



THE COMMONWEALTH OF THE BAHAMAS

“RAVEN ARROW”

IMO Number 8011328

Official Number 399426

**Report of the Investigation into
the Grounding of
“RAVEN ARROW”
at Boat Bay, Johnstone Strait, British Colombia
on
24 September 1997**

1 SUMMARY

- 1.1 "RAVEN ARROW," departed from Vancouver, British Columbia, Canada on 23 September 1997, part laden with a mixed cargo of forest products and grain. She was bound for Kitimat, British Colombia where further cargo was to be loaded.
- 1.2 In the early hours of the following morning, while proceeding Westwards along Johnstone Strait, an erroneous course alteration to Starboard was made which led to the vessel grounding in Boat Bay, West Cracroft Island, at position:
50° 31.4' North, 126° 32.4' West.
- 1.3 The vessel complied with all statutory and international requirements and certification. All equipment and machinery was in normal operating condition.
- 1.4 The bridge was manned by the vessel's Second Mate, a helmsman and one, of two, licenced pilots from the Canadian Pacific Pilotage Authority. The Master was, legitimately, not on the Bridge at the time of the grounding.
- 1.5 The Pilot had conduct of the vessel while the Second Mate independently maintained his watch routine. The Second Mate acted more as a subservient officer would to a dominant Shipmaster - in this case the Pilot - rather than an active responsible officer who monitored and advised the Pilot.
- 1.6 The primary cause of the grounding was the Pilot's mistaken assessment of the radar display after which he initiated an alteration to Starboard into Boat Bay. He believed he was about six miles further ahead along Johnstone Strait and had altered course as if to enter Blackney Passage. His failure to properly verify the vessel's position immediately before or during this manoeuvre led to the situation where the vessel was heading directly into Boat Bay.
- 1.7 The Pilot, realising his error, then ordered that the turn to starboard be continued. During this phase of the manoeuvre, when heading 056°, the vessel ran aground with the main engine still running at 105 rpm - midway between Full Sea Speed and manoeuvring Full Ahead.
- 1.8 The secondary cause was the actions of the Second Mate. As the Officer on watch he had followed the Pilot's instructions, or "advice," passed the helm order to the helmsman and then monitored his actions as the course alterations were made. He failed to verify that the vessel was in the correct position for the initial course alteration. He also failed to pay sufficient attention to his duties during the vessel's passage along Johnstone Strait to appreciate that the course alteration order should have been questioned and countered.
- 1.9 The vessel was refloated about eight hours after the grounding and then anchored at Sunderland Channel, about 20 miles to the East. Passage was eventually made back to Vancouver on 26 September where a full examination was made and temporary repairs were commenced to the vessel's Classification Society approval.

2 PARTICULARS OF VESSEL

- 2.1 “RAVEN ARROW” was a geared bulk / forest products / container carrier registered at Nassau, Bahamas, of welded steel construction. The accommodation and machinery spaces were situated aft. She had the following principal particulars:
- Length overall - 182.00 metres
 - Length BP - 174.00 metres
 - Breadth - 29.00 metres
 - Depth - 16.10 metres
 - Gross Tonnage - 25,063 tons
 - Net Tonnage - 11,226 tons
 - Deadweight - 38,771 tonnes
 - Call Sign - C6JG8
- 2.2 She was powered by a Mitsui, B & W, type 6L67GFCA, six cylinder main engine that developed 9,636 kW (13,100 bhp) and which drove a single fixed bladed propeller. She had three main generators that developed a total of 1,950 kW.
- 2.3 The cargo was carried in five holds that were arranged forward of the accommodation. She was nominally capable of carrying 1,392 teu.
- 2.4 The vessel was built in 1981 at Chiba, Japan. At the time of the incident she was owned by Gearbulk Shipowning, Hamilton, Bermuda, commercially managed and chartered to Gearbulk (UK) Limited and operationally managed by United Ship Management, Hong Kong.
- 2.5 The vessel was first registered under the Bahamas Flag in 1990 and was entered with Det Norske Veritas Classification Society. At the time of the incident she complied with all statutory and international requirements and certification.
- 2.6 “RAVEN ARROW” was last subjected, before this incident, to a Bahamas Maritime Authority Annual Inspection at the Port of Osaka, Japan on 03 December 1996 where no defects were noted.
- 2.7 She had received a United States Coast Guard Inspection at the Port of Grays Harbour, Washington State, USA on 21 September 1997 where, again, no defects were noted.

3 **NARRATIVE OF EVENTS**

3.1 **Weather, Tide and General Situation**

- 3.1.1 The weather at the time of the incident was calm with fog patches which periodically reduced the visibility to between 100 and 150 metres.
- 3.1.2 The tidal current was noted to be ebbing, in a direction of about 280° thus assisting the speed of the vessel, by about one knot.
- 3.1.3 The Master had left the vessel's bridge at 2300 hours to take some rest. He stated that a message had been left for him to be called in time to attend the bridge for the transit of Blackney Passage.
- 3.1.4 The Bridge was manned by the Second Mate, a helmsman and one, of two, Canadian Pacific Pilotage Authority coastal pilots who had been engaged for the passage. The helmsman was steering the vessel by hand. There was no independent lookout posted. The employment of Pilots in these waters is a mandatory requirement of the Canadian Authorities.
- 3.1.5 The vessel was steaming with an engine speed of 105 rpm which is the equivalent of a reduced full sea speed requiring 20 minutes notice for normal manoeuvring but giving immediate availability of main engine movements if so required. The speed for these revolutions was estimated to have been about 14 knots.
- 3.1.6 The timing accuracy of the 0115 hours and 0130 hours plotted positions is inconsistent with the other known facts. The vessel's speed over the ground during the final stages of the grounding, but before the turn to starboard into Boat Bay, was about 15.0 knots.
- 3.1.7 The Bahamas Maritime Authority Nautical Inspector was not given access to interview the Pilots. The following summary therefore includes uncorroborated evidence from a single witnesses. In these cases the source has been identified.

3.2 **First part of the Voyage**

- 3.2.1 "RAVEN ARROW" departed from Pioneer Grain Terminal, Vancouver, British Columbia at 1306 hours, 23 September 1997, bound for Kitimat, BC, a distance of about 440 miles through the "inland route." She sailed with an approximate deadweight of 23,100 tonnes, being 19,629 tonnes cargo (grain and timber products), 1,960 tonnes ballast and about 1,510 tonnes of bunkers, water and stores. The sailing draught was 7.8 metres forward, 9.58 metres aft.
- 3.2.2 The Pilots were presented with a copy of the vessel's standard Master / Pilot Information card when they joined in Vancouver.

- 3.2.3 The Master noted that the following personnel were on the bridge after departure from Vancouver.

Time	Position	Master	Pilot 1	Pilot 2
1306	Departure Vancouver	✓	✓	✓
1300-1800	Passage	Part	✓	Part
1800-1925	Passage and approach to Discovery	Part	Part	✓
1925-1950	Discovery Island speed reduction	✓	Rest	✓
1950-2300	Passage including Seymour Narrows at 1925 hours	✓	Rest	✓
2300-0135	Passage on Johnstone Strait	Rest	✓	Rest

- 3.2.4 Pilot 1 had, in effect, been on the Bridge from departure until he was relieved at about 1800 hours after which he joined the Master for dinner at 1830 hours and then excused himself in order to rest. In fact he returned to the Bridge for a short period to be with Pilot 2. Pilot 1 later relieved Pilot 2 at 2300 hours. Pilot 1 therefore had between about three and three and a half hours in which to rest. The Master also went below at 2300 hours to take some rest. The latter stated that he had the intention of being called prior to entering Blackney Passage at about 0145 hours.
- 3.2.5 Pilot 1 was observed to have been on the bridge at midnight during the watch change over. He was either sitting in a chair, from which he had good visibility, or standing near the centre of the wheelhouse. Steering was in manual mode, heading 250° and the engine room was manned, the engine being run at 105 rpm. Visibility was clear and the weather was calm.
- 3.2.6 Pilot 1 was observed by the Second Mate to be occasionally referring to his note book but he was never observed to have written any notes or times.
- 3.2.7 The Second Mate, on watch from midnight, stated that he took an azimuth observation of a star at 0024 hours. He later informed Pilot 1 that the calculated gyro error was 1° high. There were other conversations including an observation by the Pilot that some proposed courses had been plotted on the chart.
- 3.2.8 Positions were plotted on the chart by the Second Mate at either 0045 hours or 0048 hours, then at 0100 hours. He reported, in interview, that the visibility dropped to about 2 miles at about 0100 hours.

3.3 Events Leading to the Grounding

- 3.3.1 There was no apparent concern expressed about the vessel's progress by either the Second Mate or Pilot 1. Some small vessels, identified to have been fishing, were seen ahead. Courses were altered to starboard in order to avoid some of them as detailed below. This resulted in “RAVEN ARROW” following a route to the North of the plotted course line.

- 3.3.2 Shortly before 0130 hours the vessel entered a bank of rolling fog. The Second Mate had recorded a position at 0115 hours but had not plotted it until after the grounding. The Second Mate and Pilot 1 had made further conversation during this period but none of any consequence to the grounding.
- 3.3.3 **Appendices I and II** to this report contain copies of the ship's chart BA 3387. **Appendix II/1** has been cleaned of positions after refloating and includes an estimate of the vessel's track, as derived from the course recorder using an estimated speed over the ground of 15.0 knots. The three remaining marks left on the chart are the positions plotted by ship's officers for 0115 hours, 0130 hours and the grounding position. These were plotted AFTER the grounding.
- 3.3.4 A table of the course recorder analysis is attached as **Appendix III** and is summarised below. The Bridge and Engine Room Bell Books noted the time of the grounding impact to have been 0133 hours. The attached interpretation of the course recorder indicates the time to have been 0837 hours on the recorder paper. This is indicative of the timing of that machine being five minutes ahead of Universal Time Co-ordinate (UTC or GMT). The local time having been seven hours behind UTC. This gave a timing error on the course recorder of 07 hours 05 minutes. There was also a course error of 2° high. All times and courses originated from the course recorder are therefore corrected to those errors.

Time	Course or action
0043.3 hours	course altered slowly to port to 282°
0043.3 - 0048.7 hours	steady on course 282°
0048.7 - 0050.0 hours	course altered slowly to port to 275½° (5° / min.)
0050.0 - 0101.8 hours	steady on course 275½°
0101.8 - 0104.0 hours	course altered to starboard to 291° (up to 16° / min.)
0104.0 - 0105.0 hours	course altered back to port (up to 28° / min.)
0105.0 - 0108.7 hours	steady on course 280°
0108.7 - 0110.1 hours	course altered slowly to port (4° / min.)
0110.1 - 0116.5 hours	steady on course 275.5°
0116.5 - 0118.5 hours	course altered slowly to starboard (2° / min.)
0118.5 - 0120.0 hours	steady on course 280.0°
0120.0 - 0121.6 hours	course altered slowly to starboard (2° / min.)
0121.6 - 0126.1 hours	steady on course 283.0°
0126.1 - 0128.2 hours	course altered quickly to starboard (17° / min.)
0128.2 - 0130.5 hours	course steadied on about 322°
0130.5 - 0132.0 hours	maximum course alteration to starboard (27-39° / min.)
0132.0 hours	ran aground on heading of 056°

- 3.3.5 Up to 0049 hours the course had been 282°. A course alteration to port - to 275½° as steered - had then been ordered. This placed the vessel approximately on the pre-planned course of 274°, as previously marked on the ship's chart BA 3387 by the vessel's navigating officer. This course line was 9.6 miles long from the 0049 hours position to the next course alteration point into Blackney Passage.
- 3.3.6 A series of short course alterations were made from 0101¾ hours onwards. This was to avoid fishing vessels that were on or near to the vessel's track. Firstly there was an abrupt alteration to starboard to 289° which was checked until it reached 291°. It was then equally quickly altered back to 280° by 0105 hours and then to 275½° by 0110 hours.
- 3.3.7 There followed, over the ten minutes after 0116 hours, a series of small alterations of course to starboard until 0126 hours, when Pilot 1 was reported to have said to the Second Mate
- “I hope I have not overshot.”*
- That is the time at which the Second Mate claimed that he noted the bearing and distance from the nearest land. This position was subsequently plotted as the 0130 hours position. Pilot 1 then gave the instruction to alter course to starboard to 320°. **See paragraph 4.6.1.** The Second Mate recalled that Pilot 1 added:
- “Go heavy on the helm.”*
- The Second Mate repeated that order to the helmsman.
- 3.3.8 The rate of turn was arrested to a heading of about 321° and 322° before Pilot 1, and the Second Mate, realised that they had altered course into a closed bay.
- 3.3.9 The Second Mate stated that during the first stage of the alteration to starboard both he and Pilot 1 stood behind one radar each, both having reduced the range scales down to three miles. The Second Mate reported that Pilot 1 stated to him:
- “I can't see the gap on the radar screen, can you?”*
- 3.3.10 The pilot then immediately ordered 20° of starboard rudder, which was increased to hard-a-starboard soon afterwards.
- 3.3.11 The vessel ran aground between 0132 hours and 0133 hours on 24 September 1997.
- 3.3.12 The Bridge and Engine Room Bell Books noted the time of the impact to have been 0133 hours at which time the engine was stopped.
- 3.3.13 The positions recorded on the vessel's copy of chart BA 3387, timed at 0115 hours and 0130 hours were not plotted until after the grounding.
- 3.4 **Events Immediately after the Grounding**
- 3.4.1 The grounding position was recorded as 50° 31.4' North, 126° 32.4' West. No oil pollution was ever sighted or reported.

- 3.4.2 The Master, Chief Mate and Third Mate all appeared on the Bridge within about three minutes of the grounding. The Second Pilot followed soon afterwards. The Master specifically reported that Pilot 1 approached him, as soon as he met him after the grounding and immediately apologised stating that he had

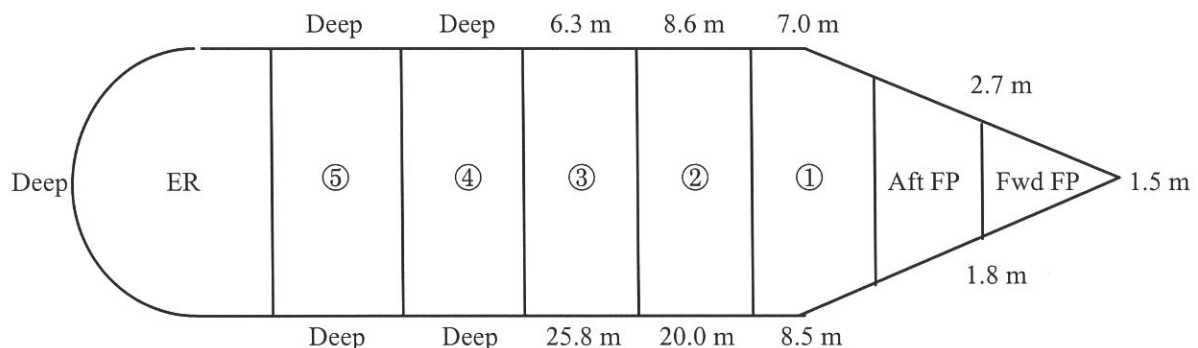
“Goofed up.”

He later repeated the same terminology to Pilot 2 adding that he had

“missed the hole.”

- 3.4.3 There followed a sequence of actions by the Master, officers, crew and Pilots that adhered to standard procedures: Individuals were dispatched to make visual reports of the situation; soundings, both within and around the outside of the vessel, were commenced; the Pilots and the Master informed the local Authorities and their principles of the situation.

- 3.4.4 The following overside hand lead soundings were taken at 0300 hours, at low water. The term “Deep” refers to a depth beyond the range of the lead line.



- 3.4.5 The Fore Peak tank (Fwd FP) was deballasted between 0242 hours and 0300 hours. Thereafter a gentle, unsuccessful, attempt was made to refloat the vessel, solely by her own power at “dead slow ahead” and “dead slow astern” (40 rpm).
- 3.4.6 The fog cleared at about 0320 hours.
- 3.4.7 A Canadian Coast Guard vessel was on scene at 0545 hours. An officer from that vessel boarded “RAVEN ARROW” some time later.
- 3.4.8 By 0615 hours soundings within the vessel had established that the Forward and Aft Fore Peak tanks (Fwd FP and Aft FP above), Nos. 1, 2 and 3 port double bottom tanks and No. 1/2 wing tank (port) had all been breached.
- 3.4.9 Transfer of bunker fuel from No. 2 centre tank to No. 6 starboard tank, was started at 0745 hours, as a precaution against pollution and to aid trim.
- 3.4.10 Three tugs arrived on scene at 0645, 0730 and 0925 hours. By the time that the last of those arrived one of the other tugs had been secured and preparations made to commence refloating. At 0925 hours the engines were ordered astern and by 0930 hours the vessel was refloated.

- 3.4.11 A relief Pilot boarded the vessel at 1026 hours when Pilot No. 1 disembarked by small boat. He left the location by seaplane.
- 3.4.12 At 1041 hours 24 September 1997, the vessel departed, under tug escort, for a suitable anchorage at Sunderland Channel where it was anchored at 1444 hours. An underwater inspection was commenced almost immediately. Later that evening the vessel was authorised by representatives of the Canadian Coastguard, after consultation with the Flag State and the vessel's Classification Society to proceed to Vancouver Harbour to undertake temporary repairs after which it sailed, under similar Authorisation to Portland, Oregon, USA.
- 3.4.13 The damage extended forward of frame No. 125 up to the bulbous bow, to the port side of the centre line. A diver's survey at Johnstone Strait revealed that plating was set in and breached revealing a total of 38 holes and fractures of various sizes way of the tanks referred to in **paragraph 3.4.8** above.

4 ANALYSIS

4.1 Manning Levels and Experience

- 4.1.1 “RAVEN ARROW” was manned in excess of the requirements of the vessel’s Safe Manning Document by a Master, officers and ratings of Indian nationality.
- 4.1.2 **The Master** had attained a Certificate of Competency as Master in 1989 and had first been promoted to Master in 1990. This was his second six month voyage on board “RAVEN ARROW.” He had sailed through these waters once before.
- 4.1.3 **The Second Mate** had been awarded a Second Mate, Foreign Going, Certificate of Competency in 1986. In the eleven years up to the date of the grounding he had accumulated four years of watchkeeping sea time and experience, mostly on board VLCC’s. He had not sailed in this area before.
- 4.1.4 The Bahamas Maritime Authority were denied access to interview either Pilot. Therefore the actions and statements of the Pilots, in particular Pilot 1, are as reported by other personnel such as the Master and the Second Mate of “RAVEN ARROW.”
- 4.1.5 There is evidence that Pilot 1 was the holder of an Ocean Navigator Class 1 Certificate of Competency issued in 1990. This qualification is the equivalent to an STCW Regulation II/2 Licence that would enable him to serve as a Master of a Home Trade Steamship or as First Mate of a Foreign Going steamship without any tonnage limitations. For the purposes of the Canadian Regulations “Home Trade” is defined as up to 200 miles off the shores of North America. Pilot 1 was therefore qualified to be a Master of vessels such as “RAVEN ARROW” within the area where the grounding occurred. We also understand that he commenced training with the Pacific Pilotage Authority in 1995 and obtained a Class 2 Pilot’s Licence in June 1996. At the time of the grounding he was in the second year of a five year programme of operational duties, training and development to attain the highest grade of licence within the Authority.

4.2 Passage Plan and Preparation

- 4.2.1 The Master had not left specific Bridge Orders at the time of the grounding, while he was at rest. There were some general Master’s Standing Orders which followed a typical style for such instructions. They included the following:
- Rules of the Road to be strictly observed. Do not hesitate to use the whistle / engines / helm as and when required.
 - The Pilot’s presence on the bridge does not relieve the OOW of his duties
 - When a Pilot is on board the OOW should plot the vessel’s position every 15 minutes.
 - The OOW shall, at all times, execute and monitor the passage plan.

- 4.2.2 The vessel did not have a separate written Passage Plan. The courses, including those under pilotage, as proposed by the Navigating Officer and approved by the Master, were plotted on the ship's charts. The only other information on chart BA 3387 (which covered the location of the grounding) was the course direction and the length of each course line. There were no additional comments such as passing distances off prominent headlands, emphasis of shoal or shallow areas close to the proposed course line or notes concerning other reference information.
- 4.2.3 The vessel's course line generally followed a route through the deep water of Johnstone Strait which was about two miles wide along the portion steamed by the vessel between 0100 hours and 0126 hours. The plotted course line was between about 0.6 and 0.7 miles off the headlands of the Northern shore.
- 4.2.4 The ship's chart shows a planned course alteration point to 296° (22° to starboard) about one mile after Boat Bay. Thereafter that course was to be kept for a distance of 4.4 miles. The course line passed about 0.4 miles off a headland after 1.2 miles of that leg. It then passed 0.45 miles off Sophia Islands and Baron Reef before reaching the next alteration point, when Cracroft Point would have been 0.65 miles on the starboard beam. This next course alteration was the entry course into Blackney Passage, charted as 007°. If the vessel followed the course lines, as plotted, it would have remained at least two cables (0.2 mile) South of any water of less than 100 fathoms (182 metres) until after the alteration into Blackney Passage.
- 4.2.5 This planned route is appropriate for a visiting vessel navigating in those waters. The local Pilots may use other courses and passing distance criteria, to benefit from their local knowledge. As a matter of prudence a vessel, with or without a pilot, would not be expected to be taken within three cables of the North shore of Johnstone Strait as it was about two miles wide throughout this portion. There was no indication that either of the Pilots on board “RAVEN ARROW” consulted with the Master or any of the watch keeping officers about their detailed planned route and how it may have differed from that previously planned by the vessel's navigating officer.
- 4.3 **Actions of the Master**
- 4.3.1 It was reasonable for the Master to have retired to his cabin in order to rest during the more open parts of the pilotage. He was on the bridge when the vessel passed through earlier critical passages and he stated that instructions had been left for him to be called at about 0145 hours before the transit of Blackney Passage.
- 4.3.2 There is no evidence of any written record of that request. There was no mark on the chart to that effect and if a written note had been left on the bridge, it was not produced to this investigation. The Master was dressed in his pyjamas at 0132 hours, the time of the grounding. This was only ten or twelve minutes before the vessel would have been at the crucial period of the approach to Blackney Passage.

4.3.3 There was no indication that the Master maintained a Bridge Order or Night Order Book, as recommended in the International Chamber of Shipping Bridge Procedures Guide which was available on the vessel. This would have provided a permanent record of a Master's orders, day by day guidance for the watch keeping officers and would include specific instruction for when he was not on the Bridge. As such it would have contained a summary of the evening passage so that each officer could be aware of the Master's plans for the passage including where, or when, he wanted to be called, the optimum passing distances to other vessels and notes of navigational dangers.

4.3.4 No independent lookout was posted, or provided for, in the operational manning of the bridge under this pilotage. As the visibility had drastically reduced at the time of starboard course alteration into Boat Bay, a dedicated lookout would not have been able identify the outline of the island that rose to 200 and 290 metres (677 and 948 feet) within one mile of the 0126 hours position. The absence of such a lookout was however contrary to good practice but not causative to the grounding.

4.4 General Conduct of the Second Mate

4.4.1 The vessel's position as indicated by the GPS receiver, had been plotted every 15 minutes up to 0100 hours. The Second Mate stated that he wrote down the GPS co-ordinates of the 0115 hours position but did not plot them. They were however plotted on the copy of the ship's chart which was later made available. The reliance on GPS positions as the sole means of position fixing, when steaming within one mile of a well formed rocky coastline is considered to be unsatisfactory practice.

4.4.2 The Second Mate stated that he had calculated a compass error based upon a celestial observation. The deck log referred to the error being verified but no such record was entered in the compass error log book. The practice of taking an azimuth bearing of a star and calculating the compass error while steaming along within one mile of a well formed rocky coastline under pilotage is not advisable. Firstly such a task deprived the bridge team of the full attention of the watch keeping officer. Secondly, a far quicker method of gaining a compass error in those circumstances would have been to take a bearing of two identifiable features, such as lit navigation aids, from the chart when they were in transit with one another and compare that with the plotted bearing. Such transits are often used by pilots to aid in the positioning of vessels and so would be known to them.

4.5 General Conduct of the Pilot

4.5.1 As previously stated the Pilot refused to make himself available for interview and so this section of the report and Section 4.6, which follows, specifically with reference to Pilot 1, is based upon observations and reports from other sources.

- 4.5.2 The grounding took place at 0132 hours. Pilot 1 joined the vessel about thirteen hours earlier in Vancouver and had taken about three or three and a half hours rest during that period. *Prima facie*, he should not have been suffering from tiredness or fatigue. His sleep pattern, before he joined the vessel or his working pattern prior to that is not known by the Bahamas Maritime Authority.
- 4.5.3 Pilot 1 was reported, by the Second Mate, not to have taken notes or written in his note book during the passage along Johnstone Strait.
- 4.5.4 It is understood that he used the radio traffic information service, although this was not reported by the Second Mate. There are no available transcripts of any conversations between Pilot 1 and any other vessels or any shore stations.
- 4.5.5 The Second Mate referred to occasional short casual conversations with Pilot 1. For example Pilot 1 joined him on the bridge wing and discussed which star he used for his azimuth bearing. Such communication is not unusual and does not necessarily detract from the concentration or awareness of the participants.
- 4.6 **Conduct of the Bridge Operations after 0100 hours**
- 4.6.1 The Second Mate had noted a GPS position at his recorded time of 0115 hours but had not plotted it on the chart. This may be indicative of some distraction although none was reported. The Second Mate commented on two occasions that throughout his watch all had been progressing smoothly. There was no anxiety, either individually or communally, until the conversation reported by the Second Mate, referred to earlier in **paragraph 3.3.7**.
- 4.6.2 Moments before the above reported exchange, Pilot 1 cut short the conversation. It is understood that he suddenly believed, by simple observation of the radar, that he was in the process of overshooting his planned entry into Blackney Passage.
- 4.6.3 The course change ordered by Pilot 1 was reported to be 310° although the course that was steadied upon was 320°. It is possible that the Second Mate misunderstood the course order but such a difference is of no consequence to the outcome of the grounding.
- 4.6.4 The course was significantly different to that which was plotted on the ship's chart. It is possible that such a course may have been similar to an intermediate course that Pilot 1 was intending to use to approach Blackney Passage. This would have, in effect, cut off part of the charted corner as shown on the ship's chart. Such a course would have resulted in the vessel heading towards a small headland on the South East part of Hanson Island. This course would have passed about three cables off Cracraft Point. Course lines have been added to indicate such a route, annotated with a triple dotted line and labelled “A - A¹,” on the Chart portion copied in **Appendix II/2**.

- 4.6.5 It is noteworthy that there is no similar charted headland in the vicinity of Boat Bay that resembled Hanson Island from the perspective of a heading of 320°. It is therefore more likely that Pilot 1's decision to alter course to starboard was as a result of the visual radar picture or silhouette of Boat Bay on his starboard side, mistakenly assumed to be the area of Sophia Islands and the approach to Growler Cove. That decision could not have been as a result of a positive recognition of any specific features identified on the radar, even less a bearing and distance taken from a known point of land - even if such had not been plotted.
- 4.6.6 A course alteration to 320°, partially towards the entrance to Blackney Passage, passing Cracroft Point three cables to starboard, would have a point of land on the South East of Hanson Island ahead at a distance of at least two miles, but more likely up to three miles. At the time when the Second Mate took his 0130 hours position - as Pilot 1 was initiating his first alteration of course to starboard towards 320° - there was a point of Cracroft Island at a distance of 1.0 mile, bearing between 310° and 320°. To transpose that position ahead to a similar point off the headland of Hanson Island, referred to earlier, “RAVEN ARROW” would have been steaming - on a heading of 283° - less than one mile directly out from Baron Reef in the position marked “B” on the chart copy of **Appendix II/2**. That is clearly an impossible situation.
- 4.6.7 At the Eastern end of Johnstone Strait, approaching Blackney Passage, a vessel that was steering a course of 283° with the intention of altering course to 320° AND in consequence passing 0.3 miles South West of Cracroft Point would have to make that alteration at least two miles off Hanson Island - position “C” on **Appendix II/2**. In that situation the vessel would have been passing unreasonably close to the promontory of land that separates Boat Bay and Growler Cove. A more practical and realistic distance off Hanson Island for such an alteration is about three miles - position “D” on **Appendix II/2**.
- 4.6.8 Pilot 1 made such an alteration of course - from 283° to 320° - when the land that ended up to be ahead after the alteration was only one mile distant as the alteration was initiated. Such a dis-similarity between the area where the alteration was made and the area where Pilot 1 thought he was suggests far more than a lack of attention over a short period of time. It is indicative of a total lack of awareness of the vessel's progress over a considerable period of time, estimated to be at least 30 minutes - from the previous chart.
- 4.6.9 The ignorance of the vessel's position over such a period of time, when navigating within about 0.7 or 0.5 miles of a steep to coast line could have easily and immediately been overcome by adhering to the most basic principles and practices of navigation - that of checking a vessel's position by a variety of means at regular and frequent intervals. Such practices were ignored. Pilot 1 falsely relied upon his ability to recognise a radar silhouette of the South coast of Cracroft Island when there were three bays or inlets which to a casual observer could have painted broadly similar radar pictures.

4.6.10 The conclusion from that scenario is that Pilot 1 failed to follow basic navigational procedures to verify his position prior to making the erroneous alteration of course to 320° from 283° at 0126 hours. He was clearly confused and disorientated. There is no evidence as to why that situation occurred. It could have been as a result of any one, or more of the following causes:

- lack of recent sleep,
- long term fatigue built up over a period of days,
- lack of familiarity with the details of the area or
- the Pilot's habitual failure to follow sound navigational practices.

4.6.11 Pilot 1 realised his error as the vessel was steadied up to the 320° course. He then quickly ordered the helm to hard-a-starboard and the swing to starboard was restarted. No order was given to alter the main engine from the 105 rpm that it had been steady throughout this event. The vessel grounded with the engine at that speed but the speed through the water had reduced to about nine knots due to the effect of the turn to starboard.

4.6.12 If the helm order, when the vessel was at 320°, was given as hard-a-port it is doubtful whether the Islands and rocks in the Western part of Boat Bay could have been avoided. Examination of that scenario would be academic as the Pilot made an on the spot decision to continue to starboard. Once in that position, at that speed, the option of whether the helm was ordered to port or starboard offered a similar chance of success. There is no criticism in respect having found himself in that position the Pilot choose to turn to starboard rather than port.

4.7 Summary of the Cause of the Grounding

4.7.1 Basic navigational procedures were completely absent from the conduct of the vessel by both Pilot 1 and the Second Mate. These men performed such duties that they did enact, with complete independence of each other until after the alteration of course to 320° from 283° at 0126 hours. Neither gave detailed or concentrated attention to the passage of the vessel before that time.

4.7.2 **The Second Mate** relied upon the expertise of the Pilot and reacted with obedience, but without any initiative, to the Pilot's sudden, mistaken, impression that they were overshooting the course alteration position. In the maintenance of his duties as the watchkeeping officer:

- i) he failed to plot regular positions on the chart,
- ii) he failed to anticipate the future courses and the arrival times at the forthcoming course alteration points,
- iii) he failed to remain aware of the vessels position,
- iv) he failed to call the Master when the vessel entered fog,
- v) the time scale is such that it is unlikely, had the vessel maintained its passage along Johnstone Strait, he would have called the Master in time for him to contribute to the approach into Blackney Passage,