



# **THE COMMONWEALTH OF THE BAHAMAS**

**ANJANA**

**IMO Number 366285**

**Official Number 7366049**

**Report of the investigation into  
the flooding and subsequent sinking of  
ANJANA  
on  
20 December 1997**

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Report Reference : 2383

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*The Bahamas Maritime Authority investigates incidents at sea for the sole purpose of discovering any lessons which may be learned with a view to preventing any repetition. It is not the purpose of the investigation to establish liability or to apportion blame, except in so far as emerges as part of the process of investigating that incident.*

*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       ANJANA was a small three-hold bulk carrier that sailed from Port Nador, Morocco on about 15 December 1997, bound for Haugesund, Norway. She had on board a bulk cargo of stone, loaded in holds Nos. 1 and 3. On the morning of 19 December 1997, when steaming through gale and storm force winds in the North Sea, only hours away from the discharge port, a check of the cargo revealed that water was entering both cargo holds.
- 1.2       Water was pumped from the hold bilges but the ingress was found to be faster than the achievable pumping rate. The vessel listed and later began to trim by the head. By 2200 hours utc, 19 December 1997, the list and head trim was so severe that the steering of the vessel became impractical.
- 1.3       At 2206 hours utc a distress message was transmitted from the position 57° 08.0'N, 005° 00.0'E. A rescue operation was staged, primarily from the Stavanger Coastguard, including helicopter assistance. The Master ordered the ship to be abandoned at 0015 hours utc, 20 December 1997 and all of the crew were winched up by the helicopter by 0035 hours utc.
- 1.4       The vessel sank later that morning with all documents and property of the crew but, fortunately, without any loss of life.
- 1.5       The cause of the ingress of seawater into the cargo holds has not been clearly identified. No significant damage was observed to the hatch covers before the incident so the most likely cause was a failure of the shell plating somewhere along the midlength of the vessel that permitted water to flow into one or both cargo holds and possibly also the small No. 2 hold.

## 2 PARTICULARS OF VESSEL

2.1 ANJANA was a gearless general cargo/bulk carrier, registered at Nassau, Bahamas, of welded steel construction having a raised forecastle and poop. The accommodation and machinery spaces were situated aft of cargo holds. She had the following principal particulars:

•	Length overall	-	102.29 metres
•	Length BP	-	95.25 metres
•	Breadth	-	15.55 metres
•	Depth	-	8.75 metres
•	Gross Tonnage	-	3,676 tons
•	Net Tonnage	-	2,177 tons
•	Deadweight	-	5,662 tonnes
•	Call Sign	-	C6PY
•	IMO Number	-	7366049

2.2 ANJANA was powered by a Mirless, four stroke, single acting, type KMR-8 main engine that developed 3,310 kW (4,500 bhp) and which drove a single fixed bladed propeller. She had two main generators that developed a total of 400 kW.

2.3 The cargo was capable of being carried in three holds: Nos. 1 and 3 were about 30 metres in length, fitted with 24.5 metre by 10.0 meter hatch covers; hold No. 2 was about 7 metres long and was fitted with two small port and starboard, 2.6 metre by 2.9 metre, hatch covers

2.4 The vessel was built in 1976 at Appledore shipyard in the UK and was formerly named Anjana D, Hermenia, Saltersgate and Green Park. At the time of the incident, she was owned and managed by Anjana A. S. of Bodo, Norway.

2.5 The vessel was first entered into the Bahamas Register in 1994 and was classed with Lloyd's Register Classification Society. She complied with the all statutory and international requirements and certification.

### 3 NARRATIVE OF EVENTS

- 3.1 On 19 December 1997 ANJANA was on passage from Port Nador, Morocco to Haugesund, Norway. Ship's time was one hour ahead of Universal Time Co-ordinate (utc.) The course was about 020° true and the weather was reported to include winds of Beaufort force 9 and occasionally 10 from the South East. Seas, approaching the vessel from just abaft the starboard beam, were also reported to be constantly shipped over the main deck and the cargo hatches.
- 3.2 At 0830 hours utc (0930 hours ship's time) the course was altered to leeward, to steer about North West, so that an inspection of the cargo could be made. Two Able Seamen were instructed to check all cargo holds. They reported that cargo hold No. 1 was part flooded with water, having a sounding, from the forward part of the tank top, of 0.60 metres. Cargo hold No. 3 had a sounding of 0.16 metres at the forward end. The Chief Engineer was ordered to pump out the No. 1 and No. 3 cargo hold bilges using ballast pumps No. 1 and No. 2. The pumps were started at about 0930 hours utc. At 1000 hours utc course was altered to head back towards Haugesund, in continuation of the voyage.
- 3.3 By 2100 hours utc the vessel was listing to her starboard side by about 10°. Consequently, the Master again steered to leeward in order to conduct another check of the cargo holds No. 1 and No. 3. The report indicated that No. 1 cargo hold was severely flooded with water to an approximate sounding of half of the cargo hold height, which approximately equates to 3.5 metres above the tank top. It was confirmed that the pumps had been running, under the personal supervision of the Chief Engineer, all the time since they were first started at 0930 hours utc.
- 3.4 By 2200 hours utc the ability to control the steering of the vessel had ceased as the vessel was trimmed by the head and the starboard list had increased to about 25° - 30°. ANJANA was still shipping seas on the starboard main deck and over the cargo hatches. The Master transmitted a distress call through the Inmarsat-C to Goonhilly Earth radio station at 2206 hours utc. He gave the position as Latitude 57° 08.0'N, Longitude 005° 00.0'E. and stated that the vessel was sinking. The Distress message was repeated over the Medium Frequency at 2215 hours utc on 2182 kHz. This Distress was initially acknowledged by Falmouth Coastguard who passed the message to the Marine Rescue Co-ordination Centre, Stavanger.
- 3.5 At 0000 hours utc, 20 December 1997, a helicopter of the Norwegian rescue services, based at Stavanger, arrived in the vicinity of the vessel, which was then reported to be severely listed to her starboard side and shipping heavy seas across the main deck and over the hatches.
- 3.6 At 0015 hours utc, 20 December 1997 the Master considered that the vessel was probably going to sink even if salvage assistance had arrived. He therefore decided to abandon ship to save the life of all ship's personnel on board. The efforts to pump out the holds had continued from the when the pumps were started at 0930 hours utc until the time of the abandon ship order.

- 3.7 By 0035 hours utc, 20 December 1997, all ship's personnel were winched on board the rescue helicopter of Stavanger Coastguard.
- 3.8 They were taken ashore where they were attended to and housed in a hotel in Stavanger. Prepared statements of the Master and the Chief Engineer were submitted but the Owner, Manager and the crew did not make themselves available for further questioning.

#### 4 ANALYSIS

4.1 There is very little contemporaneous evidence from the vessel as all of the ship's records and log books were lost when she sank.

4.2 The ingress of water into No. 1 cargo hold and the evidence of some water being in No. 3 cargo hold was noted at 0830 hours utc. The following five scenarios and discussions, either individually or in combination, may be considered:

##### 4.2.1 Scenario 1

There was a major hatch cover failure of either one or more of hatches No. 1 and No. 3 (one large hatch each), and No. 2 (two small, side by side hatches.)

- There was no recognition of any damage to the hatch covers, despite two separate cargo hold inspections made by crew members.
- It was, however, noted that there were seas breaking over the decks from early in the morning of 19 December 1997.

##### 4.2.2 Scenario 2

All three holds were made common through the collapse or major leakage of BOTH bulkheads between No. 1 and No. 2 AND No. 2 and No. 3.

- There is no evidence of any major structural collapses having been heard or seen by the crew.
- The coincidence of two such bulkheads having collapsed reduces the probability of this being a likely cause.

##### 4.2.3 Scenario 3

Holds No. 1 and No. 3 (and if No. 2 was flooded, then that as well) were common through the bilge pumping system.

- There is no evidence to suggest that this occurred prior to the list developing but the practice of leaving the bilge suction valves open to facilitate the easy draining of water from the bilges is not unknown. Such a scenario would have left, at least, holds No. 1 and No. 3 common prior to the first discovery of water in the holds.
- After water was discovered in the holds, and pumping was started from both holds at 0930 hours the above referred to bilge suction line would have been common, at some point, between the two tanks.
- That alone would not have been a source of water entering the holds. It may, however have been the means by which water already in one of the holds could have been distributed between them. The water level was seen to have been gaining in No. 1 hold.



#### 4.2.4 **Scenario 4**

There was a failure of the side shell or bottom shell plating in one, two or all three holds.

- If there was a failure in the bottom plates then it must have been severe enough to penetrate in to the hold through the double bottom or into an open piping system, such as referred to in 4.2.3 above.
- A hole in the side shell plating could have produced the water seen in one hold, but the likelihood of two such holes is remote.
- A split or fracture along a side plate seam that extended across the bulkheads between the three holds is a possibility.

4.3 Considering the above four scenarios the most probable cause of the flooding of the holds, in the manner witnessed at the two inspections, relates to scenarios 3 and 4, being either:

- ♦ A single failure or puncture hole of the side plate of hold No. 1 and the bilge pumping system piping being open making the two holds common.
- ♦ A longitudinal split in a side shell seam. The larger portion of such a split would have been in No. 1 hold.

#### 4.4 **Rate of Water Ingress and Extent of Hull Damage**

4.4.1 The following estimates of the rate of flooding into hold No. 1 are based upon the reported water depth, at the forward end of the hatch cover, of 0.60 metres at 0830 hours and second estimate, at 2100 hours, that the hold was flooded to half its depth: approximately 3.50 metres. That evidence indicates the rise in water level of 2.9 metres over an interval of 12½ hours, 11½ hours of which the pumps were running. The increase of water volume in hold No. 1 during that time may be approximately calculated as follows:

$$\begin{array}{rcl} \text{Increase in sounding} \times \text{length of hold} \times \text{breadth of vessel} \\ 2.9 \times 30.0 \times 15.5 = & 1350 \text{ m}^3 \end{array}$$

The water ingress into No. 3 hold is not known. The hold was a similar size to No. 1 hold and so, if there was flooding into that hold as well then a similar rate may have occurred. The evidence, however suggests that the sinkage of ANJANA was as a result of a starboard list and excess trim by the head. It is therefore most probable that all of the damage, or at the very least the major portion of it was in the vicinity of No. 1 hold.

4.4.2 The capacity of the ballast pumps has not been made available. The following estimates are therefore calculated using two pairs of pumps of capacities of 30 m<sup>3</sup> per hour and 100 m<sup>3</sup> per hour. It is also considered practical to assume that the water ingress originated from a single hole or aperture in No. 1 hold .

- Two 30 m<sup>3</sup> rated pumps would have pumped 690 m<sup>3</sup> in 11½ hours, and so the total ingress would have been:

2,040 m<sup>3</sup>, or 165 m<sup>3</sup> per hour.

- Two 100 m<sup>3</sup> rated pumps would have pumped 2,300 m<sup>3</sup> in 11½ hours, and so the total ingress would have been:

3,650 m<sup>3</sup>, or 305 m<sup>3</sup> per hour.

4.3.2 Using a simple standard flooding rate calculation the flooding rate at 165 m<sup>3</sup> per hour and 305 m<sup>3</sup> per hour would result from an irregular hole as shown in the following table:

Rate of 165 m <sup>3</sup> per hour		Rate of 305 m <sup>3</sup> per hour	
Hole area	Water head	Hole area	Water head
<b>96 cm<sup>2</sup></b>	3.0 metres	<b>178 cm<sup>2</sup></b>	3.0 metres
<b>118 cm<sup>2</sup></b>	2.0 metres	<b>218 cm<sup>2</sup></b>	2.0 metres
<b>137 cm<sup>2</sup></b>	1.0 metres	<b>309 cm<sup>2</sup></b>	1.0 metres

4.3.3 As a result of the hypothesis of:

- a variable rate of pumping between 60 m<sup>3</sup> and 200 m<sup>3</sup> per hour
- a single irregular hole in the side of No. 1 hold at a depth below the water line of between one and three metres,

the size of the ragged hole need only have had an area of

between about 96 cm<sup>2</sup> and 309 cm<sup>2</sup>.

Such a hole could have had

a diameter of between about 10 cm and 18 cm

**or** have been an average of a 5 mm gap in a sprung weld of length of 6.2 metres.

In any circumstances a comparatively small hole or aperture.

#### 4.4 Cause of the Damage

- 4.4.1 There are two possible scenarios to account for the failure of the side shell plating:
- There was a collision with an external floating object during the latter part of the voyage.
  - The cargo of stones shifted or exerted sufficient pressure to initiate the failure. Two extreme cargo situations may be considered:
    - i) large stones, or rocks, that can typically range from ½ tonne to 5 tonne in weight, may have shifted and their relatively sharp, jagged edges caused a hole in the side shell plating,
    - ii) a bulk cargo of small stones, such as can be found on stony beaches, may have become fluid and surged to one side causing sufficient force to initiate a failure.
- 4.4.2 There was no evidence of any sound or vibration being felt that could have been the result of contact with an external floating object. There has been no other reports of any floating objects, that may have been a danger to navigation.
- 4.4.3 If they were large stones or rocks then the rolling of the vessel in the rough seas experienced during the morning of 19 December may have caused one or more to shift within the hold. A shifting stone could have rolled up to the ship's side where it may have punctured the shell plating with a jagged edge or else simply have struck the shell plating or a side frame with sufficient force to 'spring' the frame and to fracture the plate or a plate weld.
- 4.4.4 Had the stones been of smaller size, their loading may have exerted sufficient force to cause the plating to 'pant', separating the plating from a frame and initiating a fracture similar in style to that described above for the large stone.
- 4.4.5 This fracture, whenever initiated, could then have gradually 'worked' open either throughout the voyage or after a stone had shifted, getting worse during the rough weather. It could then have grown to such a size as to permit the level of flooding calculated above.
- 4.4.6 The large time gap of 12½ hours between the first and last inspection and soundings of No. 1 hold, producing a net water ingress of over 1,200 tonnes indicates that the pumps only just failed to keep the water level under control. It was however insufficient and so, without additional outside assistance, the eventual foundering of the vessel became inevitable. Such assistance did not arrive in sufficient time.

## 5 CONCLUSIONS

- 5.1 On 19 December 1997, in strong winds and rough seas, water ingress into No. 1 hold and No. 3 hold of ANJANA was detected at 0830 hours. Two ballast pumps were set up to attempt to keep the flow of water into those hold under control. By 2130 hours another inspection revealed that the level of water within No. 1 hold was rising.
- 5.2 A starboard list and increasing head trim eventually caused the steering of the vessel to become ineffective. A distress message was initially sent at 2206 hours utc. A helicopter from the Norwegian Search and Rescue Service arrived on the scene at 0000 hours utc, 20 December 1997 and the Master gave the order for the vessel to be abandoned at 0015 hours utc. All of the crew were safely winched from the vessel by 0035 hours utc, that morning. It is not known when the vessel later sank.
- 5.3 The most probable reason for water to enter the cargo holds is a failure of the ship's hull. The precise identification of that failure has not been identified. The water ingress appeared to be primarily concentrated in No. 1 hold. The relatively slow rate of water ingress, over the pumping effect of the ballast pumps, suggests that the damage to the hull through which the water was entering was not excessively large.
- 5.4 The size of the hole or split in the hull was comparatively small. It is not known where, what shape or what size it was.

A calculation based upon the failure being between one and three metres below the sea level indicates that the hole or aperture through which the water entered was between about 96 cm<sup>2</sup> and 309 cm<sup>2</sup>. This may have been a ragged circular hole of diameter between about 10 cm and 18 cm, or a sprung weld or split in the side shell plate of an average 5 mm gap and a length of about 6.2 metres.