Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

MARINE INVESTIGATION REPORT

M99C0003

GROUNDING

THE BULK CARRIER "PATERSON"
LAC SAINT-FRANÇOIS, QUEBEC

05 APRIL 1999

Canada

Marine Investigation Report

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Summary

At twilight and in clear weather, the "PATERSON", loaded with corn, was downbound on Lac Saint-François. The vessel was under the conduct of a ship's officer who was qualified to carry out pilotage duties, in accordance with paragraph 4(1)(c) of the *Great Lakes Pilotage Regulations*. While executing a starboard course alteration to round buoy D-17 in the vicinity of Pointe aux Foins, the vessel grounded on the north side of the channel. The vessel was refloated four days later after discharging approximately 2000 tonnes of cargo into a barge. There was no pollution, and damage sustained was later determined to be minor.

Ce rapport est également disponible en français.

Other Factual Information

	"PATERSON"
Port of Registry	Thunder Bay, Ontario
Flag	Canada
Registry/Licence Number	800816
Type	Bulk Carrier
Gross Tons[1]	20,370
Length	224 m
Draught	Forward: 7.77 m Aft: 7.92 m
Built	1985, Collingwood, Ontario
Propulsion	Krupp MaK diesel, 6087 kW, driving a single controllable-pitch propeller
Number of Crew	22
Number of Passengers	None
Registered Owner	N.M. Paterson and Sons Ltd., Thunder Bay, Ontario, Canada

The "PATERSON" is a Home Trade bulk carrier with the wheel-house and accommodations aft. She has four holds served by eighteen hatches. The wheel-house is of conventional layout with the central steering position back-set from a central control position. Engine movements, bow thruster activation, and radio communications can be conducted from the central control position. Approximately two metres to the port side of the central control position is the conning position, with an electronic chart system and daylight radar, side-by-side. The chart table is to starboard and back-set in the same manner as the steering position.

The master of the "PATERSON" possessed a Master, Local Voyage certificate and had been acting in the capacity of master on various vessels since 1981. He had been acting in this capacity on the "PATERSON" for the past five years.

The officer of the watch (OOW) possessed a Master, Intermediate Voyage certificate and had been acting in the capacity of first mate for approximately the past 12 years. He had been deemed acceptable by the Great Lakes Pilotage Authority to have the conduct of an exempted ship since 1986, and had extensive experience piloting in this area. He had worked on board the "PATERSON", on and off, for the past five years.

On the morning of 05 April 1999, the "PATERSON" was downbound on Lac Saint-François, proceeding at a speed of 11.5 knots. The vessel was loaded with 28 312 tonnes of corn, and bound for Sorel, Quebec. The visibility was good and early twilight offered a weak light. All

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

systems were operating normally and the OOW, who was also performing pilotage duties since leaving Snell lock, was navigating by visual marks in conjunction with an electronic chart system (using a *Starlink* DGPS input), radar, and gyro compass. No position fixes were being plotted on the paper chart. Gyro error was minimal, at plus or minus 0.5 degree. A wheelsman was on duty at the central steering position to execute helm orders.

At approximately 0503 eastern daylight time,[2] the "PATERSON" passed calling-in point No. 6 at Pointe Mouillée and contacted Seaway Beauharnois on very high frequency (VHF) channel 14. At this time, the controller at Seaway Beauharnois indicated that the vessel "JOHN B. AIRD" was upbound and also gave information on the state of the seasonal buoy replacement program for that area. Although all VHF communications between vessels and the traffic control are normally recorded, in this instance no recording was available, owing to technical difficulties.

By 0516 the "PATERSON" had settled on a course of 029° gyro (G) and was positioned to the right of the Pointe aux Foins leading lights bearing 029°/209° true (T). At this time the OOW on the "PATERSON" had a conversation with one of the officers on the upbound vessel "JOHN B. AIRD", using the VHF radiotelephone. The officer on board the "JOHN B. AIRD" was an acquaintance and the conversation was short and of a personal nature. The vessels passed port-to-port in the normal fashion approximately 0.6 nautical mile (nm) above buoy D17, each keeping to their starboard side of the channel. The OOW on the "PATERSON" then prepared for the next course alteration off buoy D17.

The standard downbound turning procedure, used successfully by the OOW in the past, was to make the turn in two steps. The first step consisted of a course alteration to starboard when the front leading light of Pointe aux Foins was ahead at a distance of 0.9 nm. At this point the vessel's head would be brought to steer on buoy D12. Once abeam buoy D13, the vessel's head would again be brought to starboard and steadied on a course of 062.5°G, with the Pointe Beaudette leading lights astern.

The vessel was to the right of the leading lights indicating the centre of the channel due to the port-to-port encounter with the "JOHN B. AIRD". Also, the OOW believed that buoy D12 was missing. Due to these two new variables, the OOW decided to modify the standard turning procedure. The modification consisted of delaying the initial course alteration and then making one single alteration to starboard to place the Pointe Beaudette leading lights astern.

As the OOW looked forward and off to the right, he noticed a shape that resembled a spar buoy. Initially this caused some confusion, as the OOW believed that the D12 spar buoy was missing. The OOW was undeterred and the focus now shifted to what appeared, on the electronic chart display, to be shoal water in the channel ahead. After a close examination of the electronic chart display, he was satisfied that the perceived shoal water was in fact four 28-foot spot soundings.

Shortly after passing abeam buoy D17, the OOW ordered starboard helm and the wheelsman applied 30° starboard helm. As the vessel began the course alteration, the OOW crossed to the port side of the wheel-house to verify the Pointe Beaudette leading lights coming astern. Upon

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[2] All times are eastern daylight time (coordinated universal time minus four hours).

observing that the leading lights were almost in line while the alteration was still in progress, the OOW realized the turn had been made late and ordered full starboard rudder. At approximately 0530, as the ship's head continued to swing to starboard, the vessel grounded in 4.8 m of water on the north side of the channel in position latitude 45°12.62 N, longitude 074°17.61 W. The vessel came to a stop on a heading of 064°G; the next intended course was 062.5°T. The OOW put the engines to stop and called the master to the bridge. Upon his arrival on the bridge, the master attempted various engine movements but realized the vessel was firmly aground. At 0545 Seaway Beauharnois was advised of the situation.

On 09 April 1999, after transferring approximately 2000 tonnes of cargo into a barge to lighten the vessel, the "PATERSON" was refloated with the assistance of three tugs. It was later determined that the shell plating had only minor damage and that several web frames in No. 1 port water ballast tank had been locally buckled and split. There was no pollution as a result of the grounding.

Analysis

The OOW was not using blind pilotage techniques at this juncture in the voyage. Radar turning distances were not used as the vessel was being conned visually using leading lights, the lighted buoys, and by consulting the electronic chart. The night navigation down from Snell lock had been uneventful and the visibility good. Twilight was approaching and the most restricted waters had already been safely transited. Believing that buoy D12 was missing, and as the vessel was to the right of the channel, the OOW elected to make one bold starboard alteration in lieu of the usual two-step alteration. Consistent with general navigation practices, the decision was, therefore, made to delay course alteration. Some time was probably lost during the brief VHF conversation with "JOHN B. AIRD". Given that the turn was to be negotiated using new variables and that the OOW was single-handedly attending to the navigation, it is likely that the OOW was less prepared for the upcoming turn than he should have been.

At the time of the occurrence, the "PATERSON" was proceeding at a speed of approximately 11.5 knots over the bottom and experiencing a weak following current of about 0.5 knot. The required thirty-three degree course alteration would produce an advance of approximately 450 m with 30 degrees helm application.[3] The maximum room available to the downbound "PATERSON" was about 810 m. By deduction then, the margin of error available, in respect of advance, was about 360 m.[4] When transferred to a time scale, this is approximately 60 seconds. The result of delaying the course alteration, however, is to correspondingly reduce the margin of error available. In this instance, the margin of error was reduced to approximately 200 m, or about 35 seconds. In other words, the OOW had a window of opportunity of 35 seconds to initiate the (single alteration) manoeuvre. Any delay beyond this in initiating this alteration would result in grounding.

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[3] "Advance" is the distance a vessel has advanced in a direction parallel to the original course measured from the point where the helm was put over.

[4] See Appendix A for illustration of margin of error.

Pilotage in confined waters is demanding since it involves seeking and processing cues, close monitoring of a continuously evolving/developing situation, and initiating action for the safe navigation of the vessel. The practice of navigation being conducted single-handedly in confined waters means that OOWs have to take on additional workload which, in certain circumstances, may be beyond their ability to handle. This is contrary to the principles of Bridge Resource Management (BRM)—of which workload management is one element—and the safe navigation of the vessel. In this instance, the additional workload associated with traffic, communication with the "JOHN B. AIRD", change in the navigational plan, and the monitoring and execution of the developing navigational situation culminated in the OOW not initiating the course alteration in a timely manner to prevent grounding.

Monitoring a vessel's movement is critical to safe navigation, particularly in pilotage waters where the channels are restricted and time is of the essence in the initiation and execution of a manoeuvre. The absence of an additional officer on the bridge means that all navigational decisions rest with a single individual. This can become the weak link in a system prone to single-point failure. The Board has been concerned about the safety of vessels operating in the confined (Canadian) pilotage waters that are prone to a single-point failure. The Board recommended to Transport Canada that BRM training be made a pre-requisite to the issuance of new certificates of competency and continued proficiency certificates.[5] In response to the recommendation, Transport Canada Marine Safety, in consultation with industry representatives, has finalized the BRM training syllabus; some marine training institutions across Canada offer this training program. Currently, there is no plan to make these courses mandatory. However, Transport Canada Marine Safety encourages shipping companies to take the initiative in implementing BRM concepts on their vessels.

On most ships where a pilot is employed, the OOW takes some workload off the pilot. Employing two officers on the bridge while in confined waters—one executing pilotage duties and the other performing OOW duties—is a standard practice for most shipping companies that are members of the Canadian Shipowners Association. These companies have entrenched this practice in their policies. However, the policies of some smaller companies—as in this instance—do not address this safety issue.

The turn in the river at Pointe aux Foins affords more sea room than in other areas between St. Lambert and Lake Ontario. This turn has been the site of a disproportionally high number of groundings of a similar nature when compared to the rest of the voyage west to Lake Ontario. A review of the occurrences show that in many instances too much reliance had been placed on visual conning techniques alone. Mariners were possibly lulled into a false sense of security due to the increased sea room available at this location. In so doing, sound navigational practices such as blind pilotage techniques and, in particular, radar turning distances were not used.

The turn as executed by the OOW was intentionally delayed for the reasons mentioned earlier. Two other factors may have contributed to his delaying the turn longer than desired. The first was an ambiguity surrounding spar buoy D12. While passing calling-in point No. 6, the OOW understood the controller at Seaway Beauharnois to convey that buoys D12, D8, D6 and

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[5] TSB Report No. SM9501, *A Safety Study of the Operational Relationship Between Ship Masters/Watchkeeping Officers and Marine Pilots*—Recommendations M95-09 and M95-10.

anchorage buoy DE were missing. It would appear that what was meant to be communicated was that the summer lighted buoys were missing at these locations. What was not communicated was that the winter spars were still in their advertised positions. When the OOW looked forward he saw spar buoy D12 in its advertised position, and this caused him some concern and possibly some delay in verifying the identity of the buoy. A second factor was that, as he looked at the electronic chart, he noticed what appeared to be four shoal markings in the channel ahead. On the paper chart, these 28-foot spot soundings[6] just west and northwest of the D13 buoy are indeed slightly darker than the 28-foot area sounding to the north of D13. The raster type of electronic chart that was in use on the "PATERSON", an Infonav system, accurately portrayed this difference. With the electronic chart system set up for night navigation, the relative darkness of these spots was accentuated.[7] The OOW took some time to closely scrutinize the screen and thus reassure himself that these spots were in fact 28-foot soundings and not shoal water.

The electronic chart system in use on the "PATERSON" did not accurately reflect the disposition of the buoys in the area. Since the spring of 1998 certain buoys had been eliminated and others, such as the D13, had been moved. These changes were not shown on the electronic chart in use on the "PATERSON". The OOW was aware of these changes and the paper chart on board showed the appropriate corrections. While not a factor in this occurrence, it is essential that the electronic chart system used for navigation reflect the appropriate corrections.

Findings

1. The vessel was operating in compulsory pilotage waters under the conduct of a duly qualified and experienced ship's officer.

2. The OOW was single-handedly performing the duties of both pilot and OOW.

3. Shortly before making the course alteration to starboard off buoy D17, the OOW had a brief non-operations-related radio communication with the upbound vessel "JOHN B. AIRD".

4. The additional workload associated with passing traffic, communication, change in navigation plan, and the monitoring and execution of the developing navigational situation culminated in the OOW not initiating the course alteration in a timely manner.

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[6] As seen on the CHS chart 1412, 20 October 1989 reprint.

[7] On electronic navigation charts, the chart display can be selected to a desired colour palette (according to the ambient lighting) and there are other options to affect the appearance of the displayed chart.

5. While the standard practice for most shipping companies—which are members of the Canadian Shipowner's Association and are exempt from carrying a pilot—is to have two navigating officers on the bridge, some smaller companies operate with only one officer on the bridge in confined pilotage waters, to the detriment of vessel safety.

6. The practice of the OOW single-handedly conducting the navigation of the vessel in confined waters, such as this portion of the St. Lawrence Seaway, is unsafe, in that it is a system prone to a single-point failure.

7. Navigation was limited to visual conning techniques and the use of an electronic chart system, and blind pilotage techniques including radar turning distances were not used.

8. All navigational aids were in their correct, advertised positions and functioning satisfactorily.

9. The information on the status of navigational aids provided by Seaway Beauharnois was susceptible to misinterpretation.

10. As the vessel was to the right of the Pointe aux Foins leading lights, and as the OOW believed that buoy D12 was missing, he elected to delay and make one bold course alteration instead of the usual two-step alteration.

11. The turn was delayed beyond the point where, irrespective of the helm used, the vessel could have remained within the navigable channel.

12. The electronic chart system in use did not reflect the appropriate up-to-date corrections, although this is not considered to have been a factor in the occurrence.

13. The night navigation display used for the electronic chart system did not allow all the information on the chart to be easily recognizable.

Causes and Contributing Factors

The "PATERSON" ran aground because a critical course alteration was delayed beyond a point which would have allowed the vessel to stay within the confines of a navigable channel. The vessel was under the conduct of a ship's officer, who single-handedly conducted the navigation of the vessel in these confined pilotage waters, and the navigation system in use was prone to single-point failure.

Factors contributing to the occurrence were as follows: the OOW was engaged in non-operational radio communications at a critical point in the vessel's transit; the less-than-precise communication by Seaway Beauharnois with respect to the status of the floating navigational aids; over-reliance on visual navigational technique at the expense of other equally sound navigational techniques; the night navigation mode of the electronic chart system, which , being difficult to read, lead to the loss of valuable time; and the false sense of security associated with the relatively wide channel and good visibility.

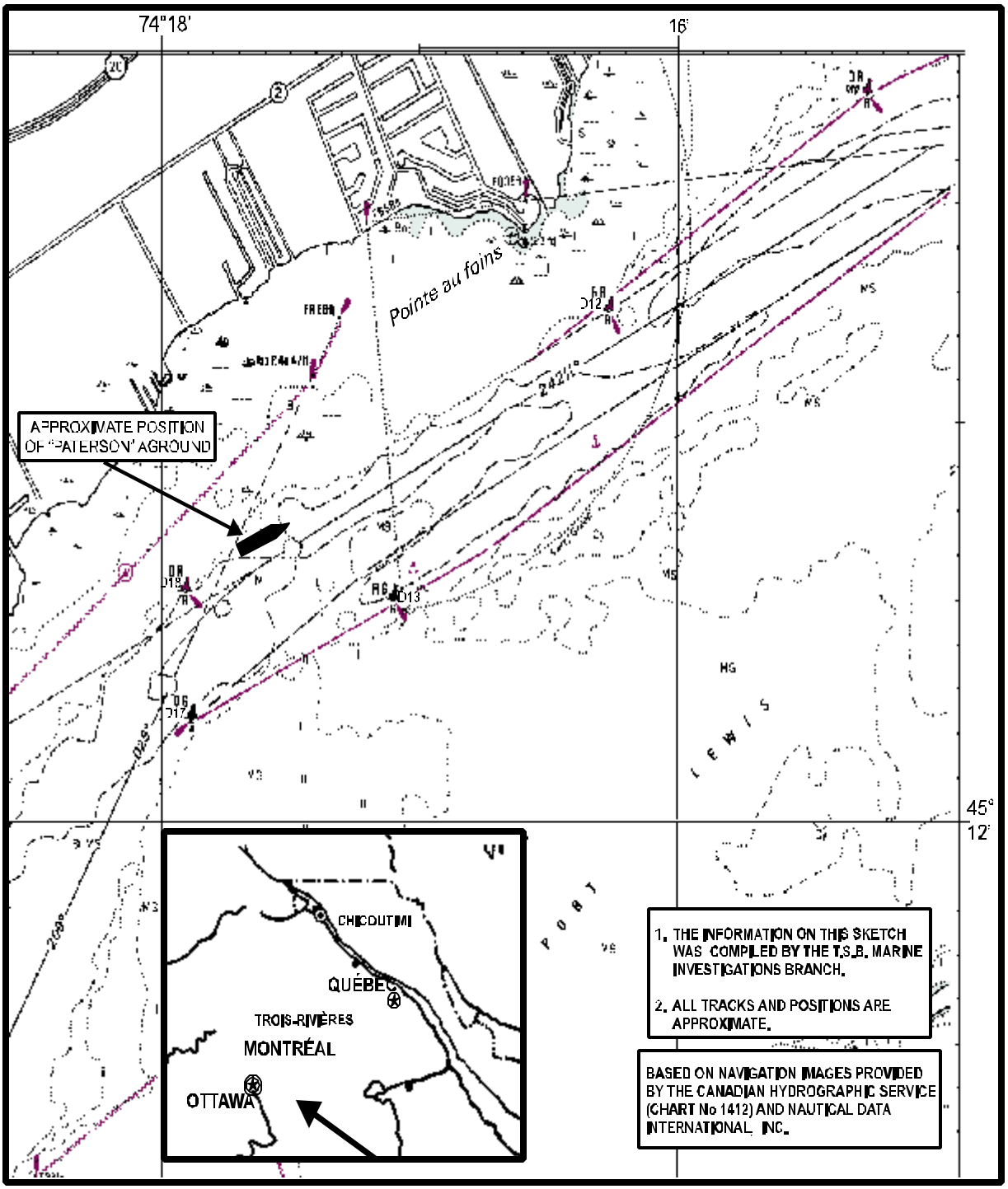
Safety Action

Following the occurrence, the TSB forwarded a Marine Safety Advisory (MSA #05/99) to Transport Canada. The advisory made reference to the *Canadian Watchkeeping Standards - TP13067,* and stated that the safety intent is lost when only one officer is present on the bridge in the confined waters of the St. Lawrence Seaway. In the Seaway, traffic meets in narrow channels, and navigation requires both accurate piloting techniques and constant vigilance; any measure that increases both will help to reduce the risk of accidents. Transport Canada's response indicated, *inter alia,* that the Great Lakes Pilotage Authority will amend its regulations to ensure that at least two navigational officers are on the bridge at all times in these waters, one of whom is duly qualified to perform pilotage duties.

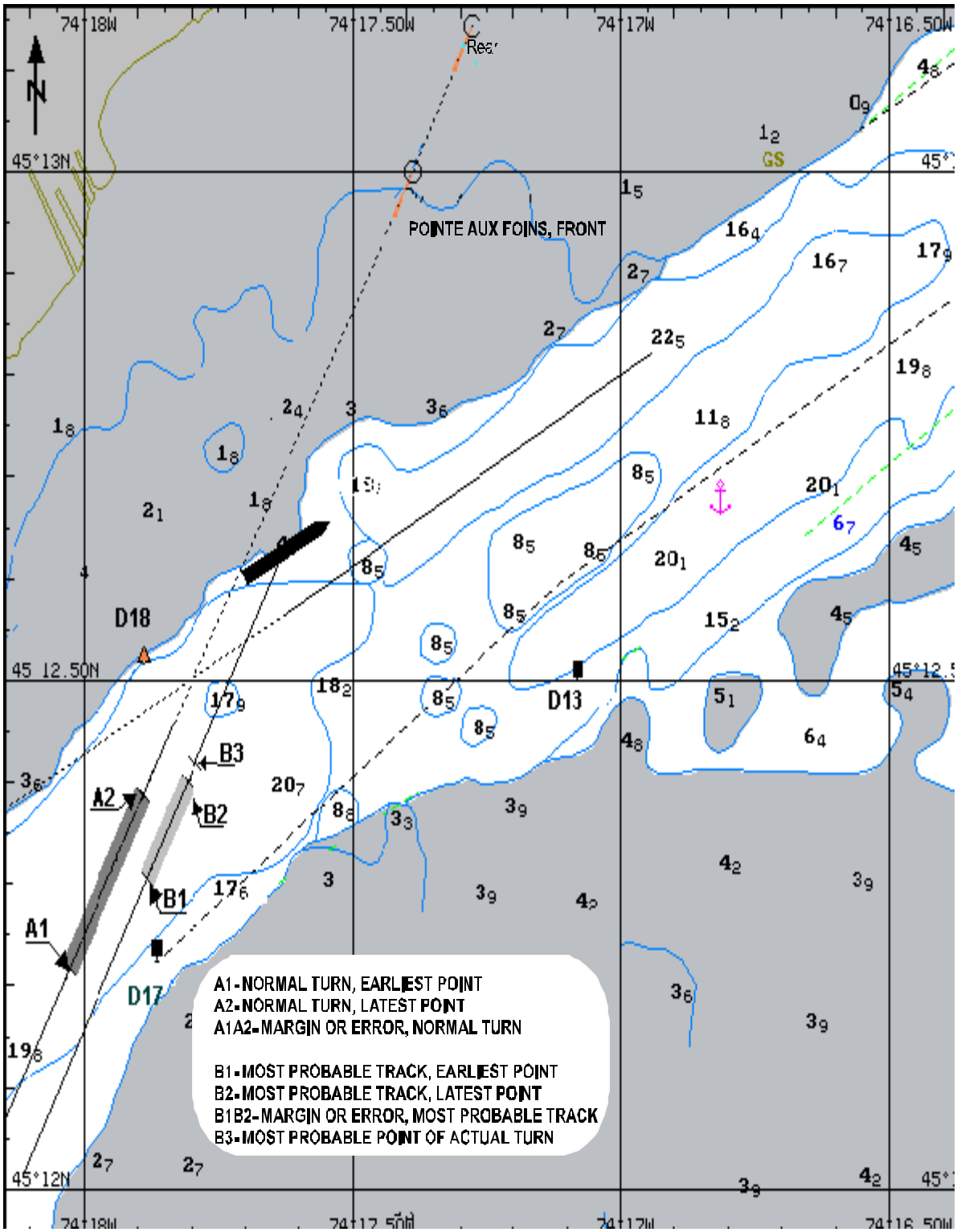
To enhance safety, changes were made to the aids to navigation in 1992 and 1998. This is reflected in fewer occurrences in the area. Following this occurrence, the Canadian Coast Guard is re-evaluating the aids to navigation in the area with a view to enhancing safety.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 17 May 2000.

Appendix A - Sketch of Grounding Area



Appendix B - Margin of Error



Appendix C - Ideal Track vs. Most Probable Track