Bahamas Maritime Authority

Report of the investigation into the engine failure and subsequent grounding of *M.V. Westchester* in the Mississippi River on 28 November 2000

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It should be noted that the Bahamas Merchant Shipping Act, Para 170 (2) requires officers of a ship involved in an accident to answer an Inspector's questions fully and truly. If the contents of a report were subsequently submitted as evidence in court proceedings relating to an accident this could offend the principle that a person cannot be required to give evidence against himself. The Bahamas Maritime Authority makes this report available to any interested parties on the strict understanding that it will not be used as evidence in any court proceedings anywhere in the world.

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1. SUMMARY

1.1 The vessel loaded a cargo of approximately 65518 tonnes (409434 barrels) of crude oil off Sabine Pass with the destination Shell Capline at St James in the Mississippi River on 27 November 2000. On 28 November 2000 at around 1800 when steaming upstream in the Mississippi at 12 knots and 70rpm under the direction of a pilot the vessel suffered main engine problems and subsequent main engine failure. Main engine failure was caused by the activation of the main engine crankcase oil mist detector into an alarm condition and subsequent crankcase explosion.

1.2 At 1810 the port anchor was dropped one shackle in an attempt to slow the vessels speed and at 1813 the starboard anchor was dropped two shackles for the same reason. Despite dropping the two anchors at 1820 the vessel ran aground with the starboard side on the east side of the river. Immediately after grounding oil leakage was observed coming from the starboard forward area of the vessel.

2. PARTICULARS OF VESSEL

1.3 *M.V.Westchester* was a single hull crude oil tanker registered at Nassau, Bahamas, of welded steel construction. The accommodation and machinery spaces were situated aft. She had the following principal particulars:

- Official Number - 372989
- IMO Number - 7902178
- Length overall - 246.85metres
- Length BP - 236.80 metres
- Breadth - 39.90 metres
- Depth - 19.00 metres
- Gross Tonnage - 49754 tonnes
- Net Tonnage - 22406 tonnes
- Deadweight - 88389 tonnes
- Call Sign - C6DK
- Year of build - 1981
- Class - ABS
- Owner - Marine Oil Trader 3 Ltd.
  80 Broad Street, Monrovia

  Manager - Ermis Maritime Corp. Athens

2.1 The cargo was carried in 5 centre tanks and in the wing tanks 1, 3 & 5. In addition the vessel was equipped with 2 slop tanks which are normally also used to carry cargo. Segregated ballast water is carried in wing tanks 2 & 4

2.2 The vessel was built in Brazil at Rio de Janeiro and was formerly named, Brazil Glory, Texaco Westchester and Star Westchester.

2.3 At the time of the incident the vessel complied with all the statutory and international requirements and certification.

3 NARATIVE OF EVENTS

3.3 All times noted in this narrative are given in the style of the standard 24 hour clock without additional annotation

3.4 MV Westchester loaded a cargo of approximately 65518 tonnes of QUA IBOE crude oil in a lightering operation off Sabine Pass with destination Shell Capline at St James in the Mississippi River. After completion of the lightering operation at Sabine Pass the drafts of the vessel were reported as 10.75 metres on an even keel.

3.5 The lightering was completed on 27 November 2000 and the vessel proceeded directly to the South West Pass area to pick up the Pilot for the Mississippi River. The vessel arrived at the SW Pass pilot station area at 1200 on 28 November and the pilot was on board at 1236. At 1506 the vessel changed pilots at Pilot town in the Mississippi River.

3.6 Shortly before the incident the vessel was sailing at full manoeuvring speed, about 70rpm and 12 knots, up stream under the direction of a pilot. At this time the officer of the watch and the pilot were on the bridge. The chief and second engineer were in the engine control room. The main engine had been on full ahead since 1509, 28 November.

3.11 At around 1752 the chief engineer instructed the second engineer to reduce the volume of fuel to the No. 4 piston because it was believed the No. 4 piston crankpin was the origin of the mist problem. The situation did improve as shown by the bell book entries above, but at 1801 an explosion in the crankcase took place. No damage was caused to the engine or injuries caused to engine room staff because the pressure release devices on the crankcase doors lifted to release the pressure in the crank case. At 1802 the bridge was informed of the situation and the engine stopped

3.12 The second officer and pilot on the bridge were not aware of any engine problems until informed at 1802 by the chief engineer that the engine had to be stopped immediately. The master who was having dinner was called to the bridge immediately. At 1810 the port anchor was dropped one shackle in order to try and slow down the vessel's speed. At 1813 the starboard anchor was dropped 2 shackles for the same reason. The dropping of both anchors was a joint decision between the master and pilot.

3.13 t 1820 the vessel ran aground despite dropping both anchors with the starboard side on the east side of the river. Immediately after the vessel grounded oil leakage was observed coming from the starboard forward side of the vessel. The master informed the US Coastguard (USCG) and the *Westchester's* operator of the incident and at 2204 the USCG boarded the vessel.

3.14 An emergency response team came into action at this point. However, in the mean time the vessel's crew had determined that the oil was leaking from the No. 1

starboard cargo tank. At 1825 the transfer of cargo from No.1 starboard tank to Nos. 3 & 5 starboard tank and the starboard slop tank commenced. By 1910 the leakage had stopped and the transfer of cargo was stopped.

3.15 From a comparison of ullages after loading and the termination of the transfer it appears that approximately 13222 barrels of oil leaked out of the vessel and 8809 barrels of water entered the vessel.

4 MAIN ENGINE AND OIL MIST DETECTOR

4.1 Propulsion power was produced by an I.H.I SEMT Pielsick 10PC4V 10 cylinder direct reversing 4 stroke diesel engine producing 11040 kW operating at a maximum of 400 rpm connected to a right hand fixed blade propeller through a gearbox .

4.2 The engine was a V type and the crank pin bearings are arranged in such a way that the following piston pairs had a common crank pin:-

	5 -10	forward
	4 - 9	
port	3 - 8	starboard
	2 - 7	
	1 - 6	aft

There were 5 pairs of pistons and consequently 6 main bearings with No.1 on the aft end and No.6 at the front of the engine. The piston pair 4 – 9 were situated between main bearing No. 4 on the aft side and No.5 on the forward side. Lubricating oil was admitted to all the main bearings and through bores in the crankshaft and webs to the crankpin of each piston.

The crank pin for piston Nos.4 & 9 were fed with lubricating oil through main bearings Nos. 4 & 5. No.4 crank pin bearing was in front of No.9. After oil reached the crankpin bearing it was further fed through a bore hole in the connecting rod to the piston top end bearing where it was sprayed onto the surface of the cylinder liner and returned to the engine sump by being scraped down the liner by the oil scraper ring fitted to the piston. This type of 4 stroke trunk piston engine did not have a separate cylinder liner lubricating oil system.

The oil mist detector for the main engine crankcase was located outside the engine control room. The No. 4 compartment that showed an alarm contained the crankpins for the Nos. 4 & 9 pistons. The first alarm was called a "deviation alarm" and concerned only one compartment of the crankcase.

The oil mist detector consisted of a photo electric cell which measured the visibility of the atmosphere drawn from each compartment of the crank case. Clear visibility was measured as a 0% reading and "no visibility"100% mist. The vessel was reported to operate normally with a crankcase mist reading of 60%.

4.3 At approximately 1747 that day an audible and visible mist alarm for No.4 compartment was observed in the control room. The electrician, who was the person in charge of the maintenance and repair of the oil mist detector, was immediately notified and appeared on the scene shortly after the alarm was observed.

5 CONCLUSIONS

5.1 Inspection of hull and main engine damage commenced on the next day 29 November 2000.

5.2 Divers established that the bilge area of the starboard No. 1 tank was punctured in 4 places in between frames 78 & 81. Frame spacing in that area were 4.6 metres. No other damage to the bottom of the vessel was found at that time. Several days later on 4 December 2000 the river bottom in the area of the grounding was scanned for hard objects, but nothing was found.

5.3 On 12 December 2000 the vessel was moved to the Magnolia anchorage. During the raising of the starboard anchor the shank was found to be broken. The port anchor was fully intact. The broken shank of the port anchor supports the theory that the puncture holes in the bilge of the starboard No.1 tank were caused by the starboard anchor and not by a hard object on the river bed. 5.4

5.4 Also on 29 November 2000 dismantling of the main engine commenced in order to determine the extent of the damage and the cause of the crankcase explosion.

5.5 First of all Nos. 4 & 9 piston assemblies were removed. It was observed that both sides of the crank pin had sustained damage. The No.9 piston big end bearing was found completely destroyed and No. 4 bearing found with less damage mainly located on the edge of the bearing shell on the side adjacent to No.9 bearing.

5.6 The bearing shells are made of mild steel with a thin layer of lead /copper alloy covered by a thin layer of tin/lead alloy on top. Both these layers are only a few 100 microns thick. The no 9. bearing layer had partially melted and seized onto the crank pin causing considerable damage to the pin. The No. 4 bearing had caused only minor damage to that side of the crank pin. No cracks were detected on the crank pin after checking for hardness and cracks. The depth of hardness was within set limits and deep enough to allow machining of the pin by 1mm, which would remove the damaged surface. Both Nos. 9 & 4 crank pin bearing would thus be replaced by undersized bearing shells.

5.7 The No. 4 bearing was removed for inspection and was found to be in a satisfactory condition with a normal wear pattern. However, the beading shell was replaced. The crankshaft in way of the No. 4 main bearing was checked for distortion, but none was detected and it was decided that the crankshaft was fit for further service.

5.8 The cylinder liners for No. 4 & 9 pistons were measured for wear. Both cylinder liners were found within the set limits, however, No 4 was renewed as the wear was 2.4 mm and the limit was 2.8mm.

5.9 The No.9 piston and connecting rod were determined suspect and replaced. During the dismantling of No.4 piston it was discovered that 2 nuts and spacers were missing from the crown holding down studs and 2 nuts were also found loose. Inspection of the mating surface of the crown and skirt revealed extensive fretting and the crown and skirt were condemned and replaced by spare ones. The missing nuts and spacers had been found in the crankcase during the initial inspection on 29 November 2000.

5.10 The No. 3 crankpin bearing, which also receives lubricating oil through the No.4 main beading was dismantled for inspection and the bearing shells were found in a satisfactory condition with a normal wear pattern. The bearing was re-assembled using the same bearing shells.

5.11 Inspection of the oil ways in the crank shaft in way of No. 4 main bearing revealed a non-metallic piece of material measuring 19 x 3mm.

5.12 The 70 micron lubricating oil discharge filter situated immediately in front of the engine was found to have unravelling screening material at the seams. This filter was reported as not being an original for the engine and was installed at a later date. The 15 micron auto clean duplex discharge filter was found in order. The 30 micron lubricating oil pump suction filter was found to have a 20 x 30mm hole in the filter material. The screening material was unravelling at the seams and an excessive amount of metallic debris was found in the filter.

5.13 After repairs the vessel reportedly under normal conditions with an oil mist detector reading of 60%. The oil mist detector system can be adjusted and alarms can be set at certain ranges of oil mist.

5.14 There is no consensus about the cause of the seizing of the No. 9 crankpin bearing and subsequent crankcase explosion. It was found that No.4 cylinder liner had been subjected to some excessive wear and also that 2 nuts and spacers from the piston crown holding down studs were missing and 2 loose out of 8 in total. The mating surface between the crown and skirt were also found badly fretted. This fretting suggested some "mini bouncing " between the crown and the skirt took place transmitting some shocks down to the No. 4 crankpin bearing causing the thin contact layers of the bearing shell to crack. Subsequently some of the loose cracked material may have found its way into No.9 crankpin bearing causing abrasion and the development of heat. Both bearing sit very close to each other of the crankpin. Nos. 3 & 4 main bearing had sustained no damage leading to the conclusion that the source of No. 9 crankpin bearing failure came from within that bearing and not from dirty of contaminated lubricating oil.

5.15 The vessel reportedly operated under normal conditions with an oil mist detector reading of around 60%. The oil detector system could be adjusted and alarms set at certain ranges of oil mist. Oil mist detectors are set to alarm at a certain value, then if the situation worsens and denser mist is developed the oil mist detector sends a signal to the governor for the main engine to slow down. It is not known what the setting were for the oil mist detector, but the engine did not slow down. Either the slow down setting was higher than the readings reached during the incident, or the system was not operational. If the engine had slowed down either via the oil mist detector signal or manually by the engineers this incident could well have been prevented.

5.16 When a hot spot develops in a crankcase, normally caused by a bearing with lack of lubrication or a piston blowby, then some of the lubricating oil begins to evaporate and forms a mist. This mist, when detected by the oil mist detector, is displayed in digital form on the oil mist detector unit. In this case the normal operating reading was 60%. After completion of repairs to the main engine the reading was still 60% during the main engine trials. This setting was re-adjusted to around 30%. So with the same level of visibility in the crankcase, the reading can be varied from 60 – 30%. In this case it appears the initial setting was not correct and that may have effected the timing of the engine slow down signal.