MARINE INVESTIGATION REPORT

M99W0058

STRIKING BOTTOM

THE BULK CARRIER "CAPE ACACIA"

WEST KINAHAN ISLAND, PRINCE RUPERT HARBOUR

9 APRIL 1999

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Summary

The "CAPE ACACIA" departed Ridley Island Coal Dock, Prince Rupert, British Columbia, on 9 April 1999, and was proceeding towards the open sea, under the conduct of a pilot, when she struck bottom on a shoal south of West Kinahan Island at 0200 local time. The bottom shell plating forward sustained extensive damage. There was no pollution as a result of this striking and no one was injured. Temporary repairs were carried out at anchor, and the vessel was granted a temporary seaworthiness certificate to proceed to Japan for repairs.

Ce rapport est également disponible en français.

Other Factual Information

Particulars of the Vessel

	"CAPE ACACIA"
Official Number	22743 - 96
Port of Registry	Panama
Flag	Republic of Panama
Type	Bulk Carrier
Gross Tonnage	87,803[1]
Length	289 m
Draught	Forward: 15.98 m Aft: 16.36 m
Built	1996, Kawasaki Kisen Kaisha Ltd. Sakaide, Japan
Propulsion	Diesel Kawasaki-Man-B&W, 15,390 kW
Cargo	Coal; 151,179 tonnes
Crew	22
Passengers	none
Owner(s)	YSK Shipholding S.A.

Description of the Vessel

The "CAPE ACACIA" is a large bulk carrier with a bulbous bow, nine cargo holds, five sets of double bottom tanks, and five sets of side tanks. The crew accommodation, bridge, and engine-room are located aft.

The navigation bridge has open wings. The distance from the bridge to the bow is 250 m and, from the bridge to the stern, 39 m. The vessel's wheelhouse poster indicates that in the loaded condition, propulsion speeds are as follows: full sea speed 14 knots, manoeuvring full ahead 12 knots, slow ahead 6.9 knots, and dead slow ahead 5.1 knots.

[1] Units of measurement in this report conform to International Maritime Organization standards or, where there is no such standard, are expressed in the International System (SI) of units.

The wheelhouse poster indicates that the tactical diameter of the "CAPE ACACIA" in shallow water, proceeding at 12 knots with the helm hard-to-starboard, is approximately one mile,[2] and the advance approximately 8 cables.[3]

History of the Voyage

The "CAPE ACACIA" completed loading a full cargo of 151,179 tonnes of coal just before midnight on April 8, and all wheelhouse and engine-room equipment was tested and found satisfactory in preparation for sailing.

The pilot boarded at 0050 on April 9, and the "CAPE ACACIA", assisted by two tugs, departed her berth at 0105, bound for Japan.[4] The engine was on wheelhouse control, movements were selected using the wheelhouse telegraph. The vessel was in the hand-steering mode, with both steering motors in operation.[5]

The master and chief engineer were Japanese, while the rest of the crew were from the Philippines. English, a second language for all the crew, was the common language used on board.

The weather at departure was fine and clear with southeasterly winds at 20 knots. The seas were slight in the sheltered waters off Ridley Island. The tide was ebbing.

At 0120, on clearing the dock, and on a heading of 205°T, to clear Bacon Rock Shoal buoy D40, the tugs were dismissed, and manoeuvring full ahead was rung on the telegraph. The pilot reported the departure of the vessel to Prince Rupert Marine Communication and Traffic Service (MCTS) on very high frequency radiotelephone (VHF R/T) channel 71.

In the wheelhouse were the pilot, who had the conduct of the vessel, the master, the third officer, who was the officer of the watch (OOW), and the helmsman. The second officer relieved the watch at about 0130, and the third officer went below.

After clearing Bacon Rock Shoal at about 0127, the course was altered to 185°T.

At about 0134, with buoy D27 close to starboard, the pilot ordered 20° starboard helm, to come around to 270°T. Once the swing began, the helm was eased to 10°, and the vessel was brought around slowly and steadied on 270°T at approximately 0137.

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[2] Refers to the perpendicular distance from the original course to the position where a ship has turned through 180°, after the helm is put over.

[3] Refers to the distance gained in the direction of the original course from the time the rudder is put over until the ship has turned through 90°.

[4] All times are Pacific daylight time (coordinated universal time minus seven hours) unless otherwise noted.

[5] Times of helm and engine movements are taken from the course recorder and bridge telegraph printouts. Ship's headings are taken from the course recorder, and positions are as plotted by the OOW.

At 0138 an audible alarm sounded in the engine-room, indicating the No. 5 main engine exhaust gas temperature was high. The engine automatic control system overrode the bridge setting and immediately reduced speed to dead slow ahead. Engineers then observed that No. 5 cylinder exhaust valve spindle was sticking.

About the same time, the pilot and the helmsman noticed that things had gone quiet and there was a definite lack of the vibration usually present when a vessel is being brought up to speed.

The wheelhouse telegraph audible alarm sounded and the RPM indicator showed that the engine revolutions were falling while the telegraph remained on full ahead.

At 0140 the chief engineer telephoned the wheelhouse from the engine control room. The OOW answered the call and passed the telephone to the master. The conversation that ensued was conducted in Japanese. The chief engineer reported the problem to the master, informing him that the main engine could only be run at dead slow speed, and that he would need approximately two hours at anchor to fix the problem.

The master relayed this information to the pilot. However, the pilot reports that it was the master who called the engine-room to find out what the problem was with the engine and that, owing to the master's limited command of English, the pilot understood that the vessel could be run at slow ahead for only 30 minutes.

A discussion took place between them as to the best anchorage. The discussion was, however, time consuming and hampered by the master's poor command of English. Water depths to suit the available amount of anchor chain were considered. The vessel was equipped with 14 shackles of chain on the port anchor and 13 shackles on the starboard anchor.[6] The master preferred to look for an anchorage outwards, to the west, while the pilot would have preferred to proceed to anchorage "Y". However, the pilot decided to return to an area near anchorage "X", to the southeast of the Kinahan Islands. This would also allow a call for tug assistance, if necessary. The pilot based this decision on the belief that the vessel would lose propulsion power in 30 minutes.

The distance of 1.1 miles between the 0139 and 0149 positions, as plotted by the OOW, indicate that the vessel was travelling at approximately 6.6 knots at this time.

The chief officer was instructed to stand by forward with his anchor party. The bosun was already standing by on the forecastle head since the anchors had not yet been secured for sea.

At 0144 the engineers transferred propulsion control to the engine-room control room and reset the main engine control system, after which the performance of the main engine gradually improved.

At about 0149 the helm was placed hard-to-starboard with the intention of coming around to an easterly heading to return towards anchorage "X". The OOW plotted the vessel's position at 0149 by GPS (Global Positioning System) and radar as being 54°11.32' N, 130°22.22' W, 5.8 cables from the southern tip of South Kinahan Island.

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[6] A *shackle* is a standard length of chain cable: 90 feet (27 m).

The pilot later reported that he was not aware that the OOW had been plotting the vessel's position at intervals along her route.

The pilot was using the starboard radar in a gyro-stabilized, North-up presentation in the automatic radar plotting aid (ARPA) mode, changing between the three- and six-mile ranges. He moved between the radar, the chart table and the steering position while the master moved between the chart table and the port side radar.

The OOW was engaged in plotting the vessel's position at intervals and attending to other duties such as answering telephones and wiping condensation from the wheelhouse windows.

Also at 0149 the chief engineer called the wheelhouse and informed the master that the speed could be increased to half ahead and that there was no need to go to anchor. The faulty exhaust valve could be replaced once the vessel was in open water.

At 0149½ dead slow ahead was rung on the wheelhouse telegraph.

The master relayed the chief engineer's update to the pilot and, at about 0152, while on a heading of 357°T, the pilot ordered that the helm be placed amidships followed by hard-a-port.

As the vessel ceased swinging to starboard and began swinging slowly to port, she was getting closer to the Kinahan Islands. The engines were placed on slow ahead at 0158 and half ahead at 0158½ in an attempt to increase the rate of swing. At approximately 0200 vibrations could be felt throughout the vessel for about five seconds, as she struck the rocky bottom. The engine-room telegraph was immediately placed on stop. The striking was in position 54°12.1' N, 130°24.7' W, immediately south of West Kinahan Island, just inside the 20 m depth contour. The vessel was swinging quickly to port and on a heading of approximately 315°T and the speed was estimated to have been between 2 and 3 knots at the time of the bottom striking.

The chief officer on the forecastle head reported that air was escaping from the forepeak tank air vent. Crew members were assigned to sound tanks and assess damage.

The vessel continued her swing to port, clearing further reefs, and the pilot informed the master that he was proceeding to anchorage "Y". He informed MCTS of his intentions and it was arranged for the docking tugs to assist at the anchorage.

The "CAPE ACACIA" was manoeuvred around Greentop Islet and anchor was dropped in anchorage "Y", south of Holland Rock, at 0327.
It was confirmed, after an underwater survey, that the vessel had sustained damage in way of the forepeak and No. 1 starboard double bottom water ballast tank (DBWBT). On April 10 the vessel was shifted to anchorage "B" in Prince Rupert harbour. Temporary repairs were carried out, the vessel was granted a temporary Seaworthiness Certificate by her Classification Society, with conditions attached, to proceed to Chiba, Japan, and departed Prince Rupert on April 17.

Damage to the Vessel

Damage was limited to the forward underwater section of the vessel. The bottom shell plating in way of the forepeak tank (FPT) had a number of holes and tears, with a maximum size of approximately 5 m x 2 m. The bottom shell plating in way of No. 1 DBWBT had three holes with a maximum size of 700 mm x 150 mm. The collision bulkhead between the FPT and No. 1 starboard DBWBT had cracks at the connection to the bottom strake. Additional denting and scratching was found at the bow section.

Certification of Vessel

The vessel was certificated, manned and equipped in accordance with existing regulations.The vessel was in compliance with the requirements of the International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code). Her Document of Compliance was issued by Det Norske Veritas 2 April 1998, valid until 29 August 2000.

Certification of Personnel

The master, chief engineer and the OOW held qualifications appropriate for the class of vessel on which they were serving and for the voyage being undertaken. The master had not undergone a recognized training course in Bridge Resource Management (BRM).

The pilot held qualifications as a Class I Pilot, to operate under the jurisdiction of the Pacific Pilotage Authority. He has a Master Home Trade Tug Certificate of Competency, with continued proficiency endorsement under the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). He had undergone training in BRM.

Personnel History

The master had 33 years' seagoing experience, including 10 years as master, of which 7 were on large bulk carriers. He had one previous trip to Prince Rupert on another vessel and had recently joined the "CAPE ACACIA", for the first time, in February 1999.

The OOW had begun seagoing as a cadet in 1981. An experienced navigating officer, he had sailed on three other vessels with the present ship owner. He joined the "CAPE ACACIA" in December 1998 and this was his first trip to Prince Rupert.

The chief engineer had 20 years' seagoing experience. He had served as chief engineer for 2 years with the present company; he joined the "CAPE ACACIA", for the first time, in February 1999.

The pilot had served 11 years with the Pacific Pilotage Authority. He was a senior pilot and had made many trips in and out of Prince Rupert over the years, including some 32 trips on coal-laden ships of a size and tonnage similar to those of the "CAPE ACACIA". He previously piloted the "CAPE ACACIA" departing from Prince Rupert in 1998.

The pilots of the Pacific Pilotage Authority work duty rosters of 20 days "on" and 10 days "off." The pilot returned from his 10 days off on April 1 and went to Prince Rupert on April 5. He piloted two vessels on April

6, including the "CAPE ACACIA" inbound to Ridley Island Coal Dock. He shifted a vessel from anchor to her berth on the afternoon of April 8, and was on the fourth job of his Prince Rupert tour in piloting the "CAPE ACACIA" outbound.

Current

High water at Prince Rupert was predicted for 2010 on April 8, with a height above chart datum of 4.7 m. The next low water was predicted for 0145 on April 9, with a height of 3.3 m above chart datum.

Tidal streams south of Kinahan Islands flood 100° at about 0.5 knot and ebb 265°at about 1.5 knots. The occurrence took place some 15 minutes after low water at Prince Rupert, at which time the current south of the Kinahan Islands would have been negligible.

Navigation Equipment

The "CAPE ACACIA" is equipped with the following navigational aids: two radars (one with ARPA and an electronic plotter); one magnetic reflecting standard/steering compass; one master gyro, at the steering position, complete with auto pilot. Gyro repeater compasses are located at the centre wheelhouse window and on the port and starboard wings. A course recorder is connected to the master gyro. There are a Global Positioning System (GPS), a radio direction finder, and two main and eight portable VHF radios. Rudder and shaft revolution indicators are above the centre wheelhouse window and on the bridge wings. The vessel carries a comprehensive chart inventory and related publications for the area. The chart in use at the time of the occurrence was British Admiralty Chart No. 2433 (corrected to date).

All navigational equipment was fully operational at the time of the bottom striking.

The course recorder recorded both the courses steered and the rudder angle selected. The rudder angle portion was normal. The time was marked on the course recorder at 0105 when departing the dock; however, the paper was not reset to coincide with the hourly and half hourly lines on the graph.

Main Engine-Room

At 0138 an audible alarm sounded in the engine-room indicating the No. 5 main engine exhaust gas temperature was high. The engine automatic control system overrode the bridge setting and immediately reduced speed. It was then observed visually at the cylinder that the exhaust valve spindle was sticking. The stroke indicator of the exhaust valve was noted to be 20 mm (normal reading 80 mm). As a result, the piston could not compress the air in the cylinder and therefore did not burn the fuel optimally.

After the cause of the alarm was known and it became evident that repairs could be carried out when the vessel reached open waters, the master was informed in the wheelhouse. The engineers transferred control to the engine control room from the bridge, the main engine was reset, and the speed gradually recovered, allowing for half ahead.

Vessel Traffic Centre

Prince Rupert MCTS is not equipped with radar equipment to monitor the passage of vessels into and out of the harbour.

Pilotage in Prince Rupert

Prince Rupert lies in compulsory Pilotage Area 4 of the Pacific Pilotage Authority. Pilots are rotated through the port of Prince Rupert approximately once per year for a one-week tour. Pilots passing through the area from the south, are also available and utilized as required by the workload.

Voyage Planning

The "CAPE ACACIA" was a deep-draught vessel and was following the recommended route south of the Kinahan Islands. The pilot had taken this route many times before.

Navigation with Pilot on Board

STCW and the International Maritime Organization (IMO) *Code of Nautical Procedures and Practices* state, in part, under the heading "Basic Principles to be Observed in Keeping a Navigational Watch":

> 10. Navigation with pilot embarked
>
> Despite the duties and obligations of a pilot, his presence on board does not relieve the master or officer in charge of the watch from their duties and obligations for the safety of the ship. The master and the pilot shall exchange information regarding navigation procedures, local conditions and the ship's characteristics. The master and officer of the watch shall co-operate closely with the pilot and maintain an accurate check of the ship's position and movement.

The pilot had piloted the vessel into port three days before the striking and was reasonably familiar with the propulsion controls. He had also piloted the vessel in 1998. A pilot card with vessel particulars and sailing information was completed by the OOW after testing the equipment prior to sailing, and was made available to

the pilot. The wheelhouse poster, displaying propulsion particulars and manoeuvring characteristics, was displayed on the after bulkhead in the wheelhouse. Upon boarding at Ridley Island coal dock he had enquired only about the vessel's draught. There was no further consultation between the master and the pilot as to the vessel's route, etc. However, the pilot was aware that courses for both inbound and outbound were drawn on the chart.

BRM

The concept of BRM is to emphasize teamwork in order to optimize the use of all available resources, including equipment, written information, procedures, and personnel. BRM fosters effective decision making during critical phases of a passage and helps to ensure that all those involved maintain an accurate assessment of the situation.

Guidance on BRM from the IMO

While there is currently no requirement for BRM training, the IMO (through the STCW) now provides guidance on keeping a navigation watch and suggests that shipping companies take the initiative in implementing the BRM concept.[7]

BRM and Passage Planning

On 2 December 1993 the bulk carrier "TRANS ASPIRATION" grounded on Kestrel Rock, Prince Rupert Harbour. The TSB report on that occurrence (M93W0011) noted one of the causes was the vessel's position not being established by the pilot before a critical course alteration. A
contributing factor was the lack of exchange of information between the bridge team and the pilot.

In two 1991 occurrences (TSB reports M91L3015 and M91L3012), the Board found that the vessels involved had left the navigation channel when the pilots had prematurely made the usual alteration of course. Neither the pilot nor the OOW had recognized that the vessel was not on the intended course before the course change. These navigation errors could have been detected if passage planning had been in place and the progress of the vessel had been monitored by the bridge team. As a result, the Board recommended that:

> The Department of Transport require that the pilotage authorities publish official passage plans for compulsory pilotage waters and make them available to masters to facilitate monitoring of the pilot's actions by the vessel's bridge team.
>
> (M94-34, issued December 1994)

In response, the Department of Transport stated that the *Pilotage Act* did not provide for the Department of Transport to require pilotage authorities to take action of the nature recommended. The Pacific Pilotage Authority also did not agree with passage plans; it expressed concern that there would be a question of liability, both for the pilot and for the Authority, should a ship following that plan become involved in an accident.

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[7] STCW 1995, Part B, Chapter VIII, Section B - VIII/2, Part 3 -1(4).

However, supported in part by the circumstances of this occurrence, the Board still felt that close monitoring of a vessel's progress in accordance with an agreed passage plan would enhance the safe conduct of a vessel. As such, in its *Safety Study of the Operational Relationship Between Ship Masters/Watchkeeping Officers and Marine Pilots*, the Board recommended that:

> The Department of Transport require that pilots, as part of their initial hand-over briefing:
>
> a) obtain the master's agreement to the intended passage plan; and
> b) invite the bridge team's support by having the officer of the watch plot and monitor the vessel's position at regular intervals and report the position to the pilot with respect to the agreed passage plan.
>
> (M95-08, issued October 1995)

The Minister of Transport accepted the intent of the recommendation and undertook that:

> The Department of Transport and the Pilotage Authorities will promote procedures that clarify the understanding of the pilot and the ship's officers as to the passage to be undertaken and their respective obligations in ensuring its successful completion.

All four Canadian pilotage authorities have instituted compulsory BRM training for their pilots. The majority of Pacific Pilotage Authority pilots have completed this training.

Analysis

BRM

Had the master been trained in BRM it is likely that he would have had a better appreciation of the importance of teamwork—with emphasis on communication. When good communication was essential, the master's limited fluency in English made communication with the pilot difficult. The pilot's decision to return to anchorage "X" was based on the fact that he believed the master had informed him that he had only a half hour to safely anchor the vessel.

There was little interaction between the master, the OOW and the pilot as the vessel's transit progressed. The master was busy between the chart table and the port-side radar, and the OOW was wiping wheelhouse windows in between his other duties, leaving the pilot to act on his own.

The pilot should have been aware that the OOW was plotting the vessel's position at frequent intervals, and both he and the master could have better assessed their alternatives when first informed of the problem with the engine by the chief engineer at 0140. A close look at the 0139 position as plotted by the OOW would have indicated that immediate action was necessary to allow the vessel to be manoeuvred to anchorage "X", approximately 4.5 cables in a northeasterly direction. Better communications also would have revealed that the vessel's engine was not about to fail in 30 minutes, allowing for a choice of anchorage. Instead, a discussion

ensued between the master and the pilot as to the best anchorage while the vessel maintained headway at approximately 6.6 knots.

A full exchange of information regarding the vessel's manoeuvring characteristics was not made before the vessel departed her berth. At 0149 the master and pilot knew full use could not be made of the main engine. This was some 10 minutes and some 1.1 miles along her intended track after the problem had been identified. Given the reduced engine power available and the vessel's loaded condition it should have been evident that it was not possible to safely make a round turn to starboard to return to anchorage "X", particularly as speed was reduced from half to dead slow ahead at 0149½. As indicated on the wheelhouse poster, at a speed of 12 knots in shallow water when the helm is placed hard-to-starboard the advance is approximately eight cables and the tactical diameter is approximately one mile, which distances would be greater at reduced speed.

After learning that the vessel did not need to go to anchor, the decision at 0152 to come around to port when on a heading of approximately 357°T, in order to proceed outbound, together with the helm and engine movements that followed, further indicate that the pilot had lost his awareness of the situation.

Throughout the occurrence there were several factors that affected the pilot's appreciation of the situation:

- the lack of clear communication between the master and the pilot, with respect to the time available before it became necessary to anchor the vessel;
- the critical passage of time during discussion of the anchorage decision;
- the inadequate sharing of information regarding the vessel's manoeuvring characteristics, and
- the knowledge of the vessel's position as plotted by the OOW.

Had those on the bridge functioned as a team, the vessel's progress could have been closely monitored throughout and more favourable decisions made with regard to her passage.

Findings

5. The "CAPE ACACIA" struck a rocky bottom south of West Kinahan Island, immediately inside the 20 m contour line, during darkness, in fine weather and clear visibility. The starboard underwater section of the bow was badly damaged.

6. The vessel experienced problems with the No. 5 cylinder exhaust valve spindle, which required the engine to be run at a reduced speed.

7. The master was not fluent in English, and the pilot misunderstood the master's description of the problems being encountered with the engines as meaning that the vessel would lose propulsion power within 30 minutes.

8. Believing that he would lose propulsion power within 30 minutes, the pilot consulted with the master regarding a suitable anchorage, and it was agreed to return to anchorage "X".

9. The period of 10 minutes to make the decision to return to anchorage "X" placed the vessel in a position from which it was unsafe to make the turn to starboard.

10. The pilot reported he was not aware that the bridge watch was plotting the vessel's position at frequent intervals.

11. Helm and engine movements, while attempting to turn the vessel around to proceed to anchorage "X", were inappropriate. The subsequent decision to abort that turn and proceed outbound is questionable.

12. Knowledge of the vessel's position, and deep draught, together with limited manoeuvring capabilities in the fully-loaded condition and reduced power, would have indicated insufficient sea room for the proposed manoeuvres.

Causes and Contributing Factors

The "CAPE ACACIA" struck bottom south of West Kinahan Island because of a delayed decision on the best course of action after experiencing engine problems. Factors contributing to the occurrence were as follows: poor communication between the master and the pilot, which led to an inadequate appreciation of the existing situation; the inadequate sharing of information among the bridge team; and a poor appreciation of the vessel's manoeuvring characteristics.

Safety Action Taken

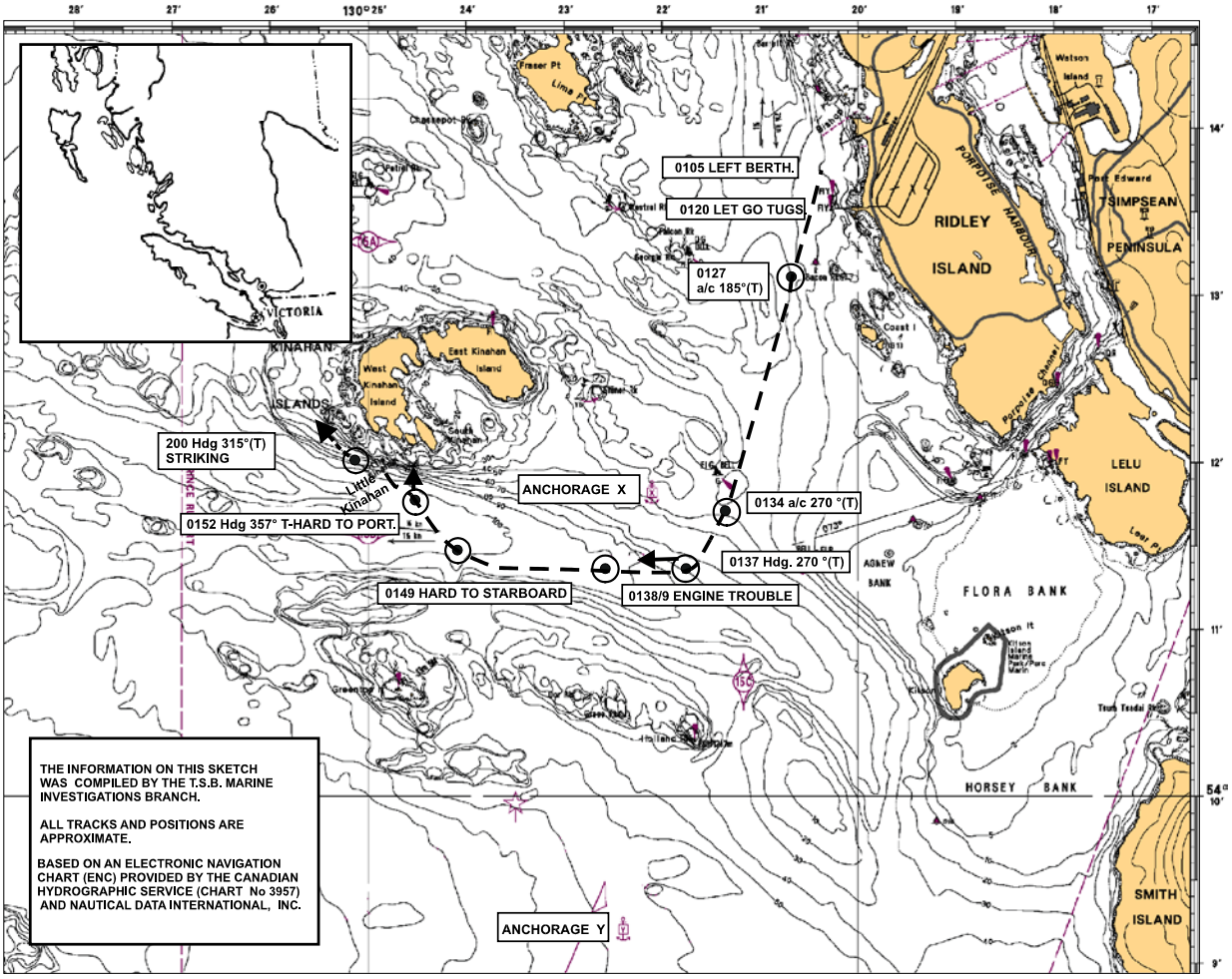
All four Canadian Pilotage Authorities have instituted compulsory Bridge Resource Management (BRM) training for pilots.

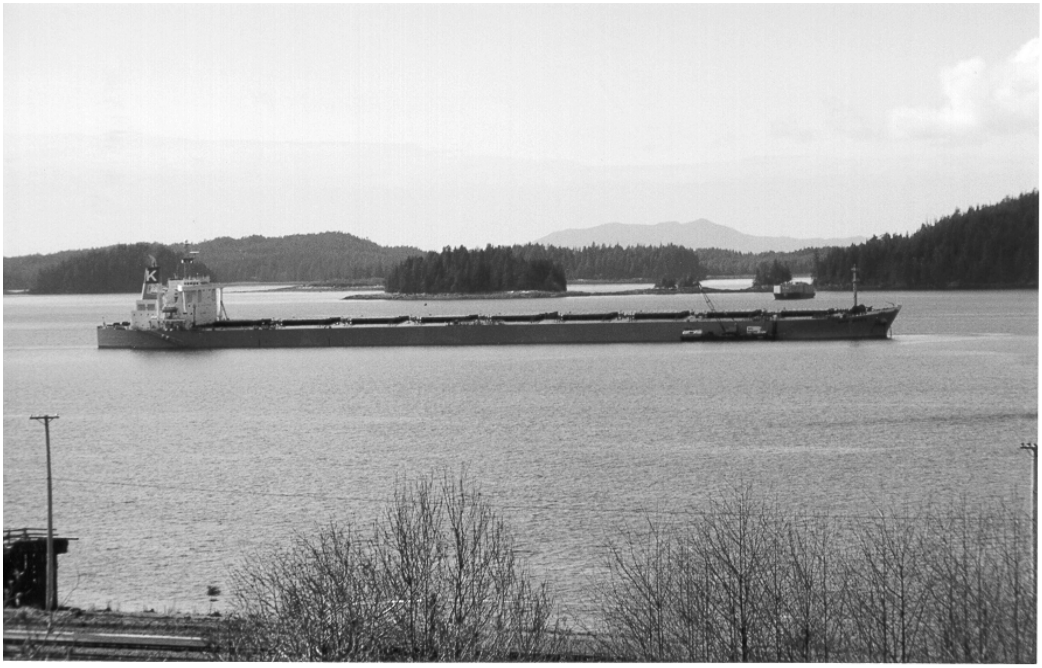
Transport Canada made amendments to the *General Pilotage Regulations* to institute compulsory BRM training for pilots. These amendments came into force on 30 March 2000 and require that licence and pilotage certificate applicants or holders, beginning on 1 January 2000, hold a certificate of attendance at a training program in BRM recognized by the Authority as meeting the requirements of Part B of Chapter VIII of the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers,* 1978 (STCW), as amended from time to time.

As a result of this occurrence, the owners of the "CAPE ACACIA" determined that all of the company's deck officers should attend a recognised BRM training program. This training program was initiated in June 1999.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 17 May 2001.

Appendix A - Sketch of the Occurrence Area





Appendix B - Photographs


CAPE ACACIA