NATIONAL TRANSPORTATION SAFETY BOARD

2021

SAFER SEAS Digest

Lessons Learned from Marine Investigations

NTSB

NTSB/SPC-22-01

Mission

Making transportation safer by
conducting independent accident investigations,
advocating for safety improvements, and
deciding pilots' and mariners' certification appeals.

The NTSB is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, highway and transit, marine, pipeline, and commercial space. We determine the probable cause of the accidents we investigate and issue safety recommendations aimed at preventing future accidents.

In addition, we conduct transportation safety studies and coordinate the resources of the federal government and other organizations to assist victims and their family members who have been impacted by major transportation disasters.

NTSB

A Message from the Chair

I am proud to present the 2021 *Safer Seas Digest* on behalf of the dedicated experts in the NTSB Office of Marine Safety. Their work over the past year is represented in the pages that follow — work that contributes greatly to public confidence in the nation's marine transportation systems.

The knowledge we gain from NTSB investigations is hard-won. The 31 marine accident investigations we closed last year are no exception; each investigation was precipitated by a "major marine casualty," which can include the loss of human life.

This was the case with the commercial fishing vessel ***Scandies Rose***, which claimed the lives of 5 crewmembers when it sank off the coast of Sutwik Island, Alaska, in 2019. The ***Scandies Rose*** tragedy contributed to our decision to include "Improve Fishing Vessel Safety" on the NTSB's 2021–2022 Most Wanted List of Transportation Safety Improvements.

We also investigate major marine casualties that result in significant property damage. This category will forever be associated with one of the most expensive marine accidents in history: the 2019 capsizing of the 656-foot vehicle carrier ***Golden Ray***.

Fortunately, no one died in the ***Golden Ray*** accident — but that doesn't mean it was without human risk. Two crewmembers suffered serious injuries and 4 others were trapped for nearly 40 hours in the engine room.

Pausing to reflect on a year's worth of investigations presents a unique opportunity to consider the meta-issues threatening safety on our waterways. In 2021, these issues included the following:

- Vessel stability
- Containing engine room fires
- Icing and severe weather
- Risk management and project planning
- Cargo preparation and securement
- Teamwork
- Effective communication
- Standard operating procedures
- Transiting in narrow channels
- Distress communications and preparations for abandonment
- Identifying navigational hazards
- AIS data input for towing operations
- Continuous monitoring of unmanned vessels
- Sufficient handover periods

The US Coast Guard is integral to the NTSB's marine investigations. Our relationship is an outstanding example of government collaboration focused on saving lives and improving safety. Every accident presented in this report was supported in a variety of ways by the men and women of the Coast Guard, and my sincerest thanks go out to every one of them who assisted us this year. The Coast Guard units that worked with the NTSB in these accidents are listed on page 86.

Though the circumstances vary, our mission is the same for every investigation we lead: to determine what happened and issue evidence-based recommendations to prevent similar events from occurring in the future. It is in pursuit of this mission that the NTSB issued dozens of safety recommendations to all parts of the marine industry in 2021.

But stakeholders at all levels must implement our recommendations to ensure safety. I hope the pages that follow inspire you to do just that.

Sincerely,

Jennifer Homendy
NTSB Chair

NTSB 2021

SAFER SEAS Digest

On the cover: The *Golden Ray* during rescue operations (*see page 4*).

Back cover: Fire aboard the *Höegh Xiamen* (*see page 48*).

Abbreviations

AB	able seaman
ABS	American Bureau of Shipping
AIS	automatic identification system
ARPA	automatic radar plotting aid
ATB	articulated tug and barge
CPP	controllable pitch propeller
DOTD	Department of Transportation and Development
ECDIS	electronic chart display and information system
ECR	engine control room
ECS	electronic charting system
ENC	electronic navigation chart
EOT	engine order telegraph
EOW	engineer on watch
EPIRB	emergency position indicating radio beacon
GPS	global positioning system
HMR	Hazardous Materials Regulations
ICW	Intracoastal Waterway
IMDG Code	International Maritime Dangerous Goods Code
LNTM	Local Notice to Mariners
mph	miles per hour
MT	metric tons
NOAA	National Oceanic and Atmospheric Administration
NOBRA	New Orleans-Baton Rouge Steamship Pilots Association
NTSB	National Transportation Safety Board
NWS	National Weather Service
OD	oil distribution
OS	ordinary seaman
PLB	personal locator beacon
PPU	portable pilot unit
Ro/Ro	roll-on/roll-off
rpm	revolutions per minute
SMS	safety management system
VHF	very high frequency
VTS	Vessel Traffic Service

Contents

Vessel Group Key

- CARGO, GENERAL
- CARGO, DRY BULK
- CARGO, LIQUID BULK
- COMBATANT/MILITARY
- FISHING
- OFFSHORE
- PASSENGER
- PATROL/SMALL CRAFT
- SPECIALTY/OTHER
- TOWING/BARGE
- YACHT/BOAT

VESSEL GROUP
CARGO, GENERAL

Capsizing of Roll-on/ Roll-off Vehicle Carrier ***Golden Ray***

St. Simons Sound, Brunswick River, near Brunswick, Georgia

ACCIDENT DATE **September 8, 2019**	REPORT NUMBER **MAR-21-03**
ACCIDENT ID **DCA19FM048**	ISSUED **August 26, 2021**

Figure 2. The *Golden Ray* heeled to its port side. SOURCE: COAST GUARD

Figure 1. Ro/Ro vehicle carrier *Golden Ray* before the accident. SOURCE: COAST GUARD

On September 8, 2019, about 0137 eastern daylight time, the Ro/Ro vehicle carrier ***Golden Ray*** capsized during a starboard turn while navigating the Port of Brunswick. Of the 23 crew and 1 pilot on board, 2 sustained serious injuries; the remaining 22 were not injured. The ***Golden Ray*** and its cargo sustained significant damage due to fire, flooding, and salt water corrosion. Total costs for the loss of the vessel were estimated at $62.5 million, and total costs for the loss of the cargo were estimated at $142 million.

On August 27, 2019, the Republic of the Marshall Islands-flagged, 656-foot-long Ro/Ro ***Golden Ray***, arrived in Freeport, Texas, to offload a portion of its cargo (vehicles) and load new cargo. The vessel had 23 crewmembers, including a master and a chief officer.

On August 30, the ***Golden Ray*** departed Freeport, Texas, en route to Brunswick, Georgia, after which the vessel was scheduled to proceed to Jacksonville, Florida, before heading to Baltimore, Maryland. After departing Freeport, to enhance the stability of the vessel in anticipation of encountering Hurricane Dorian, the chief officer oversaw the loading of about 1,500 MT of sea water ballast into the vessel's three double bottom water ballast tanks (no. 5 port, centerline, and starboard) and the no. 6 centerline water ballast tank. The ***Golden Ray*** then waited off the coast of Key West, Florida, from September 1–3 to allow the hurricane to pass.

On September 3, the charterer (Hyundai Glovis Ltd. Co.) directed the master to proceed to Jacksonville instead of Brunswick. To reduce the ***Golden Ray***'s draft to less than 9.4 meters (about 31 feet) as required by the port, the chief officer discharged about 1,500 MT of sea water ballast from the same tanks that were loaded due to the hurricane.

On September 7, 2019, at 0510, the vessel departed Jacksonville, en route to Brunswick, carrying 4,067 vehicles with a total cargo weight of 8,407.2 MT and displacing 35,044 MT with a midship draft of

30.9 feet (9.4 meters). The *Golden Ray* arrived outside the Port of Brunswick that afternoon, and, at 1453, a state pilot from the Brunswick Bar Pilots Association boarded the vessel to navigate the vessel into the port. The pilot and master conducted a master/pilot exchange to discuss the transit. After the exchange was completed, the pilot navigated the vessel to the Colonel's Island Terminal in Brunswick, docking at 1736.

Shoreside personnel and the vessel's crew began cargo operations, offloading and loading vehicles through the stern ramp. There were no issues reported by shoreside personnel or the vessel's crewmembers with cargo unloading or loading.

Cargo operations were completed by 2330, and the chief officer supervised preparations for the vessel's departure. He transferred 8 MT of water from the no. 5 port double bottom water ballast tank to the no. 5 starboard double bottom water ballast tank, resulting in the vessel's list changing from 0.42° to port to 0.03° to starboard while at the dock.

About 0030 on September 8, the same pilot boarded to pilot the vessel outbound from the port. The draft of the vessel was the same as when the vessel entered the previous day (30.8 feet [9.4 meters] forward and 31.2 feet aft [9.5 meters], which met the required minimum underkeel clearance of 3 feet in the 36-foot-deep channel). The vessel was displacing 34,609 MT, with a midship draft of 30.8 feet (9.4 meters).

About 0053, the pilot began issuing orders to take in the vessel's lines and maneuver the *Golden Ray* off the pier with undocking assistance from the tugboat *Dorothy Moran*. By 0100, the *Golden Ray* was proceeding outbound in the Turtle River Lower Range at 6 knots on a course of 113°. At 0102:43, the pilot ordered full ahead. The *Dorothy Moran* cast off its line but remained with the *Golden Ray* to provide support as needed.

About 0108, the vessel passed under the Sydney Lanier Bridge, where the *Dorothy Moran* stopped its transit with the *Golden Ray*. The *Golden Ray* proceeded outbound in the Brunswick Point Cut Range on a course of 113°, following pilot orders.

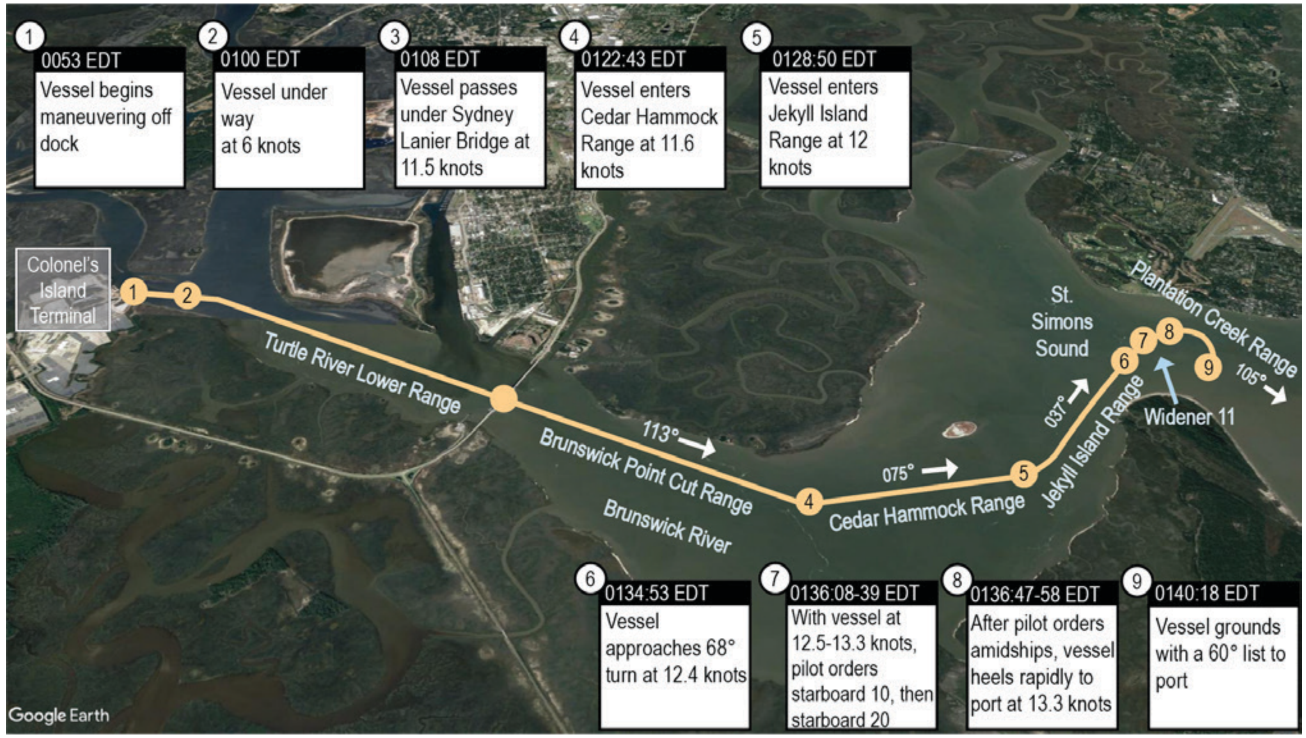


Figure 3. Trackline of the *Golden Ray* after it departed the Colonel's Island Terminal. BACKGROUND SOURCE: GOOGLE EARTH

About the same time, the master ordered the crew to open the 7-feet-high-by-7-feet-wide portside pilot door (side port), located on deck 5, in preparation for the pilot's planned departure just outside of the Port of Brunswick at the sea buoy. After supervising the opening of the portside pilot door, the chief officer went to his stateroom. No one remained at the open door as the vessel proceeded outbound.

At 0122:43, the vessel approached the Cedar Hammock Range at a speed of 11.6 knots. The pilot ordered 20° port rudder to turn left into the Cedar Hammock Range at a course of 075° (a change in course of 38°). From this turn, it was 1.3 nautical miles (1.15 statute miles) to the next left turn into the Jekyll Island Range. At 0128:50, at a speed of 12.1 knots, the pilot again ordered 20° port rudder to enter the range at a course of 037° (a change in course of 38°). The vessel made both left turns without incident.

Figure 4. The *Golden Ray* departing Jacksonville, Florida, about 0130 on September 7. The light amidship is the open portside pilot door. (The lights on the blue hull at the bow and stern are mooring line stations.)
SOURCE: COAST GUARD

At 0134:53, at a speed of 12.4 knots and a heading of 039°, the *Golden Ray* approached the 68° right turn at widener 11. The pilot ordered a heading of 044°. About one minute later, at 0136:08, the pilot ordered "starboard 10" to initiate the turn, and the helmsman moved the rudder to comply. At 0136:15, with the vessel's speed at 12.9 knots, the helmsman informed the pilot that the rudder was at starboard 10. Shortly after, at 0136:39, the pilot ordered "starboard 20" to enter the Plantation Creek Range, which had a course of 105° and led to the Atlantic Ocean. The helmsman moved the rudder to comply with the pilot's command; the vessel's speed at the time was 13.3 knots.

Seconds later, at 0136:47, the pilot ordered the rudder returned to midships (zero rudder angle). The helmsman complied with the pilot's order, and, according to the pilot, the "ship just took off." At 0136:58, the vessel started to heel to port. The pilot stated that as the vessel began to turn, it "felt directionally unstable…meaning when I started the turn, she wanted to keep turning."

The pilot and the vessel's master began rapidly issuing rudder commands in an attempt to counter the heeling. However, the *Golden Ray* continued to heel over, the rate of turn to starboard increased, and the vessel heeled to port to about 60° in less than a minute. Water entered deck 5 through the vessel's open portside pilot door and flooded through open watertight doors to the engine and steering gear rooms. The vessel eventually settled on its port side at an angle of 90°.

The Coast Guard responded to the accident, along with tugboats and pilot boats from the Port of Brunswick, as well as other first responders.

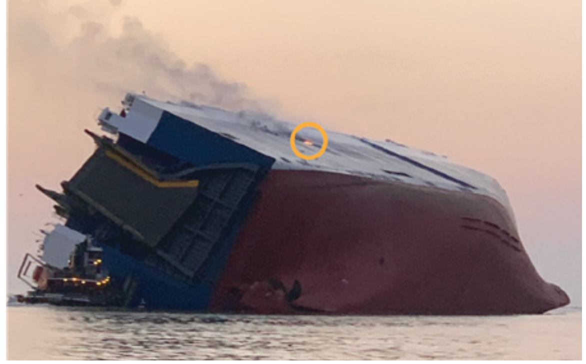


Figure 5. *Golden Ray* 6 hours after the heeling event. Flame and smoke emanate from the starboard side in the area of the cargo decks. SOURCE: COAST GUARD

Responders initially rescued the pilot and 19 of the 23 crewmembers on board. Four engineering crewmembers remained trapped in the engine room until the following evening, September 9, when responders cut into the vessel's hull to rescue them.

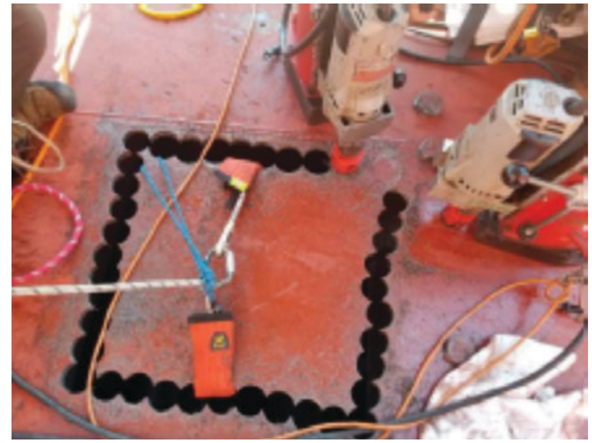


Figure 7. Responders drilled holes into the hull to access the engineers. SOURCE: COAST GUARD

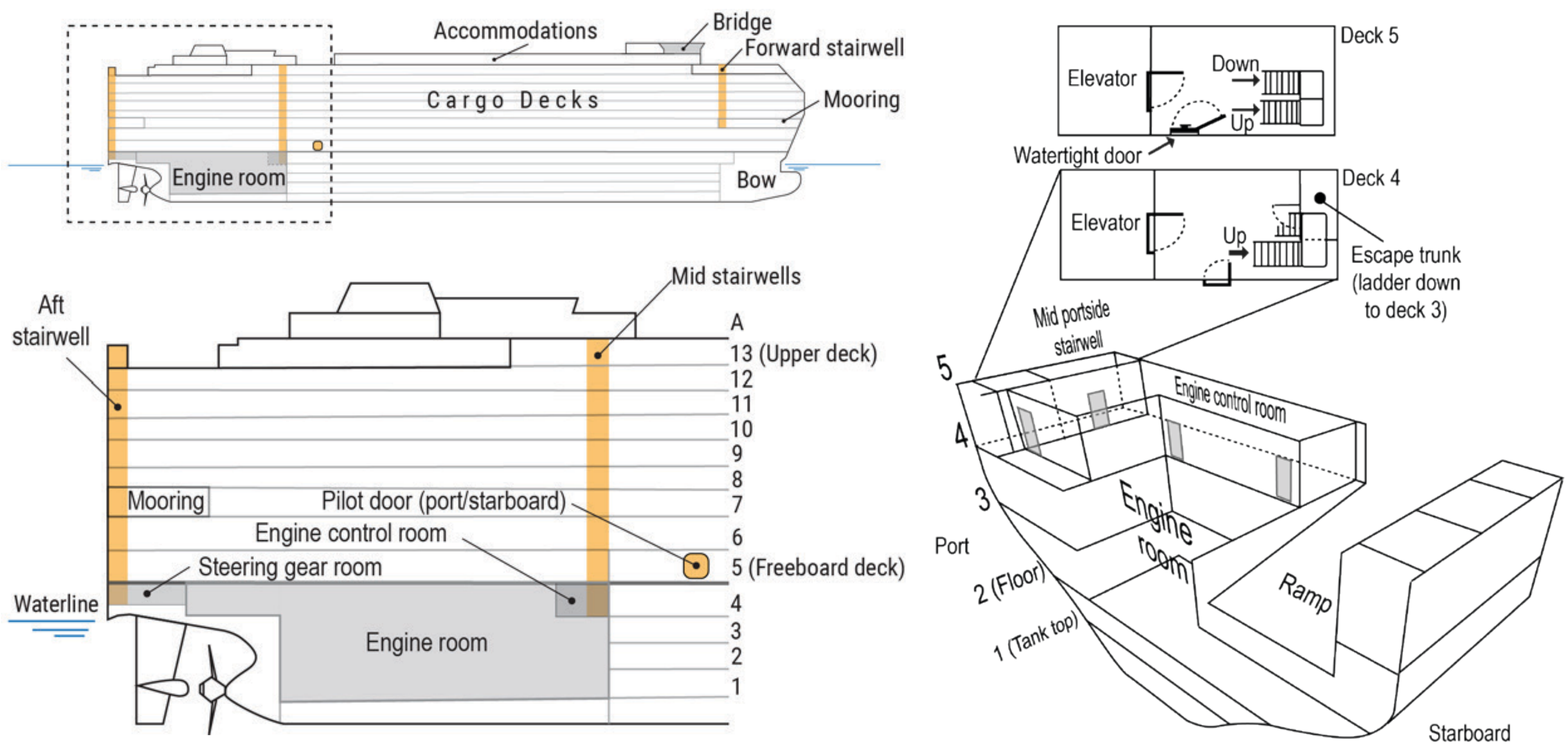


Figure 6. Simplified profile of the *Golden Ray* and 3-D diagram showing a portion of the engine room and engine control room. Exit doors shaded gray.
BACKGROUND SOURCE: GENERAL ARRANGEMENT DRAWING, HYUNDAI MIPO DOCKYARD

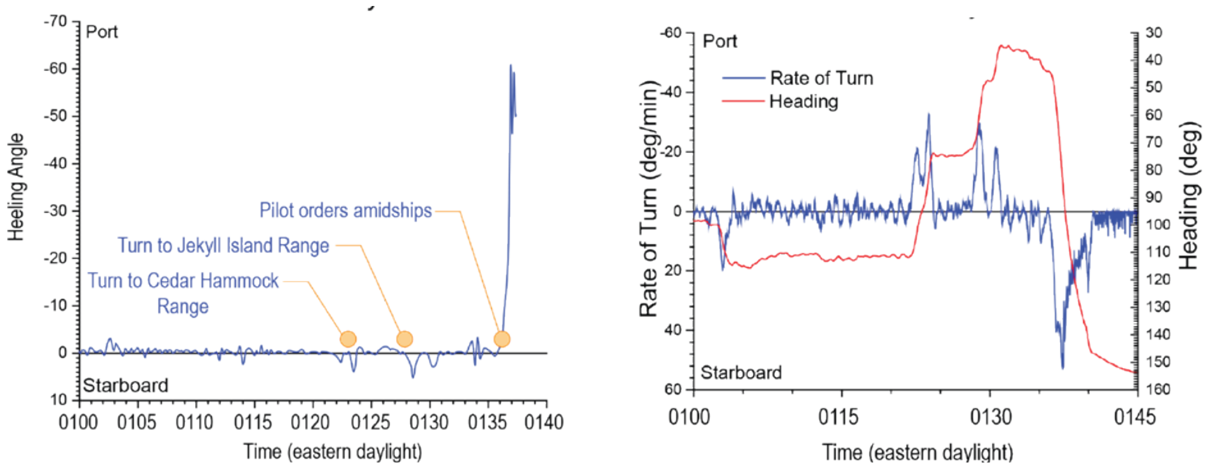


Figure 8. Graphs from the *Golden Ray* performance study by the NTSB showing the vessel's heeling angle, including the previous two left turns (*left*), and heading and rate of turn (*right*) through the transit.

Figure 9. Emergency responders work to rescue the trapped engineers and cadet. SOURCE: COAST GUARD

SAFETY ISSUES

◇ **Improperly calculating vessel stability.** The operating company, G-Marine Service Co. Ltd., did not provide stability software training for its officers who were responsible for using the *Golden Ray*'s LOADCOM stability calculation program. The company's safety management system outlined the chief officer's duties, including vessel stability calculations, but did not provide any instructions on how to use, or require competency for using, the LOADCOM computer. Since the company did not provide training on how to use the computer, it had no means to ensure that the chief officer was capable of performing his duty to accurately determine the ship's stability. After the accident, G-Marine implemented several policies to improve safety and reduce the likelihood of another similar accident, including requiring stability calculation training for chief officers.

◇ **Lack of company oversight for calculating vessel stability.** The chief officer was the only crewmember responsible for calculating the stability of the vessel. Once the chief officer had calculated the vessel's stability, he reported the vessel's final metacentric height to the master and the company (via the departure report), but neither the master nor the company verified that the chief officer's calculations met stability requirements. The company had no procedures to verify stability calculations, so the master and company were unaware that the vessel had been sailing without meeting stability requirements during the accident voyage and two previous voyages, and there was no established means for the crew or the company to identify and attempt to correct the problem.

The probable cause of the capsizing of the *Golden Ray* was the chief officer's error entering ballast quantities into the stability calculation program, which led to his incorrect determination of the vessel's stability and resulted in the *Golden Ray* having an insufficient righting arm to counteract the forces developed during a turn while transiting outbound from the Port of Brunswick through St. Simons Sound. Contributing to the accident was G-Marine Service Co. Ltd.'s lack of effective procedures in their safety management system for verifying stability calculations.

SAFETY RECOMMENDATIONS

As a result of its investigation into this accident, the NTSB issued two new safety recommendations to the *Golden Ray*'s operator, G-Marine Service Co. Ltd. The NTSB found that G-Marine's lack of oversight and procedures for auditing and verifying the accuracy of their officers' vessel stability calculations before departure contributed to the *Golden Ray* not meeting international stability standards. The NTSB recommended that G-Marine revise its SMS to establish procedures for verifying stability calculations and implement audit procedures.

The NTSB also found that the open watertight doors on deck 5 of the *Golden Ray* allowed flooding into the vessel and blocked the primary egress from the engine room, thus trapping engineering personnel. Watertight integrity is critical to the safety of a vessel and its crew, so the NTSB recommended that G-Marine revise its SMS audit process to verify crew adherence to the company's Arrival/Departure Checklist regarding the closure of watertight doors.

VESSEL GROUP
FISHING

Capsizing and Sinking of Commercial Fishing Vessel ***Scandies Rose***

North Pacific Ocean, 2.5 Miles South of Sutwik Island, Alaska

ACCIDENT DATE	REPORT NUMBER
December 31, 2019	**MAR-21-02**
ACCIDENT ID	ISSUED
DCA20FM009	**June 29, 2021**

Figure 10. The *Scandies Rose* wreck, located on February 11. SOURCE: GLOBAL

Figure 11. ***Scandies Rose*** **arriving in Kodiak, Alaska, before the accident (date unknown).** SOURCE: GERRY COBBAN KNAGIN

On December 31, 2019, Coast Guard Communications Detachment Kodiak received a distress call from the fishing vessel *Scandies Rose*. The vessel was en route from Kodiak to fishing grounds in the Bering Sea when it capsized about 2.5 miles south of Sutwik Island, Alaska, and sank several minutes later. At the time of the accident, the *Scandies Rose* had seven crewmembers aboard, two of whom were rescued by the Coast Guard several hours later. The other missing crewmembers were not found and are presumed dead. The *Scandies Rose*, valued at $15 million, was declared a total loss.

On December 29, in preparation for the Bering Sea pot cod fishery, which opened on January 1, 2020, the crew loaded 195 combination crab pots in accordance with the vessel's stability instructions, which laid out sample loading conditions that the captain could follow to ensure the vessel met stability criteria established by regulators. (The investigation found that the stability instructions were inaccurate; therefore, the vessel did not meet regulatory stability criteria.) The next day, they chained the pot stack, secured hatches, tested bilge level sensors, fueled, topped off potable water, and took on bait. The captain conducted drills that included discussions of the liferaft locations, the vessel's EPIRB, and how to make a mayday call, and a demonstration of how to don an immersion suit.

The captain and crew discussed the weather forecast along the planned route (through the Kupreanof Strait, then southwest through the Shelikof Strait toward False Pass en route to the Bering Sea). About 1630, the NWS issued a marine forecast that included a gale warning and a heavy freezing spray warning for the vessel's proposed route. The crew knew the weather "was going to be bad" and that there would be icing conditions in which sea spray could potentially freeze to the vessel and crab pots.

At 2035, the vessel departed Kodiak, maintaining an average speed of about 9–10 knots. An underway navigation watch rotation had the captain operating the vessel for 6 hours and the other six crewmembers for 1 hour each. At 0200 on December 31, the vessel entered the Shelikof Strait, and the captain departed the wheelhouse; each of the crewmembers on watch after him maintained a southwesterly course. Between 0600 and 0800, on-watch crewmembers observed that wind and waves acting on the starboard bow of the vessel began to cause ice accumulation on the forward starboard side of the vessel, railings, and pots. At 0800, when the captain took the watch, the vessel had no list or heel. At 1118, during a call to another fishing vessel, the captain said his vessel was experiencing light icing and the sea conditions were poor.

For about 6 hours, beginning at 1400, the crew rotated watches, and the average speed decreased to 6.5 knots (although the engine's rpm was constant). The wind and weather "progressively got worse all day," and the vessel was "bucking" into the seas, "making a lot of spray, and the spray was making ice." About 1915, after being woken for his 2000-0200 watch, the captain discussed the worsening weather, the accumulating ice, and the development of an approximately 2° starboard list with the departing crewmember.

They considered reducing the vessel's speed and altering course to limit the freezing spray causing icing on the vessel. At this time, all the pots were glazed over with ice. The starboard-side pots were more heavily coated with an estimated 2 inches of ice. Ice coated the inside webbing of the starboard pots as well. The captain told the departing crewmember the weather was too rough to have the crew out on deck chopping ice and that they would wait until the vessel was in protected waters.

At 1930, the vessel was about equidistant from locations to shelter to the north and southwest, and the vessel was likely experiencing heavy icing conditions. The captain was familiar with area southwest near Sutwik Island, which was also along the vessel's intended route. Ultimately, the captain decided to maintain course and speed and call the onboard engineer (likely to transfer fuel to correct the starboard list).

At 2000, the captain called a friend and said he needed to "tuck in someplace safe." At 2037, he called the fishing vessel *Pacific Sounder* and reported that the *Scandies Rose* was icing "really bad" and he was concerned about a 20° starboard list. He also noted that the winds were blowing 60–70 knots from the west and the temperature was 12°F. He further stated it was too rough to send the crew out to break ice, and he was trying to seek shelter southeast of Sutwik Island but was nervous about the "uncharted rock[s]." Although weather forecasts had projected heavy icing (0.8–1.6 inches per hour), given the weather conditions observed by the captain for the two hours between 2000–2200, the *Scandies Rose* was likely experiencing extreme icing (greater than 1.6 inches per hour) and had accumulated 6–15 inches on surfaces exposed to wind and icing during the voyage.

About 2145, the vessel was about 2.5 miles south of Sutwik Island when it turned about 50° to starboard and held a northwesterly course in the direction of Sutwik Island's southern bay. Afterward, the captain reported that his vessel's "list had gotten a lot worse." The sudden increased list at the time of the course change indicates that the course alteration to starboard exposed the vessel's port side to the prevailing wind and waves, which exacerbated the starboard list. Although the captain's decision to proceed to Sutwik Island was reasonable, by the time he was close enough to turn into the lee, the icing conditions had accelerated and reduced the vessel's stability.

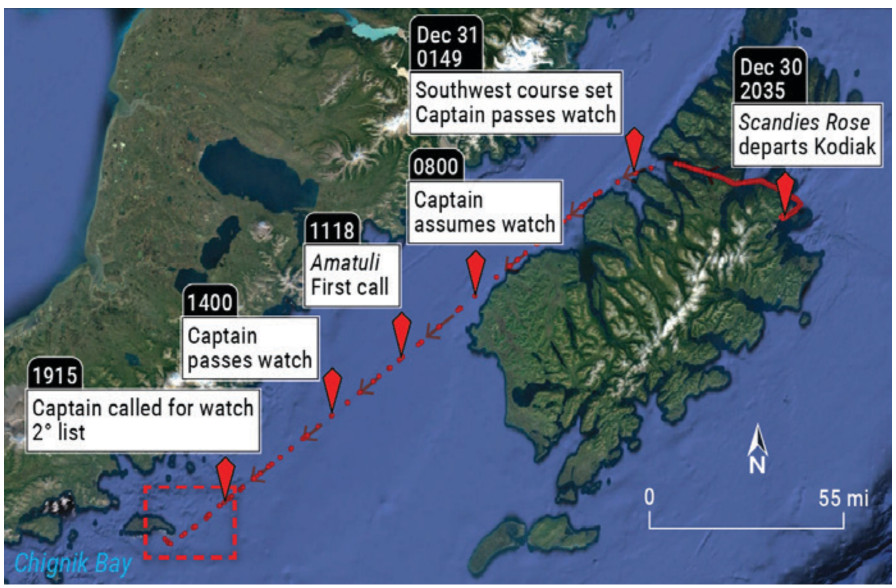


Figure 12. Timeline of the *Scandies Rose* voyage. For detail of red inset box, see accident site map at right. BACKGROUND SOURCE: GOOGLE EARTH

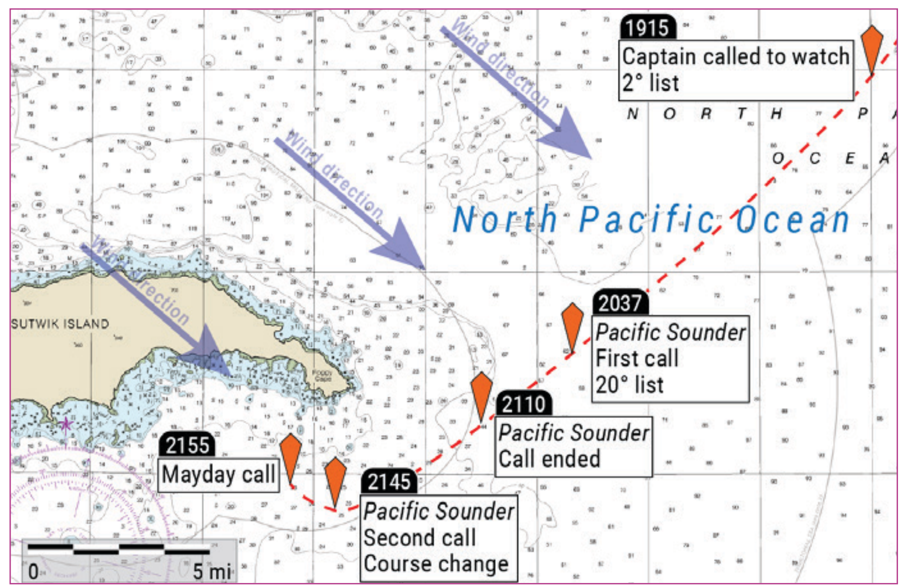


Figure 13. *Scandies Rose*'s positions over last 3 hours before mayday call.
BACKGROUND SOURCE: NOAA

Figure 14. Photo of the bridge of the *Scandies Rose* taken from the starboard helm station.
SOURCE: 2019 CONDITION AND VALUATION SURVEY

About this time, the vessel was jolted by a sudden sustained list to starboard, and all the crew rushed to the wheelhouse. At 2155, the captain broadcasted a mayday call on high frequency, announcing that they were "rolling over." He included the vessel's position in the call. The Coast Guard received the transmission and attempted to establish communications with the vessel but was unable to do so.

The first two crewmembers to arrive in the wheelhouse got out the vessel's immersion suits and got them up halfway but had difficulty because the vessel was "leaning over so hard." They climbed out the portside door and finished donning their suits outside. They attempted to use a line to assist the remaining crew inside, but the vessel sank lower, and a wave swept them over the side. They were in the water about 20 minutes before they saw the light from an inflatable liferaft (that had automatically deployed) and were able to swim to it and climb aboard. Their liferaft light went out, and they fired all their flares. Neither had a PLB.

Without the captain's distress call, the Coast Guard likely would have been initially unaware of the accident because, when the vessel sank, the GPS-equipped EPIRB did not broadcast a receivable signal. Unable to communicate with the *Scandies Rose*, the Coast Guard requested all vessels in the area assist and launched a rescue helicopter about 2330 (multiple helicopters launched throughout the day), diverted the cutter *Mellon*, and deployed a C-130 aircraft. The first helicopter arrived at the captain's mayday coordinates around 0200 and located the vessel's empty second liferaft. The two survivors saw the helicopter's lights and used a flashlight to signal. About 4 hours after entering the liferaft, they were hoisted to the helicopter with the assistance of a rescue swimmer. No other crewmembers were found.

SAFETY ISSUES

◇ **The effect of extreme icing conditions.** Sea spray icing is a serious hazard to marine vessels because the ice accumulates over exposed decks and exterior surfaces of a vessel, adding weight that may ultimately capsize a vessel. The *Scandies Rose* was carrying a full stack of pots that reached about 20 feet above the main deck, and ice from freezing spray formed asymmetrically on the starboard side and built as the voyage progressed. The added weight of accumulated ice high on a vessel—in this case, up the stack of pots, the fo'c'sle, bulwarks, and portions of the house—rapidly raises a vessel's center of gravity and diminishes its stability. The asymmetrical icing on the starboard side of the *Scandies Rose* caused the vessel to develop an increasing starboard list, and the course change at 2145 brought the 60–70 knot winds onto the port side, adding to the existing list from icing. The sudden increase in list shortly later indicated that the vessel's stability had been overcome and that the vessel was capsizing. The added weight from ice accumulating asymmetrically on the vessel and the stacked crab pots on deck raised the *Scandies Rose*'s center of gravity, reducing its stability and contributing to the capsizing.

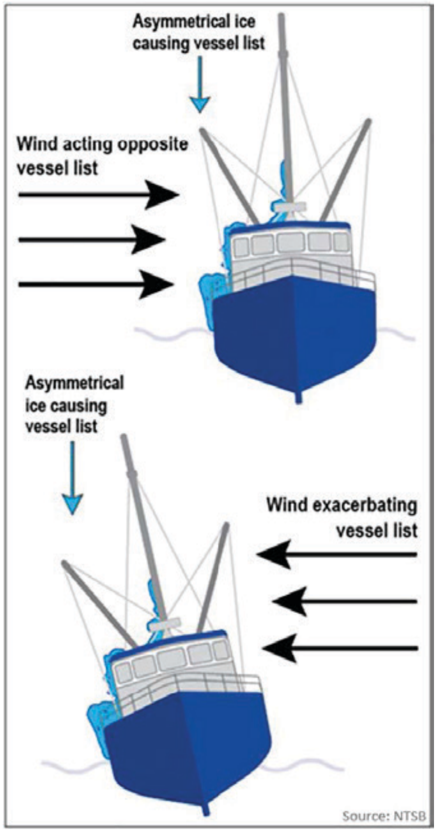


Figure 15. Right. Diagram of ice and wind acting on the *Scandies Rose*.

Figure 16. Coast Guard Cutter *Mellon* crew breaking ice during search efforts late afternoon on January 1.
SOURCE: COAST GUARD

◇ **The vessel's inaccurate stability instructions.** The intent of regulatory requirements for stability instructions is to provide information to vessel owners and operators that enables them to readily ascertain the stability of their vessels under varying loading conditions and to operate them in compliance with applicable stability criteria, which have been developed to provide an adequate level of safety for vessels that are operated prudently. A margin of safety is built into these criteria to accommodate forces that can act on a vessel, such as rolling in waves, heeling due to wind, or limited degree of listing. The investigation found that the *Scandies Rose*'s stability instructions were inaccurate, and the vessel had "dangerously low righting energy"—the amount of energy that a vessel can absorb from external heeling forces (winds, waves, weight shifts, etc.) before it capsizes—when loaded in conditions similar to those prevailing at the time of the accident. Thus, although the crew loaded the *Scandies Rose* per the stability instructions, the vessel had a smaller margin of safety than intended by the regulations and was more susceptible to capsizing.

◇ **Need to update regulatory guidelines on calculating and communicating icing for vessel stability instructions.** Stability regulations factor in a minimum set amount of added weight for accumulated ice from freezing sea spray on continuous horizontal and vertical surfaces. However, the regulations do not provide guidance on how to apply ice accumulation on crab pots, which consist of tubular frames and mesh and have additional internal ice accumulation. Nor do they account for reported asymmetric ice accumulation on exposed vessel surfaces and pot stacks. Additionally, stability instructions are currently not required to present the accumulated ice thicknesses used to calculate vessel stability, which, if communicated to masters, would better prepare them in decision making.

Figure 17. Crewmembers aboard Coast Guard Cutter *Polar Star* weigh a crab pot following a 3-day freezing spray experiment. SOURCE: COAST GUARD

◇ **Lack of accurate weather data for the accident area.** The area around Sutwik Island and west of Kodiak Island is subject to bad weather with northeast through northwest winds and cold air moving across the Alaska Peninsula. The investigation found that the *Scandies Rose* experienced wind conditions exceeding those that were forecast or measured by the closest weather stations. When observation sites are more spread out in remote areas like Alaska, the data do not accurately represent the entire area, which can lead to inaccurate and less precise forecasts and weather modeling, and vessels can encounter localized conditions that are worse than expected.

The probable cause of the capsizing and sinking of the commercial fishing vessel *Scandies Rose* was the inaccurate stability instructions for the vessel, which resulted in a low margin of stability to resist capsizing, combined with the heavy asymmetric ice accumulation on the vessel due to localized wind and sea conditions that were more extreme than forecasted during the accident voyage.

SAFETY RECOMMENDATIONS

As a result of its investigation into this accident, the NTSB issued four new safety recommendations to the Coast Guard to improve fishing vessel stability criteria (by evaluating the effects of icing), to improve stability instructions, and to strengthen oversight of stability calculations. The NTSB reiterated two recommendations to the Coast Guard: first, because the *Scandies Rose* accident showed that formal stability training would be helpful for fishing vessel crews, the NTSB reiterated safety recommendation M-11-24 to require owners, captains, and chief engineers to receive training and demonstrate competency in vessel stability, watertight integrity, subdivision and the use of stability information. Second, because the investigation found that PLBs can reduce or eliminate search-and-rescue errors by providing multiple GPS coordinates of survivors to searchers, the NTSB reiterated safety recommendation M-17-45 to require all personnel employed on vessels in coastal, Great Lakes, and ocean service be provided with a PLB to enhance their chances of survival.

The weather conditions on the accident voyage and multiple reports indicated that waters west of Kodiak Island, near Sutwik Island and Chignik Bay, are subject to freezing spray and icing and therefore pose an increased hazard to the marine community. Thus, the NTSB made two weather related recommendations: one for NOAA to increase the surface observation resources necessary for improved local forecasts for the region, and a second to the NWS to make their currently experimental Ocean Prediction Center freezing spray website—which detailed graphical icing information not currently available elsewhere—operational and promote its use in industry.

Believing that awareness of the safety issues found in the investigation would benefit fishing vessel crews, the NTSB recommended that the North Pacific Fishing Vessel Owners' Association notify their members of the specifics of this accident, the amount of ice assumed when developing stability instructions, and the dangers of icing.

VESSEL GROUPS
CARGO, LIQUID BULK • **FISHING**

Collision of Tanker *Bow Fortune* and Commercial Fishing Vessel *Pappy's Pride*

Outer Bar Channel, Galveston, Texas

ACCIDENT DATE
January 14, 2020

REPORT NUMBER
MAB-21-21

ACCIDENT ID
DCA20FM011

ISSUED
October 20, 2021

Figure 18. *Bow Fortune* docked after the casualty.
SOURCE: COAST GUARD

On January 14, 2020, about 1537 local time, the tanker *Bow Fortune* was transiting inbound to Galveston, Texas, in the Outer Bar Channel while the uninspected commercial fishing vessel *Pappy's Pride* was transiting outbound. The two vessels collided in dense fog, and the fishing vessel capsized and sank. Of the four crewmembers aboard the fishing vessel, there were three fatalities and one serious injury. There were no injuries to the pilot or the crew of 28 on board the *Bow Fortune*. A surface sheen of diesel was reported. The *Pappy's Pride*, valued at $575,000, was declared a total loss.

The *Pappy's Pride* got under way at 1325 from Pier 75 in the Port of Galveston to shrimp along the gulf coast to the north. The vessel headed outbound to the east and north of the inbound barge lane of the ship channel. The *Pappy's Pride* captain steered his vessel on the outbound transit, through the intracoastal waterway, increasing speed to cross the two channels then transiting through anchored vessels in the anchorage, most of which was done in near-zero visibility, without sounding the required fog signals, initiating or responding to any radio calls, or effectively using his available bridge equipment to determine risk of collision. Communication, especially in limited visibility, is a vital part of standing an effective watch.

Figure 19. The *Pappy's Pride* before the accident.
SOURCE: BALTICSHIPPING.COM

The *Bow Fortune* was anchored about 15 miles offshore in the East Galveston Fairway Anchorage Area with an estimated visibility at 1.5 miles (the day before, the NWS had warned of dense fog in the area). At 1415, the master navigated the vessel from the anchorage, with the fog signal energized. At 1500, a pilot boarded the *Bow Fortune*. He estimated visibility between 0.25 miles to port and 0.75 miles to starboard. During the master/pilot exchange, the master and pilot noted the fog but agreed to continue the inbound transit. The pilot set up two PPUs, sent an AB to the bow as lookout, and kept the fog whistle sounding from the forward mast. At 1507, with the engine at half ahead, the pilot on the *Bow Fortune* took the conn. At 1524, the *Bow Fortune* was inbound in the Galveston Bay Entrance Channel.

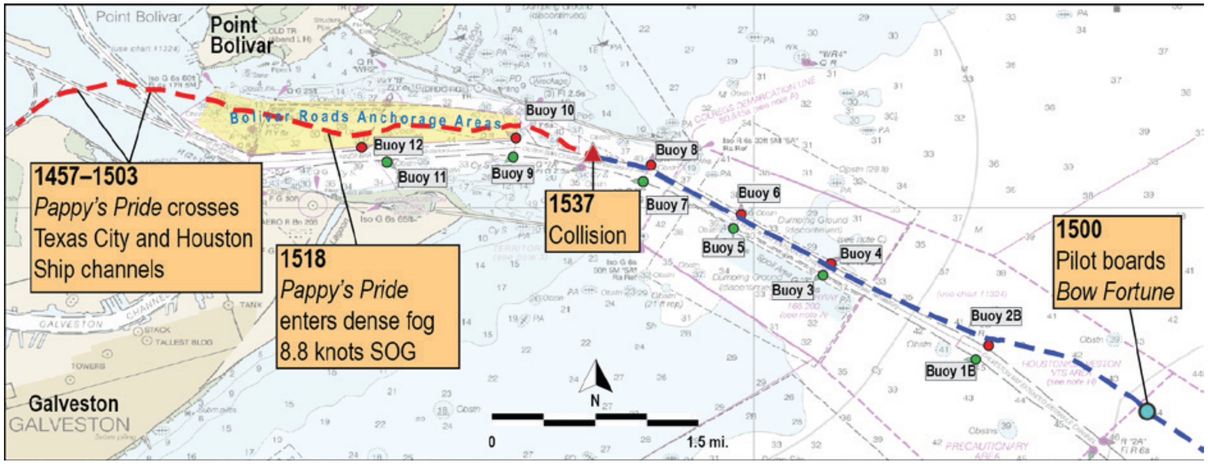


Figure 20. *Pappy's Pride* outbound track from Galveston (*red*) and *Bow Fortune* inbound track (*blue*) just before the collision. BACKGROUND SOURCE: NOAA; TRACKLINE DATA: COAST GUARD

About 1532, the *Bow Fortune* was less than 2 miles from the *Pappy's Pride*. Due to the estimated 0.2-mile visibility, the tanker would not have been visible from the fishing vessel, but its position would have been available to the *Pappy's Pride* captain on radar/ARPA and the AIS information on the electronic chart. At this point, the *Pappy's Pride* appeared to be on a course to cross the channel in front of the inbound *Bow Fortune* and behind the outbound tanker *Chemical Atlantik*.

At 1535:18, the *Bow Fortune* pilot first hailed the *Pappy's Pride* without response. Twelve seconds after the initial radio hails, the *Pappy's Pride* made a course change to port (about 19°), indicating the captain was still actively steering. At 1536:18, the *Bow Fortune* sounded five short blasts, then hailed the *Pappy's Pride*, and again sounded five short blasts at 1537:10. VTS, AIS, and the pilot's PPU electronic data captured a heading change of about 15° to port for the *Pappy's Pride* in the seconds before the collision. The captain may have thought his heading changes would keep him out of the channel and avoid the collision, respectively. However, if the last course change had been an attempt to avoid the collision, then it should have been to starboard per the COLREGS rules. Further, in this collision, if the fishing vessel had maintained its previous heading of 113°, the two vessels may have scraped port sides or avoided contact. The *Pappy's Pride*'s outbound course created a close quarters situation that was not prudent, and the lack of communication from the fishing vessel created doubt as to the *Pappy's Pride* captain's intentions.

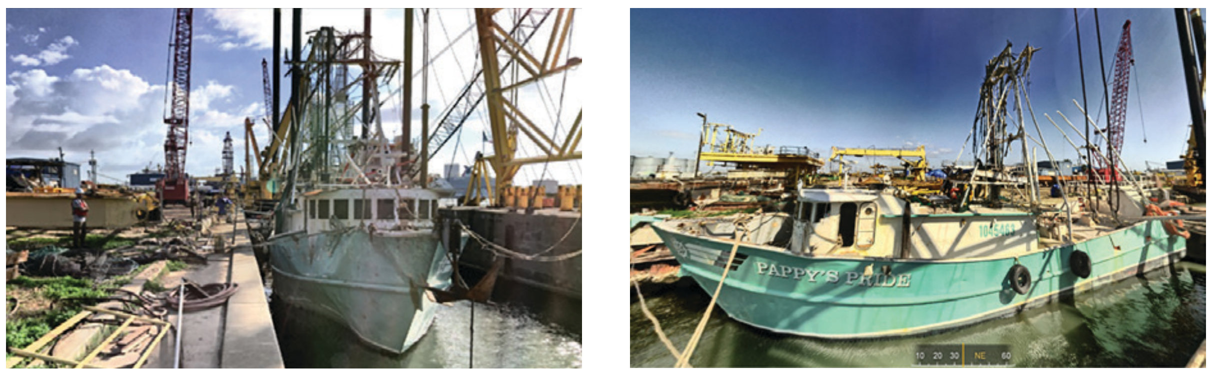


Figure 21. *Pappy's Pride* postaccident damage. SOURCE: COAST GUARD.

Early Communication

Early communication can be an effective measure in averting close quarters situations. The use of VHF radio can help to dispel assumptions and provide operators with the information needed to better assess each vessel's intentions.

At 1537:32, the vessels collided just outside the Outer Bar Channel. The speed over ground of the *Bow Fortune* was 11 knots and *Pappy's Pride* was 8.4 knots, indicating the tanker was beginning to slow but the fishing vessel's captain did not appreciably change the propulsion engine speed or direction before the collision. The damage assessed on both vessels indicates the port side of the tanker's bulbous bow struck the starboard side of the fishing vessel during the collision, which in turn led to the vessel capsizing but remaining afloat as it passed down the port side of the tank. One deckhand was rescued, but the remaining *Pappy's Pride* crew perished.

The probable cause of the collision of the inbound tanker *Bow Fortune* and the outbound commercial fishing vessel *Pappy's Pride* was the captain of the *Pappy's Pride*'s outbound course toward the ship channel, which created a close quarters situation in restricted visibility. Contributing was the lack of communication from the captain of the *Pappy's Pride*.

Collision

VESSEL GROUPS
OFFSHORE · **TOWING/BARGE**

Collision between Offshore Supply Vessel ***Cheramie Bo Truc No 22*** and Articulated Tug and Barge ***Mariya Moran–Texas***

Sabine Pass Jetty Channel, Port Arthur, Texas

ACCIDENT DATE
November 14, 2019

ACCIDENT ID
DCA20FM003

REPORT NUMBER
MAB-21-08

ISSUED
March 25, 2021

On November 14, 2019, about 0415 local time, the offshore supply vessel *Cheramie Bo Truc No 22* was outbound for sea transiting Sabine Pass with a crew of five, when it collided with the inbound ATB *Mariya Moran–Texas*, with a pilot and nine crew aboard, in the vicinity of Texas Point. About 6,641 gallons of diesel oil were released, and the waterway was closed for 12 hours. No injuries were reported. The *Cheramie Bo Truc No 22*, valued at $1.2 million, was declared a total loss. The *Mariya Moran–Texas* sustained $654,572 in damages.

After the *Cheramie Bo Truc No 22* left the dock at 0352, the mate unsuccessfully attempted to use the autopilot feature for several minutes. He struggled to maintain a safe course during the first 12 minutes of the passage, nearly striking a stationary jack-up, and the AB stated that twice he and the engineer had to remind the mate to steer back into the channel. Autopilot use is often discouraged or prohibited in restricted waters.

The manual for the *Cheramie Bo Truc No 22*'s autopilot specifically warned users not to use autopilot in a "harbor entrance or narrow channel." After returning to manual steering, the *Cheramie Bo Truc No 22* crossed the channel three times and wound up on the east side of the channel. The AB reported sighting the *Mariya Moran–Texas* to the mate.

Figure 22. *Mariya Moran–Texas*.
SOURCE: JEFF CAMERON, MARINETRAFFIC.COM.

Figure 23. *Cheramie Bo Truc No 22*.
SOURCE: SHIPSPOTTING.COM.

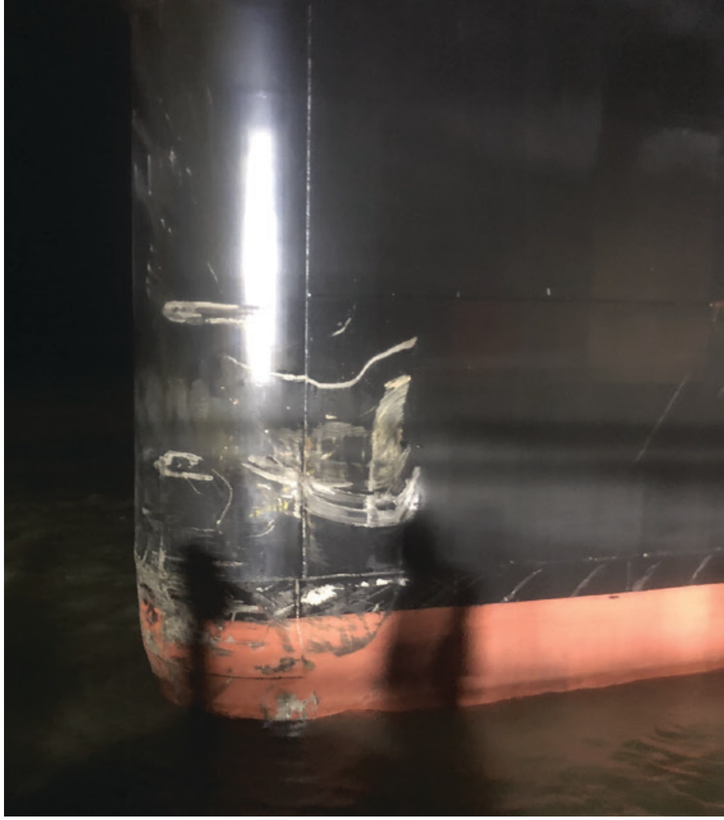


Figure 24. Damaged stem of the barge *Texas*.
SOURCE: MORAN TOWING CORP.

About 0400, roughly 0.5 miles inside the jetties, a Sabine pilot boarded the inbound *Mariya Moran–Texas* ATB and, about 10 minutes later, after the chief mate and pilot completed a master/pilot exchange, the pilot checked in with VTS, which advised him of the outbound *Cheramie Bo Truc No 22*. The pilot first noticed the *Cheramie Bo Truc No 22*'s masthead lights about 1 mile away.

Although both vessels were aware of each other, no VHF radio passing arrangement or maneuvering signals were made. The *Mariya Moran–Texas* pilot assumed a starboard-to-starboard passing based on the position of the *Cheramie Bo Truc No 22*.

About 0414, *Cheramie Bo Truc No 22* started a turn to starboard. The AB and engineer noticed the mate start the turn and recommended he come left to avoid the ATB. The mate did not acknowledge them. They did not take further action, such as summoning the captain, despite the hazardous situation.

Figure 25. The port side of the *Cheramie Bo Truc No 22*, post-collision, showing the compromised no. 1 port fuel tank and oil spillage. SOURCE: COAST GUARD.

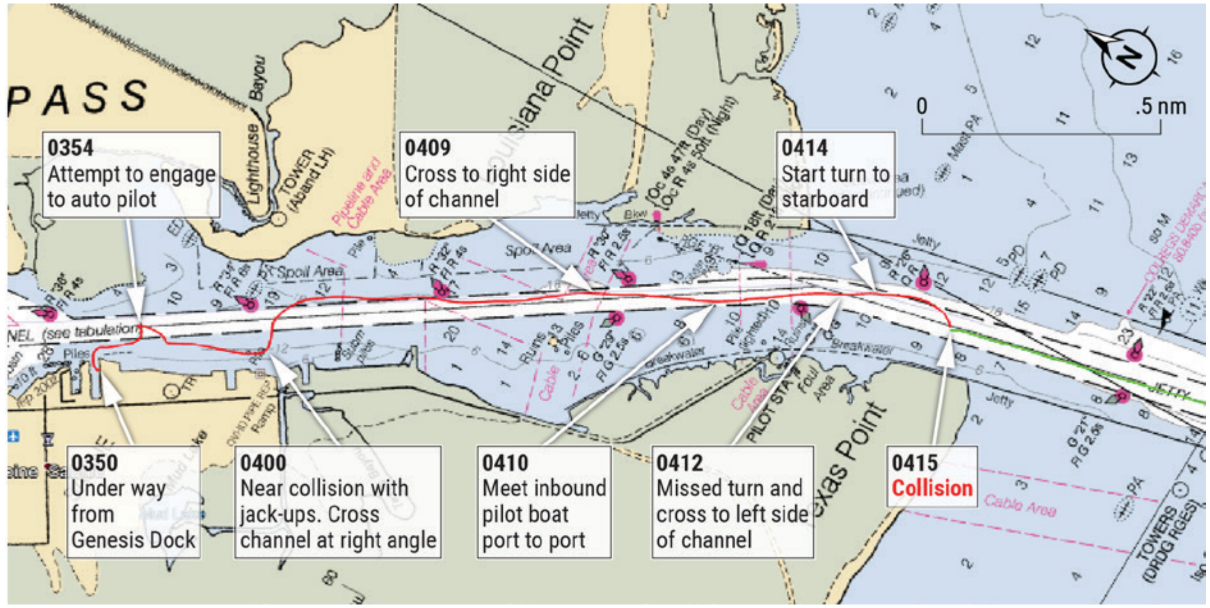


Figure 26. Sabine Pass chart showing path of *Cheramie Bo Truc No 22* (*red*) and *Mariya Moran–Texas* (*green*).
BACKGROUND SOURCE: NOAA CHART 11342

The *Mariya Moran–Texas* pilot hailed the *Cheramie Bo Truc No 22* on channel 13. The VTS watchstander noticed the *Cheramie Bo Truc No 22*'s "course had changed abruptly," placing the vessels on a collision course. He reached out to the *Cheramie Bo Truc No 22* once, on channel 1A, with no answer.

Evidence showed that there was room to pass safely starboard to starboard had *Cheramie Bo Truc No 22* continued parallel to and along the east edge of the channel. Inland Navigation Rules require either a port-to-port passage or communication either by radio or whistle signal for an agreed-upon alternate passage between two vessels. A radio call from the ATB prior to the pilot relieving the mate to confirm the offshore supply vessel's intentions may have kept the *Cheramie Bo Truc No 22* mate from steering across the ATB's bow. After the turn to starboard across the bow of the ATB, the collision was unavoidable.

The bow of the barge *Texas* collided with the *Cheramie Bo Truc No 22* at nearly a right angle, aft of the superstructure. The *Cheramie Bo Truc No 22*'s no. 1 port fuel tank was severely damaged. The no. 2 port fuel tank sustained less damage but was also compromised. Neither ATB vessel's hull was compromised.

The mate's postaccident alcohol swab test results indicated a blood alcohol concentration of at least 0.02 grams per deciliter; although indicative that the mate consumed alcohol sometime prior to the voyage, the test does not demonstrate conclusively that the mate was impaired by alcohol. However, attempting to use the autopilot in a channel, nearly colliding with stationary jack-ups, weaving across the channel, ignoring the warnings from the AB and engineer in the wheelhouse, and suddenly turning in front of the ATB all indicate a degree of misjudgment, impairment, and/or incompetence.

The probable cause of the collision between the offshore supply vessel *Cheramie Bo Truc No 22* and ATB *Mariya Moran–Texas* was the offshore supply vessel mate's turn across the path of the ATB during a meeting situation. Contributing to the accident was a lack of early communication from both vessels.

Teamwork

Safe and effective navigation is not one person's job. Bridge resource management includes the concept of teamwork, which is an essential defense against human error. A good team should anticipate dangerous situations and recognize the development of an error chain. If in doubt, team members should speak up or notify a higher authority. Vessel operators should train their crews on and enforce their safety policies.

VESSEL GROUPS
TOWING/BARGE · **CARGO, DRY BULK**

Collision between *Cooperative Spirit* Tow and *RC Creppel* Tow

Lower Mississippi River, mile 123, Destrehan, Louisiana

ACCIDENT DATE
January 26, 2020

ACCIDENT ID
DCA20FM012

REPORT NUMBER
MAB-21-16

ISSUED
August 12, 2021

Figure 27. *RC Creppel* under way before the accident.
SOURCE: JEFF L. YATES.

On January 26, 2020, at 0533 central standard time, the towing vessel *Cooperative Spirit* was pushing 40 barges upbound on the Lower Mississippi River, and the towing vessel *RC Creppel* was pushing two barges downbound when the two tows collided at mile 123, near Destrehan, Louisiana. The *RC Creppel* capsized as a result of the collision. Minutes later, the upbound dry bulk carrier *Glory First* made contact with the starboard side of the *Cooperative Spirit*'s tow. All 42 barges from both tows broke free and were later recovered. One of the four *RC Creppel* crewmembers was rescued; the remaining three were never recovered and are presumed dead. The accident resulted in the release of about 8,000 gallons of diesel fuel into the river and sulfuric acid vapors into the atmosphere, and an estimated $3,781,126 in property damage to the 3 vessels and 11 barges.

At 0433, the 200-foot-long *Cooperative Spirit* departed mile 115.4 of the Mississippi River with 40 barges arranged six across and seven long (the first two rows each consisted of five barges), headed up river. The total length of the *Cooperative Spirit* and its tow was 1,600 feet long. The vessel's pilot was in the wheelhouse.

About 0514, the 69-foot-long *RC Creppel* departed Hahnville, Louisiana, at mile 126.9, headed down river with two barges: the *SCC-95* ahead of the *RHA-2204*. The *RC Creppel* and its tow measured 514 feet long. The vessel's pilot was at the helm.

At 0522:47, the *Cooperative Spirit* pilot and the *RC Creppel* pilot agreed to a port-to-port meeting in the bend at 26 Mile Point. Because they planned to meet in a bend, the high water and strong current increased the risk of an accident occurring as both vessels maneuvered for the turn at the same time. Additionally, both operators would have only been able see each other's tows and visually assess the situation for a short time as they approached each other and would have little time to react, if necessary.

In such a situation—where two vessels are approaching a bend from opposite directions—navigational tools can help to mitigate the risk of collision. Although both the *RC Creppel* and *Cooperative Spirit* were equipped with AIS, ECS, and radar, each pilot had entered only the size of his vessel into AIS, rather than length of both the vessel and tow. Since the *Cooperative Spirit* pilot did not inform the *RC Creppel* pilot of the size or length of his tow when they planned their meeting, the *RC Creppel* pilot was likely unaware of the length of the *Cooperative Spirit* tow, and the two pilots had arranged the meeting without a complete understanding of the developing situation.

About 0531, as the *Cooperative Spirit* began to transit the bend, the vessel was tight on the left descending bank. The pilot used 15–20° starboard rudder for more than 90 seconds to execute the turn around the bend. However, the force of the current set the vessel and its tow to port (toward the right descending bank) and into the path of the downbound *RC Creppel*, which was in the center of the river as it approached the bend.

Figure 28. *Cooperative Spirit* moored after the accident.

Figure 29. *Glory First* anchored after the accident.

Once in sight of one another, there was minimal time for either pilot to react or respond to the other vessel's movements to avoid collision. The *Cooperative Spirit* pilot had to assess the risk of collision from more than 1,400 feet behind the head of the tow. He assumed that the pilot of the smaller *RC Creppel* tow would maneuver his tow closer to the right descending bank. A radio call to the other vessel would have helped both pilots identify each other's expectations, but neither pilot made a radio call after their initial call to arrange a meeting. The absence of a radio call or "danger" signal indicates that neither pilot was aware of the impending collision.

On board the *RC Creppel*, one of the two deckhands heard the general alarm sound, immediately grabbed a lifejacket, and felt an impact as the *Cooperative Spirit* tow collided with the *RC Creppel*'s tow at 0533:04. The impact separated towing lines connecting the *Cooperative Spirit*'s first and second string of barges. One of the *RHA-2204*'s pressure relief valves on the deck was ruptured, releasing sulfuric acid vapors into the atmosphere.

By 0533:26, the *RC Creppel* had capsized and begun to sink. Only one of the four crewmembers was able to escape.

The *Cooperative Spirit* continued to drift down and across the river into the upbound *Glory First*, which had slowed and evasively maneuvered toward the right descending bank, and the *Glory First* struck the aft corner of the starboard string of barges pushed by the *Cooperative Spirit*.

The probable cause of the collision of the *Cooperative Spirit* and *RC Creppel* tows was the two pilots' insufficient radio communication before meeting in a bend and not broadcasting accurate AIS information regarding tow size.

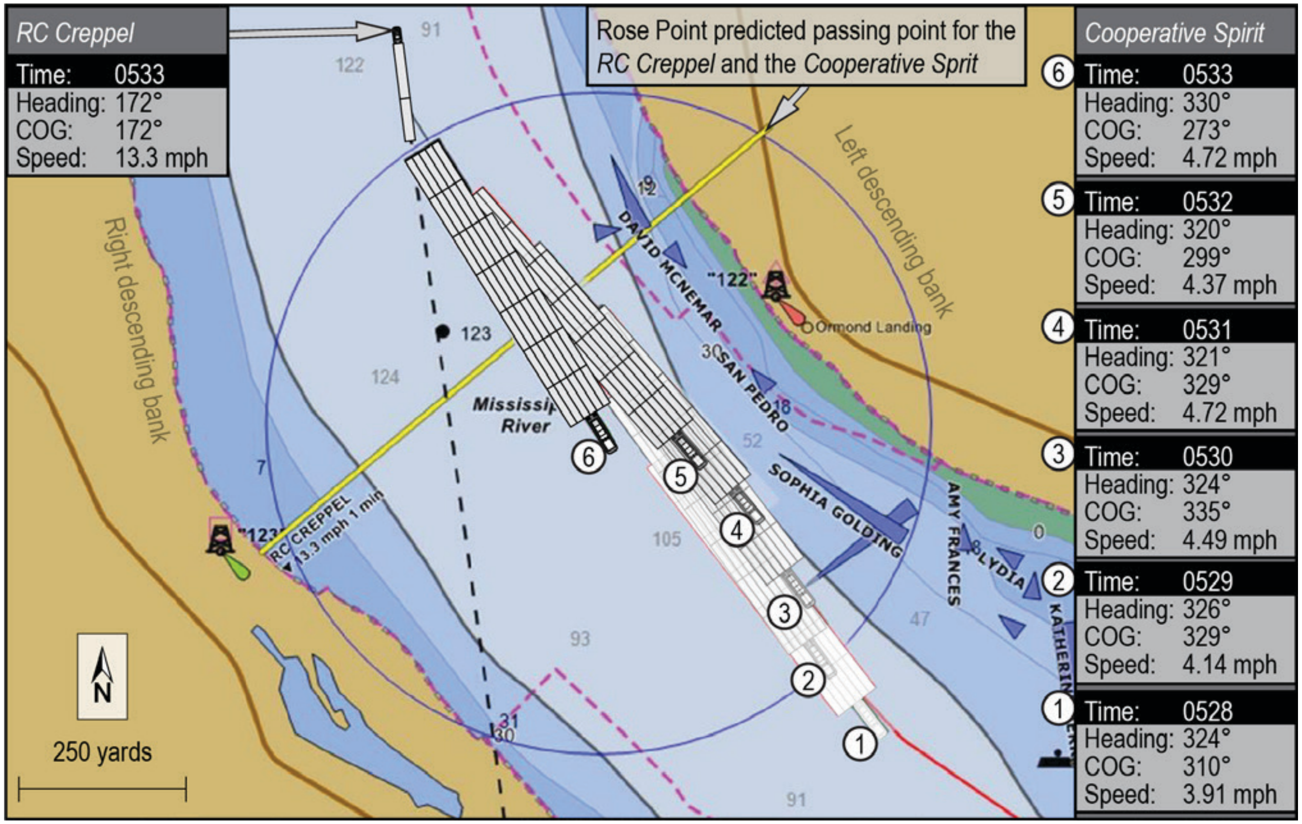


Figure 30. Rose Point ECS display at 0533 screenshot from the *Cooperative Spirit*, with previous positions of the *Cooperative Spirit* starting at 0528 (with *Cooperative Spirit* tow and *RC Creppel* tow icons added to show overall tow dimensions to approximate scale). BACKGROUND SOURCE: ARTCO

Updating the Overall Dimensions of a Tow in AIS

The NTSB has previously noted the importance of ensuring that vessels engaged in towing operations broadcast accurate AIS information regarding tow size. The overall dimensions of a vessel and its tow may change significantly with each transit. For vessels towing ahead or alongside, the dimensions in AIS should reflect the overall rectangular area of the vessel and its tow. Consistently entering the complete dimensions of a tow configuration into AIS for each transit helps to alleviate possible misinterpretation and thus enhances the situational awareness of all waterway users.

Communication When Meeting in a Bend

When meeting or overtaking a vessel in a bend, especially where high-water conditions can increase the risk of a collision, early and effective communication is critical to ensuring a successful meeting. The use of VHF radio can help to dispel assumptions and provide bridge teams and towing vessel operators with the information needed to better assess each vessel's intentions.

VESSEL GROUPS
CARGO, LIQUID BULK · **TOWING/BARGE**

Collision between Liquefied Gas Carrier *Genesis River* and *Voyager* Tow

Houston Ship Channel, Upper Galveston Bay, Texas

ACCIDENT DATE
May 10, 2019

ACCIDENT ID
DCA19FM033

REPORT NUMBER
MAR-21-01

ISSUED
March 10, 2021

Figure 32. Screen capture from wheelhouse video on board the *Voyager* at the moment that the *Genesis River* struck the *Voyager* tow. SOURCE: KIRBY INLAND MARINE, LP

Figure 31. *Voyager* moored in Channelview, Texas, following the accident.

On May 20, 2019, the outbound 754-foot-long liquefied gas carrier ***Genesis River*** was transiting the Houston Ship Channel in Upper Galveston Bay. Immediately after the vessel passed an inbound liquefied gas carrier of similar size at the southern end of the Bayport Flare, it approached the channel's west bank, sheered to port, and crossed over to the opposite side of the channel where, in the barge lane ahead, the 69-foot-long towing vessel ***Voyager*** was pushing two tank barges breasted together side by side. In the ensuing collision, two cargo tanks in the 297-foot-long starboard tank barge were breached, spilling over 11,000 barrels of petrochemical cargo into the waterway, and the port barge capsized. No injuries were reported.

About 1148 on May 10, two pilots boarded the *Genesis River* at the Targa Resources Galena Park Marine Terminal on the upper Houston Ship Channel and were escorted to the ship's bridge. The fully loaded *Genesis River* got under way shortly after noon, outbound for sea with Pilot 1 at the conn and an AB from the ship's crew at the helm. When the *Genesis River* departed its berth, it had an even keel trim. Had the vessel gotten under way trimmed by the stern (there was sufficient depth to do so), the shift of the trim toward the bow resulting from the ship making way through the channel would have had less impact on its path stability and maneuverability.

During the initial transit through the upper Houston Ship Channel, Pilot 1 determined that the ship's rudder responded sluggishly to the rudder commands. To stop the swing of the *Genesis River* following meetings with inbound vessels earlier in the transit, he used temporary increases in engine rpm, to increase wash over the rudder and improve its effectiveness.

At 1444, Pilot 2 took the conn from Pilot 1. Pilot 1 remained on the bridge for the next 15 minutes talking with Pilot 2. Pilot 1 informed Pilot 2 of the sluggish rudder, and the pilots shared concerns about large ships that were difficult to handle.

Figure 33. *Genesis River* under way in Bolivar Roads near Galveston, Texas, two weeks after the accident.
SOURCE: WILLIAM J. LEACH, JR., VESSELFINDER.COM

At 1446, Pilot 2 ordered the ***Genesis River***'s engine to full ahead. A little over a minute later, he requested an increase in engine speed to ***sea speed***, which took the engine control system out of maneuvering mode and into navigation full (Nav. Full) mode. In Nav. Full mode, the ability to change speed was limited; under normal circumstances, the pilot would give 10 minutes' prior notice before requesting another speed change. The crew complied with the pilot's request, and the engine speed, which had been at 60 rpm, began to slowly increase.

At 1500, an OS took the helm under the watch of the AB. The AB stated that he had requested permission from Pilot 2 to turn over the helm to the OS, but Pilot 2 stated that he was not informed that the OS was at the wheel. The VDR did not capture audio of the exchange.

Five minutes later, Pilot 2 radioed the inbound 740-foot-long, 120-foot-wide liquefied gas carrier ***BW Oak*** to arrange a port-to-port passing. At the time of the radio call, the ***Genesis River*** was about a mile north of the Bayport Flare—the intersection of the Houston and Bayport Ship Channels that is funnel-shaped to allow ships to negotiate the turn from one channel to the other. Based on information in his PPU, Pilot 2 knew that the passing would occur near the southern part of the Bayport Flare, where the channel makes a 15.7° turn to the east, but was not concerned, as he had met other ships there before.

As the ***Genesis River*** transited south, its engine speed continued to slowly increase until it reached between 72 and 73 rpm, which was the programmed rpm setpoint for Nav. Full. The vessel's speed over ground was 12 knots.

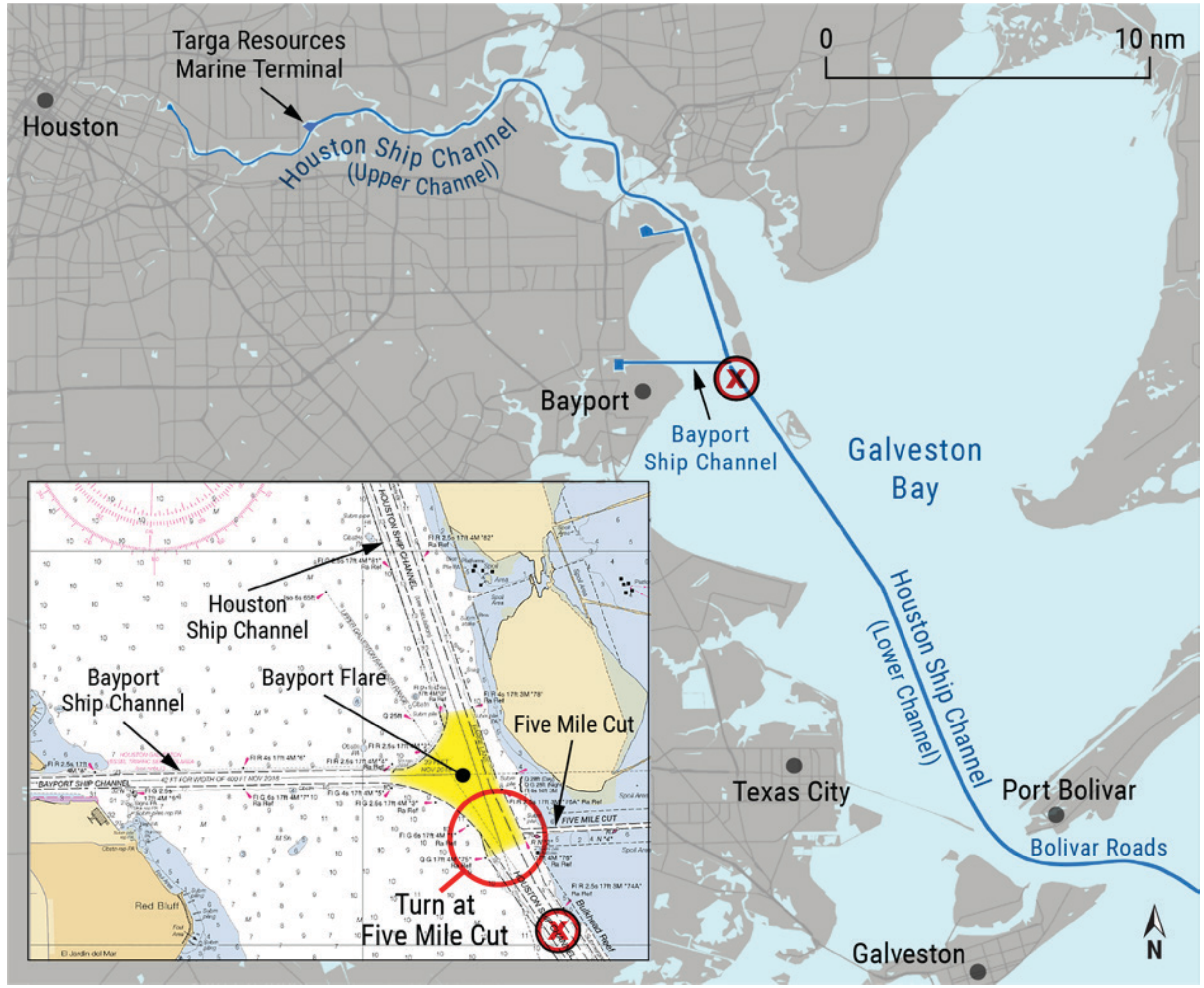
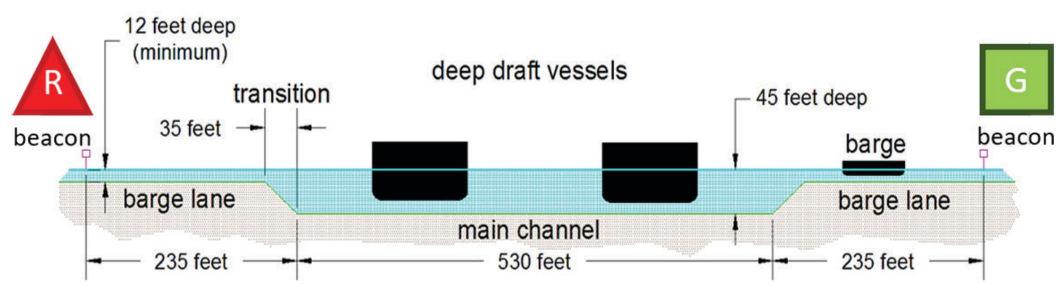


Figure 34. The accident location, as shown by the red *X*. Inset shows Bayport Flare and turn at Five Mile Cut.
BACKGROUND SOURCE: GOOGLE MAPS; INSET FROM NOAA CHART 1132714.

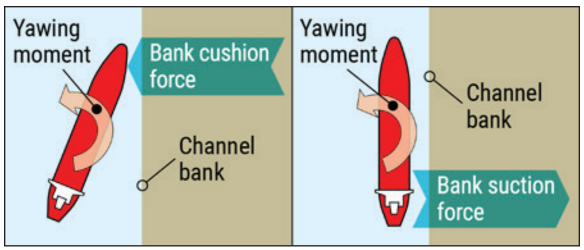
Figure 35. Typical Lower Houston Ship Channel profile with navigation beacons as viewed by an outbound vessel.



Beginning at 1509:22, Pilot 2 issued a series of orders to the helmsman to maneuver the ***Genesis River*** to pass the ***BW Oak***. As the ***Genesis River*** passed the ***BW Oak*** and entered the turn at the southern terminus of the Bayport Flare at 1512:08, the vessel was on the western side of the main deep-draft channel at a speed of 12.6 knots.

The channel narrowed and turned, which brought the western channel bank abruptly in toward the vessel, and the bank effects on the starboard side quickly increased. The closer a vessel is to the bank, the stronger the bank effect forces. These forces were likely exacerbated by unreported shoaling that had occurred on the western side of the channel at the turn. Additionally, the hydrodynamic effects of the 740-foot-long and 120-foot-wide ***BW Oak*** acting on the ***Genesis River*** were greater than the effects created by smaller vessels that the ***Genesis River*** had passed earlier.

Figure 36. Hydrodynamic bank effects acting on the *Genesis River*: cushion force (*left*) and suction force (*right*).



As a result of the combined hydrodynamic effects of the bank and the ***BW Oak***, the ***Genesis River*** sheered to port. In an attempt to stop the sheer, Pilot 2 ordered and the helmsman executed a hard starboard rudder, but the vessel did not respond, continuing to turn toward the eastern bank of the channel. Pilot 2 twice ordered increased engine rpm in an effort to improve steering effectiveness. Because the ***Genesis River*** was at sea speed in Nav. Full mode, this increase could not be accomplished by moving only the EOT as it could if the vessel was in maneuvering mode. Rather, an increase in rpm while at Nav. Full required bridge watchstanders to contact the engineering watchstanders to change the maximum rpm setpoint in the ECR, depress the engine control program bypass button, and advance the EOT.

Figure 37. *Genesis River* bridge control panel for remote engine control system (*left*) and EOT lever (*right*).

After the pilot's second order for more rpm, ***Genesis River*** bridge crewmembers contacted the ECR and requested maximum rpm, and engineering watchstanders adjusted the maximum rpm setpoint to 85. However, neither the bridge nor the ECR watchstanders pressed the program bypass button. Thus, the actual engine rpm did not change when the pilot ordered the increase.

Over VHF radio, Pilot 2 hailed the inbound towing vessel ***Voyager***, which was ahead of the ***Genesis River*** and pushing ahead two fully loaded tank barges breasted together side by side. Both of the ***Voyager***'s engines were at full throttle, and the tow was making about 5.3 knots speed over ground. The ***Voyager***'s relief captain, who was at the helm, answered the call. Pilot 2 informed the ***Voyager*** relief captain that he was having trouble controlling the ***Genesis River***. In response, the ***Voyager*** relief captain put his engines in neutral. Then, at 1513:25, Pilot 2 radioed the ***Voyager***, requesting the tow "Go to the greens," that is, cross the channel to the western side marked by green navigation beacons. Because the ***Genesis River*** was crossing from the western side to the eastern side of the channel, Pilot 2 intended for the two vessels to pass starboard to starboard once the ***Voyager*** reached the opposite side of the channel.

The pilot's direction over the radio confirmed what the ***Voyager***'s relief captain had already determined was the best action, so he immediately increased the ***Voyager***'s engine throttles back to full power and put the vessel's rudders over hard to port. AIS data showed that the two vessels were 0.55 miles apart when the head of the tow began turning to port at 1513:35. About the same time, the relief captain sounded the general alarm and radioed the deckhand on watch; the captain arrived in the wheelhouse shortly thereafter to assist the relief captain.

As the ***Voyager*** turned, its speed, which had been 5.3 knots at maximum power, decreased to as low as 3.6 knots (a decrease in speed is not unusual during a turn, particularly in vessels with inefficient hull forms, such as barges). As the ***Genesis River*** approached the eastern bank of the channel, the hydrodynamic forces of bank cushion pushed the bow of the ship back to starboard. Because of its slow speed, the ***Voyager*** was still on the eastern side of the main deep-draft channel. The NTSB estimates that the stern of the ***Voyager*** was no more than 90 feet from the eastern deep-draft channel bank as the ***Genesis River*** approached. Even if the ***Voyager*** relief captain had taken a course more perpendicular to the channel, it is likely that the tow would have been in a similar position relative to the bank, given the slow turning speed. Therefore, with its 122-foot beam, the ***Genesis River*** could not safely pass behind the ***Voyager***.

At 1516:09, the ***Genesis River***'s bow struck the starboard barge midship on the starboard side, penetrating through the double hull and breaching the no. 2 starboard cargo tank (causing reformate to leak) and capsizing the port barge. The Houston Ship Channel was closed to navigation for two days during response operations and did not fully open for navigation until May 15. The total cost of damages to the ***Genesis River*** and the barges was estimated at $3.2 million. The cost of reformate containment and cleanup operations totaled $12.3 million. There were no injuries reported.

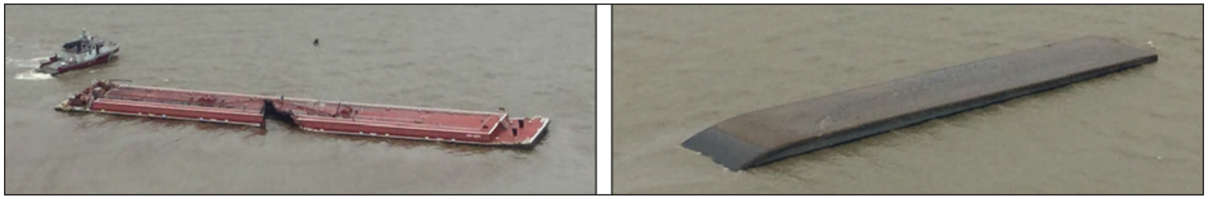


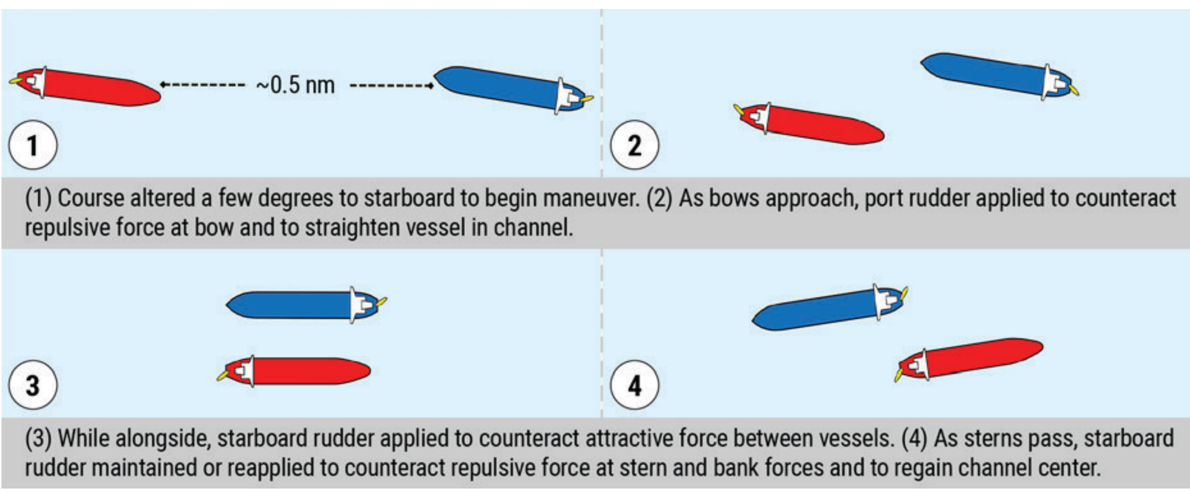
Figure 38. Barges from the *Voyager* postaccident.

SAFETY ISSUES

◇ **Challenges of navigating large vessels in the Bayport Flare area of the Houston Ship Channel.** Due to the narrowness of the channel, the large amount of vessel traffic, and the size of the vessels transiting the channel, the Houston Ship Channel is challenging to navigate and requires significant training and experience. The asymmetric shape of the channel in the vicinity of its intersection with the Bayport Ship Channel, known as the Bayport Flare, makes navigation particularly difficult due to varying hydrodynamic forces acting on a vessel's hull. When larger vessels meet in the intersection while transiting at a relatively high speed, the risk of loss of control is much greater.

◇ **Vessel speed while transiting a narrow channel.** Transiting a narrow channel at or near a vessel's maximum speed provides little room for error and little ability to increase propeller wash over the rudder to recover if control is lost. The margin for error is even more limited on ships with slow-speed, direct-drive diesel propulsion engines transiting at Nav. Full, an engine mode designed for higher speeds in open ocean waters where the ability to change engine rpm on short notice is significantly restricted. The pilot's decision to transit the wide-beam, deep-draft *Genesis River* in Nav. Full mode at sea speed subjected the vessel to greater hydrodynamic forces than had it been traveling at slower maneuvering speeds through the shallow and narrow lower Houston Ship Channel. Additionally, the higher speed resulted in the vessel trimming further down by the bow, and thus reduced path stability with increased speed due to the trim change. Finally, the maneuvering limitations imposed by being at Nav. Full prevented a rapid increase in engine speed when needed to improve rudder effectiveness.

Figure 39. Typical steering sequence during head-on meeting in a narrow, symmetrical channel. (Not to scale.)



(1) Course altered a few degrees to starboard to begin maneuver. (2) As bows approach, port rudder applied to counteract repulsive force at bow and to straighten vessel in channel.

(3) While alongside, starboard rudder applied to counteract attractive force between vessels. (4) As sterns pass, starboard rudder maintained or reapplied to counteract repulsive force at stern and bank forces and to regain channel center.

The probable cause of the collision between the liquefied gas carrier *Genesis River* and the *Voyager* tow was the *Genesis River* pilot's decision to transit at sea speed, out of maneuvering mode, which increased the hydrodynamic effects of the Bayport Flare's channel banks, reduced his ability to maintain control of the vessel after meeting another deep-draft vessel, and resulted in the *Genesis River* sheering across the channel toward the tow.

SAFETY RECOMMENDATIONS

As a result of its investigation into this accident, the NTSB issued three new safety recommendations to the Houston Pilots that focused on requiring vessels to be sufficiently trimmed by the stern prior to transiting the Houston Ship Channel; avoiding conducting passing arrangements between wide-beam, deep-draft vessels in the northern and southern terminuses of the Bayport Flare; and avoiding transiting at sea speed in the lower Houston Ship Channel.

Additionally, the NTSB found that placing as OS in training at the helm without informing the pilot was contrary to good bridge resource management practice and recommended that K-Line Energy Ship Management (the operator of the *Genesis River*) review its SMS and develop formalized procedures for watch team reliefs to ensure embarked pilots are informed of changes in personnel.

Believing that the Bayport Flare would benefit from regular risk assessments and the consideration of additional vessel routing measures, the NTSB reiterated Safety Recommendations M-16-16 and M-16-19 to the Coast Guard to develop a continuous risk assessment program for each VTS area, and to establish a program to periodically review each of the 12 VTS areas.

VESSEL GROUPS
CARGO, GENERAL · **CARGO, DRY BULK**

Collision of Cargo Vessel ***Nomadic Milde*** and Bulk Carrier ***Atlantic Venus***

Lower Mississippi River, miles 114.5, South Kenner, Louisiana

ACCIDENT DATE
May 8, 2020

ACCIDENT ID
DCA20FM017

REPORT NUMBER
MAB-21-15

ISSUED
August 11, 2021

Figure 41. *Nomadic Milde* on the right descending bank at the Cornerstone Dock showing a gash in the hull aft of the port anchor pocket. SOURCE: COAST GUARD

Figure 40. Image from video taken at 1701 from the bridge of the *Atlantic Venus* with the *Nomadic Milde* lying against its bow. SOURCE: *ATLANTIC VENUS* CREWMEMBER

On May 8, 2020, about 1655 local time, the anchored general cargo vessel ***Nomadic Milde*** collided with the anchored bulk carrier ***Atlantic Venus*** on the Lower Mississippi River near New Orleans, Louisiana, after the ***Nomadic Milde*** began to swing and drag its anchors in the current. After colliding with the ***Atlantic Venus***, which had been anchored directly behind the cargo ship, the ***Nomadic Milde*** then struck a nearby chemical dock and grounded on the bank. No injuries were reported. The ***Nomadic Milde*** released an estimated 13 gallons of lube oil into the river. Damage to both vessels and the dock was estimated at $16.9 million.

At 1350, the ***Nomadic Milde*** got under way en route to an anchorage area at Kenner Bend, with a NOBRA pilot conning. At the anchorage, the pilot positioned the vessel between and in line with two bulk carriers in ballast, and, at 1515, the starboard anchor was let go. The ***Nomadic Milde*** was then maneuvered toward the right descending bank, and at 1520, the port anchor was let go. The anchors were configured with the starboard anchor at 360 feet of chain on deck with a 12 o'clock lead and the port anchor with 270 feet of chain in the water with a 9 o'clock lead. At 1533, the pilot informed the master that the anchoring was finished and cautioned that there was "considerable current," which he estimated to be between 4 and 5 knots. The pilot departed the ship at 1542.

The on-watch second officer set an ECDIS anchor watch alarm, which would have sounded had the vessel moved beyond the set radius. However, the anchor watch alarm was set to a radius of 590 feet, while the initial estimated distance from the stern of the ***Nomadic Milde*** to the bow of the anchored ***Atlantic Venus*** aft of them was 490 feet. Thus, the setting was too large to provide for a timely alarm of the ship dragging. From 1551 to 1557, the ship began to swing to starboard toward the right descending bank, moving about 730 feet, a distance double the amount of chain that was set on the anchor, indicating that the starboard anchor likely dragged. The chief officer noticed that the vessel was not in the center of the anchor watch circle when he relieved the watch at 1602, but he did not question whether the ship had dragged or check whether the ship was remaining securely at anchor.

Figure 42. The *Nomadic Milde* loading cargo in March 2018. SOURCE: INTERSHIP NAVIGATION CO. LTD.

At 1613, the ***Atlantic Venus*** radioed to request that the ***Nomadic Milde*** monitor their holding position. However, the chief officer did not take any follow-up action. There was no evidence of either watch officer checking the ship's position at frequent intervals or by means other than the ECDIS watch alarm. Had the ship's radars been used to determine or crosscheck the ship's position, they would have provided information for the crew to determine if the range to a vessel or object had decreased or if the ship had moved. Had this been detected, the master could have been alerted earlier and undertaken necessary measures to address the problem.

About 1637, the ***Nomadic Milde***, then about 350 feet off the starboard bow of the ***Atlantic Venus***, began to swing to port, with its stern moving towards the ***Atlantic Venus***. By the time the master was called to the bridge at 1642, he had lost about half the original distance between his vessel and the ***Atlantic Venus*** in which to react to and mitigate the situation. Knowing that a pilot was required to get under way in the area, he contacted VTS and the ship's agent to request a pilot but was informed he would have to wait hours. At 1648, the main engine was ready for use on the bridge, but VTS told the master not to heave anchor and to maneuver only with their engine until a pilot arrived. This severely limited the bridge team's ability to control the vessel in the strong current, even while using the main engine up to full ahead, the bow thruster, and rudder.

At 1655, the port side of the ***Nomadic Milde*** collided with the bulbous bow and anchor chains of the ***Atlantic Venus***. With the ***Nomadic Milde*** broadside to the current and pushing on the bow of the ***Atlantic Venus***, both vessels moved towards the right descending bank and closed on a nearby chemical dock about 650 feet away. During efforts to assist the vessels, the ***Nomadic Milde*** struck the dock before grounding on the right descending bank.

The probable cause of the collision between the *Nomadic Milde* and *Atlantic Venus* was the bridge team on the *Nomadic Milde* not effectively monitoring the vessel's position and therefore not detecting that the vessel was dragging anchor and had moved from its original position during highwater conditions in proximity to other vessels.

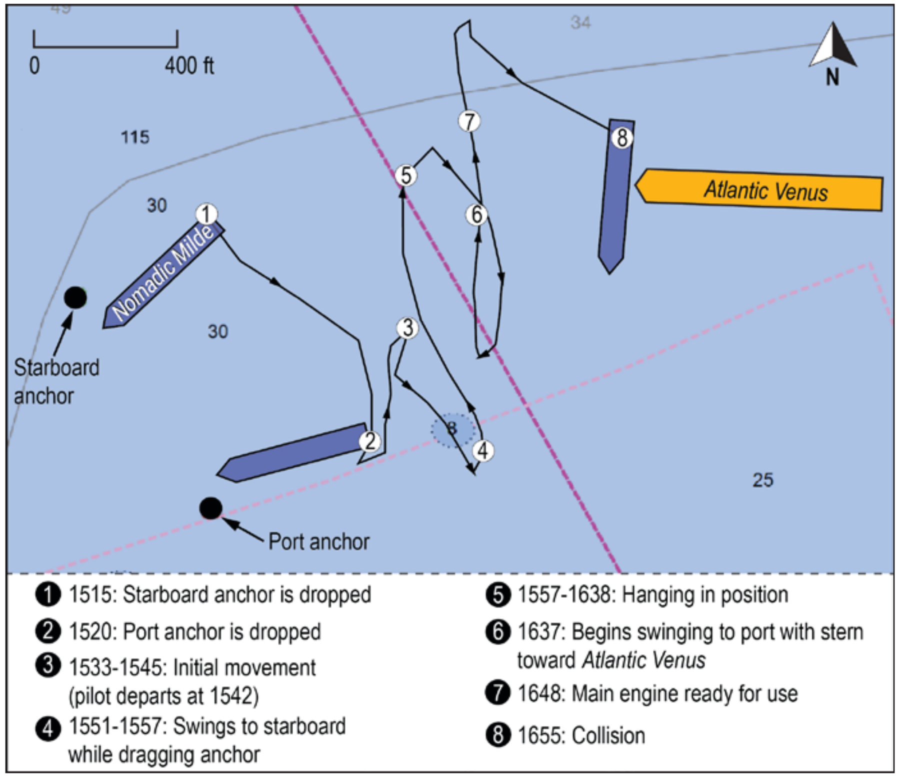


Figure 43. GPS positions of the *Nomadic Milde* from the vessel's ECDIS, from the time the *Nomadic Milde*'s starboard anchor was let go at 1515 to the collision with the *Atlantic Venus* at 1655. Note: the GPS receiver is located on the main mast above the bridge of the *Nomadic Milde*. Scale approximate. BACKGROUND SOURCE: NOAA ENC 6LA54M

VESSEL GROUP
CARGO, LIQUID BULK

Contact of Tanker ***Atina*** with Oil and Gas Production Platform SP-57B

Southwest Pass Fairway Anchorage, Gulf of Mexico, 21.5 miles south-southwest of Pilottown, Louisiana

ACCIDENT DATE
October 17, 2020

REPORT NUMBER
MAR-21-24

ACCIDENT ID
DCA21FM004

ISSUED
November 10, 2021

Figure 44. SP-57B preaccident. SOURCE: COX OPERATING

Figure 45. The *Atina*'s damaged accommodation ladder. SOURCE: COAST GUARD

On October 17, 2020, at 0446 local time, the tanker *Atina* with a crew of 21 was attempting to anchor in the Southwest Pass Fairway Anchorage in the Gulf of Mexico, about 21.5 miles from Pilottown, Louisiana, when it struck the manned oil and gas production platform SP-57B. The platform's four crewmembers and one technician evacuated to a nearby platform by helicopter after activating the emergency shutdown device to shut in wells to the SP-57B platform. No pollution or injuries were reported. Estimated damages to the platform ($72.3 million) and vessel ($598,400) totaled $72.9 million.

At 1448 on October 16, the *Atina* departed the NuStar terminal in St. James, Louisiana. About 0110 the following day, the relieving master joined the ship via launch. About 0121, the launch returned to transport the departing master to shore. At 0342 the pilot departed the *Atina,* leaving the master and second mate alone for navigation to Southwest Pass Fairway Anchorage area.

The accident master wanted to anchor soon after the pilot's departure because he was tired. According to the master's 96-hour work/rest history form, he had no sleep in the 24-hour period before the accident and 19 hours of sleep during the 96 hours before the accident. The company's SMS required a minimum 1-day turnover between senior personnel aboard a company vessel if the oncoming senior person worked for the company (and a 7-day turnover if the senior person was new to the company), yet the company requested the master change out at Pilottown or elsewhere on the Mississippi River, leaving no room for the SMS-required turnover. The accident master, without any handover period, took command of a vessel, under pilotage on the Mississippi River, at night, after having traveled for about 54 hours from his home in Turkey, on a ship he had never served on. He was likely affected by acute fatigue, defined as getting fewer than 4 hours of sleep over a 24-hour period. An overlap would have allowed the incoming master to rest and receive his counterpart's handover information.

Figure 46. SP-57B's fractured horizontal and damaged leg.

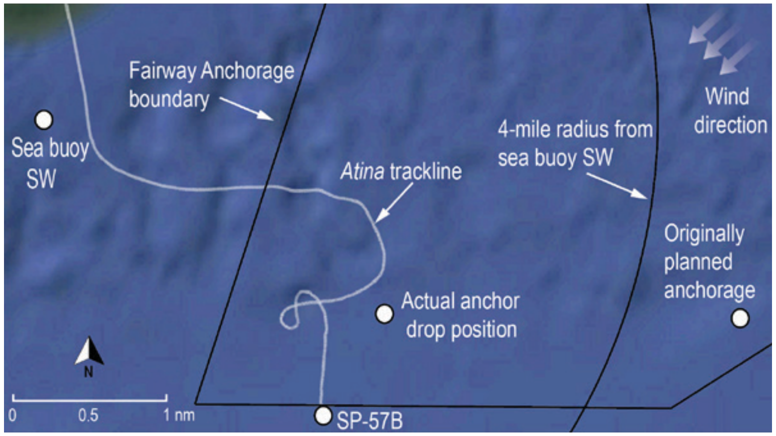


Figure 47. The *Atina*'s trackline taken from VDR data showing the tanker's position relative to sea buoy SW and platform SP-57B within the Fairway Anchorage boundaries. The image also shows the *Atina*'s originally planned anchorage location, actual anchor drop position, and the 4-mile radius from sea buoy SW.
BACKGROUND SOURCE: GOOGLE EARTH

The location the master chose was about 2.5 miles from the sea buoy "SW" and about 0.7 miles from platform SP-57B. He thought that was a sufficient distance from the platform to anchor.

After the ***Atina*** began anchoring, the Southwest Pass pilot station asked the vessel to move more than 4 miles from sea buoy SW. As the crew heaved anchor to comply with this request, the bridge team lost track of SP-57B. Based on VDR audio, it appears that the master believed the platform was another vessel. When the master asked what the vessel at 0.6 miles (SP-57B was at that approximate distance) was doing, the second mate provided information for the offshore supply vessel ***Leader***, located 1.5 miles from the ***Atina***, 0.9 miles beyond SP-57B. It is likely that the second mate was looking at the S-band radar, set at a 3-mile scale, making platform SP-57B difficult to see because it was lost in radar clutter close to the ***Atina***. The master was likely looking at the X-band radar, set to a 1.5-mile scale, making SP-57B easily visible at 0.5 miles.

Winds were about 25 knots from the northeast. The pilot had informed the master of the strong westerly set, and the radar indicated a set and drift of about 247° at 1.5 knots. However, the master did not adequately account for the current and wind that pushed his vessel toward SP-57B. Likely preoccupied with bringing the anchor in clear from the hull, the master ordered hard starboard rudder (with SP-57B on the ***Atina***'s starboard quarter and the wind coming from dead ahead), pivoting ***Atina*** toward SP-57B and putting the wind and current on the Atina's port side, thus causing the vessel to set toward the platform. As the platform's relative position to ***Atina*** shifted from the tanker's starboard quarter to the starboard bow and the ship pivoted about the anchor chain, the combination of set and the ***Atina*** moving ahead brought the ***Atina*** in contact with SP-57B as the amount of chain in the water lessened and the ship gathered speed.

The probable cause of the contact of tanker *Atina* with the oil and gas production platform SP-57B was the *Atina*'s operating company not ensuring sufficient time for the master's turnover, which resulted in the master's acute fatigue and poor situation awareness during an attempted nighttime anchoring evolution.

Handover Period

Vessel operating companies should ensure that joining crewmembers/personnel are given the opportunity to obtain a sufficient handover period and adequate rest before taking over critical shipboard duties, such as navigation, that could impact the safety of the crew, property, and the environment.

VESSEL GROUP
CARGO, DRY BULK

Contact of Bulk Carrier *Atlantic Huron* with the Soo Locks West Center Pier

Soo Locks, Saint Marys River, Sault Sainte Marie, Michigan

ACCIDENT DATE **July 5, 2020**	REPORT NUMBER **MAB-21-10**
ACCIDENT ID **DCA20FM023**	ISSUED **April 13, 2021**

Figure 49. *Atlantic Huron* under way before the accident. SOURCE: SAULTSTEMARIE.COM

Figure 48. Postaccident photo of the *Atlantic Huron* alongside the west center pier. Point of contact and damage indicated by arrows. SOURCE: COAST GUARD

On July 5, 2020, about 0250 local time, the self-unloading bulk carrier *Atlantic Huron* was transiting the Upper St. Marys River, west of the Soo Locks, in Sault Sainte Marie, Michigan, with a crew of 25. While on approach to the locks and attempting to slow, there was a propulsion problem involving the vessel's CPP system. The vessel subsequently contacted the west center pier at 6.8 knots. Before reaching the lock gate, the vessel's motion was halted, and the crew moored the vessel to the pier. No pollution or injuries were reported. Damages to the vessel ($1,633,000) and pier ($573,000) were estimated at $2.2 million.

The CPP allowed vessel movement ahead or astern without changing the propeller shaft direction. High-pressure hydraulic oil acting on a piston within the propeller hub would alter propeller pitch. A valve assembly above the OD box at the forward end of the shaft controlled oil flow. Hydraulic oil flowed into the OD box and oil transfer tube to the piston within the propeller hub to rotate the blades. As hydraulic pressure moved the piston to achieve desired pitch, this movement transferred to a mechanical follow-up mechanism, providing feedback to the control valve assembly and pitch indication at the CPP, ECR, and bridge.

At 0245, the captain slowed, allowing the vessel to "coast" toward the west center pier. As speed reduced to 3.8 knots, he ordered full astern. He noticed the CPP pitch indicator was "erratic" and received a pitch differential alarm, indicating the requested propeller pitch from the helm station did not match actual pitch. He reported the problem to the ECR.

The EOW had not received any alarms. The ECR pitch indicator matched the bridge's full astern order. After calling the chief engineer, the EOW observed the OD box shifting forward and backward. Moments later, the captain noticed the vessel's speed ahead increase. The chief engineer discovered that the OD box assembly, which normally sat on the shaft with bearings, secured with a "torque stay," or locking pin, had rotated on the shaft.

The captain announced for the chief engineer to call the bridge "immediately." He sounded the general alarm and ordered the second mate to drop the stern anchor. The captain let go the two bow anchors remotely from the bridge. The chief engineer reported the OD box failure and, with the captain's approval, stopped the main engine from the ECR. At 0250, the *Atlantic Huron*'s port bow contacted the pier.

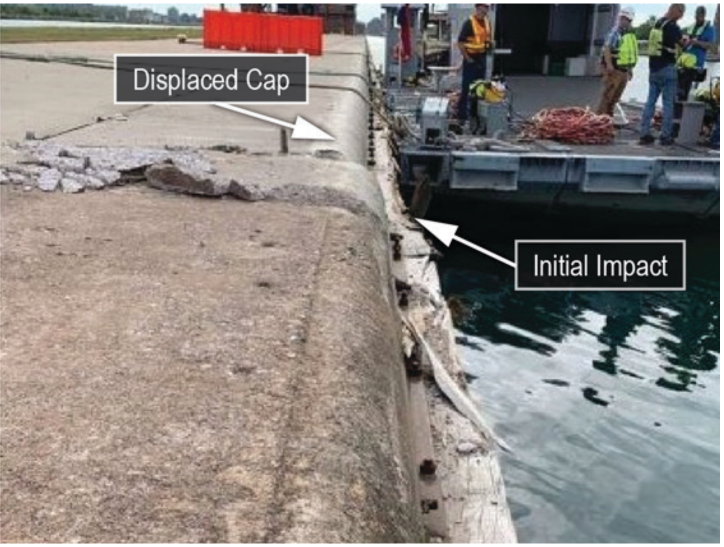


Figure 50. Postaccident photo of the west center pier. The location of initial impact is labeled and evident by a crushed timber fender. Displacement of a timber crib wall concrete cap is also labeled.
SOURCE: US ARMY CORPS OF ENGINEERS

The captain could have stopped the main engine earlier; a main engine emergency stop push button on the bridge was not activated. Given the short period in which the accident unfolded, the captain focused on reaching the chief engineer to diagnose the problem. The company's SMS procedures did not contain a policy for loss of propeller pitch control while in restricted waters. Crewmembers familiar with such a policy would be better prepared to act quickly and, in this accident, may have been more apt to stop the main engine.

Following the accident, "severe damage" to the CPP's valve block assembly was discovered. The pin holding the feedback ring in place had backed out and contacted the feedback arm, damaging both. The set screw holding the pin in place had also backed out. This failure would have inadvertently directed hydraulic fluid, producing a full ahead pitch on the propeller blades when an astern pitch was ordered. Because the feedback mechanism failed, the pitch indicators would have shown the ordered astern pitch.

Technicians discovered that a bearing within the CPP's OD box feedback mechanism had come out of position and jammed against the feedback arm 9 days before the accident, when the (non-accident) captain gave an astern pitch command and the propeller pitch went to full ahead. They also discovered that the OD box was able to move axially on the shaft an "inch or more" due to a worn torque stay. The damage during this previous voyage likely was caused by the same underlying mechanical issue that resulted in the unit's total failure on July 5.

The set screw securing the feedback ring locking pin was required to have thread-locking fluid applied when installed. This set screw was last removed and reinstalled over 4 years before the accident, during a shipyard period. When examined postaccident, technicians found no evidence that thread-locking fluid had been applied.

> The probable cause of the contact between the *Atlantic Huron* and the west center pier at Soo Locks was not following the manufacturer's requirement to use thread-locking fluid during installation of the feedback ring locking pin set screw on the vessel's controllable pitch propeller system, which led to the failure of the controllable pitch propeller's oil distribution box.

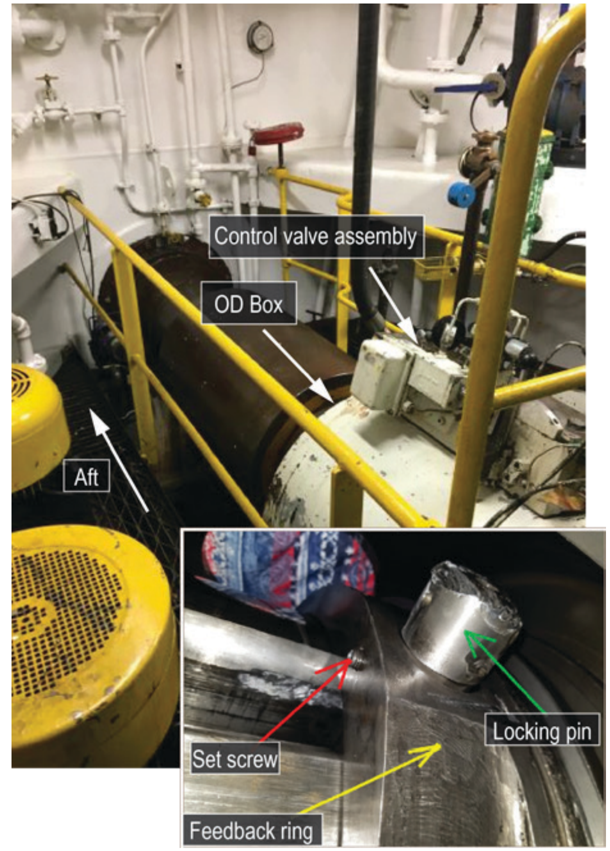


Figure 51. Postaccident photo of vessel's OD box and control valve assembly as viewed looking aft. Lower right: Postaccident photo showing damage to backed-out locking pin. BACKGROUND SOURCES: COAST GUARD, CSL

Loss of Propulsion Control Procedures

Loss of propulsion control in a critical phase of operation demands crewmembers act quickly to mitigate potential accidents. Part of a safety management system should address potential emergency shipboard situations, including loss of propulsion, collision, and contact, and establish ways to respond to them. Due to their unique blade control, vessels with controllable pitch propellers should have specific procedures for loss of engine and loss of pitch control. These emergency procedures should be well understood and practiced by crewmembers both on the bridge and in the engine room.

VESSEL GROUP
TOWING/BARGE

Barge Breakaway and Contact with Interstate 10 Bridge

San Jacinto River Fleet, San Jacinto River, Channelview, Texas

ACCIDENT DATE	REPORT NUMBER
September 19, 2019	**MAB-21-14**
ACCIDENT ID	ISSUED
DCA19FM052	**June 8, 2021**

Figure 52. Barges resting against I-10 bridge pilings after striking and damaging a protective cell. SOURCE: KJRH-TV

On September 19, 2019, at 2338 local time, during historic flood waters and high river current, 11 barges broke free from a San Jacinto River barge fleeting area just north of the Interstate 10 (I-10) bridge in Channelview, Texas, and 6 barges struck pier columns supporting the I-10 bridge. No pollution or injuries were reported. Total damages, including repairs to the I-10 bridge ($5.11 million) and removal of and repairs to the barges ($350,000), exceeded $5.46 million.

The morning of the accident, 11 barges at the San Jacinto River Fleet were secured side by side with fleeting lines and wire ropes and winches that continued outward from tier 3, with the raked bows facing down river. An empty tank barge closest to shore was secured to tier 3's three mooring pilings and two shore-based "dead men" with synthetic fleet mooring lines. Five towing vessels supported fleet operations; their crews regularly performed tier checks at the fleeting area's seven tiers.

As a result of rainfall from Tropical Storm Imelda, the Lake Houston water level rose drastically, releasing increasing amounts of water into the San Jacinto River via the Lake Houston Dam spillway. The dam's high discharge rate during this historic rainfall strengthened the current at the San Jacinto River Fleet 14 miles down river, increasing the force acting on all barges tied to tier 3.

Figure 53. Multibeam sonar images overlayed with above-surface photograph illustrate the damaged columns postaccident (sonar survey taken September 27) on the westbound span of the I-10 bridge. SOURCE: TXDOT

Usually, when severe weather approached, tier 3 barges moved to other tiers to reduce exposure to swifter currents. The port captain had planned to move barges from tier 3 to tier 2; however, the weather changed rapidly, and they did not remove the barges.

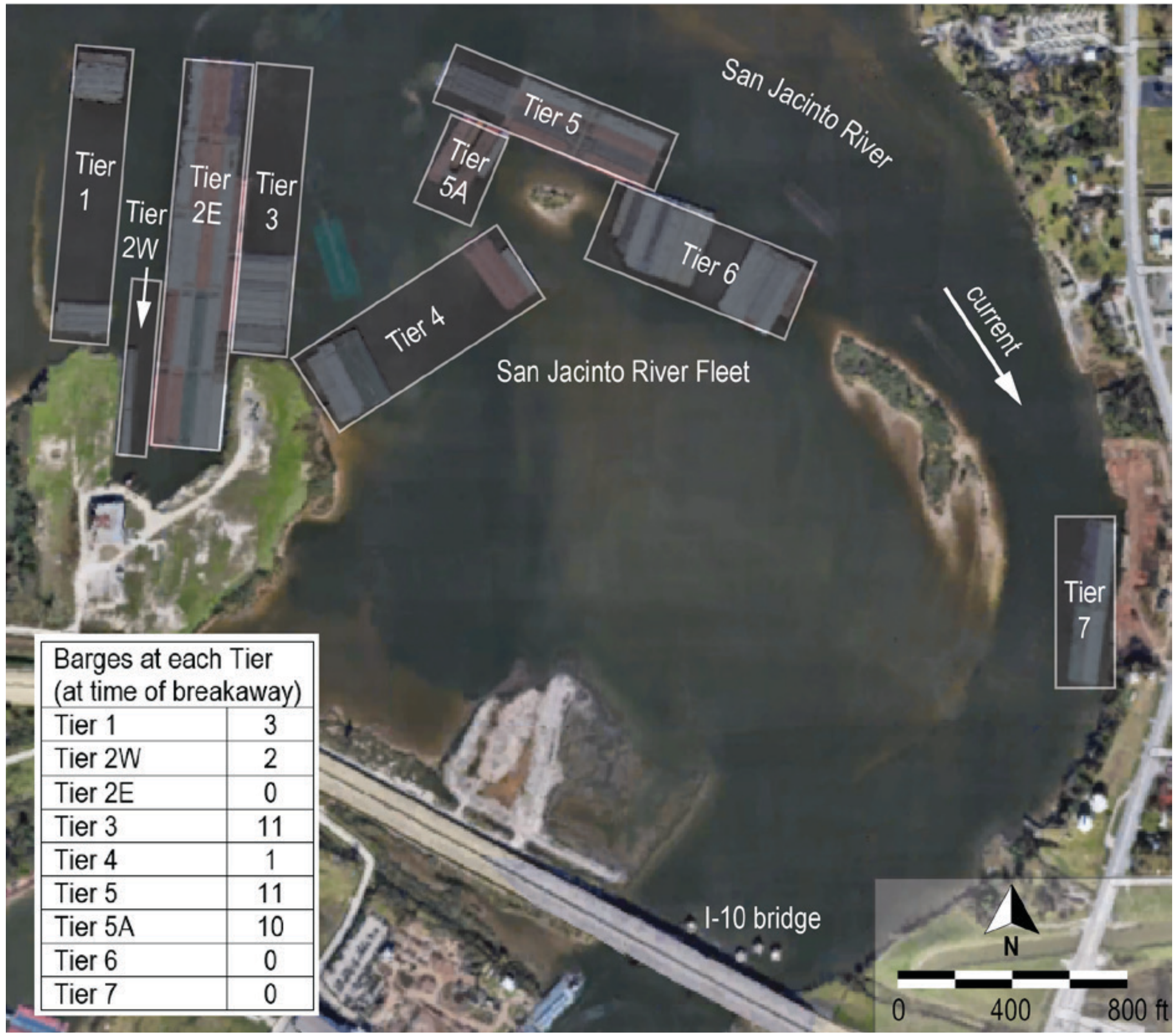
At 2050, a towboat captain and crew observed the 11 barges at tier 3 breaking away. The current's force on the barges had significantly strained the tier 3 moorings and caused the lines to part. Investigators later found parted synthetic mooring lines attached to the pilings and "dead men." It is likely that the strain was not distributed evenly among the lines due to the current, resulting in the mooring lines exceeding maximum load and parting. Once one line failed, the strain would have been placed on the next line, which would also have failed, until the breakaway occurred.

Towboats and crews worked to control the breakaway barges and return them to one of the tiers. Crews were able to transport the two empty barges that separated from the string of 11 barges safety to tier 2 east. The towboat crews struggled to control the remaining breakaway barges as they moved closer to the I-10 bridge. The increasing river current and rising water caused mooring lines and wires to part on a barge in the breakaway group. At 2330, the nine barges topped around and separated into a block of six barges and a block of two barges, with one grounded barge remaining in the mud.

Towboat crews corralled the block of six barges as they drifted down river. At 2337, they contacted and damaged the bridge's protective cell closest to the channel on the eastern bank and then struck and damaged the western bank protective cell. The barges subsequently struck the I-10 bridge fendering system and pilings at 2338. The barges' mooring lines and wires parted upon contact, and two barges became lodged between the I-10 bridge's concrete columns on the west side of the river while four barges continued under the bridge, contacting the bridge's fendering system and concrete pilings as they individually headed down river. Meanwhile, two towing vessels attempted to move two barges to tier 2, but, according to the captains, they were unable to maintain control. The two barges passed under the bridge at 2347 without contacting the bridge structure. Several Good Samaritan towing vessels pushed the six loose barges into the east bank below the I-10 bridge.

The San Jacinto River Fleet should have followed its SMS policies relating to severe weather and swift/flood water plans, implemented its severe weather plan, and taken earlier action to break down longer tiers and secure the vessels in the fleeting area. Had the longer string of barges at the tier been broken down, the resulting shorter strings would have been less vulnerable to swift currents.

The probable cause of the barge breakaway and contact with the I-10 bridge was the force of the river current acting on the moored barges at the San Jacinto River Fleet, which exceeded the capacity of the mooring lines, due to the extreme rise and flow of water in the San Jacinto River from Lake Houston dam's uncontrolled spillway release of water during a historic rainfall event. Contributing was the operating company not rearranging fleeting area tiers to mitigate the effect of current on barge tiers.



Barges at each Tier (at time of breakaway)	
Tier 1	3
Tier 2W	2
Tier 2E	0
Tier 3	11
Tier 4	1
Tier 5	11
Tier 5A	10
Tier 6	0
Tier 7	0

Figure 54. Layout of San Jacinto River Fleet's tiers. Table in lower left corner shows number of barges at each tier at the time of the accident. Photo is not from day of accident. BACKGROUND SOURCE: GOOGLE EARTH

Severe Weather Planning

Marine operating companies should develop and continuously evaluate severe weather plans to prepare for challenges accompanied by tropical storms and/or severe weather with the potential to cause flooding or swift water within their areas of operations. Severe weather can trigger prolonged periods of weather restrictions in navigable river watersheds and create challenging conditions due to high or swift water downstream.

VESSEL GROUP
TOWING/BARGE

Contact of ***Cooperative Spirit*** Tow with Hale Boggs Memorial Bridge Pier

Lower Mississippi River, mile 121.6, near Luling, Louisiana

ACCIDENT DATE	REPORT NUMBER
March 15, 2020	**MAB-21-05**
ACCIDENT ID	ISSUED
DCA20FM015	**February 10, 2021**

Figure 55. *Cooperative Spirit* tow configuration at the time of the accident.

Figure 56. *Cooperative Spirit* moored before the accident.

On March 15, 2020, about 0113 local time, the towing vessel ***Cooperative Spirit***, pushing a 29-barge tow, was transiting downstream on the Lower Mississippi River at mile 121.6 near Luling, Louisiana, when the port side of the tow struck the eastern tower pier of the Hale Boggs Memorial Bridge. The tow broke apart and began floating down river. One of the barges sank, while the remaining barges were recovered by the ***Cooperative Spirit*** and other towing vessels in the area. No pollution or injuries were reported. Multiple barges in the tow, along with other barges moored along the river banks that were struck by drifting barges, were damaged and required repairs. Two barges were determined to be total constructive losses. The estimated cost of damages to the barges and cargo was $1.65 million.

On March 6, 2020, the 200-foot-long towing vessel ***Cooperative Spirit*** departed St. Louis, Missouri, downbound on the Mississippi River with a 30-barge tow and a crew of nine. The tow was arranged six barges wide by five barges long. The total tow size, including the ***Cooperative Spirit***, was 1,195 feet long by 210 feet wide. One of the barges was empty; the rest were loaded with various grain products.

During the voyage, the tow stopped twice to conduct a crew change, during which the pilot rotated out, and to drop off the empty barge. On March 12, the tow stopped again in Vacherie, Louisiana (mile 151) because there was not adequate space in the fleeting area at the tow's final destination of Kenner Bend (mile 115.8). After the captain was informed that space had been cleared, on March 14, about 2317, the tow got under way.

At midnight, the pilot relieved the captain for the 0000–0600 helm watch. After passing a bulker at 0052, the pilot began setting up to maneuver the tow through a left-hand bend in the river at 26 Mile Point. Electronic charting system data from the towing vessel showed the tow moving toward the left descending bank of the river as it approached the bend.

While flanking around 26 Mile Point between 0055 and 0108, the ***Cooperative Spirit*** pilot worked the throttles for the three engines, using varying astern speeds to control the vessel's movement. As the tow completed the flanking maneuver, about 0.8 miles upriver from the Hale Boggs Memorial Bridge, the pilot brought the throttles to the ahead position and began working to line up the tow to pass through the bridge's channel span. At 0109:00 the vessel's port, center, and starboard shafts were turning at 155, 148, and 182 rpm, respectively. The tow's speed over ground was 5.2 mph and increasing.

The pilot stated that, as the tow came out of the turn at 26 Mile Point, the stern of his vessel was too close to the left descending bank, and the current was setting the tow into the bridge pier. About 3 minutes before the accident, the tow's heading was 124°, while its course over ground was 114°, which is consistent with the pilot's statement. Due to high-water conditions, the current was stronger than normal (6 mph), and an eddy may have formed upriver of the bridge along the left descending bank, making maneuvering more difficult.

Although the pilot stated that he used starboard rudder and increased engine speed to counteract the current, video evidence showed that he used limited rudder as the tow approached the bridge. The pilot chose to primarily use increased engine speed in an effort to move the tow to starboard away from the bridge pier, stating that he "tried to outrun [the current]." However, the tow's course over ground did not appreciably change as engine speed increased, while the increasing speed over ground reduced the time the pilot had to maneuver. Ultimately, the pilot's actions in compensating for the strong current were ineffective, resulting in the tow hitting the bridge pier at 11.9 mph.

The tow immediately broke apart, and one barge eventually sank, stern first, about 1 mile down river from the bridge, with its bow remaining above the water. The remaining barges floated freely down river, some contacting barges moored along the river banks, before they were rounded up by the *Cooperative Spirit* and other towing vessels that had responded to the accident.

The probable cause of the contact of the *Cooperative Spirit* tow with a pier of the Hale Boggs Memorial Bridge was the pilot not effectively compensating for the strong current while navigating a turn and approaching the bridge in highwater conditions.

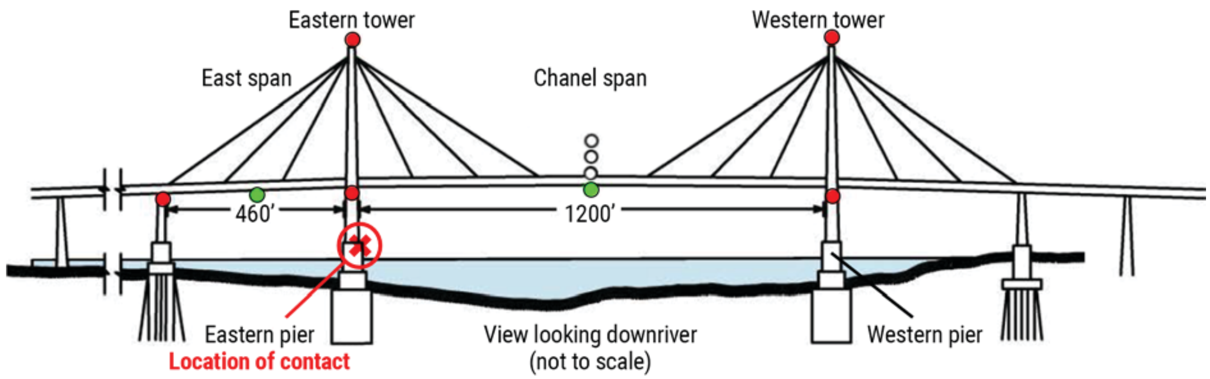


Figure 57. The Hale Boggs Memorial Bridge, with location of bridge strike on eastern tower pier indicated by a red *X*.
BACKGROUND SOURCE: US ARMY CORPS OF ENGINEERS

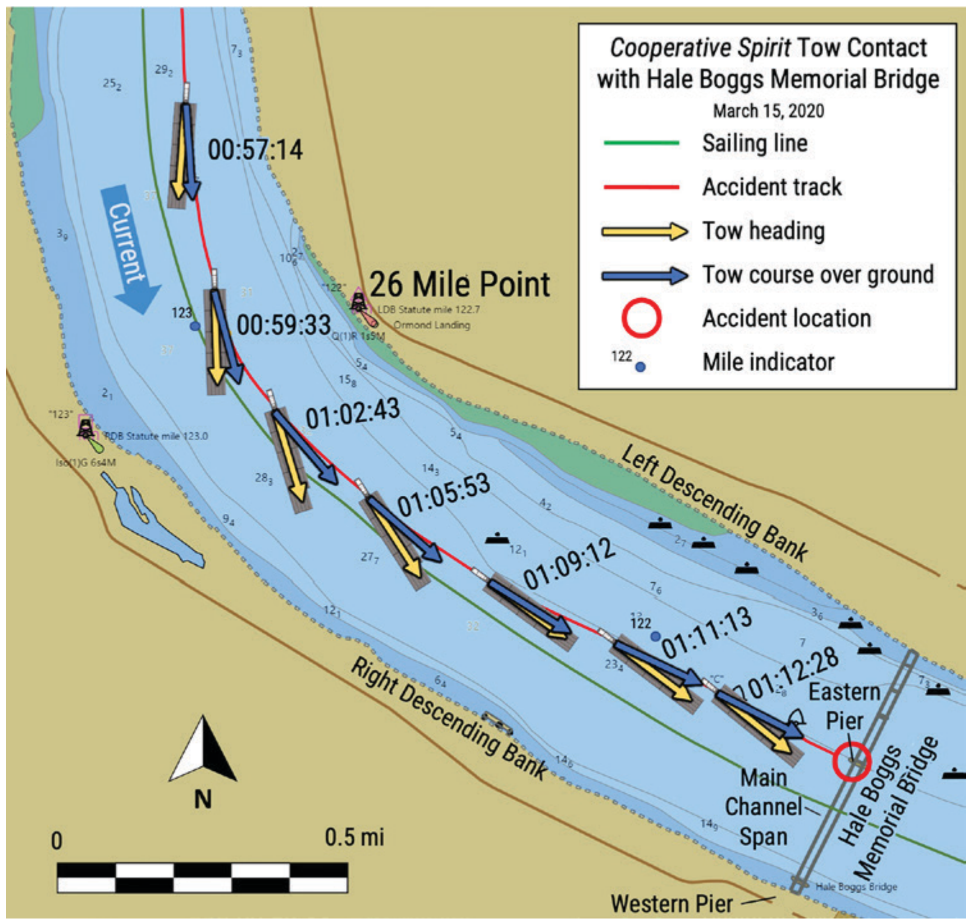


Figure 58. Track of *Cooperative Spirit* tow as it flanked the bend at 26 Mile Point and maneuvered prior to the accident.
BACKGROUND SOURCE: NOAA ENC US5LA52M

VESSEL GROUP
CARGO, DRY BULK

Contact of Bulk Carrier *GH Storm Cat*'s Crane with Zen-Noh Grain Facility

Zen-Noh Grain Facility, Lower Mississippi River, mile 163.8, Convent, Louisiana

ACCIDENT DATE
November 11, 2020

REPORT NUMBER
MAB-21-20

ACCIDENT ID
DCA21FM006

ISSUED
September 30, 2021

Figure 59. *GH Storm Cat* moored in Cork, Ireland, before the accident. SOURCE: JOE MOORE

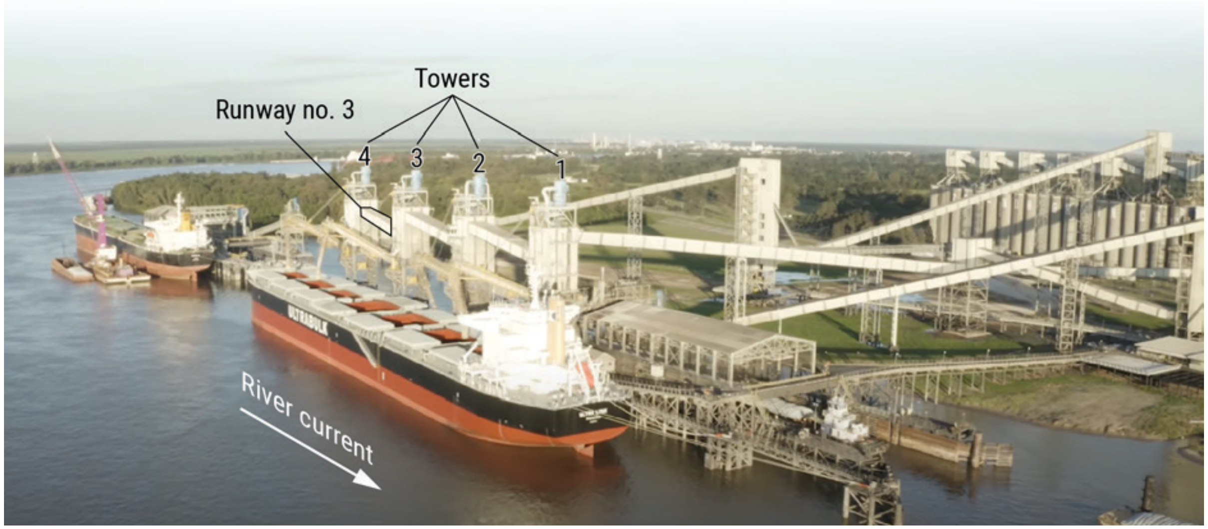


Figure 60. The ZGC shoreside facility before the accident. An unknown vessel, similar to the *GH Storm Cat*, is pictured. Runway no. 3 is noted between towers 3 and 4. BACKGROUND SOURCE: ZGC

On November 11, 2020, about 0910 local time, the bulk carrier *GH Storm Cat*'s no. 1 crane boom contacted the Zen-Noh Grain Corporation (ZGC) facility in Convent, Louisiana, while the crew was completing corn-loading operations. The vessel was moored starboard side to with a crew of 19. No pollution or injuries were reported. The vessel's crane was undamaged; damage to the shoreside conveyor gallery was estimated to be $481,006.

The afternoon before the accident, on November 10, the *GH Storm Cat* arrived at the ZGC facility, which specialized in the offloading of soybeans, corn, and other grains from barges, rail cars, and trucks, and the transfer of these commodities through a network of storage bins and elevators to ocean-going ships. Four towers, interconnected by elevated, enclosed structures known as runways, acted as distribution points to transfer product to the ships.

ZGC employees and vessel crew engaged in corn-loading operations from the shoreside facility into the vessel's five cargo holds. As each hold was filled with corn, a small tractor known as a payloader, owned by ZGC and operated by a ZGC employee, was used to level off the top of the cargo. ZGC employees and vessel crew coordinated to transfer the 8,180-pound payloader between cargo holds and to and from shore via the one of the vessel's four cranes, which were operated by a vessel crewmember.

Figure 61. ZGC-owned and -operated payloader leveling off a cargo hold. SOURCE: ZGC

The morning of the accident, the vessel's crew was removing a payloader from the no. 1 cargo hold, which had been filled. One of the ZGC employees working in the area attached the crane hook to the payloader, exited the hold, appeared to make a hand gesture in the direction of the crane cab, and then crossed over to the port side of the vessel and walked aft, out of the view of the crane operator in the crane. Following the accident, the crane operator indicated that he thought the ZGC employee who had attached the payloader to the crane hook was acting as his signalman for the lift, but the ZGC employee stated he was not.

After the crane operator hoisted the payloader from the top of the hold, he lost view of the ZGC employee who had made the connection, who he presumed would be the signalman for the lifting operation. Instead of stopping the lift and establishing communications with the signalman, as industry recommends, he continued to slew the load over the dock and lower the boom. After positioning the crane boom perpendicular to the vessel and suspending the payloader above the pier, the crane operator began lowering the boom of the crane to position the payloader to be landed on the pier. While lowering the crane boom to land the payloader on the pier, the boom tip penetrated shoreside facility runway no. 3. Had the crane operator stopped the lift and attempted to establish communications when he lost visual contact with the ZGC employee, he would have discovered that he was operating without the aid of a signalman, who likely would have noticed the proximity of the crane boom to the runway and could have intervened to prevent the crane striking the structure.

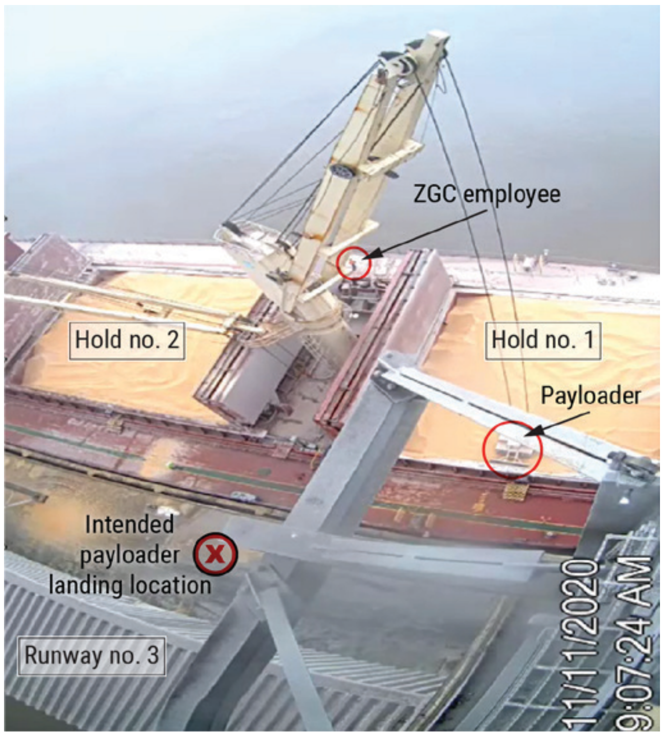


Figure 62. Video footage still image of the *GH Storm Cat*'s crane during the initial sequence of the accident lift (lifting the payloader out of ship's no. 1 cargo hold). BACKGROUND SOURCE: ZGC

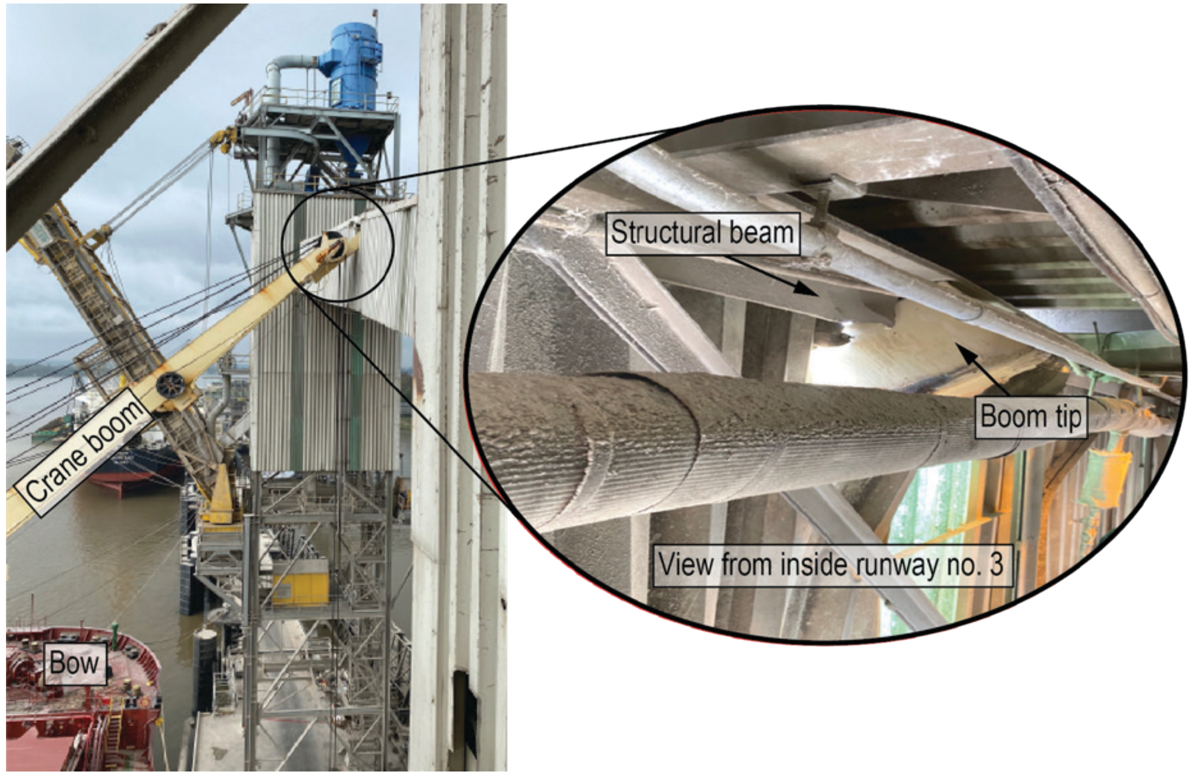


Figure 63. Point of contact of *GH Storm Cat*'s crane boom and ZGC runway no.3. BACKGROUND SOURCE: ZGC

The *GH Storm Cat*'s company quality, health, safety, and environment manual policy required crew to ensure that "the operator and/or the signaler have a clear view for the whole path of travel for the load" for lifts. Following the contact, the crane's cable was cleared of the runway, and the payloader was safely lowered to the pier. Before removing the boom tip from the runway, staff on scene completed an initial damage assessment and took measures to temporarily support the runway.

The probable cause of the *GH Storm Cat*'s crane contact with the Zen-Noh grain facility runway was the absence of a dedicated signalman, which led to the ship's crane operator's misjudgment of the location of the crane boom while lowering the payloader to the pier.

Vessel Crane Operations

All ships' crane lifts—no matter how routine—should be adequately planned and risk-assessed. All personnel involved in the lifting operation should be clearly identified and their duties understood before the start of the lift.

VESSEL GROUP
TOWING/BARGE

Contact of *Island Lookout* Tow with Centerville Turnpike Bridge

Albemarle and Chesapeake Canal, mile 15.2 of South Branch of Elizabeth River to Albemarle and Chesapeake Canal section of Atlantic Intracoastal Waterway, Chesapeake, Virginia

ACCIDENT DATE
November 14, 2020

REPORT NUMBER
MAB-21-23

ACCIDENT ID
DCA21FM005

ISSUED
November 9, 2021

Figure 65. *Island Lookout*, pushing a barge similar to the BH 2903, under way before the accident.
SOURCE: BUNGE GRAIN FACILITY

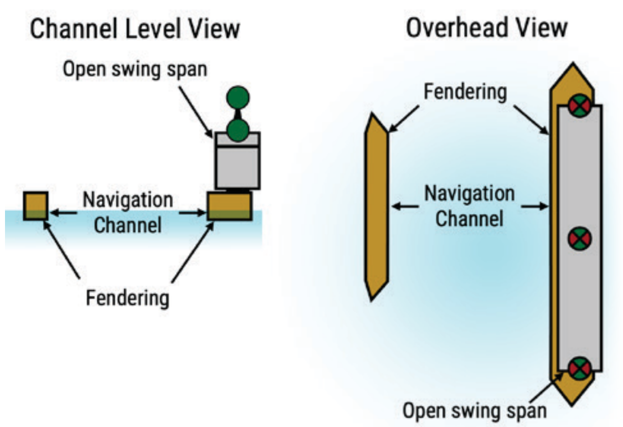
On November 14, 2020, about 0435 local time, the towing vessel *Island Lookout* was transiting eastbound on the Albemarle and Chesapeake Canal near Chesapeake, Virginia, pushing ahead barge *BH 2903*, which was loaded with scrap steel. As the tow was attempting to pass through the Centerville Turnpike Bridge, the barge struck the swing span of the bridge while it was opening. No pollution or injuries were reported. Estimated damages amounted to $2.86 million for the bridge and $34,000 for the barge.

At 2335 on November 12, the 65-foot-long towing vessel *Island Lookout* departed Baltimore, Maryland, pushing ahead the loaded 295-foot-long barge *BH 2903*, en route to Hertford County, North Carolina. The vessel had a crew of four: a captain, a mate, and two deckhands.

On the night of November 13, the mate relieved the captain for his normal 2200–0500 helm watch. After a turnover discussion, the captain went to his cabin to sleep, and the mate was alone in the wheelhouse. Just before 0400 the next morning, the mate maneuvered the *Island Lookout* and its tow into the Albemarle and Chesapeake Canal from the Elizabeth River.

At 0427:37 the *Island Lookout* was headed eastbound on the canal 0.5 miles from the Centerville Turnpike Bridge (a swing bridge). The mate radioed the bridge's operator about this time to request an opening. The mate stated that he had to call the bridge operator four times before he received a response. After each unanswered radio call, he slowed the towing vessel's engines; between 0428:07 and 0429:27, the vessel slowed from 4.5 to 3.9 knots. Video footage of the bridge at the time of the accident showed no vehicle traffic on the bridge or approaching roadway, and the bridge operator reported no delay in opening due to vehicles on the bridge. The warning gates began to close at 0431:46, and at 0432:29, the swing span began to open. Although VHF channel 13 communications were not recorded, the evidence is consistent with the *Island Lookout* mate's account, and the bridge operator likely did not respond to his request for opening until about 3 minutes 30 seconds after the first radio call.

Figure 64. Simple representation of swing span lighting.



When the swing bridge was about halfway open, the *Island Lookout* mate determined that the bridge would not be open in time for the tow to safely pass through. He attempted to avoid contact with the bridge by putting both engines full astern. However, the barge turned to port as the tow slowed, risking a collision with boats moored at a marina located adjacent to the bridge. The mate responded to the port turn by moving the port engine throttle to the ahead position and the rudders to starboard, which arrested the turn but reduced the tow's rate of deceleration. By the time the bow of the barge was about 175 feet from the bridge, the tow's speed had reduced to 2.8 knots, but its momentum carried it toward the bridge. At 0434:39, the forward starboard corner of the barge struck the end of the swing span.

Regulations governing bridges over navigable waters state that bridges must open promptly and fully for the passage of vessels. However, bridges can be delayed in opening for a variety of reasons, so vessel operators must be prepared to slow or stop in time to prevent an accident. Using the range lights on the bridge, the mate on the *Island Lookout* would have been able to determine the position of the swing span throughout its opening sequence and therefore should have had a clear understanding of the status of the bridge as he made his approach. He had 10 years' experience operating the *Island Lookout* with a barge in the Albemarle and Chesapeake Canal and thus understood the maneuvering limitations of the tow and the restrictions of the waterway. The evidence suggests, however, that the mate misjudged his speed of approach relative to the position of the bridge as it opened and did not sufficiently slow the vessel in time to safely pass.

The probable cause of the contact of the *Island Lookout* tow with the Centerville Turnpike Bridge was the mate's misjudgment of the tow's speed of approach relative to the status of the swing bridge opening, which resulted in insufficient time to slow the tow and avoid striking the bridge before it was fully open and safe to navigate.

Figure 66. Centerville Turnpike Bridge in the closed position. BACKGROUND SOURCE: CITY OF CHESAPEAKE

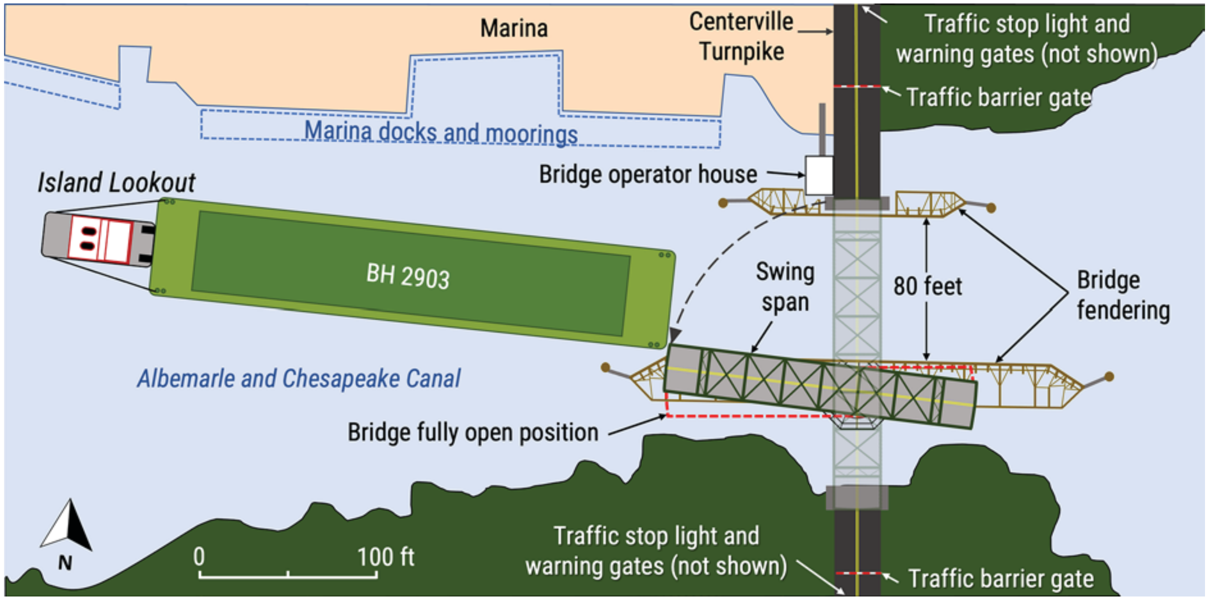


Figure 67. Illustration of the Centerville Turnpike Bridge at the time of the accident.

VESSEL GROUP
CARGO, LIQUID BULK

Contact of Liquid Petroleum Gas Carrier *Levant* with Mooring Dolphin

Petrogas Ferndale Wharf, about 5 miles west of Ferndale, Washington

ACCIDENT DATE
December 15, 2019

ACCIDENT ID
DCA20FM006

REPORT NUMBER
MAB-21-02

ISSUED
January 19, 2021

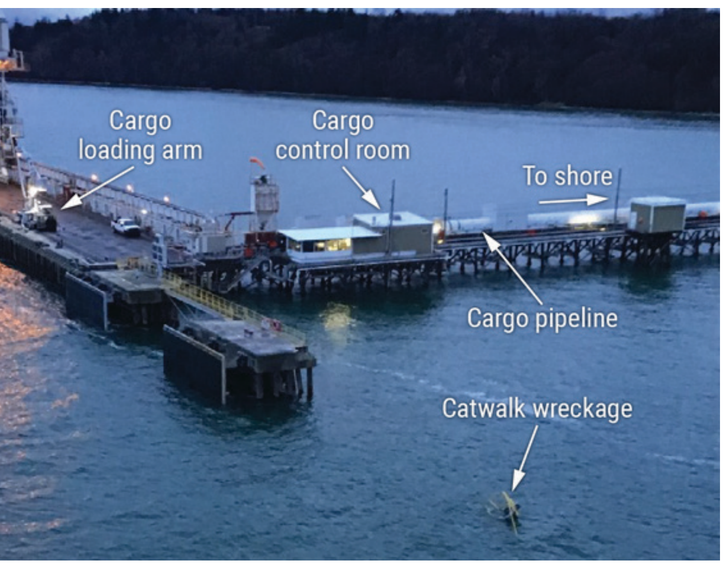


Figure 68. Petrogas Wharf on the morning of December 15 with the catwalk and south mooring dolphin missing.
BACKGROUND SOURCE: COAST GUARD

Figure 69. The Petrogas Wharf with a tanker of similar size to the *Levant* docking starboard side to the wharf.
BACKGROUND SOURCE: PETROGAS, LLC

On December 15, 2019, about 0406 local time, the liquefied petroleum gas carrier ***Levant*** was shifting 0.7 miles from its anchorage to the Petrogas Ferndale Wharf in Ferndale, Washington, when it struck the wharf's south mooring dolphin. The mooring dolphin and catwalk connecting it to the wharf were destroyed, and the ***Levant's*** forward ballast tank was penetrated and flooded. There were no injuries to the vessel's crew or persons on the wharf. There was no release of pollutants or the ship's liquified cargo of propane and butane. Damage to the vessel was estimated at $1.5 million. Damage to the south mooring dolphin and adjoining catwalk was estimated at $6.75 million.

The ***Levant*** first moored at the Petrogas Wharf on December 10, 2019, to load a full cargo. After about 3 days, the master decided to take the ship to deeper water and return to the wharf when the tide was high enough to complete loading operations. When the pilot arrived for the maneuver on December 14, he and the master conducted a master/pilot exchange and agreed that the pilot would remain on board until the early morning shift back to the wharf. The ***Levant*** then shifted off the wharf and anchored about 0.7 miles away.

At 0341 on 15 December, the master commenced heaving the port anchor. The master recalled the pilot saying they would approach the Petrogas Wharf at a 65° heading and then turn the vessel to line up with the wharf. The pilot explained there would be a tug fast on the stern and a tug on the port bow, "same as before."

There was not an effective information exchange between the pilot and bridge team prior to getting under way. While certain conditions of the December 14 master/pilot exchange had not changed since the pilot last departed the bridge, variables such as wind, current, and tidal conditions were different for the docking. Unlike a passage where a vessel proceeds to sea or picks up a pilot for passage to a dock, the ***Levant*** was shifting only a short distance back to a wharf where it had been just hours earlier using the same pilot and tugs; a condition of complacency likely existed among the pilot and members of the bridge team.

The pilot began issuing helm and propulsion orders at 0354, and two minutes later he ordered slow ahead. Following that, the pilot informed the master that the current was setting to the north-northwest along the shoreline at a velocity he calculated at 1.2 knots. At 0401, at a speed of 4.5 knots, the pilot ordered dead slow ahead. For about the next 2 minutes the master and pilot conversed about non-navigational matters.

At 0403 the pilot ordered the rudder hard to port. The pilot recalled that, "something didn't feel right," so he briskly walked out to the starboard bridge wing. The

Levant's bow was less than two ship lengths from the wharf's south mooring dolphin. The *Levant* approached the Petrogas Wharf at too steep of an angle, at an excessive speed for the proximity to the wharf. With two high-powered tractor tugs available and no time pressures, the option to approach the wharf at a slower speed was available. At 0405, at a speed of 4.5 knots, the pilot ordered stop engine and the tug aft to pull straight back. About 1 minute later, the *Levant* struck the south mooring dolphin.

The lack of shared mental model between the pilot and bridge team diminished the bridge team's capacity to monitor the passage and alert the pilot should any deviations from the plan occur. Additionally, both the pilot and master were likely distracted by a non-pertinent conversation about 3 minutes before the contact. The vigilance of a pilot and bridge team should be increased, not decreased, with a ship's proximity to dangers.

By the pilot's own admission, he was not paying attention to the vessel's position in relation to the dangers a short distance ahead and had no expectation of the master or the bridge team to provide him any information. The bridge resource management fundamentals of planning, communication, use of all available resources, monitoring, and management of distractions are essential to operations with a pilot on board a vessel. Had these fundamentals been effectively employed, opportunities to detect problems may not have been missed.

The probable cause of the contact of the liquid petroleum gas carrier *Levant* with a mooring dolphin at the Petrogas Ferndale Wharf was the pilot's approach with excessive speed and at too steep an angle, resulting from the pilot's and bridge team's poor bridge resource management.

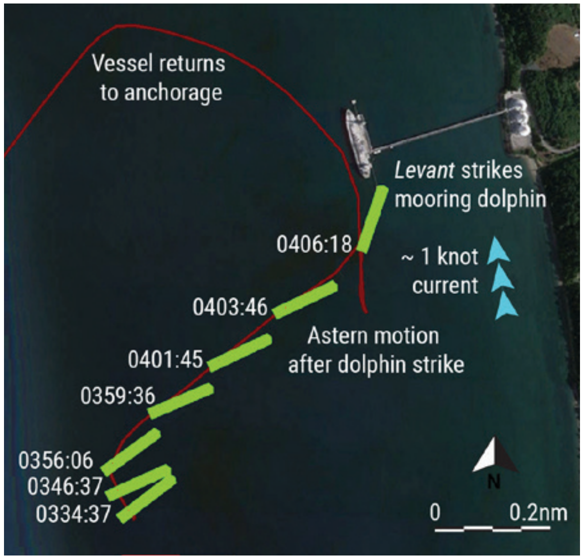
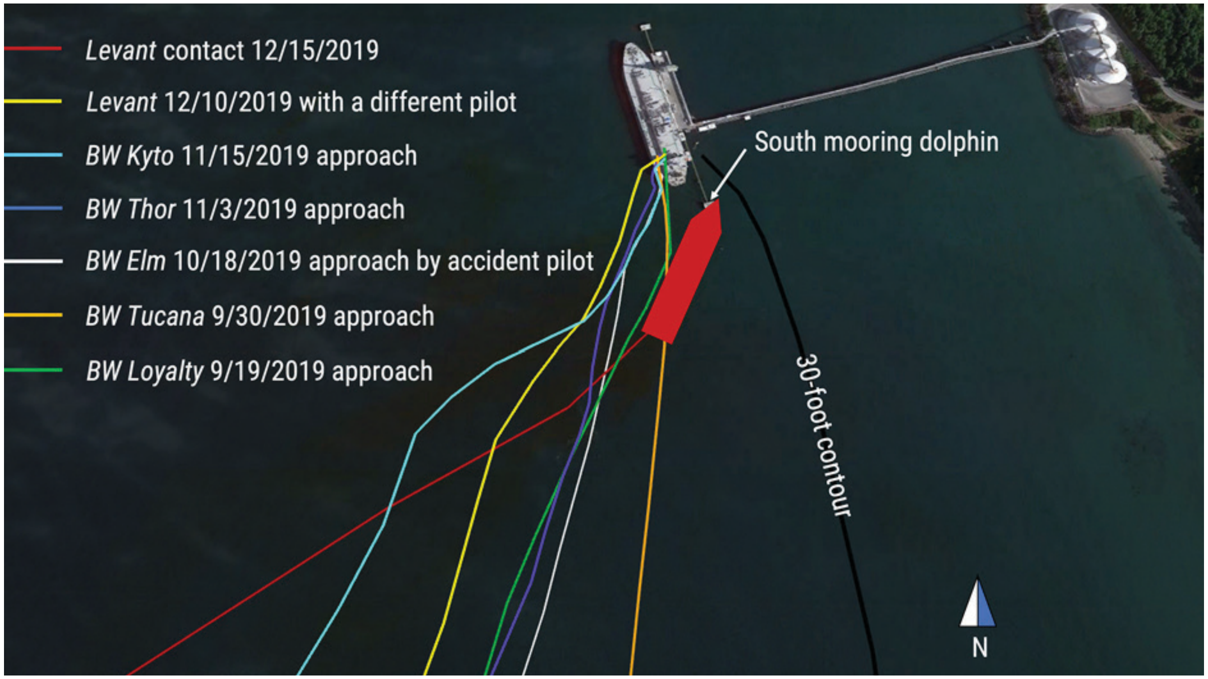


Figure 70. The *Levant*'s positions as it moved from the anchorage to the Petrogas Wharf, based on AIS data. Vessel scale approximate; vessel at pier was not present at the time of the accident.

BACKGROUND SOURCE: GOOGLE EARTH

Figure 71. Below: AIS tracks of all liquid petroleum gas carrier approaches to the Petrogas Wharf from September 19 to December 15, 2019. Included is the initial approach of the *Levant* to the wharf on December 10 (*yellow line*), and the accident pilot's last approach to the wharf on October 18 (*white line*). *Levant* scale approximate; vessel at pier was not present at the time of either approach.

BACKGROUND SOURCE: GOOGLE EARTH



Passage Planning for Short Transits

Regardless of the length of the transit or maneuver, the master/pilot exchange is a critical opportunity for a pilot and bridge team to establish and share necessary information (shared mental model) for the task ahead.

Contact

VESSEL GROUP
TOWING/BARGE

Contact of ***Old Glory*** Tow with Peter P. Cobb Memorial Bridge

Intracoastal Waterway, Indian River, mile 965, Fort Pierce, Florida

ACCIDENT DATE **August 19, 2020**	REPORT NUMBER **MAB-21-13**
ACCIDENT ID **DCA20FM025**	ISSUED **June 2, 2021**

Figure 72. *Old Glory* under way.
SOURCE: RIVER VENTURES, LLC

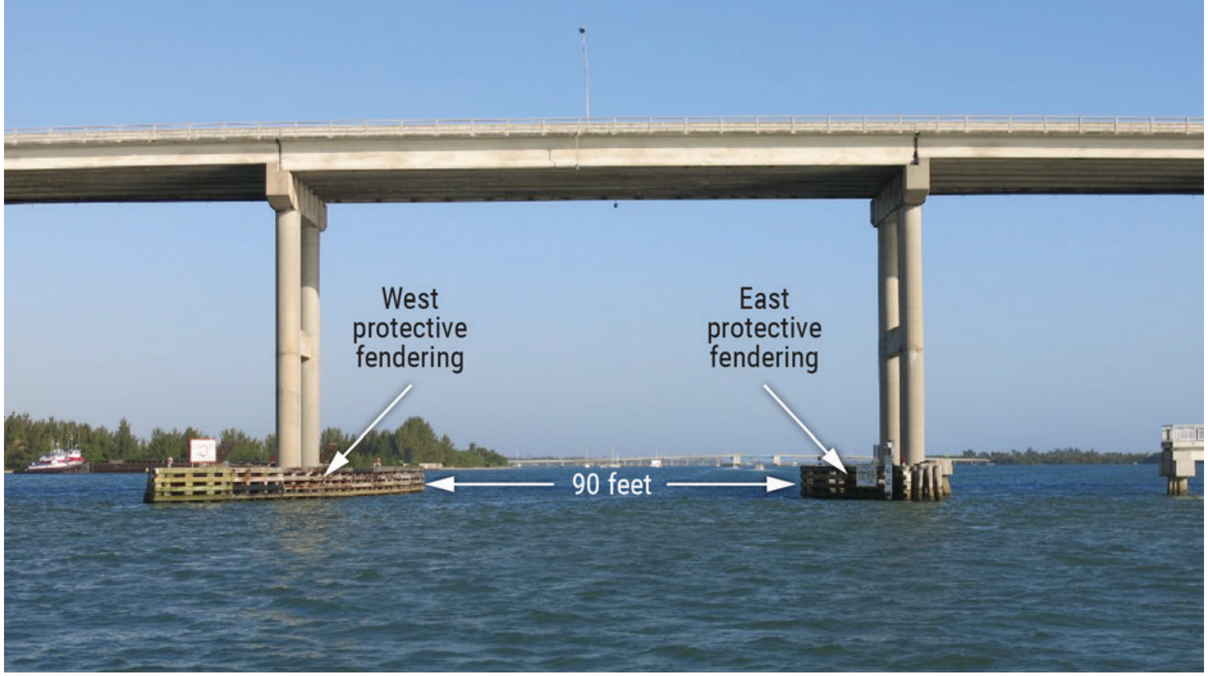


Figure 73. The ICW approach to the Peter P. Cobb Memorial Bridge from the south.

On August 19, 2020, about 0251 local time, the towing vessel ***Old Glory,*** pushing the loaded hopper barge ***Cole*** northbound on the ICW, struck the protective fendering for the Peter P. Cobb Memorial Bridge at mile 965 near Fort Pierce, Florida. There were no injuries to the four crewmembers on the ***Old Glory***, and there was no pollution reported. Damage to the barge was estimated at $5,000. Damage to the protective fendering was $641,000.

About midnight on August 19, 2020, the relief captain took over the watch. At 0245, the ***Old Glory*** was about a half mile south of the Peter P. Cobb Memorial Bridge. According to the relief captain, the current started to set the tow from the center to the west side of the channel. About 0246, the barge's bow was outside the channel's western limit. The relief captain said he was caught off guard, not expecting the current to be running, considering that the time he was passing through the bridge was near low tide (which he understood to be 0230, rather than 0340, the predicted low tide at the location nearest to the accident). Both the *United States Coast Pilot* and navigational charts had information on "strong cross" and "extremely fast" currents near the Peter P. Cobb Memorial Bridge.

At 0248, about a quarter mile from the bridge, both the ***Old Glory*** and ***Cole*** were now outside the channel's western limit by about 65 feet. The relief captain explained that the current took the head of the tow to the west (port), which he was not expecting; he applied rudder correction to starboard. At 0249, the tow had returned to the channel's western limit with a speed of 6.1 mph. The relief captain observed the current again set the tow to the west just before the vessel reached the bridge.

As he approached the bridge, the relief captain said he began to slow the tow, which in turn reduced the maneuverability of the tow while the current pushed the tow to the western limit and then outside of the channel into the northern approach to the Fort Pierce City Marina channel. The relief captain explained that "the boat started bogging down," and he could "not bring the head back up." He tried to "twist" the ***Old Glory***'s stern to get the "head [of the tow] in there, as it is, to go through the bridge." At 0250, the head of the tow neared the southern end of the west protective fendering. The last time the relief captain checked, the vessel's speed was 4 mph. He noted he was "backing down," but not getting the power he expected.

The relief captain steered the tow into the bridge's east fendering, which he considered the safest place to strike since it did not affect any bridge structures. At 0251, the barge's port side touched up against the west-side fendering, and its starboard bow struck the middle eastern fender wall. The starboard-side face wire also parted.

The tow became wedged under the bridge, where the vessel owner, and the crew replaced the starboard face wire. According to the relief captain, "when the tide finally changed," the tow "straightened itself out" under the bridge and floated out to the south with the rising tidal flow, and the tow was back under way and passed through the bridge at 0635.

Although the relief captain acknowledged the available navigational information on the vessel's ECS and in the *Coast Pilot* publication, he did not use all the resources available to him. Towing vessel regulations require the officer of a navigational watch to conduct a navigational assessment, using all resources available to gather information on conditions that could impact the safety of navigation. Had the relief captain been aware of the cautionary note and information contained in the *Coast Pilot*, he would have been better prepared to address the risk of strong currents often seen near the bridge.

The probable cause of the contact of the towing vessel *Old Glory* and barge *Cole* with the Peter P. Cobb Memorial Bridge protective fendering was an inadequate navigational assessment that did not identify the risk of strong cross-currents in the area of the bridge transit.

Familiarization with Local Information

The *Coast Pilot* and navigational charts are valuable sources to mariners that contain amplifying information on local conditions such as tides and currents, channel characteristics, and bridge descriptions. It is important to check the *Coast Pilot* and charts when developing voyage plans to improve knowledge of an area and prepare for a safe passage.

Figure 74. Postaccident damage to the eastern fendering of the bridge looking to the south (*left*) and to the north (*right*).
SOURCE: COAST GUARD

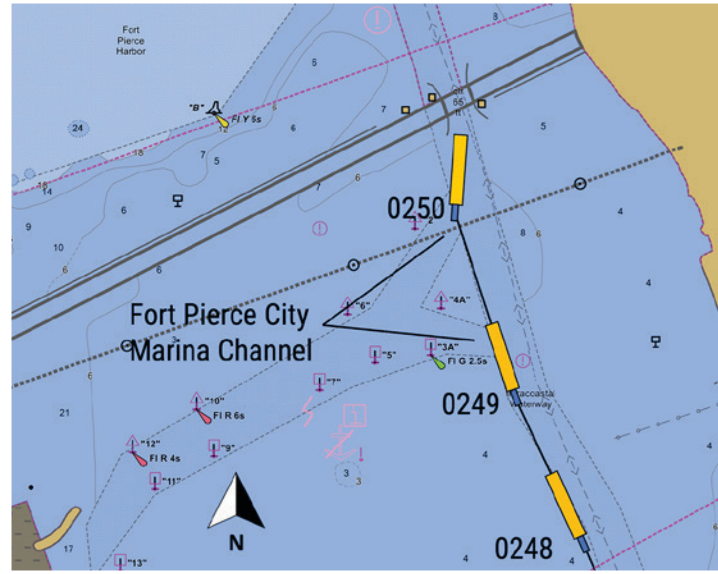


Figure 75. AIS trackline of the *Old Glory* and *Cole* outside of and alongside the western boundary of the ICW.
BACKGROUND SOURCE: PORTVISION

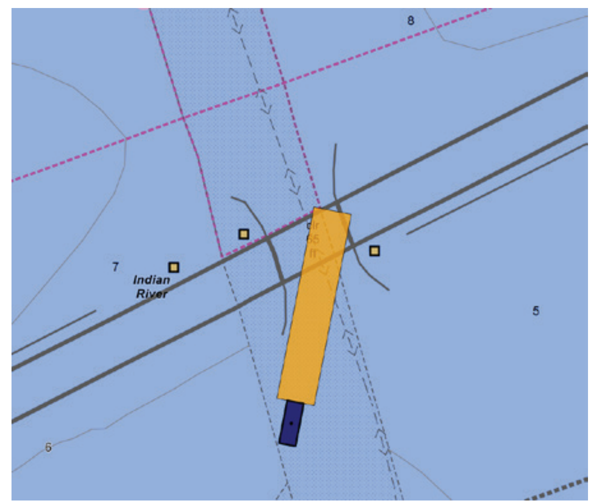


Figure 76. The approximate position of the tow after striking the protective fendering system under the Peter P. Cobb Memorial Bridge.
SOURCE: NOAA CHART USFL88M

Contact

VESSEL GROUP
TOWING/BARGE

Contact of ***Savage Voyager*** Tow with Jamie Whitten Lock & Dam

Jamie Whitten Lock & Dam, Tennessee-Tombigbee Waterway, mile 411.9, near Dennis, Mississippi

ACCIDENT DATE
September 8, 2019

REPORT NUMBER
MAB-21-06

ACCIDENT ID
DCA19FM049

ISSUED
February 19, 2021

Figure 77. Preaccident photo of *Savage Voyager*.
SOURCE: JEFF CUMPTAN

Figure 78. A tow with a similar arrangement to the *Savage Voyager* locking down in the lock chamber after the accident, with newly repainted warning line. BACKGROUND SOURCE: US ARMY CORPS OF ENGINEERS

On September 8, 2019, at 0355 local time, the towing vessel *Savage Voyager* and its tow of two loaded tank barges were engaged in southbound locking operations at the Jamie Whitten Lock & Dam on the Tennessee-Tombigbee Waterway, 6 miles from Dennis, Mississippi. After lock operations began, the bow of barge *PBL 3422* contacted the lock's upper gate sill and was hung up as the water level dropped, resulting in hull failure and a cargo tank breach. About 117,030 gallons (2,786 barrels) of crude oil were released into the lock. No injuries were reported. The damaged barge cost $402,294 to repair, and costs to return the lock to service 18 days later were about $4 million.

On September 4, 2019, at 1620, the *Savage Voyager*'s tow got under way southbound on the Upper Mississippi River from Hartford, Illinois, en route to Tuscaloosa, Alabama. The tow's barges, *SMS 30056* and the *PBL 3422*, were secured in a line, stern to stern, with the *SMS 30056* forward and the *PBL 3422* aft, pushed by the *Savage Voyager*. The vessel was 83.5 feet long, and each barge was 297.5 feet long, giving the tow a total length of 678.5 feet.

By 0330 on September 8, the tow had arrived at the Jamie Whitten Lock & Dam on the southern end of Bay Springs Lake, Mississippi. The pilot radioed the lock operator to request permission to conduct downbound locking operations. About 0345, the lock operator granted permission, and the pilot maneuvered the tow through the open upper gate and into the 600-foot-long lock chamber.

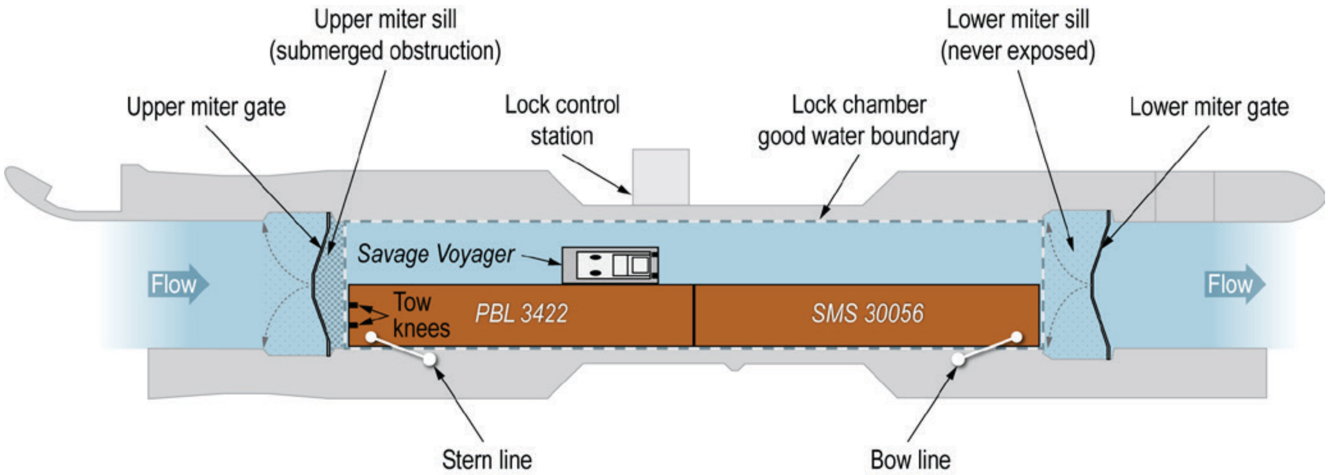


Figure 79. Depiction of *Savage Voyager* tow prior to locking down (towboat position approximate).

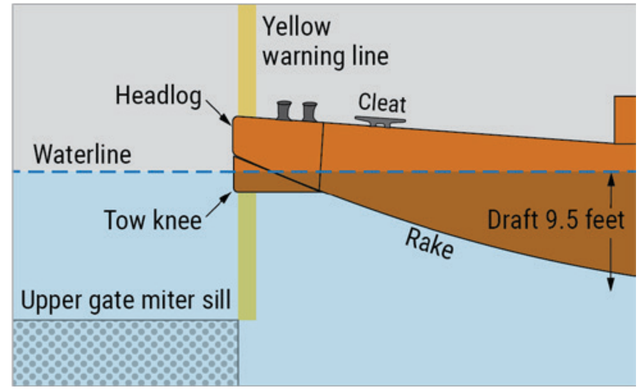


Figure 80. Depiction of the *PBL 3422* in lock chamber during lock operations (not to scale).

The on-watch deckhand and tankerman followed the Corp of Engineers' standard operating procedures and used two lines (one forward and one aft) to secure the two barges inside the lock chamber. The 678.5-foot-long tow would not fit in the lock chamber, so the crew "knocked out" the ***Savage Voyager*** and secured the towboat alongside the barges, ensuring the tow did not cross the yellow warning line that marked the upper gate's submerged miter sill.

The pilot radioed the lock operator to inform him that the crew was ready to commence lock operations. The lock operator closed the upper gate, then closed the fill valves and opened the emptying valves so that the water level began to drop. During the locking—a total descent of 83 feet at the time—the deckhand (on the rake of the *PBL 3422*) and tankerman (on the rake of the *SMS 30056*) were responsible for tending their respective lines to keep the tow within the lock chamber. With the *Savage Voyager* at the barge's side, the tow's length was reduced to 595 feet, and the crew had only 5 feet of clearance in which the tow might safely move, leaving a very small margin of error and requiring the deckhand and tankerman to closely watch their respective lines.

At some point during locking, the *PBL 3422* crossed the upper gate's yellow warning line, placing the tow in danger of contacting the miter sill. Postaccident testing by the Corps of Engineers showed it took a combined 3 minutes and 58 seconds for the water level to drop to the sill. The *PBL 3422*'s tow knees were 1.6 feet below the surface of the water; therefore, a 21.4-foot drop would likely have resulted in contact with the sill. With the water lowering at a calculated average rate of about 1 foot every 10.3 seconds, after about 3.7 minutes, the barge's tow knees would have contacted the sill. The deckhand stated that he noticed the barge was stuck "maybe a couple seconds after" locking began. However, it would have taken over 3 minutes after lock operations began for the barge to contact the miter sill, so it is unlikely that the deckhand was attentively minding the stern line. Additionally, the tankerman was not aware that the vessel was out of position until the deckhand radioed him. Had the deck crew been vigilantly monitoring the vessel's position, they would have noticed the barge was out of position before it became stuck on the sill and could have alerted the pilot.

Once the *PBL 3422*'s rake became hung on the concrete miter sill, the deckhand notified the pilot, who sounded the towboat's general alarm and radioed the lock operator to halt the locking process. However, since it took over 2 minutes for the emptying valves to fully close, the water continued to rapidly descend in the lock chamber, and the barge became hung on the sill, bending the rake and breaching the forward cargo tank before the barge dropped into the water.

The probable cause of the contact of the *Savage Voyager*'s tow with the Jamie Whitten Lock & Dam was the tow moving out of position in the lock chamber while locking down when the crew did not effectively monitor and maintain the vessel's position during its descent, resulting in the aft barge becoming hung on the upper gate miter sill.

Vigilance During Lock Operations

Although locking operations can seem routine, the margins for safety are frequently low. Maintaining vessel position and communication with the lock operator are critical practices to ensure safe lockage. Crews should avoid complacency and vigilantly monitor lines at all times to prevent "running" in a lock.

VESSEL GROUP
TOWING/BARGE

Contact of *Trent Joseph* Tow with Barataria Bridge

Barataria Waterway, Barataria, Louisiana

ACCIDENT DATE	REPORT NUMBER
November 22, 2020	**MAB-21-22**
ACCIDENT ID	ISSUED
DCA21FM008	**November 1, 2021**

Figure 81. *Trent Joseph* (*above*) and *George C* (*below*) under way before the accident.
SOURCES: COASTAL TOWING, LLC; CVITANOVIC TOWING, LLC

Figure 82. Postaccident damage to Barataria Bridge looking north. SOURCE: ANONYMOUS

On November 22, 2020, about 2122 local time, the towing vessels *Trent Joseph* and *George C* together were towing two barges southbound in the Barataria Waterway near Barataria, Louisiana. While passing through the open Barataria Bridge, the second barge contacted the bridge's swing span. The bridge, which was the only means of road access for the community of Barataria, was damaged and remained unusable until November 28. There were no injuries and no pollution reported. Damage to the barge was negligible, while damage to the bridge was reported to be more than $500,000.

About 2003, the tow was on the Gulf Intracoastal Waterway west, en route to Grand Isle, Louisiana. The 67-foot-long *Trent Joseph* was operating as the lead boat and towing two barges behind in a single string by means of a tow bridle and shock line. The combined length of the barges was about 404 feet, with the larger aft 51-foot-wide barge extending about 3 feet wider on each side than the forward barge.

Aft of the barges, connected by a tow line, was the 68-foot-long tail boat *George C*. Acting based on the instructions given by the captain of the *Trent Joseph*, the tail boat would use its propulsion and steering to keep the barges from running over the lead boat if it were to slow down or stop, or to help move the tow to port and starboard as needed. Overall, the estimated length of the tow was 624 feet.

About 2100, the tow turned into the Barataria Waterway; about 0.9 miles ahead was the Barataria Bridge, a swing bridge owned and operated by the Louisiana DOTD. Because of the following current, which was estimated to be about 1.4 mph, the captain of the *Trent Joseph* ordered the tail boat *George C* to "clutch reverse." About 2104, the captain of the *Trent Joseph* called the Barataria Bridge tender by radio to request it be opened. The bridge tender logged the bridge as being open at 2110, when the *Trent Joseph* was about 0.5 miles north of the bridge.

About 2121, when the *Trent Joseph* was about 100 feet from the bridge, the captain saw the northeast-facing corner of the open swing span had "over-rotated" and extended past its protective fender wall. He called the captain of the *George C* by radio and told him to keep an eye on the bridge and to "do what he had to do" to keep the barge from hitting it.

As the *Trent Joseph* passed through the bridge's navigable channel, the barges began to fall to starboard towards the swing span and protective fender. The captain of the *Trent Joseph* corrected (steered) to port. The *George C*'s captain was then able to see the swing span (his view had previously been obstructed by equipment on the aft barge), and he, too, noticed the bridge span protruding past the fender. He called the captain of the *Trent Joseph* but did not receive a reply, so he kept his vessel in clutch reverse. He noted that after the correction, with the fair tide, everything went "sideways" to the bridge.

At 2122, at a speed over ground about 2 mph, the starboard forward side (port aft quarter) of the aft barge struck the northeast-facing corner of the swing span and dislodged it from its mounting and supports. After the accident, the swing span was lifted back into the closed position and opened to vehicular traffic on November 28, 2020; the bridge remained closed to marine traffic and was later destroyed during Hurricane Ida on August 30, 2021.

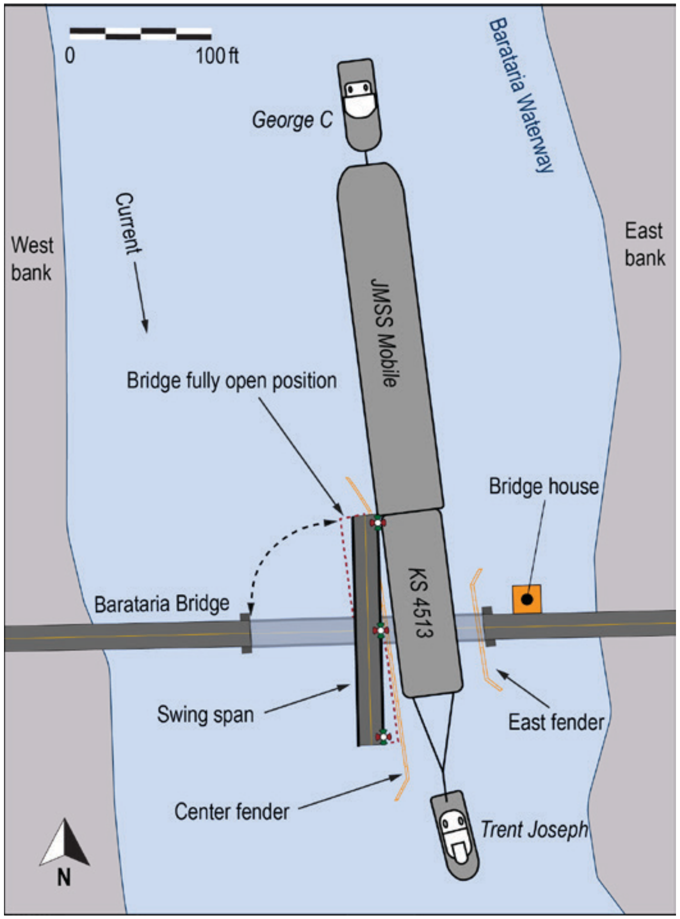


Figure 83. Estimated position of the *Trent Joseph* tow as it passed through the Barataria Bridge and approximation of the contact of barge *JMSS Mobile* with the northeast corner of the swing span. (Navigation lights not to scale.)

Photos taken at the scene and a postaccident survey report confirmed that the swing span's beam was struck by the aft port corner of the aft barge. By design, the protective fender was in place to shield the swing span from being struck when rotated to the open position. As such, if the swing span had been behind the fender as it should have been, the tow would have contacted the fender instead of striking the swing span. Although the fendering system contained previous damage, if the tow had contacted the fender, damage (if any) to the fendering would have been minimal due to the tow's low speed.

Louisiana DOTD maintenance records indicated that, 2 days before the accident, work had been conducted on the bridge's limit switches (which prevent the movement of the swing span beyond a predetermined point). Additionally, work had previously been performed on the limit switches on four occasions dating back to October 2019. Although no detail was provided in the maintenance records as to what sort of work and return-to-service testing was conducted, these records indicate a recent issue with the span's opening rotation limit.

The probable cause of the contact of the tow of the *Trent Joseph* with the Barataria Bridge was a corner of the bridge's swing span protruding outside of its protective fendering into the navigable channel after recently attempted repairs to the limit switch system that controlled the swing span's rotation limit.

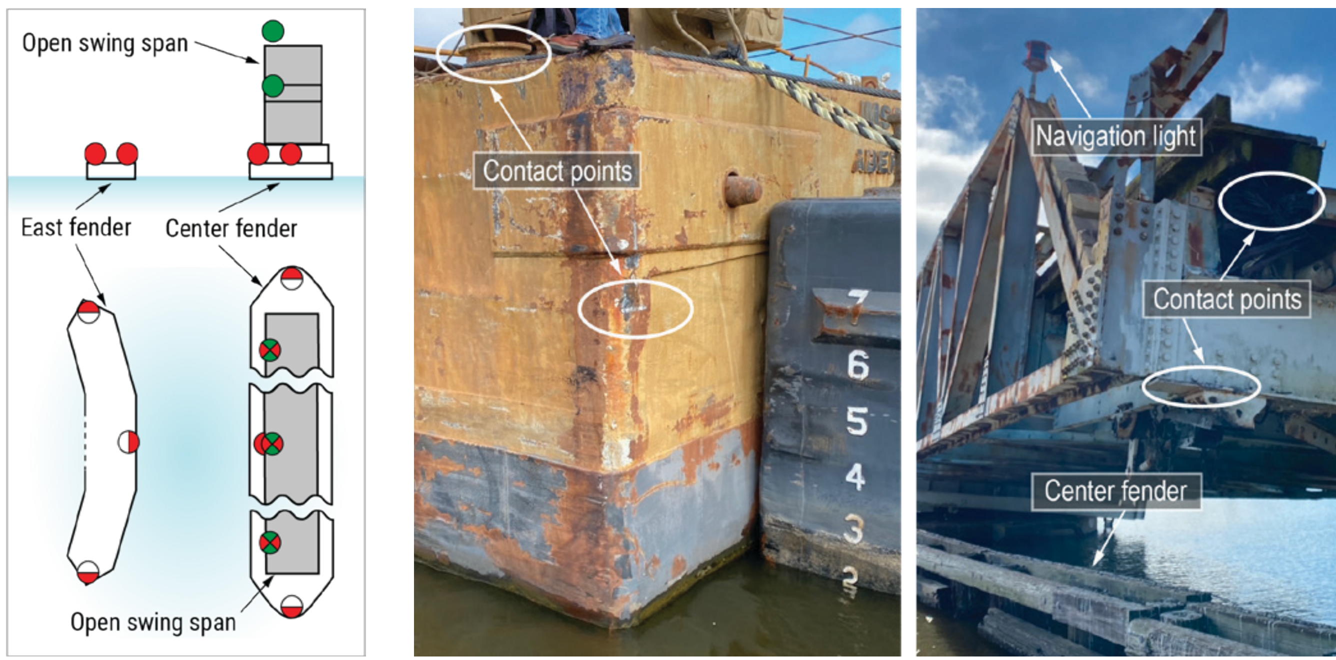


Figure 84. Left: Simple representation of fendering and swing span lighting; profile (*top*) and plan (*bottom*) views. BACKGROUND SOURCE: COAST GUARD. **Middle and Right:** Postaccident damage to the corner of barge *JMSS Mobile*, with damage markings and scrapes about 6 feet above the waterline, and to the northeast corner of the Barataria Bridge, with points of contact with the barge *JMSS Mobile* indicated. SOURCE: ANONYMOUS.

VESSEL GROUP
YACHT/BOAT

Contact Fire aboard Private Yacht ***Andiamo***

Island Gardens Deep Harbour Marina, Miami, Florida

ACCIDENT DATE
December 18, 2019

ACCIDENT ID
DCA20FM007

REPORT NUMBER
MAB-21-17

ISSUED
August 27, 2021

Figure 86. *Andiamo* docked in Miami before the accident. SOURCE: MARINEVIDEOPRODUCTION.COM

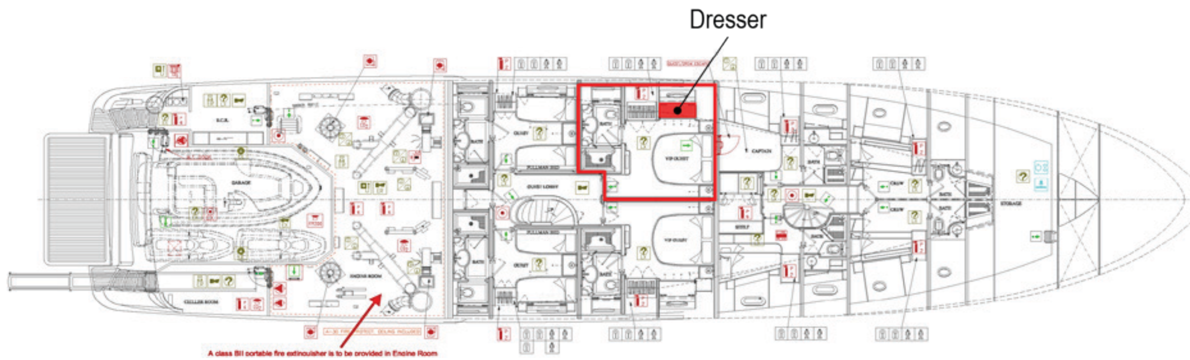


Figure 87. Plan view of the lower deck showing the dresser in the port VIP suite where the candles were lit.
SOURCE: BENETTI FIRE & SAFETY PLAN

Figure 85. *Andiamo* listing to starboard as fireboats attempt to extinguish the fire. SOURCE: MIAMI-DADE FIRE RESCUE

On December 18, 2019, about 1921 local time, a fire broke out aboard the privately owned yacht *Andiamo* while moored at the Island Gardens Deep Harbour Marina on Watson Island in Miami, Florida. The crew of four and a guest on board safely evacuated the vessel as the fire quickly spread. While local firefighters and crews from neighboring yachts attempted to extinguish the fire, the yacht capsized onto its starboard side. No injuries were reported, but an oil sheen was observed. Total damage was estimated at $6.78 million: the *Andiamo*, valued at $6.3 million, was declared a constructive total loss; repair costs for the marina and adjacent vessels were $480,000.

On the afternoon of December 18, the crew of the *Andiamo* was preparing for the arrival of a guest of the owner. While preparing the port VIP suite, the chief stewardess and second stewardess noticed that the lights throughout the lower deck and in the main salon on the main deck above were not working. They reported the issue to the captain, who believed the problem was connected to the automated lighting computer on the bridge. Since the chief engineer was not on hand, the captain solicited guidance from an “engineer friend” over the phone.

About 1910, the owner’s guest arrived on board the vessel and was escorted to the VIP suite. To illuminate the suite, the chief stewardess lit three candles and placed them on top of the wood veneer dresser beneath a porthole decorated with curtains above. After extinguishing one but leaving the other two lit candles unattended, the chief stewardess followed the guest up to the sky lounge.

When the chief stewardess went down to the galley to pick up refreshments for the guest—she estimated about 3 minutes later—the second stewardess and chef told her that they noticed "a funny smell" in the main salon. The chief stewardess then opened the door to the main salon and saw a plume of black smoke about 4 feet high from the deck.

The captain, who was on the bridge, heard the two stewardesses yelling, "Fire!" He investigated but could not determine the origin of the fire. He instructed the chief stewardess to have everyone evacuate the vessel and to call for help. At 1923, the second stewardess called 911.

Most of the crew evacuated the burning vessel. The captain and chef attempted to connect a fire hose, but both realized "there was no fighting it," so they also evacuated the vessel.

Although several of the rooms and adjoining spaces on the lower deck were equipped with smoke detectors, the fire-detection and alarm system for the vessel had been inoperable during the two months before the fire, as reported by ABS on October 2. While attempts were being made by the crew to repair the system, multiple visits from ABS indicated the system and alarms were not functioning. If fully functional, the fire-detection and alarm system would have alerted the crew of the fire's location at its onset and thus provided an opportunity for a direct response. Earlier detection of the fire likely would have allowed the crew to suppress the fire with onboard equipment such as handheld fire extinguishers.

After all the crewmembers and guest were safely on the dock, the captain instructed them to alert adjacent vessels. He also shut down the shore power to the vessel by opening the breakers at the electrical power pedestal on the pier.

Neighboring vessels and responders from the City of Miami Fire Rescue and Miami-Dade Fire Rescue fought the fire. However, as firewater flooded the upper decks of the vessel, the *Andiamo* started to list to starboard, rolled, and capsized on its starboard side, coming to rest on the marina's sea floor at 2130. The fire was extinguished at 2220.

The postaccident fire report revealed the fire originated in the port VIP suite. As the *Andiamo*'s flag state warned, "leaving open flames such as…candles unattended" poses a fire risk. The candles also had not been secured on candle holders or any other type of secondary containment to ensure they would remain stationary, a precaution particularly important on a vessel likely to sway even within its berth. As the open flames burned, the curtains hanging above the dresser nearby likely provided the combustible material that started the fire. The vessel's interior spaces were framed in wood with veneer, as well as outfitted and furnished with wood and other flammable materials, allowing the fire to spread upward.

The probable cause of the fire aboard the private yacht *Andiamo* was burning candles left unattended that resulted in an undetected fire in a guest cabin. Contributing to the severity of the fire was the crew's failure to complete timely repairs to a fire-detection and alarm system known to be inoperable for two months.

Figure 88. Promotional and postaccident photos indicate location of the candles (*yellow rectangle*) in the unattended port VIP suite. SOURCE [*TOP PHOTO*]: MCA YACHTS

Avoiding Candle Use on Vessels

According to the National Fire Protection Association, burning candles results in hundreds of millions of dollars in damages ashore in the United States, including injury and loss of life. Candle usage on a vessel, whether attended or not, also poses a fire risk. Given the dynamic environment of a vessel, candles can move, and their open flames can ignite combustible materials. The abundance of flammable materials on board can allow a fire to quickly spread out of control. Flashlights and battery-powered lighting are safer alternatives to use during a loss of electrical power.

Fire/Explosion

VESSEL GROUP
TOWING/BARGE

Engine Room Fire aboard Towing Vessel *City of Cleveland*

Lower Mississippi River, mile 348, near Natchez, Mississippi

ACCIDENT DATE	REPORT NUMBER
February 26, 2020	**MAB-21-04**
ACCIDENT ID	ISSUED
DCA20FM014	**January 27, 2021**

Figure 89. Flames coming from the starboard rudder room door. SOURCE: COAST GUARD

Figure 90. *City of Cleveland* under way before the accident. SOURCE: JEFF L. YATES

On February 26, 2020, about 1600 local time, the towing vessel *City of Cleveland* was pushing 18 dry cargo barges (15 loaded and 3 empty) upbound on the Lower Mississippi River, approximately 15 miles south of Natchez, Mississippi, when the vessel experienced a main engine failure followed by an engine room fire. All nine crewmembers safely evacuated to the barges and were rescued by nearby Good Samaritan vessels, which worked to extinguish the fire. The *City of Cleveland* was later towed to the operator's facility in Rosedale, Mississippi. No pollution or injuries were reported. Damage to the vessel was estimated at $2 million.

The vessel left New Orleans, Louisiana, on February 24. On February 26, about 1600, crewmembers reported hearing a loud or strange noise that "sounded—it felt like it was a log in the wheel." The port main engine stopped, and the pilot and first mate immediately saw flames from the open engine room ventilation housings on the upper deck. From his office, the engineer saw that the upper engine room was engulfed in fire. The running generator in the upper engine room then stopped, and the vessel lost power, rendering the vessel's fire hoses unusable. The starboard main engine continued to run.

The doors from the weather deck to the engine room were closed since the vessel was under way, but the exterior windows were open for engine room ventilation. The crew was unable to close them due to heat and smoke from the fire. The steel door between the rudder room and the upper engine room was open, and fire spread aft to that space. The two semi-portable extinguishers, stowed on each side of the upper engine room, were the only means for the crew to fight the conflagration. However, the portside extinguisher was inaccessible due to the flames, and the hose on the starboard extinguisher failed proximate to the extinguisher.

Figure 91. Semi-portable extinguisher in starboard engine room following the fire.

The engine room was not equipped with a fixed fire-extinguishing system, nor was it required to be by existing regulations. If the vessel had a fixed fire-extinguishing system in the engine room, as well as a means to close the ventilation and open windows in the engine room from the outside, the fire may have been able to be extinguished. Without an effective means to fight the fire, the crew was forced to evacuate to the tow's barges. Between 1700 and 1745, two nearby Good Samaritan vessels arrived and assisted with securing the *City of Cleveland* and its tow, evacuating the crew, and fighting the fire. Crewmembers told investigators that the fire in the rudder room proved challenging to fight, as steering gear hydraulic oil, having spilled from burnt hoses, was burning while floating on the firefighting water and was spreading further by the hose streams. The fire was extinguished by 1900, and the crew was taken ashore.

During a postaccident examination of the wreckage, the no. 4 left and right cylinder master connecting rods and articulating rods were found still attached to each other outside the crankcase, and the piston pin and connecting rod clamp were missing. Therefore, the initial failure was likely of the connecting rod clamp or the bolt that held the piston pin. Regardless, the force of the connecting rods driven loose inside the engine was enough to puncture a hole in the side of the crankcase on the port side and eject the piston head through the no. 4 right cover on the starboard side.

The failure of the connecting rod and subsequent catastrophic damage to the crankcase likely allowed hot pressurized fuel and oil to spread to the lower engine room and thereby ignite. The significant heat and smoke damage to the upper engine room indicated that the fire spread up the port side of the engine room, then aft in the upper engine room, and eventually to the rudder room. The air drawn through the open windows in the upper engine room likely further exacerbated the fire's spread.

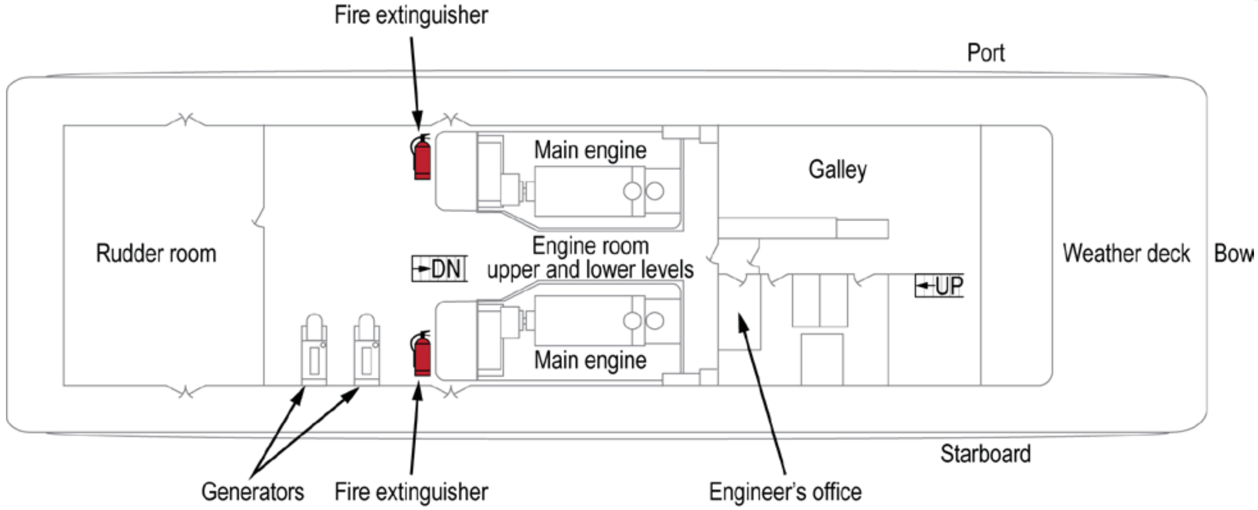


Figure 92. *City of Cleveland* main deck arrangement.

Figure 93. Holed crankcase at no. 4 left cylinder inspection cover (*left*), no. 4 left and no. 4 right connecting rods (*middle*), and connecting rod clamp (*right*).

The probable cause of the fire aboard the towing vessel *City of Cleveland* was the catastrophic failure and crankcase breach of the port main engine resulting from the failure of a connecting rod assembly. Contributing to the severity of damage to the vessel was the lack of a fixed fire-extinguishing system for the engine room, as well as the loss of electrical power to the single fire pump.

Engine Room Fires

Engine rooms contain multiple fuel and ignition sources, making the spaces especially vulnerable to rapidly spreading fires. Designers and operators of towing vessels should evaluate fire hazards and provide effective means to mitigate them. Operators should have equipment and procedures in place to quickly contain and suppress engine room fires before they can spread to other spaces and/or cause a loss of propulsion and electrical power.

VESSEL GROUP
CARGO, GENERAL

Fire aboard Roll-on/Roll-off Vehicle Carrier *Höegh Xiamen*

Pier 20, Blount Island, Jacksonville, Florida

ACCIDENT DATE	REPORT NUMBER
June 4, 2020	**MAR-21-04**
ACCIDENT ID	ISSUED
DCA20FM020	**December 1, 2021**

Figure 94. *Höegh Xiamen* under way before the accident. SOURCE: HÖEGH TECHNICAL MANAGEMENT INC.

Figure 95. Thermally damaged vehicles after removal from the *Höegh Xiamen*, Blount Island, Jacksonville, Florida, July 23, 2020.

Figure 96. Firefighters conducting exterior boundary-cooling the day after the fire was discovered. SOURCE: JACKSONVILLE FIRE AND RESCUE DEPARTMENT

On June 4, 2020, about 1500 eastern daylight time, the crew of the pure car and truck carrier (a type of Ro/Ro vessel) *Höegh Xiamen*, completed loading used vehicles on board the vessel while docked at the Port of Jacksonville, Florida. While preparing the vessel for departure, the chief mate noticed smoke coming from a ventilation housing for one of the exhaust trunks that ran between deck 12 (the weather deck) and one of the cargo decks. The crew found a fire on deck 8 and attempted to fight the fire before being relieved by shoreside firefighters. The fire was extinguished over a week later on June 12. None of the 21 crewmembers on board were injured; nine firefighters sustained injuries while responding to the fire. The *Höegh Xiamen* and its cargo of 2,420 used vehicles sustained significant damage due to the fire and were declared a total loss valued at $40 million.

Between June 3 and June 4, 2020, the crew of the 600-foot-long, Norwegian-flagged *Höegh Xiamen* worked with shoreside stevedores to load vehicles on board the vessel. About 1500 on June 4, loading was completed, and the vessel's crew began preparing for the vessel's scheduled 1700 departure for Baltimore, Maryland, to load the last of its transatlantic cargo.

While waiting for rain to subside in order to secure the stern ramp, the chief mate saw smoke coming from a ventilation housing for one of the exhaust trunks that ran from deck 12 to one of the cargo decks.The chief mate immediately informed the crew over his radio that smoke was on cargo decks 7 and 8. The second mate in turn informed the master and chief engineer. The chief mate reactivated the fire detection system at 1545, which had been secured (not activated) in accordance with cargo loading procedures. The system immediately alarmed, indicating the presence of smoke.

Crewmembers discovered a fire on cargo deck 8. The chief mate sent the vessel's electrician to close the remotely controlled ventilation dampers, which slowed but did not stop the smoke (the ventilation system's manually operated dampers remained open). The crew attempted to fight the fire but were repelled by heavy smoke. The master instructed the chief mate to close all the manual cargo deck ventilation housing dampers on deck 12 (the weather deck).

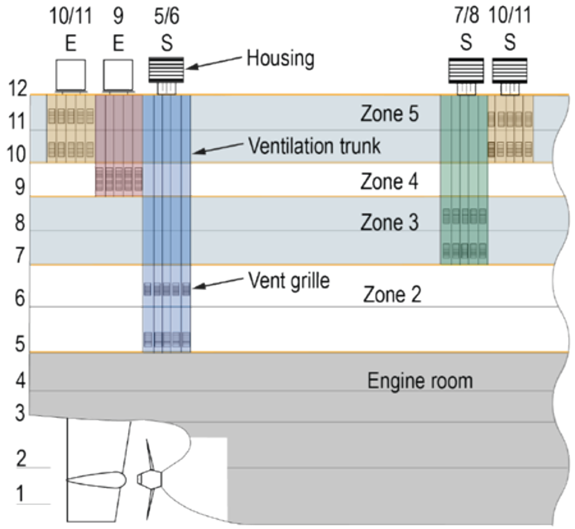


Figure 97. Arrangement of portside aft cargo ventilation trunks on deck 12. Each exhaust is marked with an "E," and each supply is marked with an "S." This only represents a portion of the exhaust and supply ventilation trunks.

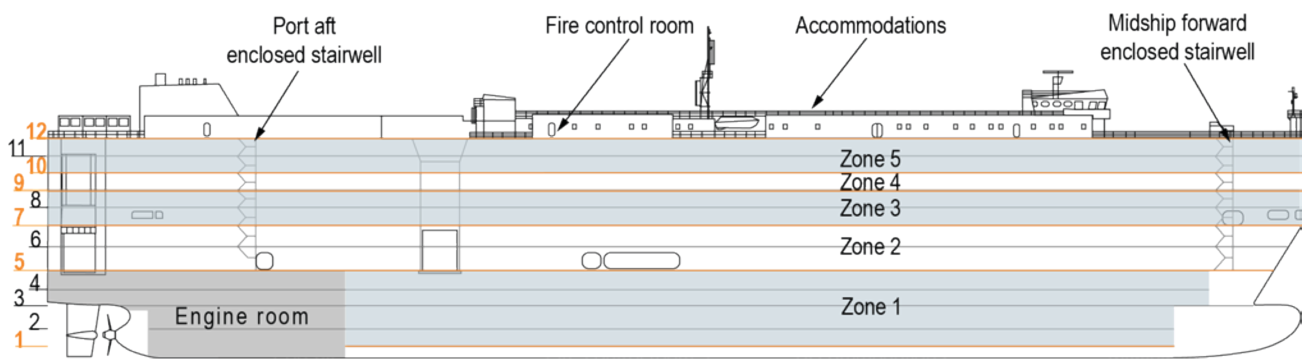


Figure 98. *Höegh Xiamen* fire zones. The vessel's gas-tight decks, which separate fire zones, are highlighted orange.
BACKGROUND SOURCE: HÖEGH TECHNICAL MANAGEMENT

Figure 99. Damaged aft ventilation housings after the reported explosion of portside vent housing for deck 9 (*9E in the photo*). BACKGROUND SOURCE: JACKSONVILLE FIRE AND RESCUE DEPARTMENT

Beginning at 1549, the master made several calls for help over VHF radio to "Jacksonville Port Control," an entity that did not exist (the NTSB and Coast Guard investigators were unable to determine which channel was used). At 1554, an unknown vessel answered the VHF call and advised the master to switch to channel 14 to reach the pilot station, and he did so. The pilot station relayed the distress call to the Coast Guard.

The Coast Guard hailed the *Höegh Xiamen* on channel 16 several times beginning at 1555:49. The master returned to the radio at 1558:20 and informed them that there was a fire on deck 8 and requested assistance. He did not specify where the vessel was moored when asked, nor did he use the radio's distress button. Neither the master nor any other crewmembers answered subsequent radio calls.

About 1559, an onshore witness who had observed smoke coming from the vessel called 911 emergency services to report the fire. Shortly after, the nearby passenger vessel *Norwegian Pearl* reported to the Coast Guard that the *Höegh Xiamen* was at Berth 20, they could see shoreside responders were en route, and the ship was accessible from shore.

Shoreside firefighters from the Jacksonville Fire and Rescue Department arrived at 1603 and relieved the crew. The captain, after consulting with and receiving concurrence from the fire department, had CO_2 from the vessel's fixed fireextinguishing system released into decks 7 and 8, and the crew then evacuated from the *Höegh Xiamen*. The fire continued to spread to the higher cargo decks and the accommodations. Firefighters decided to enter decks 7 and 8, again from the port aft stairwell. Initially, there was no heat or smoke in the stairwell, and they found the doors to each deck (except deck 12) closed. There was no pressure behind the doors when they accessed decks 7 and 8.

They encountered two smoldering vehicles and a small amount of fire on the port bulkhead on deck 8. After cooling the cars and putting out the small fire, the heat seemed to increase substantially, so they retreated from the deck.

Figure 100. Left: Engine 48 arriving on scene about 1603. Starboard vents 10/11E and 7/8E and port vents 10/11E and 9E exhibit smoke flow. **Right:** About 1608, 5 minutes after Engine 48's arrival, the white paint on the starboard side of the vessel exhibits thermal discoloration (*circled in orange*). Starboard vents 10/11E and 7/8E and port vents 10/11E and 9E exhibit smoke flow. SOURCE: JACKSONVILLE PORT AUTHORITY

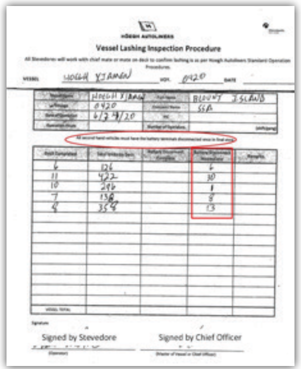
Firefighters were assigned to deck 12 to search for hatches to open for ventilation to evacuate smoke and improve visibility on the decks below with fires. Once they arrived on deck 12, about 1846, they were ordered to open any doors to the housings around the ventilation trunks. About 60 seconds after firefighters on deck 12 opened the exhaust vent for deck 9, they heard "a loud roar that sounded like a jet engine," and the ventilation housings for the decks 9 and 10/11 trunks "exploded" and were destroyed. Nine firefighters who were working in the stairwell or who had been staged on deck 5 were burned, five of them seriously, by the superheated air that rushed down the stairwell. It is likely not coincidental that the "explosion" occurred about the same time that the firefighters opened the exhaust. On their way to deck 12, firefighters had opened the deck 9 door from the stairwell and found thick, black smoke just inside. The deck likely contained a rich atmosphere of heated flammable vapors, which rapidly combusted when fresh air was introduced via the opening of the ventilation trunks for decks 9 and 10/11. This reaction is analogous to an overpressurization event. Following the explosion, the firefighters, assisted by the Coast Guard, transitioned to a defensive strategy, cooling external exposed surfaces.

SAFETY ISSUES

◇ **Lack of training for vehicle battery securement.** Grimaldi Deep Sea, the vessel's charterer, provided SSA Atlantic stevedores with their battery disconnect procedure. However, after the accident, Coast Guard investigators examined several of the used vehicles loaded on board the vessel and found improperly secured batteries. Stevedores stated that some of the vehicles stored on decks 7 and 8 had sustained so much damage that battery securement crews were unable to gain access to the engine compartments. If they had followed Grimaldi's procedures, these vehicles would have been rejected and would not have been loaded on board the vessel. Instead, the stevedores flagged these vehicles (once loaded) by raising the windshield wipers and wrapping them in caution tape.

◇ **Ineffective oversight of vehicle battery securement.** Grimaldi's port captain had the ultimate discretion as to whether to accept any vehicle for loading, as well as oversight authority to ensure that cargo was properly secured and in a safe condition. However, during loading operations, the port captain missed opportunities to require longshoremen to properly isolate the vehicle electrical systems. The Coast Guard's postaccident examination of a sample of 59 vehicles did not find a single battery that was secured in accordance with Grimaldi's battery disconnect procedure. Even from random and cursory inspections, it should have been immediately obvious to the port captain that the battery disconnection crews were not correctly performing their tasks. Additionally, an SSA stevedore gave the *Höegh Xiamen*'s chief mate a "Vehicle Lashing Inspection Procedure" document that indicated that 58 vehicles loaded onto various decks had "incomplete" battery disconnections. Although the chief mate signed the procedure, he did not take any action to address the hazards noted on the procedure.

Figure 101. Left: Battery in towed vehicle removed from deck 7. The disconnected bare cable lug was in physical contact with unprotected battery terminal post. **Right:** Battery in forklift vehicle removed from deck 5. The disconnected battery cable lugs were located near terminal posts, and the battery terminal posts were unprotected.
BACKGROUND SOURCE: COAST GUARD


Vessel Lashing Inspection Procedure

Signed by Stevedore

Signed by Chief Officer

Figure 102. Completed "Vehicle Lashing Inspection Procedure." The document states "all second hand [sic] vehicles must have the battery terminals disconnected once in final stow" (*red oval*) and lists the number of batteries on each cargo deck for which the disconnection was "incomplete" (*red rectangle*) for the accident loading.

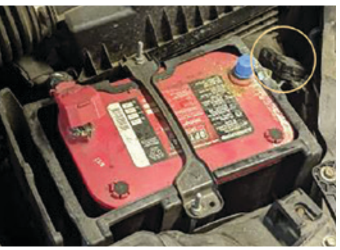


Figure 103. Excerpt from Grimaldi battery disconnect procedure showing a vehicle battery secured with a blue plastic negative terminal cap and disconnected cable (*circled*) tucked inside. SOURCE: GRIMALDI

◇ **Regulatory exceptions for used and damaged flammable-liquid-powered vehicles.** The used vehicles loaded on to the *Höegh Xiamen* were considered excepted from the requirements of the HMR because the vessel's cargo space had been approved by the flag state as specially designated and approved for vehicles, and vehicles with leaking fluids were not to be accepted. The IMDG Code contained similar provisions that would have excepted this shipment from international dangerous goods regulations. However, the circumstances of this accident and others suggest that used vehicles, particularly those that are older with unknown maintenance history and/or crash damage, require extra protections to mitigate the risk of vehicle fires on board Ro/Ro vehicle carrier vessels. Better inspection, oversight, and enforcement would ensure effective implementation of battery securement and vehicle inspection policies in used vehicles across all vehicle carrier operations.

◇ **Fire detection system deactivation during cargo loading.** During loading operations, the crew deactivated the *Höegh Xiamen*'s fire detection system, as was required by Höegh Technical Management's (the operator) "Cargo Safety Awareness" procedure, to prevent alarms from continuously activating due to exhaust from the vehicles being loaded onto the vessel. Following the completion of loading, the crew left the cargo decks and began preparing the vessel for sea. Höegh's procedure did not specify at what point after the completion of loading the crew should reactivate the fire detection system, so the system remained deactivated. Without the fire detection system being activated and without crew on the cargo decks to detect any smoke or fire, there was a gap between the completion of loading and the discovery of the fire, during which the vessel was unprotected.

◇ **Ineffective emergency distress calls.** A successful emergency response is contingent on early distress notification and clear, effective communication. To report the fire, the master first attempted to call the ship's agent by mobile phone but was unable to reach the agent. He next went to the bridge and called for help by VHF radio after sounding the general alarm; however, the entity he attempted to reach, "Jacksonville Port Control," did not exist. Although the vessel had a non-tank vessel response plan, which listed the local Coast Guard's contact information, and the master should have been familiar with using VHF channel 16 for emergencies in port, he did not use either option.

The probable cause of the fire aboard the vehicle carrier *Höegh Xiamen* was Grimaldi's and SSA Atlantic's ineffective oversight of longshoremen, which did not identify that Grimaldi's vehicle battery securement procedures were not being followed, resulting in an electrical fault from an improperly disconnected battery in a used vehicle on cargo deck 8. Contributing to the delay in the detection of the fire was the crew not immediately reactivating the vessel's fire detection system after the completion of loading.

SAFETY RECOMMENDATIONS

As a result of its investigation into this accident, the NTSB issued eight new safety recommendations to federal regulators and the companies involved in the accident to reduce the risk of transporting used vehicles, such as those that were loaded on vessels like the *Höegh Xiamen*. Used vehicles are often damaged and present an elevated risk of fire. Better inspection, oversight, and enforcement are needed to reduce this risk. The NTSB therefore recommended that the Pipeline and Hazardous Materials Safety Administration eliminate the exceptions in the HMR for used and damaged vehicles transported by Ro/Ro vessels. The NTSB also recommended the Coast Guard propose that the IMO eliminate similar exceptions from the IMDG Code.

Additionally, it is imperative that operators of similar Ro/Ro vessels engaged in the transportation of used vehicles act to ensure that any personnel involved in loading operations—including vessel crews, stevedores, and longshoremen—be aware of the importance of disconnecting batteries on used vehicles. To that end, the NTSB recommended that the companies involved revise their procedures to improve oversight of vehicle loading and battery securement.

The investigation showed that the detection of the fire was delayed because the vessels' fire detection systems remained deactivated after loading was completed. Additionally, the Jacksonville Fire and Rescue Department's response to the accident was delayed because the master seemingly did not know how to report a fire to local authorities. The NTSB recommended that the vessel's operator further revise their procedures to minimize the amount of time vessels' fire detection systems are deactivated and ensure that contact information for emergency response authorities is immediately available.

VESSEL GROUP
SPECIALTY/OTHER

Fire aboard Dive Support Vessel ***Iron Maiden***

Gulf Intracoastal Waterway, mile 36, Larose, Louisiana

ACCIDENT DATE
April 16, 2020

ACCIDENT ID
DCA20FM016

REPORT NUMBER
MAB-21-11

ISSUED
April 21, 2021

Figure 104. The *Iron Maiden* before the accident, with previous name and different owner. SOURCE: COAST GUARD

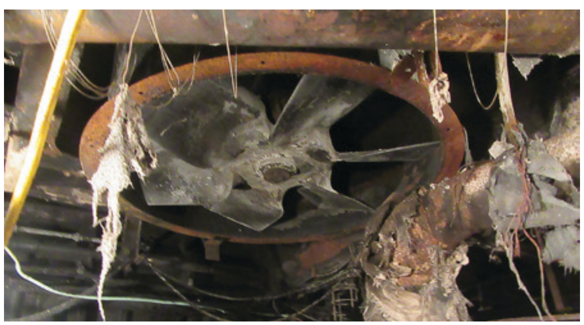


Figure 105. Starboard exhaust trunk fan (post-fire) located above the No. 1 generator. SOURCE: COAST GUARD

Figure 106. Fire damage to living quarters (*left*) and generator room (*right*). SOURCE: COAST GUARD

On April 16, 2020, about 0110 local time, a fire on board the dive support vessel *Iron Maiden* occurred while the vessel was docked at the Allied Shipyard in Larose, Louisiana. Local firefighters extinguished the fire at 0225. No one was aboard the vessel at the time of the fire. No pollution or injuries were reported. Damage to the vessel was estimated at greater than $900,000.

On April 15, shipyard workers entered the vessel at 0800 to conduct hot work with acetylene torches on the starboard exhaust trunk under the bridge deck and on the fo'c'sle deck by the starboard-side mooring/securing bitt. Both work areas were located directly above the generator room on the main deck. The room had three diesel-engine-driven generators, which were secured. The number one generator was directly under the starboard exhaust fan (which was secured) and had a fire cloth over it for protection from falling sparks that could come down the exhaust trunk. The shipyard foreman examined the generator room at approximately 0930 and determined that the space was safe, since there was no indication of fire or smoke.

By 1630, all work on the *Iron Maiden* was concluded, and all shipyard workers departed the vessel. The vessel company representative left about 1735, leaving two vessel crewmembers, who finished eating dinner and left about 1800 to return to their hotel for the evening. The shore power to the *Iron Maiden* remained energized. There was no crewmember or shipyard worker staying on board the *Iron Maiden* during the night.

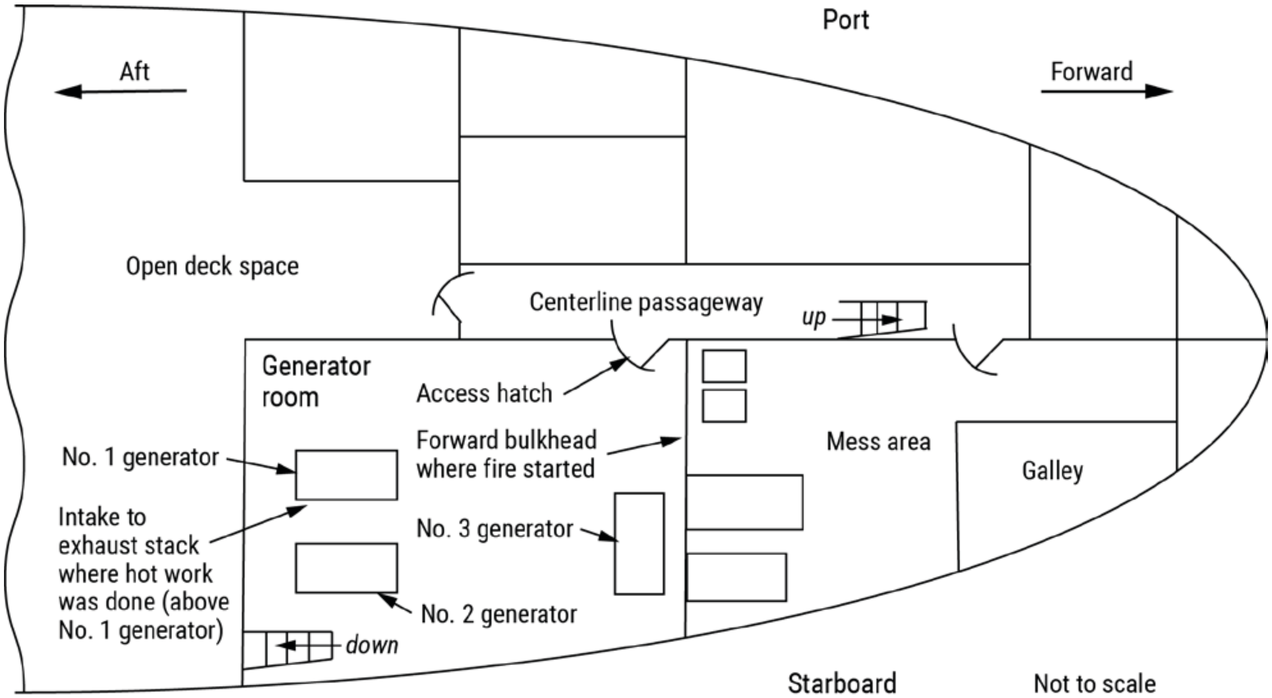


Figure 107. General layout of the *Iron Maiden* generator room and surrounding main deck spaces with area fire started as identified by the LaFourche Parish Fire District.

On April 16, at 0110, the Lafourche Parish Fire District dispatcher received a phone call from the Larose Bridge tender (located roughly 2,000 feet from the shipyard) reporting smoke and flames coming from a vessel at the shipyard. Firefighters discovered smoke coming from the starboard side of the ***Iron Maiden***'s pilothouse. The fire extended from the main deck up to the pilothouse, encompassing the generator room and the living spaces on the fo'c'sle deck. As the fire grew, the wood paneling and furniture in the space above the generator room ignited and provided a path for the fire to expand from the generator room up into the living quarters. With the vessel's fire detection system secured for the shipyard period and no continuous or periodic scheduled monitoring of the vessel by shipyard or owner personnel, the fire was able to spread undetected.

The responding firefighters boarded the vessel and extinguished the fire with water hoses. About 0900, shipyard personnel found an area still emitting smoke behind the fuel tank on the starboard side of the generator room, but it was "dug up" by shipyard personnel and quickly extinguished with water from a garden hose.

Fire investigators from the LaFourche Parish Fire District noted extensive damage to the generator room and significant damage to the passageway outside the generator room and living quarters (above the generator room). They also noted smoke damage to the mess area and the galley (forward of the generator room) and the interior stern section of the pilothouse (two decks above the generator room), as well as sections of burned exterior paint around the starboard smoke trunk and pilothouse. Within the generator room, the most severe damage was observed on the forward bulkhead near the access hatch from the passageway.

According to the fire investigator's report, "The fire started in the generator room on the wall area common to the mess area." They could not rule out the possibility of an electrical short as the potential source of the fire. Because the battery charger, alarm panel, and generator push button start-stop panel were in the area of fire ignition identified by fire investigators, one of these components may have been the source of the fire as the result of an electrical short. However, the exact location of the source of the fire could not be identified by fire investigators.

The probable cause of the fire aboard the dive support vessel *Iron Maiden* was an electrical short from an unidentified source located on the forward bulkhead within the generator room. Contributing to the undetected propagation of the fire was the lack of continuous monitoring of the vessel while it was docked at the shipyard.

Continuous Monitoring of Inactive Vessels

Fire and flooding are risks for both crewed and unattended vessels. To protect personnel, property, and the environment, it is good marine practice for owners, operators, and shipyard managers to coordinate and implement some form of continuous monitoring for vessels undergoing maintenance in a shipyard, in lay-up, or in some other inactive period without regular crews aboard. Continuous monitoring can consist of scheduled security rounds and/or active monitoring with sensing and alarm systems.

VESSEL GROUP
FISHING

Engine Room Fire aboard Fishing Vessel ***Lucky Angel***

Gulf of Mexico, 20 miles south-southwest of Pascagoula, Mississippi

ACCIDENT DATE	REPORT NUMBER
December 10, 2020	**MAB-21-25**
ACCIDENT ID	ISSUED
DCA21FM010	**December 1, 2021**

Figure 108. *Lucky Angel* on fire, December 11. SOURCE: COAST GUARD

On December 10, 2020, about 2205 local time, the fishing vessel ***Lucky Angel*** was trawling for shrimp in the Gulf of Mexico, 20 miles from Pascagoula, Mississippi, when a fire broke out in the vessel's engine room. The three crewmembers attempted to fight the fire but were forced to abandon the vessel. They were rescued by the Coast Guard, and the vessel sank 2 days later. No pollution was reported, but there was one minor injury. The vessel was a total constructive loss with an estimated value of $120,000.

About 0600, after 5 days of shrimping, the ***Lucky Angel*** docked in Bayou La Batre so the captain could attend a doctor's appointment. The captain returned to the boat and sailed about 1455 with two deckhands on board. The ***Lucky Angel*** entered the open waters of the Gulf of Mexico at Horn Island Pass at 1820.

Approximately 2000, the captain and the deck hands began shrimping operations, and about 2100, the vessel began to trawl for shrimp. The captain looked into the engine room twice (2130 and 2200), and, believing that everything was fine, continued to trawl at 2.7 knots.

About 2205, a smoke alarm for the engine room indicated on the alarm panel in the wheelhouse. The captain immediately went to the open engine room door in the after part of the house. From the inside platform, he saw white smoke that "smelled pretty much like [something] electrical was shorting." He saw sparks coming from a bundle of wires located overhead and slightly to the right of the inside platform. Investigators later determined that the group of wires contained 120-volt AC wires to the deck flood lights and the aft bilge pump. It is likely the fire's source of ignition was the electrical sparking.

Without maintenance records or a pre- or post-purchase survey, investigators were unable to determine the condition of the wiring bundle. If the wiring was original, dating back to 1968, it may have deteriorated due to decades of being subjected to the atmosphere and chemicals found in a hot engine room environment. Chafing from the material used to support the wiring could have also caused the wires' insulation to fail. In either case, a failure in the floodlights and aft bilge pump wiring insulation likely caused arcing, which was the ignition source to the ensuing fire. The arcing would have ignited some form of nearby combustible material to initiate and sustain combustion. The fire then likely spread from the engine room to other combustibles in the house of the ***Lucky Angel.***

The captain emptied three dry chemical fire extinguishers into the engine room from the platform, but he did not close the two access doors or two exhaust fan vents to the engine room. He tried to turn on the switch for the deck wash pump but received an electric shock that caused him to fall backwards—investigators later confirmed that the deck wash pump wiring was run separately from the sparking bundle of wires.

The captain returned to the wheelhouse and, in an attempt to limit the spread of the fire, opened all the electrical breakers to the wheelhouse, which rendered all his bridge equipment inoperable. He and the two deckhands attempted to extinguish the fire by tossing sea water from 5-gallon buckets into the engine room. They did this for about 20 minutes until they became exhausted.

Next, the captain and crew closed all doors and hatches to the house and engine room, except the two exhaust fan vents, and went to the bow of the boat because smoke had now filled the house. The captain used his cell phone to call two other nearby shrimp boats that he knew, but he got no answer. He then called his wife on his cell phone, and she contacted the nearby boats.

He then called 911, who routed his call to the Coast Guard District 8 command center about 2231, before his phone went dead. About the same time, the boat's main engine and generator shut down.

The crew inflated and launched the liferaft and abandoned the vessel; the vessel's EPIRB and lifejackets were inaccessible due to the smoke and were left on board. The Coast Guard rescued the crew at 2327. The ***Lucky Angel*** continued to burn through the next day, and eventually, damage from the fire likely caused a failure in hoses or piping connected to a through-hull fitting for a sea water system that allowed water to enter the hull and sink the vessel on December 12. The vessel was not salvaged.

The probable cause of the engine room fire aboard the fishing vessel *Lucky Angel* was the deterioration or chafing of wiring insulation, which caused arcing that ignited nearby combustible materials.

Figure 109. *Lucky Angel* pierside at Bayou La Batre, Alabama, before the accident.
SOURCE: JULIAN PRICE

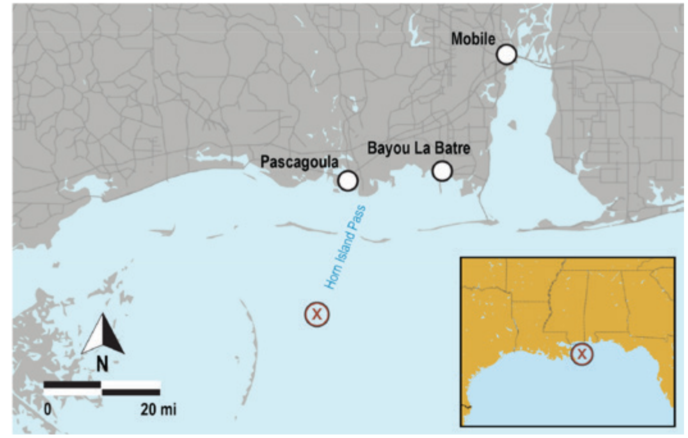


Figure 110. Area of accident where the *Lucky Angel* fire started, as indicated by the red *X*.
BACKGROUND SOURCE: GOOGLE MAPS

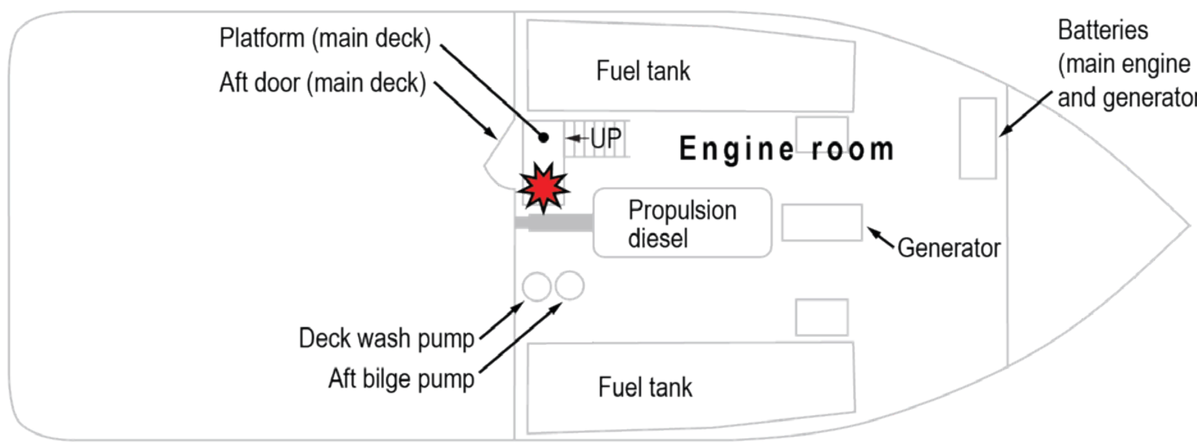


Figure 111. Engine room layout and area where captain observed sparking.

VESSEL GROUP
FISHING

Engine Room Fire aboard Fishing Vessel ***Master Dylan***

Gulf of Mexico, about 32 miles west-southwest of Port Fourchon, Louisiana

ACCIDENT DATE
December 1, 2020

ACCIDENT ID
DCA21FM009

REPORT NUMBER
MAB-21-19

ISSUED
September 23, 2021

Figure 112. Photos taken from the Coast Guard small boat showing the *Master Dylan* aground after being towed by the *Master Dustin II* (*left*) and the burning *Master Dylan* cloaked in smoke (*right*). SOURCE: COAST GUARD

About 0745 on December 1, 2020, the fishing vessel ***Master Dylan*** was trawling for shrimp in the Gulf of Mexico when an explosion occurred in the engine room. Attempts to fight the subsequent fire from on board the vessel were unsuccessful, so the crew abandoned ship to a Good Samaritan vessel. The fire was eventually extinguished by other responding vessels, and the ***Master Dylan*** was taken under tow. However, during the tow, the stricken vessel ran aground, the fire re-flashed, and the vessel later sank. The vessel was a total constructive loss with an estimated value of at $300,000.

The vessel had a main diesel engine and the two diesel generators that were "rebuilt" during a scheduled maintenance period 5 months before the accident voyage. (The extent of the overhaul and the condition of any replacement parts could not be confirmed through records.) The crew told investigators that there were no operational problems with the main diesel engine or the two diesel generators either on the previous voyage following the maintenance or during the accident voyage.

On the morning of the accident, the crew lowered the shrimping nets into the water around 0730, and the captain conducted a routine inspection of the engine room where the main engine and the starboard generator were operating. He found nothing unusual and returned to the wheelhouse at approximately 0740.

About 5 minutes later, the crew heard a "loud explosion" in the engine room, after which they saw fire and black smoke. The captain attempted to extinguish the fire but was unsuccessful. The captain determined that the fire could not be extinguished, so he directed the crew to prepare to abandon the vessel and to raise the nets out of the water. The crew engaged the winch, which operated off the main diesel engine, and were able to maneuver the nets as directed.

A nearby fishing vessel rescued the crew from the burning vessel, and an offshore supply vessel eventually extinguished the fire. The ***Master Dustin II***, a vessel owned by the same company, proceeded to tow the ***Master Dylan*** to the nearest point of land. The ***Master Dylan*** ran aground during the tow and the fire re-flashed.

It is likely that the vessel's engine room hoses, connected to hull fittings to main engine cooling water systems, generator cooling water systems, and salt water service systems, failed due to the long-term exposure to the heat of the fire, which most likely resulted in the sinking of the vessel. As the hoses failed, water would have entered the hull, causing the vessel to lose stability, roll, and sink.

Because the vessel was not salvaged, the exact cause of the fire in the engine could not be determined. Investigators could not determine if electrical power was lost, so they could not confirm if the fire source was a generator malfunction. However, the crew was able to operate the winch, indicating that the main engine was still operating and therefore could not have been the source of the explosion.

A mechanical failure could have catastrophically damaged the operating starboard generator's engine, producing the reported explosion. Since the vessel's fuel oil supply valves for the main diesel engine and the generators were in the engine room, the fire and smoke prevented the crew from securing the fuel supply from tanks to the diesel engines to stop fuel from feeding the fire. The wooden frames and furniture within the house, as well as the dry supplies located inside the forepeak, likewise would have provided additional fuel to sustain the fire as it spread beyond the engine room.

Figure 113. The *Master Dylan* before the accident.
SOURCE: MARINETRAFFIC.COM

The probable cause of the engine room fire on board the *Master Dylan* was the catastrophic failure of a diesel generator. Contributing to the spread of the fire was the location of the fuel shutoff valves within the engine room, which prevented the crew from securing them.

Accessing Remote Engine Room Shutdowns

Following the initiation of an engine room fire, it is imperative to remove the source of available fuel to the fire found in the fuel oil and lube oil systems. In this accident, the vessel had no remote emergency cut-off valves outside the engine room, and thus fuel to the fire could not be stopped and the vessel was eventually consumed by the flames. Vessel designers, builders, owners, and operators are encouraged to install, regularly test, and have emergency drills that incorporate remote cut-off valves for fuel and lube oil lines.

Fire/Explosion

VESSEL GROUP
OFFSHORE

Diesel Generator Engine Failure aboard Offshore Supply Vessel *Ocean Intervention*

Anchorage B, Mamala Bay, Honolulu, Hawaii

ACCIDENT DATE
December 19, 2020

REPORT NUMBER
MAB-21-26

ACCIDENT ID
DCA21FM012

ISSUED
December 2, 2021

Figure 115. The damaged section of the engine (*left*), as indicated by the yellow square, from where the connecting rod from the no. 3 DG (*right*) was ejected. SOURCE: OCEANEERING INTERNATIONAL, INC.; COAST GUARD

Figure 114. *Ocean Intervention* under way before the accident. SOURCE: OCEANEERING INTERNATIONAL, INC.

At 1303 local time on December 19, 2020, the no. 3 diesel generator engine aboard the ***Ocean Intervention*** sustained a mechanical failure while the offshore supply vessel was anchored off Honolulu, Hawaii. The failure led to the ejection of components from the engine and resulted in a fire in the engine room. The crew isolated the fire before it could spread throughout the vessel. No pollution or injury to the 16 crewmembers on board was reported. Damage to the *Ocean Intervention* totaled $3,046,624.

About noon on December 18, the *Ocean Intervention* was docked in Honolulu Harbor awaiting orders with a partial crew standing deck and engineering watches. While at anchorage, the crew troubleshot speed variation issues related to the nos. 1 and 3 diesel generators (DGs) throughout the afternoon and the following morning, which involved replacement and calibration of several electrical components and multiple engine restarts. About 1050 on December 19, the no. 3 DG was put online, sharing the electrical load with the no. 1 DG.

Two hours later, the no. 1 DG was taken offline, and the vessel's electrical load was shifted onto the no. 3 DG—leaving the no. 3 DG carrying the vessel's electrical load.

At 1303, the chief engineer and engineer on watch heard "an abnormal sound, similar to something heavy dropping on the deck," as the no. 3 DG underwent a catastrophic mechanical failure, resulting in cylinder no. 1's connecting rod being ejected through the engine crankcase while running at rated speed. The ejection of the connecting rod allowed atomized oil to be released and ignite, starting a fire in the engine room. Thick, black smoke filled the engine room.

Engineering watchstanders did not receive any alarms indicating issues with the operational parameters of the no. 3 DG in the minutes preceding the failure. The crew quickly stopped the running engines, isolated all fuel supplies, shut down engine room ventilation systems, and closed the space's air dampers to effectively starve the fire of fuel and oxygen, which prevented the spread of the fire. Additionally, they used the emergency fire pump to provide cooling water to the exterior surrounding bulkheads and decks above to reduce the heat in the engine room. The crew's quick and effective actions resulted in the extinguishment of the fire without putting crewmembers at risk by having to enter the space.

During the postaccident forensic teardown of the no. 3 DG, factory-trained technicians were able to identify the most likely sequence of events that led to the failure of the engine but were unable to determine the root cause due to several unknown preconditions of the engine. The possibility of fluid, such as cooling water or fuel oil entering the cylinder, causing a loss of clearance on the connecting rod bearing and starting the failure sequence was considered as a viable scenario; however, this theory could not be verified due to damaged components and operational alarms not activating before the failure. The condition of the connecting rod bearings, showing signs of cavitation erosion (some considered excessive) was another possible root cause of the failure. If the cavitation erosion became excessive enough, as found on cylinder no. 13's connecting rod bearing by technicians, it could have caused the bearings to fail due to increased tolerances between the components and excessive movement outside of these tolerances.

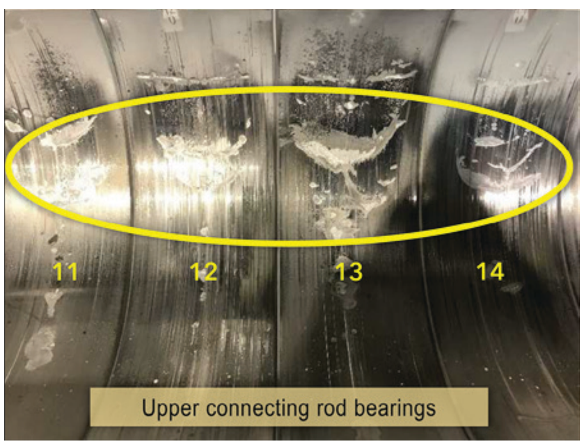


Figure 116. Cavitation erosion in upper connecting rod bearings from the no. 3 DG in cylinder nos. 11, 12, 13, and 14, encircled. SOURCE: OCEANEERING INTERNATIONAL, INC.

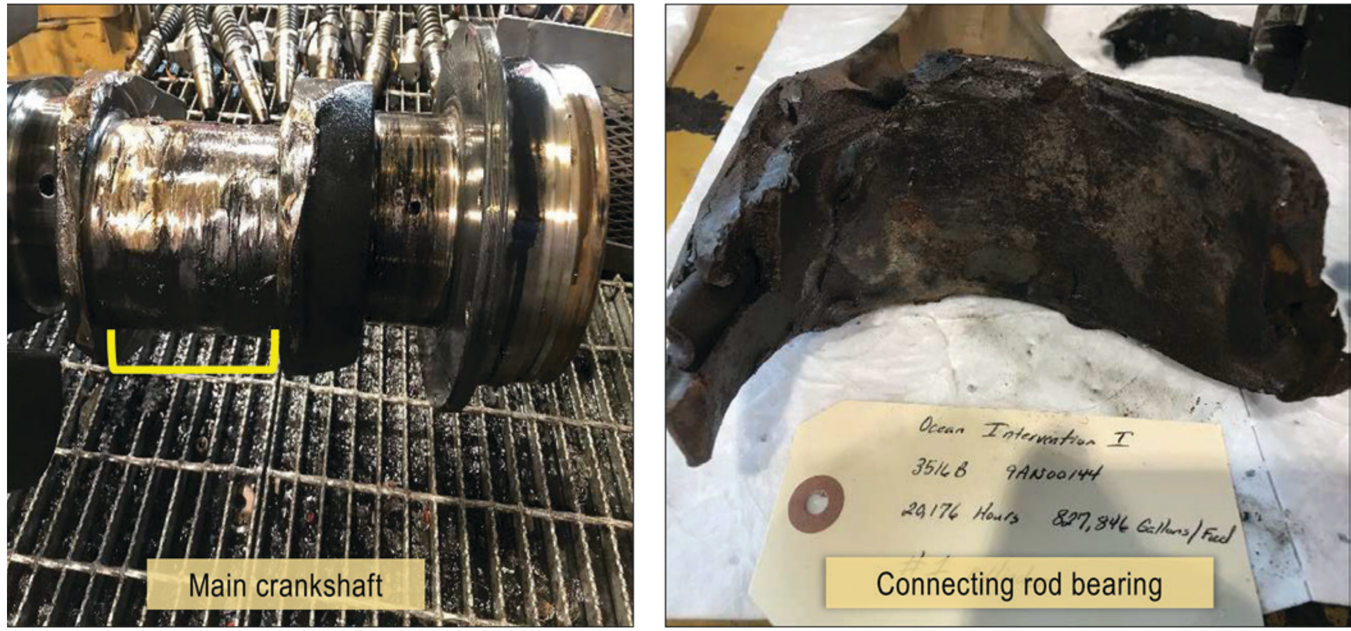


Figure 117. The yellow bracket identifies the damaged area of the main crankshaft of the no. 3 DG (*left*), where the no. 1 connecting rod bearing failed (*right*). SOURCE: OCEANEERING INTERNATIONAL, INC.

The probable cause of the diesel generator engine failure aboard the offshore supply vessel *Ocean Intervention* was a cylinder's connecting rod bearing adhering to the crankshaft, which led to the ejection of the connecting rod and catastrophic damage to the engine.

Containing Engine Room Fires

Engine rooms contain multiple fuel sources as well as mechanical ventilation, making the spaces especially vulnerable to rapidly spreading fires. The crew of the *Ocean Intervention* effectively contained the spread of a fire by removing fuel and oxygen sources. Vessel crews should familiarize themselves and train frequently on machinery, fuel oil, lube oil, and ventilation shutoff systems to quickly act to contain and suppress engine room fires before they can spread to other spaces and/or cause a loss of propulsion and electrical power

VESSEL GROUP
TOWING/BARGE

Engine Room Fire on board Towing Vessel *Susan Lynn*

Barataria Waterway, Lafitte, Louisiana

ACCIDENT DATE	REPORT NUMBER
October 8, 2019	**MAB-21-03**
ACCIDENT ID	ISSUED
DCA20FM001	**January 26, 2021**

Figure 118. *Susan Lynn* (original name *Rock Bluff*), under previous ownership. SOURCE: LESLIE JENKINS, JANTRAN INC.

Figure 119. The *Susan Lynn* at its berth following the fire.

On October 8, 2019, about 0600 local time, the *Susan Lynn* was docked and in layup status at Tom's Marine & Salvage yard on the Barataria Waterway in Lafitte, Louisiana, when a fire started in the engine room. The vessel's watchman could not contain the fire and evacuated the vessel. Local firefighters extinguished the fire. No pollution or injuries were reported. Damage to the vessel was estimated at $1,350,000.

On October 4, 2019, an engineer arrived at the shipyard to reside on board the *Susan Lynn*, relieving the previous watchman. The vessel was not hooked up to shore power. He told investigators that the port generator was operating to power the hotel loads during his stay on board and had been the only generator used since mid-August.

The engineer told investigators that at 0600 on October 8, he woke to a "beeping fire alarm." He observed there was no power and decided to check the engine room. He peered through the open interior forward centerline door to the upper engine room, observed smoke, and left to grab carbon dioxide and dry chemical fire extinguishers. He returned to the engine room and discharged the two extinguishers in the direction of the two generators located forward of the main engines. He said there was no way to secure the exhaust trunk ventilation to the engine room, he did not secure any fuel shutoff valves, and he did not attempt to use the semi-portable fire extinguisher located near the aft starboard-side engine room door on the main deck. He left the vessel and called 911 and the vessel operator. The Lafitte Barataria Crown Point Volunteer Fire Department arrived on scene at 0628 and fought the fire with water hoses and foam. The fire was declared out at 1315.

The heaviest fire damage was in the engine room, near the generators, with additional damage on the main and second decks forward of the galley. The fire's spread beyond the engine room was likely the result of the open position of the interior forward and aft centerline upper engine room doors, which had been left open while the vessel was in layup and remained open throughout the fire. While the vessel was in layup, the engine room doors should have been closed as a fire safety measure.

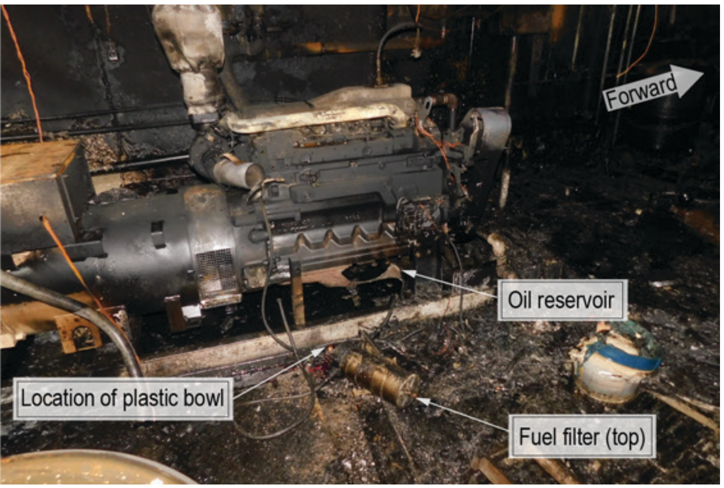


Figure 120. The *Susan Lynn* port generator and lower engine room following the fire. BACKGROUND SOURCE: LOUISIANA OFFICE OF STATE FIRE MARSHAL

Figure 121. Ruptured *Susan Lynn* port generator oil reservoir. BACKGROUND SOURCE: COAST GUARD

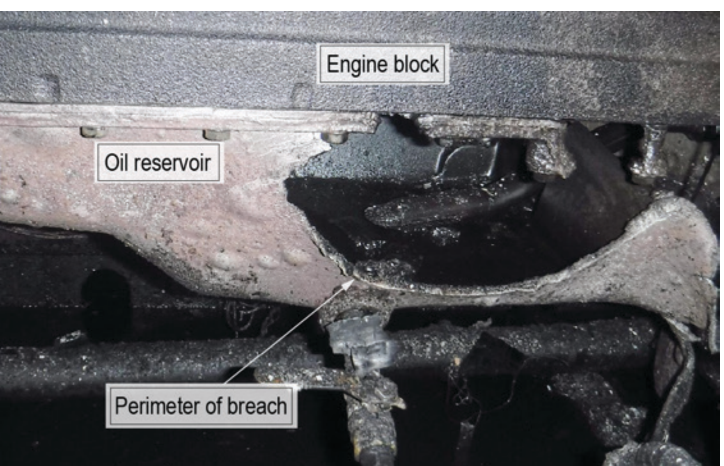


Figure 122. Crew quarters on board the *Susan Lynn*.
SOURCE: LOUISIANA OFFICE OF STATE FIRE MARSHAL

Examinations of the vessel by Coast Guard investigators and inspectors, a Louisiana State fire marshal investigator, and the ***Susan Lynn***'s operator provided limited evidence to identify the cause of the engine failure and subsequent fire. They noted significant damage to the port generator oil reservoir, including a hole in it, and that the generator engine exhaust piping had no lagging installed. The fire marshal investigator could not identify the cause of the fire, saying he could not "rule out mechanical/ electrical failure" nor identify the heat source that ignited "combustible materials and ignitable liquid fuel." The vessel operator told investigators that he noticed the connecting rod had separated from piston number 3 and was hanging down through the hole of the ruptured oil reservoir and still connected to the crankshaft. Detailed evidence was not available because a forensic examination of the port generator engine was not conducted, nor was the engine rebuilt.

Because of the limited evidence, the exact cause of the fire and the generator's engine failure cannot be determined. However, the rupture of the oil reservoir may have been caused when part(s) of the failing connecting rod and/or a piston struck the inside wall of the oil reservoir. A rod and/or piston striking and then rupturing the oil pan would have released oil into the engine room under heat and pressure. This ejected lube oil mist may have ignited off a hot surface, potentially the generator's unlagged (not insulated) exhaust components. The intensity and duration of the fire was likely exacerbated by the melting of the bowl on the bottom of the generator's Racor fuel filter combined with the vessel's fuel shutoff valves not being closed, allowing additional fuel for the fire.

The probable cause of the fire on board the *Susan Lynn* was a catastrophic engine failure resulting in an oil reservoir breach and an ensuing fire initiated by ejected lube oil igniting off a hot surface. Contributing to the extent of the fire were the open engine room doors and the unsecured fuel shutoff valves.

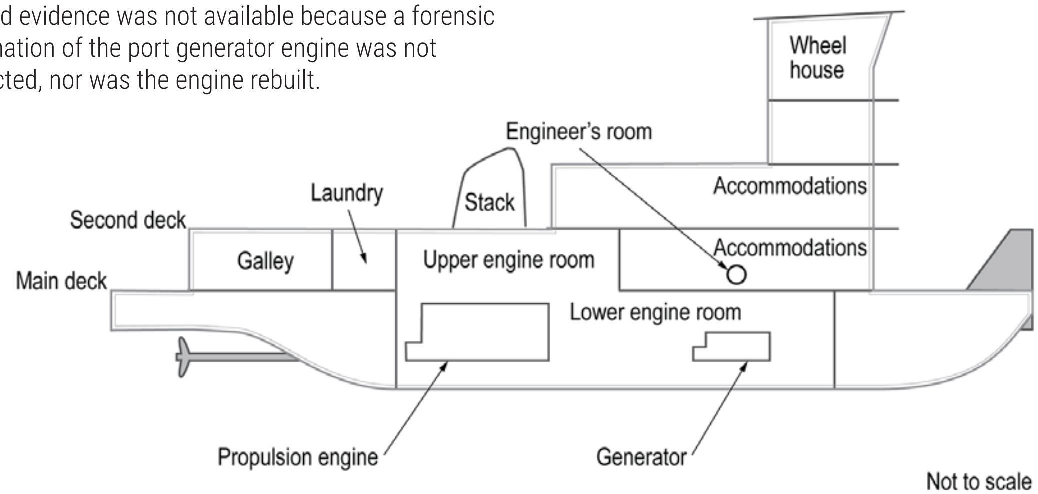


Figure 123. Simplified inboard profile of the *Susan Lynn*.

Fire/Explosion

VESSEL GROUP
SPECIALTY/OTHER

Hazardous Liquid Pipeline Strike and Subsequent Explosion and Fire aboard Dredging Vessel *Waymon Boyd*

EPIC Marine Terminal, Corpus Christi Ship Channel, Corpus Christi, Texas

ACCIDENT DATE
August 21, 2020

ACCIDENT ID
DCA20FM026

REPORT NUMBER
MAR-21-05

ISSUED
December 7, 2021

Figure 124. *Waymon Boyd* preaccident.
SOURCE: ORION MARINE GROUP

Figure 125. Post-fire photo of the *Waymon Boyd*, before sinking. SOURCE: COAST GUARD

On August 21, 2020, about 0802 central daylight time, the US-flagged dredge *Waymon Boyd* struck a submerged 16-inch liquid propane pipeline during dredging operations in Corpus Christi, Texas. A geyser of propane gas and water erupted adjacent to the vessel. Shortly thereafter, propane gas engulfed the vessel, and an explosion occurred. Fire damaged the vessel and surrounding shoreline. A total of 18 personnel employed by Orion Marine Group were working or resting on the dredge and assist boats (tender boats, anchor barges, booster barges, and a supply barge) on the day of the accident. Three crewmembers aboard the *Waymon Boyd* and one on an adjacent anchor barge died in the explosion and fire. Six crewmembers aboard the dredge were injured, one of whom later died from his injuries. The *Waymon Boyd*, valued at $9.48 million, was a total loss. The cost of pipeline damage was $2.09 million. The cost of physical damage to the EPIC facility was $120,000.

Figure 126. Dredge *Waymon Boyd* before the accident.
SOURCE: ORION MARINE GROUP

In 2019, EPIC Crude Terminal Company LP (EPIC) began planning for a second crude oil loading pier, designated the East Dock, at the former Interstate Grain Terminal, which required the construction of a bulkhead along the shoreline and the dredging of a ship berth between the dock and the main shipping channel. EPIC selected the Orion Marine Group (Orion) for the project. Dredging for the East Dock was conducted in two phases. Phase 1 occurred from May to June 2019, and phase 2 was planned for July to October 2020.

EPIC commissioned a survey to identify all utilities running through the terminal property. The surveyors located one abandoned and two active pipelines that ran parallel to the shoreline along the entire length of the terminal area. The lines were buried onshore but partially exposed in the water, lying in the bottom sediment of the waterway. The active pipelines were owned and operated by subsidiaries of Enterprise Products Partners LP (Enterprise). The most northerly of the pipelines, a 16-inch-diameter pipe designated TX219, carried non-odorized liquefied propane.

In October 2019, EPIC was granted a permit to extend the East Dock berth another 167 feet to the west. Consequently, Orion assigned Schneider Engineering and Consulting (Schneider), a wholly owned subsidiary of Orion Marine Group's parent company, to update the phase 1 dredging plans to reflect the revised berth dimensions.

The revised engineering plans for the East Dock berth were passed to Orion's survey superintendent, who used the plans to build a dredge template in DREDGEPACK, a module in the hydrographic data collection and processing software HYPACK. DREDGEPACK was used by the dredge operator (leverman) to display where the digging tool that he was controlling (the cutterhead) was in relation to the dredge template. Using the software display, the leverman could determine in real time what areas required dredging and whether the cutterhead was operating within the dredge template. The survey superintendent loaded the dredge template onto the computer on board the ***Waymon Boyd***, the dredge scheduled to conduct the phase 2 work.

On June 23, 2020, an Orion project engineer made a one-call notification—a notice of intent to excavate—for the phase 2 dredging operations. An Enterprise technician contacted the project engineer to discuss the project and schedule a site visit. On June 29, the Orion project engineer sent the Schneider dredging plans to the Enterprise technician noting in the accompanying email that the areas where the pipelines were furthest in the water had already been dredged, "so there shouldn't be a need for concern."

A site visit with the Orion and Enterprise representatives was set for June 30; however, due to issues stemming from the COVID-19 pandemic, they did not meet as planned. The pipeline technician and the project engineer had a phone call during which they agreed that it was not necessary to physically mark the pipelines because they did not conflict with the dredging area.

As a result of their assessment of plans and information provided by the project engineer, Enterprise technicians closed the one-call tickets, believing pipeline TX219 would be clear of the project and there would be no dredging near the shoreline. Thus, technicians concluded that no marking or other protective measures would be required because the dredging boundary exceeded the Enterprise damage prevention program 50-foot distance limit for mandatory marking.

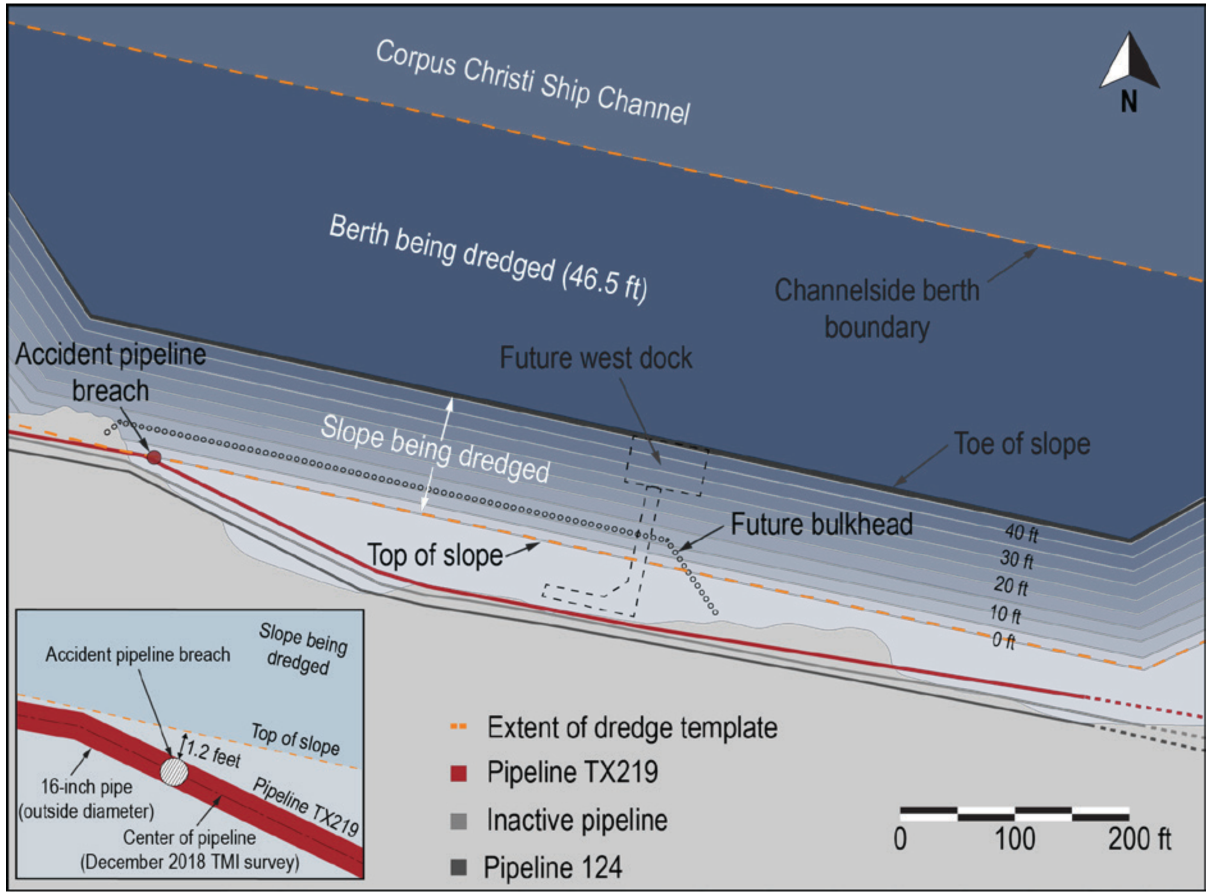


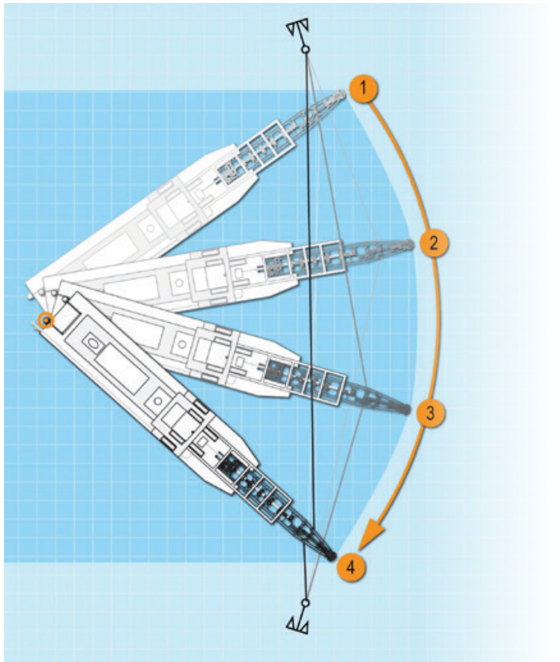
Figure 127. NTSB depiction showing comprehensive view of dredge template and pipeline locations.

Figure 128. EPIC dock project area, 1968 and 2016, showing the extent of land loss. The blue line indicates the TX219 location, and the red circle is the approximate accident location. SOURCES: US DEPARTMENT OF AGRICULTURE [*LEFT*]; US GEOLOGICAL SURVEY [*RIGHT*]; PHOTOS GEOREFERENCED AND OVERLAID ON A MAXAR TECHNOLOGIES IMAGE.

Two weeks after the one-call tickets were closed, Orion followed up with an informal request to have the pipelines marked with cane poles for dredge anchor avoidance. Enterprise technicians, who had still been led to believe dredging activities would be outside of the mandatory marking zone, used an optional marking technique known as "courtesy marking" in which the pipeline was delineated with widely-spaced cane poles. While a portion of on-land pipeline was marked with color-coded flags and paint, the cane poles were not color-coded or flagged. On July 16, the Orion project engineer and the two Enterprise technicians met at the dredging site, boarded a skiff, and courtesy-marked the location using cane poles provided by Orion.

The Orion project engineer's supervisor, the project manager, also reviewed the Schneider dredging plans. Although the Orion project manager did not expect that the excavation would be near the pipelines, during a subsequent discussion with the project engineer, he suggested that the anchors could be placed near them. He also discussed this concern with the dredge superintendent and directed the project engineer to inform Enterprise about the anchors.

Figure 129. Typical dredging operations.



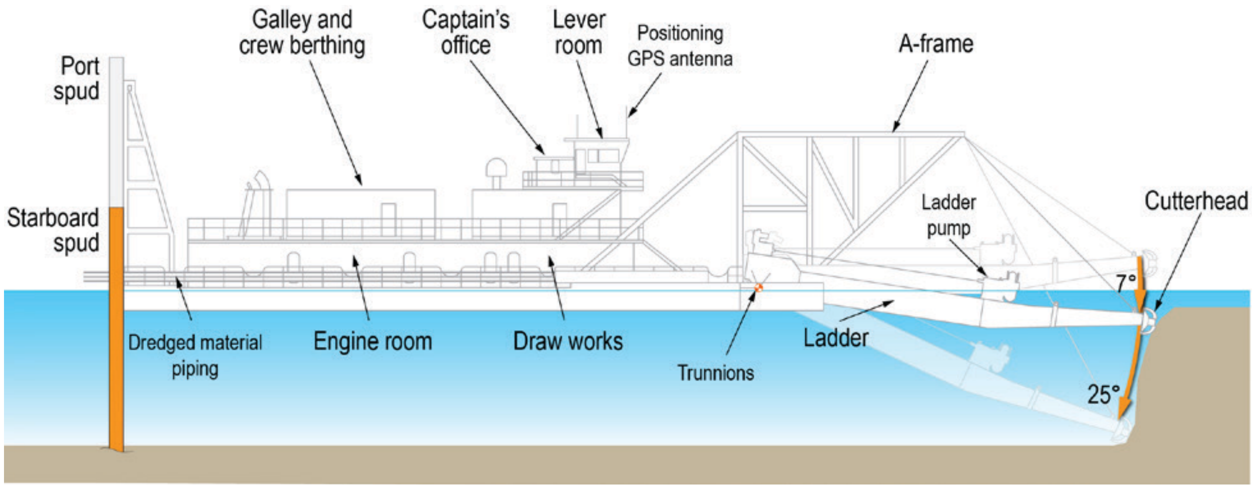


Figure 130. *Waymon Boyd* general arrangements.

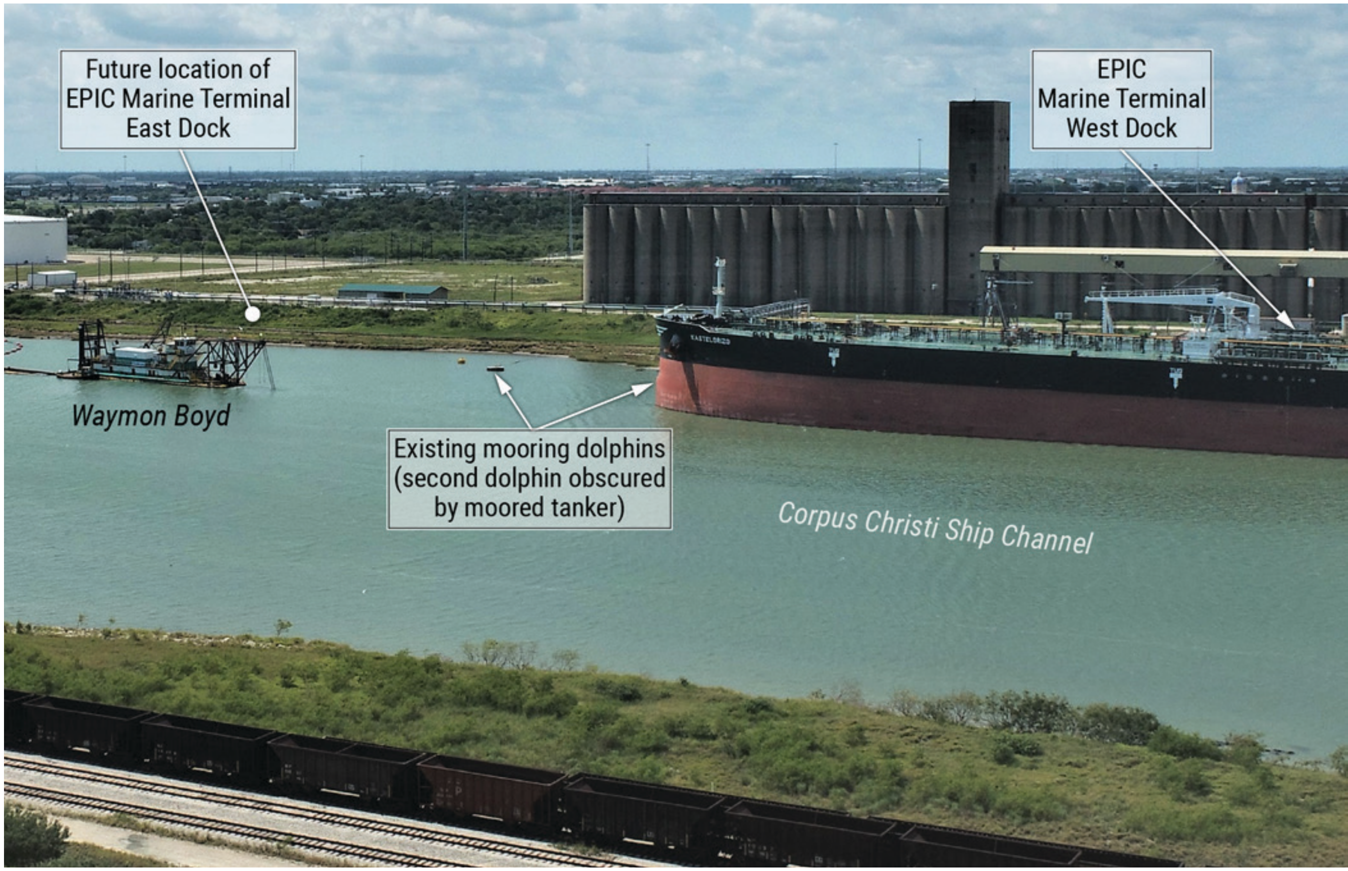


Figure 131. The *Waymon Boyd* at the EPIC Marine Terminal East Dock site, August 7, 2020. SOURCE: ORION MARINE GROUP

On July 29, 2020, the ***Waymon Boyd*** was towed into position at the East Dock site and began phase 2 dredging. Through the end of July and the first weeks of August, the ***Waymon Boyd*** operated at the dredge site, working generally east to west beginning on the channel side and moving progressively inshore.

In the early morning hours of August 21, the dredge was working in an area between two existing mooring dolphins located on the western side of the project area. About 0800, the leverman finished a series of side-to-side swings of the dredge and cutterhead and then operated the controls to advance the dredge forward about 3 feet. When the cutterhead was about 5 feet from the southern edge of the dredge template during his swing to port, the cutterhead struck pipeline TX219, causing a breach in the line that allowed propane to escape, and water began shooting up off the surface of the waterway, about 2–3 feet landward of the cutterhead.

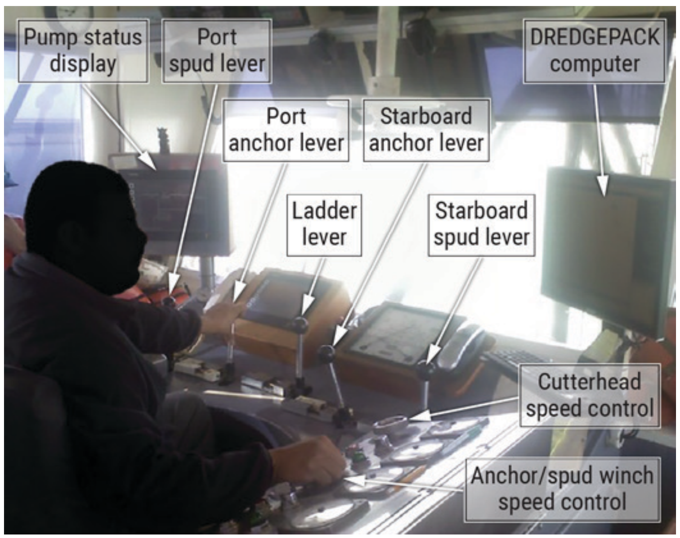


Figure 132. Above: *Waymon Boyd* lever room postaccident. BACKGROUND SOURCE: ORION MARINE GROUP

Figure 133. Left: Front view of cutterhead assembly after underwater recovery (*looking aft*).

Figure 134. Screen captures from security camera footage showing (*top to bottom*) the water and gas eruption before the explosion (*as noted by red arrow*), the initial explosion, and the ensuing fireball. The *Waymon Boyd* is outside of the frame of the camera. SOURCE: EPIC CRUDE TERMINAL COMPANY

Sixty-six seconds after the water eruption began, an explosion occurred as the propane gas—which had been drawn into the dredge's engine room by ventilation fans—ignited.

Although the leverman attempted to swing the dredge away from the geyser of water that was carried with the escaping propane, the vessel was less than 200 feet away from the pipeline breach, and the expanding gas cloud enveloped it. Enterprise later estimated that 6,024 barrels of propane were released from the pipeline.

Within seconds after the breach of pipeline TX219, the pipeline controller at the Enterprise control center identified the pressure drop at the Viola Meter Station. The pipeline was shut down within 3 minutes, and technicians responded to valve control facilities within 13–29 minutes. After the Coast Guard was notified of the explosion at 0810, Coast Guard surface and air units joined the response effort. Tugboats remained at the accident site until the fire on the ***Waymon Boyd*** was extinguished about 1300. Residual propane rising from the breached pipe continued to burn until 1610, when the pressure in pipeline TX219 equalized with the water pressure, the release of propane diminished, and the fire self-extinguished. The dredge, which continued to smolder, began to founder at 1400. Efforts to stabilize the vessel were unsuccessful, and it sank at 2151.

Figure 135. Tugboats *Ted C Litton* and *Evelena* fight the fire at the accident scene. SOURCE: COAST GUARD

SAFETY ISSUES

◇ **Inadequate project planning and risk assessment.** Orion and its design engineers did not take measures to address the risk of dredging near the pipelines before they started dredging. These measures could have included consulting with Enterprise representative, conducting a formal risk assessment, or implementing effective engineering controls. Had Enterprise been invited to participate in preconstruction and kickoff meetings, they may have been more aware that the dredging area was unacceptably close to their pipelines and could have suggested safer alternatives. Because Orion did not complete a formal risk assessment for the EPIC dock project, the hazard presented by conducting dredging operations near pipeline TX219 was never formally identified or documented, and the risk was not completely understood. Had a formal risk assessment been completed, controls could have been put in place to mitigate the risk posed by dredging near pipeline TX219.

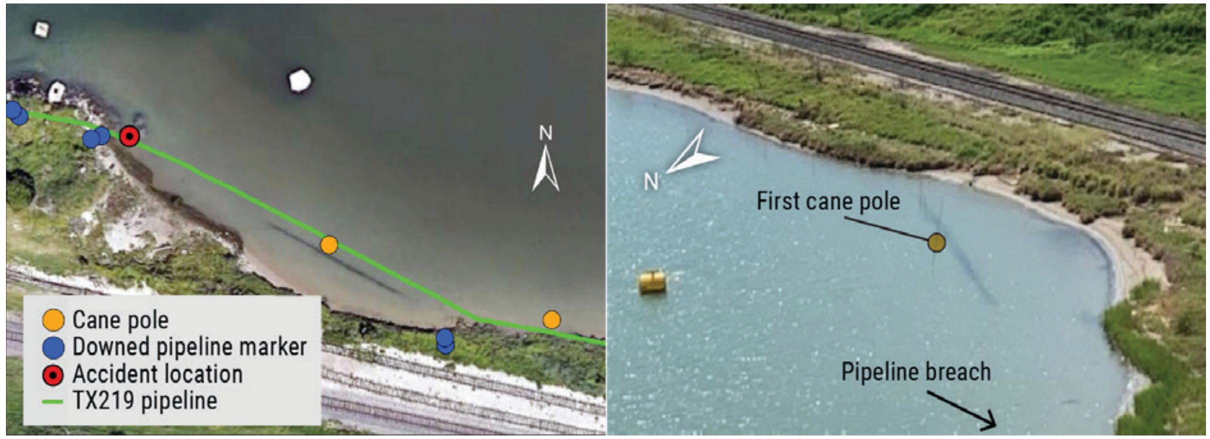
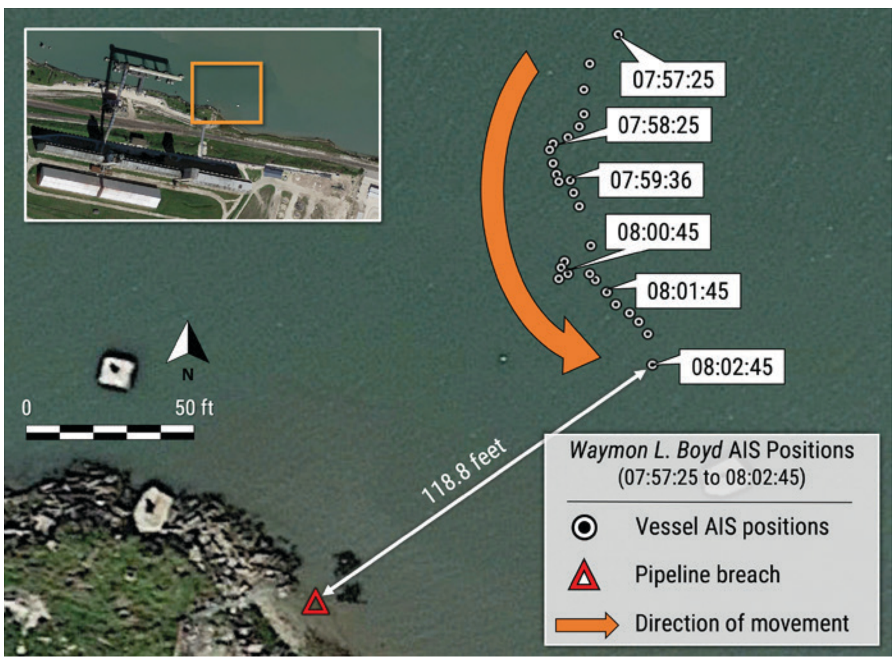


Figure 137. Postaccident temporary and permanent pipeline marker survey locations, accident location, and pipeline TX219 (*left*); preaccident photo of marking cane pole (*right*). BACKGROUND SOURCES: ENTERPRISE PRODUCTS [LEFT]; EPIC CRUDE TERMINAL COMPANY [RIGHT]

Figure 136. *Waymon Boyd* AIS data from 0757:25 to 0802:45 on the accident date. BACKGROUND SOURCE: GOOGLE EARTH



◇ **Ineffective pipeline damage prevention.** In this accident, the tools used for pipeline damage prevention—the one-call process, pipeline marking, dredging area marking, and tolerance zones—were either inadequate or ineffective. Marine dredging projects require a greater level of collaboration and review between pipeline operators and dredging companies than the one-call process provides because of the challenges associated with marking marine pipelines and the lack of precision associated with dredging operations.

Additionally, the Schneider engineering plans provided to Orion for the project did not clearly depict the extent of the dredging area or the pipeline location in all drawings. This resulted in the Orion project engineer misinterpreting the information, overestimating the distance between the dredging area and pipeline TX219, and communicating incomplete and inaccurate information during the one-call process, which dissuaded Enterprise from protecting pipeline TX219 in accordance with the company's damage prevention program.

Proper line locating and marking by the pipeline operator following a one-call notification are necessary to ensure that an excavation will be sufficiently clear of buried pipelines. Although Enterprise courtesy-marked the pipelines with cane poles, the markers did not meet pipeline excavation damage protection standards, nor were they required to, based on the incorrect information provided by Orion, and therefore were insufficient to visually warn the leverman of the danger of the pipeline. Further, a technique known as white-lining (the placement of white paint or flags to delineate the boundary of proposed excavation areas) could have been used on this project as an added measure of communicating the precise location of proposed excavation/dredging activity to pipeline technicians in advance of their one-call review. Project boundary marking requirements for dredging projects (equivalent to land-based white-lining requirements) would provide utility operators with additional visual information about the location of dredging projects to confirm any encroachment of the proposed project on pipelines.

Finally, the clearance required by existing state-regulated tolerance zones is not adequate for large-scale dredging activities because of the inherent inaccuracies associated with operating a cutterhead dredge. Dredging safety would be improved if guidelines identified consistent dredging tolerance zones, within which special provisions and procedures are enacted for pipeline avoidance.

◇ **Lack of pipeline hazard training.** Although 8 months before the accident the Council for Dredging and Marine Construction Safety had published recommended actions for a dredge crew in the event of an emergency involving a pipeline breach, Orion did not have an emergency procedure or crew training for a pipeline breach. The dredge crew lacked function-specific pipeline safety training and emergency procedures that could have prepared them to react quicker and more effectively to the gas pipeline strike.

The probable cause of the hazardous liquid pipeline breach, propane release, and subsequent explosion and fire aboard the dredging vessel *Waymon Boyd* was Orion Marine Group's inadequate planning and risk management processes, which failed to identify the proximity of their dredging operation to Enterprise Products' pipeline TX219 and resulted in the absence of effective controls to prevent the dredge's cutterhead from striking the pipeline. Contributing to the accident were deficient dredging plans provided by Schneider Engineering and Consulting, which resulted in incomplete and inaccurate information communicated to Enterprise Products by Orion Marine Group during the one-call process, which resulted in insufficient measures to protect the pipeline from excavation damage.

SAFETY RECOMMENDATIONS

As a result of its investigation into this accident, the NTSB issued ten new safety recommendations to a federal regulator, industry organizations, and the companies involved in the accident.

The NTSB believes that pipeline operators and dredging companies would benefit from the federal regulator and industry organizations establishing guidance for obtaining and using accurate pipeline location data, and for clearly identifying and marking dredging boundaries, during project planning. The NTSB therefore recommended that PHMSA collaborate with Coastal and Marine Operators and the Council for Dredging and Marine Construction Safety to develop guidance for the industry to follow.

Believing that the existence of standard minimum tolerance or safety zones for dredging would reduce confusion during dredging planning and operations, the NTSB recommended that PHMSA include criteria for minimum tolerance or safety zones for dredging in state pipeline safety program evaluation guidelines, and that Enterprise revise its damage prevention program guidelines to include a larger tolerance zone for dredging operations.

The investigation revealed that Orion Marine Group did not adequately assess the risk for dredging near underwater pipelines during the planning process, and Schneider Engineering and Consulting, which produced the engineering plans and drawings, did not consistently include the pipelines or any tolerance zones in project plans. Therefore, the NTSB recommended that Orion Group Holdings incorporate risk assessments, written policies and procedures for planning dredging operations, and specifications and quality control measures related to pipelines and other hazards for engineering plans and drawings into its subsidiary companies' practices.

Finally, because the dredging industry would benefit from learning about the circumstances of this accident, the NTSB recommended that the Coastal and Marine Operators modify existing pipeline safety training to incorporate lessons learned from this accident.

Figure 138. Post-salvage images of the *Waymon Boyd* lever room and captain's office (*above*) and engine room portside bulkhead, bowed outward (*right*).

VESSEL GROUP
TOWING/BARGE

Flooding of Towing Vessel ***Alton St. Amant***

Harvey Canal, New Orleans, Louisiana

ACCIDENT DATE
May 17, 2020

ACCIDENT ID
DCA20FM019

REPORT NUMBER
MAB-21-07

ISSUED
March 11, 2021

Figure 139. *Alton St. Amant* under way before the accident. SOURCE: VESSEL FINDER

Figure 140. *Alton St. Amant*, partially submerged, on the morning of May 18. SOURCE: COAST GUARD

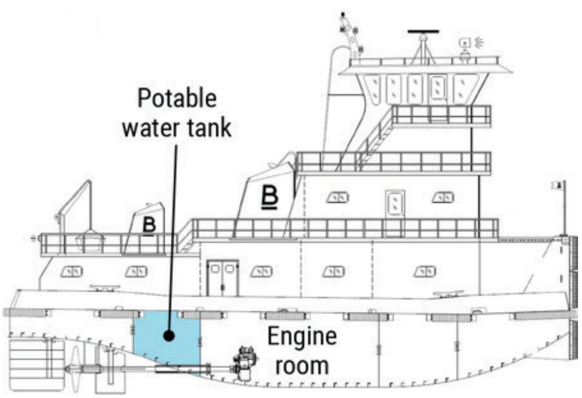
On May 17, 2020, about 0530 local time, a shipyard worker reported that the towing vessel *Alton St. Amant* was partially submerged while moored at a shipyard in the Harvey Canal in New Orleans, Louisiana. There were no crewmembers or shipyard workers aboard the vessel. Approximately five gallons of diesel fuel were released into the water. Damage to the vessel was estimated at $1.5 million. No injuries were reported.

On May 9, after spending about 6 weeks at the Bollinger Quick Repair shipyard, the ***Alton St. Amant*** was shifted from drydock to a wet berth to complete outstanding maintenance items. Among the remaining work, two bilge pumps, which had been removed from the vessel for overhaul, were to be reinstalled; the sealing rings on several of the vessel's tank access hatches were to be replaced; and the sealing surfaces of the hatches were to be cleaned.

On Friday, May 15, about 24,000 gallons of fuel were loaded onto the vessel. The flush hatches to the vessel's two potable water tanks located on the main deck in the rudder room had been opened for maintenance, but the covers were not reinstalled at the end of the day. That same day, the port engineer requested that the shipyard workers fill the two potable water tanks.

A pipefitter returned to the shipyard the following morning, on Saturday, May 16, and began reinstalling the bilge pumps with three other shipyard workers about 0500. About 1000, after completing the pump installation, he started filling the potable water tanks from a shoreside water manifold that was connected to the vessel's potable water fill pipe via a 2-inch hose through the open exterior engine room doors. He opened the supply (fill) valve at the shoreside manifold, and began filling the two tanks, which had a combined capacity of 13,233 gallons. Unaware that the potable water tank access hatches were open in the rudder room, he left the shipyard about 1030 with plans to return the next day (although a pre-work safety meeting was conducted each day, the status of these hatches was not communicated to the pipefitter). He intended to fill the tanks and then allow them to overflow onto the exterior main deck through their vents to flush out any residual debris inside before turning off the water supply.

Figure 141. Simple profile of the *Alton St. Amant* (not to scale), with the potable water tank highlighted.
BACKGROUND SOURCE: BLESSEY MARINE SERVICES



Throughout the remainder of the day and throughout the night, the two potable water tanks continued to fill with fresh water on the unmanned vessel. After the pipefitter departed the vessel, no other persons came aboard to monitor the status of the tank levels, and there was no shipyard policy for monitoring the filling process. Having been filled for several hours, the potable water tanks reached capacity, resulting in an overflow through the open hatches in the rudder room (rather than the tank vents as planned). After the rudder room flooded, the water spilled over the open doorsill onto the main deck of the engine room and began flooding down into that space.

About 0630 on Sunday, May 17, a shipyard worker walking past the *Alton St. Amant* noticed that the vessel was sitting low in the water and called the shipyard general manager.

The general manager found the *Alton St. Amant* partially submerged and resting on the bottom of the canal alongside the pier. The engine room was flooded, and the main deck was partially submerged. The general manager noticed the potable water hose connected to the vessel was charged; he then closed the potable water supply valve on the pier manifold. Fresh water had been filling the potable water tanks for over 20 hours.

Pollution mitigation and recovery efforts began that morning. By 1630, the *Alton St. Amant* was lifted by crane from the bottom of the canal and refloated. The following morning, shipyard workers who were disconnecting electrical power cables from the recovered vessel found the potable water hose still connected to the fill pipe on the *Alton St. Amant*.

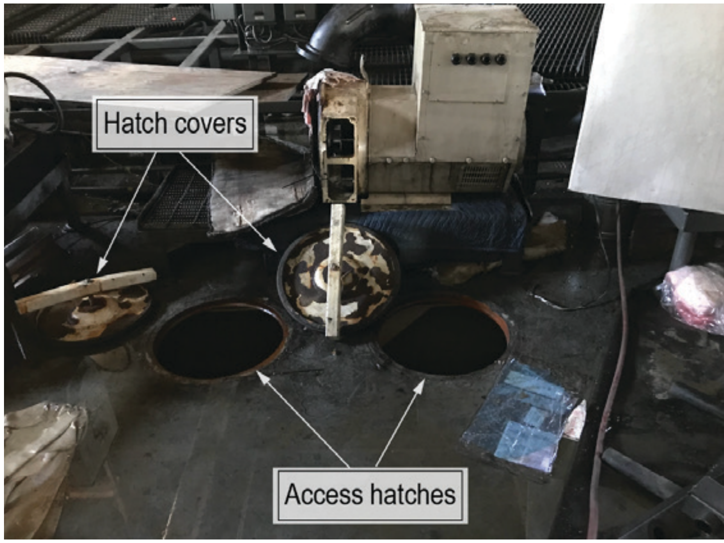


Figure 142. Open access hatches and their covers for the two potable water tanks in the rudder room.
SOURCE: COAST GUARD

The probable cause of the flooding of the towing vessel *Alton St. Amant* was the absence of shipyard pre-inspection and monitoring procedures for water transfer, which resulted in potable water tanks overflowing through their open access hatches during an unmonitored transfer.

Precautions for Tank Filling

Crew and shipyard personnel designated to conduct liquid transfers must be aware of the status of a vessel's tanks, including their access hatches and associated piping systems, whether ashore or at sea. When filling a tank, open access hatches create a risk of unintended flooding. Pre-inspection and monitoring of transfers provide the opportunity to identify and remedy any issues in order to ensure they are safely completed

VESSEL GROUP
FISHING

Engine Flooding and Sinking of Fishing Vessel ***Rebecca Mary***

Atlantic Ocean, about 40 miles south of Martha's Vineyard, Massachusetts

ACCIDENT DATE
June 17, 2020

ACCIDENT ID
DCA20FM021

REPORT NUMBER
MAB-21-12

ISSUED
May 13, 2021

Figure 144. *Rebecca Mary* before the accident. SOURCE: MARINE SAFETY CONSULTANTS

Figure 143. *Rebecca Mary* before the accident.
SOURCE: MARINE SAFETY CONSULTANTS

On June 17, 2020, in the early morning, the commercial fishing vessel ***Rebecca Mary*** began flooding in the aft portion of the vessel while under way in the Atlantic Ocean about 40 miles south of Martha's Vineyard, Massachusetts. The vessel capsized and subsequently sank. All four crewmembers abandoned the vessel in their survival suits and were rescued by a Coast Guard helicopter crew with no injuries reported. The vessel had approximately 3,000 gallons of diesel fuel aboard; after the vessel sank, an oil sheen was visible in the water. The ***Rebecca Mary***'s estimated value was $375,000.

On June 17, the ***Rebecca Mary*** was returning to New Bedford, Massachusetts, after fishing the previous two days. During the return transit, with a typical load of illex and ice on board, the vessel's freeboard was lower than it typically would be with an empty fish hold. Crewmembers witnessed waves washing onto the aft deck via the ramp into the hog pen area, which had its stern boards removed. While some seawater flowed back overboard via the ramp, the hog pen accumulated and contained some seawater that did not drain overboard via the port and starboard freeing ports.

About 0230, the engine room high-level bilge alarm sounded on the bridge. The deckhand on watch exited the wheelhouse, lined up the bilge system, and pumped out the water in the engine room. He stated that there was very little water, and everything appeared normal.

About 0400, the fish hold high-level bilge sump alarm sounded, which, according to the deckhand, was typical during a watch, due to melting ice. Crewmembers observed that the stern was sitting low enough that seawater began washing over and covering the non-watertight, raised lazarette hatch, which was equipped with a cover that could not be latched closed. The captain believed the cover for the lazarette was no longer sitting on top of the hatch after the water level rose above it. It is likely that seawater displaced the lazarette cover, causing the lazarette to flood through the open hatch. As seawater entered the lazarette, the vessel's freeboard would have been reduced further.

Figure 145. Inverted and mostly submerged *Rebecca Mary* during rescue operations on the morning of the sinking. SOURCE: COAST GUARD

The deckhand woke the captain, who started a second bilge pump. He stopped pumping the fish hold bilge sump and started pumping from the two aftermost compartments, the net locker and the lazarette. The deckhand stated that he did not hear high-level bilge alarms for the net locker or the lazarette when in the wheelhouse; the captain stated that when he started the bilge pumps for those spaces, he observed water exiting through the two overboard discharge pipes, indicating water was present.

The captain woke the other two crewmembers, and they all donned survival suits. At 0409, he made a distress call to the Coast Guard on VHF channel 16 and activated the EPIRB.

About 0500, the seawater level approached the forward part of the working deck, and the vessel began listing to port. It is unclear whether there was progressive flooding through the bulkhead from the lazarette to the net gear locker, or the water was from another ingress source.

Once the stern lowered to a certain point, water would have downflooded into the fish hold after displacing the raised, rectangular, non-watertight hatch cover.

The crew deployed the liferaft by throwing its canister overboard. After the liferaft inflated, the *Rebecca Mary* rolled over to port; the vessel's rigging punctured the liferaft, instantly deflating it. As the vessel capsized, all four crewmembers jumped overboard in their survival suits. They locked arms and waited about 15 minutes until a Coast Guard helicopter arrived. Crewmembers reported that the main engine continued to run throughout the flooding sequence and shut down when the *Rebecca Mary* capsized.

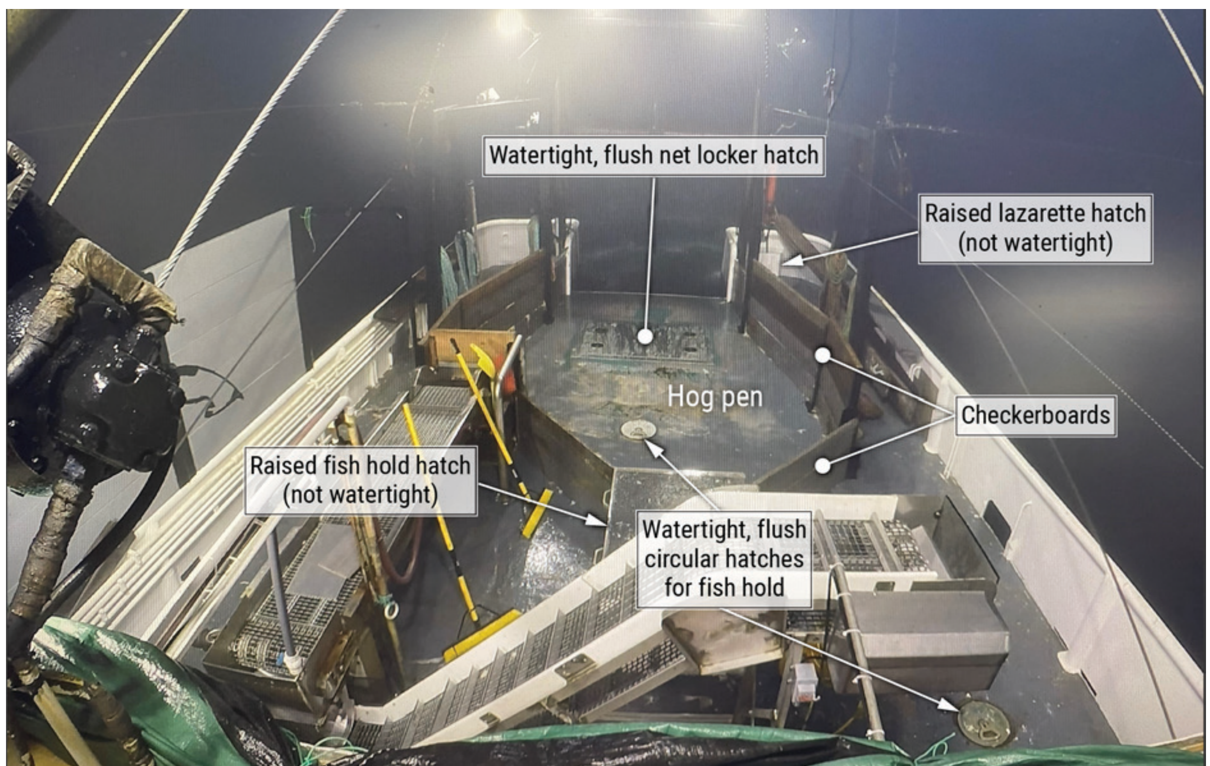
A survey vessel attempted to locate the sunken vessel using a multi-beam echosounder and side scan sonar systems, but the *Rebecca Mary* was not detected. Because the *Rebecca Mary* was not salvaged, there was no postaccident vessel examination to determine the initial flooding source.

The probable cause of the flooding and sinking of the fishing vessel *Rebecca Mary* was undetected flooding of the lazarette, likely through a non-watertight raised hatch.

Preparing for Abandonment

Early communication with the Coast Guard and preparing to abandon ship by donning survival suits or personal flotation devices when experiencing significant flooding, fire, or other emergencies increases the likelihood of survival. When deploying liferafts and other life-saving appliances, crews should attempt to launch in areas clear of obstructions.

Figure 146. Working deck of *Rebecca Mary*. BACKGROUND SOURCE: KEVIN RALPH



VESSEL GROUP
FISHING

Engine Stranding and Subsequent Loss of the Fishing Vessel ***Miss Annie***

Calibogue Sound, Hilton Head Island, South Carolina

ACCIDENT DATE
December 19, 2019

REPORT NUMBER
MAB-21-01

ACCIDENT ID
DCA20FM008

ISSUED
January 14, 2021

Figure 148. *Miss Annie* under way. SOURCE: COAST GUARD

Figure 147. *Miss Annie* shortly after all three crew were rescued. SOURCE: COAST GUARD

On December 19, 2019, about 0700, the fishing vessel ***Miss Annie*** was transiting out of Calibogue Sound, 2.3 miles north of Tybee Island, Georgia, when the vessel stranded on a submerged wreck. The three crewmembers aboard remained with the vessel until they were rescued by the US Coast Guard, and the vessel later broke apart. No pollution or injuries were reported. The vessel was a total loss. The vessel value was estimated at $60,000.

On November 1, 2019—over a month before the accident date—a yacht owner reported to the Coast Guard the location of a "significant object" that his vessel struck as he was leaving Hilton Head Island. Five days later, the Coast Guard published a hazard to navigation warning in the LNTM, reporting the submerged wreck's approximate position and advising caution. However, the LNTM reported the location of the charted and last known location for the wreck of the ***Miss Debbie*** (a 40-foot shrimp boat that sank during a storm in 2017), which was just over 800 yards southwest of the reported yacht strike location. The warning was repeated in weekly LNTMs through the end of 2019.

On November 12, 2019, NOAA updated its charts, using the location that was published in the LNTM, to indicate that the last known location for the wreck of the ***Miss Debbie*** was "approximate." On November 21, 2019, NOAA conducted a bottom survey of the area near the yacht strike, which showed a submerged wreck submerged less than 200 yards northwest from the reported yacht strike location. About 3 weeks after the survey—on the accident date—NOAA released corrections for their charts covering the area, marking the wreck found during the survey. Following NOAA's update for the accident area, the Coast Guard published the information in an LNTM.

The day of the accident, the 78-foot-long ***Miss Annie***, a single-propeller wooden fishing vessel, departed from Hilton Head Island at 0530. The captain was following his usual route through the Calibouge Sound entrance channel; two deckhands were also on board. Although the crew had been aware of the ***Miss Debbie*** wreck, they had not sighted it in over a year and were not looking for it. About 0700, as the captain steered southeast at a speed of about 10 knots, the vessel came to a complete stop and listed to its starboard side. The captain told investigators that it was "like I hit a rock." At 0723, the captain sent a distress call to Coast Guard Sector Charleston, and a response boat arrived on scene at 0735. After the first crewman boarded the response boat at 0745, the ***Miss Annie*** rolled, causing the remaining two crewmembers to slide into the water. By 0747, the crew of the response boat had recovered the two persons from the water. A day later, the ***Miss Annie*** had broken apart.

Based on the locations of the ***Miss Annie*** strike and the wreck charted in the NOAA survey on November 21, 2019 (likely the ***Miss Debbie***), the ***Miss Annie*** most likely struck the wreck identified and surveyed about a month before the accident. It appears that the previously charted wreck of the ***Miss Debbie*** had moved over the 2 years since its sinking and last charted position.

Although the captain could not confirm if his GPS unit had the most recent charts, the last software update had been in April 2019 and would not have included the surveyed wreck. Similarly, although the initial hazard warning and NOAA chart update noted the wreck in the area, the location was based on the last known position of the ***Miss Debbie*** wreck—more than 800 yards southwest from the location of the ***Miss Annie*** strike. Even if the ***Miss Annie*** captain had read the LNTM, noted the warning, and had the latest GPS updates, he would likely not have altered his route, thinking he was clear of the hazard.

For chart correction tools to be useful, mariners must read them. Mariners must be alert to new hazards along their intended route and adopt a process to identify the hazards before getting underway. That process should include viewing the NOAA weekly chart update and the LNTM before getting underway. A particular emphasis should be placed on identifying obstructions, such as a wreck, along the intended track of the vessel.

The probable cause of the *Miss Annie* stranding and subsequent loss was the vessel striking an unmarked wreck, whose position had shifted from its previous known position and was yet to be charted or announced in the notice to mariners.

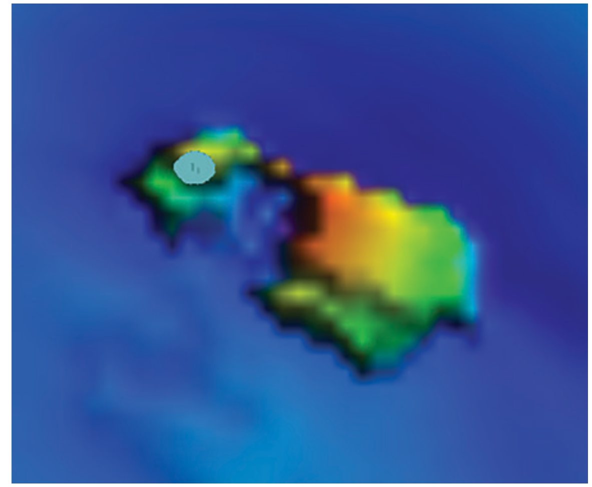


Figure 149. Image of wreck from NOAA Danger to Navigation Report. SOURCE: NOAA

Figure 150. *Miss Annie* top of wheelhouse and debris washed ashore. SOURCE: COAST GUARD

Identifying Navigation Hazards

Situation awareness demands a mariner should be alert for new hazards that can appear along their intended route. NOAA and the Coast Guard track these hazards and publish chart corrections each week. Mariners should adopt a process for identifying new hazards that are not marked on their paper or electronic chart system, before getting underway.

NOAA provides weekly chart updates: https://distribution.charts.noaa.gov/weekly_updates/

The U.S. Coast Guard provides NOAA chart corrections each week in Section IV – Chart Corrections in the Local Notice to Mariners: https://www.navcen.uscg.gov/?pageName=lnmMain

For a list of all chart corrections for paper charts tracked by chart number and edition: https://ocsdata.ncd.noaa.gov/ntm/Default.aspx

VESSEL GROUP
CARGO, GENERAL

Breakaway of Containership *CMA CGM Bianca*

Napoleon Avenue Container Terminal, Lower Mississippi River, mile 100, New Orleans, Louisiana

ACCIDENT DATE
August 2, 2020

REPORT NUMBER
MAB-21-18

ACCIDENT ID
DCA20FM024

ISSUED
September 2, 2021

Figure 152. *CMA CGM Bianca* before the accident. SOURCE: HENRY KADOCH, HARBORSHOTS.COM

On August 2, 2020, about 1402 local time, the containership *CMA CGM Bianca* was loading cargo while moored at the Napoleon Avenue Container Terminal in New Orleans, Louisiana, when a sudden, localized thunderstorm passed through the area. The vessel's mooring lines parted in the high winds, and the ship moved away from the pier. Containers being lifted by shoreside gantry cranes struck the ship, and one damaged container dropped in the water, spilling a cargo of plastic pellets. A crane operator suffered a minor injury; no other injuries were reported among ship and shore personnel. The total cost of damages was estimated at $15 million for the shoreside gantry cranes and $60,196 for the ship.

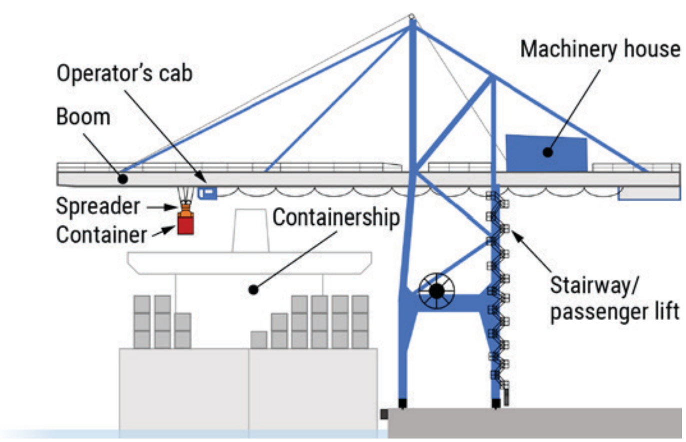
At 0418 that morning, the 1,099-foot-long *CMA CGM Bianca* had moored starboard side to at the container terminal. Eight lines were rigged from the bow, and eight lines were rigged from the stern. The mooring lines were certificated and in good or acceptable condition. The ship was equipped with self-tensioning-capable mooring winches; however, the auto-tensioning devices on the mooring line winches were not engaged because, according to the master, the river current in the Mississippi River and wash from passing vessels could trigger unwanted payout, resulting in slack lines. Instead, the mooring winches were secured by their brakes, and the lines were inspected by the crew during regular rounds to ensure adequate tension. At the completion of mooring, the containership's main propulsion engine was shut down. At 0712, after a safety meeting, container unloading commenced, followed shortly thereafter by concurrent loading operations, using gantry cranes nos. 5 and 6.

At 1300, a second shift of longshoremen arrived to take over cargo operations. The crane no. 5 operator said that the weather at the time of the shift change was "bright and sunny." However, about an hour into the shift, "it got pretty cloudy." The two crane operators stated that work normally continued during rain, only stopping during reduced visibility or high winds. So, although the crane no. 6 operator saw the approaching weather, he proceeded with operations.

The NWS issued a special weather statement about 40 minutes before the accident, reporting a thunderstorm in the area moving east toward the accident site. However, the statement made no mention of the threat of high winds, and a severe thunderstorm warning was not issued.

At 1350, security cameras at the terminal recorded rain beginning to fall. The rain increased steadily while visibility decreased, completely obscuring the camera view. Ten minutes later, "gale force winds and strong rain" hit the containership. The master described the

Figure 151. Simplified diagram of gantry crane no. 6.



conditions as "in the form of a tornado," and both crane operators stated that the winds developed "in seconds." A vessel located very close to the accident reported a wind gust at 73 mph, and both the no. 5 and no. 6 cranes shut down automatically, indicating sustained winds of at least 45 mph or gusts of at least 55 mph. The evidence suggests that the *CMA CGM Bianca* was struck by outflow winds from a downburst.

Under the force of the wind, at 1402, seven forward mooring lines and three aft mooring lines on the *CMA CGM Bianca* parted, and the ship moved away from the pier. Due to the wind's sudden onset and extreme velocity, the crane nos. 5 and 6 operators had little time to act to move the cranes and attached containers into a safe position. The cranes began moving forward to aft along their rails. The container suspended from crane no. 5 hit other containers stowed on the ship and then fell from the ship. The container hit the pier and broke open before falling in the water. Part of the container's cargo of plastic pellets was discharged into the river and were "irretrievable."

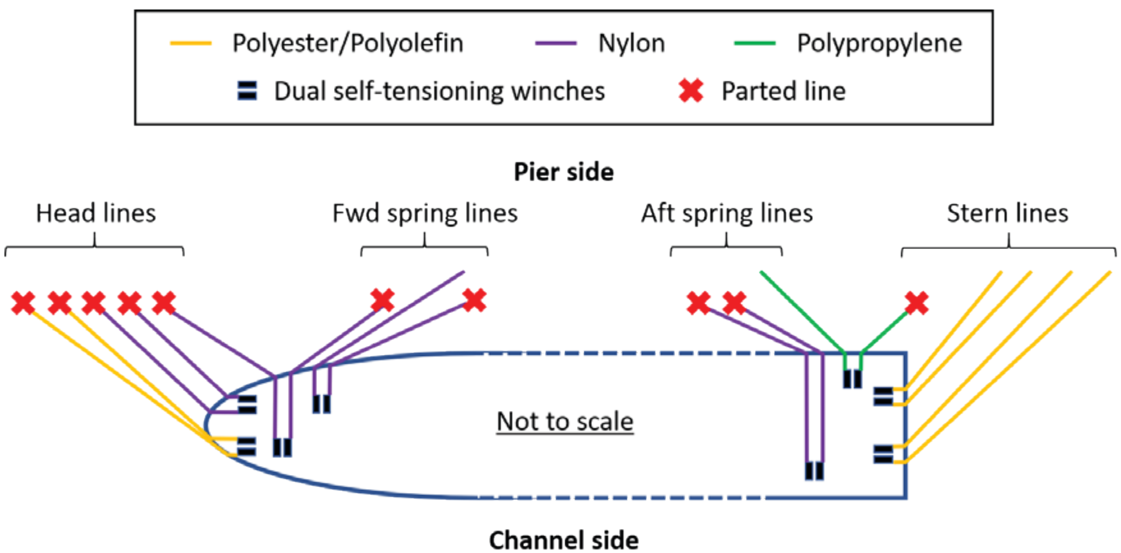
The container suspended from crane no. 6 struck a hatch cover guide in the *CMA CGM Bianca*'s cargo bay, puncturing the container. The forward spreader bars then detached from the spreader, dropping the container and the forward spreader bars into the ship's hold. The remainder of the spreader, still attached to the crane, then impaled and lodged in another container.

Within minutes of the lines parting, the crew had dropped both anchors in the water, energized the bow thruster, started the main engine and transferred control to the bridge. The crew then used the thruster and engines, along with the anchors, to hold the vessel's position in the river. The quick actions of the crew prevented the vessel from drifting down river, where it could have caused damage to other vessels or shore infrastructure.

The probable cause of the breakaway of the containership *CMA CGM Bianca* from the Napoleon Avenue Container Terminal wharf and the ensuing equipment damage was the sudden onset of unforecasted severe winds likely originating from the outflow of a thunderstorm-generated downburst.

Figure 153. Right: Security camera footage of Napoleon Avenue Container Terminal pier during accident.
BACKGROUND SOURCE: PORTS AMERICA

Figure 154. Simplified diagram of *CMA CGM Bianca*'s mooring line arrangement.



VESSEL GROUP
TOWING/BARGE

Container Damage and Loss aboard Deck Cargo Barge *Ho'omaka Hou*, Towed by *Hoku Loa*

Pacific Ocean, 6.9 miles north-northwest of Hilo, Hawaii

ACCIDENT DATE
June 22, 2020

REPORT NUMBER
MAB-21-09

ACCIDENT ID
DCA20FM022

ISSUED
April 6, 2021

Figure 155. Locking cone (left) and stacking cone (right) similar to ones used on the *Ho'omaka Hou*. BACKGROUND SOURCE: COAST GUARD

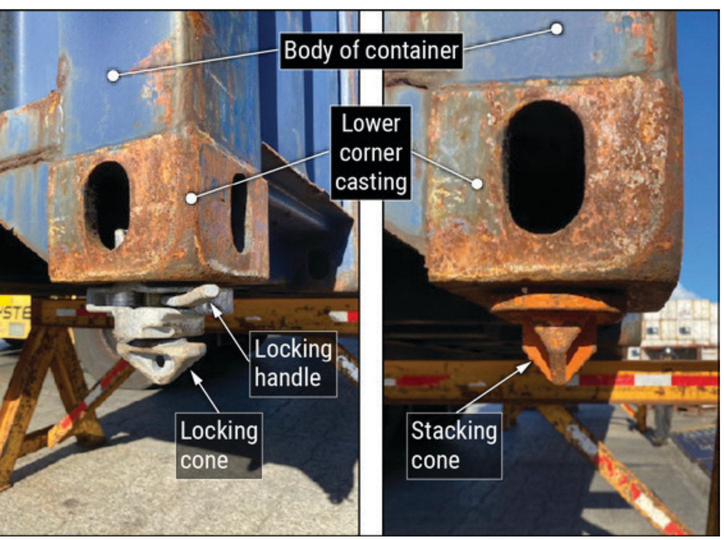


Figure 156. The collapsed row of containers, from the starboard quarter of the *Ho'omaka Hou*. SOURCE: COAST GUARD

On June 22, 2020, about 0230 local time, the deck cargo barge *Ho'omaka Hou* was under tow by the towing vessel *Hoku Loa* off the northeast coast of the big island of Hawaii en route to Hilo, when fifty 40-foot containers stacked on the after deck of the barge toppled, causing 21 to fall into the ocean. There were no injuries or pollution reported. Eight containers were eventually recovered by salvors, and 13 remain missing. Cargo loss was estimated at $1.5 million, and damage to the barge and containers was estimated at $131,000.

After its last voyage, the 340-foot-long-by-90-foot-wide *Ho'omaka Hou* had been empty for a few days before loading commenced for the accident voyage. The company port engineer performed a thorough inspection of the barge prior to loading and found no deficiencies that would compromise cargo.

On June 20, cargo was driven aboard by the machine operators and secured by lashers. The lashings were checked to confirm that all were secure and tight, and, about 1830, the barge superintendent informed the dispatcher that the barge was ready for the tug. The cargo consisted mostly of 20- and 40-foot-long dry cargo and refrigerated containers but also included ISO tank containers, wheeled vehicles, flatracks, and palletized cargo. There was no initial barge load plan with weights of the containers because load planning was done "as the day goes on" during loading. Therefore, barge team members were never given a copy of a stow plan to assist them in stacking the containers.

An initial barge load plan showing stratified container weights would have been a useful tool to assist the barge team machine operators in stacking containers on the barge to reduce or eliminate reverse stratification—meaning that heavier containers were loaded above lighter containers. Reverse stratification results in stacks having a higher center of gravity than stacks created by placing the heaviest containers on the deck, with progressively lighter containers above—referred to as normal stratification. Normal stratification is preferred, because it creates a stack having the lowest possible center of gravity.

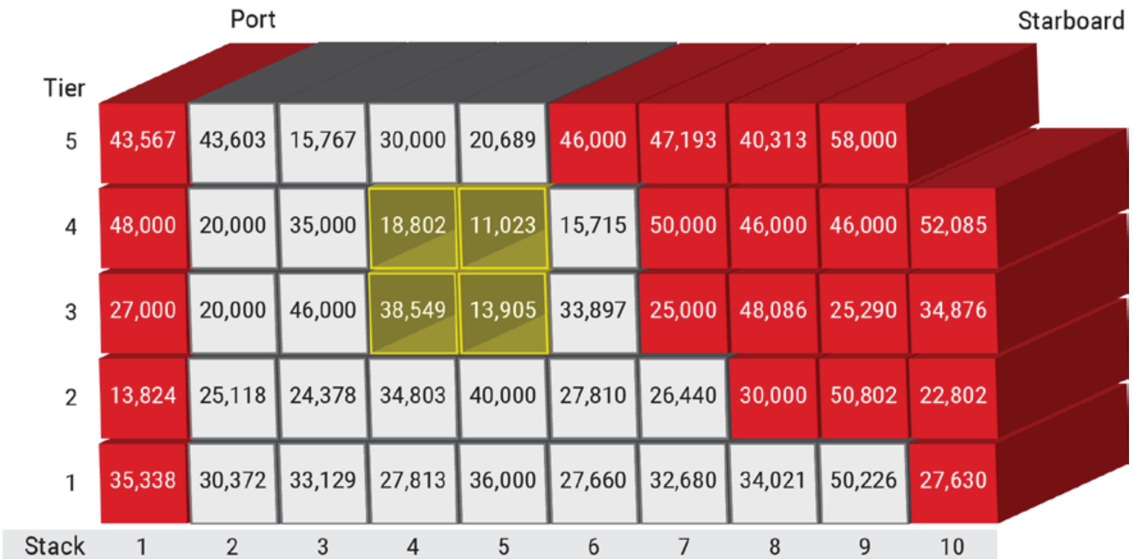


Figure 157. Portion of stow plan showing container weights of the toppled container row. All weights are estimated gross weights in pounds. Red containers went overboard. Flatracks are indicated by yellow squares: tare weight is 11,023; gross weight cannot exceed 54,000 pounds.

Figure 158. The *Ho'omaka Hou*, loaded for a previous voyage, as viewed from the stern. Note the loading of the barge was not the configuration of the accident voyage.
SOURCE: YOUNG BROTHERS, LLC

Even though machine operators stated they tried to stack containers with heavy containers on the bottom and light ones on top, neither the barge team member job descriptions nor the company-provided Container Lashing Tips included instructions pertaining to the order in which to stack containers. Instead, heavy containers were often loaded over lighter containers, and stacks 1, 7, 8, and 10 were loaded almost exactly in reverse stratification. In addition, the company did not provide the barge team procedures or calculations to determine if the lashing arrangements were sufficient for the reverse-stratified container stacks.

About 2004, the 108-foot-long *Hoku Loa* arrived at pier 39, where the *Ho'omaka Hou* was docked. The master used the barge superintendent's report to the company dispatcher to determine that the tow was in compliance with the vessel's stability letter and applicable loadline regulations. The company did not provide the master with the weights of the cargo to afford him a means to determine if the lashings were sufficient for the way the containers were stacked. The tow got under way at 2028 en route to Hilo, entering the open ocean about 2115.

The reverse-stratified stack's securing arrangements would have been subject to increased forces while moving in a seaway. The containers were secured primarily with stacking cones, which provided little protection against the containers leaning or tipping. About 0200 on June 22, the barge turned about 30° to a new south-southeasterly course, and it is likely that the dynamic rolling from the seas on the vessel's beam resulted in forces on the container stacks with the greatest reverse stratification so that, unchecked by the lashings used solely on outboard stacks of containers and the stacking cones used as the primary securing point between containers, the containers tipped over and caused the row to collapse.

At 0400 on June 22, during the approach to the dock at Hilo, the captain of the *Hoku Loa* was informed that the containers on the stern of the barge had toppled over. This was the first time any of the *Hoku Loa* crew realized the collapse had occurred. Once moored, shoreside personnel found that the aftermost row of containers stowed in a fore and aft direction had collapsed and that 21 40-foot containers had fallen overboard. Later that afternoon, a salvage company was hired to search for and recover the lost containers.

The probable cause of the collapse of container stacks on board the barge *Ho'omaka Hou* towed by the *Hoku Loa* was the company not providing the barge team with an initial barge load plan, as well as inadequate procedures for monitoring stack weights, which led to undetected reverse stratification of container stacks that subjected the stacks' securing arrangements to increased forces while in transit at sea.

Sufficiency of Container-Securing Arrangements on Barges

It is important for cargo planners to have tools, such as stow plans and calculations, to assist with determining proper stowage and the sufficiency of securing arrangements for containers stacked on barges. These tools should address the potential that container stacks may be stacked in a reverse stratified manner.

Lessons Learned

Accident investigations completed in 2021 demonstrate a variety of hazards foundational to marine transportation. For example, stability is critical for any vessel from a canoe to a containership, and stability calculations and instructions must be accurate and must be followed. Icing and severe weather are longstanding threats to marine transportation, and dovetail with stability concerns when ice is not accounted for in stability calculations.

Containment of engine room fires has been a concern since vessels have been powered, and proper cargo preparation and securement is critical when cargo itself poses a hazard or when considering the loss of cargo overboard. Other marine casualties closed in 2021 vividly exemplified the need for continuing improvement to communications, teamwork, and technology.

The NTSB responds to accident lessons by issuing and reiterating safety recommendations, until safety improvements become realities onboard vessels, throughout the organizations that operate them, and in the Coast Guard's regulations.

Vessels routinely transit our seas and waterways without incident. But when there are tragedies at sea, mariners, masters, and managers ashore who disregard accident lessons all but invite the circumstances to repeat. NTSB recommendations can reduce this risk, once acted upon. But so can you, the individual. Knowing the circumstances of the last accident can well be the edge you need in preventing the next one.

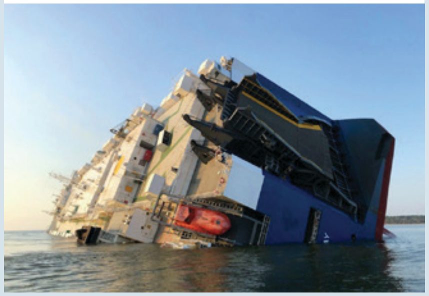
View your ship or your company's operations through the eyes of our investigators. What lessons might investigators find if your vessel were in an accident? Have previous investigations yielded mitigations? We hope that these lessons learned help you, the reader, to view your own operation with a cold, critical eye and take appropriate action.

Vessel Stability

Through proper design, loading, and operation, a vessel should possess enough stability to return to its upright position after being heeled over by any combination of wind, waves or forces from operations. Stability criteria, established by regulators, are generally recognized as providing an adequate level of safety for vessels that are operated prudently. The intent of stability requirements is to provide information to vessel's crew that will enable them to readily ascertain the stability of their vessel under varying loading conditions. A vessel's stability instructions must be accurate, and the crew must use the instructions correctly when determining stability to ensure a vessel is loaded such that it meets the stability criteria intended by the vessel designers and approved by regulators.

Inaccurate stability instructions and the **effect of icing on stability** were factors in the *Scandies Rose* casualty.

An **incorrect determination of vessel stability** was a factor in the *Golden Ray* casualty.



Containing Engine Room Fires

Engine rooms contain multiple fuel sources and are especially vulnerable to rapidly spreading fires. Following the initiation of an engine room fire, it is imperative to remove the source(s) of available fuel to a fire. Designers and operators should evaluate fire hazards and provide effective means to mitigate them. Vessel owners should encourage crews to familiarize themselves and train frequently on machinery, fuel oil, lube oil, and engine room ventilation shutoff systems.

A **lack of remote emergency cut-off valves** for the engine room was a factor in the *Master Dylan* casualty.

The **lack of a fixed fire-extinguishing system** for the engine room and the **loss of electrical power to a single fire pump** were factors in the *City of Cleveland* casualty.

Quick and effective actions by the crew resulted in the **successful containment and extinguishment of the engine room fire** aboard the *Ocean Intervention*.

Icing and Severe Weather

Severe weather can create challenging conditions, including strong currents and high winds and seas. In cold weather climates, wave-generated sea spray can cause icing, which can severely affect the stability of a vessel. Additionally, in remote locations where weather observation sites are more spread out, there can be inaccurate and less precise forecasts. Marine operating companies should develop and continuously evaluate severe weather plans to prepare for challenges accompanied by severe weather, and mariners should take caution when operating in conditions where sea spray icing can occur.

Extreme icing and lack of accurate weather data were factors in the *Scandies Rose* casualty.

Severe weather was a factor in the I-10 Bridge Barge Breakaway and *CMA CGM Bianca* casualties.

Risk Management and Project Planning

A formal risk assessment, which involves identifying hazards and estimating the risk they pose, is a critical component of casualty prevention. By considering the likelihood and severity of each risk, risk matrices increase the visibility of risks and help managers select controls commensurate with the risk level. With such information, a hazard control plan can be developed and implemented.

Inadequate risk management and project planning were factors in the *Waymon Boyd* and *GH Storm Cat* casualties.

Cargo Preparation and Securement

It is important for cargo planners to have tools and procedures, such as stow plans, calculations, and preparation instruction, to assist with determining proper stowage and the sufficiency of securing arrangements for cargo loaded aboard vessels. These tools and procedures must consider the type of cargo and the design of the vessel, as well as the potential hazards presented by the cargo. Operators must ensure that these procedures are followed during the loading of the vessels.

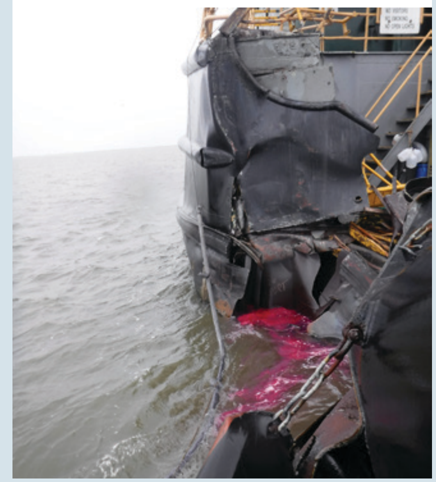
The **improper securing of cargo** was a factor in the *Höegh Xiamen* and *Ho'omaka Hou/Hoku Loa* casualties.

Teamwork

Safe and effective operations are not one person's job. Teamwork is an essential defense against human error, and a good team should anticipate dangerous situations and recognize the development of an error chain. If in doubt, team members should speak up or notify a higher authority. Sharing information among crew, pilots, and facility operators and providing a thorough turnover are also critical components of effective teamwork.

A **lack of effective teamwork** was a factor in the *Savage Voyager* and *Cheramie Bo Truc No 22* casualties.

An **ineffective master/pilot exchange** was a factor in the *Levant* casualty.



Effective Communication

Early and effective communication is critical to avoiding close-quarters situations. The use of VHF radio can help dispel assumptions and provide bridge teams and vessel operators with the necessary information to adequately assess other vessels' intentions. In situations where a casualty cannot be avoided, early and effective communication can mitigate the effects, reducing damage, injuries, or loss of life.

A **lack of early and effective communication** was a factor in the *Bow Fortune/Pappy's Pride* and *Cooperative Spirit/RC Creppel* casualties.

Early and effective communications during the *Genesis River/Voyager* tow casualty likely prevented the loss of the towing vessel and injuries to its crew.

Standard Operating Procedures

Safety of vessel operations and compliance with mandatory rules and regulations can be achieved, in part, by establishing clear standard operating and emergency procedures. In conjunction, regularly training crews and personnel involved in operations in standard operating procedures can prepare for and mitigate the risk of emergency situations.

A **lack of specific standard operating procedures** was a factor in the *Atlantic Huron, Golden Ray, Ho'omaka Hou* (below), *Hoegh Xiamen*, and *Waymon Boyd* casualties.

A **failure to follow standard operating procedures** was factor in the *Höegh Xiamen* casualty.

Transiting in Narrow Channels

Narrow channels can be particularly challenging to navigate due to the hydrodynamic effects on a vessel and the substantial amount of traffic in the waterway. Larger, deeper draft vessels are even more prone to the hydrodynamic forces created by the channel banks and passing vessels. Transiting a narrow channel, like the Houston Ship Channel, at sea speed, in which the vessel is at or near its maximum speed while the engine is less responsive, provides little room for error and should be avoided.

Transiting a narrow channel at sea speed was a factor in the *Genesis River* casualty.

Distress Communications and Preparations for Abandonment

A successful emergency response is contingent on early distress notification and clear, effective communication. Additionally, preparing to abandon ship by donning survival suits or personal flotation devices increases the likelihood of survival when experiencing significant flooding, fire, or other emergencies.

Early distress communication and the crew's preparation to abandon ship in the *Rebecca Mary* casualty contributed to their survival.

An **ineffective emergency distress call** was a factor in the severity of the *Höegh Xiamen* casualty.

Identifying Navigational Hazards

Situational awareness demands a mariner should be alert for new hazards that can appear along their intended route. It is important to check the Coast Pilot and navigational charts when developing voyage plans to improve knowledge of an area and prepare for a safe passage.

A **failure to identify navigational hazards** was a factor in the *Old Glory* and *Miss Annie* casualties.

AIS Data Input for Towing Operations

To enhance others' situational awareness and alleviate possible misinterpretation, the combined dimensions of a vessel and its tow, reflecting the overall area covered by the tow, should be entered into AIS and broadcasted while under way.

Broadcasting inaccurate AIS information was a factor in the *Cooperative Spirit/RC Creppel* casualty.

Continuous Monitoring of Unmanned Vessels

Fire and flooding are risks not only for crewed vessels, but those unattended as well. To protect personnel, property, and the environment, it is good marine practice for owners, operators, and shipyard managers to coordinate and implement some form of continuous monitoring for vessels undergoing maintenance in a shipyard, in lay-up, or in some other inactive period without regular crews aboard. Continuous monitoring can consist of scheduled security rounds and/or active monitoring with sensing and alarm systems.

A **lack of continuous monitoring** was a factor in the *Alton St. Amant* and *Iron Maiden* casualties.

Sufficient Handover Period

Fatigue is a longstanding issue that continues to adversely affect the safety of marine operations. Failing to get adequate sleep is a high-risk practice that leads to casualties. When joining vessels, crewmembers must often travel long distances, including internationally, and may have little time for rest. It is critical that vessel operating companies ensure that joining crewmembers have the opportunity to obtain adequate rest and allow for a sufficient handover period before they take over critical shipboard duties.

An **insufficient crew handover period** for a was a factor in the *Atina* casualty.

"Though the circumstances vary, our mission is the same for every investigation we lead: **to determine what happened and issue evidence-based recommendations to prevent similar events from occurring in the future...**
But stakeholders at all levels must implement our recommendations to ensure safety."
Jennifer Homendy, NTSB Chair

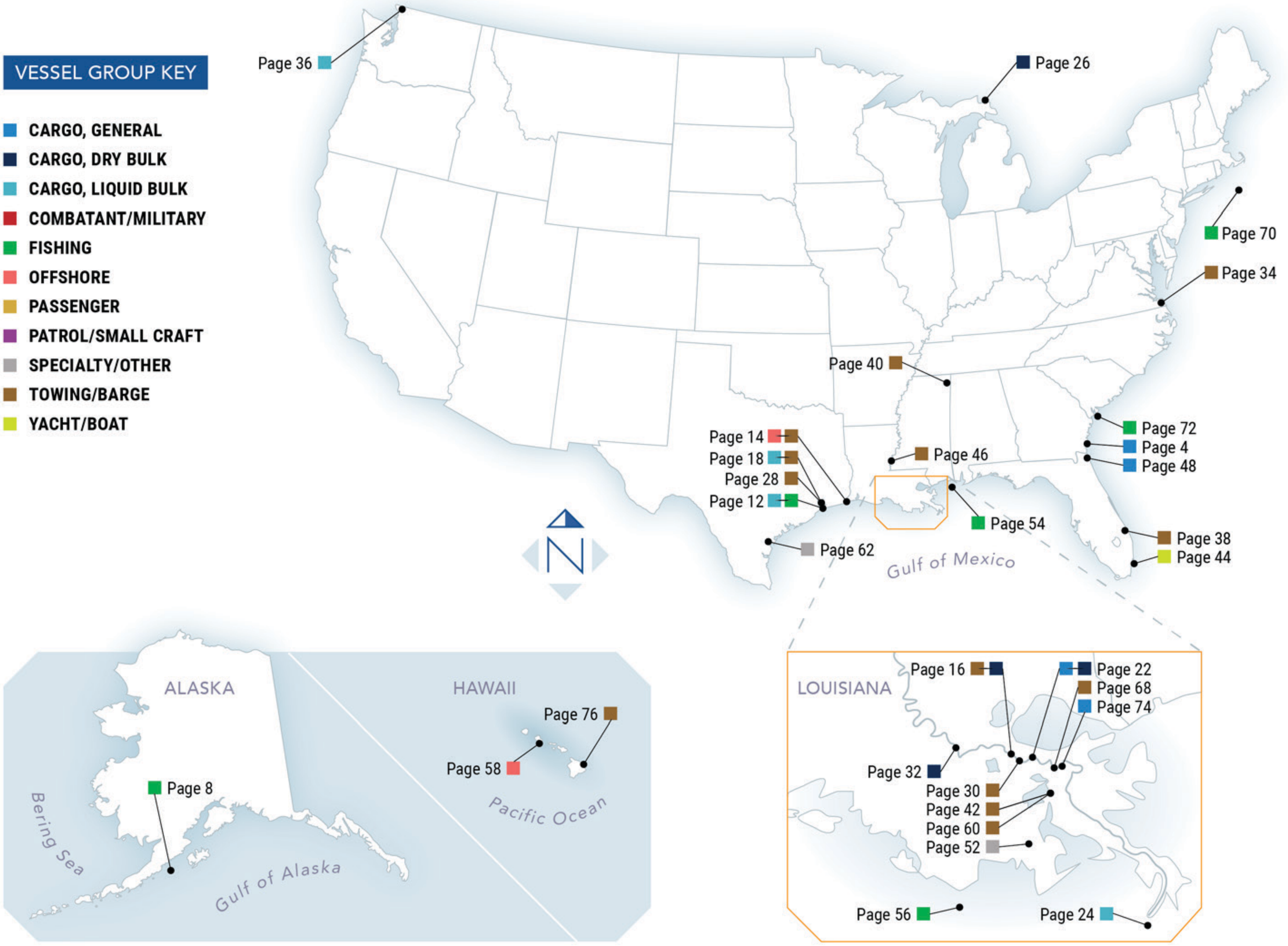
Vessel Particulars by Vessel Group

VESSEL NAME	VESSEL TYPE	FLAG	LENGTH	DRAFT	BEAM/WIDTH	PERSONS ON BOARD	PAGE NO.
CARGO, DRY BULK							
Atlantic Huron	Self-unloading bulk carrier	Canada	736 ft (224 m)	26.5 ft (8.1 m)	26.5 ft (8.1 m)	**25**	28
Atlantic Venus	Dry bulk carrier	Panama	590.2 ft (179.9 m)	21.1 ft (6.4 m)	92.5 ft (28.2 m)	**20**	12
GH Storm Cat	Dry bulk carrier	Marshall Islands	656 ft (200 m)	43.6 ft (13.3 m)	4106 ft (32 m)	**19**	40
Glory First	Dry bulk carrier	Marshall Islands	200 ft (61 m)	13 ft (4 m)	35 ft (10.7 m)	**22**	76
CARGO, GENERAL							
CMA CGM Bianca	Containership	Malta	1,099 ft (335 m)	42.7 ft (13 m)	140.4 ft (42.8 m)	**27**	82
Golden Ray	Ro/Ro	Marshall Islands	656 ft (200 m)	30.9 ft (9.4 m)	116 ft (35.4 m)	**24**	16
Höegh Xiamen	Ro/Ro	Norway	599.7 ft (182.8 m)	26 ft (8 m)	81 ft (31.5 m)	**21**	94
Nomadic Milde	General cargo ship	Marshall Islands	453 ft (138.1 m)	26.4 ft (8.1 m)	68.9 ft (21 m)	**16**	14
CARGO, LIQUID BULK							
Atina	Oil tanker	Malta	898 ft (273.7 m)	Aft 28.9 ft (8.8 m)	157.5 ft (48 m)	**21** (plus **5** on oil platform)	10
Bow Fortune	Chemical/product tanker	Norway	600.7 ft (183.1 m)	28.9 ft (8.8 m)	105.6 ft (32.2 m)	**29**	14
Genesis River	Liquefied gas carrier	Panama	754 ft (229.9 m)	36.8 ft (11.2 m)	122 ft (37.2 m)	**30**	38
Levant	Liquefied gas carrier	Marshall Islands	741.5 ft (226 m)	34.1 ft (10.4 m)	120 ft (36.6 m)	**21**	56
FISHING							
Lucky Angel	Fishing vessel	United States	75 ft (22.9 m)	11.2 ft (3.4 m)	22.4 ft (6.8 m)	**3**	46
Master Dylan	Fishing vessel	United States	85.2 ft (26 m)	12.5 ft (3.8 m)	29.5 ft (9 m)	**4**	22
Miss Annie	Fishing vessel	United States	78.2 ft (23.8 m)	6.5 ft (2 m)	22 ft (6.7 m)	**3**	78
Pappy's Pride	Fishing vessel	United States	81.7 ft (24.9 m)	9 ft (2.75 m)	24 ft (7.3 m)	**4**	96
Rebecca Mary	Fishing vessel	United States	74 ft (22.6 m)	11.2 ft (3.4 m)	22 ft (6.7 m)	**4**	54
Scandies Rose	Fishing vessel	United States	130 ft (39.6 m)	11.3 ft (3.4 m)	34 ft (10.4 m)	**7**	6
OFFSHORE							
Cheramie Bo Truc No 22	Offshore supply vessel	United States	167 ft (50.8 m)	10.5 ft (3.2 m)	38 ft (11.6 m)	**5**	34
Ocean Intervention	Offshore supply vessel	United States	243 ft (74.1 m)	13.3 ft (4.1 m)	53.5 ft (16.3 m)	**16**	10

VESSEL NAME	VESSEL TYPE	FLAG	LENGTH	DRAFT	BEAM/WIDTH	**PERSONS ON BOARD**	PAGE NO.
SPECIALTY/OTHER							
Iron Maiden	Dive support vessel	United States	163.6 ft (49.6 m)	15 ft (4.5 m)	44 ft (13.4 m)	**0**	90
Waymon Boyd	Dredge	United States	151.3 ft (46.1 m)	5.5 ft (1.7 m)	33.8 ft (10.3 m)	**18**	56
TOWING/BARGE							
Alton St. Amant	Towing vessel	United States	83.5 ft (25.4 m)	7 ft (2.1 m)	30 ft (9.1 m)	**0**	18
Barge breakaway	Various towing vessels and tank barges	United States	52–200 ft (31–61 m)	7–13 ft (2.7–4m)	20–48 ft (10.4–14.6 m)	**9**	68
BH 2903	Hopper barge	United States	295 ft (89.9 m)	9.6 ft (2.9 m)	54 ft (16.5 m)	**0**	32
City of Cleveland	Towing vessel	United States	140 ft (46.2 m)	11 ft (3.4 m)	42 ft (13 m)	**9**	84
Cole	Hopper barge	United States	230 ft (70.1 m)	7 ft (2.1 m)	45 ft (13.7 m)	**0**	70
Cooperative Spirit	Towing vessel	United States	200 ft (61 m)	10 ft (3 m)	54 ft (16.5 m)	**9**	24
George C	Towing vessel	United States	67.5 ft (20.6 m)	6 ft (1.8 m)	26 ft (7.9 m)	**4**	22
Ho'omaka Hou	Deck cargo barge	United States	340 ft (103.6 m)	11.9 ft (3.6 m)	90 ft (27.4 m)	**0**	42
Hoku Loa	Towing vessel	United States	108 ft (32. 9 m)	16.9 ft (5.2 m)	34 ft (10.4 m)	**6**	18
Hoku Loa	Towing vessel	United States	108 ft (32. 9 m)	16.9 ft (5.2 m)	34 ft (10.4 m)	**6**	18
Island Lookout	Towing vessel	United States	65 ft (19.8 m)	7 ft (2.1 m)	26 ft (7.9 m)	**4**	44
Mariya Moran (Tug of ATB–***Texas***)	Towing/Barge ATB	United States	121 ft (36.9 m)	17 ft (5.1 m)	36 ft (11 m)	**9**	14
Old Glory	Towing vessel	United States	51 ft (15.7 m)	7 ft (2.1 m)	20 ft (6 m)	**4**	48
PBL 3422	Tank barge	United States	297 ft (90.7 m)	9.5 ft (2.9 m)	54 ft (16.5 m)	**0**	30
RC Creppel	Towing vessel	United States	69 ft (21 m)	10 ft (3 m)	30 ft (9.1 m)	**4**	52
Savage Voyager	Towing vessel	United States	83.5 ft (25.5 m)	10 ft (3.1 m)	32 ft (9.8 m)	**6**	22
Susan Lynn	Towing vessel	United States	119 ft (36.3 m)	6 ft (1.8 m)	28 ft (8.5 m)	**1**	30
Texas (Barge of ATB–***Mariya Moran***)	Towing/Barge ATB	United States	463 ft (141.2 m)	16 ft (4.9 m)	78 ft (23.8 m)	**1**	84
Trent Joseph	Towing vessel	United States	67 ft (20.4 m)	10 ft (3 m)	24 ft (7.3 m)	**4**	12
Voyager	Towing vessel	United States	68.9 ft (21 m)	8.5 ft (2.6 m)	26.1 ft (8 m)	**4**	82
YACHT/BOAT							
Andiamo	Private yacht	Marshall Islands	120 ft (36.6 m)	12.9 ft (3.9 m)	25.8 ft (7.9 m)	**5**	66

Table and Map of Accident Locations

PAGE	VESSEL NAME	VESSEL GROUP	LOCATION
	CAPSIZING/LISTING		
4	***Golden Ray***	CARGO, GENERAL • Ro/Ro	St. Simons Sound, Brunswick River, near Brunswick, **Georgia**
8	***Scandies Rose***	FISHING • Fishing vessel	Pacific Ocean, near Sutwick Island, **Alaska**
	COLLISION		
12	***Bow Fortune / Pappy's Pride***	CARGO, LIQUID BULK • Chemical/product tanker / FISHING • Fishing vessel	Outer Bar Channel, Galveston, **Texas**
14	***Cheramie Bo Truc No 22 / Mariya Moran–Texas***	OFFSHORE • Offshore supply vessel / TOWING/BARGE • Towing vessel / Barge	Sabine Pass Jetty Channel, Port Arthur, **Texas**
16	***Cooperative Spirit / RC Creppel / Glory First***	TOWING/BARGE • Towing vessel / Towing vessel / CARGO, DRY BULK • Dry bulk carrier	Lower Mississippi River, mile 123, Destrehan, **Louisiana**
18	***Genesis River / Voyager***	CARGO, LIQUID BULK • Liquefied gas carrier / TOWING/BARGE • Towing vessel	Houston Ship Channel, Upper Galveston Bay, **Texas**
22	***Nomadic Milde / Atlantic Venus***	CARGO, GENERAL • Cargo vessel / CARGO, DRY BULK • Dry bulk carrier	Lower Mississippi River, mile 114.5, South Kenner, **Louisiana**
	CONTACT		
24	***Atina***	CARGO, LIQUID BULK • Oil tanker	Southwest Pass Fairway Anchorage, Gulf of Mexico, 21.5 miles south-southwest of Pilottown, **Louisiana**
26	***Atlantic Huron***	CARGO, DRY BULK • Self-unloading bulk carrier	Soo Locks, Saint Mary's River, Sault Sainte Marie, **Michigan**
28	**Barge Breakaway**	TOWING/BARGE • Towing vessels / Tank barges	San Jacinto River Fleet, San Jacinto River, Channelview, **Texas**
30	***Cooperative Spirit***	TOWING/BARGE • Towing vessel	Lower Mississippi River, mile 121.6, near Luling, **Louisiana**
32	***GH Storm Cat***	CARGO, DRY BULK • Dry bulk carrier	Zen-Noh Grain Facility, Lower Mississippi River, mile 163.8, Convent, **Louisiana**
34	***Island Lookout / BH 2903***	TOWING/BARGE • Towing vessel / Hopper barge	Albemarle and Chesapeake Canal, mile 15.2 of southern branch of Elizabeth River, to Albemarle and Chesapeake Canal section of Atlantic Intracoastal Waterway, Chesapeake, **Virginia**
36	***Levant***	CARGO, LIQUID BULK • Liquefied gas tanker	Petrogas Ferndale Wharf, near Ferndale, **Washington**
38	***Old Glory / Cole***	TOWING/BARGE • Towing vessel / Hopper barge	Intracoastal Waterway, Indian River, mile 965, Fort Pierce, **Florida**
40	***Savage Voyager / PBL 3422***	TOWING/BARGE • Towing vessel / Tank barge	Jamie Whitten Lock & Dam, Tennessee-Tombigbee Waterway, mile 411.9, near Dennis, **Mississippi**
42	***Trent Joseph / George C***	TOWING/BARGE • Towing vessel / Towing vessel	Barataria Waterway, Barataria, **Louisiana**
	FIRE/EXPLOSION		
44	***Andiamo***	YACHT/BOAT • Private yacht	Island Gardens Deep Harbour Marina, Miami, **Florida**
46	***City of Cleveland***	TOWING/BARGE • Towing vessel	Lower Mississippi River, mile 348, near Natchez, **Mississippi**
48	***Höegh Xiamen***	CARGO, GENERAL • Ro/Ro	Pier 20, Blount Island, Jacksonville, **Florida**
52	***Iron Maiden***	SPECIALTY/OTHER • Dive support vessel	Gulf Intracoastal Waterway, mile 36, Larose, **Louisiana**
54	***Lucky Angel***	FISHING • Fishing vessel	Gulf of Mexico, 20 miles south-southwest of Pascagoula, **Mississippi**
56	***Master Dylan***	FISHING • Fishing vessel	Gulf of Mexico, about 32 miles west-southwest of Port Fourchon, **Louisiana**
58	***Ocean Intervention***	OFFSHORE • Offshore supply vessel	Anchorage B, Mamala Bay, Honolulu, **Hawaii**
60	***Susan Lynn***	TOWING/BARGE • Towing vessel	Barataria Waterway, Lafitte, **Louisiana**
62	***Waymon Boyd***	SPECIALTY/OTHER • Dredge	Epic Dock, near Inner Harbor, Corpus Christi, **Texas**
	FLOODING/HULL FAILURE		
68	***Alton St. Amant***	TOWING/BARGE • Towing vessel	Harvey Canal, New Orleans, **Louisiana**
70	***Rebecca Mary***	FISHING • Fishing vessel	Atlantic Ocean, about 40 miles south of Martha's Vineyard, **Massachusetts**
	GROUNDING/STRANDING		
72	***Miss Annie***	FISHING • Fishing vessel	Calibogue Sound, Hilton Head Island, **South Carolina**
	SHIP/EQUIPMENT/CARGO DAMAGE		
74	***CMA CGM Bianca***	CARGO, GENERAL • Containership	Napoleon Avenue Container Terminal, Lower Mississippi River, mile 100, New Orleans, **Louisiana**
76	***Hoku Loa / Ho'omaka Hou***	TOWING/BARGE • Towing vessel / Deck cargo barge	Pacific Ocean, 6.9 miles north-northwest of Hilo, **Hawaii**


VESSEL GROUP KEY
CARGO, GENERAL
CARGO, DRY BULK
CARGO, LIQUID BULK
COMBATANT/MILITARY
FISHING
OFFSHORE
PASSENGER
PATROL/SMALL CRAFT
SPECIALTY/OTHER
TOWING/BARGE
YACHT/BOAT
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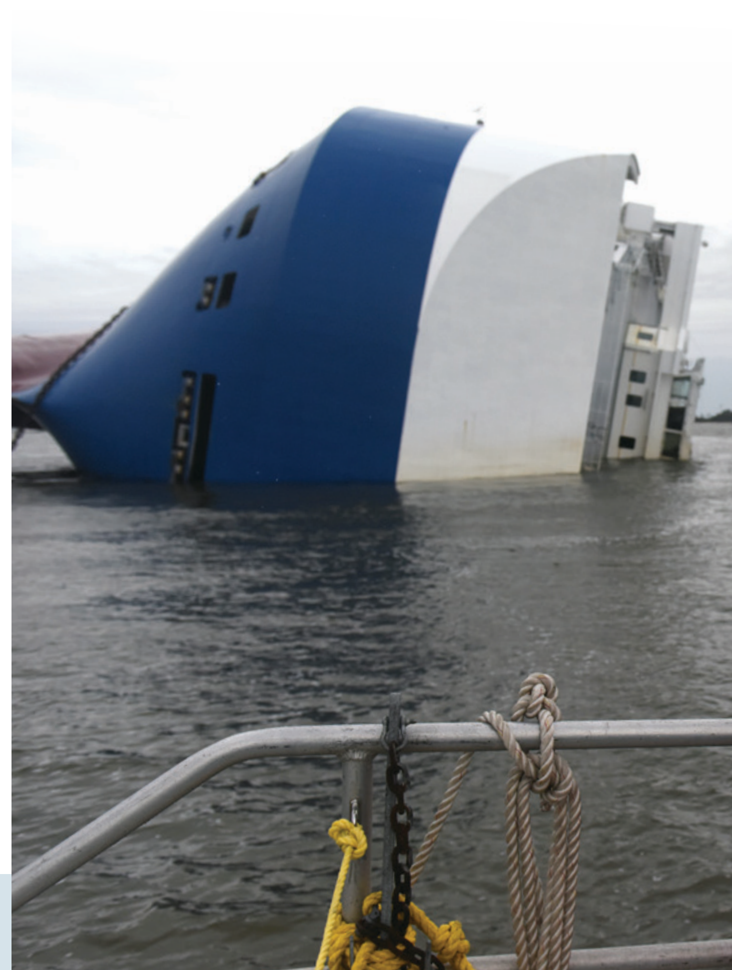
Acknowledgment

For each marine accident the NTSB investigated, investigators from the Office of Marine Safety worked closely with the Coast Guard Office of Investigations and Casualty Analysis in Washington, DC, and with the following Coast Guard units:

ACCIDENT VESSEL	COAST GUARD UNIT
Alton St. Amant	Coast Guard Sector New Orleans
Andiamo	Coast Guard Sector Miami
Atina	Coast Guard Sector New Orleans
Atlantic Huron	Coast Guard Sector Sault Sainte Marie
Barge breakaway (various barges)	Coast Guard Sector Houston
Bow Fortune / Pappy's Pride	Coast Guard Sector Ohio Valley Louisville and Marine Safety Unit Texas City
Cheramie Bo Truc No 22 / Mariya Moran–Texas	Coast Guard Marine Safety Unit Port Arthur
City of Cleveland	Coast Guard Marine Safety Detachment Vicksburg
CMA CGM Bianca	Coast Guard Sector New Orleans
Cooperative Spirit	Coast Guard Sector New Orleans
Cooperative Spirit / RC Creppel / Glory First	Coast Guard Sector New Orleans
Genesis River / Voyager	Coast Guard Sector Houston-Galveston
GH Storm Cat	Coast Guard Sector New Orleans
Golden Ray	Coast Guard Marine Safety Unit Savannah
Höegh Xiamen	Coast Guard Sector Jacksonville
Hoku Loa / Ho'omaka Hou	Coast Guard Sector Honolulu
Iron Maiden	Coast Guard Marine Safety Unit Houma
Island Lookout / BH 2903	Coast Guard Sector Virginia
Levant	Coast Guard Sector Puget Sound
Lucky Angel	Coast Guard Sector New Orleans
Master Dylan	Coast Guard Marine Safety Unit Houma
Miss Annie	Coast Guard Sector Charleston
Nomadic Milde / Atlantic Venus	Coast Guard Sector New Orleans
Ocean Intervention	Coast Guard Sector Honolulu
Old Glory / Cole	Coast Guard Marine Safety Detachment Lake Worth
Rebecca Mary	Coast Guard Sector Southeastern New England
Savage Voyager / PBL 3422	Coast Guard Marine Safety Detachment Nashville
Scandies Rose	Coast Guard Sector Anchorage
Susan Lynn	Coast Guard Sector New Orleans
Trent Joseph / George C	Coast Guard Sector New Orleans
Waymon Boyd	Coast Guard Sector Corpus Christi

Figure 159. Coast Guard personnel observe the *Waymon Boyd* engulfed in flames (*above*) and the *Golden Ray* after it capsized (*below and opposite page*).
SOURCE: COAST GUARD



Who Has the Lead: USCG or NTSB?

In a memorandum of understanding (MOU) signed June 17, 2021, the NTSB and the US Coast Guard agreed that when both agencies investigate a marine casualty, one agency will serve as the lead federal agency for the investigation. The NTSB Chair and the Coast Guard Commandant, or their designees, will determine which agency will lead the investigation.

Figure 160. The NTSB Chair meets with Coast Guard Sector New York personnel to discuss marine safety issues and cooperation between the two agencies.

The NTSB may lead the investigation of major marine casualties, defined in the MOU as involving another transportation mode; serious threat of, or presumed loss of six or more lives on a passenger vessel; serious threat of, or presumed loss of 12 or more lives on a commercial vessel; serious threat of, or presumed high loss of life beyond the vessel(s) involved; significant safety issues relating to the infrastructure of the maritime transportation system or the environment by hazardous materials; safety issues of a recurring character; or significant safety issues relating to Coast Guard statutory missions, specifically aids to navigation, search and rescue, and marine safety.

Table of Figures

NTSB 2021–2022 Most Wanted List of Transportation Safety Improvements

The NTSB's Most Wanted List (MWL) highlights transportation safety improvements needed now to prevent accidents, reduce injuries, and save lives. We use the list to focus our advocacy efforts during the current MWL cycle. The NTSB urges lawmakers, industry, advocacy and community organizations, and every American to learn more about what they can do to implement and champion the 2021–2022 MWL. Adopting NTSB safety recommendations associated with these safety items will save lives.

AVIATION

- Require and Verify the Effectiveness of Safety Management Systems in all Revenue Passenger-Carrying Aviation Operations
- Install Crash-Resistant Recorders and Establish Flight Data Monitoring Programs

HIGHWAY

- Implement a Comprehensive Strategy to Eliminate Speeding-Related Crashes
- Protect Vulnerable Road Users through a Safe System Approach
- Prevent Alcohol- and Other Drug-Impaired Driving
- Require Collision-Avoidance and Connected-Vehicle Technologies on all Vehicles
- Eliminate Distracted Driving

MARINE

- **Improve Passenger and Fishing Vessel Safety**

RAIL, PIPELINE, AND HAZARDOUS MATERIALS

- Improve Pipeline Leak Detection and Mitigation
- Improve Rail Worker Safety

To find out how to take action, and for a complete history of action or inaction on these recommendations, visit **www.ntsb.gov/mwl**.

Improve Passenger and Fishing Vessel Safety

Passenger and fishing vessels present distinct safety challenges within the marine transportation industry. The US Coast Guard can improve safety on both passenger and fishing vessels by implementing our recommendations.

PASSENGER VESSELS

Passenger vessels range in size from small charter vessels, such as dive boats and amphibious passenger vessels (DUKW boats or "duck boats") to large cruise ships operating in international waters. The number of passengers and crew on these types of vessels may vary.

Fires pose a catastrophic threat to passenger vessels, as we saw in the 2019 *Conception* dive boat accident off the coast of California in which 34 people died. Our investigations have revealed that crew training and safety regulations for these vessels vary, increasing the risk to passengers and crew.

To prevent needless deaths and mitigate injuries, passenger vessels should have safety management systems, use voyage data recorders, and provide adequate fire-detection and extinguishing systems and enhanced emergency egress options. Operators need to ensure their crews have enhanced training that includes fire drills and firefighting techniques. We also need to see more roving patrols on our waterways to ensure passengers are being transported safely.

COMMERCIAL FISHING

The commercial fishing industry, which remains largely uninspected, is another marine sector of concern. Fishing consistently tops the list of most deadly occupations, due, in large part, to challenging work environments, such as poor weather and rough waters. These conditions threaten vessel stability and integrity—an issue we have seen in our investigations. More than 800 fatalities have occurred on fishing vessels in the past two decades.

We need new standards to address—and periodically reassess—intact stability, subdivision, and watertight integrity in commercial fishing vessels up to 79 feet long. Many fishing crews aren't trained in stability management techniques or emergency response, and we have found that many vessels do not have proper life-saving equipment, such as flotation devices and search-and-rescue locator devices.

OUR SOLUTIONS . . . TAKE ACTION NOW!

The Coast Guard needs to act on our recommendations. Although many of our recommendations call for regulatory action, passenger and fishing vessel associations, training centers, and marine safety advocacy groups should also promote awareness and encourage operators to take voluntary measures to improve safety on their vessels.

On passenger vessel safety, the Coast Guard should:

- Require all operators of domestic passenger vessels to implement safety management systems.
- Develop a US voyage data recorder standard for ferry vessels that meets the International Maritime Organization's performance standards and require the installation of such equipment on new and existing ferry vessels.
- Require companies operating domestic passenger vessels to develop and implement a preventive maintenance program for all systems affecting the safe operation of their vessels.
- Evaluate the feasibility of creating a passenger vessel safety specialist billet and staff sector-level billets at each sector that has the potential for a search and rescue activity.
- Require fire-detection systems in unoccupied spaces with machinery or other potential heat sources on board small passenger vessels.

- Require newly constructed vessels and those currently in service with overnight accommodations to have interconnected smoke detectors in all accommodation spaces.
- Develop and implement an inspection procedure to verify that small passenger vessel owners, operators, and charterers are conducting roving patrols.
- Require newly constructed small passenger vessels and those constructed prior to 1996 with overnight accommodations to provide a secondary means of escape into a different space than the primary exit.
- Review the suitability of regulations regarding means of escape to ensure there are no obstructions to egress on small passenger vessels constructed prior to 1996 and modify regulations accordingly.
- Ensure that amphibious passenger vehicle operators tell passengers that seat belts must not be worn while the vessel/vehicle is operated in the water and visually check that each passenger has unbuckled his or her seat belt.
- Require DUKW amphibious passenger vessels to have sufficient reserve buoyancy through passive means, and for those that don't, require the removal of canopies, side curtains, and their associated framing during waterborne operations.
- Require that amphibious passenger vessels equipped with forward hatches enable operators to securely close them during waterborne operations.
- Review the circumstances of the *Stretch Duck 7* sinking and other amphibious passenger vessel accidents, and revise Navigation and Vessel Inspection Circular 1-01 to address the issues found in these accidents.
- Examine existing training and knowledge requirements for understanding and applying fundamental weather principles to waterborne operations for Coast Guard-credentialed masters who operate small passenger vessels; and, if warranted, require additional training.

On passenger vessel safety, operators and organizations representing small passenger vessel operators should:

- Implement safety management systems to improve safety practices and minimize risk.
- Develop and/or improve procedures to manage and account for all persons aboard in the event of a mass evacuation of a ship while in port.
- Perform a worst-case scenario risk assessment for all active water-based fire-suppression systems to evaluate whether the existing freshwater supply is sufficient.
- Review lifesaving appliance training programs, including recordkeeping procedures, and revise the programs to ensure that crewmembers are proficient with onboard systems.
- Provide formal and recurrent training to shoreside management and senior shipboard officers to ensure that all senior leaders are fully knowledgeable about the policies and procedures in the safety management system.
- Develop and apply an oversight system to ensure that maintenance programs comply with the manufacturer's recommended preventive maintenance program.
- Revise marine firefighting and job training programs, including documenting, both onboard and ashore, that all crewmembers are qualified and can continually demonstrate proficiency in their duties.
- Review and revise current operating policy to provide specific guidance on vessel operations when adverse conditions could be encountered during any part of the waterborne tour by implementing a go/no-go policy.
- Modify spring-loaded forward hatches of modified DUKW amphibious passenger vessels to enable their closure during waterborne operations.
- Re-evaluate emergency procedures regarding lifejacket donning aboard modified DUKW amphibious passenger vessels when equipped with fixed canopies.
- Share the circumstances of the *Conception* accident and encourage members to voluntarily install interconnected smoke and fire detectors in all accommodation spaces and a secondary means of escape into a different space than the primary exit.

On fishing vessel safety, the Coast Guard should:

- Establish standards for new and existing commercial fishing industry vessels of 79 feet or less in length that address intact stability, subdivision, and watertight integrity and include periodic reassessment of the vessels' stability and watertight integrity.
- Require all owners, masters, and chief engineers of commercial fishing industry vessels to receive training and demonstrate competency in vessel stability, watertight integrity, subdivision, and use of vessel stability information, including preventing and properly responding to emergency situations as well as the actual use of emergency equipment.
- Require that all personnel employed on vessels in coastal, Great Lakes, and ocean service be provided with a personal locator beacon.

STATS TO KNOW

58,000
Commercial fishing vessels in service in the US in 2020.
SOURCE: COAST GUARD

805 fatalities
In commercial fishing vessel accidents in the US between 2000 and 2020.
SOURCE: COAST GUARD

36 **NTSB recommendations pertaining to fishing or passenger vessel safety issued since 2002.**

To see our full list of recommendations, visit ntsb.gov, select Search CAROL on the home page, then Published Searches.

NTSB Office of Marine Safety

The Office of Marine Safety investigates and determines the probable cause of major marine casualties on or under US territorial waters, major marine casualties involving US-flagged vessels worldwide, and accidents involving both US public (federal) and nonpublic vessels in the same casualty. In addition, the office investigates select catastrophic marine accidents and those of a recurring nature.

The US Coast Guard conducts preliminary investigations of all marine accidents and notifies the NTSB when an accident qualifies as a major marine casualty.

For select major marine casualties, the office launches a full investigative team and presents the investigative report to the Board. For all other major marine casualties, the office launches a field team of marine investigators to the scene to gather information to develop either an investigation report or brief. Most briefs are issued by the office director through delegated authority; those involving public or nonpublic marine accidents and those that contain safety recommendations are adopted and issued by the Board.

The office also participates with the Coast Guard as a substantially interested State in investigations of serious marine casualties involving foreign-flagged vessels in international waters. Additionally, as part of the NTSB's international marine safety program, the office coordinates with other US and foreign agencies to ensure consistency with IMO conventions and cooperates with other accident investigation organizations worldwide at annual meetings, which track developments related to marine accident investigations and prevention.

The NTSB is the only federal organization that performs independent, comprehensive, and transparent multidisciplinary investigations to determine the probable cause of marine accidents, with the goal of making safety recommendations to prevent similar events from occurring in the future.

The thoroughness and independence of these investigations maintain public confidence in marine transportation systems and provide policymakers with unbiased analysis.

Figure 161. An NTSB investigator measures ice accretion on a crab pot during the *Scandies Rose* investigation.

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