Report of the Investigation

into the Power Failure on

CANBERRA

off the Isle of Wight

on 7 December 1994

Marine Accident Investigation Branch
5/7 Brunswick Place
SOUTHAMPTON
SO15 2AN

Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1994

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the causes 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.

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1. SUMMARY

In the early hours of 7 December 1994 the UK registered passenger vessel CANBERRA, with 1,495 passengers and 931 crew on board, suffered a loss of propulsive and main electrical power. At the time of the incident CANBERRA was seven miles south-east of the Isle of Wight bound for Southampton. The sea was rough and the wind was south-by-west force 8.

Following the change of boiler fuel supply from one set of tanks to another, pressure fluctuations were experienced so that the supply was changed back to the original tanks. The fuel pressure then dropped and main steam pressure was lost. This in turn resulted in the loss of main propulsion motors and all electric power. The emergency generators activated and supplied power for lighting and services.

The Coastguard was alerted by CANBERRA's "SECURITÉ" message; subsequently an Urgency "PAN PAN" signal was broadcast and tugs in the Solent area were alerted.

About half an hour after the loss of main electric power, steam pressure was raised slowly on one boiler, but with CANBERRA still continuing to drift towards the coast, it was decided to anchor the vessel.

Just over two hours after the start of the incident, full electrical power was regained, but weighing of anchors was delayed because one anchor had fouled the cable of the other. The first tugs arrived on scene three hours after having first been alerted, and after successfully weighing and stowing anchors CANBERRA proceeded without assistance to Southampton where she berthed later that morning.

The loss of steam pressure was due to a failure in the fuel oil supply which in most part was due to inadequate procedures and supervision. The investigation also found some weaknesses within the bridge watchkeeping team during the period prior to anchoring the vessel.

There was no loss of life or injury as a result of the incident.

PART I FACTUAL ACCOUNT

2. PARTICULARS OF SHIP AND CREW

2.1	Name	:	CANBERRA
	Type	:	Passenger Cruise Liner
	Built	:	1961 Harland & Wolff, Belfast
	Port of Registry	:	London
	Overall Length	:	249.49 metres
	Extreme Breadth	:	31.25 metres
	Maximum Draught	:	9.989 metres
	Gross Tonnage	:	49,073
	Main Engines	:	2 x steam turbines driving 2 x 32,200 kW 6000v AC alternators driving 2 x 42,500 shp electric motors
	Main Boilers	:	3 x water tube ESD II boilers each 64.9 bar 515 °C S/H
	Auxiliary Alternators	:	4 x 1500 kW turbines 440v 60Hz AC
	Emergency Generators	:	2 x 200 kW diesels 440v 60Hz AC
	Managers	:	P&O Cruises (UK) Ltd London
	Classification Society	:	Lloyd's Register of Shipping

2.2 Bridge and Navigational Equipment

The vessel is fitted with a comprehensive navigational and communication system which is connected to both main and emergency electrical power sources. In the event of a main power failure, the equipment is automatically connected to the emergency power supply. The majority of the bridge equipment, despite the change in power supplies, would continue to operate with some manual intervention. Individual items such as radars would automatically revert to a standby mode on power interruption and require manual intervention to restore them to the operating condition.

A Voyage Event Recorder is installed.

2.3 Manning

When at sea under normal operational conditions, the bridge is manned by two navigating officers, a coxswain and one seaman. In the event of an emergency, the bridge becomes the command centre and focal point for any subsequent action.

Under normal steaming conditions at sea the watch in the engine and boiler rooms is manned by four engineer officers, an electrical engineer officer and four crew members. When "standby" is rung on the engine room telegraph, the Chief Engineer joins the watch, together with any additional engineering staff considered necessary. In an unforeseen emergency, the engineering staff respond to the engine room alarm by mustering at the control platform in the engine room.

3. NARRATIVE

Universal Co-ordinated Time (UTC) is used throughout

3.1 CANBERRA was proceeding on passage from Madeira to Southampton, approaching the Nab Tower from the south-west. The planned ETA at the pilot station was 0230 hrs on 7 December 1994. She had 1,495 passengers and 931 crew on board including six contractors preparing the vessel for her dry dock and refit period.

3.2 At 0112 hrs on 7 December, with St Catherine's Point Light bearing 304° x 10 miles (see Figure 1), the deck officer of the watch began a 360° turn to port in order to maintain the ETA without further reducing speed. The wind was south-by-west force 8, and with high water at Portsmouth being predicted for 0204 hrs.

3.3 At 0045 hrs, the fuel pump suction was changed over from No 22 P&S settling tanks to No 21 P&S settling tanks. At about 0115 hrs the boiler fuel pump then started to experience severe discharge pressure fluctuations. The fuel oil pressure was restored when the fuel pump suction was changed back to No 22 P&S settling tanks.

3.4 However, at approximately 0125 hrs, it was noticed that the boiler fuel oil pressure, and consequently the boiler steam pressure, was falling. The bridge was advised immediately. The two standby boiler fuel pumps were started but failed to pick up suction. All three of the main boiler fuel pumps were then started and the fuel filters changed over. However fuel suction still could not be obtained. In order to conserve steam pressure, steam consumption was reduced by slowing down the propulsion motors and by shedding electrical load to reduce electrical demand to a minimum.

3.5 As the vessel lost main propulsion an attempt was made to gain more sea-room by turning to port but by 0143 hrs headway was lost, at which time she settled, heading to the west, in a position with St Catherine's Light bearing 296° x 8.6 miles.

3.6 At about this time the Master broadcast a "SECURITÉ" message on VHF Channel 16 in order to warn vessels in the immediate area that CANBERRA was drifting and not under command (NUC). NUC lights were also displayed, and a plot of the vessel's drift was started.

3.7 Because of low steam pressure, the auxiliary turbo-alternator revolutions dropped. As a result the alternators tripped off the switchboard under a low voltage trip leaving the vessel in a black-out condition. In response, the stand-by emergency diesel generator started up automatically supplying power to the emergency services including navigational equipment in the wheelhouse. Included in this equipment were, the radar, Global Positioning System (GPS), satellite navigator and gyro compass. Power supply to the equipment was momentarily disrupted as emergency power replaced main power. During electrical load shedding and final black-out, instability of the power supply caused alarms to be activated on the bridge.

3.8 At 0145 hrs all passengers were informed of the situation by the Master using the public address (PA) system. In addition, the vessel's Deputy Captain and other officers visited all the public rooms to reassure passengers. The passenger areas were manned and generally quiet with most passengers either asleep or preferring to remain in their cabins. The passengers who remained in the public spaces were kept informed of the developing situation throughout the incident, supplemented by additional broadcasts over the public address system made by the Deputy Captain from his cabin.

3.9 During the easterly passage up the Channel, ballast had been moved to counteract the effect of the strong wind on the starboard side of the vessel. When the vessel finally settled heading to the west, the offset ballast combined with the wind on the port side caused the vessel to list 4° to starboard. Apart from this observation, the vessel was described as lying comfortably to the sea.

3.10 Having heard the "SECURITÉ" message the Coastguard contacted CANBERRA and requested more information. As a result of the communications which followed, at 0152 hrs CANBERRA asked the Coastguard to alert tugs to proceed to the assistance of the vessel. Additionally, various lifeboat stations and other emergency services were put on alert. At 0207 hrs the Coastguard broadcast a "PAN PAN" message with the agreement of the Master. At 0216 hrs the Coastguard confirmed that a tug was on its way.

3.11 By 0220 hrs the ebb tide was having a greater effect on the drift of the vessel and her set had changed to the north- west. The coastline was 4.5 miles away at this time.

3.12 As a further containment action, of the two main boilers available, No 1 boiler was shut down. No 2 boiler was kept on line using the harbour start-up boiler fuel system. By 0212 hrs sufficient steam pressure was available to run up an auxiliary turbo-alternator. However, during the attempt to change over the supply from the emergency diesel generator to the turbo-alternator, electrical power was temporarily lost.

3.13 At the second attempt the auxiliary turbo-alternator was run up successfully, albeit on reduced load. The bridge was advised at 0225 hrs that electrical power was being progressively restored and that it was hoped power would be available within 45 minutes.

3.14 At 0240 hrs, with the vessel continuing to drift north-westerly towards the bank to the south of St Catherine's Deep, final preparations for anchoring were made. The port anchor was let go from the hawse pipe at 0251 hrs. It was run out and held at 8 shackles of cable on deck. The subsequent plot of the vessel's drift indicated that the vessel was dragging this anchor to the west (see Figure 1). At 0301 hrs the starboard anchor was also let go and run out to 8 shackles of cable. After the second anchor was dropped there was very little drag and the movement detected can largely be attributed to the vessel swinging and being brought up to the second anchor. St Catherine's Point Light was bearing 284°(T) x 4.7 miles.

3.15 Venting of the boiler fuel pumps eventually brought them back into full service and from 0255 hrs power began to be regained. At 0305 hrs and 0325 hrs respectively limited main propulsion electrical power, then full electrical power supply to other services was available with three auxiliary turbo-alternators back on load. Full power to the propulsion motors was available at 0355 hrs. At this time CANBERRA's crew began to heave up the port anchor. The port anchor was aweigh at 0424 hrs, but at 0426 hrs was found to be fouled with the starboard cable.

3.16 The tug BUSTLER arrived at 0512 hrs and was told to stand by. Three other harbour tugs VECTA, FLYING KESTREL and FLYING OSPREY, which were en route to CANBERRA, were held in the eastern approaches to the Solent where they arrived off the Nab Tower at 0519 hrs. CANBERRA cleared her fouled anchor cables at 0601 hrs and the anchors were aweigh by 0622 hrs. Passage to the Nab Tower was resumed with the pilot boarding at 0724 hrs and the vessel berthed at Southampton at 1030 hrs on 7 December 1994.

PART II CONSIDERATION OF POSSIBLE FACTORS

4. CAUSE OF LOSS OF BOILER FUEL OIL PRESSURE

4.1 Loss of boiler fuel oil pressure and consequent loss of boiler steam pressure resulted in a black-out situation and loss of propulsion.

Problems had been experienced with the settling tank heating system, so that oil temperature in the tanks was somewhat lower than the more normal 49 °C (120 °F). Although this lower temperature increased the viscosity of the fuel thus making it more difficult to pump, it is unlikely that this would cause the total loss of the fuel supply. The results of a fuel oil bunker analysis supported the view that the fuel itself was not a cause of the problem.

4.2 No defects were identified on the three main fuel pumps and the two auxiliary fuel pumps themselves. It was deduced therefore that loss of fuel pressure was due either to a blockage in the supply lines from the settling tanks, an ingress of water into the system, or the loss of pump suction because of ingress of air or fuel starvation.

4.3 The changing over of fuel filters during the incident failed to improve or change the situation. Examination of the three filter blocks within the system did not reveal any defects or evidence of heavy sludge, and the possibility that choked fuel oil filters contributed to loss of fuel pressure was therefore discounted.

4.4 There is no record of spluttering and blow-back at the boiler front and therefore the presence of water and sludge in the fuel oil is not suspected. The absence of these residues was confirmed by an internal inspection of the tanks which showed no evidence of excessive sludge. It was also reported that the settling tanks had been regularly de-sludged and drained of water.

4.5 The fuel pumps had to be vented for a considerable time until fuel pressure was restored. This must have been due to air ingress into the system and/or blockage in the fuel supply line to the pumps. As there is no evidence that a blockage in the system existed, it is considered that air ingress was the cause of the problem.

The fuel supply piping to the boiler pressure pumps and the pumps themselves were examined but no defects were found that may have contributed to air ingress.

It is deduced therefore that the most probable reason for air ingress was due to exposure of the open end of a settling tank suction pipe. Operation of the settling tanks during the preceding 24 hour period was therefore investigated to establish the quantity of fuel oil in the settling tanks when fuel oil pressure failure occurred.

4.6 The bunkering officer left instructions to the engine room watchkeepers that for dry-docking reasons the quantity of fuel in No 21 P&S settling tanks should be reduced to 40 tonnes by arrival at Southampton. (The accepted normal minimum operating level of the settling tanks is 60 tonnes). During the 4 to 8 afternoon watch on 6 December the fuel tanks were changed over from No 21 P&S to No 22 P&S. It was recorded that 60 tonnes and 38 tonnes were left in No 21 P and No 21 S tanks respectively. Since both these tanks were used simultaneously, each tank should have contained approximately the same amount of fuel. There is no evidence to show if, or when, this gauge error became known to the bunkering officer or the watchkeepers, although the watchkeepers on the 4 to 8 afternoon watch were aware of the discrepancy as they changed over from No 21 to No 22 settling tanks, as 38 tonnes was recorded in No 21 S during their watch.

4.7 At 2400 hrs No 22 P&S were still in use and contained 75 and 73 tonnes respectively. At about 0045 hrs, the 12 to 4 watchkeeper decided to change over the fuel tank suctions from No 22 P&S to No 21 P&S, opening the valves of the latter before closure of the suction valves on the former. The watchkeeper mistakenly assumed that the error was in the remote tank gauge reading of 38 tonnes for No 21 S, and that the tank held 60 tonnes, the same amount indicated in No 21 P. By placing these tanks back on line, the watchkeeper intended to reduce the tank contents to 40 tonnes in accordance with the bunkering officer's instructions.

4.8 After the change over, at 0115 hrs, fuel pressure variations occurred consistent with fuel starvation. The settling tanks were changed over once more bringing No 22 P&S back on line. Although there was a larger head of fuel in these tanks, it is considered that the system had by then taken in a considerable quantity of air and that the sudden application of a larger head of fuel oil on the system compressed this air and ultimately forced it down towards the fuel pump. Once there, the pump was air-locked and ceased to function.

4.9 After reverting back to No 22 P&S, the fuel pressure stabilised for a period of 15 minutes before all suction was lost. However, considering the length of pipe involved, it may be that sufficient oil remained within the pipe to give the impression that the situation had been regained before air locking occurred. The watchkeeper noted that the vessel rolled heavily at about the same time that suction was lost. This may have been coincidental and probably was not a significant factor in the loss of fuel pressure. In order to regain consistent fuel oil pressure, extensive system venting was required; this supports the view that a low level of fuel in No 21 S was the most likely cause of the loss of fuel pressure.

4.10 The investigation into the loss of boiler fuel oil pressure called into question the standards of technical supervision practised aboard CANBERRA. It is considered that inadequate supervision onboard increased the risk to the safety of the vessel: significant inaccuracies were found in the recorded contents of No 22 P&S settling tanks; a defective settling tank contents gauge was in use; and settling tanks were used with less than normal operational levels.

The risk was further compounded by virtue of the fact that CANBERRA was sailing in coastal waters in heavy weather.

5. RESTORATION OF ELECTRICAL POWER

5.1 The maintenance of emergency electrical switch-gear, particularly on a passenger vessel, demands a very high degree of reliability. The failure of various items of components on this equipment undoubtedly delayed the resumption of power and significantly increased the level of risk to the vessel. Recovery was also delayed due to electrical staff being unfamiliar with certain aspects of the equipment and emergency procedures.

5.2 The emergency diesel generator started up automatically to supply power to the emergency services via the emergency switchboard. However emergency power to the boiler room auxiliaries necessary for the restoration of steam pressure is designed not to be automatically available, but is provided by manually engaging the interconnecting breaker between the main and emergency switchboard. On this occasion the breaker failed to engage. Only after a number of unsuccessful attempts was it realised that this was due to an incorrect operating set-point on the overload current trip. It is possible that the unsuccessful attempts to engage the interconnecting breaker were the cause of power fluctuations which resulted in various bridge alarms being activated. It is probable that weekly planned maintenance tests of the breaker caused undetected slackness to develop in the dash-pot linkage. This allowed the mechanism to move resulting in the trip operating point becoming sufficiently remote from its normal position as to prevent engagement of the breaker.

5.3 The circuit breaker was not fitted with a visual indicator or "trip flag" to indicate that there was a problem.

5.4 Unfamiliarity with the interconnecting breaker mechanism, coupled with poor communication between staff standing by the main and emergency switchboards, seriously delayed identification and correction of what should have been a relatively minor fault.

5.5 Once emergency power was available for the boiler room auxiliaries, it was possible to use the harbour start-up boiler fuel system to build up steam pressure. When sufficient pressure was available, one of the auxiliary turbo-alternators was run up. However, on attempting to change over the supply from the diesel generator to the auxiliary turbo-alternator, a second black-out occurred. This was due to a low voltage trip on the auxiliary turbo-alternator not having been manually reset after the initial black-out.

6. MEASURES TAKEN BY P&O CRUISES TO PREVENT RECURRENCE

The following measures were put in place by P&O before CANBERRA returned to passenger service after the incident.

6.1 The fuel management system was amended so that fuel suction is from one settling tank at a time, utilising No 21 S and No 22 P&S settling tanks. No 21 P is now permanently dedicated as the emergency standby tank.

6.2 The fuel suction system was modified to provide a dedicated reserve fuel supply to a dedicated standby fuel pump. This was achieved by maintaining approximately 160 tonnes of fuel in No 21 P settling tank and isolating that tank from the main suction rail. This retained fuel provides a guaranteed positive head of fuel to the suction side of the standby fuel pump. Sludge residue will not be recycled into this tank. Additional pipe work and valves were installed to provide a separate and isolated suction line directly to the nominated standby fuel pump.

6.3 Differential pressure and fuel discharge pressure alarms were fitted to the fuel system. Pump suction and discharge pressure gauges were led to and mounted on the boiler control console. Instructions have been issued not to allow the contents of the in-use tanks to fall below 60 tonnes.

6.4 The remote gauges for the contents of the settling tanks were recalibrated.

6.5 De-sludging of the settling tanks is now carried out at least once per watch, always prior to a changeover of tank suctions and is formally recorded in the Boiler Room Log. Sludge is not now recycled into No 21 P.

6.6 Recording of all fuel transfers now includes precise details of quantity, time and tanks involved.

6.7 Lloyd's Register Fuel Oil Bunker Analysis and Advisory Service's (FOBAS) analysis of fuel bunkers was reinstated.

6.8 A structured programme of onboard training in emergency procedures for all key personnel was instigated. After consultation with ship's staff, formalised instructions listing actions to be taken in the event of an emergency were produced.

6.9 Senior officers have been instructed to initiate an immediate training programme to ensure all key personnel fully understand and are wholly competent to operate equipment and systems for which they are responsible or likely to be called upon to operate, particularly in an emergency.

6.10 Watchkeeping standards and practices are now more closely and regularly monitored by shore management.

7. NAVIGATIONAL RESPONSE

7.1 Introduction

With the wind and tide combining to give drift rates in excess of three knots, it is to the credit of the Master and his bridge team that the situation was contained, the passengers not overly concerned and that finally the voyage to Southampton was safely completed. However, from examination of the evidence there was some incorrect reporting and position fixing which meant that a true picture of the situation was not continuously available, especially to the Coastguard, although it did not affect the final outcome.

7.2 The Bridge Team

The complement of the bridge watch on CANBERRA on the morning of 7 December consisted of two deck officers, a coxswain and two seamen. At the time of the incident they were joined by the Master. Other deck officers, on being woken or responding to the engine room alarm in their accommodation and the public address announcement, made themselves available to the bridge team. The Deputy Captain dealt with matters concerning the passengers, the Chief Officer with preparations for anchoring, and the First Officer with general tasks around the vessel on instruction from the Master. Two other Third Officers assisted on the bridge.

The Master was faced with the situation of having lost all main electrical and propulsive power, his vessel was drifting seven miles from a lee shore in winds of force 8 and with 2,426 persons onboard. To complicate matters no reliable estimate was available as to when electrical and propulsive power would be regained. Also as the situation developed he continued to be unable to get precise information from the engine room. He therefore needed to assess, among other things, the direction and rate of the vessel's drift and consider the methods available to slow or halt that drift. These are discussed in the following sections.

7.3 The Direction and Rate of Drift

Of prime importance, and within the direct control of the bridge team, was the accurate assessment of the direction and rate of drift of the vessel.

The emergency electrical power to the wheelhouse served, among other instruments, the gyro compass, radars and GPS navigator. When the main electrical power supply failed, all navigational equipment was temporarily disrupted. The main GPS is fitted with an emergency battery supply so that the data stored is retained. The gyro compass readings, sensibly, were treated with some suspicion until checked over a period comparing them with the magnetic compass. The main radar, which had switched itself to standby mode on detecting a fluctuating current, was not reactivated on emergency power for about 10 minutes. However, with the GPS navigator fully operational and with the back-up of a magnetic compass, the vessel was well equipped to enable her position, drift direction and rate to be accurately assessed.

Positions were plotted on the chart which was in use at the time of the power failure, "Anvil Point to Beachy Head" No BA 2450. This was not the largest scale chart available. The GPS navigator was giving good estimates of direction and speed over the ground throughout, and these were used in the early stages of the incident.

The chart was changed at 0157 hrs to the larger scale "Outer Approaches to the Solent" chart No BA 2045. There was an error in the first position, gained from two radar ranges, which was plotted on the new chart at 0157 hrs. Being the first position on the new chart it was used as the basis for subsequent charted drift direction and rate assessments during the next half an hour. These were consequently incorrect. The inaccuracy of the drift direction and rate assessment was further compounded by subsequent plotted positions at 0205 hrs, 0209 hrs and 0214 hrs also being in error (see Figure 1).

It is apparent, from the Voyage Event Recorder, that the Master was told that the wind was from the south-west whereas the true wind direction was just to the west of south. He asked for tidal information at 0135 hrs and was told that the tidal stream was setting to the east when in fact at that time it was predicted to have been slack prior to the beginning of the westward flowing ebb tide.

The wrongly assessed wind and tidal stream directions lent force to the incorrect interpretation of the drift direction obtained from the charted positions, which was preferred to the drift direction and rate derived from the GPS navigator as the officers were apparently uncertain about the accuracy of the equipment at that time. It was reported that the vessel was drifting to the north-east (see Figure 1). This information was communicated to the Coastguard at 0216 hrs.

It must have become apparent to the Master soon after this time that the vessel was, in fact, drifting towards the coastline. However for a period, drift direction and rate assessments were inaccurate. Inaccuracy in this critical area, combined with uncertainty as to the elapsed time before power might be regained, could have affected the Master's risk assessment and influenced his strategic decisions. Notwithstanding these difficulties, the Master had already identified that CANBERRA should be able to anchor if necessary on the bank to the south of St Catherine's Deep.

7.4 Tug Assistance

One method whereby the drift could have been slowed or halted in the absence of the vessel's own propulsion power was assistance by tugs.

Despite prompt action to organise tugs, the first tug did not arrive until 0512 hrs. If in fact the drift direction had been clear of the nearest coast, the tugs may have arrived in time to prevent the vessel grounding. However, if limited propulsion power had not been available and if the anchors had not held, the tugs would have arrived only after the vessel had grounded under the cliffs of the south coast of the Isle of Wight.

7.5 Anchoring

The other method was the use of the vessel's own anchors. The anchors were cleared away at an early stage but, as there was no power to the windlass, they could not be walked back out of the hawse pipes as is normal practice in preparation for anchoring. The Master considered letting go the anchors early in the incident. However he decided to anchor if power was not restored prior to reaching the bank south of the Isle of Wight, or when it became necessary.

The Master's reasons for this decision are understandable and were based on his many years of experience on the vessel and consideration of all the factors known to him, including his concern for the nature of the holding ground (rock) prior to closing the shoal bank.

Whereas it is recognised that there were valid arguments which influenced the Master's decision to delay anchoring it is nevertheless considered that it would have been more prudent to have anchored at an earlier stage for three reasons:

(i) One of the potential problems involved in dropping an anchor directly from its hawse pipe is the uncertainty of whether the anchor will run out freely; however the Master was not concerned with this aspect as no such problem had been experienced previously on CANBERRA.

(ii) The vessel was drifting for over an hour before the anchors were deployed. In this time shore emergency services were being mobilised against the event that CANBERRA grounded and required evacuation.

(iii) If successful, early use of the anchors would have put the safety of the vessel beyond doubt.

The Master decided that he would anchor the vessel as it drifted towards the bank to the south of St Catherine's Deep. The port anchor was let go first, as the vessel drifted towards the southern ledge of a bank. The vessel was probably drifting at three knots at this time and the first anchor did not hold her but did reduce the drift. The drift was successfully stopped, or at least slowed to a minimum, after the starboard anchor had also been let go.

8. COMMUNICATIONS

8.1 Following the loss of power the Master was reluctant to communicate immediately with the Coastguard, at least until he had discussed the situation with the P&O management. In the initial stages, problems were experienced in obtaining a telephone connection between the Master and a senior manager due to the power failure affecting the satellite communication system.

8.2 At 0142 hrs a "SECURITÉ" warning message was broadcast on VHF Channel 16 to all vessels in the area. Solent Coastguard monitored this transmission and, being concerned about her reported situation, they contacted CANBERRA for more information.

8.3 The initial information which was passed to Solent Coastguard was not precise. First the Coastguard were asked to wait while the Master fully assessed the situation. Subsequently, at 0150 hrs, they were contacted and given an imprecise position, but a correct drift direction and a statement indicating that the vessel was about to use its anchors. Solent Coastguard contacted CANBERRA at 0154 hrs. At this time CANBERRA told Solent Coastguard:

> "It does not look as though we will get power back for some time. I'm going to attempt to drop the anchors very shortly".

During this period several unsuccessful attempts were made to make contact between CANBERRA's bridge and P&O management. This connection was finally made at 0158 hrs.

8.4 There followed several conversations between CANBERRA and Solent Coastguard concerning tugs. No other positional or drift information was passed to or requested by the Coastguard until 0216 hrs at which time Solent Coastguard asked for the vessel's position in latitude and longitude, the distance from shore and the estimated rate and direction of drift. CANBERRA replied with an inaccurate position and with the information that the vessel was drifting north-easterly at 3.4 knots, and that there were approximately 8 miles to the shallows.

This drift direction and rate was based on the erroneous 0157 hrs charted position and therefore was itself completely wrong. In fact the vessel was drifting to north-north-west towards the coast, which was four miles distant, at a rate of about 3 knots (see Figure 1).

8.5 It is not considered that there was any conscious effort to give false information. However, the information was not verified as accurate before being passed to the Coastguard. This led, albeit inadvertently, to the Coastguard obtaining an inaccurate picture of the situation onboard. This, in its turn, had implications on the ability of the Coastguard to accurately assess the risk to the vessel.

PART III FURTHER COMMENT AND DISCUSSION

9. HM COASTGUARD

9.1 The Coastguard Maritime Rescue Sub-Centre (MRSC) at Lee-on-Solent maintains a 24 hour listening watch with sophisticated communications equipment. Its personnel are trained to make the appropriate risk assessment and consequent strategic decisions in order to save life at sea and protect the environment. They do not maintain radar surveillance or a visual lookout. They are totally reliant on information communicated to them in order to be able to perform their role.

9.2 **Risk Assessment**

The initial information passed to the Coastguard was imprecise. The first positional information obtained by the Coastguard consisted of the statement made at 0143 hrs in the "SECURITÉ" broadcast:

> "Three miles south of the Isle of Wight and drifting to the north-north-east".

This was followed by another imprecise position at 0150 hrs which was recorded in the Coastguards' log as:

> "Five miles SE of St Catherine's Point, Isle of Wight, drifting north-westerly".

It should be noted that the transcript of the voice recorder on CANBERRA's bridge reveals that the drift direction was passed as north-north-westerly.

In the absence of any other indication the Coastguard had assumed the 0143 hrs position to be three miles south of St Catherine's Point. When the two positions were plotted on the chart (see Figure 2) they assumed the vessel had been proceeding on a course of about 085°. They were aware that the tidal stream was predicted to be flowing to the west-south-west and, with the southerly gale force wind that their instruments indicated, the vessel would drift northwards.

After this time there were a number of conversations concerning tugs. The Coastguard realised that some of the information they had been given in the early stages was contradictory and that more information was needed to enable them to form their own risk assessment. Therefore they called CANBERRA and asked for the vessel's position in latitude and longitude, the estimated drift direction and rate and the distance offshore. In reply CANBERRA gave the following information at 0214 hrs:

> "50°32'.1N 001°06'.3W, drifting 045° at a rate of 3.4 knots, approximately 8 miles from the shallows".

The Coastguard asked for confirmation that 045° was indeed the true direction. CANBERRA confirmed this.

At 0150 hrs and again at 0154 hrs the Coastguard received the impression that the vessel was going to use its anchors in order to slow down the drift. It is considered that these were conversational remarks rather than definite statements from the vessel but, nevertheless, the Coastguard were left with the impression that the anchors were going to be used. CANBERRA's officers did not mention anchors again until 0236 hrs, at which time they stated that they intended to try to anchor if power was not regained within twenty minutes.

The plot of positions on the chart extract (see Figure 1), shows that the vessel was actually drifting towards the coast of the Isle of Wight throughout the period between 0143 hrs, when headway was reported as lost, and 0254 hrs, when the first anchor was let go. The second chart extract (see Figure 2), shows the information as it was recorded by the Coastguard. Armed with only this latter information, the Coastguard would have been unable to assess the risk to the vessel accurately.

In the event this did not affect the final outcome. However, in other circumstances, if the vessel had grounded for instance, this could have had serious implications for the ultimate safety of the vessel, passengers and crew.

10. PASSENGERS' CONCERNS

10.1 The demeanour of the passengers throughout the incident was described as calm. Nevertheless a number of points of concern were made by passengers in both correspondence and during interviews. Some of this concern was understandably misconceived because of mis-information.

10.2 Mis-information

Information stating that CANBERRA entered the English Channel on one main engine with the other in the process of being stripped down ready for the re-fit was incorrect. The investigation confirmed that, on entering the English Channel, the vessel was in a safe operational condition. Two main boilers were on line supplying steam to one of the main propulsion turbo-alternators which was in turn supplying electrical power to both main propulsion motors. The two boilers were steaming well below their maximum output with the main engines operating at about 25% maximum load. Both main engines were in use with the second propulsion turbo-alternator available if required. There was therefore no question of CANBERRA being at risk when she entered the Channel.

Also the fact that some contractors were onboard led to concern that their presence was related to the incident. As was the usual practice, pre-refit activities had started on CANBERRA with six contractor's staff joining the vessel in Barbados. This pre-refit work in the engine room and accommodation consisted of pre-installation work necessary for updating the fire detection system together with preparation work on the casing and economizer system for No 3 main boiler. None of this pre-refit work had any involvement in the loss of fuel oil pressure and the subsequent electrical black-out.

10.3 Vessel's List

In order to counter a slight port list due to the effects of the strong wind whilst on passage to Southampton, additional ballast tanks had been filled on the starboard side. After the loss of power, CANBERRA settled with the wind on the port side. The effect of the wind and the offset ballast combined to give her a starboard list. Without power it was not possible to correct the list but once power had been regained, ballast was transferred and she was brought upright.

10.4 Emergency Lighting

Passengers' comments on the emergency lighting confirm that, in so far as they were aware, the system functioned correctly in the alleyways and public rooms. A Marine Safety Agency surveyor who was onboard at the time, took the opportunity of "walking" all decks and confirmed the availability and effectiveness of the emergency lighting.

10.5 Emergency Information and Care

Comment has been made on the apparent lapses in keeping the passengers informed of the developing situation. It was suggested that there was a delay of about 20 minutes between the start of the incident and the first announcement being made to the passengers and that only one senior officer was seen on the

passenger decks during the emergency. The transcript of the voice recording tapes was examined by the Inspectors and it was apparent that although the first public announcement was made some 17 minutes after electrical load shedding had started (which resulted in partial black-out in the accommodation), arrangements to reassure the passengers and to keep them informed were in hand within minutes of that happening. Although criticism of this time delay may be justified, the Master was having to cope with a rapidly developing situation and what he considered to be the twin demands of vessel and passenger safety. Initially, the greater demand was to try and obtain more sea room. The Deputy Captain and other officers, the entire entertainments staff and a large number of the hotel staff were "roving" the passenger accommodation during this period reassuring the passengers and the cabin staff were standing by in their sections. Moreover the Deputy Captain made three announcements, at approximately 20-25 minute intervals, after checking the latest information from the bridge. These were broadcast on circuits for the passenger areas.

10.6 **Anchoring**

Various comments were made in correspondence from passengers regarding the apparent delay in anchoring the vessel. One passenger suggested that she had been told that the vessel was unable to anchor until CANBERRA was in shallower water. The water depth in the area in which power failure occurred was suitable for anchoring at any time. The Master had decided early in the incident to anchor in his selected position only if this became necessary.

Reference by another passenger to "Bembridge Lighthouse" is indicative of the confusion that arises in incidents of this nature; there is no lighthouse at Bembridge. There is however a lighthouse at St Catherine's Point which may be the one referred to. The nearest that CANBERRA came to that point was in the order of four miles.

One passenger, with experience of the shipping industry and anchor cables in particular, queried the effect on the anchor cables of the vessel anchoring under emergency conditions. CANBERRA's cables are inspected annually and both cables were subsequently ranged and inspected in dry dock as part of a pre-programmed survey. Both, apart from the replacement of three link adaptors, were found to be satisfactory and a new certificate issued.

10.7 **Crew Awareness**

One passenger noted that during the emergency when CANBERRA was anchored but without main power, the crew began placing liferaft containers on the deck alongside the ship's side rails. Checks have been made and there is no evidence that liferafts were being moved while the vessel was at sea.

On a general note, the Marine Safety Agency surveyor onboard at the time, as well as walking around the vessel to check the emergency lighting also observed the performance of the ship's company and the reactions of the passengers. No panic was observed and several members of the crew were seen talking to passengers, reassuring them that the situation was under control and that there was no cause for alarm.

11. COMMUNICATIONS AND THE MEDIA

11.1 During the incident, media interest progressively increased until communications between the vessel, P&O management and Coastguard were seriously affected. Because the press were monitoring open VHF radio channels there was a tendency in the later stages to rely more heavily on mobile and satellite telephones as the main communication links. This, in turn, led to problems because CANBERRA's telephone numbers were readily available to the media and the lines were overloaded by the press trying to contact CANBERRA direct. It became necessary for the Master to positively identify each caller, in case members of the press posed as Coastguard or other officials to gain access to information.

11.2 To overcome such problems in the future P&O Cruises have installed an additional satellite communication system which incorporates a dedicated line to allow secure, instant and direct communications between CANBERRA and shore telephone systems.

PART IV CONCLUSIONS

12. FINDINGS

12.1. The loss of suction at all fuel pumps was due to air entering the system when the watchkeeper changed over supply to settling tanks which did not contain an adequate quantity of fuel.

12.2. The watchkeeper believed he had to reduce the contents of No 21 P&S settling tanks to 40 tonnes as per the bunkering officer's instructions and assumed that 60 tonnes were remaining in each tank.

12.3. The failure of various items of electrical equipment and unfamiliarity of the electrical staff with the equipment delayed resumption of power.

12.4. A degree of confusion existed in the engine room in the early stages of the emergency and there was an apparent lack of an effective command structure.

12.5. Even with a relatively large number of qualified officers on the bridge the work of individual officers was not adequately overseen and checked for accuracy. The standard of position fixing was poor and some inaccurate information was passed to the Master.

12.6. There was an initial reluctance to communicate with the Coastguard until contact had been made with P&O management. This was exacerbated by the problems encountered in setting up a communications link with P&O shore management.

12.7. Some incorrect information was passed to the Coastguard which affected their ability to assess the risk to the vessel.

12.8. An attempt to anchor could have been made at any time during the emergency. As a general rule and in order to put the safety of the vessel beyond doubt it is considered that it would have been more prudent to have anchored the vessel during the early stages of the incident. However, the Master's reasons for deciding not to anchor before he did are understandable and were based on his many years of experience on the vessel and consideration of all the factors known to him.

12.9. In general the safety and care of passengers was kept in the forefront of the Master's mind even though he was beset with both navigational and communication problems.

13. RECOMMENDATIONS

The investigation has highlighted a number of deficiencies in both equipment and operational procedures onboard. In normal circumstances these deficiencies would lead to a number of recommendations being made to prevent a similar incident occurring again. However, P&O Cruises have initiated a number of modifications to the boiler fuel supply system and operational procedures which make such recommendations unnecessary.

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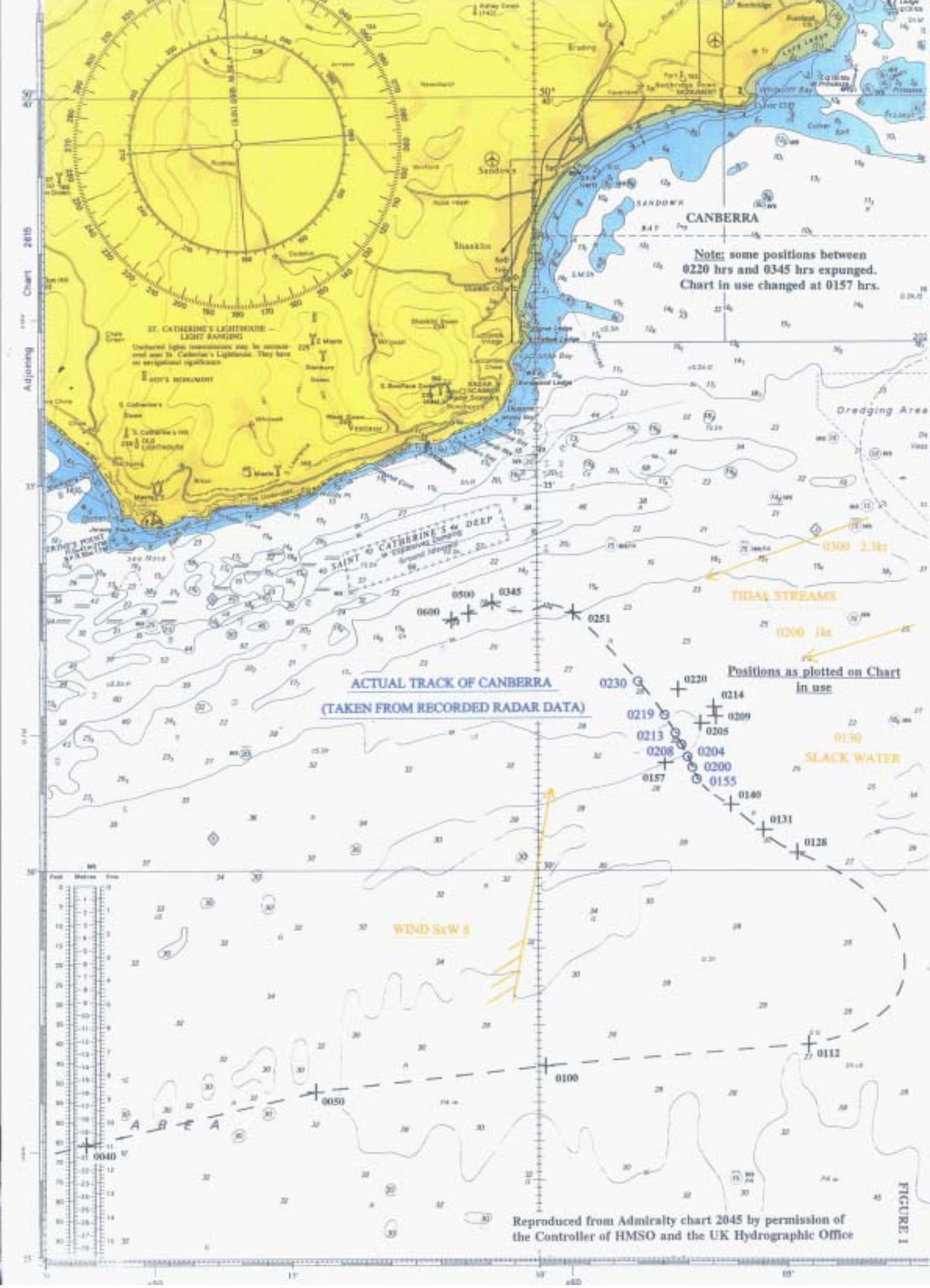

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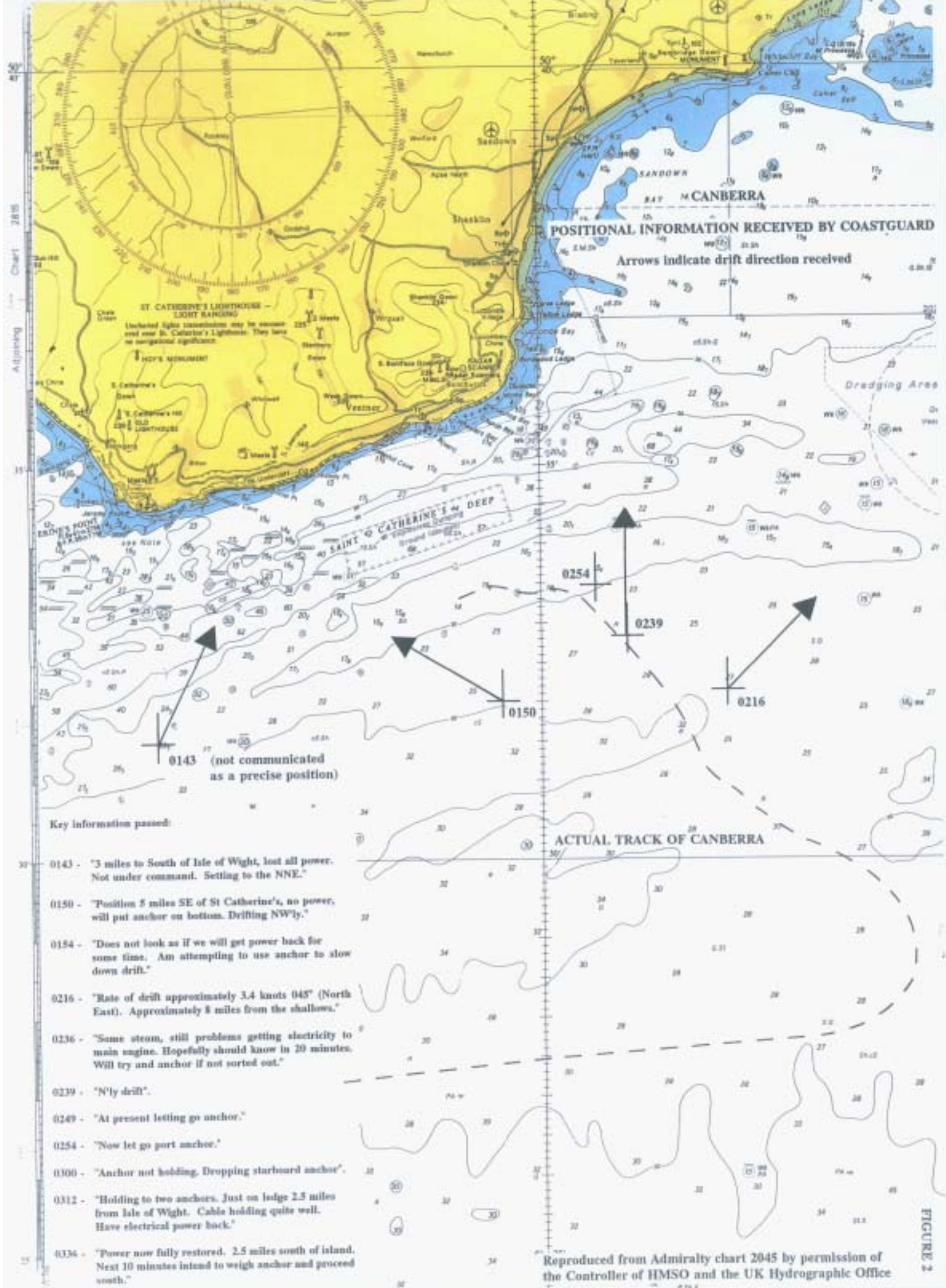
FIGURE 1



Key information passed:

0143 - "3 miles to South of Isle of Wight, lost all power. Not under command. Setting to the NNE."

0150 - "Position 5 miles SE of St Catherine's, no power, will put anchor on bottom. Drifting NW'ly."

0154 - "Does not look as if we will get power back for some time. Am attempting to use anchor to slow down drift."

0216 - "Rate of drift approximately 3.4 knots 045° (North East). Approximately 8 miles from the shallows."

0236 - "Some steam, still problems getting electricity to main engine. Hopefully should know in 20 minutes. Will try and anchor if not sorted out."

0239 - "N'ly drift".

0249 - "At present letting go anchor."

0254 - "Now let go port anchor."

0300 - "Anchor not holding. Dropping starboard anchor".

0312 - "Holding to two anchors. Just on ledge 2.5 miles from Isle of Wight. Cable holding quite well. Have electrical power back."

0336 - "Power now fully restored. 2.5 miles south of island. Next 10 minutes intend to weigh anchor and proceed south."

FIGURE 9.4