



Transportation
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Bureau de la sécurité
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du Canada



MARINE TRANSPORTATION SAFETY INVESTIGATION REPORT M18C0018

ON-BOARD FATALITY

Bulk carrier *Sage Amazon*
Port-Daniel–Gascons, Quebec
17 March 2018

Canada 

ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 3 occurrence. For more information, see the Policy on Occurrence Classification at www.tsb.gc.ca

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MARINE TRANSPORTATION SAFETY INVESTIGATION REPORT M18C0018

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Summary

On 17 March 2018, the master of the bulk carrier *Sage Amazon* experienced a cardiac event while standing on an access ladder of No. 3 cargo hold. He fell from the ladder onto the main deck, receiving serious head injuries. At the time, the vessel was anchored 3 nautical miles off Port-Daniel–Gascons, Quebec. Medical aid, including CPR, was provided on the vessel, but was unsuccessful in reviving the master. He was later evacuated to the hospital in Chandler, Quebec, where a death certificate was issued.

1.0 FACTUAL INFORMATION

1.1 Particulars of the vessel

Table 1. Particulars of the vessel

Name of the vessel	<i>Sage Amazon</i>
IMO* number	9573713
Port of registry	Monrovia
Flag	Liberia
Type	Geared bulk carrier
Gross tonnage	35 812
Length overall	199.99 m
Draft/deadweight (summer)	13.32 m/63 301 tonnes
Built	2012, Yangzhou Dayang Shipbuilding Co. Ltd., China
Propulsion	1 low-speed 2-stroke diesel engine (8300 kW), driving a single 4-blade fixed-pitch propeller
Cargo	None (ballast condition)
Crew	19
Registered owner	Defender 9 Ltd., Liberia
Technical manager	V.Ships Asia Group Pte Ltd., Singapore

* International Maritime Organization

1.2 Description of the vessel

The *Sage Amazon* (Figure 1) is a double-hulled geared bulk carrier fitted with four 36-tonne electro-hydraulic deck cranes. The vessel is built of steel and has 5 cargo holds. The machinery spaces and accommodations are located aft. These include the shipboard hospital (sick bay), which is on the starboard side of the main deck. The vessel is propelled by a diesel engine with a maximum continuous rating of 8300 kW at 91 rpm. The vessel has no bow thruster.

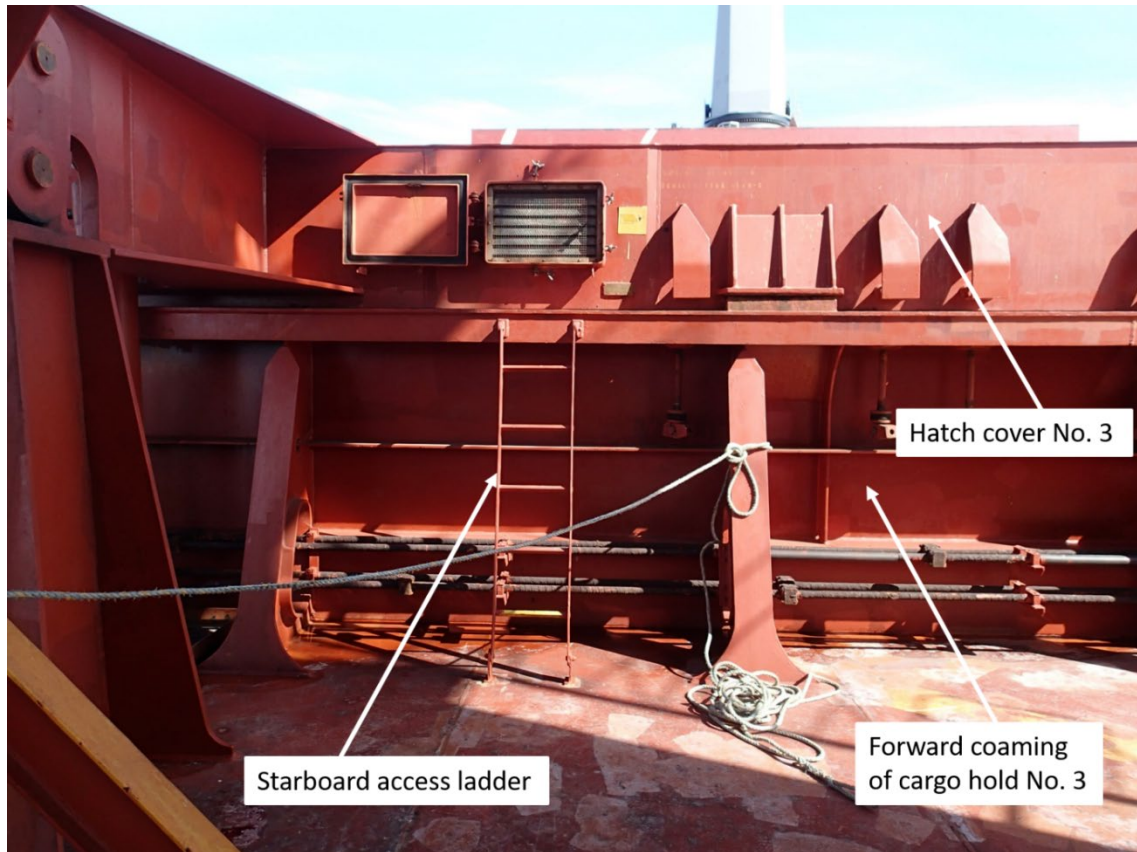
Each cargo hold opening has a coaming 1.78 m high and 2 independent folding-type hatch covers, each operated by 2 hydraulic cylinders.

At the front of cargo hold No. 3, there are 3 access ladders 1.76 m high. The ladders are bolted to the main deck and to the top of the hatch coaming. Two are positioned near the port and starboard hydraulic cylinders, and one is positioned on the centreline of the vessel (Figure 2).

Figure 1. Sage Amazon (Source: Hannes van Rijn)



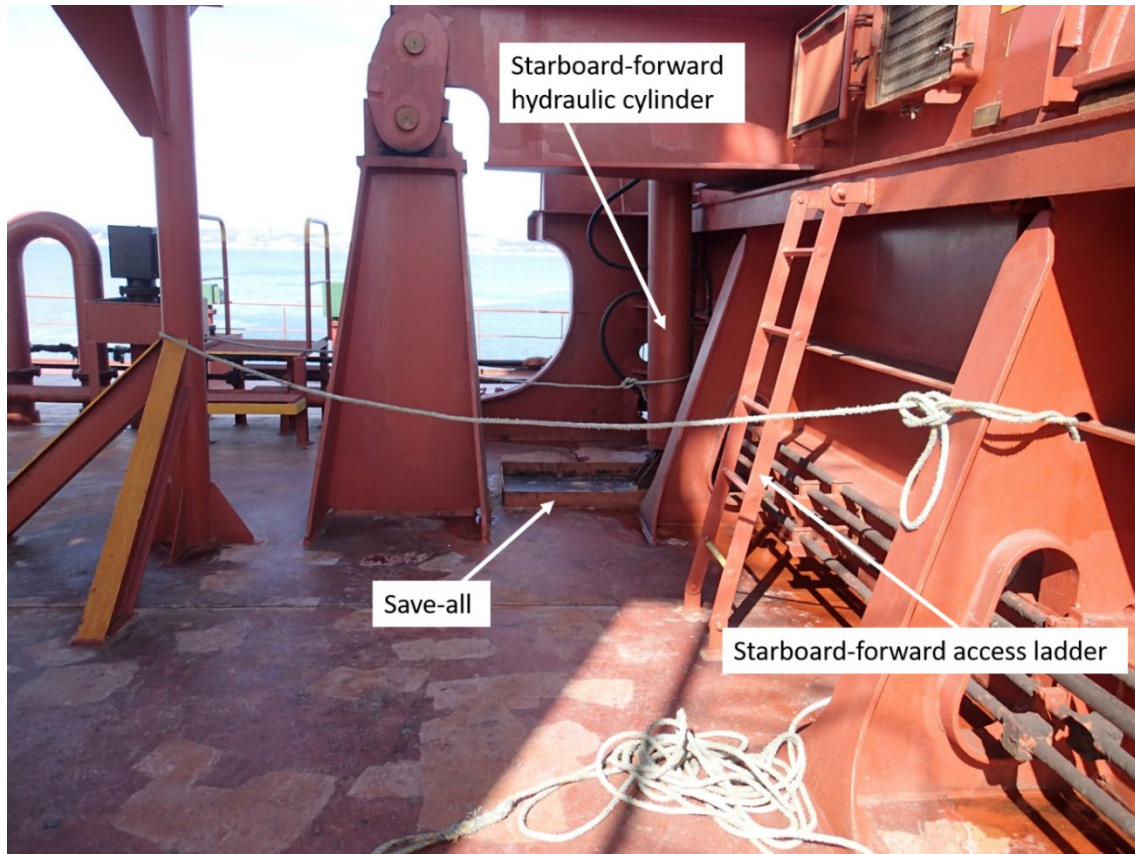
Figure 2. Access ladder on the starboard-forward section of cargo hold No. 3



Near each hydraulic cylinder, a save-all¹ 9.5 cm high is welded to the main deck (Figure 3).

¹ Save-alls are trays welded to the deck that are designed to contain any spillage of hydraulic fluid from the hydraulic cylinders used to operate the hatch covers.

Figure 3. Location of save-all in relation to the starboard-forward hydraulic cylinder and access ladder



1.3 History of the occurrence

On 16 March 2018 at 2110,² the *Sage Amazon* anchored approximately 3 nautical miles off Port-Daniel-Gascons, Quebec, (Appendix A) after having arrived from the United Kingdom in ballast condition. The vessel was scheduled to load cement at the McInnis Cement marine terminal. To prepare for berthing and subsequent loading operations, the ballast water in cargo hold No. 3 was pumped out early in the morning of 17 March. The entire deck crew then went down into the hold to sweep and dry the top of the tank.

At 0730, the master and chief officer proceeded on the main deck to cargo hold No. 3 to verify the status of the work being carried out in the hold. To look into the hold, they climbed up the access ladders located on the forward coaming. The master used the starboard ladder, and the chief officer used the port ladder. Both climbed as far as the second rung from the top of the ladder, a height of 1.5 m, from which they could look over the coaming and down into the hold.

At 0735, a muffled sound was heard and the master was seen lying unconscious on the main deck. The back of the master's head was resting on the save-all, and his hard hat was lying on the main deck beside him. The chief officer immediately called for help using his portable radio. The crew mustered at the accident site at 0740 and established that the master's

² All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours).

condition warranted performing first aid. At 0750, the crew placed the master, still unconscious, onto a stretcher and carried him inside the accommodations. They then placed him on the conference table in the vessel's office, located on the main deck.

At 0757, an ice advisor who was on board, first called the harbour master at the McInnis Cement marine terminal for guidance and to request a boat or other means of bringing the master ashore. The ice advisor then called 911 using his personal cellphone. In the minutes that followed, the ice advisor provided the 911 operator with the master's vital signs and confirmed that the vessel was not carrying an automated external defibrillator (AED). Per the 911 operator's instructions, the crew administered medical oxygen to the master and provided the 911 operator with details of the head injuries.

At 0804, the 911 operator transferred the call to Canadian Coast Guard (CCG) Maritime Rescue Sub-Centre Quebec (MRSC Quebec) in Québec, Quebec, to dispatch the necessary resources to carry out an offshore medical evacuation (medevac). MRSC Quebec then coordinated with the Joint Rescue Coordination Centre (JRCC) in Halifax, Nova Scotia, to carry out the medevac. At 0808, the CCG vessel *Terry Fox* was tasked from Belledune, New Brunswick, and, at 0812, the CH-149 Cormorant helicopter *R909* was tasked from 413 Squadron, located at the Department of National Defence (DND) base in Greenwood, Nova Scotia.

At 0821, the ice advisor reported that the master was still breathing, but that his forehead was cold. At 0830, the ice advisor reported that the master no longer had a pulse and that the colour of his skin had changed. The chief engineer and the chief officer immediately began CPR.

At 0848, the MRSC Quebec contacted the fire department in Chandler, Quebec, which is listed as a local marine rescue unit, to transport an AED to the *Sage Amazon* using its rigid-hull inflatable boat (RHIB). However, the fire department's RHIB had been out of service for almost 9 months. At 0923, the fire department located and initiated the deployment of an RHIB owned by a private citizen.

Meanwhile, at 0932, the *R909* launched from Greenwood. By 0954, the *Terry Fox* reached ice-free waters and launched its fast rescue craft, carrying 2 rescue specialists and an AED. At 1043, the fast rescue craft arrived alongside the *Sage Amazon* and the 2 rescue specialists boarded the vessel. Between 1046 and 1057, they used the AED on the master. The AED automatically went through 8 diagnosis cycles but did not initiate defibrillation.³ CPR was resumed and remote medical counselling was established at 1059 by satellite telephone.

At 1118, the *R909* arrived on scene and 2 search-and-rescue (SAR) technicians were lowered down to the vessel. At 1120, the physician providing remote medical counselling recommended stopping CPR, based on the lack of response to CPR and the absence of any vital signs, and pronounced the master dead.

³ Defibrillation is the application of an electric shock to the heart to restore normal coordinated contractions. An AED will not initiate defibrillation in a person if it does not detect any cardiac activity.

At 1202, the 2 SAR technicians left the *Sage Amazon* and the *R909* departed the scene. At 1216, an RHIB carrying the firefighters from Chandler arrived alongside the *Sage Amazon*, and they boarded the vessel. At 1231, the CCG rescue specialists disembarked, and the *Terry Fox* departed.

At 1300, the vessel's starboard provision hoist was used to lower the master's body into the RHIB. The firefighters departed the vessel in the RHIB at 1313. Once they were on shore, they transferred the master's body to an ambulance in Port-Daniel–Gascons for transport to the Chandler hospital, where the emergency department's attending physician issued a death certificate at 1420.

1.4 Environmental conditions

On 17 March, between 0700 and 0800, the wind off Port-Daniel–Gascons was at 14.3 knots from the west-northwest. The air temperature was -9.3 °C, and relative humidity was 68%. The sky was overcast, and visibility was 15 nautical miles.

The prevailing environmental conditions did not induce rolling or pitching of the *Sage Amazon* while it was at anchor, and the vessel was stable during the occurrence. There were some localized ice patches on the main deck, but the area around the forward coaming of cargo hold No. 3 was free of ice and snow. The ladder on which the master was standing during the occurrence was free of ice and snow, and the rungs were not slippery.

1.5 Vessel certification

The *Sage Amazon* carried all of the required certificates for a vessel of its class and intended voyage. Its last periodic (5-year renewal) inspection had been carried out on 05 March 2017 by the flag state's recognized organization.

The *Sage Amazon's* minimum safe manning document,⁴ issued by the flag state on 05 June 2017, required the vessel to have a master holding the necessary licence per the *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers* (the STCW Convention).⁵

On a merchant vessel, the master, as the highest-ranked officer, oversees all 3 shipboard departments (deck, engine, and catering) and is responsible to the company for the efficiency and effectiveness of all of the vessel's operations and activities. The master is also accountable to the flag and port states' authorities for the vessel's regulatory compliance.

⁴ A minimum safe manning document sets out the minimum number of crew and their required certifications in order for the vessel to be considered seaworthy.

⁵ International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, Chapter II: Master and deck department, Regulation II/2: Mandatory minimum requirements for certification of masters and chief mates on ships of 500 gross tonnage or more.

According to the STCW Convention, “the master has ultimate responsibility for the safety and security of the ship, its passengers, crew and cargo, and for the protection of the marine environment against pollution by the ship [...]”⁶

As soon as it was reported that the master of the *Sage Amazon* was incapacitated, the Canadian Port State Authority restricted the vessel from sailing; it was considered temporarily unseaworthy because the minimum manning requirements⁷ were no longer met. The restriction on sailing was lifted on 28 March 2018 when a new master joined the vessel.

1.6 Personnel experience and certification

The master of the *Sage Amazon* held a master’s certificate of competency and had sailed as a master on various vessels since at least 2014. He had joined the *Sage Amazon* on 26 October 2017. This was his 6th contract with the company and his 1st contract on board the *Sage Amazon*. The master had undergone a pre-employment medical examination on 20 September 2017, conducted under the authority of the Ukrainian Commission of Medical Examination (Ministry of Public Health) and the Republic of Liberia’s Deputy Commissioner of Maritime Affairs, and had been declared “fit for duty – deck service” without restrictions.

The chief officer held a chief mate’s certificate of competency, issued in 2015. He had joined the *Sage Amazon* on 03 March 2018. Although this was his 1st contract as chief officer, he had held the position of second officer on board the *Sage Amazon* during a previous contract. The chief officer had been certified as a medical care person⁸ since 2015, and the company had designated him as such on board the *Sage Amazon* in the event of an accident or illness at sea.⁹

The ice advisor held a master’s certificate of competency, first issued in 1978. He had worked as an independent ice advisor in various locations since 1981, mainly in the Gulf of St. Lawrence, Voisey’s Bay (Newfoundland and Labrador), and Antarctica.

All of the certified officers and ratings on the *Sage Amazon* had taken mandatory basic first aid training as part of their marine emergency duties training, as required by the STCW.¹⁰

⁶ Ibid., section A-II/2, subsection 3.

⁷ These requirements are prescribed by the vessel’s minimum safe manning document.

⁸ International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, section A-VI/4, paragraphs 4-6: Standard of competence for seafarers designated to take charge of medical care on board ship.

⁹ Maritime Labour Convention, 2006 (MLC 2006), Title 4: Health protection, medical care, welfare and social security protection, Regulation 4.1: Medical care on board ship and ashore, Standard A4.1: Medical care on board ship and ashore, paragraph 4(c).

¹⁰ International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, Chapter VI, Regulation VI/1: Mandatory minimum requirements for safety familiarization, basic training and instruction for all seafarers.

1.7 Cause of death

1.7.1 Initial post-mortem examination

The examination, conducted at the hospital in Chandler, showed that the master had received a deep laceration of the scalp 6 cm long over the occipital bone, after falling and hitting his head on the edge of the save-all. Consequently, the master's cause of death was initially established as severe cranial trauma causing a cerebral hemorrhage and culminating in cardiopulmonary arrest.

1.7.2 Autopsy and toxicology

An autopsy was conducted in Rimouski, Quebec, on 30 March 2018. On 03 and 18 April 2018, toxicological analyses were also performed at the Centre de toxicologie du Québec in Québec, Quebec.

The autopsy established that the master died of an acute myocardial infarction (a heart attack) in the left ventricle and that his head injuries, although serious, were not fatal. The scalp laceration was not associated with cranial trauma. His skull and brain were intact, and there was no evidence of a cerebral hemorrhage.

The master had an enlarged heart (myocardial hypertrophy),¹¹ with thickened walls in the left ventricle and atherosclerotic lesions in the coronary arteries and the aorta. It was observed that the master had had a previous myocardial infarction before the fatal one.

The toxicological analyses determined that the master was taking metformin, a drug normally used to treat type 2 diabetes.

1.8 Master's medical profile

The master had heart and arterial conditions and had in his possession 12 different medications to treat diabetes, heart arrhythmia, high blood pressure, and renal dysfunction. One of these medications was nitroglycerin, which can be used as a vasodilator during a cardiac event. The investigation could not determine whether a physician had prescribed these medications for him, nor their source. The master's family members and fellow crew members were unaware that he was taking medication.

The master had a body mass index (BMI) of 36.67 kg/m² (a weight of 111 kg and a height of 174 cm), which is considered Class 2 obesity according to the World Health Organization.¹²

¹¹ The master's heart weighed 700 g, whereas the average weight of a human male heart is 270 to 360 g.

¹² World Health Organization, *Obesity and overweight* (18 October 2017), at <http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight> (last accessed on 14 March 2019).

1.9 Fitness for duty at sea

Any seafarer employed on a seagoing merchant vessel subject to the STCW Convention and sailing on unlimited voyages must undergo a periodic medical examination to assess the seafarer's fitness to carry out all assigned duties at sea.¹³ The purpose of these examinations, as specified in the *Guidelines on the medical examinations of seafarers* published by the International Labour Organization/International Maritime Organization, is "to reduce risks to other crew members and for the safe operation of the ship, as well as to safeguard their personal health and safety."¹⁴ Seafarers who pass the medical examination are granted a medical certificate that specifies their fitness for duty and any associated restrictions.

Medical examinations of seafarers must be conducted by recognized medical practitioners.¹⁵ During a medical examination,

[t]he examinee's intended position on board ship and, as far as practicable, the physical and mental demands of this work and the anticipated voyage pattern should be established. This may give insights that enable work to continue but with limitations based on the nature of the voyage (for example, fit for coastal or harbour service only) and the job to be held.¹⁶

Medical practitioners are guided to collect information about the seafarer's previous medical history, to ask point-by-point questions about the details of previous diseases and injuries, and to record the results.¹⁷ Seafarers are required to fully disclose their medical conditions and history to the medical practitioner. The process does not allow the examining medical practitioner to access or request the seafarer's personal medical records, which are normally maintained by the seafarer's personal health care provider(s), unless specifically authorized by the seafarer.

During a seafarer's medical assessment, the medical practitioner should refer to the provided guidance on medical criteria used to evaluate whether the seafarer is fit or unfit for work at sea. The age and experience of the seafarer, the nature of the duties to be

¹³ Maritime Labour Convention, 2006 (MLC 2006), Title 1: Minimum requirements for seafarers to work on a ship, Regulation 1.2: Medical certificate, Standard A1.2: Medical certificate, and International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, Article III and Chapter I, Regulation I/9.

¹⁴ International Labour Organization/International Maritime Organization, *Guidelines on the medical examinations of seafarers* (ILO/IMO/JMS/2011/12), 2013, Part 1: Introduction, section I: Purpose and scope of the Guidelines.

¹⁵ *Ibid.*, section VIII: Recognition of medical practitioners.

¹⁶ *Ibid.*, section XII: Conduct of medical examinations, subsection (iii).

¹⁷ *Ibid.*, section XII: Conduct of medical examinations, subsection (iv).

performed, the type of shipping operation, and the type of cargo carried by the vessel must be taken into account.¹⁸

The STCW standards of physical and medical fitness require that seafarers have no medical condition, disorder, or impairment that would prevent the effective and safe conduct of their routine and emergency duties on board, that they are not suffering from any medical condition likely to be aggravated by service at sea, and that they are not taking any medication that has side effects that would impair the effective and safe performance of those duties.¹⁹

A seafarer's medical fitness for duty at sea can be limited by high BMI or obesity and by heart or blood-vessel diseases, among other factors.²⁰ A seafarer with a diagnosis of high blood pressure (hypertension) has an increased likelihood of ischemic heart disease, eye and kidney damage, and stroke, or a risk of an acute hypertensive episode. However, there are no limitations prescribed unless the seafarer has systolic blood pressure of more than 160 mm Hg or diastolic blood pressure of more than 100 mm Hg. For seafarers who have experienced cardiac events, such as myocardial infarctions, the medical practitioner can apply restrictions to the seafarer's medical certificate, such as increasing the frequency of medical examinations by limiting the period of validity of the certificate, downgrading the type of seagoing voyages from "unlimited" to "near coastal waters," or restricting the seafarer from working alone or conducting solo watchkeeping on board the vessel.²¹

In Canada, Transport Canada technical publication (TP) 11343 is to be used by medical practitioners when examining individuals seeking to obtain a marine medical certificate. This publication, first published in 2001, was revised in 2007 to take into consideration the *Guidelines on the medical examinations of seafarers*.²²

1.9.1 Master's medical examination

The master last underwent a medical examination on 20 September 2017, when the medical practitioner who conducted the examination certified the master as fit for duty at sea. The medical practitioner was an approved practitioner and reported having conducted the examination according to the requirements of the STCW; the Maritime Labour Convention (MLC), 2006; and the International Labour Organization/IMO guidelines on the medical examinations of seafarers.

¹⁸ Ibid., section XII: Conduct of medical examinations, subsection (xii).

¹⁹ International Maritime Organization, *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, Part A, Chapter I, section A-I/9, subsections 2.3 to 2.5.

²⁰ International Labour Organization/International Maritime Organization, *Guidelines on the medical examinations of seafarers* (ILO/IMO/JMS/2011/12), 2013., Appendix C – Physical capability requirements, Medical conditions and physical capability.

²¹ Ibid., Appendix E – Fitness criteria for common medical conditions, diagnostic codes I10-15 and I20-25, pp. 39-40.

²² Transport Canada, TP 11343E, *Medical Examination of Seafarers: Physician's Guide* (June 2007 edition).

The medical centre where the master's examination took place is recognized as an approved clinic to certify seafarers for fitness for duty at sea. The centre was licensed by the Ukrainian Ministry of Public Health, had a quality management system certified in accordance with ISO 9001:2008, was accredited by a major classification society and 2 major protection and indemnity clubs, and was accredited by major shipping companies and flag states for compliance with the MLC 2006 and the STCW.

During the medical examination, the medical practitioner carried out multiple tests and the master answered a wide range of questions about his medical profile. During testing, the medical examiner measured a heart rate of 76 beats per minute and a blood pressure of 140 mm Hg (systolic) over 88 mm Hg (diastolic). This blood pressure measurement is considered "high-normal" and corresponds to Stage 2 hypertension.²³ A resting electrocardiogram²⁴ was also conducted; the medical practitioner did not note anything abnormal.

The medical examination records include sections entitled "general appearance" and "heart (cardiovascular)." Both had been noted as "normal." The master's exercise performance and tolerance to physical work was measured in an exercise stress test to 85% of his predicted maximum heart rate and had been noted as "high," and his blood pressure reaction was noted as "normotonic."²⁵

For the following questions, the "No" answer boxes were checked:

- have you ever been hospitalized?
- are you aware that you have any medical problems, diseases, or illnesses?
- are you taking any non-prescription or prescription medications?
- high blood pressure?
- heart/vascular disease?

The master had signed a declaration stating that he had made a full disclosure of all of his medical history to the medical examiner and that all of the information provided was true to the best of his knowledge. The form did not have a provision for the master to consent to the release of his personal medical records for review by the medical practitioner.

²³ American Heart Association, "Understanding Blood Pressure Readings," at http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/KnowYourNumbers/Understanding-Blood-Pressure-Readings_UCM_301764_Article.jsp#.Wv7FE8uouUA (last accessed 14 March 2019).

²⁴ A resting electrocardiogram is often used alongside other tests to help diagnose and monitor conditions affecting the heart. It can be used to investigate symptoms of a possible heart problem and can help detect arrhythmias, coronary heart disease, heart attacks (myocardial infarctions), and cardiomyopathy. Source: United Kingdom Department of Health and Social Care (National Health Service – NHS), at <https://www.nhs.uk/conditions/electrocardiogram> (last accessed on 14 March 2019).

²⁵ "Normotonic" means that the subject's systolic and diastolic blood pressures varied according to the medical standards during and following a physical effort.

1.9.2 Independent review of medical examination results

The TSB requested that an independent medical doctor, an internal medicine physician with expertise in cardiology, review all of the master's medical information (both the information that was made available to the medical practitioner in September 2017 and the information that had not been disclosed by the master) and evaluate the master's fitness for duty based on this information. The independent medical doctor established that the resting electrocardiogram conducted in September 2017 was abnormal and suggested underlying heart problems. Some of the medication in the master's possession suggested that he had ongoing symptoms of coronary disease (angina). The independent medical doctor noted that there was no indication that the marine medical examiner had been aware of these undisclosed medical issues.

After conducting the review, the independent medical doctor concluded that had the marine medical examiner been aware of these issues, it would have been appropriate to investigate the underlying heart condition in more detail and to assign a limited certificate, for example, one restricted to near coastal waters, as per the international guidelines on the medical examinations of seafarers.

1.10 Requirements relating to the carriage of medical supplies on board ship

Pursuant to Regulation A4.1 of the *Maritime Labour Convention, 2006*, as amended,

- (a) all ships shall carry a medicine chest, medical equipment and a medical guide, the specifics of which shall be prescribed and subject to regular inspection by the competent authority; the national requirements shall take into account the type of ship, the number of persons on board and the nature, destination and duration of voyages and relevant national and international recommended medical standards.²⁶

The *Sage Amazon* carried all of the mandatory equipment and medicines in its medical cabinet, including a cervical collar²⁷ and a mortuary bag. The investigation found that neither the chief officer nor the second officer was aware of the presence of the cervical collar in the medical cabinet, and it was not used during the medical emergency involving the master.

On the *Sage Amazon*, responsibility for maintaining the shipboard hospital and medical cabinet was assigned to the second officer. This responsibility involved ensuring that the minimum required quantities of medicine and medical supplies were kept on board, that the medical supplies were in good condition, and that expiry dates were followed up if applicable.

²⁶ Maritime Labour Convention, 2006 (MLC 2006), Regulation 4.1: Medical care on board ship and ashore, Standard A4.1: Medical care on board ship and ashore, subsection 4(a).

²⁷ A cervical collar is used to immobilize and support a person's neck and head when traumatic injuries are suspected following a horizontal or vertical impact such a fall on a hard surface.

1.10.1 Automated external defibrillators

An AED is a portable battery-powered medical device that automatically detects a person's heart rhythm using a computer program. The AED can identify when a person has a heart rhythm problem called ventricular fibrillation or pulseless ventricular tachycardia (life-threatening conditions that result in cardiac arrest or sudden cardiac death) and then prompts the AED operator to administer an electric shock to restore normal heart rhythm. The AED automatically adjusts the intensity of the electric shock. AEDs can be used safely by people who do not have medical training. If used within 2 or 3 minutes of cardiac arrest and followed up by hospital care, an AED may improve short-term outcomes for a person experiencing this type of cardiac event.

According to the World Health Organization, “[i]f AEDs are carried, crew should be trained in their use, and in the care of patients surviving cardiac arrest.”²⁸ The *Sage Amazon* did not carry an AED, nor was it required to.

1.11 National search-and-rescue system

The SAR response in this occurrence involved federal, provincial, municipal, and private organizations. Some were involved as first responders providing on-site medical assistance, while others provided remote medical assistance; coordinated the deployment of the land, marine, and air resources; and assessed the event for criminal aspects or safety issues. The readiness posture and response times of these organizations varied and are discussed below.

1.11.1 Federal responders

The CCG vessel *Terry Fox* became involved in the SAR response at 0808 when it received the SAR mission tasking from the JRCC. Just before the SAR mission, at 0753, the *Terry Fox* had finished escorting a vessel in ice-covered waters in the vicinity of the harbour of Belledune, New Brunswick. The *Terry Fox* departed the area immediately toward Port-Daniel–Gascons, since it was already underway at sea. Upon arriving in ice-free waters, it was able to launch its fast rescue craft, which arrived on scene at 1043.

The DND helicopter *R909* became involved in the SAR response at 0812 when it received the SAR mission tasking from the JRCC. The helicopter was stationed at the airbase in Greenwood, Nova Scotia, with no aircrew on site. One minute later, the members of the aircrew, who were standing by from their homes, were paged and mustered at the airbase to prepare the aircraft. Issues with the staffing of the airbase's motor truck used to supply fuel caused an unexpected 30-minute delay before refuelling the aircraft. The *R909* took off

²⁸ World Health Organization, *International medical guide for ships: including the ship's medicine chest*, 3rd edition (2007), Chapter 1: First aid on board, p. 7.

at 0932, 80 minutes after having been tasked on the SAR mission for the *Sage Amazon*, and arrived on scene at 1118.

In Canada, the SAR national guidelines and standard operating procedures are provided in the *Canadian Aeronautical and Maritime Search and Rescue (CAMSAR) Manual*.²⁹ This manual supplements the *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*.³⁰ The CAMSAR manual describes the state of readiness for all primary SAR squadrons, including 413 Squadron, to which the *R909* belongs. The manual indicates that “SAR crews shall respond immediately to all SAR taskings and SAR aircraft shall be airborne as soon as safely possible.”³¹

Normally, the readiness posture (maximum allowable time for a dedicated aircraft and its crew to become airborne) for DND aircraft is 30 minutes during Monday to Friday from 0800 to 1600 (Tier 1 SAR readiness posture) and 2 hours during “quiet hours” and statutory holidays (Tier 2 SAR readiness posture).

Tier 1 readiness posture normally applies for 40 hours per week. Extending the Tier 1 readiness posture beyond this number of hours requires the approval of the commander of the First Canadian Air Division of the Royal Canadian Air Force.³² The commander has the discretion to realign SAR readiness postures to coincide with periods of greatest SAR activity, such as the opening of specific fisheries or boating activities and events.

The events on the *Sage Amazon* occurred on a Saturday morning, when the *R909* was operating on a Tier 2 SAR readiness posture. The *Terry Fox* was assigned as the primary SAR unit and was following a 30-minute readiness posture.³³

In 2007, 2 years after the capsizing of a small fishing vessel³⁴ that involved 1 confirmed fatality and 3 persons missing and presumed drowned, the Canadian National Search and Rescue Secretariat initiated a review of the CAMSAR manual and the air SAR readiness posture. A similar review had previously been conducted in 1999. Additionally, in May 2013, the federal government tasked the secretariat with conducting quadrennial

²⁹ Department of National Defence (DND) and Canadian Coast Guard (CCG), *CAMSAR: Canadian Aeronautical and Maritime Search and Rescue Manual*, Combined Edition – Volumes I, II and III, B-GA-209-001/FP-001, DFO 5449 (effective 03 January 2017), paragraph 2.10.2.

³⁰ International Maritime Organization and International Civil Aviation Organization, *International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual*, Volumes I, II and III (2016).

³¹ Department of National Defence (DND) and Canadian Coast Guard (CCG), *CAMSAR: Canadian Aeronautical and Maritime Search and Rescue Manual*, Volume I, Chapter 2: System Components, subsection 2.10.2.

³² *Ibid.*, subsection 2.10.8.

³³ *Ibid.*, subsection 2.11.1.

³⁴ TSB Marine Investigation Report M05N0072.

reviews of the national SAR system.³⁵ These reviews have not resulted in any change to the air SAR readiness posture, and they have indicated that resource availability continues to be the primary factor in determining SAR response standards.

In 2018, the Standing Senate Committee on Fisheries and Oceans published the final report³⁶ of its study of Canadian maritime SAR. The study was initiated because of gaps identified over the past decade regarding coverage, capacity, prevention, and governance. The committee learned that many factors contribute to reaction and response times and the success or failure of a SAR mission, such as the deployment time of assets and personnel. There was also considerable discussion of the reaction time on a Tier 2 SAR readiness posture.

The committee's final report states that Canada is not on par with other countries and has a longer maritime SAR reaction time: "aeronautical SAR assets operated in the United Kingdom, Ireland, and Denmark respond within 15 minutes during the day and between 30 and 45 minutes at night."³⁷

1.11.2 Provincial, municipal, and private responders

The Chandler Fire Department (CFD), the Sûreté du Québec (stationed in Pabos, Quebec), and the 911 coordination centre (operated by a private company located in Rimouski, Quebec) were all involved in the emergency response as well. As local first responders, they are required to immediately respond to any life-threatening emergency, such as the occurrence on board the *Sage Amazon*.^{38,39,40}

The CFD is composed of volunteer firefighters, who are paged during an emergency. The number of responders and the response time to any given emergency varies, depending on each individual's readiness, location, and availability.

At the time of the occurrence, the RHIB owned and operated by the CFD had been out of service since 22 July 2017, when it was damaged during a deployment. The unavailability of

³⁵ Public Safety Canada, *Quadrennial Search and Rescue Review* (December 2013), at <https://www.publicsafety.gc.ca/cnt/rsrscs/pblctns/archive-nss-qdrnrl-rvw/index-en.aspx> (last accessed on 14 March 2019).

³⁶ Senate of Canada, Senate Standing Committee on Fisheries and Oceans, *When every minute counts: Maritime Search and Rescue* (November 2018), at <https://sencanada.ca/en/info-page/parl-42-1/pofo-sar-maritime> (last accessed on 14 March 2019).

³⁷ *Ibid.*, p. 25.

³⁸ Gouvernement du Québec, *Fire Safety Act* (chapter S-3.4), Chapter III, Division III: Municipal Fire Safety Services.

³⁹ Gouvernement du Québec, *Police Act* (chapter P-13.1, s. 81), Regulation respecting the police services that municipal police forces and the Sûreté du Québec must provide according to their level of jurisdiction (chapter P-13.1, r. 6), section 2.

⁴⁰ Gouvernement du Québec, *Civil Protection Act* (chapter S-2.3, s. 52.4), Regulation respecting standards, specifications and quality criteria applicable to 9-1-1 emergency centres and to certain secondary emergency call centres (chapter S-2.3, r. 2), section 10.

spare parts warranted the retirement of the RHIB from service, and the City of Chandler had postponed the purchase of a replacement craft for financial reasons. Although the MRSC Quebec had designated the CFD as the local marine rescue unit, the MRSC was unaware that the RHIB was out of service when it tasked the CFD during the occurrence.

When it was dispatched at 0848, the CFD began searching for a suitable replacement RHIB. In total, 2 hours and 27 minutes elapsed between when the CFD was dispatched and when a suitable rescue craft was located, prepared, staffed, and waterborne. It then took 61 minutes for the RHIB to reach the *Sage Amazon*.

1.12 Previous TSB occurrences related to disclosure of medical information

M09M0073 (*Pubnico Explorer*) – On 16 December 2009, the small fishing vessel *Pubnico Explorer*, with a crew of 4 on board, capsized and sank approximately 11 nautical miles southwest of Cape St. Mary's, Nova Scotia. Three crew members were rescued by the CCG shortly afterward. The master was missing and presumed drowned. One of the risks identified by the TSB during its investigation was that “employers and employees who do not fulfill their shared responsibilities with respect to disclosure and fitness for duty may be placing vessels and crew at unnecessary risk.”

M10C0043 (*River Rouge*) – On 29 July 2010, the passenger vessel *River Rouge*, with 71 passengers and crew on board, ran aground in the Quarry Rapids on the Red River, north of Winnipeg, Manitoba. Following an unsuccessful attempt to refloat the vessel, all 63 passengers and 6 of the crew were evacuated by the CCG. During the investigation, the TSB determined that, although the master had been declared fit by a medical examiner following a medical examination in 2006, Transport Canada had made subsequent requests to him for further information about his medical condition, but no additional information was provided to satisfy these requests. His health deteriorated in the following years and, at the time of the occurrence, an independent medical assessment found him medically unfit.

M15A0009 (*Grace Sparkes*) – On 21 January 2015, the roll-on, roll-off passenger ferry *Grace Sparkes*, with 8 crew and 4 passengers on board, was transiting the harbour channel at Burnside, Newfoundland and Labrador, when it struck Burnside Rock. There were no injuries or pollution, but the vessel sustained damage to the hull and the bilge keel. One of the risks identified by the TSB during its investigation was that “[i]f seafarer medical information and associated medical files are incomplete, i.e., the seafarer has not disclosed fully and the marine medical examiner has not requested supporting data to verify the seafarer's reports, there is an increased risk that significant medical conditions will go undetected, allowing the seafarer to carry out his duties when not medically fit, increasing the risk of accidents.”

M15P0347 (*Leviathan II*) – On 25 October 2015, the passenger vessel *Leviathan II* was on a whale-watching excursion with 27 people on board when it capsized off Plover Reefs in Clayoquot Sound, British Columbia. The subsequent rescue operation recovered 21 survivors, which included 18 passengers and 3 crew members. There were 6 fatalities. One of the risks identified by the TSB during its investigation was that “[i]f seafarers do not fully

disclose medical information, and marine medical examiners do not request supporting data, medical files may be incomplete, increasing the risk that seafarers will carry out their duties when not medically fit.”

M16P0162 (*C.T. Titan* and *Albern*) – On 24 May 2016, the tug *C.T. Titan* collided with the tug *Albern* in Northumberland Channel, British Columbia. The *Albern* capsized and sank, and the vessel’s 2 crew members were rescued by the crew of the *C.T. Titan*. The TSB investigation established that the master of the *C.T. Titan* did not disclose relevant medical conditions during his medical examination. As a result, the marine medical examiners did not have the opportunity to determine whether the master’s medical conditions could have had an impact on the safety of the vessel and its crew.

2.0 ANALYSIS

This analysis will look at the medical examination process for seafarers, the shipboard readiness for a medical emergency on the *Sage Amazon*, and the search-and-rescue (SAR) response to this occurrence.

2.1 Factors leading to the fatality

While the master on the *Sage Amazon* was standing on an access ladder for the No. 3 cargo hold, he experienced an acute myocardial infarction. As a result, he fell onto the main deck where the back of his head made contact with the edge of a save-all, causing a deep laceration of the scalp.

The crew assumed that the master, who was unconscious, had slipped or tripped on the access ladder and provided first aid to address his visible head injury, not suspecting a cardiac event. With no automated external defibrillator (AED) on board, the crew was unable to determine the master's cardiac condition when asked to do so by the 911 operator. Various SAR resources were dispatched but could not reach the vessel immediately.

About 1 hour after his fall, based on the absence of a pulse, the crew initiated cardiopulmonary resuscitation, but it had no effect. An AED was eventually transported to the vessel and used, but, because more than 3 hours had elapsed since the master's fall, it was no longer of use.

The master was pronounced dead approximately 4 hours after falling from the access ladder.

2.2 Assessment of medical fitness and disclosure of medical information

Both medical practitioners and seafarers have obligations to ensure that marine medical examinations are comprehensive and accurate. The medical practitioner is responsible for collecting sufficient medical information to substantiate the outcome of the assessment, while the seafarer is required to disclose any medications or medical conditions that may be relevant.

During the course of the investigation, the TSB identified that, although the master had a number of medical conditions, had previously experienced a myocardial infarction, and was taking medication to control his symptoms, this information was not disclosed on the form the master signed in the presence of the medical practitioner during the marine medical examination.

In the past, the TSB has identified that seafarers may not disclose medical conditions out of concern that they will lose their medical certificates and, by extension, their employment. Since 2009, 5 other TSB marine investigations have identified issues with respect to self-

reporting of medical conditions.⁴¹ However, when seafarers do not disclose pertinent medical information, medical practitioners are limited in their ability to fully understand the extent of the seafarer's medical conditions and make an accurate assessment of fitness for duty. Moreover, the medical certification process does not allow the medical practitioner to access or to request the seafarer's personal medical records, normally maintained by the seafarer's personal health care provider(s).

In the case of the master of the *Sage Amazon*, had the medical practitioner been aware of his medical condition, it would have been appropriate to investigate the underlying issues in more detail and trigger mitigation measures. These might have taken the form of limitations on the time of service permitted between the mandatory medical examinations, limitations on where the master could conduct sea voyages (e.g., being restricted to coastal or inland waters), or limitations on working alone or conducting solo watchkeeping.

An independent examination of the master's medical records, conducted for the purpose of this investigation and based on full disclosure of his medical conditions, concluded the master was fit for duty with limitations, requiring a more detailed investigation of his underlying heart condition and recommending that the type of seagoing voyages be restricted to near coastal waters. Given this assessment, the master would not have been considered fit to carry out the duties he was undertaking as master on board the *Sage Amazon* on this particular unlimited seagoing voyage. Considering the safety-critical role of a master on board the vessel, it is important that masters be in adequate medical condition to carry out their duties.

If medical practitioners do not have access to full medical information and records, fitness for duty may not be assessed accurately, increasing the risk of seafarers endangering themselves, the vessel, the crew, and the environment in a medical emergency.

2.3 Shipboard readiness for a medical emergency

Ensuring that a vessel is prepared for a shipboard medical emergency is critical to increasing the likelihood of a successful outcome, especially because many vessels sail in remote areas where medical resources may not be able to reach them in a timely manner. Current international standards do not include AEDs as part of standard medical equipment. Modern AEDs are compact, reliable, easy to use, and relatively inexpensive to purchase and maintain. Vessels that carry these devices are better equipped to respond to some medical emergencies, which may improve their outcomes.

The *Sage Amazon* carried all of the required medical equipment and had an officer designated to maintain the equipment. The crew had undergone basic first aid training, and the vessel had a designated medical care person. The crew provided medical attention, including CPR, for over 3 hours until the SAR crew arrived.

⁴¹ TSB marine investigation reports M09M0073, M10C0043, M15A0009, M15P0347, and M16P0162.

There was no AED on board the *Sage Amazon*, nor was the vessel required to carry one. However, this meant that, when the 911 operator suspected a cardiac event and recommended the use of an AED early in the emergency care of the master, the crew did not have access to one. Furthermore, it took more than 3 hours for a rescue vessel carrying an AED to reach the *Sage Amazon*.

If crew do not have access to medical equipment such as an AED, which could assist in a medical emergency such as a cardiac event, there is a risk that shipboard personnel will not receive adequate medical treatment.

2.4 Search-and-rescue response

Given the vessel's position at the time of the occurrence, the deployment locations of available SAR resources, their respective transit times to reach the vessel, and the time at which the master's pulse was no longer detectable (approximately 55 minutes after his fall), it is unlikely that the elapsed time of the SAR response affected the outcome of this occurrence. Nevertheless, the investigation identified the following regarding the SAR response:

- The Department of National Defence helicopter tasked to respond to the *Sage Amazon's* emergency was tasked at 0812 and took off at 0932. This was within the 2-hour Tier 2 SAR response readiness posture, but was approximately 50 minutes later than had the occurrence taken place during weekday working hours, when a 30-minute Tier 1 readiness posture is in effect.
- The Canadian National Search and Rescue Secretariat has conducted multiple reviews of the *Canadian Aeronautical and Maritime Search and Rescue Manual*, but none of these reviews has resulted in changes to the air SAR readiness posture. Resource availability continues to be the primary factor in determining SAR response standards.
- The first SAR resource to reach the *Sage Amazon* and provide an AED was the Canadian Coast Guard vessel. Although its response time was also within its readiness posture, more than 3 hours elapsed between the master's myocardial infarction and the delivery of the AED on board.
- About 2.5 hours elapsed between the master's myocardial infarction and when the Chandler Fire Department located and put to use a suitable replacement rigid-hull inflatable boat (RHIB). The Chandler Fire Department's RHIB had been out of service for almost 9 months before the occurrence, and a replacement had been postponed for financial reasons; Maritime Rescue Sub-Centre Quebec was unaware of this.

3.0 FINDINGS

3.1 Findings as to causes and contributing factors

1. The master experienced an acute myocardial infarction while standing on an access ladder for the No. 3 cargo hold and fell onto the main deck, receiving serious head injuries. First aid initially focused on his head injuries.
2. When the possibility of a cardiac event was raised, with no automated external defibrillator (AED) on board the vessel, it was not possible to confirm the master's cardiac condition.
3. Various search-and-rescue resources were dispatched, but it took approximately 3 hours for first responders to reach the vessel, at which point it was too late for medical assistance.
4. The master was pronounced dead about 4 hours after the cardiac event and subsequent fall.

3.2 Findings as to risk

1. If medical practitioners do not have access to full medical information and records, fitness for duty may not be assessed accurately, increasing the risk of seafarers endangering themselves, the vessel, the crew, and the environment in a medical emergency.
2. If crew do not have access to medical equipment such as an AED, that could assist in a medical emergency such as a cardiac event, there is a risk that shipboard personnel will not receive adequate medical treatment.

3.3 Other findings

1. The medical certification process for fitness for duty does not allow the examining medical practitioner to access or to request the seafarer's personal medical records, which are normally maintained by the seafarer's personal health care provider(s).
2. Although the Chandler Fire Department was identified as a local marine rescue unit by the Canadian Coast Guard Maritime Rescue Sub-Centre, the Maritime Rescue Sub-Centre was unaware that the department's rigid hull inflatable boat had been out of service for approximately 9 months when it tasked the department during the occurrence.

4.0 SAFETY ACTION

4.1 Safety action taken

4.1.1 Republic of Liberia

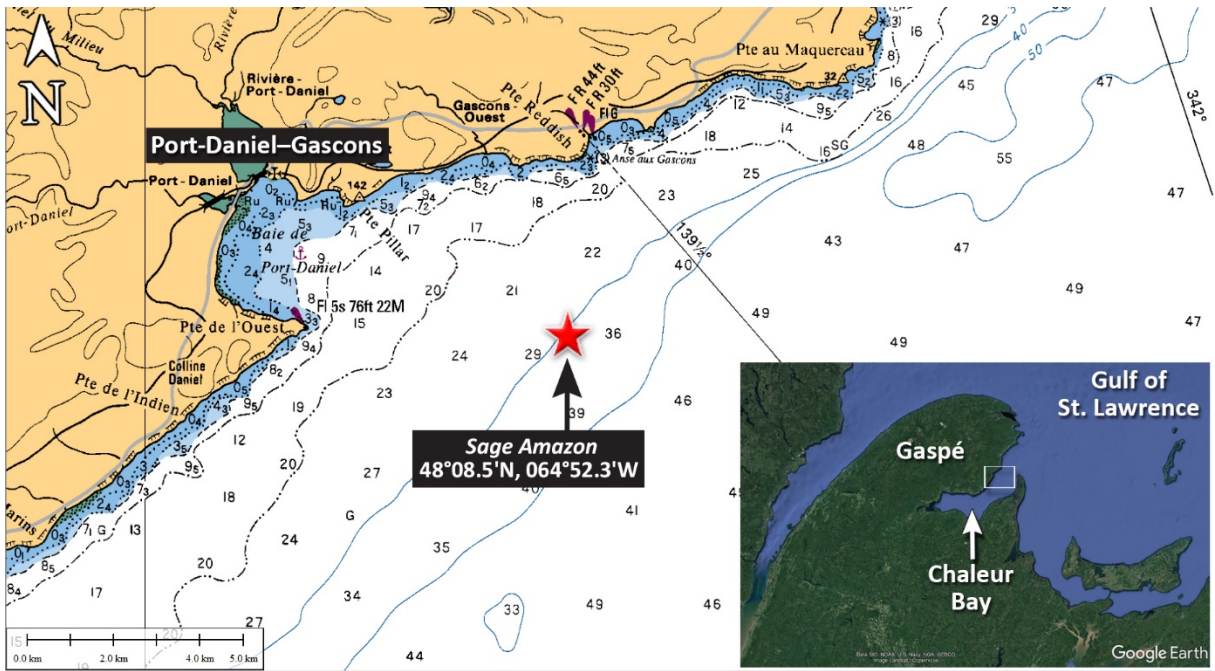
Following the occurrence, the Republic of Liberia, the flag state for the *Sage Amazon*, conducted an investigation into this marine casualty incident and recorded the incident in its internal files for future reference and analysis. Because the Republic of Liberia determined that the master's death was due to natural causes, a formal report of investigation was not produced under the International Maritime Organization (IMO)'s *Code of the international standards and recommended practices for a safety investigation into a marine casualty or marine incident* (the Casualty Investigation Code).

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 31 July 2019. It was officially released on 06 August 2019.

Visit the Transportation Safety Board of Canada's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

APPENDICES

Appendix A – Area of the occurrence



Source:

Main image: Canadian Hydrographic Service Chart No. 4486, with TSB annotations

Inset image: Google Earth, with TSB annotations