MARINE INVESTIGATION REPORT

M00C0069

STRIKING

BULK SELF-UNLOADER "ATLANTIC HURON"

AND

CANADIAN COAST GUARD SHIP "GRIFFON"

PELEE PASSAGE, LAKE ERIE

25 SEPTEMBER 2000

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

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Summary

The bulk carrier "ATLANTIC HURON" was proceeding eastwardly across Lake Erie at night. The speed was 12 knots and visibility was good. As the vessel neared Pelee Passage light, the course was altered to starboard for a port-to-port passage with an approaching vessel. Further course alterations to starboard were made to provide more sea room. In doing so, the "ATLANTIC HURON" struck the Canadian Coast Guard vessel "GRIFFON", which was at anchor. Both vessels were damaged but there was no pollution. Four people sustained minor injuries on board the "GRIFFON".

Ce rapport est également disponible en français.

Other Factual Information

Particulars of the Vessels

	"ATLANTIC HURON"	"GRIFFON"
Port of Registry	Montreal, Quebec	Ottawa, Ontario
Flag	Canada	Canada
Registry/Licence Number	800815	328110
Type	Bulk self-unloader	Icebreaker/buoytender
Gross Tonnage	22 746[1]	2212
Length	224.3 m (overall)	71.3 m (overall)
Draught	Forward: 7.76 m Aft: 7.90 m	Forward: N/A[2] Aft: N/A
Breadth	23.19 m	15.09 m
Built	1984, Collingwood, Ontario	1970, Lauzon, Quebec
Propulsion	Diesel engine (11 100 kW), bow thruster, one controllable-pitch propeller	Diesel-electric (3980 kW), bow thruster, two fixed-pitch propellers
Number of Crew	28	25
Number of Passengers	None	None
Registered Owner	Canada Steamship Lines Inc.	Government of Canada
Operator	Acomarit Canada Inc.	Canadian Coast Guard

Description of the Vessels

"ATLANTIC HURON"

The vessel is a five-hold Great Lakes and coastal self-unloading bulk carrier. The crew accommodation, navigating bridge, and machinery space are located aft. The vessel regularly carries cargo between ports within the Great Lakes and the eastern seaboard of Canada.

"GRIFFON"

The vessel is primarily used for ice-breaking and to service navigational aids, including light-station re-supply and maintenance, in the upper St. Lawrence River and in Lake Ontario and Lake Erie.

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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 Not available; drafts were not entered in the ship's log.

History of the Voyages

"ATLANTIC HURON"

Upon completion of cargo operations at 2040 eastern daylight time (EDT),[3] on September 24, the "ATLANTIC HURON", fully loaded with 25 250 tonnes of wheat and soya pellets and trimmed by the stern, departed Windsor, Ontario, for Halifax, Nova Scotia. The vessel proceeded downbound in the Detroit River. The master had the con of the vessel. No pilot was on board, nor was any required.

At 2315, the vessel cleared East Outer light, which is located at the entrance to the Detroit River, and altered to port to make good a course of 096°T to fairway buoy "P" which marks the western entrance of Pelee Passage. The speed of the vessel was 12 knots (kn) and there was a slight list to starboard associated with the settling of cargo. The master then retired from the bridge and left the conduct of the vessel with one of his officers.

At 2350, the third officer and the wheelsman were relieved by the second officer and another wheelsman. At the changeover of the watch, the vessel's position was determined by using the electronic chart system (ECS), which was overlayed with an automated radar plotting aid (ARPA) image. The vessel was on automatic pilot. The officer of the watch (OOW) had been informed by the third officer that the vessel "CSL NIAGARA" was upbound and had called in while at the calling-in-point (CIP) near Southeast Shoal. On the bridge, two very high frequency (VHF) radiotelephones were tuned to channels 12 and 16. The OOW tracked the "CSL NIAGARA" on the ECS and determined that it would pass well clear of the "ATLANTIC HURON". There was no other downbound traffic.

At 0015, the master checked the ECS display in his cabin and looked out his forward accommodation window. He saw several lights, including those of the "CSL NIAGARA" and two other vessels, one just to the south of Pelee Passage light and the other beyond Southeast Shoal light. He also saw a vessel lit up by many lights near Pelee Passage light. He assessed that since there was no vessel traffic congestion south of the light, he would not be needed to assist on the bridge and went to sleep.

At 0036, the OOW heard the "RESERVE" issue a SÉCURITÉ call on VHF channel 16 that it was westbound and 30 minutes from Southeast Shoal. At this time, the "ATLANTIC HURON" was eight nautical miles (M), or approximately 38 minutes, west of fairway buoy "P". The OOW set about to determine where the "RESERVE" would be encountered when a second vessel, the "LADY SANDALS",[4] was detected ahead of the "RESERVE" and near Southeast Shoal light. The OOW tracked the "LADY SANDALS" using the ECS and determined that it would be encountered near and to the east of fairway buoy "P".

At 0108, the "ATLANTIC HURON" was approximately 1.4 M, or seven minutes, west of fairway buoy "P". The OOW called the "LADY SANDALS" on VHF channel 16 and requested they switch to channel 8. They agreed to a port-to-port passage and no other information was exchanged. The OOW then ordered the wheelsman to disengage the autopilot and to hand steer the vessel on a course of 099°T. The speed of the "ATLANTIC HURON" as recorded by the ECS was 12 kn. The "LADY SANDALS" also made a course alteration to starboard to provide more room for a port-to-port passage.

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[3] All times are EDT (Coordinated Universal Time minus four hours).

[4] A 35.39-m yacht with a draught of 2.38 m and a breadth of 7.92 m. The yacht is registered in the Cayman Islands.

The OOW reportedly noticed on the ECS that the “LADY SANDALS” maintained its course along the recommended 302°T course line, leaving little room for the two vessels to safely pass each other. When the OOW looked out through the bridge front window to see the “LADY SANDALS”, he saw another vessel (later identified to be the “GRIFFON” off the starboard bow beyond buoy “E9“). However, he experienced difficulty in identifying whether the vessel was at anchor or under way. No target was observed on the ECS that would indicate the vessel’s presence.

At 0110, the OOW ordered a course of 110°T. Because the vessel was slow to respond, the OOW ordered 120°T. The rudder angle indicators were by now at 20 degrees starboard, but the vessel’s heading was only changing slowly. Not satisfied with the rate of turn and concerned about a possible collision with the “LADY SANDALS”, the OOW ordered the helm hard to starboard to accelerate the rate of change of heading. With the helm hard over, the vessel began to shudder.

When the OOW saw that the “LADY SANDALS” would pass by safely, the helm was ordered to midships. The vessel’s heading, however, continued to alter to starboard and towards the “GRIFFON”, which the OOW now realized was at anchor. The vessel passed close by and north of buoy “E9”. Aware that a striking was now imminent, the OOW ordered the helm hard to port. He also sounded the whistle and the general alarm after he located the unlit switches in the darkened wheelhouse with the use of a flashlight.

At 0116, the bow of the “ATLANTIC HURON” struck the port bow of the “GRIFFON” in position 41° 51' 15" N and 82° 34' 26" W, at an approximate angle of 80°. The striking displaced the “GRIFFON” 1.6 cables[5] south-southeast from its original position. No injuries were reported on board the “ATLANTIC HURON”.

Immediately after the striking, the officers and crew of both vessels took emergency action. The “ATLANTIC HURON” called the “GRIFFON” three times on VHF channel 16 before it responded. By 0140, both vessels had reported the striking to Marine Communications and Traffic Services (MCTS) in Sarnia. Both vessels remained in the area until each was able to get under way safely.

“GRIFFON”

The OOW was alone on the bridge as the quartermaster made his fire rounds. The vessel was at anchor approximately four cables east of Pelee Passage light and had reported its position to MCTS at 1334. Its fore and aft anchor lights were lit, as were the lights of the flight deck, poop deck, main deck and forecastle, and on the bridge deck at each side of the vessel’s funnel. Some of the lights on the upper decks were not lit to prevent light reflection on the wheelhouse windows from interfering with the ability to maintain a lookout. Two floodlights were also lit to provide extra lighting on the main deck. Its main engines were on a 30-minute standby.

When “ATLANTIC HURON” and the “LADY SANDALS” were approximately 5 to 6 M west and east of the “GRIFFON”, respectively, the time of which was estimated to be about 0050, the OOW began to track the two approaching vessels on the ECS. The OOW determined that the closest point of approach (CPA) of the “ATLANTIC HURON” was four cables. The CPA was similar to that of other vessels which had passed by previously when the “GRIFFON” was at anchor. The OOW tracked the “LADY SANDALS” on the ECS proceeding along the recommended 302°T course line.

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[5] One cable is equal to 0.10 M (or 185.2 m).

At 0108, the OOW monitored the VHF call between the “ATLANTIC HURON” and the “LADY SANDALS” on channels 16 and 8. After the call, the OOW noticed on the ECS that both vessels altered to starboard. The “LADY SANDALS” moved north of the recommended 302° course line. The CPA of the “ATLANTIC HURON” reduced to three cables and the OOW became concerned.

When the CPA of the “ATLANTIC HURON” was two cables, the OOW informed the master of the situation. Under the master’s instructions, the port searchlight was turned on to raise the attention of the “ATLANTIC HURON”. The heading of the approaching vessel continued to change towards the “GRIFFON”. With a striking now imminent, the OOW attempted to sound the general alarm and to make an announcement on the vessel’s public address system but was unsuccessful. He had difficulty locating the switches in the darkness of the bridge and he could not hear from his position on the bridge if a public address announcement was being broadcast. One of the passageway doors leading from the bridge deck to the navigating bridge deck was a fire door, and both doors were closed. After the striking, the general alarm sounded on the vessel and the carbon dioxide (CO_2) release siren-type alarm sounded on the bridge.

Four persons sustained minor injuries on board the vessel as a result of the striking; these ranged from head trauma to contact injuries suffered by watchkeepers at their work stations. Two of the injured sought medical attention.

Weather

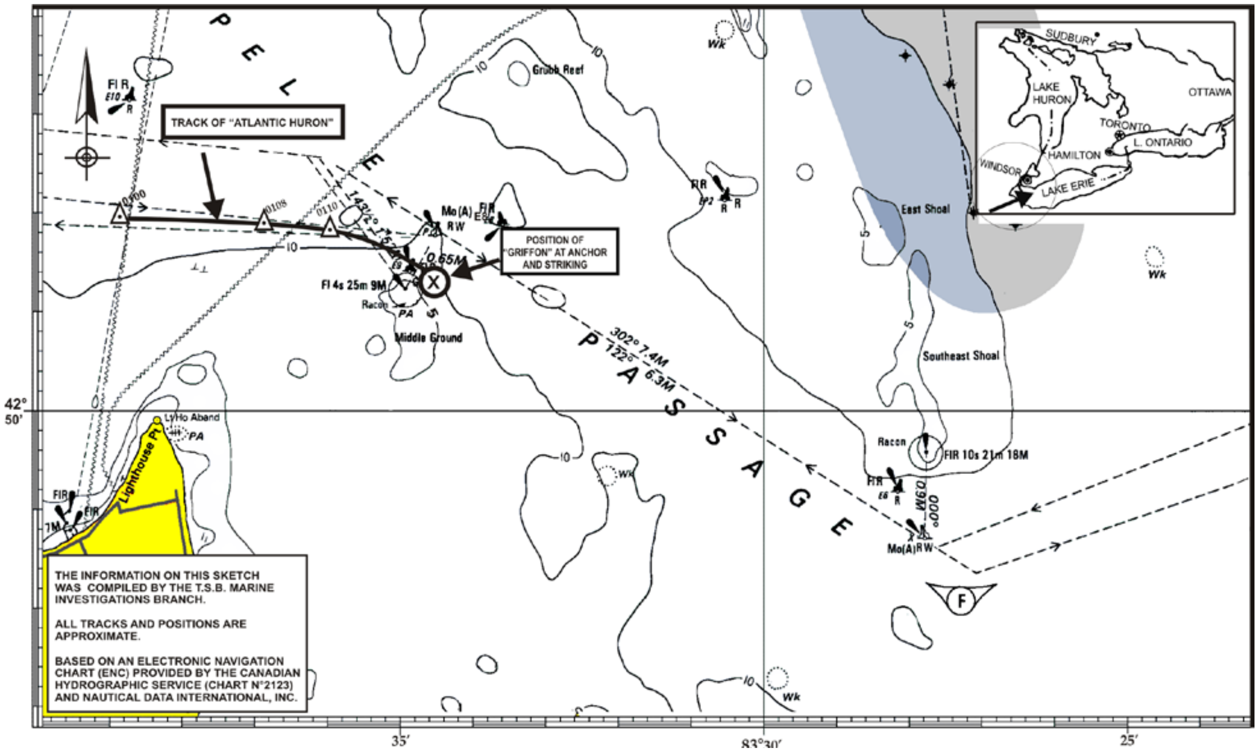
Weather observations taken on board the “GRIFFON” and taken by Environment Canada at Southeast Shoal, before and after the occurrence, indicated the following: winds backed from northerly to northwesterly and were 15 to 20 kn; visibility was greater than 10 km; and there was no precipitation.

Navigation in Occurrence Area

Pelee Passage is the main shipping channel for commercial vessels crossing western Lake Erie (see Figure 1). The fixed light is situated on a pier south of the light buoys at the north end of Middle Ground Shoal and is shown from a circular tower which extends up from a 14-m square helipad. A radar beacon (RACON) is fitted above the light.

Near the eastern entrance to Pelee Passage is a voluntary CIP located south of Southeast Shoal light. Vessels which arrive at the CIP may make a report to MCTS in Sarnia on VHF radiotelephone channel 12, but they are not required to do so.

There are two printed charts available for Pelee Passage—Canadian Hydrographic Service Chart 2123 and United States National Oceans and Atmospheric Administration Chart 14830. The scales of the charts are the same (1:100,000) and are the largest scale available for that geographic area.



Reporting to Marine Communications and Traffic Services

The Canadian Coast Guard (CCG) established MCTS centres to facilitate the safe and efficient movement of marine traffic and to safeguard the environment by providing, *inter alia*, traffic information, navigational safety information, radar navigational assistance, and space management services. The information is provided to assist masters in the safe conduct of vessels, and there is no intention on the part of the CCG to attempt to navigate or manoeuvre vessels from a shore station.[6]

Canadian waters in western Lake Erie, which includes Pelee Passage, are within a voluntary reporting area which has radio coverage only and a voluntary CIP near Southeast Shoal for upbound and downbound vessels. Because the CIP is voluntary, not all vessels participate by making a report.

In the 1980's, the CCG proposed regulations which would have made the CIP near Southeast Shoal mandatory. Representatives of shipping companies which operated in the Great Lakes objected to the proposal and a voluntary CIP was established. Shipping companies do require their vessels to make a report when at the CIP or to issue a SÉCURITÉ call when approaching the CIP. However, all commercial vessels do not necessarily participate in this reporting.

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[6] Canadian Coast Guard. *Notices to Mariners* 1 to 46, Annual Edition, April 2000.

The CCG is involved with a number of initiatives to address the implementation of an Automatic Identification System (AIS)[7] for Canada in order to enhance the safety and efficiency of vessel navigation with respect to the East and West coasts and the lower St. Lawrence River. Internationally-adopted AIS carriage requirements stipulate that AIS be fitted on certain ships through a phased implementation program from 1 July 2002 to 1 July 2008.[8]

It is anticipated that in 2002, the St. Lawrence Seaway Management Corporation will have an AIS operational within the Seaway system. An AIS transponder will be mandatory on all commercial vessels passing through the Seaway. The location of the occurrence was outside of the seaway boundaries controlled by the St. Lawrence Seaway Management Corporation.

Electronic Chart System Used Aboard

The ECS data log files retrieved by the TSB from both vessels contain a record of the electronic information from both external sensing devices and screen presentations. In this instance, the data log was updated every 10 seconds and each log entry contained the following information: date, time, vessel latitude, vessel longitude, position source, vessel heading, heading source, vessel course made good, vessel speed made good, number of satellites in use, and number of satellites in view. In addition, log files of the "GRIFFON" contained information on depth of water, wind direction, and wind speed.

From the data log files of both vessels, no major system malfunction was recorded by ECS, and past tracks data were logged without interruption at the set 10-second intervals.

"ATLANTIC HURON"

According to the data log files, the vessel entered Pelee Passage at a speed over the ground of 12 kn. At 0110, with the heading at approximately 102°T and falling to starboard, a cross track deviation warning was activated.[9] The warning was acknowledged five seconds after it was activated.

At 0113, this warning became an alarm and the vessel's heading steadied at about 125°T. At 0114, the vessel's heading went to starboard and continued to do so right up to the time of the striking. At 0116, when the vessel struck the "GRIFFON", its heading was at about 152°T, approximately 30 degrees beyond the recommended course line, and its speed was 11 kn. At 0118, the cross track deviation visual alarm had been acknowledged.

"GRIFFON"

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7 AIS is a shipboard broadcast transponder system that is capable of sending information such as identification, position, course and speed to other ships as well as to shore. By using global positioning system technology, the exact location of any vessel carrying an AIS transponder is transmitted to other AIS-equipped vessels on the waterway.

8 *International Convention for the Safety of Life at Sea* (SOLAS)*, 1974,* and the *1988 Protocol relating thereto*. Chapter V, Regulation 19.

9 This type of warning is triggered when the vessel distance to the planned route exceeds a certain value set by the operator. Since the loaded route and its parameters are not recorded in the log files, the alarm distance cannot be determined strictly from the log file.

The data log files reported a stationary position at approximately 41°51' 15" N and 82°34' 26" W, and at the time of the striking,[10] the vessel's heading went from about 50°T to about 158°T in 60 seconds. The momentum of the striking was such that the vessel was displaced 1.6 cables south-southeast of its original position.

Damage to the Vessels and the Environment

The "ATLANTIC HURON" sustained damage to the starboard bow, and the shell plating above the spar deck had a fracture approximately 3.6 m long.

The "GRIFFON" sustained damage to the port bow above the ice-belt up to the bulwarks. There was also damage to the forecastle deck, boatswain store, motor generator and buoy winch compartments, and the buoy workshop. There was no report of a release of pollutants.

Vessel Certification

Both vessels were crewed, equipped, and operated in accordance with existing regulations.

Personnel History

"ATLANTIC HURON"

The master had been a seafarer for about 26 years, all but two of which were with Canada Steamship Lines Inc. He was issued Master, Inland Waters and Master, Local Voyage certificates in 1984 and 1999, respectively. He had been the master on board the "ATLANTIC HURON" for the last two and one-half years and rejoined the vessel on 1 September 2000.

The OOW had been a seafarer since 1973 and had worked in a number of deck and engine rating positions on a variety of vessels. Most of his seafaring career had been spent on the Great Lakes. In 1989, he was issued a Watchkeeping Mate certificate. His first assignment as a third officer was in 1993 and he continued to work as third or second officer on a number of vessels until 1997, where he has since been a second officer on board the "ATLANTIC HURON". He rejoined the vessel on 4 September 2000. The OOW was first introduced to Electronic Chart Precise Integrated Navigation System (ECPINS) in 1992. He had no formal training on the use of ECS but became familiar with its use by self-study and practice. He had taken two bridge resource management training courses which incorporated the use of ECS.

The wheelsman, who had been working at sea for about 40 years, joined the vessel as an able seaman and wheelsman in 1997. He rejoined the vessel on 31 July 2000.

"GRIFFON"

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[10] Times for the data log files of the "GRIFFON" in this report were adjusted by three minutes to account for the time difference between the log time references used by the two vessels.

The master had been employed with the CCG since graduating from the CCG College in 1970 and was issued a CCG Command Certificate in 1973. He had been sailing as master on different vessels since 1985. He was issued a Master Mariner certificate in 1991 and had been sailing as master on the "GRIFFON" since 1993.

The OOW had been employed with the CCG since graduating from the CCG College in 1986. He was issued First Mate, Home Trade and Master, Inland Waters certificates in 1989 and 1995, respectively. He had been working on the "GRIFFON" as second officer since 1992.

Analysis

Collision Avoidance

"ATLANTIC HURON"

Good seamanship practice dictates that speed be adjusted according to restrictions such as prevailing conditions of light or darkness, sea room, traffic, weather conditions, and navigational aids available. Given the circumstances of the occurrence, a reduction in speed could have provided the navigating officer more time to resolve the situation and avoid passing in the narrow constraints of the channel, more so as he believed that the "LADY SANDALS" was a large vessel.

The course alteration to starboard and off the recommended 302°T course line by the "LADY SANDALS" did not place it as close as was practicable to the (starboard side) outer limit of the recommended route where there was sufficient sea room to manoeuvre.

The OOW was concerned about sufficient sea room for a port-to-port passage and he did not use the VHF radiotelephone to full advantage to seek additional information or make use of the ship's whistle to indicate such doubt. Instead, the OOW made an assumption that culminated in the large vessel "ATLANTIC HURON" keeping out of the way of the small vessel "LADY SANDALS".

"GRIFFON"

The OOW was aware that the "ATLANTIC HURON" would be passing by within three cables, but he did not take any action to attract its attention until it was just under two cables away. Also, the radiotelephone was not used to communicate with the "ATLANTIC HURON".

As individuals are exposed to a situation repeatedly and do not experience direct negative feedback, their perception of the associated risk decreases. This is true of both high and low risk situations. The navigating personnel of the "GRIFFON" had previously tracked other vessels passing two to four cables off their anchored position. Navigating personnel continued to monitor passing vessels and had become accustomed to such close passages to the extent that it was expected that a vessel would pass close by. Furthermore, because their vessel was lit up at night, the bridge team assumed that transiting vessels would take appropriate action to avoid coming dangerously close to the "GRIFFON".

Anchoring near Shipping Routes

Owing to the nature of the work, CCG vessels remain in close proximity to aids to navigation. Factors influencing the master's decision to anchor in this location included the following:

- The forecasted winds, which were light to moderate northeasterly winds backing to northwesterly, would keep the vessel away from the shallow water to the west.
- Being close to the work site permits timely action to be taken in the event of an emergency relating to the work boat or should the weather become foul.

The anchored position of the "GRIFFON" was four cables from the recommended course line printed on the chart, and a SÉCURITÉ call was not broadcast by the vessel.[11] A NOTSHIP was neither initiated by the vessel nor broadcast by MCTS to warn transiting vessels of the presence of the "GRIFFON". Consequently, the "ATLANTIC HURON" and the "LADY SANDALS" were unaware of information necessary to the safety of vessels operating in the area.

Detection by Other Vessels

Other vessels transiting the passage saw the trace of the target of Pelee Passage light on the radar but did not see the trace of a target indicating the presence of the "GRIFFON"—with one exception. The "CSL NIAGARA" saw an unclear trace of a target in the vicinity of Pelee Passage light but did not see a vessel's lights and thought it was an abnormal RACON signal. The vessel contacted MCTS in Sarnia which confirmed that the "GRIFFON" was near the light.

The ability of the radar to discriminate between two objects which are on the same bearing depends on the strength of echoes, which, in turn, depends on the material of construction, and target aspect, position, size, and shape. Two targets, when close together, can be mistaken for one target.

Pelee Passage light has a RACON fitted on top of the light structure. The RACON emits a signal showing the relative direction to a vessel when it detects the presence of the vessel's radar pulse. The RACON at Pelee Passage light emits a Morse Code "M" (– –) signal which would appear on the side opposite from the RACON as seen by an approaching vessel. The radar return of a vessel can be masked if the position of that vessel coincides with the plume of the RACON signal.

There is also a period of time in which the RACON does not respond to allow radar targets which may be masked by the plume of the RACON signal to be detected. The RACON at Pelee Passage does not respond for nine seconds over a 30-second period. As well, the RACON can be desensitized by the radar of a nearby vessel which could, in fact, further reduce, from 42 to 6 seconds, the amount of time normally made available in one minute for the RACON's active signal.

It is likely that the close proximity of the "GRIFFON" to a large light structure resulted in two targets being mistaken for one. The plume of the RACON signal may also have partially masked the radar return from the "GRIFFON" as observed on board the "ATLANTIC HURON". As a result of the reduction of the time available for the RACON's active signal, bridge teams on vessels which are farther away from the RACON would need to pay particular attention to radar. The detection of the "GRIFFON" by other vessels was therefore hampered by its proximity to a large light structure and the light's RACON signal.

Confirmation Bias

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[11] *VHF Radiotelephone Practices and Procedures Regulations,* 9(1)(k).

Once an individual has developed a working model of a situation, information is incorporated selectively and will favour that which confirms the individual's mental model. Information which does not match the mental model may be rationalized into the model or discounted altogether. In essence, an individual will use information that he or she expects to see and may not incorporate information which is present but does not fit the model.[12] In such situations, barring strong intervention, be it by way of a strong cue or by outside intervention, the individual may experience difficulty in realigning the model to correspond with the situation.

Given that the OOW of the "ATLANTIC HURON" had no prior indication that the "GRIFFON" was anchored near the tower and the target of the "GRIFFON" was not evident on the radar, the mental model of the OOW of the "ATLANTIC HURON" likely did not include the vessel's presence. Even though the OOW detected lights in the vicinity of the light tower, they did not fit his mental model and taken with the other cues, were not sufficient to alter his mental model. It is likely that the OOW of the "ATLANTIC HURON" did not realize the inaccuracies of his mental model until the "LADY SANDALS" had passed and the danger of collision with that vessel had receded. The rapidly looming lights of the "GRIFFON" then most probably captured his attention and led to the initiation of emergency action.

Reporting to Marine Communications and Traffic Services

As reporting to MCTS was not mandatory for this area, MCTS did not volunteer traffic information to vessels unless specifically requested to do so. Such was the case with the "CSL NIAGARA". Further, when the "RESERVE" issued a SÉCURITÉ call, it was not informed of the presence of the "GRIFFON". The absence of all pertinent safety information to vessels may result in decision-making based on incomplete information thereby jeopardizing the safety of vessels operating in such areas.

Pelee Passage is an area in which MCTS reporting is voluntary, all commercial vessels may not participate in it, and there is no radar coverage. Consequently under the current regime, the reliability, completeness and accuracy of information provided by MCTS to vessels cannot be assured.

The introduction of AIS will enhance safety through real-time vessel-to-vessel communication and provide valuable information such as vessel name, position, course, and speed, to other vessels and MCTS. Had AIS been fitted aboard the vessels in this occurrence, more accurate and more timely information (relative to that obtained from the ARPA) on which to base action would have been available.

ECDIS and ECS Training

Electronic chart display and information systems (ECDIS) and ECS are rapidly being embraced in the maritime community as they offer numerous benefits compared to conventional navigation systems. These include the continuous real-time display of a ship's position, various predictive functions and the potential for radar overlay. Unlike printed charts, ECDIS and ECS are complex computer-based information systems that can provide valuable new capabilities to bridge crews. Like most navigational aids, these integrated systems also have limitations, an appreciation of which is essential to derive optimal benefit from their use.

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12 Marvin S. Cohen, "Three Paradigms for Viewing Decision Biases", in *Decision Making in Action: Models and Methods*, Gary G. Klein, Judith Orasanu, Robert Calderwood, and Caroline E. Zsambok, eds., Norwood, NJ: Ablex Publishing, 1995.

The compelling nature of systems such as ECDIS and ECS is a serious drawback which has been identified in research on automation.[13] Because of the very high fidelity representations of the world associated with an ECDIS or ECS system, operators may selectively use the apparently precise information, placing less emphasis on other real-world cues, such as visual cues. In this occurrence, while the OOW had noticed some lights in the vicinity of the light structure, the presence of the "GRIFFON" was not evident on the radar overlay. Given the immediate goal of passing the "LADY SANDALS", the OOW focussed on the apparently precise representation of the area provided by the ECS system, and did not appreciate the variance between its representation and the visual cues.

The international community, through the IMO, has recognized the need for ECDIS training to ensure correct operation and users' appreciation of system limitations. The IMO has developed a model course for ECDIS, as well as a handbook[14] that provides guidance on the development and implementation of such a course

Transport Canada syllabus and training requirements are available, as laid out in TP 4958, for the purpose of approving ECDIS training courses. This follows the training syllabus approved by the IMO. While this training is available at Canadian marine institutions, there are, however, no Canadian or international requirements that this training be taken in order to be issued a certificate of competency or associated endorsement of certificate pursuant to the provisions of the 1995 amendments to the Annex to the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, 1978 (STCW 95).

ECS provides a large number of navigational functions, including predictive displays which can provide advance warning in the form of audible and visual alarms of impending dangerous situations. There is a fine balance between providing warning alarms and generating nuisance alarms. Numerous cases are on record where systems which excessively generate nuisance alarms have been deactivated, and as such were unable to provide a warning. On board the "ATLANTIC HURON", the ECS audible alarm was previously deactivated because of the unacceptable number of nuisance alarms generated. The OOW had not received formal training in the use of ECS, which would have enabled him to better set up the ECS system, and would have thereby reduced the number of nuisance alarms and maximized the opportunity to detect impending dangers.

Use of Audible Alarms During Emergency Situations

Alarms are used to indicate the presence of an abnormal condition, malfunction, or other dangerous situation requiring attention. They may use audible and/or visual means at the site and at a central position, such as the navigating bridge, to draw attention to the situation.

Typically, vessels have various audible alarms on the navigating bridge and, to be effective, each audible alarm should be clearly heard above the ambient noise levels of normal operations. Ideally, these audible alarms should not interfere with the safe navigation of the vessel nor hinder operations during emergency situations.

Following the striking, the master of the "ATLANTIC HURON" called the "GRIFFON" on VHF radiotelephone channel 16 several times, but there was no reply. When the "GRIFFON" was struck, a CO_2

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13 S. Dekker and D. Woods, "Automation and Its Impact on Human Cognition", *Coping with Computers in the Cockpit*, S. Dekker and E. Hollnagel eds., 1999.

14 International Maritime Organization Model Course 1.27, *The Operational Use of Electronic Chart Display and Information Systems (ECDIS)*.

siren-type alarm sounded on the bridge, the intensity of which prevented communications on the bridge and between the bridge team and the emergency teams and muster stations. The alarm was activated by the release of CO_2 gas in the forward boatswain stores. The alarm sounded for approximately five minutes before the reset switch was located and the alarm was silenced. Its reset switch was labelled with a number only and was located among other breaker switches in a panel located forward of the chart table. None of the bridge team members, other than the chief officer, was aware of the location of the reset switch.

Activation of Emergency Alarms

The ability to locate and operate an alarm during an emergency situation is imperative for the safety of the crew of the vessel. Delays in alerting the crew may preempt the taking of appropriate action and may result in serious injury. There have been other occurrences where the bridge crew was unable to activate alarms in a timely manner.[15] Given the normal tendency of those involved to attempt to extricate themselves from a developing situation, activation of alarms is normally left as a last measure once it is apparent that the situation is critical. At this point in the emergency, crews may experience difficulty in locating and identifying the appropriate alarms due to the heightened level of stress and anxiety associated with the situation. The difficulty can be further exacerbated in nighttime scenarios, where the perception of visual cues may be less likely.

On board the “ATLANTIC HURON” and the “GRIFFON”, the switches for the general alarm, public address system, and whistle are unlit. During an anchor watch or when under way, switches and labels cannot be seen easily at night by bridge team members. It is common practice on many vessels for the crew to make use of a flashlight. The difficulty experienced by the OOWs on the “ATLANTIC HURON” and the “GRIFFON” in locating and activating the general alarms was likely due to the high level of stress associated with the emergency situation, exacerbated by nighttime conditions.

The probability of successful activation of safety critical switches can be improved through a number of options ranging from training and focussing on emergency drills to applying ergonomic design principles (such as location, grouping, coding, and lighting), which take into account the impact of performance shaping factors such as stress and the environment.

Effect of Underkeel Clearance on Manoeuvrability of Vessel

As a vessel moves ahead in a restricted shallow channel, the flow of water under the hull is accelerated and causes a reduction in pressure, such that the vessel settles deeper than its static mean draught. This phenomenon is known as “squat” and depends on the vessel's speed, the ratio of its static draught to channel depth, and the cross sectional areas of the hull and the channel. When the speed (through the water) is such that some underkeel clearance (UKC) is retained and bottom contact is not made, the hydrodynamic effects of the squatting condition continue to affect the vessel's trim and have a detrimental effect on its handling characteristics. These detrimental effects include increased wave making—especially at the forward end, which generally causes the vessel to become sluggish and slower to respond when manoeuvring.

There was a tendency for the “ATLANTIC HURON” to squat during the voyage as a result of proceeding at full speed with a low UKC. The situation would have been further exacerbated by its list to starboard. The reluctance of the vessel to swing to starboard when avoiding the “LADY SANDALS”, as well as the shuddering when full helm was applied, are consistent with the reduction in the manoeuvrability of a vessel when

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[15] TSB Report No. M98F0039, “AGAWA CANYON” and “EMERALD STAR”; TSB Report No. M96M0031, “ADA GORTHON” and “NATALIE DON II”.

experiencing squat, and particularly when entering shallower waters.

Findings

Findings as to Causes and Contributing Factors

1. The detection of the “GRIFFON” by other vessels was hampered by its proximity to a large light structure and the light’s RACON signal.

2. The detection of the “GRIFFON” was further exacerbated by assumptions of the OOW of the “ATLANTIC HURON” that no vessel would be at anchor, at that location, at night.

3. The VHF radiotelephone was not used to advantage by either the “ATLANTIC HURON” to obtain pertinent information from the approaching vessel or by the “GRIFFON” to broadcast a SÉCURITÉ message.

4. No NOTSHIP was initiated by the “GRIFFON” to inform other vessels of its location.

5. The “LADY SANDALS” did not keep as close as was practicable to the starboard outer limit of the recommended route, where there was sufficient room for it to manoeuvre.

6. The OOW of the “ATLANTIC HURON” did not fully appreciate that his vessel was experiencing squat which reduced the manoeuvrability of the vessel.

Findings as to Risk

1. Non-illuminated switches for emergency alarms on vessel bridges are more difficult to locate during emergency situations under night conditions, increasing the risk to persons aboard the vessels.

2. The absence of feedback to the person initiating the general alarm or making public address announcements from the navigating bridge precludes confirmation of the successful transmission of critical information essential for the safety of ship’s complement.

3. The OOW of the “ATLANTIC HURON” had not received formal training in the use of ECS, which would have enabled him to better set up the ECS system, and would have thereby reduced the number of nuisance alarms and maximized the opportunity to detect impending dangers.

Safety Concerns

Training on the Use of Electronic Chart Systems for Navigation

This occurrence highlights the importance of the need for formal training on the use of technologies such as ECDIS/ECS. These technologies and their use is increasing within the industry to further navigation safety and reduce navigation workload. Such training would allow crews to appreciate the limitations of the equipment and take full advantage of the technology. Without it, decisions made will be based on incomplete information. The Board is concerned that formal trainin1g is not keeping pace with changing technology. The absence of such training exposes vessels to risk of accidents thereby compromising the safety of their crews.

Communications Between Vessels

The timely exchange of pertinent information between vessels is an important consideration in contributing to the safe navigation of a vessel. Without it, the time available to permit crews to better appreciate a close-quarters or collision situation is reduced. Furthermore, as demonstrated by this occurrence, the lack of an exchange of information can result in unsafe decision making based on insufficient information.

Inadequate communications, as was revealed in this investigation, is not limited to this accident; the TSB has conducted several investigations into marine accidents in which inadequate communication was noted, including the following:

TSB Report No.	Name of Vessels
M94C0015	“TARANTAU” and “RESERVE”
M96M0031	“ADA GORTHON” and “NATALIE DON II”
M97L0053	“FRÉDÉRIC C” and “NICOLE CLAUDE”
M97W0152	“WESTISLE”, barge “IB NO. 1”, and tug “COASTAL DESTINATIONS”
M98W0239	“HARKEN NO. 5”, barge “BARNSTON ISLAND NO.3”, and tug “CENTURION VI”

For example, in the investigation into the 1994 collision between the “TARANTAU” and the “RESERVE”, the collision occurred due to a lack of communication by both vessels. Neither master called the other to advise him of his actions; each master thought that he was aware of the other’s actions and intentions.

Adequate communications ensure that crews share a common understanding of a situation and of each party’s intentions. The Board is concerned that without it, crews will continue to make decisions based on incomplete information thereby putting themselves and their vessels unnecessarily at risk.

This report concludes the Transportation Safety Board’s investigation into this occurrence. Consequently, the Board authorized the release of this report on 11 December 2001.

Appendix A - Glossary

A	aft
AIS	automatic identification system
ARPA	automated radar plotting aid
CCG	Canadian Coast Guard
CIP	calling-in-point
CPA	closest point of approach
CO_2	carbon dioxide
ECDIS	electronic chart display and information system
ECPINS	Electronic Chart Precise Integrated Navigation System
ECS	electronic chart system
EDT	eastern daylight time
F	forward
IMO	International Maritime Organization
kn	knot(s)
kW	kilowatt(s)
m	metre(s)
M	nautical mile(s)
MCTS	Marine Communications and Traffic Services
N	north
NOTSHIP	Notice to Shipping
OOW	officer of the watch
RACON	radar beacon
SI	International System (of units)
SOLAS	*International Convention for the Safety of Life at Sea, 1974*, and *the 1988 Protocol relating thereto.*
STCW 95	1995 amendments to the Annex to the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, 1978.
T	true
UKC	underkeel clearance
VHF	very high frequency
W	west
°	degree(s)
‘	minute(s)
“	second(s)