Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

MARINE INVESTIGATION REPORT
M04L0092

GROUNDING

CONTAINER SHIP *HORIZON*
SAINTE-ANNE-DE-SOREL, QUEBEC
24 JULY 2004

Canada

Marine Investigation Report

Grounding

Container Ship *Horizon*
Sainte-Anne-de-Sorel, Quebec
24 July 2004

Report Number M04L0092

Summary

In the early morning hours of 24 July 2004, the loaded container vessel *Horizon* was downbound from Montréal, Quebec, in clear weather and under the conduct of a pilot. While off Saint-Anne-de-Sorel, Quebec, the vessel overshot alter course position and grounded along its entire length. Initial attempts to pull the *Horizon* free were unsuccessful, and a lightering plan was adopted. Eleven days later, after having off-loaded 109 containers, the vessel was re-floated and sailed to the port of Sorel. No pollution was observed, and damage to the vessel was minor.

Ce rapport est également disponible en français.

Other Factual Information

Name	*Horizon*	
IMO[1] Number	7911624	
Port of Registry	Valetta, Malta	
Flag	Malta	
Type	Container ship	
Gross Tonnage	19 872	
Length[2]	184 m	
Draught	Forward: 8.44 m	Aft: 9.54 m
Built	1982, Astilleros Españoles S.A., Puerto Real, Spain	
Propulsion	Astilleros Españoles B&Wdiesel, 17 822 kW, driving a single fixed-pitch, right-hand propeller	
Cargo	657 containers	
Crew	28	
Registered Owner	Ruler Shipping, c/o Tsakos Shipping & Trading S.A.	
Manager/Operator	Tsakos Shipping & Trading S.A., Athens, Greece	

Description of Vessel

The *Horizon* is a 1552 twenty-foot equivalent unit (TEU)[3] container ship. At the time of the grounding, the vessel was carrying 175 20-foot containers and 482 40-foot containers.

Photo 1. The *Horizon*

History of the Voyage

In clear weather and with good visibility, the *Horizon* departed the port of Montréal, Quebec, at 0020[4] on 24 July 2004. The trip downriver to Sorel was without incident. The three-person bridge team consisted of the officer of the watch (OOW), a helmsman, and a river pilot. The master was also on the bridge but was attending to duties other than navigation. The pilot was seated on the port side of the wheelhouse, the helmsman was standing at the helm station, and the OOW was standing near the engine telegraph to starboard of the helmsman.

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1 See Glossary at Appendix C for all abbreviations and acronyms.

2 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 of units.

3 Twenty-foot equivalent unit (TEU); the 20-foot and the 40-foot containers are equivalent to 1 and 2 TEUs respectively.

4 All times are eastern daylight time (Coordinated Universal Time minus four hours).

Passing Sorel, the vessel was settled on the Île du Moine leading lights, 082.5° True (T). These were observed forward of the bow, with the helmsman steering 084° Gyro (G) as per the pilot's advice. The Gyro error was reported to be 1.5° high, and the river current was setting about 090° T at two knots. With the engine full ahead and the river current nearly astern, the speed over the ground was between 15 and 15.5 knots.[5]

Soon after the vessel passed buoy S-139 on the starboard side, the helmsman noticed a tendency for the vessel to swing to port. He applied 5 and then 10 degrees of starboard helm to maintain the ordered course, but the vessel continued the trend to port. The helmsman read aloud the descending ship's heading, zero, eight, three – zero, eight, two – zero, eight, one. At this point, the pilot stood up and ordered hard-a-port. The helm was applied accordingly, and the vessel began to swing in that direction. As the vessel turned to port, it also slowed down and made contact with the muddy channel bottom. At 0317, the vessel grounded on the 056° G heading, in position 46°03' 57" N latitude, 073° 02' 13" W longitude, approximately one cable to the southeast of the channel limit (see Figure 1). The Marine Communications and Traffic Services (MCTS) centre at Montréal was contacted and made aware of the situation. Damage to the vessel was minor.

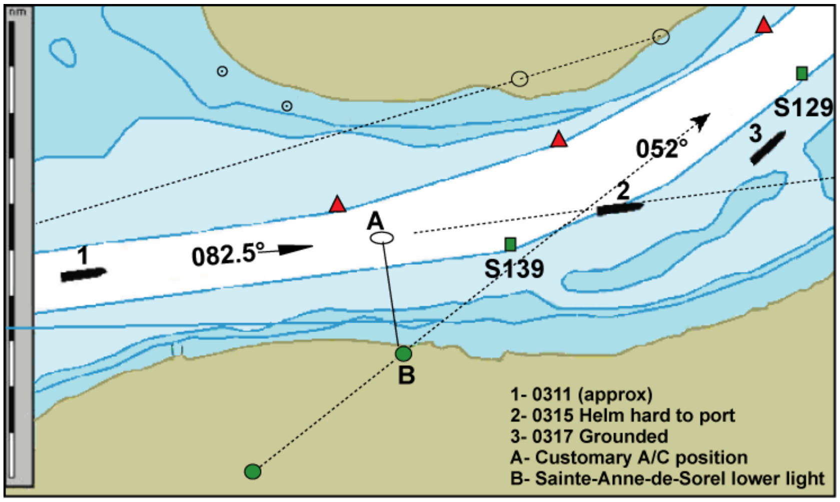

Figure 1. Area in the vicinity of alter-course (A/C) position

Salvage

The master communicated with the vessel's owners in Greece. The emergency response team (ERT) comprising company experts in Greece was promptly mobilized and arrived on site on 26 July 2004.

Although the depth of water on the port side was greater than on the starboard side, soundings around the vessel indicated that it had lost approximately 1.4 m of buoyancy; that is, the draught cut was 7.20 m forward, 7.55 m amidships, and 8.03 m aft. Given the vessel's tonnes per centimetre (TPC) immersion of 41, this lost buoyancy works out to approximately 5740 tonnes in salt water, or 5589 tonnes in fresh water.

5 All speeds are over the bottom unless otherwise noted.

It was decided to remove 2500 tonnes of ballast water from double bottom tanks Nos. 3 and 4, and to fill the deep tank forward with 320 tonnes of ballast. The net loss of buoyancy was now reduced to about 3409 tonnes (that is, 5589 - 2500 + 320 = 3409). Both the master and the company's ERT nonetheless expected that the nature of the channel bottom would permit the vessel to be refloated, and two tugs were ordered.[6]

At 1200 on 24 July 2004, the deballast operation was completed and two tugs, *Ocean Golf* and *Duga,* were on scene to begin refloating attempts. Efforts proved unsuccessful and another tug, the *Ocean Jupiter*, was called. After two more hours without success, a fourth tug, the *Ocean Intrepid*, was summoned, arriving on scene near midnight, but the *Horizon* still remained immobile.

By 26 July 2004, plans to lighter the *Horizon* were now being considered. On July 30, Ocean Group was awarded the salvage contract. The salvor in turn contracted a barge and a self-propelled floating crane in order to discharge 112 containers weighing approximately 2400 tonnes.

Photo 2. Lightering operations

Lightering commenced on 01 August 2004, and by August 3, some 71 containers had been discharged, for a total mass of approximately 1320 tonnes. As abundant rainfall on July 28, 30, and 31 had returned the river level to essentially the same height as on the morning of the grounding, it was decided to refloat the vessel using five tugs. This attempt, too, was unsuccessful, and on August 4, another 38 containers were discharged, bringing the total to 109 removed containers, for a combined weight of 2240 tonnes. At 1650, now with the additional help of a sixth tug, the *Horizon* began moving. By 1700, it was afloat in the channel, with fore and aft draughts of 7.05 m and 7.81 m, respectively.

Personnel Qualifications and Experience

The master held a Master Mariner certificate of competency and has been at sea since 1964 and in a command position since 1979.

The OOW held a Watchkeeping Mate certificate issued in 2003. He has been at sea since 1998 and has about five years' experience performing OOW duties.

The pilot was a certified Class A pilot in 2003 and has been a pilot since 1998. He commenced his sea career in 1983 as an OOW.

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6 The emergency response team had not yet arrived on scene but was in contact with the master.

Pilot's Work/Rest Schedule

On 21 July 2004, the pilot had no pilotage assignments. That night, the pilot went to bed about 2100 and was awoken about 0200 the following day; his sleep was reported as good. On July 22, he assumed conduct of a vessel from approximately 0325 until 1045. He took naps during the day on both July 22 and 23. During the evening of July 23, at 2300, he was called for the *Horizon* assignment, and he boarded the vessel at 2340.

Soon after the grounding, the pilot contacted the pilotage dispatch office and requested a relief pilot. Contractual arrangements between the pilotage corporation and the Laurentian Pilotage Authority (LPA) call for a 12-hour lead time before starting an assignment, and before the arrival of any relief. The pilot remained on board during the morning and afternoon of 24 July 2004 to help the master carry out tug work for the initial refloating attempts. He was relieved by another pilot at 1510 that day.

Fatigue Awareness

In 2003 and 2004, pilots contracting their services to the LPA were made aware of fatigue issues affecting performance. Training was given in the form of information sessions based on the Transport Canada (TC) publication TP 13960E, *Fatigue Management Guide for Canadian Marine Pilots*. The pilot did not attend the fatigue awareness training in 2003 and 2004. However, during the Bridge Resource Management (BRM) training, which he attended four years before the grounding, there was a session on fatigue management.

Bridge Layout and Position of Bridge Team Members Before the Grounding

The *Horizon*'s bridge layout is typical of the majority of ocean-going cargo vessels. The arrangement can be seen in Figure 2, which shows the position of the bridge team members just before the grounding. The four black squares just aft of the instruments and forward of the chart table are structural pillars that extend from deck to deckhead.

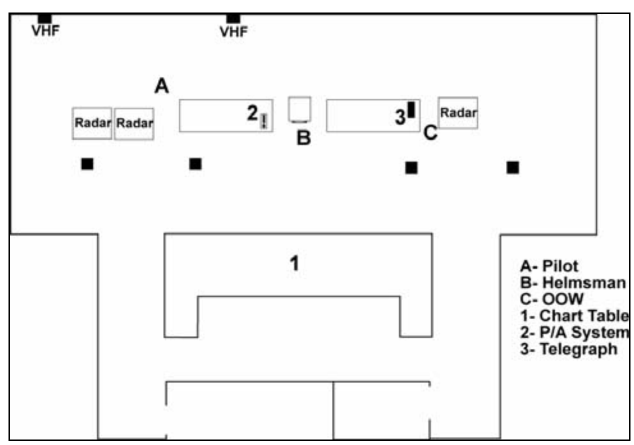

Figure 2. Bridge layout

Bridge Design

Ergonomic design standards and guidelines have been established by the International Maritime Organization (IMO)[7] and the International Organization for Standardization (ISO).[8] Since the *Horizon* was constructed in 1982, its bridge was not influenced by any of these documents.

Emergency Response

Seven hours after the grounding, at approximately 1000, a TC inspector boarded the vessel to assess the situation. His main concerns were the possible danger to crew, along with the vessel's seaworthiness and the risk of pollution. Satisfied that there was neither risk of pollution nor a danger to the crew, he left the vessel approximately four hours later. The TC inspector returned later that day, near midnight, for further consultations with the crew. He subsequently left after being assured that a salvage plan would be submitted to TC.

On 29 July 2004, the salvor submitted a salvage plan to TC. It was accepted on July 31. For the days leading up to the refloating, an employee with the Department of Fisheries and Oceans (DFO) was on board to witness the operation as a government representative in case of pollution. A TC inspector was onboard during all the refloating attempts.

It is the position of TC that it is the ship's responsibility to respond to an emergency, such as an oil spill or grounding. Federal agencies step in only when safety of life or the environment is being threatened through inadequate response. Accordingly, each time grounding occurs, the procedure is similar:

- the vessel's crew or pilot informs authorities of the grounding;
- the vessel specifies whether there has been release of pollutants (if so, the vessel's spill response plan is activated);
- the crew assesses the extent of damage to the vessel;
- the vessel attempts to refloat, usually with the help of tugs;
- if the vessel remains grounded, a salvage plan is submitted;
- the plan may include a salvor's participation;
- lightering is carried out if necessary;
- the vessel is subsequently refloated; and
- during the operation, TC monitors the execution of the plan and represents the government in case of pollution.

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7 Regulation 15 of Chapter V (V/15) of the International Convention for the Safety of Life at Sea (SOLAS) entitled "Principles Relating to Bridge Design, Design and Arrangement of Navigational Systems and Equipment, and Bridge Procedures."

8 ISO 8468, *Ship's Bridge Layout and Associated Equipment – Requirements and Guidelines, 1990.*

DFO also agrees that the ship is responsible to respond in an emergency and will coordinate its resources with other federal agencies as required with respect to search and rescue, direction of marine traffic and pollution response activities. In cases where the polluter is unknown, unable, or unwilling, DFO assumes the lead for pollution response.

Other Events and Information Requests Related to the Salvage Operation

On 26 July 2004, DFO served the *Horizon*'s operators with a notice stipulating that DFO be informed of corrective action to be taken towards an oil spill threat. The same day, DFO also requested a capacity plan (tank plans, capacities) and the status of the vessel from the master before a refloat attempt.

On 28 July 2004, DFO asked the ship's agents for a loading plan and the location of any dangerous cargo. The agents sent the information, adding that TC had also requested the same information at an earlier time.

On 29 July 2004, DFO requested that the *Horizon*'s operators submit an environmental protection plan (EPP) before refloating, reiterating this on August 2 when no EPP had yet been received.

On 03 August 2004, the operators submitted an EPP, which was evaluated and accepted by the Canadian Coast Guard's Environmental Response Division (DFO) and Environment Canada.

Analysis

Fatigue

During the voyage downriver, the pilot was alternately sitting, standing, and walking to consult the radar and use the very high frequency (VHF) radiotelephone. Nothing in his actions before the grounding indicated less-than-adequate ability to perform. Although the pilot was experienced, the vessel was allowed to continue past the customary course alteration point by approximately three cables or, alternately, by 50 seconds at a speed of 15 knots.

While the pilot had more than 24 hours off between his previous assignment and the assignment on the *Horizon*, both assignments included working at irregular hours during the early morning. Consequently, these assignments would have had an effect on his sleep-wake pattern—the biological clock that regulates many of the body's daily functions. Reportedly, the pilot napped for a few hours in the early evening before his assignment. This may not have been restorative, as it occurred when his biological clock would have indicated wakefulness. Such conditions are conducive to fatigue.

Although pilots have received fatigue awareness training and the contractual arrangements set out adequate rest for pilots, fatigue continues to be a factor in occurrences.

Bridge Resource Management

Just before the grounding, the *Horizon* was proceeding at about 15 knots. In restricted waters, it is imperative that orders for a course alteration and its execution are promptly carried out. The pilot, seated to port, was essentially the only person on the bridge who knew where the vessel was at any given time, due to his extensive local knowledge, training, and experience with this particular run of the river. Although the OOW put the vessel's position on the chart from time to time, he was, for the most part, standing near the engine room telegraph in case engine orders were needed. On the *Horizon*'s bridge at night with the bridge team spread out, communication among members was minimal in the minutes leading up to the grounding.

In order to be an effective bridge team member, the OOW must at all times possess a mental model similar to that of the pilot. Because of the extent of the restricted waterway (Montreal to Trois-Rivieres and beyond) it is unrealistic to think the OOW can navigate in real-time using radar parallel index techniques. However, continuous monitoring of the vessel's position in relation to the intended track by the OOW is necessary.

One instrument with the potential to further safety of navigation in pilotage waters is the electronic chart system (ECS) or Electronic Chart Display and Information System (ECDIS). It allows complete, dock-to-dock routes to be stored in a computer memory. Continuous, real-time positioning is accurate, and the navigator can see the vessel to scale on the (chart) screen. Additionally, it permits auto-diagnostic alarms to be set to warn the bridge team when the ECDIS position information is unreliable. Properly used, an ECDIS complements existing instruments, especially in pilotage waters, and helps enhance BRM effectiveness.

Although the *Horizon* is not equipped with an ECS/ECDIS, nor was it required to be, this equipment would have provided the OOW with cues and appropriate information at an early stage for decision making and action, and to effectively participate as a bridge team member.[9]

In this occurrence, without the benefit of local knowledge or other means to continually compare real-time vessel position with the intended track, such as ECS/ECDIS, the OOW did not intervene or otherwise challenge the pilot. BRM,[10] originally born out of the airline industry as a product of the cockpit environment,[11] has been widely accepted as a means to further navigation safety. Modern BRM theory and practice relies intimately on operation, which in turn is influenced by design. Successful application of BRM methodology, however, has been hampered by bridge layout and ergonomics.

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9 A recent United Kingdom Marine Accident Investigation Branch report, although on a different vessel, highlights this point, stating that, had the vessel been fitted with an ECS, and monitored, ''the probability that the vessel would have run aground would have been reduced." (Marine Accident Investigation Branch, *Report on the Investigation of the Grounding of the Italian Registered Chemical Tanker Attilio Ievoli*, United Kingdom, 2004.)

10 BRM is the effective management and utilization of all resources, human and technical, available to the bridge team to ensure the safe completion of the vessel's voyage.

11 In such an environment, all instruments are within view of two seated operators, and team members work in unison, communicating in closed loops of information and counter-validating each other's actions and the progress of the aircraft.

Bridge Ergonomics

During the night-time trip downriver, the bridge team was spread throughout the darkened wheelhouse, with the various members attending to their respective duties. Communication among team members was limited. The pilot voiced headings to steer, and the helmsman repeated these headings as each manoeuvre was executed. Just before the grounding, the pilot, who was seated to port, was 3.3 m from the helmsman at the steering stand and approximately 6.7 m from the OOW, who was standing near the engine room telegraph.

The bridge of the *Horizon*, for example, as well as many other vessels of even more recent construction, is essentially the same as those constructed in the 1950s or even earlier—only with more buttons, controls, and alarms to consider. Such a layout, which has not kept pace with advances in ergonomics and technology, is not conducive to BRM techniques and precise vessel control.

Regulation 15 of Chapter V of the International Convention for the Safety of Life at Sea (SOLAS), as amended in 2002, can be seen as innovative, with its premise that ship control is a socio-technical system.[12] However, the classification societies under the umbrella of the International Association of Classification Societies have not yet formally adopted an accepted unified interpretation (UI) for the application of Regulation 15.[13] Without a UI or other agreed-upon method to demonstrate conformity among Class and/or flag states, Regulation 15's intent and purpose may remain unfulfilled. Bridge layouts will continue to be a reflection of a bygone era, and thus conducive to single-point failure.

Emergency Response

The *Horizon* grounded in the ecologically sensitive area of the Sorel Archipelago. Although tides are not present, water levels can vary as much as 50 cm within a few days, depending on rainfall and runoff from the Great Lakes. The channel bottom, composed primarily of sand and mud, presents no great dangers, and currents are light. Sea swell is not present, and the proximity of land in all directions means that wave action is reduced even in high winds. A salvage operation, however, can still prove challenging and time consuming, as this occurrence demonstrated.

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12 ATOMOS IV (Advanced Technology to Optimize Maritime Operational Safety—Intelligent Vessel), Revision, WP8.5 Rationale for SOLAS Regulation V/15 Template, 2003.

13 UI SC 181, *Bridge Design, Equipment Arrangement and Procedures*.

Previously, incomplete or improper assessment of all the variables, as well as inadequate emergency response, has caused incidents to escalate.[14] Subsequent to the 1999 *Alcor* grounding, the TSB recommended that "contingency plans" be developed, implemented, and exercised "to ensure that risks associated with navigation-related emergencies are adequately addressed."[15] It is the position of both TC and DFO that it is the ship's responsibility to respond to an emergency such as grounding or an oil spill; federal agencies step in only when the safety of life or the environment is being threatened through inadequate response. Consequently, the two agencies' initial role is to monitor the accident. In the event that they do have to take direct action, it is necessary for this action to be firmly based on well-documented contingency plans that have been appropriately tested.

Since the master does not usually possess in-depth knowledge of the grounding area or the resources that are available, the bridge team must rely on local experts for guidance. The initial attempts to free the vessel involved one tug, then two, three, and finally four. Attempting to refloat with the tools immediately at hand—de-ballasting and tugs—is understandable. However, in view of the extent of the lost buoyancy, it should have been apparent that lightering would have to be an essential component of any salvage attempt.

Powerful tugs pulling at full capacity on an immovable vessel risk the dangerous failure of mooring equipment and tow lines, placing personnel at risk. The failure of such equipment when under load has been previously documented and is a concern at IMO.[16]

Notwithstanding the previous TSB recommendation and many examples worldwide of salvage attempts gone wrong,[17] TC and DFO continue to address navigation-related emergencies such as groundings without the benefit of contingency plans and area-specific risk assessments. A United States Coast Guard paper on marine salvage succinctly states the issue:

> Salvage operations must be conducted with the utmost concern for safety of personnel, as well as protection of the marine environment and property. Due to the highly dynamic circumstances involved . . . there is no standard or foolproof method for responding. . . . Therefore, contingency planning and pre-established relationships with industry become indispensable to ensure informed decision making, maximum responder cooperation, and optimum asset coordination.[18]

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14 TSB Report M99L0126, the *Alcor* (1999). Other examples include the *Torrey Canyon* (1967), the *Amoco Cadiz* (1978), the *Sea Empress* (1996) and the *Venus* (1997).

15 Recommendation M03-03, issued January 2004.

16 IMO Sub-Committee on Safety of Navigation, NAV 49/6, 2003.

17 The *Torrey Canyon* (1967), the *Amoco Cadiz* (1978), the *Sea Empress* (1996), the *Venus* (1997), and the *Alcor* (1999).

18 Michael R. Moore et al., *U.S. Coast Guard Federal On Scene Coordinator Role in Vessel Salvage Scenarios.*

Without proper preparation, government officials risk being unable to give timely and beneficial guidance to crews of vessels in difficulty—when time is of the essence—nor can they themselves take necessary measures if crews do not perform appropriately.

Pilot Relief

A refloating attempt is an extremely demanding undertaking. One of the elements necessary for a successful mission is the pilot's performance and his/her ability to retain full concentration. However, the need to quickly relieve a pilot involved in an occurrence has been recognized by the Great Lakes Pilotage Authority.[19] Although the LPA recognizes the benefit of pilot relief subsequent to a marine emergency, there are no specific measures in place to promptly provide pilot relief. This means that relief can take up to 12 hours because of the routine notice required. In this occurrence, the pilot on the *Horizon*, on his own initiative, requested relief soon after the grounding; however, he remained on board during the morning and afternoon of 24 July 2004 until relieved at 1510.

Degradation in pilot performance due to remaining on board has been identified as a factor in previous occurrences.[20] In a safety communication addressed to the LPA in 2001, the TSB emphasized that the lack of a formal post-accident pilot relief policy increases risks.

Findings as to Causes and Contributing Factors

1. The pilot, seated on the port side of the wheelhouse and having the conduct of the vessel, did not order a timely course alteration.

2. Fatigue may have been a factor in the pilot's decreased vigilance at a critical time.

3. The vessel's progress was not effectively monitored by the officer of the watch.

4. In the minutes leading up to the grounding effective Bridge Resource Management techniques were not used and the communication between team members was minimal.

Findings as to Risk

1. In the event of a navigation emergency, Transport Canada and the Department of Fisheries and Oceans continue to operate without the benefit of detailed contingency plans and area-specific risk assessments.

2. Initial refloating attempts were not based on sound salvage practices. Using powerful tugs under such circumstances - that is pulling at full capacity on an immovable vessel—increased chances of failure of the mooring equipment or lines, placing personnel at risk.

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19 Great Lakes Pilotage Authority, *Work Regulations and Assignment Procedures*, Annex J-1.

20 TSB Reports M97L0030 and M99L0126 (specifically, the second groundings of both the *Venus* and the *Alcor).*

3. While the Laurentian Pilotage Authority recognizes the benefit of pilot relief subsequent to a marine emergency, there is no measure in place to promptly provide pilot relief.

4. Despite fatigue awareness training and contractual arrangements that set out adequate rest for pilots, fatigue continues to be a factor in occurrences.

5. Without the benefit of local knowledge or the availability of an electronic chart system (ECS) or Electronic Chart Display and Information System (ECDIS), an officer of the watch is largely reliant on visual means to monitor the vessel's track, which limits his or her ability to intervene effectively in complex pilotage waters.

Other Finding

1. Bridge ergonomics and layout on many vessels are not conducive to seamless Bridge Resource Management techniques and precise vessel control by a team.

Safety Action

Action Taken

Since this occurrence and in response to an earlier recommendation subsequent to the grounding of the vessel *Alcor* in 1999 (recommendation M03-03), Transport Canada Marine Safety – Quebec Region (TC) and the Canadian Coast Guard (CCG) – Quebec Region (Department of Fisheries and Oceans [DFO]) have developed a guide that is used in assessing marine emergencies such as groundings.

The DFO has indicated that it is currently concentrating on measures such as increasing the efficiency of information exchange and setting up an expert committee subsequent to a marine emergency. For the time being, area specific risk assessments and contingency plans cannot be undertaken due to lack of human and financial resources.

From 31 October to 02 November 2006, the DFO and TC undertook a major simulation exercise to help prepare stakeholders at the various levels of government to deal with marine emergencies.

Safety Concerns

Both pilot fatigue and pilot relief have been issues raised in past Board reports and have been the subject of recommendations or safety concerns.

Pilot Fatigue

Pilot fatigue was the subject of Board recommendation M99-04. Canadian Pilotage authorities responded positively to this recommendation and fatigue awareness programs were initiated. Other fatigue mitigation measures in the Laurentian Pilotage Authority's jurisdiction, such as pilot service contracts that impose two pilots if the assignment is to take longer than 11 consecutive hours, are in effect as well. However, as this occurrence has demonstrated, fatigue continues to be a factor. The Board is concerned that despite fatigue awareness training and contractual arrangements that set out adequate rest for pilots, fatigue continues to be a factor in occurrences.

Pilot Relief

Pilot relief subsequent to an occurrence has been the subject of past Findings[21], a Marine Safety Information Letter addressed to the Laurentian Pilotage Authority,[22] as well as a factor mentioned in a Board safety concern relating to pilot performance.[23] Although the Laurentian Pilotage Authority has expressed agreement, in principal, with the issue of relieving a pilot as soon as is practicable after an occurrence, the authority still does not have written procedures or policies that embed these measures into its operations. Other pilotage authorities, such as the Great Lakes Pilotage Authority, have had such procedures for quite some time.

Even though the vessel was easily accessible from the port of Sorel, Quebec, and the occurrence pilot requested relief soon after the grounding, he remained on board to the full extent of the allowable time as specified in the service contract before being relieved. During this time the pilot was helping the master carry out tug work for the initial refloating attempts and making other safety critical decisions. The Board is concerned that, despite an agreement in principal by the Laurentian Pilotage Authority, risks are still greater than they could be in this jurisdiction due to pilots not being relieved as soon as is practicable after a serious occurrence.

Emergency Response

Timely and effective emergency response to navigation-related occurrences such as groundings is paramount in reducing risks to the environment and the transportation system. In most cases, the response will be adequately handled by the vessel owners and a contracted salvage company. Only in the case when the owner's response is not adequate or timely will government agencies take action themselves as opposed to monitoring the action of others. In the present case, the risks presented to the environment and navigable channel were low – and the vessel's owner took the required action in a timely manner.

Both TC and the DFO are particularly well attuned to responding, in a coordinated fashion, to pollution incidents and life threatening incidents or accidents by way of the national search and rescue scheme that includes rescue co-ordination centers, equipment and personnel. However, as documented in past reports such as the *Alcor* (M99L0126), these agencies are not well prepared to quickly and effectively deal with salvage issues.

Since this occurrence, TC Marine Safety Quebec Region and the DFO (CCG – Quebec Region) have cooperated in developing a guide that will be used to assist decision making when assessing marine emergencies such as groundings. Although it is currently relevant only to the

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[21] TSB Reports M97L0030 and M99L0126 refer to the groundings of the vessels *Venus* and *Alcor*.

[22] Marine Safety Information Letter 05/01.

[23] TSB Report M99L0126, Grounding of the vessel *Alcor*.

Quebec region, the Board is encouraged by progress being made. The DFO (CCG – Quebec Region) is also concentrating on increasing the efficiency of information exchange and setting up an expert committee subsequent to a marine emergency. However, the Department of Fisheries and Oceans has informed the Board that, for the time being, area-specific risk assessments and contingency plans cannot be undertaken due to lack of human and financial resources – even though this work is fundamental to laying the foundations for effective and timely risk-based decision making in the event of an occurrence such as grounding.

The Board believes that a planned and coordinated approach is necessary to deal with navigation-related emergencies in Canadian waters while supporting the vessel owners' efforts to deal with an occurrence. The Board is therefore concerned that the continuing lack of comprehensive contingency planning for navigation related emergencies will continue to place vessels, crew, and the environment at risk.

The Board will continue to monitor these safety issues.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 19 June 2007.

*Visit the Transportation Safety Board's Web site (**www.tsb.gc.ca**) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.*

Appendix A - SOLAS Chapter V, Regulation 15

Regulation 15 — Principles relating to bridge design, design and arrangement of navigational systems and equipment and bridge procedures

All decisions which are made for the purpose of applying the requirements of regulations 19, 22, 24, 25, 27 and 28 and which affect bridge design, the design and arrangement of navigational systems and equipment on the bridge, and bridge procedures shall be taken with the aim of:

1. facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;

2. promoting effective and safe bridge resource management;

3. enabling the bridge team and the pilot to have convenient and continuous access to essential information which is presented in a clear and unambiguous manner, using standardized symbols and coding systems for controls and displays;

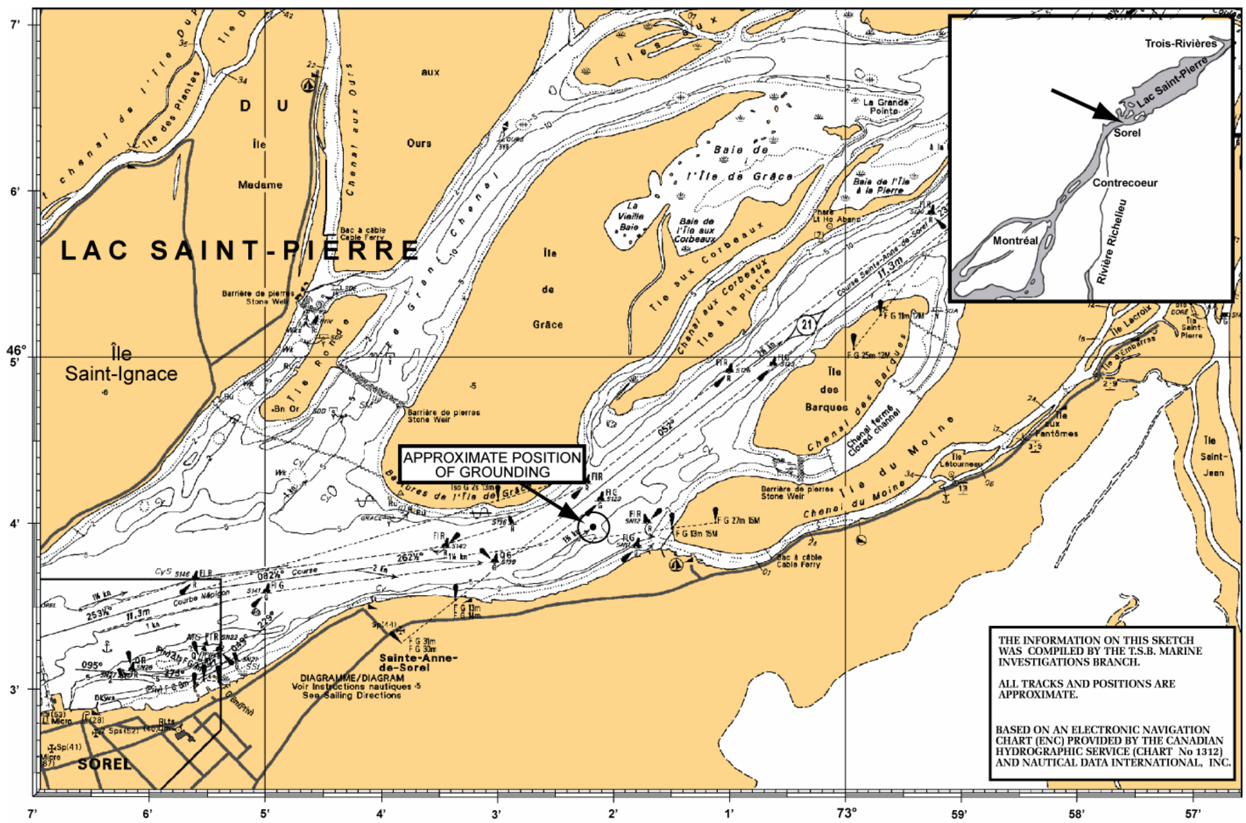
4. indicating the operational status of automated functions and integrated components, systems and/or sub-systems;

5. allowing for expeditious, continuous and effective information processing and decision-making by the bridge team and the pilot;

6. preventing or minimizing excessive or unnecessary work and any conditions or distractions on the bridge which may cause fatigue or interfere with the vigilance of the bridge team and the pilot; and

7. minimizing the risk of human error and detecting such error if it occurs, through monitoring and alarm systems, in time for the bridge team and the pilot to take appropriate action.

Appendix B - Chart of the Occurrence Area



Appendix C – Glossary

A/C	alter-course
BRM	Bridge Resource Management
cm	centimetres
DFO	Department of Fisheries and Oceans
ECS	Electronic Chart System
ECDIS	Electronic Chart Display and Information System
EPP	environmental protection plan
ERT	emergency response team
G	Gyro (degrees)
IMO	International Maritime Organization
ISO	International Organization for Standardization
kW	kilowatts
LPA	Laurentian Pilotage Authority
m	metres
MCTS	Marine Communications and Traffic Services
N	north
OOW	officer of the watch
P/A	public announcement
SOLAS	International Convention for the Safety of Life at Sea
T	True (degrees)
TC	Transport Canada
TEU	twenty-foot equivalent unit
TP 13960	Transport Canada publication entitled *Fatigue Management Guide for Canadian Marine Pilots*
TPC	tonnes per centimetre
UI	unified interpretation
U.S.	United States
VHF	very high frequency
W	west