure was violated with the knowledge and acceptance of the Master. It is assumed that it was always being done the same way, i.e. it was a routine violation. The C/O was on board for only 1 ½ months, it was his first time as C/O and undertaken duties only three days before the accident. Obviously, this is the practice he learned during his 1 ½ months training period onboard. Also, the Bosun who was first time as Bosun, in the absence of Pumpman should have attend if the meeting was held. He may know how to organize the ABs, but he did not have the knowledge and experience of the Pumpman. It would have been beneficial to the inexperienced C/O and

Bosun to receive instructions and information from the Master and the C/E. It would instil the spirit of teamwork to the Bosun and the feeling that he was not alone on deck but his C/O and Master although in the accommodation, were aware about the operations in progress on the deck and maybe he would not subsequently get panicked.

The Safety Management System Manual refers to “Pumpman” but there was no such a rank on the vessel and crew list. Instead the duties of the Pumpman were assigned to an inexperienced and untrained Bosun. Therefore, it is considered that a Safety Management System’s requirement for a Pumpman’s rank was violated and it was a contributing factor to the accident.

Safety Management System’s procedure for tank cleaning not properly implemented, was a contributing factor to the accident.

Violation of Safety Management System’s requirement for a Pumpman’s rank, was a contributing factor to the accident.

4.4.2 Tank preparation for cleaning

M/T “ATHLOS” at Larnaca roads discharged benzine (petrol) and diesel. During discharging, the Bosun was doing the work of the Pumpman. According to his statement, his understanding of the discharging operation was that, each cargo tank has its own pump and discharging is being carried out with the closed system. The vapours were going out via the PV valves. During discharging the Inert Gas System was working. When the pressure is over 2000 PSI the PV valve opens. It closes when the pressure becomes 350 PSI. The Inert Gas System was working during discharging until the cargo is finished. Also that, when discharging was completed, the cargo tanks were fully inerted.

The C/O ordered the Bosun, to prepare everything for washing, which means according to the working practice on board, to strip the tanks and transfer the strippings in the slop and after to commence ventilation.

According to the above, the Bosun had the impression that during discharging at Larnaca, the Inert Gas System was working and that discharging was carried out with the closed system. His understanding of preparation for washing, meant, to strip the tanks, transfer the strippings in the slop tank and after to start ventilation.

When the cargo tanks are fully inerted is the ideal condition for tank cleaning. Ventilating inerted tanks before washing, has no logic. If the next cargo would be the same or compatible with the previous one, washing was not required and the tanks should have been maintained in inerted condition.

Also, according to his statement, the Bosun had the impression that he started the fire pump and the foam from the CCR which could not be done. Therefore, his credibility is called into question. It is considered that the discharging operation was carried out without operation of the vessel’s Nitrogen Inert Gas System. No use the Inert Gas System resulted in the creation of an enriched flammable mixture in the cargo tanks.

Between 08:20-08:35 l.t., the C/O had a small meeting on main deck with the Bosun and the three (3) ABs. He told them that will wash No. 2 Port & Stbd and 5(P) and 6(P) Cargo Oil Tanks (COT).

According to crew statements, the ventilation was not in operation. No.5 (P) and No.6(P) hatch coamings, as well as the respective sounding/sighting ports, were opened. The two ABs, connected the flexible venting tube to the main venting line and the other end was placed near No.6(P) hatch coaming.

It is assumed that, the fact that the No.6 (P) sounding /sighting port was opened and the respective No.6 COT was not gas freed or inerted, resulted in hydrocarbon gasses escaping from the No.6 COT to the deck. The existence of hydrocarbon gasses on the deck area near the No.6 (P) sounding /sighting port, allowed the flames when they splashed out from the plastic bucket to propagate and enter into the No.6 COT, causing the explosion. Therefore, opening of No.6(P) sounding / sighting port was a factor to the accident. The SMSM Chapter 7.5.8.3.V.d requirement that: “Openings to tanks which have not been washed and which are not gas freed shall be kept closed”, was violated.

Violation of SMS requirement that openings to tanks which have not been washed and which are not gas freed shall be kept closed was a direct cause of the ultimate accident, the explosion of cargo tanks.

4.4.3 Inert Gas System

The vessel is equipped with Nitrogen Inert Gas System installation, although for its type and size it is not required by regulations. Nevertheless, had the cargo tanks been inerted during discharging UNLD 95, UNLD 98, ULSD 10PPM and GAS OIL and remained inerted after completion of discharging, with cargo tanks openings closed, the catastrophic accident would not have occurred. The reason for not operating the vessel’s Nitrogen Inert Gas System during discharging is unknown.

No use of the Nitrogen Inert Gas System was a contributing factor to the accident.

4.4.4 Safety Management System - Documentation

SMSM Ch.7, does not provide instructions on when to use the Inert Gas System of the vessel. SMSM Ch.7, refers to Pumpman but there is no Pumpman in the crew list.

Chapter 8-Emergency Preparedness forms refer to “life-boats” lowering to embarkation deck instead of “free-fall life-boat”.

The “Procedures and Arrangements Manual” concerns another ship for which was approved by class on 07/01/2009.

The above indicate that the SMSM was not been properly reviewed by the MC.

Safety Management System documentation not been properly reviewed by the Management Company (Safety issue).

4.4.5 Safety Management System – Resources and Personnel

The Chief Officer had 18 years seagoing experience. He signed-on as Second Officer on 12/11/2018, i.e., he was on board for 1 ½ months. It was his first contract with the Company and his first time as C/O. He was promoted and replaced the previous Chief Officer on December 26th

2018. When the incident occurred, he was only three days as Chief Officer. He was holder of Advanced Oil Tanker Operation STCW certificate.

According to Ch.6.10.5. “Non-simultaneous discharging of Senior Officers and overlapping service period”:

Quote

Company has adopted as a standard policy and will be hereafter committed NOT to replace at the same time two senior Officers, such as Master/Chief Officer and Chief Engineer / 2nd Engineer. An overlapping period with the off-signer Officer has been established, during which the off-signer Officer remains with the on-signer Officer:

-One round voyage, including two cargo operations for on-signers Masters, C/Es and C/Os joining the vessel for the first time. Otherwise one cargo operation in port may suffice for the handing over.

-One cargo operation for on-signers Masters, C/Es and C/Os served onboard Company’s vessels.

Unquote

The period from 12/11/2018, until 26/12/ 2018, is adequate overlapping period for more than one round voyage, including two cargo operations (due to short voyages). During this period, the requirement for familiarization as required by SMSM Ch.6.10.4- “Resources and Personnel- Seagoing personnel familiarization and hand-over procedure” was fulfilled.

The SMSM requirement Ch.6.8. “Experience criteria and Table No.2 Minimum experience requirements for seagoing personnel”, requires for employment on the Company’s vessels, service on rank not less than one year. Nevertheless, the Chief Officer who was first time with the Company and first time at the rank of the Chief Officer, did not have at least one-year sea service as Chief Officer. Therefore, the Safety Management System’s criterion regarding minimum experience requirements for seagoing personnel had been violated.

SMSM / Chapter 7 VI. Planning of tank cleaning, refers to “Pumpman” a rank that does not exist on board the “ATHLOS”, instead an inexperienced and first time Bosun performed the duties of the Pumpman during cargo operations.

Violation of Safety Management System’s experience criterion for seagoing personnel was a contributing factor to the accident.

4.4.6 Safety Management System - Supervision

The SMSM Ch.6.10.4.5. requires that:

Quote

“Where an Officer is new to the Company or has just obtained his first license, his performance must be closely monitored by the Master or the C/E, who must satisfy themselves as to Officer’s capability and proper familiarisation with the Company requirements.

Unquote

The C/O was first time with the Company, was on board for 1 ½ months as Second Officer and undertaken the demanding duties of the Chief Officer on the 24th December 2019, i.e. five days before the accident. After his first discharging operation was not closely monitored by the Master, who should satisfy himself, as to the Chief Officer’s capability, during his first cleaning operation. The SMSM Chapter 7.5.8.3-VII requires that:

Quote

Carrying through and supervising the tank cleaning procedure:

Before commencing the tank cleaning operation, the C/O must ensure that preparations have been carried out according to the “Tank Washing Checklist” form CB 014.

The actual carrying through of tank cleaning shall, as a matter of course, be supervised by the C/O who is responsible to ensure that all safety regulations and other directions are duly observed.

Unquote

Even if the C/O filled-in the “Tank Washing Checklist” form CB 014, he did not ensure that the preparations for tank washing had been properly carried out and left the Bosun unsupervised to make the preparations for tank cleaning and went to rest. He did not check what the Bosun and deck crew were doing.

Therefore, inadequate supervision by the vessel’s management of the newly promoted and new to the company Chief Officer as well as to a first time Bosun who also performed the duties of the Pumpman, was a contributing factor to the accident.

Inadequate supervision was a contributing factor to the accident.

4.4.7 Cargo Drain System

On board “ATHLOS”, for the stripping/draining of cargo tanks, an air driven pump (Wilden Pump) and a Vacuum Ejector are installed on the main deck over No.6(P) cargo tank area. The Wilden Pump and the Vacuum Ejector create suction and draw out liquid cargo remains from the tanks as well as, air/gas. The liquid cargo drains, are then sent by the Wilden Pump to the deck slop tank. The tanks are stripped/drained one by one or sometimes is possible to strip two tanks simultaneously.

The Vacuum Ejector operates along with the Wilden Pump. The Vacuum Ejector aids the Wilden Pump, by enhancing its dry suction capacity to about 8-9 meters. According to the MC, the vessel was bought second hand with this arrangement and no modification had been made. The MC has not in its possession drawings and specifications of the Vacuum Ejector from its makers and it is not shown in the cargo lines drawing. The MC has in its possession drawings and specifications only for the Wilden Pump. According to the MC, the Vacuum Ejector is building yard's supply and not maker's (WILDEN supply). The Vacuum Ejector was not certified for use on a tanker’s hazardous environment, although it was operating on a tanker’s deck in the presence of hydrocarbon gasses.

Ejector’s air/gas de-aeration along with droplets created during suctioning, are directed through two small de-aeration pipes into a plastic bucket, placed on the main deck, immediately below them. The Vacuum Ejector’s de-aeration pipes, are directed downward and into the plastic bucket in which droplets and air/gas, mix up with rags and other rubbish.

According to the Code of Safe Working Practices for Merchant Seamen: Spontaneous combustion-Dirty or damp waste, rags, sawdust and other rubbish—especially if contaminated with oil—may generate heat spontaneously, which may be sufficient to ignite flammable mixtures or set the rubbish itself on fire.

Flammability: When petroleum products burn, it is the gas / vapour that ignites and not the fuel itself. Gas / vapor, reacts with oxygen in the air and produces carbon dioxide and water vapor. But still, it is needed a correct combination of air and gas mixture to burn. The air-gas mixture that can burn is called flammable mixture. The flammable mixture will not burn if the mixture is too lean or too rich. Being much heavier than air these gases tend to stay down in containers, buckets, etc., or tanks. These if not properly ventilated can ignite anytime with slightest of the heat source. It is under this condition many explosions happen on tankers.

Flammable: Capable of being ignited and of burning.

Upper flammable limit (UFL), 10% gas in air: The concentration of a hydrocarbon gas in air above which there is insufficient amount of oxygen to support and propagate combustion. Sometimes referred to as upper explosive limit (UEL).

Lower flammable limit (LFL), 1% gas in air: The concentration of a hydrocarbon gas in air below which there is insufficient amount of hydrocarbon to support and propagate combustion. Sometimes referred to as lower explosive limit (LEL).

Therefore,

- a) Rubbish in the bucket may have generated heat spontaneously which was sufficient to ignite a flammable air/gas mixture (within the limits of 1% to 10% by volume) which was coming out from the Vacuum Ejector's de-aeration pipes, directed downward and into the plastic bucket and being heavier than air, stayed down in the bucket.
- b) Rubbish in the bucket may have generated heat spontaneously which may have been sufficient to set them on fire and then this fire to ignite a flammable air/gas mixture, which was coming out from the Ejector's de-aeration pipes and directed downward and into the plastic bucket.

Build-up of Static Electricity: The static electrical charge that builds up during the handling of petroleum products on board tankers presents a potential source of ignition. Certain operations can give rise to accumulations of an electric charge that may be released suddenly in electrostatic discharges with sufficient energy to ignite flammable oil/air mixtures. As petroleum product is pumped through the steel pipelines that are part of the ship's installations, static charges accumulate between the oil and the pipe. The charge left on the pipe will quickly pass to the structure of the ship and dissipate into the sea and thereby to ground. Between the two pipes and the plastic bucket, there was no electrical continuity, which may have resulted, in the build-up of static electricity. No arrangement existed for the collection of the air / gas and the droplets from the de-aeration pipes.

In addition, the plastic bucket, was not grounded and presented another source of static electricity. When petrol was mixed with water /moisture which may existed in the plastic bucket, a static charge may have been generated between them.

Deck Electrical Equipment: The adjacent Cargo Pump was not running i.e. had no power at the time of the explosion.

The arrangement of the Vacuum Ejector, and the inappropriate practice of using the plastic bucket for the Vacuum Ejector's de-aeration, allowed the migration of hydrocarbon vapour in the plastic bucket.

Although the source of ignition was not determined, there is evidence that the initial fire was developed in the plastic bucket. It is unlikely that the adjacent cargo pump, provided the ignition source for the fire. The fire broke out, due to an accumulation of air /gas in the plastic bucket or from static electricity generated by the suspension of electrical continuity of the Ejector's de-aeration pipes.

4.4.8 Vacuum Ejector and plastic bucket

With reference to the arrangement for the de-aeration of the Vacuum Ejector and the placement of plastic bucket on a tanker's cargo area where there is presence of hydrocarbon gasses, i.e., a hazardous environment, the MC did not take any corrective measures. No any deficiency was noted during ISM/SMS internal and external audits. The use of the Vacuum Ejector and the plastic bucket in the cargo system, was not based on risk assessment. The design, function and logic of the Vacuum Ejector and plastic bucket system, created an unsafe situation, incompatible with the tanker's cargo operations.

An unsafe working practice was devised to collect cargo stripping gasses and droplets for the de-aeration of the Vacuum Ejector in the plastic bucket. This unsafe working practice was not identified and corrected. It was accepted and condoned by the shore management and the vessel's management, as necessary for operations. No relevant deficiency was noted in the last internal audit. It is a question whether this deficiency should have been known by the highest level of management. Nevertheless, to the superintendent and auditor level, i.e. the intermediate level of management, it was known and was accepted by them, as necessary for the cargo tanks' stripping operations without being based on risk assessment. It should have been taken care by them and/or inform the highest level of management.

In addition, the plastic bucket was not emptied from its contents i.e. oil droplets rubbish etc. Although the SMSM requirement refers to manifold and pipeline drains, its purpose is relevant. (SMSM Chapter 7.5.4.3.II: Drip trays: The C/O must make a thorough inspection of all manifold and pipeline drains, both on deck and in pumproom to ensure that all are shut and caps fitted. Any water in the drip trays must not contain oil and men are stand-by in case they have to decant water from the deck).

Therefore, the inappropriate work practice of using a plastic bucket for cargo tanks' vacuum pump de-aeration, approved by at least the intermediate level of management and the ship's management, was a factor in the accident.

Inappropriate work practice of using a plastic bucket for cargo tanks' vacuum pump de-aeration, approved by at least the intermediate level of management and the ship's management, was a contributing factor in the accident.

The inappropriate arrangement for the de-aeration of the Vacuum Ejector and the placement of inappropriate equipment (plastic bucket), in a hazardous environment, in the presence of hydrocarbons, of a tanker's cargo area was a contributing factor to the accident.

The installation by the ship's construction shipyard of not-approved, uncertified for use in a hazardous environment and defective equipment for cargo tanks stripping (Vacuum-Ejector), was a factor to the accident.



Sounding /Sighting Port

Cargo Pump

Plastic Bucket

Ejector

De-Aeration Pipes

Although the source of ignition was not determined:

1)There is evidence that the initial fire was developed in the plastic bucket. It is unlikely that the adjacent cargo pump, provided the ignition source for the fire. The fire broke out, due to an accumulation of air /gas in the plastic bucket or from static electricity generated by the suspension of electrical continuity of the Ejector's de-aeration pipes.

2)The plastic bucket could not be grounded and presented another source of static electricity. When petrol is mixed with water /moisture which may existed in the plastic bucket, a static charge may have been generated between them.



Sounding /Sighting Port Pipes

Plastic Bucket

Ejector

Wilden Pump

De-Aeration



A fixed gas freeing fan and venting line is fitted on deck. The flexible venting tubes are connected to the venting line.

4.4.9 Action by crew during fire emergency situation

The two ABs, were preparing the water supply flexible black hoses for the washing of No.2(P) and No.2(stbd) COTs. The Indian AB was giving to the Greek AB the water supply flexible black hoses from above, while the Greek AB was on the main deck, in order to connect them to the Butterworth tank cleaning machines. The CO would then send water through Butterworth to wash the cargo tanks.

When the Greek AB finished connecting the No.2(P) hose and walked to go to the No.2(stbd), he saw smoke near No. 6(P) COT. Then, both ABs run aft, through the hoisted deck-way, towards No.6(P) COT area where the fire was sighted.

At the same time, the Bosun who was forward, saw smoke near No.6 (P) COT. He also run aft and saw the fire in the plastic bucket located aft of the Vacuum Ejector.

The two ABs started preparing the Fire-Hose. The Bosun shouted “fire-fire-fire”, and went in the CCR and started the Fire Pump. The two ABs were keeping the fire hose and nozzle, awaiting the water to come. The Bosun returned from the CCR, went close to them and untied the hose because it was knitting. The ABs directed the nozzle to the fire in the plastic bucket and water came out with pressure.

After sprayed water for 5-6 seconds the fire spread. Its size, from half a meter became 2-3 meters. The plastic bucket melted. Some remaining liquid in the plastic bucket splashed on the deck and got fire. The fire spread around 3-4m.

When the Greek AB saw the fire intensifying, shouted at the Bosun and the Indian AB to leave. They let the hose down and ran forward.

The flames propagated and entered into the No 6(P) COT, through the open No 6(P) sounding / sighting port, which was open according to crew statements for assisting the tank’s ventilation. Nevertheless, it should have been closed until commencement of ventilation. The flames have most probably propagated through the flammable gasses getting out from the non-inerted open No.6(P) sounding / sighting port and entered from the port into the No.6(P) COT.

When the flames entered into the No 6(P) COT, followed successive explosions in the cargo and ballast tanks and fire broke out on the main deck. Sequential explosions in cargo and ballast tanks from No.4 to No.6 caused the collapse of the cargo and ballast tanks bulkheads, resulting in list to starboard.

The deck crew attempted to extinguish the fire in the plastic bucket with inappropriate extinguishing media. They should have used dry powder or foam portable extinguisher. Portable foam fire extinguishers were in the vicinity: Four inside the vent fan store, one at the pumproom entrance, one at the entrance of the accommodation space and one in the CCR. They failed to adequately evaluate

the risks associated with the particular course of action of spraying water onto a hydrocarbon fire, and this faulty evaluation lead to the spreading of the fire outside from the plastic bucket on the deck and finally into the adjacent No.6(P) sounding / sighting port.

Before that, they should have alerted the other crew by pushing an alarm button or calling the Master or Nav Bridge. They selected the wrong course of action by omitting to first raise the fire alarm (A Fire Alarm button was available near CCR at the accommodation entrance) and after to try to extinguish the fire by themselves. They proceeded as intended, but their plan was

inappropriate for the situation. They made a judgment and decision-making error. Crew members at the scene, did not prioritize the tasks as required to manage the immediate situation and violated the proper procedure which requires first to alert (press an alarm button which is located nearby and subsequently attempt to extinguish the fire by their own). They did not demonstrate effective firefighting competence.

Their inappropriate actions can be attributed to panic and to not absorbed training because all of them have received STCW Basic Safety Training which includes fire-fighting and have participated in on board fire-fighting drills. A “Fire in Cargo Tank” drill was performed according to documentation provided to the investigator, on 17/12/2018 from 10:00 to 10:40, in which participated all crew except watchkeepers, with “good results”.

Therefore, panic in conjunction with not absorbed training resulted in a judgment and decision-making error, was a root cause of the ultimate accident, the explosion of cargo tanks.

The use of inappropriate medium – water to extinguish a hydrocarbon fire, was the direct cause of the ultimate accident, the explosion of cargo tanks.

The Bosun stated, that he started the Fire Pump and the Foam Pump from the CCR. If he had done so, he should have entered in the Air-condition Room where the Foam system is in and started the Foam Pump. Also, he did not state that he opened the main valve of the Foam System. This means, that he had the wrong impression that he had activated the Foam System because he did not know how to activate it and he didn't know the existence of the Foam Valve. This is an indication of inadequate training and familiarization with the vessel's systems.

Inadequate training and familiarization with the vessel's systems, was a contributing factor to the accident.

4.4.11 Emergency Response

4.4.11.1 The Master

According to the SMSM Chapter 8 - Emergency response No.9: Explosion, the Master's priorities in case of explosion should be

- Ensure safety of the vessel and persons on board
- Limit damage to the vessel and cargo
- Prevent environmental pollution
- Provide information to the Emergency response team at Head Office
- Take into consideration relevant check-lists

As soon as the explosions occurred, the Master went up to the Nav Bridge and:

Instructed the 2/O to call on the public address system all crew and order to go to Muster Station. Then, to send distress call MAYDAY on Ch. 16 - give the nature of the distress – Fire/Explosion/ need assistance. Also pressed the general alarm (GA) button. Pressed distress button of MF/HF, VHF Ch.70 and INMARSAT-C. At 09:29 l.t., the Larnaca Joint Rescue Coordination Centre (Larnaca JRCC) received the distress call from "ATHLOS”.

The Master gave orders to abandon the ship at abt 09:32 l.t., because the vessel was continuously listing to stbd.

In the meantime, the Master checked with ECDIS the ship's position and the area the ship was at that time. It was close to the southern coast of Cyprus, on the course of the ship, 3-4 NM from the shores. Thinking that the ship with the gradient he had picked up could be overturned, he decided to be as close as possible to rescue services from land. He looked in ECDIS to find a suitable coast for beaching the vessel. He found a coast with a suitable seabed, (mud-sand) and directed the ship to that point. He took the wheel and turned the ship to the shore.

The Master gave orders to cancel the abandonment at abt 09:50 l.t., because the fire was extinguished by the foam monitor guns.

Contact was established with Larnaca JRCC on VHF Ch. 16/06. The C/E was speaking on the VHF saying what the Master was telling him, while the Master still keeping the wheel. It was given the ship's position, the kind of danger "Explosion-Fire- Big List" and that is proceeding for beaching.

At 09:55 l.t., as the vessel approached full speed ahead to the point of deliberate grounding, the Master reduced speed with the telegraph and pressed the ME emergency stop button. At 10:00 l.t., at position Lat.: 34° 43 77N - 033° 21 73E, the ship with the minimum speed that had, touched the seabed smoothly, without violent clutter.

At 10:04 l.t., the Master contacted on mobile phone the MC and informed about the situation.

At 10:05 l.t., the Larnaca JRCC informed the Master, that 5 crew members were rescued.

At 10:10 l.t., the Master called the crew on the Bridge and counted them and found that 5 were missing.

At 10:12 l.t., the C/O and 2/O went on deck for taking soundings of Ballast Tanks and depths around the vessel.

At 10:41 hrs, the Master contacted company's ERT and agents and requested them to assist in the necessary actions and measures for the potential prevention in case of oil spill.

The actions of the Master were in accordance with the SMSM Chapter 8 - Emergency response No.9: Explosion. He acted with knowledge, courage, decisiveness and good seamanship.

4.4.11.2 The Crew

The No1 and No.2 Oilers, went in the alleyway, where met the 2/O (12-4). Then as they were going out, met the C/O outside CCR who said "abandon-abandon ship".

The C/O proceeded up via the external stairs to the Free-Fall Life Boat (FFLB). He was followed by the 2/O (12-4), the three Oilers and other crew members.

They removed the FFLB battery charging cable.

Then opened the FFLB door. The CO told them to get into the FFLB. No.1 Oiler told him that it was very high and showed him the Life-Rafts. Also, the vessel had developed excessive list. Then they saw a speed-boat near the vessel and shouted "help-help".

Some crew members descended from the external stbd stairs to the Poop Deck stbd side.

The C/O left from the FFLB area and went in the Nav Bridge. Then, with the 2/O went to the poop deck and deployed the LR. Then, the C/O went in the CCR and started de-ballasting the stbd side tanks to correct the stbd list. The C/O remained in CCR and the 2/O returned on the Nav Bridge.

At about 09:40 l.t., a speed-boat arrived close to the vessel for granting help. The No.1 and No.2 Oilers and the 2/O who were wearing life-jackets, jumped into the sea. They boarded on the speed-boat.

At abt 09:50 l.t., the fire was extinguished by the foam monitor guns. Therefore, the Master gave orders to cancel the abandonment.

The 2/O should have been on the Nav Bridge. Not all crew went to the muster station. The C/O did not count heads at the muster station. The C/O told the crew, to get into the FFLB but when the No.1 Oiler told him that it was very high and showed him the Life-Rafts, he consented. Even if the FFLB was very high, it would have been the best choice, had the vessel exploded. Before the Master cancel the abandonment, they left from the muster station, the C/O went in the CCR and the 2/O with the two Oilers jumped into the sea.

According to documentation provided to the investigator, an abandon ship drill by FFLB was carried out on 12/12/2018 from 10:00 to 10:40 with “good results”.

The actions of the C/O and the crew indicate that they were hesitant to drop the FFLB.

The C/O did not have self-confidence and consented to the No.2 Oiler. Then they dropped the life-raft but did not boarded on it.

The crew actions during emergency response indicate that they were untrained and panicked.

Inadequate crew emergency response (Safety Issue)

4.4.12 The Management Company

1. The Management Company violated the Safety Management System’s experience criterion for seagoing personnel by selecting for demanding ranks, individuals with limited experience.
2. The Management Company Violated Safety Management System’s requirement for a Pumpman’s rank.
2. The Management Company did not perform risk assessment and failed to identify/correct through internal audits, superintendents’ visits, designated person ashore, unsafe practice associated with the vacuum ejector – plastic bucket system.
3. The Management Company failed to identify and correct, through internal audits, superintendents’ visits, designated person ashore, that the Safety Management System’s procedure for tank cleaning was not properly implemented.
4. The Management Company did not properly review the Safety Management System’s documentation.
5. The Management Company did not adhere to safety by failing to use the Inert Gas System during discharging. Had the cargo tanks been inerted during discharging UNLD 95, UNLD 98, ULSD 10PPM and GAS OIL and remained inerted after completion of discharging with all tank openings closed, the catastrophic accident would not have occurred.

6. The Management Company failed to provide adequate crewing resources. The crew placement was inadequate for chemical/product tanker demands. Inexperienced personnel which was placed in critical positions, was a contributing factor to the accident.

The above suggest, that the Management Company's concept of operations accepted unnecessary risks which led to an unsafe situation and to a catastrophic accident. Given that the root causes of an accident lie deeply within the system of an organization, it is considered that the Management Company's concept of operations was a root cause of the accident.

Management Company's concept of operations was a root cause of the accident.

Conclusions

Direct Cause:

The use of inappropriate medium – water to extinguish a hydrocarbon fire, was a direct cause of the ultimate accident, the explosion of cargo tanks.

Violation of Safety Management System's requirement that openings to tanks which have not been washed and which are not gas freed shall be kept closed was a direct cause of the ultimate accident, the explosion of cargo tanks.

Root Cause:

Management Company's concept of operations was a root cause of the accident.

Panic in conjunction with not absorbed training resulted in judgment and decision-making error, was a root cause of the ultimate accident, the explosion of cargo tanks.

Contributing Cause(s):

Inappropriate work practice of using a plastic bucket for cargo tanks' vacuum ejector's de-aeration, was a contributing factor in the accident.

The inappropriate arrangement for the de-aeration of the Vacuum Ejector and the placement of inappropriate equipment (Plastic Bucket), in a hazardous environment, in the presence of hydrocarbons, of a tanker's cargo area was a contributing factor to the accident.

Safety Management System's procedure for tank cleaning not properly implemented, was a contributing factor to the accident.

Inadequate supervision was a contributing factor to the accident.

Inadequate training and familiarization with the vessel's systems, was a contributing factor to the accident.

Inexperienced personnel placed in critical positions, was a contributing factor to the accident.

Violation of Safety Management System's experience criterion for seagoing personnel was a contributing factor to the accident

No use of the Inert Gas System was a contributing factor to the accident.

Safety Management System's requirement for a Pumpman rank which was violated, was a contributing factor to the accident.

Safety Issue

Safety Management System's documentation not been properly reviewed.

Inadequate crew emergency response.

Recommendations

To the Management Company (All within 3 months)

1. Proper arrangement to be made for the de-aeration of the Vacuum Ejector and approved by class.
2. Safety Management System Manual to be reviewed and detailed cargo operations and procedures including when to use the inert gas system, to be inserted in the SMSM.
3. Inert Gas System to be in operation during cargo and cleaning operations.
4. Safety Management System's procedure for tank cleaning to be properly implemented.
5. Safety Management System's recruitment procedure to be properly implemented.
6. A Pumpman to be placed on board as required by the SMSM.
7. An additional internal ISM audit to be carried out, the results of which to be used for improvement of the existing concept of operations.
8. Realistic training to be performed during drills.
9. The requirements of STCW and MLC for Hours of Work & Rest to be adhered to and a solution to be found and implemented for the Chief Officer's fatigue issue during cargo operations.
10. The Management Company by circular or other means to inform the crews of its fleet of the accident and the need to implement the SMSM procedures before operations, as well as during emergencies