Report on the preliminary investigation of

the engine room fire onboard

Ice Flake

Offshore South Africa

10 August 2006

Cayman Islands Shipping Registry
Maritime Authority of the Cayman Islands
3rd Floor, Kirk House
22 Albert Panton Street
George Town
PO Box 2256 GT
Cayman Islands

Casualty 2006 / 10

The fundamental purpose of investigating an accident under the Cayman Islands Merchant Shipping Law, as amended, is to determine its circumstances and the cause 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 liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

NOTE

This report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in future.

Synopsis

At 21:55 (local time) on 10 August 2006 an engine room fire broke out onboard “Ice Flake” during the passage from Maputo to Cape Town. Although the fire was quickly brought under control, the engine room was severely damaged and the ship was subsequently towed into Durban for repairs.

The direct cause of the fire was established as the failure of a generator lube oil instrument line resulting in a pressurised spray of lube oil impinging on the hot exhaust surfaces of the generator.

The engine room was equipped with a fixed Halon fire fighting system. Several of the Halon bottles in the engine room failed to discharge. This failure is attributed to the “retro fitting” of copper pilot lines to replace the steel pilot lines specified by the system manufacturer.

No personal injuries or pollution of the marine environment resulted from the incident.

Glossary of Acronyms and Abbreviations

2/E	Second Engineering Officer
3/O	Third Officer
AB	Able Bodied Seaman
BA	Breathing Apparatus
C/E	Chief Engineering Officer
C/O	Chief Officer
CO_2	Carbon Dioxide
CISR	Cayman Islands Shipping Registry
DFM	Dobson Fleet Management
EEBD	Emergency Escape Breathing Device
ER	Engine Room
“Power Pack”	A motor / generator set housed in a shipping container on deck and connected to the ship’s main switchboard.
(L)	Local Time

Factual Information

Particulars of “Ice Flake”

Vessel details

Registered owner:	Ice Flake Shipping Ltd
Manager:	Dobson Fleet Management
Type:	Refrigerated Cargo Ship
Gross Tonnage:	5,755
Deadweight:	Not applicable
Flag:	Cayman Islands
Port of Registry:	George Town
IMO Number:	8615227
Built:	1987, Netherlands
Length (overall):	118.4m
Breadth:	18.51m
Depth:	12.58m
Draught:	8.1m
Construction:	Steel
Engine Type / Power:	Oil Engine Geared Drive
Estimated Speed:	12 knots
VHF	Very High Frequency
Voyage Data Recorder:	Not provided

Incident details

Date and time:	10 August 2006 at 21:55
Location of accident:	21° 18’ 21” S, 33°03’ 38” E (approximately 7 miles offshore)
Persons onboard:	18 Crew
Condition of the ship:	Part cargo of fruit
Injuries:	None
Damage:	Severe damage to No 2 Generator. Other Generators damaged. Sever cabling damage in engine room. Extensive smoke damage in Engine Room

Weather Conditions:

The weather at the time of the incident was reported as fine and dry with good night visibility.

Sequence of events

Date Time	Description
10/08/2006 16:50	Pilot departs and ship en route to Cape Town from Maputo. Bridge and Engine Room watches being maintained. Off duty personnel were on deck having a barbeque.
21:55	The master and off duty personnel were still on deck. On watch are: 3/0 and AB on the Bridge and C/E, Motorman and Refrigeration Engineer in the engine room. The Chief Engineer was working on the fresh water evaporator when he smelled burning and noticed flame, but not smoke, above No 2 Generator. The Chief Engineer returned to the control room and ordered the Refrigeration Engineer and motorman to evacuate. Pausing only to stop the main engine, the Chief Engineer then evacuated the engine room. The engine room has now become smoke logged. The Chief Engineer decided not to return to the Control Room for one of the EEBDs stored there, but continued up the short flight of stairs to the changing room and engine room exit. On leaving the engine room the Chief Engineer proceeded to the Emergency Control Station and: Activated the emergency stops for the fuel oil separator units, engine room ventilation, thermal oil heater (boiler) and fuel oil pumps. Closed the fuel and lube oil quick closing valves. At this point the ship has blacked out and the emergency generator auto started to supply essential services. The master returned to the bridge where the 3/O is attempting to contact the engine room. The fire indicator panel indicated a fire in the engine room zone and black smoke was issuing from the engine room vents visible from the bridge. The master sounds the general alarm and the crew mustered. The bridge team is sent to close the engine room vent flaps while the master remained on the bridge in communication with the C/O at the muster station.

Date Time	Description
22:06	The master is informed by the C/O that the C/E had tripped the engine room ventilation, remote machinery stops and activated the engine room quick closing valves. The Chief Engineer asked the master for permission to release the Halon fixed fire extinguishing agent in to the engine room. The master reserved permission until it was confirmed that all engine room ventilation flaps have been closed and all persons onboard accounted for. A head count was taken and everyone was found to be accounted for.
22:10	Master ordered the release of Halon into engine room. Checks were made of the engine room boundaries for elevated temperatures. The emergency fire pump was started and boundary cooling applied to the aft deck and deck store for over 2 hours. (In addition to the Halon released on the master's orders approximately 450kg of Freon refrigerant was released into the engine room when the cargo refrigeration equipment lost containment due to fire damage to the system.)
11/08/2006	Communication was established with Dobson Fleet Management. DFM informed of status of ship (no main engine or generators available; ship running on emergency generator). As well as an account of events to this time it was confirmed that all crew were safe and accounted for. A report was made of the ship's position, distance from shore and current weather). Anchors were prepared should they be needed. Communications were maintained with DFM by telephone and email throughout.
04:15	Engine Room boundaries confirmed at normal temperatures.
04:30	Motorman and 2/E enter engine room from ER changing room with BA sets and fireman's outfits. No safety lines were used, however a second team in BA was on standby in the changing room.
04:37	Motorman and 2/E exit the engine room and report: No Fire or smoke in engine room. Apparent fire damage to No 2 and 3 Generator Sets along with extensive cable damage.

Date Time	Description
05:05	Engine room doors, hatches and vents were opened to ventilate the engine room.
06:15	C/E and Electrician entered engine room with BA sets and confirmed the earlier findings of the 2/E and Motorman.
07:00	Chief Officer entered engine room in BA set and checked the atmosphere for oxygen. No tests were made for the presence of Freon refrigerant. The oxygen level was confirmed as adequate for entry into the engine room without BA sets.
07:30	Access allowed to the engine room. Engine room staff commenced checking status of machinery.
09:00	Deck "Power Pack" started to supply power to the ship. Emergency generator stopped. Chief engineer changed fuel oil system to marine diesel due to unavailability of thermal oil heater. Main engine now available. Although contact be email and telephone had been maintained with Dobson Fleet Management throughout the night, first contact is only now made with Durban Radio by VHF radio. Status of the ship was reported as follows: Main engine operational if required. One generator available and running. The ship's position. Confirmation that the ship is not in immediate danger.
11:20	Radio contact made with "Pinto Service", the tug contracted to take Ice Flake in tow to a repair facility.
13:30	Cargo refrigeration plant restarted after securing the Freon circuit and recharging.
12:15 to 13:05	Main engine run at "dead slow ahead" to move the ship to 11 nautical miles offshore.
13:15	"Pinto Service" on location with Ice Flake. Weather started to deteriorate at this time.
15:45	Decision made to postpone connecting tow due to bad weather. Pinto Service remains on station with Ice Flake.
18:30	Ice Flake now 3.5 nautical miles from shore. Main engine started and run

Date Time	Description
	"dead slow ahead".
20:30	Main Engine stopped with Ice Flake now 20 nautical miles offshore.
12/08/2006 07:00	Commence connecting tow.
07:15	Tow fast and commence tow to Durban.
14/08/2006	Pinto Service with Ice Flake in tow arrives at Durban Roads.
15/082006	At Durban Roads, awaiting weather to come along side.
16/08/2006 11:30	Ice Flake alongside at Dormac Shipyard in Durban.

Findings and Conclusions

1 The fire was caused by the failure of a copper instrument line on a differential pressure gauge fitted to No 2 Generator. When this line failed, hot pressurized lube oil impinged on the hot exhaust surfaces of the generator and ignited. Lube oil from the fracture continued to supply fuel to the fire and it rapidly spread to other combustible material in the area. (See Appendix 1, Figure 1)

2 At some time in the past it appears that the steel instrument lines on some of these gauges had been changed to copper. Of the other similar installations on the generators some were found to be steel while others were copper. (See Appendix 1, Figure 2).

3 The compression fitting in way of the failure had been brazed to the instrument line. The heat input from this operation would have almost certainly changed the mechanical properties of the copper (strength, toughness, resistance to fatigue, etc). (See Appendix 1, Figure 3). This is seen as directly contributing to the failure.

4 Although the exhaust arrangements on the generators were lagged to an acceptable standard, there were no shields in place to deflect flammable liquids away from the exhaust in the event of an instrument line failure.

5 Although full communications were maintained between the ship and the company throughout the incident, no contact was established with coastal RCC authorities until 11 hours after the fire started. No “Urgency” message was transmitted to other ships in the area and who may have been able to offer assistance.

During this 11 hour period the ship was drifting without main electrical or propulsive power less than 7 miles from shore. (The ships position at 04:00h on 11 August was less than 2.5 miles from shore) Had the fire not been quickly brought under control or if the weather had deteriorated, early notification to coastal authorities and other ships in the area would have been instrumental in preventing potential loss of life or a serious pollution incident.

6 The order to release Halon 1301 into the engine room was absolutely correct and well controlled.

When the order to release the Halon 1301 into the engine room was given, three of the eight bottles in the engine room failed to discharge.

Halon is discharged by admitting CO_2 at a minimum pressure of 50 bar into pilot lines that run from the control station (Appendix 1, Figure 4) to the actuators on each Halon 1301 bottle located throughout the engine room. (The system onboard uses CO2 at 70 bar) The manufacturer specifies that steel pilot lines are to be used for this purpose. (See Appendix 2)

On inspection it was noted that when the Halon 1301 bottles had been changed at some time in the past, the pilot lines which had to be altered to accommodate the new bottles had been re-run in copper, not the manufacturer specified steel. (See Appendix 1, Figure 5).

There was evidence of failures in the copper pilot lines that would have compromised the pilot signal for other Halon 1301 bottles on the same pilot circuit.

The system was last serviced in August 2005 and the copper pilot lines were not reported. (See Appendix 3)

7 When the fire reached the cargo refrigeration compressors in the engine room, containment of the refrigerant circuit was lost and approximately 450kg of Freon refrigerant was admitted into the engine room.

This loss of refrigerant into the engine room undoubtedly assisted with the rapid suppression of the engine room fire. When Freon is subjected to elevated temperature or open flame it breaks down into highly toxic components (including Hydrochloric and Hydrofluoric Acid). Although the engine room was well ventilated and tested for oxygen after the fire had been extinguished, no tests were made for the presence of Freon or its products of decompisition.

Recommendations:

1 The Maritime Authority of the Cayman Islands should issue guidance to all ships on:

(a) The possible consequences of unapproved modifications to fixed fire fighting systems.

(b) Measures to prevent the failure of instrument and similar lines resulting in serious fires in engine rooms.

(c) The dangers associated with large quantities of refrigerant gasses in emergency situations.

2 Dobson Fleet Management should inspect:

(a) all similar fixed fire fighting systems throughout its fleet and ensure that such systems have not been modified other than in accordance with the manufacturer's specifications and in particular to ensure that pilot tubing conforms to the manufacturer's specifications;

(b) all vessels in their fleet to ensure Instrument lines carrying flammable fluids are fit for purpose and reasonable precautions (such as shielding) are in place to reduce the risk of failure leading to fire or explosion.

3 Dobson Fleet Management should:

(a) review its guidance and instructions for the ships of its fleet with respect to the hazards associated with the use and handling of bulk refrigerants, especially in emergency situations in which such gases are exposed to fire, and in particular the need to test atmospheres for dangerously toxic gases following such an incident; and

(b) ensure that masters of the ships throughout its fleet are fully aware of the importance of transmitting an appropriate Safety (i.e. Securité or Pan - Pan) message when a potentially dangerous emergency has arisen onboard.

Appendix 1

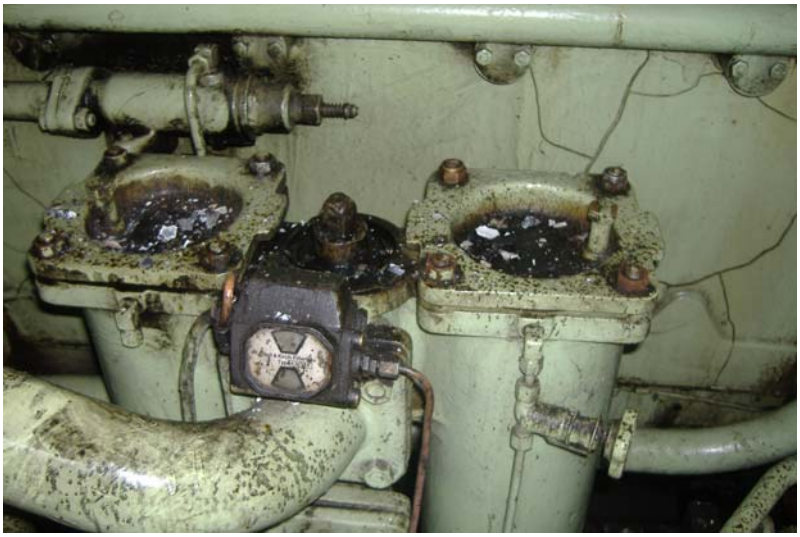

Figure 1: Showing a differential lube oil gauge and instrument lines similar to those which failed on No 2 Generator. Note that these instrument lines are also copper.

Figure 2: The copper instrument line which failed and an original steel instrument line removed from a similar gauge on Generator No 1.

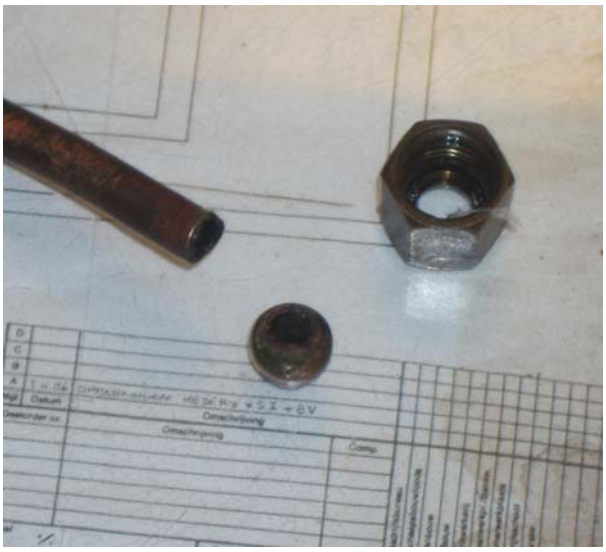

Figure 3: Close up of the failure site. Note the brazing of the compression fitting to the instrument line.

Figure 4: CO_2 Pilot Cylinders (discharged) for release of Halon into the Engine Room.

Figure 5: Copper pilot lines on Halon 1301 bottles.

Appendix 2

Extract from the Halon 1301 manufacturers manual specifying the use of steel pilot lines.

Appendix 3

Report of last servicing of Halon 1301 fixed fire fighting system.