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

Marine Transportation Safety Investigation Report M20P0320

GROUNDING

Barge *Lafarge Eagle*, towed by tug *Mauna Loa* with tug *Sea Imp XI* assisting
Fraser River, British Columbia
01 November 2020

Description of the vessels

The *Mauna Loa* is a single-screw steel tug built in 1963. Main propulsion is provided by a 2088 kW marine diesel engine. The tug also has a 150 kW hydraulic bow thruster. An electrically operated, double-drum tow winch is fitted on the aft deck, and towing pins are located at the stern.

The wheelhouse contains a conning station with navigation equipment and machinery controls. A second conning station is located on the aft starboard side of the deck (Figure 1). This conning station faces aft and contains controls for the engine, bow thruster, steering, and towing pins. The tug is registered in the United States (U.S.) and is owned and operated by Salmon Bay Barge Line, Inc.

At the time of the occurrence, the tug had 97 777 L of diesel fuel on board. Approximately 37 854 L were in the 2 aft fuel tanks and the balance was in the 2 forward fuel tanks. The tug's departure draft was approximately 3.20 m forward and 3.66 m aft.

Canada

Figure 1. The *Mauna Loa*, with aft conning station labelled (Source: Jackie Pritchard, with TSB annotations)

The *Lafarge Eagle* (Figure 2) is a non-propelled steel barge that is 98.57 m in length and used for transporting bulk cement. The hull is divided by 5 transverse watertight bulkheads into fore and aft peak compartments and 4 cargo holds. The cargo holds are capable of carrying approximately 7700 t of bulk cement. The barge has a raked bow and stern. The stern has a deep, rounded pushing notch and port and starboard towing skegs. A towing bridle is attached to eye bolts on the port and starboard sides of the bow. The barge is owned and operated by the same company as the *Mauna Loa* and is also registered in the U.S.

At the time of the occurrence, the barge was loaded with approximately 7051 t of bulk cement. The maximum draft was 5.64 m, and the vessel was trimmed 0.24 m by the stern.

Figure 2. The *Lafarge Eagle* (Source: Salmon Bay Barge Line, Inc.)

The *Sea Imp XI* is a twin-screw tug built in 2017. The tug is 16.31 m long and is powered by 2 diesel engines of 896 kW in total, driving fixed-pitch propellers. The tug is owned and operated by Catherwood Towing Ltd. and is registered in Canada.

History of the voyage

On the morning of 30 October 2020, the tug *Mauna Loa* left Seattle, Washington, with the barge *Lafarge Eagle* in tow. The *Lafarge Eagle* was loaded with 3000 t of slag. The tug and barge arrived at the Lafarge terminal in Richmond, British Columbia, on the morning of 31 October. Cargo operations began shortly after arrival. The plan was to offload the 3000 t of slag and then load approximately 7700 t of 2 different grades of cement for Seattle.

On the morning of 01 November, cargo operations were still underway. The master on the *Mauna Loa* anticipated that the barge would be ready to depart later that evening and asked the company agent to arrange for an assist tug for approximately 2230[1] to help with departure. At approximately 1452, the Lafarge terminal manager contacted the master to discuss changes in the load due a shortage of product. Without exact loading quantities available and therefore unable to predict the departure trim of the barge, the master called the agent to postpone departure and, as a result, an assist tug was scheduled for the next day.

At approximately 1730, upon learning that the vessel had rescheduled its departure, the Lafarge terminal manager contacted the master and notified him that the barge needed to depart that day because the product was required in Seattle the next day.

At 1800, when loading was completed, the master contacted the company agent again to request an assist tug at the earliest opportunity. The *Sea Imp XI* was the only tug available on short notice and was scheduled to provide assistance for 2200. This was the first time that the *Sea Imp XI* was to be

[1] All times are Pacific Standard Time (Coordinated Universal Time minus 8 hours).

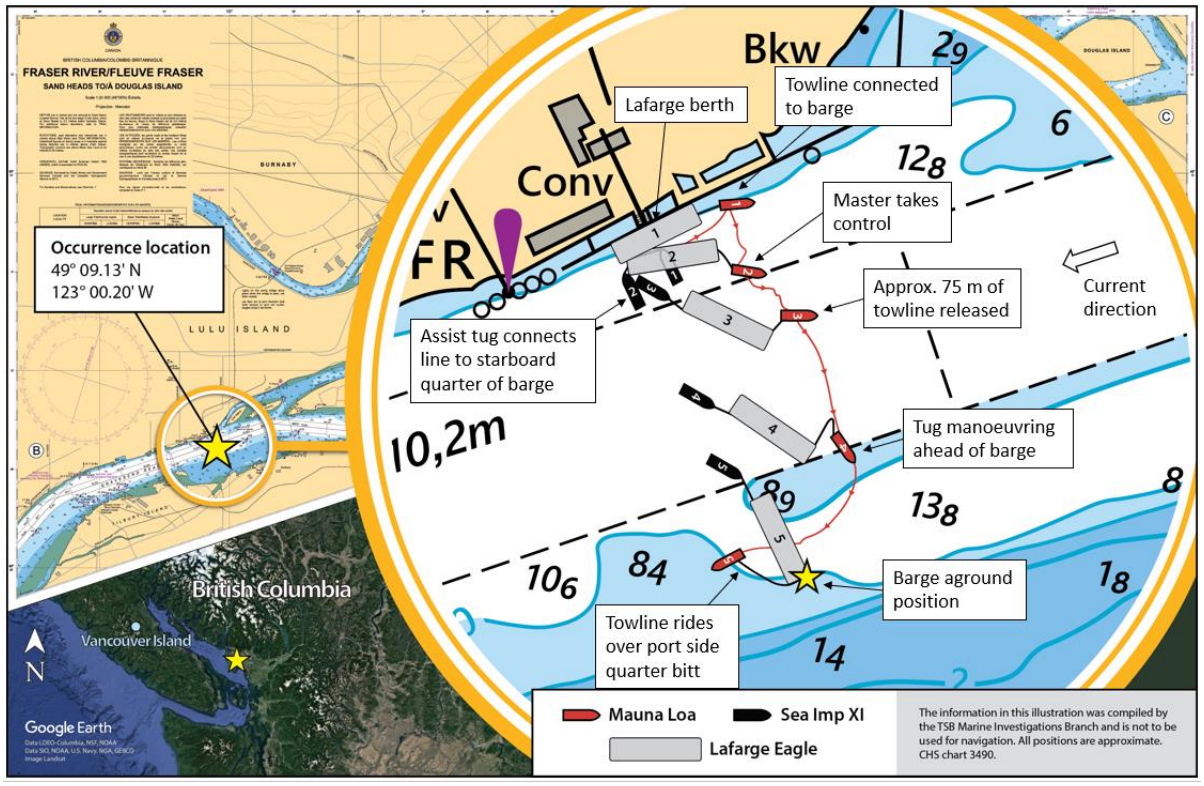
used as an assist tug at Lafarge. It was not regularly used for assists by Salmon Bay Barge Line, Inc., but was of comparable size and power to the usual assist tugs and had an experienced crew.

At 2045, the *Mauna Loa* commenced pre-departure checks. The *Sea Imp XI* arrived at 2100, and a safety meeting was conducted on the deck of the 2 tugs, during which the master of the *Mauna Loa* discussed the unmooring plan with the crew of the *Sea Imp XI*. The plan was for the *Mauna Loa* to pull the barge off the dock and up the river a short distance before executing a turn and heading downriver. The *Sea Imp XI* was to hold the barge alongside until it got moving and then proceed to the starboard quarter of the barge, make fast a line, and assist with turning the barge.

Visibility was clear, and it was dark at the time of departure. The wind was light and the current was at maximum ebb at approximately 2.5 knots.

At 2120, the *Mauna Loa* made fast the tow while the *Sea Imp XI* held the barge alongside to prevent it from moving down river under the influence of the current (Figure 3). The length of the towline was approximately 20 to 30 m from the stern of the *Mauna Loa* to the barge. A training master was on board the *Mauna Loa*, and he was assigned to the controls at the aft conning station with the master monitoring beside him. At 2145, the crew commenced unmooring, and the barge was underway at 2157.

Figure 3. Map and chart showing the location of the occurrence, with inset image showing the track of the *Mauna Loa*, and the estimated positions of the *Lafarge Eagle* (Source of map: Google Earth, with TSB annotations. Source of chart and inset image: Canadian Hydrographic Service, with TSB annotations)



Shortly after departing, the *Mauna Loa* came under the influence of the current, and the training master experienced difficulty maintaining the tug's heading upriver. At about 2200, the effects of the current on the tug's movement caused it to track across and downriver, and thus lose the ability to

control the barge effectively. The master took over the controls from the training master and attempted to regain control of the tow by manoeuvring the tug upriver and in front of the barge. The *Sea Imp XI,* meanwhile, secured a line to the starboard quarter of the barge and awaited instructions.

At approximately 2201, the *Mauna Loa* positioned upriver and in front of the barge, but the tug and barge were now on courses that diverged by almost 90°. The tug was making good a course of 142° at 1.7 knots, while the barge was making good a course of 226° at approximately 1.5 to 2 knots. The relative motion of the 2 vessels resulted in the towline becoming taut and heeling the *Mauna Loa* approximately 20° to starboard. To avoid a risk of girding,[2] the master released approximately 75 m of towline.

With the towline slack, the barge continued making good a course across the river toward the shallows on the other side. The master attempted to manoeuvre the *Mauna Loa* ahead of the barge, turn to starboard, and begin towing the barge downriver. However, by approximately 2204, the barge ran aground approximately 100 m outside the channel in position 49°09.12' N, 123°00.31' W, just as the *Mauna Loa* had completed rounding off ahead of the barge and had altered its own course downriver.

The grounding of the barge caused the towline to ride up over the tug's port-side quarter bitt, and the master released an additional 365 m of towline to prevent the *Mauna Loa* from girding. The *Sea Imp XI* remained attached to the starboard quarter of the barge, awaiting instructions.

At 2245, the *Mauna Loa* and the *Sea Imp XI* unsuccessfully attempted to recover the barge. At 2310, an assessment of the grounded barge was conducted, and it was confirmed that there was no ingress of water and that the barge was grounded at the forward end.

At 0116 on 02 November, the *Mauna Loa* made another attempt to recover the barge with the assistance of the *Sea Imp XI* and a second assist tug that had arrived on scene. This time, refloating efforts were successful, and the *Mauna Loa* continued towing the barge toward Seattle with the *Sea Imp XI* assisting in the river until 0345.

Risk management

Vessel operators must be cognizant of the hazards involved in their operations and proactively manage them to reduce risks to as low as reasonably practicable. Implementing effective risk management processes provides vessel operators with the means to identify hazards, assess risks, and establish ways to mitigate them. A documented and systematic approach also helps ensure that individuals at all levels of the operation, including the master, have the knowledge, tools, and information necessary to make effective decisions in any operating condition.

When the *Mauna Loa* departed the Lafarge terminal with the barge in tow, there were several conditions present that were not viewed as hazards by the crew: the departure was in darkness, the channel in which the loaded barge was to be turned was narrow, and the current was at maximum ebb. Additionally, the *Mauna Loa's* single-screw configuration increased the difficulty of the planned manoeuvre, as did the light fuel load and its forward distribution. Consequently, the tug was lighter aft than usual, resulting in the propeller providing less thrust than the crew were accustomed to. Furthermore, schedule changes resulting from loading issues had led to the engagement of an assist

[2] Girding occurs when a vessel is pulled broadside by a towline force and is unable to manoeuver out of this position. The TSB created this video to illustrate the factors leading to girding and the recovery methods.

tug that had never assisted at this location or for this company. Finally, a training master was assigned to the *Mauna Loa's* controls, even though the departure manoeuvre was challenging and had the potential for significant consequences in the event it did not go as planned.

Although Salmon Bay Barge Line, Inc. had voluntarily implemented a safety management system (SMS), the SMS did not contain any formal risk management processes and had not been audited by an external authority. No written guidance was provided to the master on assessing risk, such as weather, current limitations for executing various towing manoeuvres, tug characteristics and configuration, and assist tug requirements. The company relied solely on the experience and judgment of individual masters to make decisions about such factors. Without any formal risk management processes, the master did not have the benefit of a systematic approach to help with the identification of hazards and the mitigation of risks. TSB investigations have previously identified the absence of formal risk management processes by towing operators as causal or contributory to an occurrence, or as a risk factor.[3]

Communications

Effective communication is key to the success of manoeuvres that involve the coordination of multiple vessels. During towing operations, the lead tug is often out of sight of the assist tug, and therefore maintaining aural communication is essential. Effective communication includes, among other things, the use of pre-towing safety briefings (sometimes known as toolbox talks) and the clear transfer of instructions between the lead tug, the vessel being towed or assisted, and any assist tugs. The absence of effective communication is a factor that the TSB has frequently identified as causing or contributing to accidents.[4]

In this occurrence, after the pre-towing safety meeting, the training master on the *Mauna Loa* was assigned the controls and the responsibility for communicating with the Sea Imp XI (the assist tug) during departure. When the *Mauna Loa* came under the influence of the current and began to deviate from the intended track, there was no communication between the 2 tugs. During the 4 minutes from the time the *Mauna Loa* master took control from the training master until the barge's grounding, it was unclear who was responsible for communicating with the assist tug. Noise from the vent stack near the aft conning station also made communications between the master and training master more difficult. The assist tug did not query the *Mauna Loa* when it became evident that the manoeuvre was not going according to plan, which meant that the master of the *Mauna Loa* was not prompted about how the assist tug could help control the barge or stop its forward momentum.

TSB Watchlist

The TSB Watchlist identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. Safety management is a Watchlist 2020 issue. As this occurrence demonstrates, even when formal processes are present, they are not always effective in identifying all hazards or managing the risks in every aspect of a vessel's operations. Furthermore, when an operator

[3] TSB marine transportation safety investigation reports M16P0062, M16C0036, and M15P0037.

[4] TSB marine transportation safety investigation reports M19C0387, M19P0020, and M18P0230.

voluntarily implements an SMS, the system does not receive any oversight to ensure that it is effective.

Safety messages

An SMS is only effective at identifying hazards and mitigating risks if it includes a formal risk assessment process. Operators that have implemented an SMS, including those that have voluntarily done so, must ensure that they have a risk assessment process in place, particularly for critical stages of a voyage.

Towing operations frequently require the coordinated efforts of multiple vessels, making it vital that all vessels involved maintain effective communication and proactively intervene when manoeuvres do not go according to plan.

This report concludes the Transportation Safety Board of Canada's investigation into this occurrence. The Board authorized the release of this report on 16 June 2021. It was officially released on 23 June 2021.

ABOUT THIS INVESTIGATION REPORT

This report is the result of an investigation into a class 4 occurrence. For more information, see the Policy on Occurrence Classification at www.tsb.gc.ca

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