

MARINE OCCURRENCE REPORT

M99C0016

BOTTOM CONTACT

PASSENGER VESSEL "CANADIAN EMPRESS"

LAKE SAINT-LOUIS, QUEBEC

13 MAY 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.

Marine Investigation Report

Bottom Contact

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Summary

On the morning of 13 May 1999, the passenger vessel "CANADIAN EMPRESS" was upbound in Lynch Channel on Lake Saint-Louis in clear weather. The vessel was under the conduct of the master, with 48 passengers and 14 crew on board. Shortly after the vessel rounded the northern end of Dowker Island, on a heading of approximately southwest by west, an unusual rumbling sound was heard. The various compartments were verified visually and sounded; there was no ingress of water. The vessel continued on to Sainte-Anne-de-Bellevue wharf where divers proceeded with an underwater inspection; the vessel's keel coolers on the starboard side had been damaged beyond repair. A bypass arrangement in the engine room was subsequently installed that allowed cooling of the starboard-side machinery by way of the port-side keel coolers. On 14 May 1999, once the bypass was completed, the vessel continued on her voyage up the Ottawa River without incident.

Ce rapport est également disponible en français.

Other Factual Information

	"CANADIAN EMPRESS"
Port of Registry	Kingston, Ontario
Flag	Canada
Registry/Licence Number	395989
Type	Passenger vessel
Gross Tons ¹	463
Length	31 m
Draught	Forward: 1.3 m (4 feet 3 inches) Aft: 1.6 m (5 feet 3 inches)
Built	1981, Gananoque, Ontario
Propulsion	Two Volvo-Penta diesel engines, 544 kW total power, driving two fixed-pitch propellers
Crew	14
Passengers	48
Registered Owner	St. Lawrence Cruise Lines Inc., Kingston, Ontario

The "CANADIAN EMPRESS" is a small passenger vessel of aluminum construction, with a crew of 14, capable of embarking a maximum of 66 passengers. Built in 1981 to maximum Rideau Canal dimensions, the vessel has since offered cruises throughout the Thousand Islands area, the St. Lawrence Seaway and River, and the Ottawa River area.

The master of the "CANADIAN EMPRESS" held a Master Minor Waters certificate of competency. He had worked on this vessel for 15 years, the last 10 of which as master.

The mate held a Master Minor Waters certificate of competency. This was his seventh year as mate on board the "CANADIAN EMPRESS".

The navigation team of the "CANADIAN EMPRESS" consists of a master and a mate who work together on the bridge while the vessel is under way. Alternately, one is at the helm while the other cons the vessel. Both can see the daylight radar screen and chart from their respective positions.

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.

The traditional “four hours on, eight hours off” watch system with a dedicated officer of the watch is not kept on the “CANADIAN EMPRESS” because this vessel is essentially a day boat and ties up at various ports of call each evening.

The “CANADIAN EMPRESS” is equipped with a Magellan “Chart Mate” Differential Global Positioning System (DGPS) receiver, but this receiver is not connected to an electronic chart or video plotter. With this model of DGPS receiver, as with many other models, a predetermined route may be entered, allowing the navigator to monitor the vessel’s progression along the intended track. The possibility also exists of entering up to 99 permanent waypoints. The radar is a recent model three-centimetre Furuno with excellent capabilities for river navigation.

At 0700 eastern daylight saving time (EDT)² on 13 May 1999, the “CANADIAN EMPRESS”, with 48 passengers on board, left the Côte Sainte-Catherine wharf bound for Montebello, Quebec. Winds were light, 10 to 15 knots from the northwest, and visibility was excellent. Water levels, however, were extremely low for this time of year. On Lake Saint-Louis, the level was 0.28 metre (m) (11 inches)³ above chart datum, a full 1.17 m (3 feet 10 inches) below the average water level for mid May. The master was aware of the low water level because he had listened to the Coast Guard Radio Station broadcast the day before. After negotiating the South Shore Canal towards Lake Saint-Louis, at approximately 0800, the vessel proceeded out of the Seaway channel at buoy “Lachine A” and onto the leading lights of the small craft channel south of Dorval Island.

The buoys that mark the small craft channel in this area were in the process of being laid for the summer season by the Canadian Coast Guard. Buoys between “Lachine A” and buoy AD-18, inclusively, were in place. The remaining buoys to Sainte-Anne-de-Bellevue and above were not yet in place.

The buoys that had remained in for the winter were unreliable because their positions had not yet been verified by the Coast Guard. Only three other buoys had been placed or their positions verified in the river above buoy AD-18 at this time. Above Sainte-Anne-de-Bellevue, buoys H-12 and H-22 had been placed, and the position of buoy H-2 had been verified. This had been done earlier in the spring following a request for an early placement and verification of these particular buoys made to the Canadian Coast Guard by the owner/operator of the “CANADIAN EMPRESS” on behalf of St. Lawrence Cruise Lines Inc.

² All times are EDT (coordinated universal time [UTC] minus four hours).

³ All soundings and measurements have been included in imperial units because the charts in use, 1410 and 1510, as well as the distances used by the navigation team are in these units.

Navigation in these waters usually commences with the official opening of the locks at Sainte-Anne-de-Bellevue and Carillon on the Friday preceding the Victoria weekend in May. Consequently, the buoys are not normally placed or positions verified before this time. Special arrangements, however, can and are made by several companies with the lock operator⁴ in order to pass through the locks before this date.

At approximately 0845, having followed the small craft channel towards Sainte-Anne-de-Bellevue without incident, the vessel was now nearing the north end of Dowker Island and proceeding at a speed of seven knots. At this time, the mate was at the helm and the master was a few feet away on the starboard side of the wheelhouse. The master was conning the vessel using the radar to take distances off known points of land, and the mate was steadying the vessel on a heading of 233° (DGPS). No gyrocompass was fitted,⁵ and although a magnetic compass was available directly in front of the ship's wheel, courses in the river were steered principally using the DGPS.

At approximately 0849, the master was satisfied with the ship's position abeam a small, unnamed point of land on the northwest side of Dowker Island at the predetermined distance of 213 m (700 feet). This put the vessel in the centre of the recommended navigation channel, and the master was now preparing to come abeam the next point of land on Dowker Island at 244 m (800 feet). Before 1996, the centre of the recommended channel was indicated by leading lights at Madore Point, but these lights had since been discontinued. The master and the mate had made numerous trips up and down the river in this area over the years, both before and after the leading lights at Madore Point had been discontinued. (See Appendix A.)

The depth sounder had been left running as a standard procedure, and as the vessel proceeded up past Dowker Island, the mate noticed that the water indicated under the keel was beginning to decrease. The last sounding he noticed, shortly before the occurrence, was 1.98 m (6½ feet). At approximately 0850, after having steadied the vessel on a course of 233° (DGPS) and with the vessel just south of the charted position of buoy AD-38 (it had not yet been placed), an unusual rumbling sound was heard throughout the ship. The throttles were put to neutral at once, and the master took the helm, instructing the mate to go below and investigate. At this point, the master reportedly pushed the "man overboard" button on the DGPS to mark the position of the incident. Soon thereafter, at least one passenger observed that the waters astern the "CANADIAN EMPRESS" were muddied.

The ship did not veer from the course steered nor was an angle of heel detected. None of the passengers was inconvenienced by the incident.

Reports from the mate and the chief engineer confirmed that there was no ingress of water. The engines were re-engaged to stem the current, estimated to be between one and two knots, and keep the vessel in the channel. Seemingly undamaged, the vessel then continued on her voyage and soon was approaching the downstream wall of Sainte-Anne-de-Bellevue lock. At this point, the starboard-side generator was indicating an overheat

⁴ Parks Canada

⁵ The Canadian *Navigating Appliances and Equipment Regulations* does not require a gyrocompass to be fitted on vessels less than 500 gross tons.

condition and was shut down. The decision was taken to tie up to the downstream approach wall of the lock and inspect the underwater portions of the hull with the help of divers.

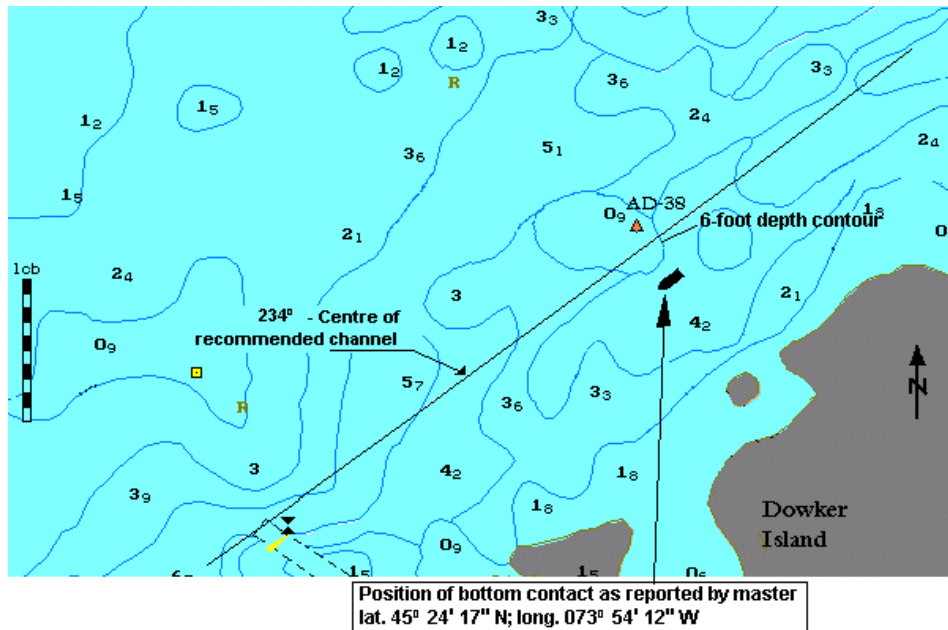
The underwater inspection confirmed damage to the starboard-side keel coolers. The damaged keel coolers were removed from the hull by the divers and found to be covered with a clay-like substance. A bypass arrangement in the engine room was installed that allowed cooling of the starboard-side machinery by way of the port-side keel coolers. On 14 May 1999, once the bypass was completed, the vessel continued on her voyage up the Ottawa River without incident.

Analysis

None of the route or waypoint functions of the DGPS was used during the passage up the small craft channel to help validate radar and visual information. These functions could have been of great assistance to the vessel in making the planned deviation to the southeast of the centre of the recommended channel near the position of buoy AD-38. For a vessel such as the "CANADIAN EMPRESS", a deviation to the southeast of the centre of the recommended channel is necessary in order to avoid crossing over the 1.83 m (6-foot) depth contour that overlaps the centre of the channel at this position.

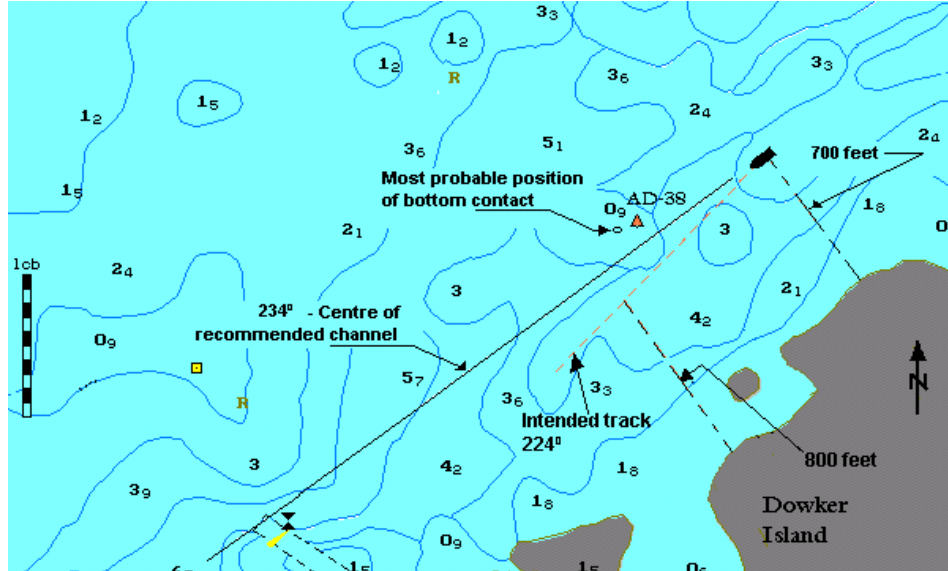
There is no gyrocompass fitted on the "CANADIAN EMPRESS"; consequently, the radar display is not gyro-stabilized. This seriously compromises the potential of the radar for navigation in restricted waters because without gyro-stabilization, parallel indexing is less accurate. Course made good, as indicated on a DGPS, is only accurate when the vessel is making way and when all the components of the DGPS system (land-based and space-based equipment) are functioning adequately.

Although the master thought that he had correctly pushed the "man overboard" button on the DGPS to mark the position of the incident, no position was recorded. The master declared that he possibly did not hold the "man overboard" button down long enough for the function to register. Two days after the incident, the master reported the occurrence position to the Coast Guard Radio Station as latitude 45°24'17" N, longitude 073°54'12" W (see Figure 1) but qualified this position as "approximate" due to the numerous tasks and distractions immediately after the incident.



Both the master and mate had extensive experience in these waters, but they had never navigated in that area with water levels so low. The predetermined distances used successfully in the past by the master for passing up Lynch Channel and past buoy AD-38 have the vessel crossing the tip of a 1.83-m (6-foot) depth contour that overlaps the centre of the recommended channel, as seen in figures 1 and 2. In the past, with water levels consistently 0.9 m to 1.2 m (3 to 4 feet) above chart datum, this was not a problem. On this voyage, with the water level only 0.28 m (11 inches) above chart datum, the intended course brought the vessel in proximity to water depths of less than 2.10 m (6.9 feet).

Once abeam the first point at the predetermined distance of 213 m (700 feet), the intended track would have to have been approximately 224° true in order to make the second point at the predetermined distance of 244 m (800 feet) (see Figure 2). A proper passage plan was not being executed by the navigation personnel, and the progress of the vessel was not being plotted on the chart. The vessel was being steered by DGPS and followed a path of 233° (DGPS), very nearly the 234° true that would follow the centre of the recommended channel. This would suggest that the vessel was in fact more to the northwest than the “approximate” position reported by the master.



Scarcely 30 m (100 feet) to the northwest of the “approximate” position given by the master is the 1.83 m (6-foot) depth contour mentioned earlier. The only individual sounding within this depth contour is a 0.91-m (3-foot) sounding 61 m (200 feet) to the northwest of the centre of the recommended channel. While all other depths within this contour are not known precisely, it is known that depths are less than 1.83 m (6 feet) above chart datum. At the time of the incident, the “CANADIAN EMPRESS” was drawing 1.6 m (5 feet 3 inches) aft, and the keel coolers were exceeding the hull by approximately 0.05 m (2 inches).

Given that the damaged keel coolers were covered with a clay-like substance and given the observation by a passenger of the muddied waters astern the “CANADIAN EMPRESS” subsequent to the rumbling sound heard throughout the ship, it may be concluded that the vessel made contact with the bottom. The Canadian Hydrographic Service later sounded the area around the position of the grounding as reported by the master, but no anomaly in depth was found. As illustrated in Figure 2, the vessel was most probably 61 m to 76 m (200 to 250 feet) to the northwest of the reported “approximate” position of the incident and thus inside the 1.83-m (6-foot) depth contour when contact was made with the bottom.

Findings

1. The water level on Lake Saint-Louis, although 0.28 m (11 inches) above chart datum, was exceptionally low, at 1.17 m (3 feet 10 inches) below the average water level for the same time of year.
2. The owner had requested that buoys above Sainte-Anne-de-Bellevue be placed early to facilitate the voyage up the Ottawa River. The Canadian Coast Guard had agreed to the request, and buoys H-2, H-12 and H-22 were in position before the “CANADIAN EMPRESS” began her first voyage of the season up the Ottawa River.
3. All other buoys above buoy AD-18 were not yet in place, and the leading lights at Madore Point had been removed in 1996.
4. The vessel’s progress along her intended track was not adequately monitored by regularly plotting positions on the chart.
5. Key navigational aids, such as the DGPS route and waypoint features, were not used to their fullest potential to assist in monitoring the vessel’s progress.
6. The “man overboard” button on the DGPS was reportedly depressed at the time of the incident, but no position was recorded subsequent to this action.
7. The navigation personnel reported the bottom contact to the Canadian Coast Guard two days after the incident.
8. Shortly after the incident, the waters astern of the “CANADIAN EMPRESS” were observed to be muddied.
9. When the damaged keel coolers were removed from the hull, they were found to be covered with a clay-like substance.
10. Both starboard keel coolers were damaged beyond repair due to bottom contact.

Causes and Contributing Factors

The vessel came into contact with the bottom because the navigation instruments and the technique used by navigation personnel did not permit precise navigation in the restricted channel. The route and waypoint features of the DGPS were not used to help monitor the vessel’s progress along her intended track. Also, the water level was unusually low, leaving little room for error. The elimination of the Madore Point range and the absence of buoy AD-38 contributed in reducing the situational awareness of the navigation team.

Safety Action Taken

Canadian Hydrographic Service

Subsequent to the occurrence, the Canadian Hydrographic Service conducted soundings in the area surrounding the reported position of bottom contact. No anomaly in charted depth was found.

As a result of the investigation into the occurrence, the TSB became aware of a difference between charts 1410 and 1510 in the charted location of the 6-foot bathymetric contour line of the shoal patch marked by buoy AD-38. A Marine Safety Information Letter (MSI 02/99) was forwarded to the Canadian Hydrographic Service apprising them of this difference.

The Canadian Hydrographic Service has since produced chart amendment patches for charts 1410 and 1510. These amendment patches should appear in Canadian Notices to Mariners by mid 2000.

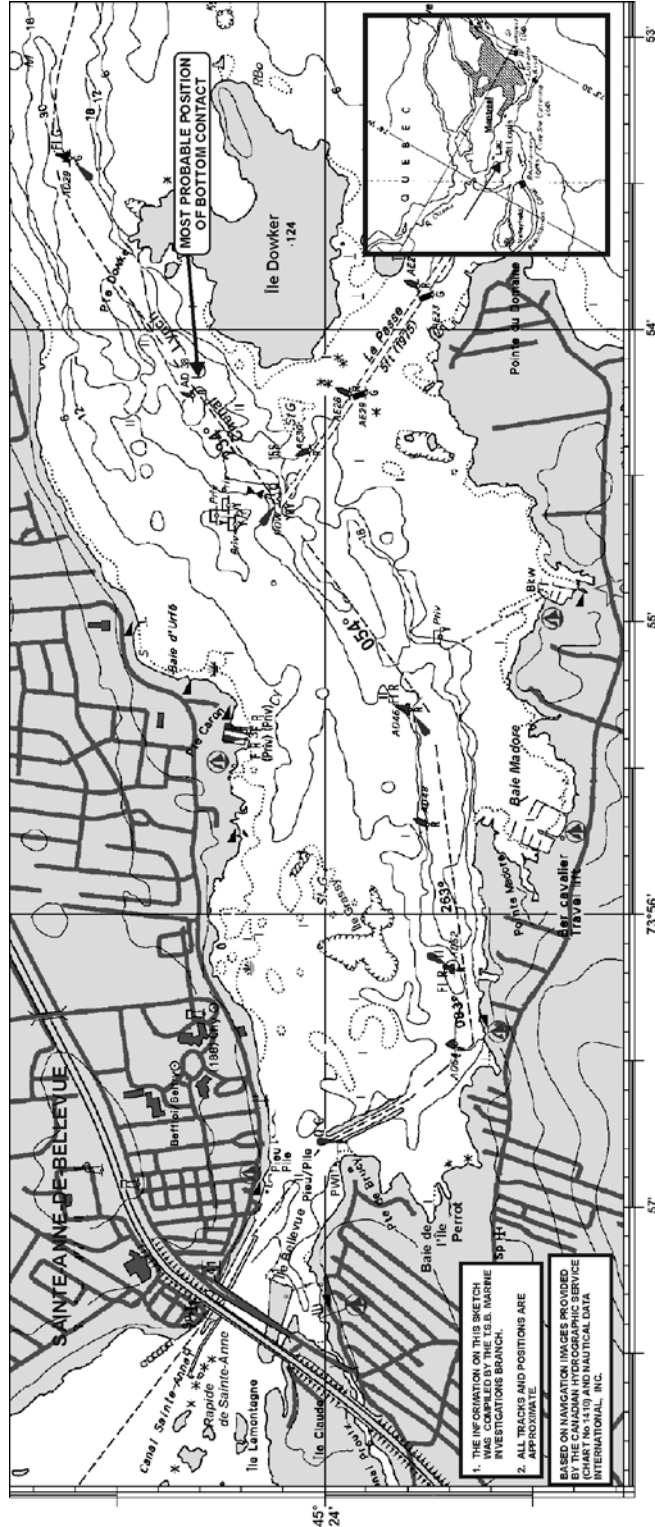
Safety Concerns

Aids to navigation have been reduced in the past four to five years. In particular, there are fewer buoys, and leading lights in small craft channels have been discontinued. The option of equipping small vessels, particularly passenger vessels, with gyrocompasses may be a way of increasing the accuracy of navigation and hence contributing to their safer operation.

Currently, the *Navigating Appliances and Equipment Regulations* do not require passenger vessels between 300 and 500 gross tons to have gyrocompasses fitted. The Board is therefore concerned that there is an inherent risk when transporting passengers on small vessels without the equipment to navigate precisely in restricted waters under all conditions.

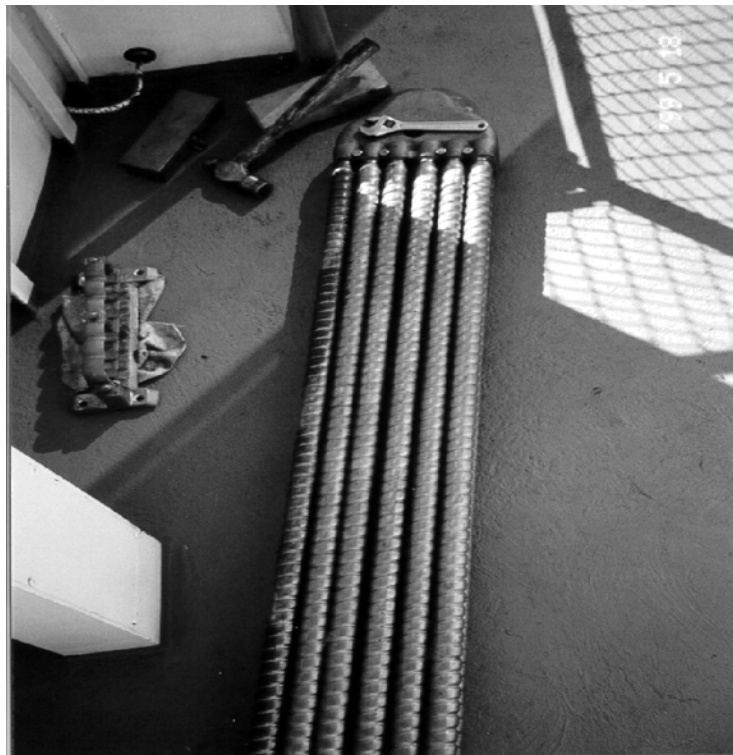
This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 13 June 2000.

Appendix A



Appendix B

“CANADIAN EMPRESS”



NEW KEEL COOLER ON (DECK)