MARINE OCCURRENCE REPORT
M98C0046

CONTACT WITH BOTTOM

THE PASSENGER HYDROFOIL "SUNRISE V"
FOUR MILE POINT, LAKE ONTARIO
23 AUGUST 1998

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Summary

On the evening of 23 August 1998, the "SUNRISE V" departed Lewiston, New York, bound for Port Dalhousie, Ontario, with no passenger on board. Due to adverse weather conditions over western Lake Ontario, the master chose to avoid deep water waves by skirting the shoreline with the vessel at shallow draught in the foil-borne, high-speed mode. The "SUNRISE V" was disabled when she made contact with a submerged object off Four Mile Point, Ontario. The resulting damage to the propulsion system and rudder caused no pollution and no one was injured.

Ce rapport est également disponible en français.

Other Factual Information

	"SUNRISE V"
Port of Registry	Toronto, Ontario
Flag	Canada
Official Number	720517
Type	Passenger Hydrofoil, High Speed Craft (HSC)
Gross Tons	53
Length	23.2 m[1]
Draught	2 m in displacement mode, 1.1 m in foil-borne mode
Built	1989, Leningrad, U.S.S.R.
Propulsion	One M-401A diesel engine, 809.6 kW @ 1,600 rpm
Number of Crew	4
Number of Passengers	None (66 persons maximum)
Registered Owner	1293728 Ontario Ltd. Mississauga, Ontario

The "SUNRISE V" is a Soviet-type Voskhod-2 passenger hydrofoil, designed for operation on navigable rivers and fresh water basins in temperate climate countries. The hull and superstructure are of welded aluminium-magnesium alloy construction, mounted on fixed, stainless steel, surface-piercing foils forward and aft. The hull below the enclosed passenger deck is subdivided into eight watertight compartments, designed to allow the vessel to remain afloat in calm water following damage to the machinery space or to any other single watertight compartment. The bridge is located forward and the machinery space aft. Propulsion power is provided by one high-speed marine diesel engine driving a single, highly skewed propeller through a "V" drive reduction gear. (See Appendix A.)

In June 1998, the "SUNRISE V" was introduced into service for fast transit of passengers across Lake Ontario between Toronto and the Niagara region. Certified to carry a maximum of
66 passengers, the ferry is permitted to operate at foil-borne speeds (of up to 60 km/h), in wave conditions not exceeding 1.3 m in height. The vessel's schedule varies from day to day. Weekday trips of about one hour's duration between Toronto and Port Dalhousie and Niagara-on-the-Lake provide commuter service from 0700 to 2200 eastern daylight time (EDT)[2]. On weekends, the vessel usually transits between Toronto and Lewiston, New York, from 0900 to 0130 the next morning.
On 23 August 1998 at 1620, the "SUNRISE V" departed Toronto with 66 passengers on board, on a regularly

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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.

2 All times are EDT (Coordinated Universal Time (UTC) minus four hours) unless otherwise noted.

scheduled voyage of about 37 miles to Lewiston, New York. At approximately ten miles out and travelling at foil-borne speed, the vessel encountered wave heights that exceeded her safe operating limits. The speed was then reduced to settle the vessel into the displacement mode until she reached the sheltered waters of the Niagara River. The hydrofoil arrived in Lewiston at 1815 and discharged her passengers. Due to the adverse weather, the return trip to Toronto was cancelled.

The master decided to depart Lewiston that evening and deliver the vessel to Port Dalhousie, where she would be ready for a scheduled departure at 0700 the next morning. In order to avoid the high waves further out on the lake, the master set a course close to the shoreline. At 1856, the vessel departed Lewiston and proceeded at foil-borne speed down the Niagara River, rounded Mississauga Light and turned to port to skirt the shoreline of the lake in a westerly direction towards Port Dalhousie. The master was alone on the bridge.

At 1915, the "SUNRISE V" was passing Four Mile Point on a reported course of 282°True, when the vessel shuddered then veered to starboard. The engineer reported to the master that a vibration and screeching noises were coming from the reduction gear and shaft. The main engine was declutched and the vessel settled into displacement mode for an emergency stop. The master reported that his position after coming to a stop was 43° 16' N, 079° 07' W. The anchor was dropped but did not hold. The vessel drifted in a north-easterly direction towards a line of yellow spar buoys demarcating a Department of National Defence firing range danger area that the vessel had crossed earlier.

Several residents ashore saw and heard the hydrofoil touch bottom close to Four Mile Point and they watched the vessel continue for approximately 100 m before turning away from shore and coming to a stop. One resident immediately alerted the Canadian Coast Guard (CCG) Search and Rescue (SAR) station at Port Weller, Ontario.

Unable to make radio contact with anyone on board the "SUNRISE V", Port Weller SAR dispatched the rescue vessel "CGR 100" which arrived on scene at 1937. At that time, the "SUNRISE V" was approximately 460 m off Four Mile Point in position 43° 15.75' N,
079° 07.85' W. The water depth was approximately 3.2 m. After ascertaining that there was no passenger on board, that no one was injured and that the vessel was not taking on water, the "CGR 100" stood by to await the arrival of an assisting vessel owned by the same company. The conventional ferry "LAKE RUNNER" arrived on scene at 2114 and took the disabled hydrofoil in tow to Port Weller. It was determined later that the "SUNRISE V" had sustained damage to the rudder, shaft, propeller, skeg, reduction gear and coupling.

The master of the vessel regularly monitored Environment Canada weather broadcasts and sought reports on lake conditions from local shipping. At the time of the occurrence, the wind was from the south-west at 20 to 25 knots, with waves 1 to 2 m high over the lake. In the lee of the shoreline, wave heights were 0.3 to 0.6 m and visibility was clear. A severe thunderstorm watch had been issued by Environment Canada at 1730 for western Lake Ontario. Also, the water level for Lake Ontario was 0.678 m above chart datum (measured at Port Weller).

At present, no Canadian regulations exist for the inspection of high-speed vessels. Until regulations can be developed, the Board of Steamship Inspection (BSI) has allowed the use of the *Code of Safety for Dynamically Supported Craft (DSC Code)*[3], and the *International Code of Safety for High Speed Craft (HSC Code)*[4] for inspecting high-speed craft.

The DSC Code was prepared by the International Maritime Organization (IMO) in 1977 to facilitate research and development of dynamically supported craft in order that they would be accepted internationally. It was predicated on the idea that the traditional method of regulating passenger ships should not be accepted as the only possible way of providing an appropriate level of safety. Over a period of 30 years, new vessel designs had been developed that could not fully comply with existing safety conventions, but they had demonstrated an acceptable level of safety when operating on restricted voyages under approved maintenance and supervision schedules. In 1983, when the first hydrofoil-type vessel was to enter passenger service in Canada, the BSI approved the use of the DSC Code for inspection and regulation of such vessels in Canada.

The HSC Code was prepared by IMO in 1994 as an update to the previous DSC Code. The safety philosophy of the Code is based on the management of risk through accommodation arrangement, active safety systems, restricted operation, quality management, and human factors engineering. The application of the Code is subject to several provisions, amongst them that "the management of the company operating the craft exercises strict control over its operation and maintenance through a quality management system."[5] In 1996, the BSI approved the use of the HSC Code for certification and approval of Canadian high-speed craft, stating:
"*the Board ruled that the IMO Code of Safety for High Speed Craft, modified and amplified by the provisions of Annexes 1 and 2 to this Decision may be applied for the certification and approval of Canadian High Speed Craft."*[6]

The HSC Code applies to high-speed vessels built or imported into Canada after 01 January 1996. However, it is the contention of Transport Canada Marine Safety (TCMS) that the HSC Code does not apply to vessels operating in the Great Lakes. As a result, the "SUNRISE V" was inspected under the provisions of the older DSC Code and the company was not required to have a quality management system in place.

Accordingly, the "SUNRISE V" was approved and certified to carry 66 passengers and 4 crew on voyages across western Lake Ontario, not more than 20 nautical miles from a port of refuge. The vessel was restricted from operating in foil-borne mode when wave heights exceeded
1.3 m.

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[3] IMO 1977

[4] IMO 1994

[5] HSC Code Section 1.2.3

[6] BSI decision No. 5837

Commercial use of hydrofoil craft is new to Canada and few ship's officers have experience in their specialized high-speed operation. However, TCMS now issues HSC endorsements for qualified masters, mates, and engineers.

The managing owner of the "SUNRISE V" had previous experience operating hydrofoils in the Mediterranean. He established an "in-house" training program whereby an officer would train for a minimum of two weeks as mate and a further two weeks as master, receiving TCMS endorsements at each level. Marine Safety surveyors witnessed each candidate in the actual operation of the hydrofoil prior to certification. At the time of the occurrence, six masters and mates had received HSC endorsements.

The vessel carries a master, mate, engineer, and purser. Minimum certification for the master is a Master Home Trade 350 tons certificate, and for the engineer a second class motor certificate. If the vessel carries more than 50 passengers, the mate must hold at least a watchkeeping mate's certificate, otherwise no qualifications are required for the mate.

At the time of the occurrence, the master and engineer held qualifications appropriate for the class of vessel on which they were serving and for the voyage being undertaken. The mate held no marine qualifications despite the fact that the vessel had just completed a voyage with
66 passengers on board. The purser held no marine qualifications nor was she required to.

The master had over 20 years' experience as a ship's officer, mainly on the Great Lakes. He had worked for the owner during the previous year as captain on board the conventional ferry "LAKE RUNNER". His first operational experience with hydrofoils began with his training on board the "SUNRISE V" in May 1998, one month prior to the vessel's formal entry into passenger service. Following this, he sailed for two weeks under the supervision of the managing owner before receiving a master's HSC endorsement from TCMS. He had worked an average of 51 hours per week with only occasional days off since the end of April 1998. In order to maintain an adequate amount of sleep when not at home or between voyages, the master sometimes napped in a passenger seat on board or in a chair at the company office. He also made use of a small two-berth cabin on board the "SUNRISE V" where he had slept on the evening prior to the occurrence. He had no training in Bridge Resource Management (BRM).

The mate had worked previously as a deck-hand on board the Port Weller pilot boat. His primary occupation was ashore with a local steel company. Due to a strike at his primary place of employment , he had worked full-time during the 1997 sailing season as a deck-hand on board the "LAKE RUNNER". During the 1998 season, he was hired on a part-time basis on board the "SUNRISE V", usually for weekends and holidays.

The engineer was an experienced seagoing engineer since 1987. He had been employed with the company during 1997 on board the "LAKE RUNNER", and in 1998 he served on board the "SUNRISE V" and her sister hydrofoil the "SUNRISE VI ". He had worked an average of
57 hours per week both on scheduled voyages and on machinery maintenance since the beginning of June, with only occasional days off.

The navigation equipment on the "SUNRISE V" was found to be in good working condition. However, the layout of the cockpit is such that the Furuno model 1721 radar and Furuno model GP 30 global positioning system (GPS) cannot be easily seen by a second person sitting in the jump seat behind the operator. The radar was on and set to a scale of two miles when the hydrofoil struck bottom. The master reported that the vessel's

position was being determined by a combination of radar / GPS and "visual estimation".

The "SUNRISE V" carried on board Canadian Loran chart L/C 2077 covering the entire western end of Lake Ontario, but the scale was small and it did not show details of the lake bottom for the area around Four Mile Point. Canadian Hydrographic Service (CHS) chart No. 2043 would have been more appropriate. At the time of the occurrence, no paper chart was displayed at the conning position nor was a space provided for one to be displayed. Following the collision between the conventional ferry "QUEEN OF SAANICH" and the high-speed ferry "ROYAL VANCOUVER" (TSB Report No. M92W1012), it was found that no navigational charts were available to bridge personnel on the high-speed ferry. Subsequently, the operator of the "ROYAL VANCOUVER" prepared nautical charts for the vessel's route, divided into plasticised sections, to facilitate effective and quick reference from the conning position.

Contrary to the DSC Code, the vessel was not fitted with a depth-sounder for use when the vessel was in displacement mode, and subsequent to the hydrofoil coming to an emergency stop, the crew used poles over the side to try to ascertain the depth of water. As a consequence of the bridge being uncrewed during this initial stage of the occurrence, attempts by SAR stations to make radio contact with the disabled vessel were unsuccessful.

All aids to navigation in the area were reported to be in position and operating normally at the time of the occurrence.

The CHS *Sailing Directions* warns that "shoal water near Four Mile Point extends up to 0.3 mile (550 m) offshore. Boaters are cautioned to avoid this danger by keeping farther offshore." Boulders litter the lake bottom in the shoal area and it is reported by CCG SAR Port Weller that numerous pleasure craft go aground or are stranded in this area each year.

A Department of National Defence (DND) small arms firing range danger area is located midway between the entrance to the Niagara River and Four Mile Point and extends 2.8 km offshore. It is marked with a series of yellow spar buoys. The occasional use of the firing range is announced by local CCG marine radio broadcasts, and by advertisement in local papers. Because of the dangers presented by the shoal water, boulders and DND firing range area, local mariners usually sail at a safe distance off Four Mile Point.

The company operating the "SUNRISE V" did not have a safety management system in place, and formal procedures were limited to two pages of general instructions to the crew. No company procedures were available concerning navigational safety measures required on routes such as between the Niagara River and Port Dalhousie. The company did not provide recommended sailing routes to its masters. Instead, reliance was placed on the master choosing the best route to the vessel's destination.

The "SUNRISE V" had passed close to Four Mile Point on at least two previous occasions. At about 1720 on 21 August, the "SUNRISE V" passed through the area of shoal water and boulders near the Point. At approximately 1015 on 23 August, the vessel again passed close to Four Mile Point. On both occasions the vessel was heading in an easterly direction.

Analysis

It would appear that the vessel touched bottom directly off Four Mile Point and continued for approximately 100 m before turning to starboard away from land. When the "CGR 100" arrived on scene, the "SUNRISE V" was 460 m offshore in position 43° 15.75' N, 079° 07.85' W. However, reports originating from the vessel placed the position of the striking 255 m further downwind to the north-east.

Taking into account:

- the effect of a strong south-westerly wind on the drifting vessel during the 27 minutes between the time of the incident and the arrival of the SAR unit;
- the recorded water depths; and
- the vessel's relatively shallow foil-borne draught of 1.1 m,

it is probable that the vessel touched bottom somewhat closer to the shoreline than reported by the vessel (see Appendix A).

Although the master has overall command of the vessel, a basic premise of modern safety management is that shore management has the ultimate responsibility for setting policies, procedures, and operating instructions for the safe operation of the entire enterprise.

Introduction of a safety management system requires that a company develop and implement safety management procedures to ensure that conditions and activities, both ashore and afloat, affecting safety and environmental protection are planned, executed and checked in accordance with regulatory and company requirements. A structured system also enables the company to focus on the enhancement of safe ship operations and on preparing for emergencies. Companies which are successful in establishing a safety management system may expect to see a reduction in accidents that could cause injuries to people, or damage to property and the environment.

Depending on their geographical location, two differing standards apply to high-speed craft in Canada. TCMS does not apply the provisions of the HSC Code to high-speed vessels operating in the Great Lakes, and instead utilizes the less stringent DSC Code. As a result, companies operating high-speed craft in the Great Lakes are not required by TCMS to have safety management systems in place.

For the "SUNRISE V", the establishment of a safety management system incorporating company procedures for voyage planning, on-board provision of proper charts/publications, ensurance that all crew members are qualified and the practice of bridge resource management, may have provided additional guidance and warnings to the master to avoid the dangers to navigation in the Four Mile Point area.

Direct crossings of Lake Ontario in good weather did not present any undue risk. However, on the evening of the occurrence, the waves on Lake Ontario were too high for a return voyage to Toronto and the company did not have procedures in place to guide the master as to where he should berth the vessel for the night. However, several options were available to him.

A) Stay in Lewiston for the night and reposition the vessel to Port Dalhousie the next morning.

B) Stay in Niagara-on-the-Lake for the night and reposition the vessel to Port Dalhousie the next morning.

C) Continue on to Port Dalhousie immediately, taking a course close inshore to avoid the weather.

These options can be viewed in terms of gains and losses:

Option A) Gain: the vessel would be safe for the night.
Loss: the master and crew would have to sleep aboard the vessel (only 2 berths) and rise early the next morning . It was possible that their arrival in Port Dalhousie would be delayed.

Option B) Gain: the vessel would have covered part of the distance to Port Dalhousie within the sheltered estuary of the Niagara River.
Loss: the dock in Niagara-on-the-Lake is exposed to weather and currents.

Option C) Gain: the vessel would be repositioned for the scheduled voyage from Port Dalhousie to Toronto the following morning. The master would have been able to sleep at home overnight and get up at a normal time for work.
Loss: skirting the shoreline in shallower water involves more diligent navigation and runs the risk of going aground.

Knowledge of human behaviour tells us that when people find themselves in a situation where they must solve a problem to which no rules apply and a new solution or plan must be formulated, there may be a tendency to frame the problem as a choice between gains and losses. With respect to losses, people are biased towards choosing the risky loss, which is potentially more disastrous, but less probable, than the certain loss.

Although skirting the shoreline while continuing on to Port Dalhousie had a potentially higher loss (more disastrous consequence), the loss was seen as less probable than the certain losses (sleeping on the vessel, repositioning after sunrise, arriving late in Port Dalhousie). Without the guidance given by formal company procedures derived from a safety management system (based upon sound risk management principles), the master chose to deliver the vessel to Port Dalhousie along a route passing over the shoal at Four Mile Point.

Nautical publications provide information critical to safe navigation and they must be referred to on board. Contrary to the *Charts and Nautical Publications Regulations*, the small scale of the chart (L/C 2077) carried on board did not provide sufficient detail of the area around Four Mile Point for the operator to be aware of the existence of the boulders on the lake bottom. Also, no provisions for readily displaying a chart were available on the bridge. As a result, the master did not have adequate charted information at his disposal or a facility on which to determine his position in relationship to the hazards off Four Mile Point.

The master was not trained in BRM and the first mate, who was not on the bridge at the time of the occurrence, did not possess a certificate of competency. Without a qualified mate to assist the master with the navigation of the vessel under difficult circumstances, the chances of a successful near-to-shore passage between the Niagara River estuary and Port Dalhousie were reduced.

Special precautions should be taken by high-speed craft travelling in the vicinity of shallow waters. The DSC Code requires that vessels be fitted with a depth-sounder for use when operating in displacement mode (during docking or in shallow areas when the submerged foils could touch bottom). Because of interference caused by water flow past the hull,
depth-sounders become less effective at higher speeds, and dangers such as the rapidly shoaling water and boulders at Four Mile Point cannot be readily detected. Had the "SUNRISE V" been equipped with a depth-sounder used effectively with the vessel operating at slower speeds, navigation around the shoal areas at Four Mile Point may have been easier to achieve safely. Also a depth-sounder would have been useful after the occurrence to avoid all hands being used for poling water depths over the side, thereby allowing someone to stand watch on the bridge and respond to SAR radio signals.

Fatigue may be described as a physiological state typically caused by an inadequate quantity or quality of sleep and characterized by impaired performance and diminished alertness. Although the master may not have been in a state of sleep deprivation, he may have suffered from fatigue as result of poor quality sleep obtained while napping in passenger seats between voyages, or while sleeping on board the previous night.

Findings

1. Due to adverse weather encountered on Lake Ontario, the "SUNRISE V" was prevented from completing her remaining scheduled voyages across the lake.

2. The vessel was required to be in Port Dalhousie the following morning for a departure at 0700.

3. The master chose to take a more sheltered inshore route to Port Dalhousie, by "skirting" the shoreline over a dangerous shoal area strewn with boulders off Four Mile Point.

4. The master was alone on the bridge during the passage from the Niagara River towards Port Dalhousie.

5. The vessel was in high-speed foil-borne mode when she was steered too close to shore and made contact with a submerged object off Four Mile Point.

6. When the SAR unit arrived on scene, the vessel was disabled in a position 460 m from shore. The shoal area extends offshore for 550 m.

7. The nautical chart on board did not show details of the lake bottom in the vicinity of Four Mile Point.

8. A larger scale chart of the area exists (CHS No. 2043), but it was not on board.

9. At the time of the occurrence, there was no easy means of referring to charted information at the conning position.

10. A detailed passage plan had not been prepared and the vessel's position was not being plotted as she proceeded along the shoreline towards Port Dalhousie.

11. The master's recorded position of the vessel at the time of bottom contact was inconsistent with the location of the vessel when the SAR unit arrived on scene.

12. The vessel is not equipped with a depth-sounder.

13. The company did not have a safety management system in place giving detailed operating procedures, including recommended sailing routes.

14. Bridge resource management was not practised between master and mate. The mate was not on the bridge to assist the master during the passage from the Niagara River towards Port Dalhousie.

15. The mate held no formal marine qualifications.

Causes and Contributing Factors

The "SUNRISE V" was steered too close to shore at foil-borne speed when she made contact with a submerged object in an area of shoal and boulders extending from Four Mile Point. Contributing to the occurrence were the absence of a suitable nautical chart of the immediate area, non-fulfillment of the normal practice of plotting the vessel's position during the voyage, failure of the master to utilize the mate's assistance on the bridge, lack of a depth-sounder for use at slower speeds and of a company safety management system to encompass procedures for voyage planning, cancellations and emergency situations.

Safety Action

Action Taken

Safety Management Systems

The operations of high-speed vessels are more demanding than that of conventional vessels and accidents have a greater potential to result in serious damage and injuries. The HSC Code recognizes this fact and requires that companies operating high-speed craft have in place a quality management system. Furthermore, it cautions that the code is a unified document and administrations should apply all sections because "non-compliance with any part of the Code could result in an imbalance which would adversely affect the safety of the craft, passengers and crew."[7] Contributing to the occurrence was a lack of formal procedures which would be inherent in a formal safety management system. As a result, the TSB issued Marine Safety Advisory (MSA) No. 02/99 to apprise TC of the need for safety management systems to be in place within companies operating high-speed craft before the vessels are placed in service.

[7] HSC Code, Preamble, sect. 13

Availability of Charts at the Conning Position on High-speed Craft

Following an occurrence involving a collision between the conventional ferry "QUEEN OF SAANICH" and the high-speed ferry "ROYAL VANCOUVER" in 1992, the TSB issued
MSA No. 09/92 advising TCMS that no navigational charts were available at the conning station of the "ROYAL VANCOUVER", and that the existing chart table was not large enough to accommodate standard nautical charts. While there was a chart available, there was no easy means of displaying charted information at the conning position of the "SUNRISE V" and no chart was being used at the time of the occurrence.

As a result, in January 1999 TCMS amended its Notices to Surveyors, advising inspectors to ensure that navigational charts, including those used in conjunction with any electronic charts such as ECDIS, are in a suitable format (such as strip charts or flip charts) and located so that the navigating officer at the conning station has the facility to readily refer to them.

Certification of Vessel

As a result of several incidents involving high-speed craft operations, and the "SUNRISE"-type of hydrofoils in particular, TCMS initiated a review of all such operations on Lake Ontario. As a result, the "SUNRISE"-type of hydrofoils will no longer be certified for unrestricted Great Lakes voyages.

TC Inspection Procedures

As a result of the review of high-speed craft operations, the Ontario regional manager issued instructions to ensure that the following items are implemented prior to a certificate or permit being issued:

- The on-board operations manual is to be reviewed for completeness and to ensure that it includes adequate operational and maintenance instructions that are consistent with a quality management system.

- A warning is to be posted in the wheel-house regarding the dangers of operating in shallow or hazardous waters.

- The certificate must be endorsed with the requirement for the vessel to exchange information on adverse changes in weather conditions with all high-speed vessels in the vicinity.

Regulatory Development

TCMS will put forward for national consideration and development the recommendations that:

– Specific marine qualifications for this class of vessel be developed.

– A syllabus be prepared outlining crew training.

– Appropriate Canadian inspection certificates and permits be developed, as required by the *Code of Safety for Dynamically Supported Craft*.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 02 June 1999.

Appendix A - Chart and General Arrangement