NATIONAL TRANSPORTATION SAFETY BOARD 2023

SAFER SEAS Digest

NTSB

Lessons Learned from Marine Investigations

SPC-24-05

In memory of Captain Morgan Turrell, director of the NTSB Office of Marine Safety, who passed away on March 1, 2024, after a brief illness. We are saddened by the loss of a warm and insightful colleague who was a tireless champion of safety on the water.

NTSB

Who we are and what we do

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

Our mission

Making transportation safer. We carry out our mission by—

- Maintaining our congressionally mandated independence.
- Conducting objective, thorough investigations and safety studies.
- Deciding, fairly and objectively, appeals of enforcement actions by the FAA and US Coast Guard and certificate denials by the FAA.
- Advocating implementation of safety recommendations.
- Assisting victims and survivors of transportation disasters and their families.

A Message from the Chair

I am proud to present the *Safer Seas Digest* on behalf of the NTSB. This publication encapsulates 31 investigations completed by the NTSB Office of Marine Safety in 2023. It is our sincere hope that you apply the knowledge uncovered by our world-renowned investigators to prevent future marine casualties and save lives.

The pages that follow contain lessons learned that can help prevent harm to property and the environment, both of which occurred following the release of 588 barrels of crude oil into San Pedro Bay. The cause? An anchor strike on an underwater pipeline 8 months earlier. The NTSB called on the Coast Guard to restructure federal anchorages in San Pedro Bay, among other measures, in the wake of this disaster.

Some investigations followed events that threatened the lives of passengers and crew. The ***Spirit of Norfolk*** engine room fire is one such investigation; thankfully, all 108 people on board evacuated safely. We determined that the lack of an engine room fire-detection system delayed detection and allowed the fire to grow, burning for 4 days before it was extinguished. As such, we recommended the closure of regulatory loopholes that allow some small passenger vessels—like the ***Spirit of Norfolk***—to operate without engine room fire-detection systems.

The most sobering investigations we conduct involve the loss of human life. In 2023, we completed our investigation of the fatal collision between the Coast Guard cutter ***Winslow Griesser*** and the center-console boat ***Desakata***, which took the life of one ***Desakata*** crewmember and seriously injured the other. We found that neither vessel's crew maintained a proper lookout, and we issued a Safety Alert encouraging small-vessel operators to improve their vessels' detectability.

While each marine casualty is unique, there are some commonalities among the cases outlined in this digest. Our investigators identified the following broad safety risks and challenges:

- **Small vessel detection**
- **Effective communication, including the proper reporting of chart changes and hazards**
- **Proactive equipment inspection**
- **Timely hull maintenance and repair**
- **Proper maintenance and repair of equipment and machinery**
- **Fatigue**
- **Anticipation of fire hazards, including those presented by lithium-ion batteries**
- **Firefighting training**
- **Effective watchkeeping**
- **Nonoperational cell phone use**
- **Lack of appropriate planning**
- **Excessive speed during bow-to-bow harbor-assist operations**
- **Reporting potential anchor strikes**

The Coast Guard is integral to all NTSB marine investigations. Our relationship with them is a shining example of government collaboration focused on saving lives and improving safety. My sincerest thanks go out to every one of the men and women of the Coast Guard who assisted us. The Coast Guard units that worked with the NTSB in 2023 are listed on page 84.

The NTSB will advocate tirelessly for our safety recommendations because we know from our investigations what's at stake. Our work teaches us how fragile and precious life is. And when loss hits home, it hits us hard. I am, of course, referring to the death of our Director of Marine Safety, Captain Morgan Turrell.

Morgan was a marine safety expert. He was a proud graduate of the US Merchant Marine Academy; served as a licensed deck officer, including Master, on a variety of commercial vessels; and was a strong advocate for improving safety on our waterways. He was an incredible person: so kind and thoughtful and a mentor, a teacher, and a friend to so many of us in both the marine community and at NTSB.

Each year, Morgan was proud to produce the *Safer Seas Digest*. So, it is fitting that we dedicate this year's edition to Morgan's memory. It's just one way we choose to honor his extraordinary life.

Jennifer Homendy
NTSB chair

NTSB 2023

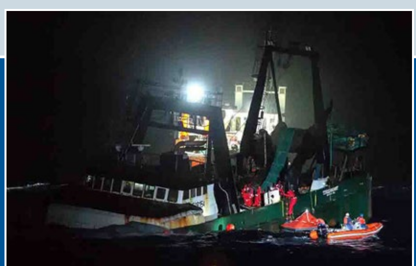
SAFER SEAS Digest

Lessons Learned from Marine Investigations

Since 2014, the NTSB has issued the *Safer Seas Digest*, an annual publication organized around investigations completed by the NTSB Office of Marine Safety during the previous calendar year. *Safer Seas* shares the safety issues identified and recommendations developed during these investigations with the marine community. Sorted by casualty type, each digest in *Safer Seas* summarizes a marine investigation report, highlighting lessons learned that can prevent or mitigate future casualties.

Past issues of the *Safer Seas Digest*, as well as the full investigation reports and docket, can be found on our website at **ntsb.gov**. Use either the investigation's report number or the accident ID to search our investigation pages.

Note: The table at the front of each casualty summary references "estimated damages." Estimated damages typically include vessel and other property damage repair and loss costs. Estimated damages were correct as of the date that the investigation report was issued or adopted.



On the cover: Fishing vessel *Tremont* during the abandonment with fishing vessel *Drysten* in the background, as seen from the research vessel *Atlantis* (*see page 18*). SOURCE: LANCE WILLS

Back cover: Fishing vessel *Challenger* sinking off the coast of Kodiak Island, Alaska (*see page 62*). SOURCE: COAST GUARD

Abbreviations

Abbreviation	Definition
AB	able seaman
AIS	automatic identification system
ARPA	automatic radar plotting aid
ASD	azimuthing stern drive
ATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
CO_2	carbon dioxide
COLREGS	*Convention on the International Regulations for Preventing Collisions at Sea, 1972*
DSC	digital selective calling
ECDIS	electronic chart display and information system
ENC	electronic navigation chart
EPIRB	emergency position indicating radio beacon
FAA	Federal Aviation Administration
FAD	fish aggregating device
FDNY	Fire Department of the City of New York
GMDSS	Global Maritime Distress and Safety System
INR	Inland Navigation Rules
MAK	Caterpillar Motoren GmbH
NOAA	National Oceanic and Atmospheric Administration
NOBRA	New Orleans-Baton Rouge Steamship Pilots Association
NTSB	National Transportation Safety Board
OMD	oil mist detector
OMS	Office of Marine Safety
OSHA	Occupational Health and Safety Administration
OSV	offshore supply vehicle
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLB	personal locator beacon
PMS	planned maintenance system
SEND	satellite emergency notification device
STEHMO	ST Engineering Halter Marine and Offshore
SWL	safe working load
UC	unified command
UHF	ultra-high frequency
VDR	voyage data recorder
VHF	very high frequency
VMS	vessel monitoring system
VTS	vessel traffic service
VTS LA-LB	Vessel Traffic Service Los Angeles/Long Beach
WSF	Washington State Ferries

Vessel Group Key

- Cargo, Dry Bulk
- Cargo, General
- Cargo, Liquid Bulk
- Combatant/Military
- Fishing
- Offshore
- Passenger
- Towing/Barge
- Yacht/Boat

Table of Contents

NTSB | National Transportation Safety Board

Making Transportation Safer

VESSEL GROUPS
TOWING/BARGE · **TOWING/BARGE**

Capsizing and Sinking of Crane Barge *Ambition*, Towed by *Karen Koby*

Gulf of Mexico, 48 miles southeast of Cameron, Louisiana

CASUALTY DATE **June 15, 2022**	ACCIDENT ID **DCA22FM024**
INJURIES **0**	ESTIMATED DAMAGES **$6.3 million**
REPORT NUMBER **MIR-23-18**	ISSUED **August 24, 2023**

***Left to right*: Towing vessel *Karen Koby* and crane barge *Ambition* before the casualty.**
SOURCES: LA CARRIERS AND RIGID CONSTRUCTORS

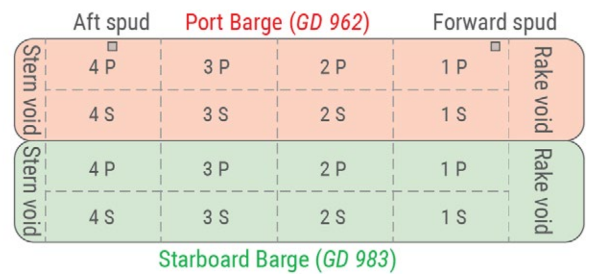
On June 15, 2022, about 0400 local time, the towing vessel *Karen Koby* was towing the crane barge *Ambition* when the barge capsized and sank in the Gulf of Mexico, about 48 miles southeast of Cameron, Louisiana. There were no persons on the barge, and none of the *Karen Koby*'s four crewmembers were injured. The *Ambition* was partly submerged in about 54 feet of water, where it was later salvaged. The sunken barge released an estimated 1,980 gallons of oil. The *Ambition* and its crane were determined to be a total loss, with damages estimated at $6.3 million.

On June 14, the *Ambition* (owned by Rigid Constructors) was spudded down at the Devall fleet on the Gulf Intracoastal Waterway (near mile 242) near Sulphur, Louisiana, where it had been in a nonworking status for about 4–5 weeks. The two barges that made up the *Ambition* were 27 (port barge) and 24 (starboard barge) years old and had been in service before being welded together in 2020 to create a deck barge that could hold a crane.

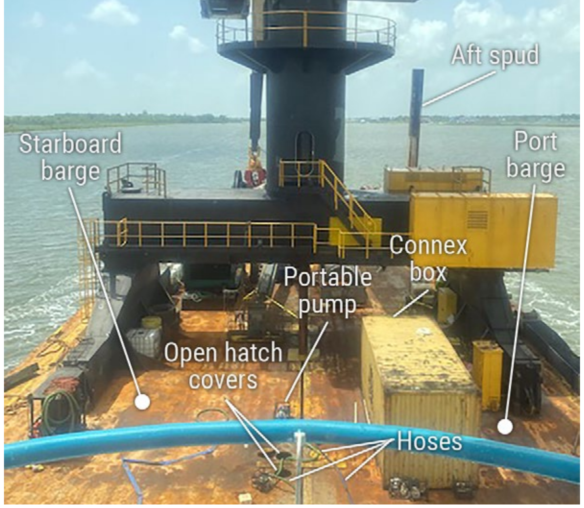
At 0940, the tug *Karen Koby* (owned and operated by LA Carriers) arrived at the *Ambition*'s location to provide towage services, as requested by Rigid Constructors. A Rigid Constructors crew of five was sent to the *Ambition* to "secure everything" for its transit, and, about 1020, the *Karen Koby* got underway with the *Ambition*, headed down the Calcasieu River to a fuel facility at the mouth of the river.

After fueling, the Rigid crew departed. The *Karen Koby* took the *Ambition* under stern tow into the Gulf of Mexico for an eastbound transit toward the Mississippi River. The *Ambition* had at least six hatch covers that were either missing or not properly secured, and, as a result, the barge was towed offshore with open and unsecured compartments that were intended to be watertight. (The NTSB previously found that improperly secured hatch covers and gaps in LA Carriers' policy and audit program were the cause of the loss of another barge in 2018, *PTC 589*.)

Simplified layout of the barge *Ambition* with compartment numbers and subdivisions. Below-deck compartments of each barge are annotated by a number (lowest forward and highest aft) and letter (P for port and S for starboard). SOURCE: NTSB



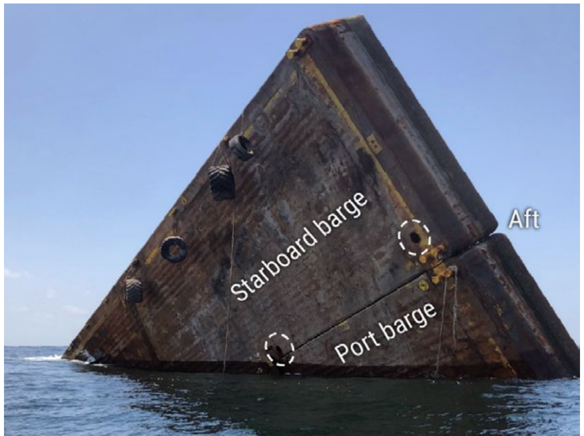
The bottom of the centerline longitudinal bulkhead between the no. 1S and no. 1P compartments of the port barge showing metal loss and corrosion holes.
SOURCE: K. SMITH MARINE SURVEYING



The barge *Ambition* at 1200 on June 14 while being pushed southbound on the Calcasieu River en route to the fuel facility. A portable pump and hoses are visible leading into open hatches on the deck of the starboard barge near the bow on the inboard side, with a discharge hose leading out onto the main deck.
SOURCE: KAREN KOBY MATE

On June 15, about 0330, while the tow was underway in the Gulf of Mexico, the mate on watch noticed the speed of the *Karen Koby* had dropped. About half an hour after noticing the vessel's speed drop, the mate saw the *Ambition* capsize, with the port corner of the bow dipping down before rolling over "quickly" to port. The *Ambition* partly sank in about 54 feet of water.

The partly sunken barge *Ambition* the morning of the casualty with the starboard stern of the barge out of the water. The dashed circles show holes where hatch covers had fallen off during the capsizing.
BACKGROUND SOURCE: UNKNOWN



The port barge's separation at the weld seam, between the bottom plate and bilge knuckle plate.
SOURCE: COAST GUARD

At some point, a temporary repair, which consisted of steel plates welded to the floor and knuckle plating, forming a box inside compartment no. 1S, had been made to the area around the separation, to contain water ingress. However, the separation had grown aft, beyond the steel box, likely due to it being in an area known to be subject to longitudinal stress. The corrosive deterioration of the bottom and bilge knuckle plating and their separation along their weld seam would have allowed water to enter compartment no. 1S of the port barge, which was the likely origin of initial water ingress.

The initial hull failure and subsequent progressive flooding would have caused the *Ambition* to heel to port and ride further down by the bow, likely exposing the open hatch at the port corner to seas reaching the main deck. Additionally, the barge had about a 4-foot freeboard underway in the 2–3-foot seas, yielding a foot of residual freeboard. Therefore, it is likely that downflooding through the open hatch into the port barge's rake void accelerated the rate of flooding and contributed to the *Ambition*'s capsizing.

Rigid Constructors did not have an inspection or maintenance plan for the *Ambition*'s hull. As such, they failed to conduct permanent repairs in an area critical to hull strength, and the separation between the bottom plating and the bilge knuckle plating progressed beyond the temporary repair. Rigid Constructors' lack of hull inspection, maintenance, and permanent repairs resulted in the poor hull condition that caused the failure of the hull. Additionally, there was evidence of past dewatering of two compartments on the starboard barge of the *Ambition*, implying that water accumulation was a known issue with those compartments. However, none of the Rigid crewmembers were tasked with checking compartments and voids on the barge for water. Thus, Rigid Constructors allowed for the *Ambition* to be taken under offshore tow without verifying the watertight integrity of the hull.

THE PROBABLE CAUSE of the capsizing and sinking of the crane barge *Ambition* was the barge owner's lack of hull inspection and maintenance, and not conducting permanent repairs, which resulted in the failure of the hull and subsequent flooding. Contributing was likely downflooding through an open deck hatch due to the tow operator's failure to ensure adherence to its procedures for barge watertight integrity before getting underway, despite being aware of deficiencies with the watertight integrity of the barge.

LESSON LEARNED: Effective Hull Inspection and Maintenance

To protect vessels and the environment, it is good marine practice for vessel owners to conduct regular oversight and maintenance of hulls, including between drydock periods. An effective maintenance and hull inspection program should proactively address potential steel wastage, identify hull and watertight integrity deficiencies, and ensure corrosion issues are repaired in a timely manner by permanent means.

Collision

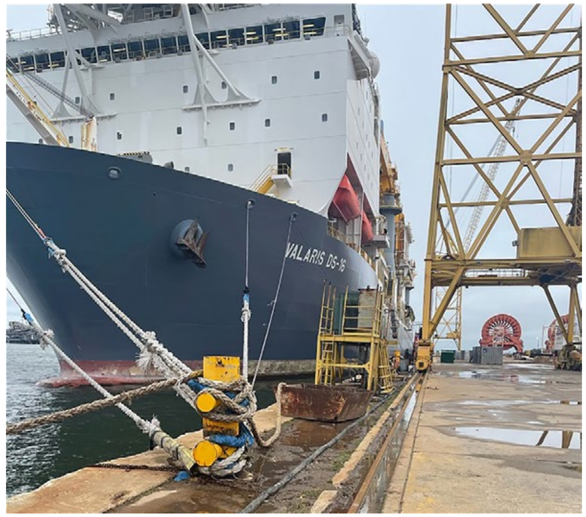
VESSEL GROUPS
OFFSHORE • **CARGO, DRY BULK**

Breakaway of Moored Mobile Offshore Drilling Unit ***VALARIS DS-16*** and Subsequent Collision with Cargo Vessel ***Akti***

Bayou Casotte, Pascagoula, Mississippi

CASUALTY DATE	ACCIDENT ID
March 12, 2022	**DCA22FM013**
INJURIES	ESTIMATED DAMAGES
0	**$5 million**
REPORT NUMBER	ISSUED
MIR-23-05	**March 7, 2023**

***VALARIS DS-16* after the casualty.**
SOURCE: COAST GUARD

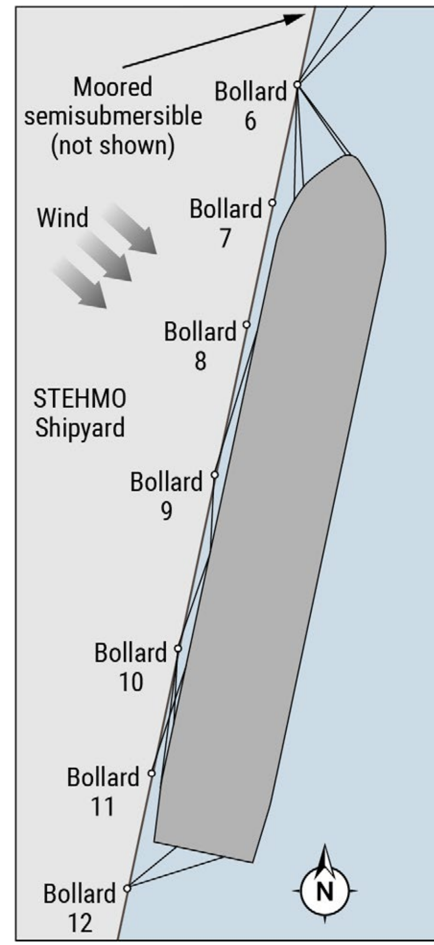


***VALARIS DS-16* moored at STEHMO Shipyard at unknown date before the casualty with lines secured to bollard 6 (before lines were adjusted for the March 12 strong winds).** SOURCE: *VALARIS DS-16* CAPTAIN

On March 12, 2022, about 0020 local time, the mobile offshore drilling unit ***VALARIS DS-16*** was in layup status at the STEHMO Shipyard in Pascagoula, Mississippi, when it broke away from the dock, drifted across the Bayou Casotte channel, and collided with the bulk cargo vessel ***Akti*** moored at the Chevron Refinery dock no.6. There were no injuries reported for the 164 crewmembers and personnel on board the ***VALARIS DS-16*** or the 22 crewmembers on board the ***Akti***, and there was no pollution reported. The total damage resulting from the breakaway was estimated at $5 million.

The ***VALARIS DS-16*** had been moored at STEHMO Shipyard on January 6, 2022. According to a mooring analysis completed by the ***VALARIS DS-16***'s operating company before it arrived at the STEHMO Shipyard, the vessel would be most vulnerable to wind forces from the west—because the vessel would be moored port side to a pier with its bow facing a northerly direction (012˚)—which would exert pressure directly on its port side (blowing the vessel away from the dock). The mooring analysis calculated the limiting sustained wind speed at 34 knots with northwest winds and 60 knots with north winds. The vessel's crew was directed to drop anchor and call tugs alongside for assistance if they expected the limitations to be exceeded.

Two months later, about a week before the casualty, the captain was notified of a weather system with strong winds (25- to 30-knot north-northwest winds and gusts up to 44 knots) predicted for the early morning hours of March 12. The maximum predicted winds and direction for the cold front were less than the limitations of the mooring analysis, and the captain believed that additional measures (beyond preparing the port anchor, relocating an aft-leading mooring line and shifting it to have a forward lead, and monitoring the mooring lines with deckhands on shore) were not needed. When the cold front passed through the area, the ***VALARIS DS-16*** was exposed to 30- to 40-knot winds from the north-northwest. Due to the northerly component of the wind direction, the operating company's mooring analysis limitations were not exceeded. Therefore, the ***VALARIS DS-16***'s mooring arrangement should have been sufficient to secure the vessel to the dock.



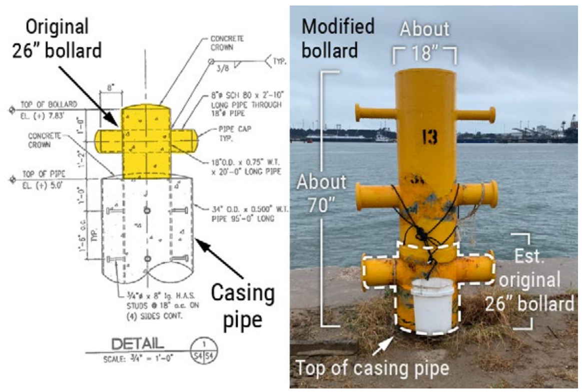
Representation of mooring arrangement at time of casualty. Wind direction estimated (scale approximate). SOURCE: NTSB

Remaining base of bollard 6 after breakaway.
SOURCE: COAST GUARD

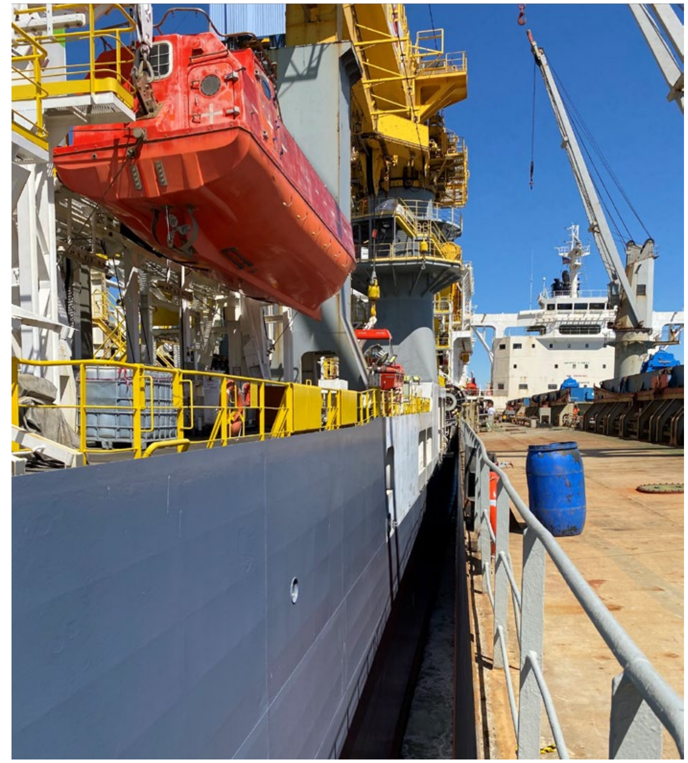
However, during elevated sustained winds, bollard 6, which secured the *VALARIS DS-16*'s four bow lines and an adjacent semisubmersible rig's two stern lines, broke free at its base and was pulled off the pier into the water. As the *VALARIS DS-16* began drifting away from the dock and into the channel, the vessel's marine crew took timely and appropriate actions (including dropping anchor) to attempt to reduce the effects of a collision with vessels moored across the channel. However, the swing of the *VALARIS DS-16*'s stern to starboard continued due to the force of the wind, and the vessel collided with the moored cargo vessel *Akti*.

Postcasualty ultrasonic thickness tests performed on the remaining bollards in the area where the *VALARIS DS-16* was moored indicated that there was deteriorated steel at the lower portion of several bollards. The broken top of bollard 6 was not recovered from the channel, but a postcasualty measurement of the remaining 18-inch-diameter base of the bollard showed that the steel wall thickness was less than 0.25 inches on the side farthest from the edge of the pier—an apparent reduction in thickness of about 0.5 inches (original bollard design drawings showed a wall thickness of 0.75 inches). Additionally, several bollards showed signs of external corrosion and wastage.

There were no records of any pull tests that could confirm the safe working load of the bollards used by the *VALARIS DS-16*. All the bollards had been modified from the original 1997 design (for which there were no engineering records). The modifications increased the bollard pipes' overall height from just over 2 feet to about 4 to 7 feet—about 2 to 5 feet higher than originally designed—with additional horns, which allowed for additional mooring lines to be placed higher on the bollards. As the height of a bollard (or its horns) increases, the horizontal or up-leading pull on the upper portion of the bollard significantly increases the moment of force applied to the base of the bollard. Therefore, bollard 6 and many of the other bollards used to secure the vessel's mooring lines were likely incapable of sustaining the working loads of their original design.



***Left to right:* 1997 construction plans for bollards and a modified bollard in October 2022, seven months after the casualty.**
BACKGROUND SOURCES: STEHMO AND COAST GUARD



***VALARIS DS-16* (*left*) alongside the *Akti* after colliding.**
SOURCE: COAST GUARD

THE PROBABLE CAUSE of the breakaway of the *VALARIS DS-16* from the STEHMO Shipyard dock and the subsequent collision with the cargo vessel *Akti* was the failure of one of the shipyard's mooring bollards—which had been modified to increase its height to accommodate more lines—used to secure the *VALARIS DS-16*'s bow mooring lines to a pier, during a cold front with strong winds.

LESSON LEARNED: Bollard Inspections

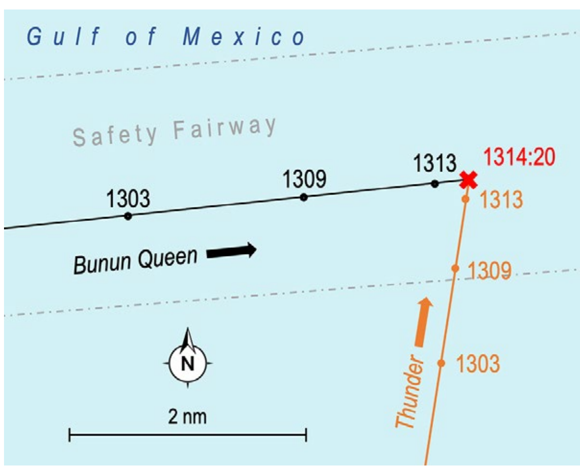
As a result of continuing increases in vessel size and sail area, bollards that were previously sufficient may not have adequate capacity to moor larger vessels. There are currently no Coast Guard or OSHA regulatory requirements for facilities to inspect and verify loading capacities of bollards at shoreside facilities. Bollards and associated pierside mooring equipment are vital equipment that must be capable of withstanding the tremendous forces that large vessels exert on them. Due to their exposure to seawater, bollards and associated pierside mooring equipment are also at high risk for corrosion, which can significantly affect service life. The Coast Guard has recommended that facility owners and operators develop routine inspection programs for bollards and other mooring equipment.

VESSEL GROUPS
CARGO, DRY BULK • **OFFSHORE**

Collision between Bulk Carrier ***Bunun Queen*** and Offshore Supply Vessel ***Thunder***

Gulf of Mexico, 66 nautical miles south of Port Fourchon, Louisiana

CASUALTY DATE	ACCIDENT ID
July 23, 2022	**DCA22FM030**
INJURIES	ESTIMATED DAMAGES
0	**$12.3 million**
REPORT NUMBER	ISSUED
MIR-23-09	**May 22, 2023**



Tracklines of the *Bunun Queen* and *Thunder* leading up to the collision, based on VDR data.
SOURCE: NTSB

***Left to right*: *Bunun Queen* and *Thunder* at sea before the casualty.**
SOURCES: JACKSON OFFSHORE, WISDOM MARINE INTERNATIONAL

On July 23, 2022, about 1314 local time, the bulk carrier *Bunun Queen*, transiting eastbound in the Gulf of Mexico with 20 crewmembers on board, and the northbound offshore supply vessel *Thunder* collided about 66 miles south of Port Fourchon, Louisiana. The *Thunder* sustained substantial damage to its port side, which resulted in the flooding of one of its propulsion rooms and three other spaces. Eleven of *Thunder*'s 18 crew were evacuated to a Good Samaritan vessel, and the remaining crew stayed with the vessel to control the flooding while it was towed back to port. There were no injuries, and no pollution was reported. Damage to both vessels was estimated at $12.3 million.

At 1149 that morning, while the *Thunder* was on a northerly heading in autopilot at 10 knots, its AIS receiver picked up the *Bunun Queen* AIS broadcast, showing the *Bunun Queen* 23 nautical miles away on a true bearing of 300°.

When the *Bunun Queen* second officer took the watch at noon, the bulker was in autopilot on a heading of 091° and a speed of 14.8 knots. The vessel's telegraph order was navigation full ahead, and it was transiting in a safety fairway free of oil well structures.

At 1300, the *Thunder* was 3.8 nautical miles away on a bearing of 117°; the offshore supply vehicle was present on the *Bunun Queen*'s ARPA both as a radar and AIS target but was not being tracked. Similarly, on the *Thunder*'s ARPA, the *Thunder* was present as both a radar and AIS target but was also not being tracked.

At 1313, on the *Thunder*, the AIS receiver had the *Bunun Queen* on a bearing of 286° at 0.4 nautical miles away.

On the *Thunder*, an AB saw a ship close on the port side. Concerned by its proximity, he went toward the wheelhouse. The second mate also saw a ship out the portside galley porthole and, at 1313:58, he called the master over the vessel's internal radio. At 1314:03, the master disengaged the autopilot. At 1314:12, the AB entered the wheelhouse and announced to the master, "target to port." The master increased the throttles and turned to port to minimize damage.

At 1314:19, the bulbous bow of the *Bunun Queen*, which was traveling at 14.4 knots, struck the port side of the *Thunder*, traveling at 9 knots.

At the time of the collision, the *Bunun Queen* was still in autopilot mode, and there was no recorded change of engine telegraph or rudder order. About 18 seconds after impact, the second officer engaged manual steering and turned the rudder hard to port.

The *Convention on the International Regulations for Preventing Collisions at Sea, 1972* (72 COLREGS) requires that "every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate." In the time leading up to the casualty, neither vessel's officer on watch maintained a lookout—either by visual scanning or by using available electronic means such as plotting and tracking tools via the ARPA—to prevent a collision.

Both officers on watch stated they were engaged in non-navigational tasks. The ***Thunder*** master was using a cell phone before the collision. The ***Bunun Queen*** second officer was engaged in other duties and not maintaining a lookout, while the AB normally assigned lookout duties was in his cabin resting. Both officers failed to maintain a proper lookout. Therefore, neither vessel's bridge watch officer detected the approach of the other vessel.

On both vessels, a single individual occupied the bridge. The ***Bunun Queen*** company policy allowed, with conditions, the bridge to be occupied by a sole watchstander, which the master approved. For the ***Thunder***, the master's standing orders required at least two people on the bridge when underway. The ***Thunder*** master violated his own standing orders by allowing himself to be the sole watchstander on the bridge. Had either vessel had another person on the bridge, it is likely that at least one vessel's crew would have sighted the other vessel.

THE PROBABLE CAUSE of the collision between the bulk carrier *Bunun Queen* and the offshore supply vessel *Thunder* was the *Bunun Queen* officer's distraction due to performing non-navigational tasks and the *Thunder* officer's distraction due to cell phone use, which kept both officers from keeping a proper lookout. Contributing to the casualty was the *Thunder*'s officer on watch not following his company's watchkeeping policies.

The *Thunder* being towed to a dock in Port Fourchon after the collision. SOURCE: COAST GUARD

Damage to the bulbous bow of the *Bunun Queen* after the casualty. SOURCE: COAST GUARD

Damage to the aft port side of the *Thunder*.
SOURCE: COAST GUARD

LESSON LEARNED: Distraction Due to Personal Electronic Devices

Nonoperational use of cell phones and other wireless electronic devices by on-duty crewmembers in safety-critical positions has been a factor in casualties and accidents in all transportation modes. Using cell phones and other personal electronic devices has been demonstrated to be visually, manually, and cognitively distracting. Nonoperational use of cell phones should never interfere with the primary task of a watchstander or a bridge team member to maintain a proper lookout. It is important for personnel to follow established protocols regarding cell phone use.

VESSEL GROUPS
COMBATANT/MILITARY • **FISHING**

Collision between US Coast Guard Cutter ***Winslow Griesser*** and Center-console Boat ***Desakata***

Atlantic Ocean, near Dorado, Puerto Rico

CASUALTY DATE **August 8, 2022**	ACCIDENT ID **DCA22PM034**
INJURIES **1 serious** / FATALITIES **1**	ESTIMATED DAMAGES **$58,800**
REPORT NUMBER **MIR-23-14**	ADOPTED **July 3, 2023**

Area where the *Winslow Griesser* and *Desakata* collided, as indicated by a circled *X*. The *Desakata*'s trackline is approximate. BACKGROUND SOURCE: GOOGLE MAPS

Coast Guard cutter *Winslow Griesser* before the casualty. SOURCE: COAST GUARD

On August 8, 2022, about 1417 local time, the 154-foot-long Coast Guard cutter *Winslow Griesser* (WPC-1116) and the 23-foot-long center-console boat ***Desakata*** collided about 4 miles off the northern coast of Puerto Rico. The cutter, with a crew of 21, was transiting westbound along the coast, and the boat was transiting northbound while trolling (fishing). Of the two ***Desakata*** crewmembers, one was seriously injured, and one was fatally injured. None of the *Winslow Griesser* crewmembers were injured. No pollution was reported. The ***Desakata***, valued at $58,800, was a total loss.

The center-console boat ***Desakata*** left Cerro Gordo, Vega Alta, Puerto Rico, about 0930 headed northeasterly toward a FAD buoy 7.4 miles north of the coastline. On board were two brothers (one was the owner).

Center-console boat *Desakata* before the collision.
SOURCE: SAMUEL ROSARIO

The *Winslow Griesser* got underway from Coast Guard Base San Juan at 1335. At 1345, as the vessel exited San Juan Harbor, personnel assumed their normal at-sea watches. During at-sea operations, bridge watches consisted of an officer of the deck and a quartermaster of the watch. The commanding officer, though not on watch, was also on the bridge. The cutter's training petty officer, who had transferred recently and was working toward his quartermaster of the watch qualification, was on the bridge for training. A visiting port engineer shadowed the officer of the deck as he explained the uses of various bridge equipment including the helm station.

At 1350, once clear of shoal water, on the west side of the San Juan Harbor approach, the bridge team altered the cutter's course to a northwesterly direction and increased speed from 15 to 29 knots. The AIS transmitter was secured at 1353, after the vessel exited restricted waters, in accordance with the vessel's checklist for getting underway (the cutter did not transmit AIS due to its law enforcement mission). About 1406, the bridge team again altered the cutter's course to port, closer to a westerly course.

After departing Cerro Gordo, following the coast, then turning north, the ***Desakata*** slowly proceeded north while trolling for fish with four lines in the water. The owner operated the ***Desakata*** from the center console as the boat headed toward the FAD buoy, making about 5 knots with the seas on the starboard beam.

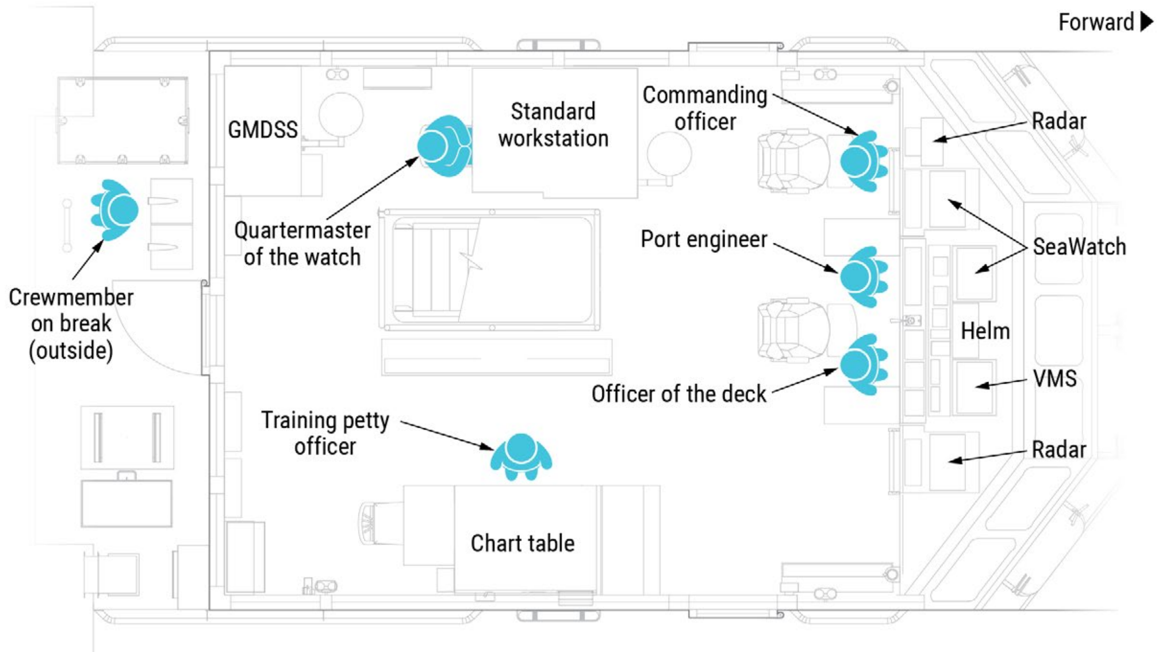
The coastal weather forecast issued at 1106 called for 15- to 20-knot easterly winds and 4- to 6-foot seas with occasional 8-foot seas.

The cutter was proceeding at 29 knots with seas and swells from astern. Standing watch at the forward console with the vessel on autopilot to maintain heading, the officer of the deck continued to review equipment with the port engineer, who told investigators she was not aware of any visual targets and she was not looking at the radar.

According to the port engineer and the training petty officer, the quartermaster of the watch was attending to administrative tasks in the aft part of the bridge. At one point, the port engineer and training petty officer observed the commanding officer working on the port forward console, adjusting the tracklines to Punta Cana.

***Winslow Griesser* bridge, looking forward.** SOURCE: NTSB

A forward-looking camera high on the *Winslow Griesser*'s mast above the bridge first captured the ***Desakata*** about 19 seconds before the collision, crossing from port to starboard at a near right angle roughly 10° off the bow. The camera footage, which was not clear because of a salt-crusted lens, appeared to show the ***Desakata*** disappearing and reappearing in the waves a few times. Camera footage also showed the *Winslow Griesser* yawing to port and starboard in following seas.



***Winslow Griesser* bridge arrangement and approximate location of individuals at the time of the collision.**
SOURCE: NTSB

***Left*: The *Desakata* (circled) as recorded from the *Winslow Griesser*'s salt-encrusted mast camera at 1416:53, 19 seconds before the collision, and at 1417:12, immediately before the collision.**
SOURCE: COAST GUARD

About 1417, as seen from the footage from the forward-looking camera on the mast, the cutter and the fishing boat collided. Crewmembers on the cutter's mess deck, located on the main deck below the bridge, felt a shudder and heard a bang. Some crewmembers checked for damage in the engine room. Another crewmember was outside taking a break behind the bridge and saw wreckage drift down the cutter's port side. He immediately reported this to the bridge watch, who had not realized that the cutter had struck anything.

The owner of the ***Desakata***, who survived the collision, stated that the vessel was trolling about 5 knots at the time of the collision. The owner was operating the boat from the center console and talking to his brother, while his brother was reaching for bait at the time of the collision. The *Desakata* owner told investigators that neither he nor his brother saw or heard the cutter approach.

The commanding officer of the cutter relieved the officer of the deck and maneuvered the vessel as the crew went to man overboard stations. The *Desakata* had been split in two, and among the wreckage, the cutter crew spotted the owner waving to them and holding his brother. The crew maneuvered the cutter alongside and deployed liferings and the Jacob's ladder while they prepared to launch the small boat and a rescue swimmer. The small boat crew recovered both the owner and his injured and nonresponsive brother and returned to the cutter. The *Winslow Griesser*'s crew treated the owner for head trauma. They medically assessed his brother and determined he had been fatally injured.

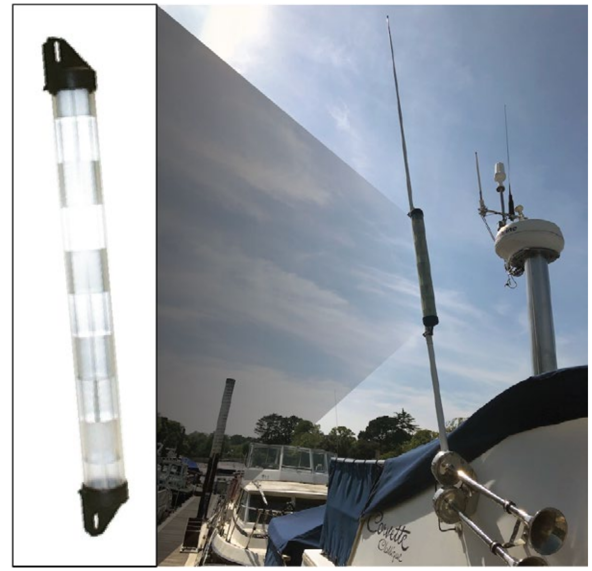
During the investigation, the *Winslow Griesser* commanding officer, officer of the deck, and quartermaster of the watch declined requests of NTSB investigators to be interviewed, based on advice of their counsel. NTSB found that, had the *Winslow Griesser* been equipped with a VDR or its equivalent, investigators would have been provided with additional critical factual information about the collision, which could help identify potential safety issues and result in safety improvements.

THE PROBABLE CAUSE of the collision between the Coast Guard cutter *Winslow Griesser* and the center-console boat *Desakata* was the failure by both vessels' crews to maintain a proper lookout. Contributing to the casualty was the *Winslow Griesser* commanding officer and officer of the deck not taking sufficient measures to increase situational awareness while transiting at a high speed.

SAFETY ISSUES

◇ **Inadequate lookout on both vessels given the operating conditions.** We found that because neither vessel's crew saw the other vessel in the developing crossing situation before the collision, neither had time to assess or apply the navigation rules to avoid the collision. The *Winslow Griesser* should have been visible to the *Desakata* operator before the collision, but the operator was not maintaining a proper lookout. Similarly, the *Desakata* should have been visible to the *Winslow Griesser* crewmembers before the collision, but the bridge watchstanders were not maintaining a proper lookout. We also found that the *Winslow Griesser* commanding officer and officer of the deck did not take sufficient measures to increase situational awareness when the cutter was transiting at high speed.

◇ **Difficulty detecting small vessels by radar.** We also found that fitting small vessels with equipment—such as radar reflector or AIS—when combined with proper visual lookout, would improve the opportunity for vessels with radar to detect them, therefore reducing the risk of a collision.



***Left to right*: An example of a tubular style radar reflector and a tubular radar reflector mounted on a pole aboard a recreational vessel.**

SOURCES: AYAMARNAUTICO.COM, NTSB

***Right*: The Desakata's bow section adrift immediately after the collision.**

SOURCE: COAST GUARD

SAFETY RECOMMENDATIONS

Lessons learned from tragedies like this collision can be useful as training tools and for reviewing current watchstanding (in particular lookout) practices to identify weaknesses and find areas for improvement. Therefore, we **recommended** that the Coast Guard provide information about the circumstances of this collision to cutter crews and emphasize the importance of maintaining a proper lookout and ensuring situational awareness when transiting at high speed.

Charged by Congress as the only independent investigator of Coast Guard casualties, the NTSB requires the availability of objective, time-stamped data, such as that provided by a VDR, to complete timely and thorough investigations that involve Coast Guard cutters. VDRs are one of the most valuable sources of information following a marine casualty because they maintain continuous, sequential records of data relating to a ship's equipment and its command and control, and they also capture bridge audio. Although investigators gathered vital information from camera footage, interviews with crewmembers not on watch, and other sources, the presence of a VDR on board the *Winslow Griesser* would have provided access to additional critical data. Therefore, we **recommended** that the Coast Guard install equipment on all cutters that records vessel parametric data and audio information that is equivalent to International Maritime Organization voyage data recorder performance standards.

The *Winslow Griesser*'s small boat in the seas immediately following the collision.
SOURCE: COAST GUARD

As a result of this investigation the NTSB issued ***Safety Alert 087: Reducing Collision Risk by Improving Small Vessel Detectability*** (*see page 88*).

Collision

VESSEL GROUPS
TOWING/BARGE · **CARGO, GENERAL**

Collision between Tugboat *George M* and Containership *MSC Aquarius*

Houston Ship Channel, Upper Galveston Bay, Texas

CASUALTY DATE **April 14, 2022**	ACCIDENT ID **DCA22FM015**
INJURIES **0**	ESTIMATED DAMAGES **$933,665**
REPORT NUMBER **MIR-23-15**	ISSUED **July 11, 2023**

The *MSC Aquarius* after the casualty. SOURCE: OSVALDO TRAVERSARO, MARINETRAFFIC.COM

The *George M* after the casualty.
SOURCE: COAST GUARD

On April 14, 2022, about 0346 local time, the tugboat *George M* and containership *MSC Aquarius* collided while both vessels were transiting north in the Houston Ship Channel approaching Morgan's Point, Texas. About 1,000 gallons of gear oil were released from the *George M*'s damaged port propulsion unit. No injuries were reported. Damage to the *George M* was estimated at $750,000; damage to the *MSC Aquarius* was $183,665.

On April 13, the *George M* was tasked with assisting vessels, and the mate operated the tugboat under the supervision of the captain while the *George M* assisted in three vessel movements. Based on his observation of the mate and previous experience, the captain assessed that the mate was capable of safely operating the tugboat. Although the mate was familiar with Z-drive tugboats (like the *George M*) and was fully qualified under company standards for 30–75-class vessels, the *George M* was a 30–80-class tugboat, and it was the mate's first rotation on board that class of vessel. While the 30–75- and 30–80-class tugboats were similar, small differences between platforms can impact operator performance, particularly during difficult maneuvers or emergencies where quick action is required.

On April 14, at 0234, while the *George M*'s mate was on watch and the captain was asleep, the *George M* received tasking for a harbor-assist operation to dock the *MSC Aquarius*, which was inbound through the Houston Ship Channel.

The *George M* and another tugboat met the *MSC Aquarius* in the channel south of Morgan's Point, about 0330. To make up the *George M* to the *MSC Aquarius* at the center lead forward position, the mate maneuvered the tugboat into position centerline on the bow of the *MSC Aquarius*, which was transiting at 9.7 knots.

Hydrodynamic forces created by a ship increase exponentially with speed, and therefore an increase of even a few knots will have a significant effect on the forces acting on a tugboat in the center lead position.

When the *George M* approached the *MSC Aquarius*, the speed of the containership was 2.7 knots above the towing-company-directed limit of 7 knots for the bow-to-bow maneuver and 3.7 knots above the 6-knot limit preferred by pilots, tugboat captains, and ship masters surveyed by an International Tug Masters Association/Nautical Institute working group. Hydrodynamic forces also increase with decreasing distance to the bow, and, consequently, the forces acting on the *George M* were even greater as the tugboat approached the bow of the *MSC Aquarius* to make up the hawser.

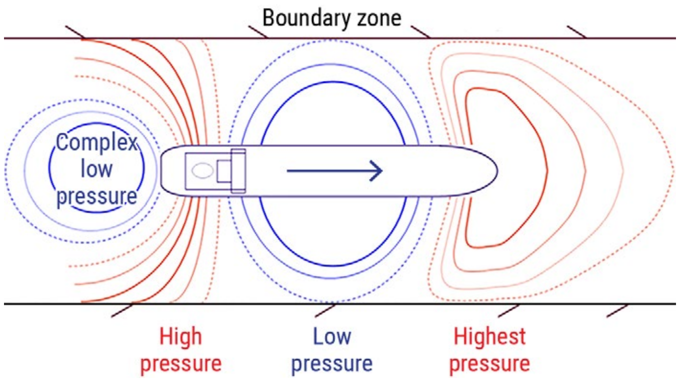
In addition to producing significantly increased hydrodynamic forces, higher speed reduces the amount of reserve propulsion power available to the operator. If the tugboat moves out of position, the operator has less power to regain position as compared to the same maneuver at a lower transit speed. In this casualty, the difference between the maximum astern speed of the *George M* and the speed of the *MSC Aquarius* was 2.3 knots. In other words, the containership's speed was 81% of the maximum astern speed of the tugboat, far greater than the 60% recommended in the *Bow Tug Operations with Azimuth Stern Drive Tugs* textbook. As an assisted ship's speed increases, the margin of error decreases to the point where regaining position may be impossible.

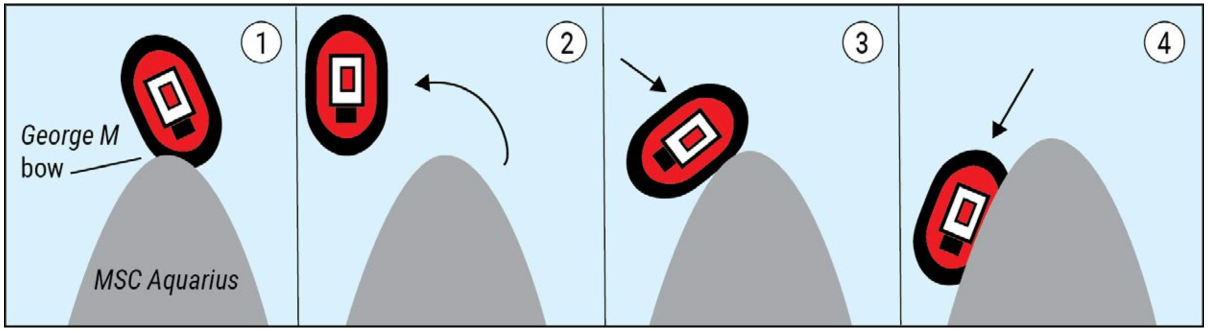
As the tugboat's AB made up the heaving line to the hawser messenger, and the containership's crew began heaving in the line, the *George M* moved out of centerline with the *MSC Aquarius*. The mate attempted to maneuver the tugboat back to centerline, but the tugboat did not respond to the mate's inputs as he expected based on his previous experience. He was unable to regain position, and his attempt to do so resulted in two collisions between the vessels.

According to the *George M* captain and mate, as well as the *MSC Aquarius* pilot, the mate could have requested that the *MSC Aquarius* slow, and the pilot would have slowed the containership if it was operationally feasible. If not operationally feasible, the tugboat mate could have worked with the pilot to delay making up the tugboat until it was safe to do so. However, neither of these actions happened. The *George M* mate did not communicate with the pilot after being assigned to the center lead forward position, and consequently, the pilot was not aware of the status of the tugboat or the need to slow.

THE PROBABLE CAUSE of the collision between the tugboat *George M* and the containership *MSC Aquarius* was the *George M* mate's attempt to make up bow to bow while the tugboat and containership were transiting at a speed that was excessive for the advanced harbor-assist maneuver. Contributing to the casualty was the *George M* mate's lack of experience operating the tugboat.

Ship-generated pressure fields for a vessel navigation in enclosed/confined water. SOURCE: P. J. MCARTHUR





Sequence of events in *George M/MSC Aquarius* collision (scale approximate). (1) After moving to the starboard side of the *MSC Aquarius*, the *George M* moved back to port and the starboard bow of the tugboat collided with the bow of containership; (2) the *George M* accelerated and moved to a position to port and ahead of the *MSC Aquarius*; (3) the *George M* moved toward the centerline of the *MSC Aquarius*, the tugboat's speed decreased, and the vessels collided again; (4) the *George M* slid aft along *MSC Aquarius*'s port side until it became lodged in the flare of the containership's port bow. SOURCE: NTSB

LESSON LEARNED: Speed During Bow-to-bow Harbor-assist Operations

The risk of a casualty during bow-to-bow harbor-assist operations with ASD tugboats increases with increasing speed. Hydrodynamic forces around an assisted vessel's bow increase exponentially with speed, while the amount of reserve propulsion power available to the tugboat operator decreases. Therefore, owners and operators of ASD tugboats that perform bow-to-bow harbor-assist operations should set speed limits for these maneuvers. These limits may vary for different classes of tugboats based on design. Tugboat operators should communicate these pre-determined speed limits to ship masters or pilots in command of the vessels that they are assisting before engaging in these maneuvers.

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

Collision between Cargo Ship ***Damgracht*** and Cargo Ship ***AP Revelin***

Sabine Pass, Port Arthur, Texas

CASUALTY DATE	ACCIDENT ID
August 21, 2022	**DCA22FM038**
INJURIES	ESTIMATED DAMAGES
0	**$3.4 million**
REPORT NUMBER	ISSUED
MIR-23-16	**August 1, 2023**

***From top*: Cargo ships *Damgracht* and *AP Revelin* anchored after the collision.**
SOURCE: NTSB

***Left to right*: Port bow of the *Damgracht* and damaged stern area of the *AP Revelin* after the collision.** SOURCE: NTSB

On August 21, 2022, about 1045 local time, the cargo ship *Damgracht* was inbound in the Sabine Pass Outer Bar Channel en route to Beaumont, Texas, and the cargo ship *AP Revelin* was outbound, when the two vessels collided near Port Arthur, Texas. There were no injuries to the *Damgracht*'s 16 crewmembers nor to the *AP Revelin*'s 19 crewmembers, and no pollution was reported. Damage to the *AP Revelin* was estimated at $3.4 million, and there were no reported damage costs for the *Damgracht*.

The *Damgracht* had gotten underway at 1030, with a pilot from an anchorage east of buoy 29. The pilots aboard the two ships arranged to meet port-to-port near buoys 33 and 34. However, at 1043 the *Damgracht*'s main engine shut down due to "high oil mist density" sensed by its OMD, and, as a result, the *Damgracht* lost propulsion. The vessel maintained electrical power and rudder control, but the bow thruster was disabled.

With the abrupt loss of propulsion, while transiting at 15 knots, the *Damgracht* began veering to port into the path of the *AP Revelin*, which was about a half mile away and was transiting about 10 knots. The *Damgracht* pilot broadcast the loss of propulsion over VHF radio, directed the captain to sound the "danger" signal, and ordered the rudder hard to starboard. However, he was unable to alter the vessel's heading, since his rudder commands were unable to counter the vessel's veering to port due to the lack of propeller wash passing over the rudder.

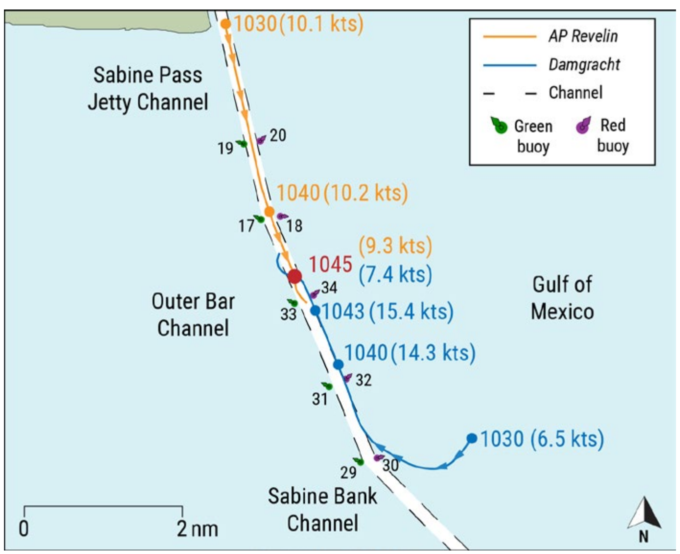
Upon hearing the VHF broadcast, the pilot aboard the *AP Revelin* took action to avoid the approaching *Damgracht*. However, because there was only a half mile between the two vessels when the *Damgracht* lost propulsion, and, given the speed at which the two vessels had been transiting, there was not enough time for the *AP Revelin* pilot's evasive actions to be effective. About 2 minutes after the *Damgracht*'s engine failure, its bow struck the port quarter of the *AP Revelin*.

The previous afternoon, when first transiting inbound, the *Damgracht*'s main engine had an automatic emergency shutdown and the vessel lost propulsion. As a result, the vessel was towed and anchored east of the Sabine Bank Channel (the alarm was due to low cooling water pressure and high cooling water temperature). That evening, the crew cooled down the main engine, disassembled the no. 6 cylinder head, and found a failed cylinder head gasket. When the gasket failed, high-temperature, high-pressure gas likely escaped from the combustion chamber into the crankcase and into the cooling water system, reducing the effectiveness of the cooling system and causing the engine to overheat. The gasket failure also likely allowed products of combustion and cooling water to leak into the cylinder and contaminate the engine's lube oil system.

The gasket repair work resulted in the interior sections (crankcase doors, cylinder head) of the engine being opened and exposed to humid conditions (about 90% humidity that evening). In humid conditions, a higher concentration of airborne water molecules can enter an engine and be absorbed by its lube oil, especially when an engine is cool. After the repairs, the crew used the engine's cooling water system to preheat the engine and put the lube oil purifier online (with its heating system). The crew tested the engine for about 30 minutes and again opened the crankcase for inspection. Throughout the evening and following morning, due to operational conditions, the engine went through several temperature changes, which can cause water vapor to condense and change back into a liquid and form droplets that can collect in the lube oil sump.

Area where the *Damgracht* lost propulsion (1043) and collided with the *AP Revelin* (1045), as indicated by a red circle.

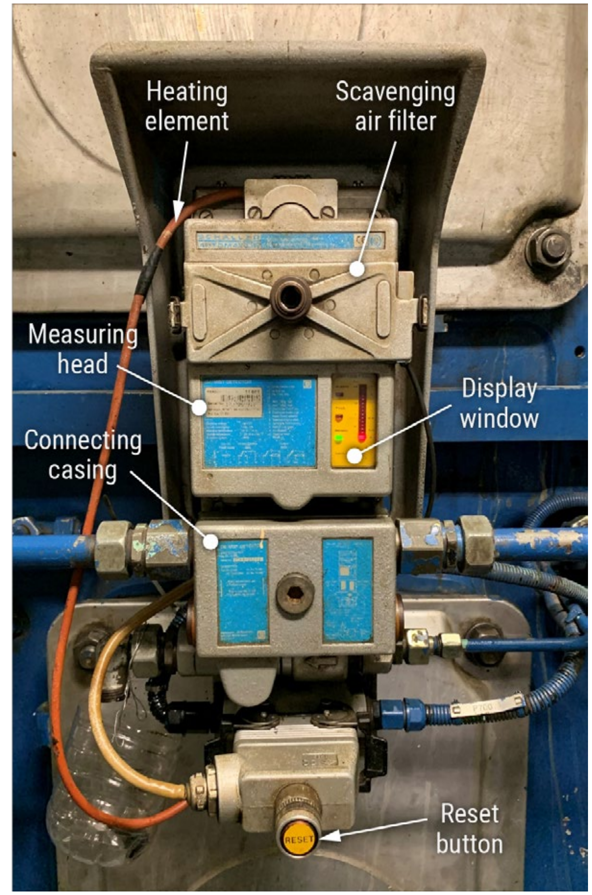
BACKGROUND SOURCE: NOAA CHART 11341



Typically, normal quantities of moisture in an engine crankcase evaporate when the engine is started and reaches operating temperatures. On the morning of the collision, the crew started the main engine and ran it for about 30 minutes before the OMD alarmed and automatically shut it down. Due to the ambient air conditions the engine was exposed to during repairs and cooling water that had likely leaked into and contaminated the lube oil from the failed gasket, it is likely that higher levels of water entered the crankcase than could be removed overnight by the lube oil purifier or evaporate from the heat of the running engine in the short time it was tested post repair.

Because there were no elevated bearing temperatures or high crankcase pressure when the OMD alarmed, the chief engineer found no abnormalities or impurities on the OMD sensing glass following the shutdown, and the engine operated without incident after being restarted, it is likely that the OMD had triggered a false alarm after sensing water vapor that had condensed in the sample.

THE PROBABLE CAUSE of the collision between the cargo vessel *Damgracht* and the cargo vessel *AP Revelin* was the *Damgracht*'s loss of propulsion caused by an automatic shutdown of the main engine due to a false alarm, likely triggered by water vapor sensed by the oil mist detector shortly after engine maintenance was completed to replace a failed cylinder head gasket during high-humidity conditions.



Main engine oil mist detector aboard the *Damgracht*.

SOURCE: NTSB

LESSON LEARNED: Oil Mist Detector Precautions After Engine Maintenance

When certain engine components, such as cylinder head gaskets, fail, cooling water can be introduced into engine lube oil systems. Ambient air conditions, such as high humidity or extreme cold temperatures, can also increase the water content within engine lube oil sumps. The elevated quantity of water in lube oil systems can trigger false alarms in engine crankcase oil mist detectors (and lead to an engine shutdown) due to water droplets passing through the measuring track or the filter glass detecting condensation (mistaking it for oil mist). After an engine's crankcase is opened and exposed to these conditions during maintenance and repair, it is good practice for engine crews to inspect and test the lubricating oil system for water intrusion and ensure lube oil purifying equipment is functioning properly to remove any water or other contamination in the lube oil.

VESSEL GROUPS
CARGO, GENERAL • **FISHING**

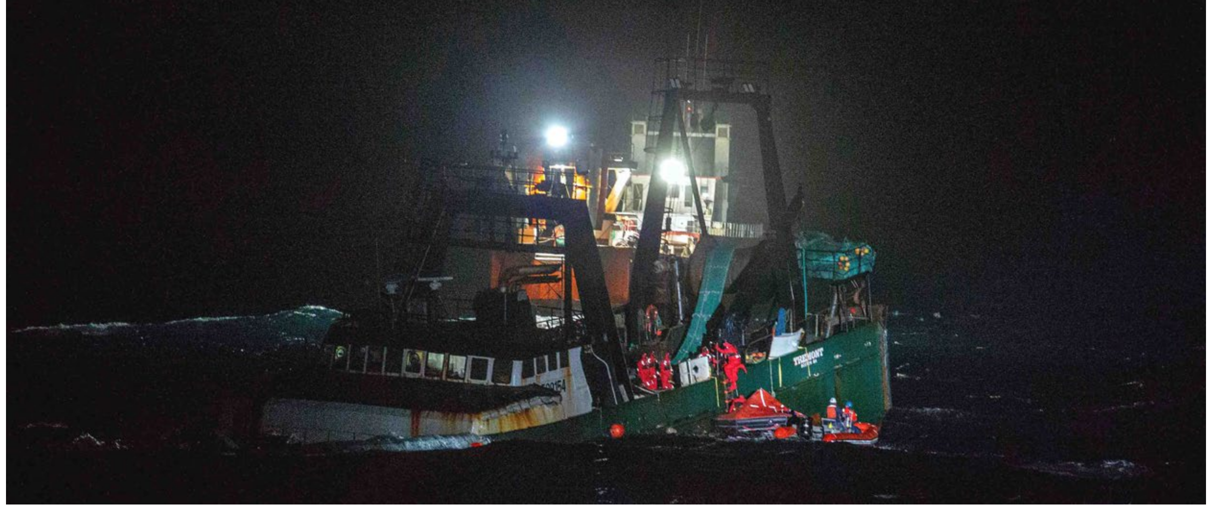
Collision between Containership ***MSC Rita*** and Fishing Vessel ***Tremont***

Atlantic Ocean, 55 miles southeast of Chincoteague, Virginia

CASUALTY DATE **October 28, 2022**	ACCIDENT ID **DCA23FM003**
INJURIES **0**	ESTIMATED DAMAGES **$6.25 million**
REPORT NUMBER **MIR-23-27**	ISSUED **December 18, 2023**

***MSC Rita* (*above*) and *Tremont* (*below*) before the collision.**

SOURCES: SHIPSPOTTING.COM AND TREMONT FISHERIES



***Tremont* bow awash during the abandonment.** SOURCE: LANCE WILLS

On October 28, 2022, about 0036 local time, the containership *MSC Rita* and the fishing vessel *Tremont* were underway in the Atlantic Ocean, 55 miles southeast of Chincoteague, Virginia, when the two vessels collided. The 13 people aboard the *Tremont* abandoned the vessel and were rescued by Good Samaritan vessels and a Coast Guard helicopter. No injuries were reported. An oil sheen was reported; a potential of up to 31,000 gallons of diesel fuel were lost with the fishing vessel. Damage to the vessels was estimated at $4.75 million (*Tremont*) and $1.5 million (*MSC Rita*).

On October 7, the *Tremont* sailed south from New Bedford, Massachusetts, to fish for squid off the east coast of the US. On board were 12 crewmembers, including one of the owners, who served as the vessel's mate and engineer, and one passenger. Over the next 20 days, the crew fished between New Jersey and North Carolina.

On the morning of October 27, the *MSC Rita* left Staten Island, New York, en route to Charleston, South Carolina. On board were 22 crewmembers.

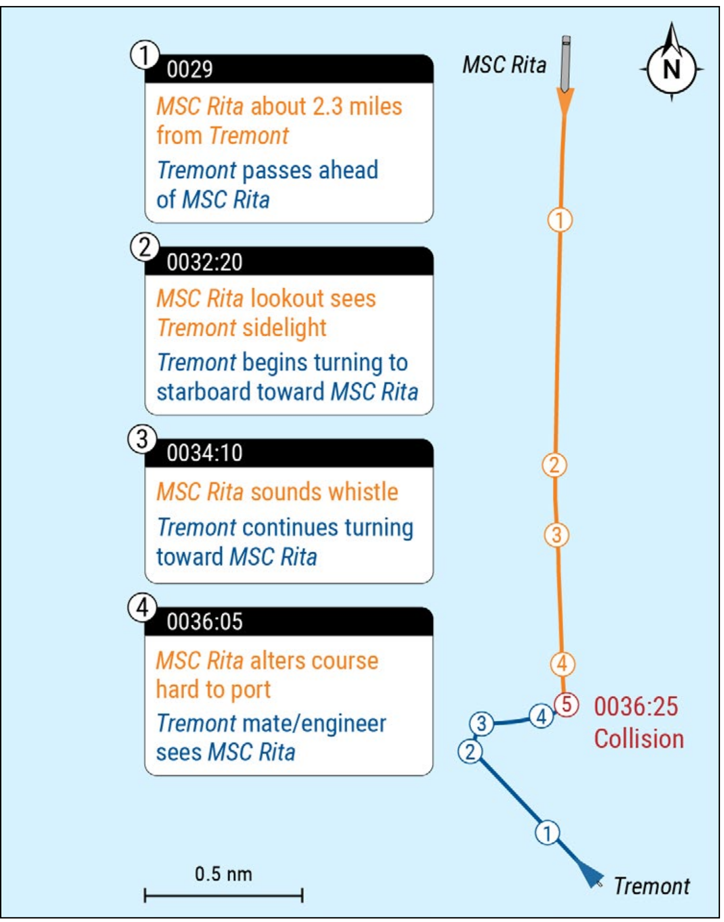
Early in the morning on October 28, while the *MSC Rita* was transiting southbound in the Atlantic Ocean, southeast of Chincoteague, the *Tremont* was transiting north-northeast in the same area. Shortly after the *Tremont* passed ahead of the *MSC Rita*, the *Tremont* unexpectedly turned sharply back toward the containership.

At that time, the *Tremont* mate was operating the vessel and attempting to fix the vessel's gyrocompass, which had been off by 10° since 4–5 days into the trip (investigators were unable to determine what was wrong with the gyrocompass). As he worked to fix the gyrocompass, the mate left the vessel's autopilot engaged.

The *Tremont*'s autopilot required heading feedback from the vessel's gyrocompass and a user to input the heading setpoint (desired course). As a result of this heading feedback and user input, the *Tremont*'s autopilot would then output the calculated rudder commands to correct any heading deviation. The amount of rudder used was a function of heading setpoint deviation, the rate of change in the deviation, and the mean deviation. Therefore, as the mate adjusted the gyrocompass to troubleshoot the cause of its error, the autopilot processed the heading feedback, causing the vessel to turn to starboard and toward the *MSC Rita*.

When a mariner is in doubt about a vessel's erratic movements or an operator's intentions, they should sound blasts of the whistle to signal uncertainty. When the fishing vessel was about 1.3 miles away, the *MSC Rita* second officer sounded five short blasts of the whistle. Additionally, the 1,100-foot-long *MSC Rita* would have presented a substantial radar target, and since the containership was displaying navigation lights, the mate should have been able to see it visually. However, the *Tremont* mate, standing watch alone in the wheelhouse, was preoccupied with troubleshooting the gyrocompass and did not hear the containership's whistle, nor did he see it visually or on radar until immediately before the collision. Therefore, the mate's distraction due to troubleshooting the gyrocompass prevented him from maintaining a proper lookout, and the *Tremont* continued on the same heading, closing on the *MSC Rita*. Although the *MSC Rita* helmsman switched to hand steering and came hard to port to avoid a collision, there was not enough time to maneuver the containership out of the path of the *Tremont*, and the fishing vessel struck the *MSC Rita* about 20 seconds later.

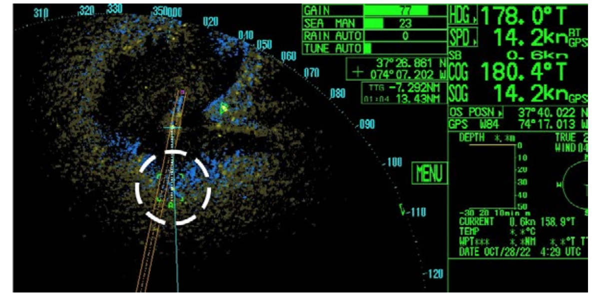
***Tremont* (blue) and *MSC Rita* (orange) tracklines leading up to the collision.** SOURCE: NTSB



Within 10 minutes of the collision, flooding reached the *Tremont*'s main deck above the fish hold. The crew did not determine the source of the rapid flooding and subsequently abandoned the vessel. The flooding was likely caused by portside shell damage at the engine room and/or the vessel's forepeak.

The *Tremont* captain used VHF to signal distress, but because of the distance between the vessel and the nearest Coast Guard station ashore, the distress call was weak. The captain used the vessel's satellite phone to call 911 and communicate the nature of the emergency and the vessel's position. The *Tremont* was equipped with VHF-DSC; by pushing and holding the red distress button on the radio, a VHF-DSC call could have communicated the nature of the distress and the latest position of the vessel to nearby vessels, unlike a satellite call, and would have continued to transmit distress messages until the call was acknowledged.

THE PROBABLE CAUSE of the collision between the containership *MSC Rita* and the fishing vessel *Tremont* was the *Tremont* mate not maintaining a proper lookout and keeping the autopilot engaged while troubleshooting the vessel's gyrocompass, which resulted in the vessel turning into the path of the *MSC Rita*.



***Tremont* (circled) crossing ahead of *MSC Rita* at 0029:17 as seen on the containership's X-band radar.**
SOURCE: *MSC RITA*

Damage to the *MSC Rita*'s starboard hull.
SOURCE: COAST GUARD

LESSONS LEARNED:

Conducting Maintenance on Critical Equipment while Underway

In this casualty, maintenance of the gyrocompass was being conducted while the vessel was underway with its autopilot—which was receiving heading information from the gyrocompass—engaged. Simultaneous operations, often referred to in safety management systems, is a situation where two or more operations occur in the same place at the same time and may interfere with each other. Managing simultaneous operations is an essential element of safety management and safe vessel operation. Before beginning work, mariners should identify hazards associated with working on one piece of equipment that may affect another, such as sensors feeding information to other equipment, and manage those risks to avoid unsafe conditions.

Using VHF-DSC to Communicate Distress

Modern VHF radios are equipped with DSC. Pressing the VHF-DSC button alerts search and rescue authorities and nearby vessels, and automatically provides the vessel's position. Time permitting, mariners can also select the nature of distress on the radio and verbally communicate with nearby responders. When a vessel is in distress, mariners should use all available means to signal emergency responders, including VHF-DSC.

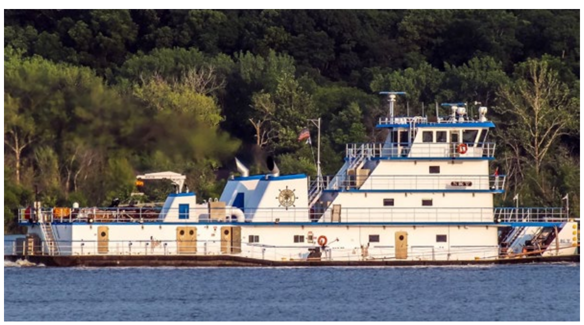
VESSEL GROUP
TOWING/BARGE

Collision between ***Big D*** and ***Carol McManus*** Tows

Lower Mississippi River, mile 312, near Fort Adams, Mississippi

CASUALTY DATE	ACCIDENT ID
January 9, 2023	**DCA23FM012**
INJURIES	ESTIMATED DAMAGES
2 minor	**$1.36 million**
REPORT NUMBER	ISSUED
MIR-23-30	**December 27, 2023**

***Left to right*: Hopper barge *IN065432* from the *Carol McManus* tow and tank barge *FMT1052* from the *Big D* tow, postcasualty.** SOURCE: INGRAM BARGE COMPANY



***Big D* (*above*) and *Carol McManus* (*below*) underway before the casualty.** SOURCES: FLORIDA MARINE TRANSPORTERS AND INGRAM BARGE COMPANY

On January 9, 2023, the towing vessel *Big D* was pushing 19 barges downbound on the Lower Mississippi River and the towing vessel *Carol McManus* was pushing 42 barges upbound on the river. At 0152 local time, the two tows collided at mile 312 near Fort Adams, Mississippi, causing the barges in both tows to break free. Several barges were damaged in the collision, and about 1,380 gallons of ethanol spilled into the waterway. Two minor injuries were reported. Damages to the barges were estimated at $1.36 million.

At 0134 on the morning of the casualty, the downbound *Big D* was pushing its tow at mile 314, approaching a bend near Fort Adams at a speed over ground of 10.4 mph. The upbound *Carol McManus* was pushing its tow about 4 miles downriver of the *Big D* tow, below the bend, and making 6.0 mph speed over ground.

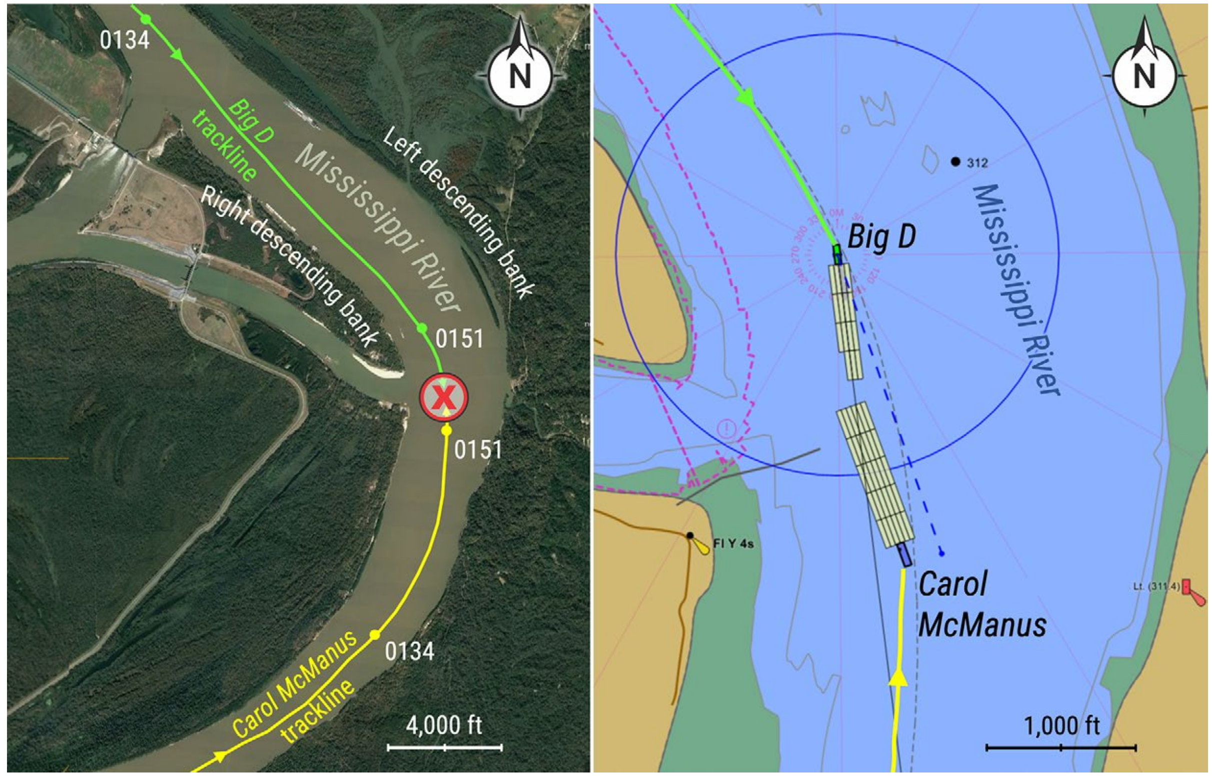
According to the Inland Navigation Rules, when two vessels are meeting or crossing, each vessel shall signal its maneuvering intentions by using the vessel's whistle. One short blast of the whistle indicates, "I intend to leave you on my port side"—a portside-to-portside passage; a vessel would sound two whistles if proposing a starboard-side-to-starboard-side passage. The rules also allow mariners to use VHF radio, in lieu of whistles, to make passing arrangements, and it is common for operators to refer to the whistle signals as a shorthand when making these arrangements. For example, when proposing via radio that two vessels meet port to port, a mariner may ask that the other vessel "see me on one whistle."

Seeing that the vessels would be meeting at the bend, the *Big D* pilot radioed the *Carol McManus* to make passing arrangements. The *Big D* pilot proposed a port-to-port passage, and the *Carol McManus* pilot agreed to the arrangement without repeating it back. The *Big D* pilot then maneuvered his downbound tow toward the right descending bank to set up for the agreed-upon arrangement. About 20 minutes elapsed between the agreement and the tows meeting.

Although the Inland Navigation Rules do not require an operator to repeat back a proposed passing arrangement when using radio, verbally repeating or "rehearsing" a piece of information, such as a passing arrangement, serves two purposes: it ensures that both operators understand the arrangement, and it reinforces the storage and maintenance of passing arrangement information in each operator's working memory until the information is required to be accurately recalled (when the vessels meet). Repeating back a proposed arrangement is critical when there is a long period of time between passing arrangements being made and when the vessels meet. As he was preparing to meet the ***Big D*** tow, the ***Carol McManus*** pilot "got confused" and incorrectly recalled the arrangement, and, as a result, he navigated his upbound tow toward the right descending bank. At the time, the pilot was not impaired by fatigue, or alcohol or other drug use, or distracted by cell phone use. Had the ***Carol McManus*** pilot repeated back the proposed arrangement, he would have been more likely to correctly recall the agreement and maneuver his tow to the left descending bank of the river.

Although visibility was unrestricted as the vessels neared the bend in the darkness, the trees and vegetation along the banks likely obscured each pilot's view of the other tow until the tows were about 1,100 feet apart. When they saw they were in danger of colliding, the pilots attempted to maneuver to avoid the collision, but there was insufficient time before the tows collided and broke apart.

THE PROBABLE CAUSE of the collision between the *Big D* tow and the *Carol McManus* tow was the *Carol McManus* pilot incorrectly recalling the agreed-upon passing arrangement, which resulted in the *Carol McManus* tow encroaching on the downbound *Big D* tow.



***Left to right*: AIS tracklines of the *Big D* and *Carol McManus*, with a circled *X* marking the location where the tows collided, and the positions of the tows just before the collision at 0152.**

BACKGROUND SOURCES: GOOGLE EARTH; US ARMY CORPS OF ENGINEERS ENC U37LM236, AS PRESENTED ON ROSE POINT ELECTRONIC CHART SYSTEM

LESSON LEARNED: Repeating Passing Arrangements via Radio

When mariners are making passing arrangements via radio, several factors may impact each mariner's understanding of the final agreed-upon arrangement. These factors include garbled radio transmissions, strong accents or an unfamiliarity with the English language, a mariner's preconceived expectation of the event, fatigue, or distraction. When one mariner proposes an arrangement to another, the other mariner should repeat back the proposed passing arrangement to ensure both parties have a shared understanding of the arrangement. The repeat-back also reinforces the agreed arrangement with each mariner.

VESSEL GROUP
OFFSHORE

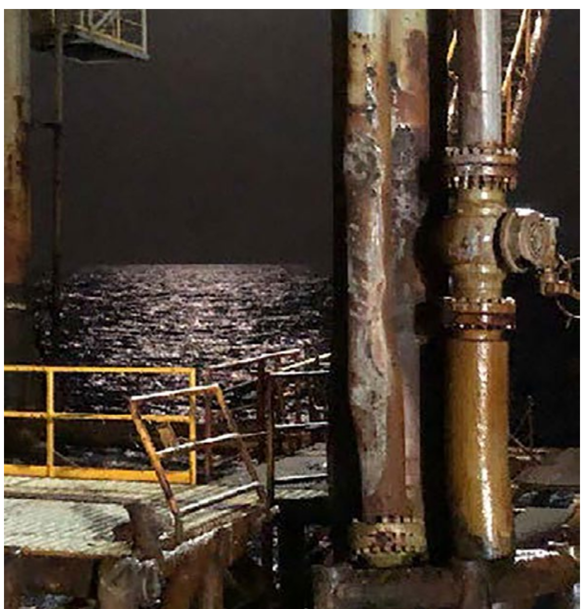
Contact of Offshore Supply Vessel ***Elliot Cheramie*** with Oil and Gas Production Platform EI-259A

Gulf of Mexico, 77 miles southwest of Port Fourchon, Louisiana

CASUALTY DATE **June 25, 2021**	ACCIDENT ID **DCA21FM031**
INJURIES **4**	ESTIMATED DAMAGES **$362,814**
REPORT NUMBER **MIR-23-01**	ISSUED **January 12, 2023**

***Left to right*: *Elliot Cheramie* and EI-259A before the casualty.**
SOURCES: CHERAMIE MARINE, COX OPERATING

Damage to platform EI-259A. SOURCE: COX OPERATING



On June 25, 2021, about 0245 local time, the offshore supply vessel *Elliot Cheramie* was transiting in the Gulf of Mexico with four crew and five offshore workers aboard when it struck the uncrewed/shut-in oil and gas production platform EI-259A (Eugene Island Block 259 "A" platform) 77 miles southwest of Port Fourchon, Louisiana. Four minor injuries were reported. Damage to the vessel, platform, and pipelines was $362,814.

At 0630 on June 24, the *Elliot Cheramie* moored at its regular fuel facility in Port Fourchon after completing a 12-hour transit from Vermillion Block 397 "A" platform (VR-397A) with four crewmembers, three offshore workers, and equipment on board. During the day, crewmembers offloaded equipment and loaded material for the next trip to VR-397A.

The vessel's crew consisted of a captain, credentialed mate, deckhand/engineer, and deckhand. At 1900, the relief captain and the relief deckhand arrived aboard the *Elliot Cheramie*, completing the crew change at 1930. The deckhand learned he had been assigned the 00–12 watch when he boarded. At 2000, with the captain at the helm, the *Elliot Cheramie* was underway outbound to VR-397A, and the engineer/deckhand stood watch.

The mate woke up at his usual time of 2200 in preparation for his watch and arrived in the wheelhouse about 2345 to relieve the captain. The deckhand got in his bed at 2130, and set an alarm for 2344—giving him at most 2.5 hours of rest before his watch started—and did not wake up. The engineer/deckhand went to bed at midnight without waking up the deckhand.

During his 2 weeks off, the deckhand kept a normal schedule of being awake during the day and asleep at night. He changed his schedule to working at night on the same day as his return to the vessel. This disruption to his circadian rhythm, combined with his awake hours during the day and only having 2.5 hours of sleep before the 00–12 watch, increased the risk of fatigue and likely contributed to the deckhand sleeping through his alarm. Had the company followed its SMS recommendation to give crewmembers at least 24 hours of notice before beginning night work, he would have had more time to acclimate to his schedule.

In the early morning hours on June 25, the mate was in the wheelhouse alone, navigating in the darkness and steering the vessel in autopilot mode, following the GPS track to VR-397A. The mate stated he was "more tired than usual" and felt "groggy." Having received only 5 hours of sleep in the previous 24 hours, and, given the physical nature of work performed the previous afternoon (offloading and loading material and provisions), the mate was likely experiencing the effects of acute fatigue, leading to diminished alertness and decision-making and a reduction in operator vigilance.

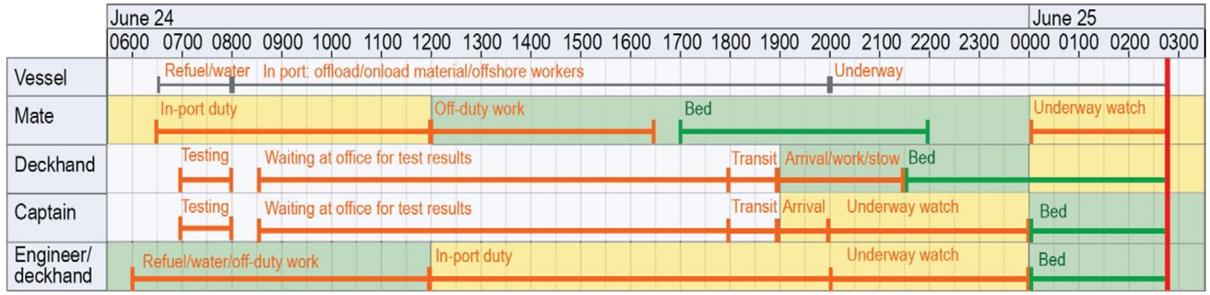
After sitting in the wheelhouse chair, the mate fell asleep. He woke up with the platform "dead ahead." He pulled back on both engine throttles, but "it was too late," and the vessel struck oil and gas production platform EI-259A.

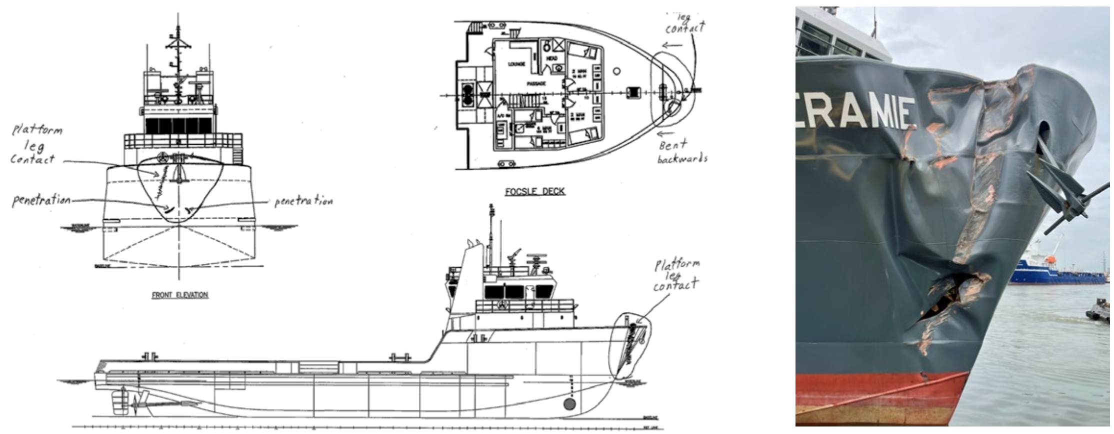
The deckhand, who was supposed to be on watch with the mate, would have been responsible for the bridge navigation watch; however, other duties would have taken him away from the wheelhouse for extended periods of time. Therefore, even if the deckhand had been on watch, the mate may have fallen asleep when the deckhand was off the bridge, and his presence would not have necessarily prevented the contact.

Based on the work/rest history of the mate, the company requirement that credentialed personnel "may not work for more than 12 hours in a consecutive 24-hour period" was not followed. Although part of the SMS, the company's *Fatigue Mitigation* document was written as guidance, presenting fatigue mitigation measures that "can be used." None of the document's suggested policies were required, and the work/rest histories of the mate and deckhand show that the guidance was not followed. Further, the in-port unloading and loading took all hands several hours to complete, indicating that there were not enough crewmembers or workers to complete the necessary tasks while ensuring that crewmembers had adequate rest time. Had the fatigue mitigation measures in the SMS been required, the crew still would not have had the resources to adhere to such policies. A company SMS should be constructed such that companies and crews have clear policies and procedures to follow, and companies should provide sufficient resources to ensure safe operations and be compliant with those policies.

THE PROBABLE CAUSE of the contact of the offshore supply vessel *Elliot Cheramie* with oil and gas production platform EI-259A was the owner/operator not adhering to their 12-hour work hour limit policy, which led to the fatigued mate falling asleep while on watch.

Timeline of crewmember watches and activities. Yellow shaded times are watches, and green shaded times are off duty, while orange text indicates work activities and green text indicates rest. SOURCE: NTSB





***Left to right*: Diagram of vessel damages as provided to the NTSB and damaged bow of the *Elliot Cheramie*.**
SOURCES: CHERAMIE MARINE, COAST GUARD

LESSON LEARNED: Fatigue Management

In this casualty, and as the NTSB has previously noted in numerous commercial vessel casualties, crew fatigue was a significant causal and contributing factor. Company operational policies and requirements should incorporate and follow fatigue management best practices to ensure that crewmembers receive enough rest to adequately perform navigational, lookout, engineering, and other watch stander duties. Such policies should include the maximum hours (both duty hours and off-watch work) crewmembers are allowed to work in a consecutive 24-hour period, except in an emergency. Additionally, companies should ensure that vessels are crewed with the appropriate number of trained personnel to safely perform operations without compromising the work/rest schedules of off-duty watchstanders. Companies and vessel captains should also actively monitor the watch schedules and any off-watch work performed by their crews to ensure that fatigue mitigation policies are adhered to, adjusting watch schedules accordingly for crewmembers at risk for fatigue.

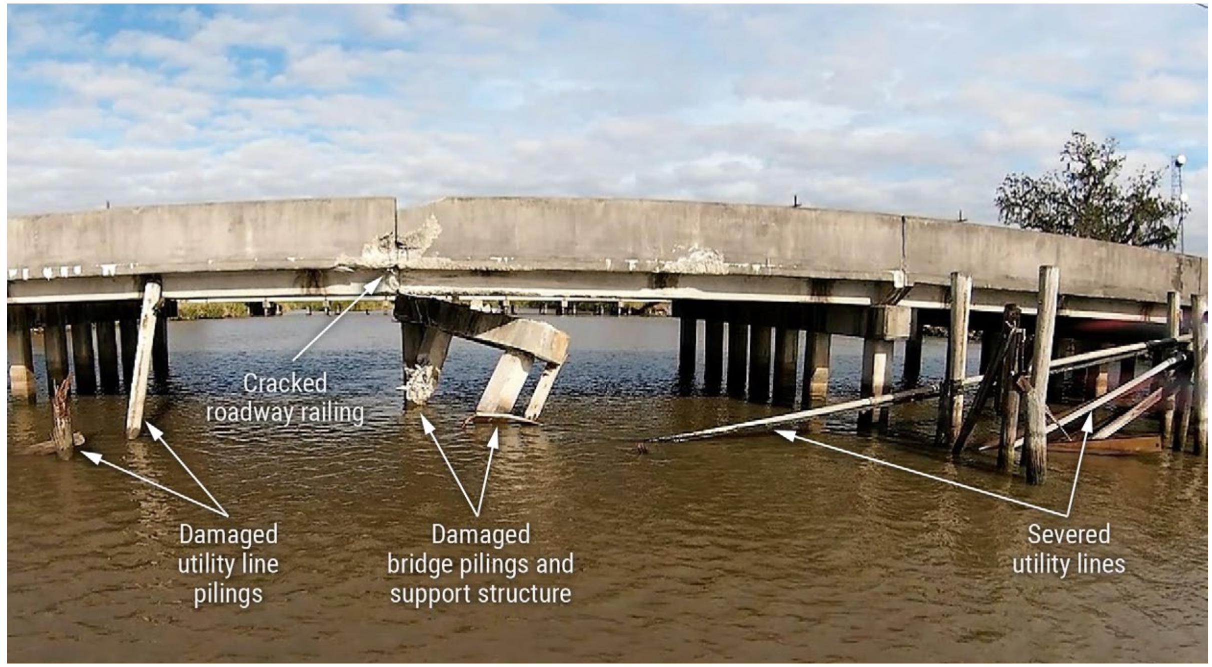
Contact

VESSEL GROUP
TOWING/BARGE

Contact of *Miss Mollye D* Tow with Route 182 Bridge

Bayou Boeuf, 1.3 miles southeast of Morgan City, Louisiana

CASUALTY DATE **December 23, 2021**	ACCIDENT ID **DCA22FM008**
INJURIES **0**	ESTIMATED DAMAGES **$2 million**
REPORT NUMBER **MIR-23-04**	ISSUED **February 9, 2023**



Route 182 bridge damage. BACKGROUND SOURCE: CAJUN DRONE PHOTOGRAPHY, JIM PIERCE JR.

***Miss Mollye D* moored following the casualty.**
SOURCE: COAST GUARD

On December 23, 2021, at 0326 local time, the towing vessel ***Miss Mollye D*** was pushing six barges eastbound on Bayou Boeuf between Morgan City and Amelia, Louisiana, when the tow left the channel and struck the Route 182 bridge, which ran parallel to the waterway. The operator then maneuvered the tow back into the channel, and the tow continued eastbound. Utility workers discovered damage to the bridge later that morning and notified the Coast Guard. None of the five crewmembers aboard the *Miss Mollye D* were injured, and no pollution was reported. Damage to the bridge was estimated at $2 million.

Just after 0300, the pilot was working the tow around a gradual bend in Bayou Boeuf at 2 mph. As the *Miss Mollye D* proceeded eastbound, the tow veered to port. The pilot stopped the tow before the lead barges could impact the north bank, but it blocked the entire channel. During this time, the *Miss Mollye D*'s stern was close to the south bank and risked grounding.

The tow remained in this position for 8 minutes, while the pilot said he considered what to do about the possibility of fog. At 0314, the pilot straightened the tow back in the channel, and then the tow began heading eastbound again.

A few minutes later, the *Miss Mollye D* passed a westbound tow in the channel. Then, at 0324, the tow began swinging to port. The pilot said he noticed that the tow had begun to turn but took no action before looking at a weather report for a minute to a minute and a half—a long period of time considering that the tow was veering toward the opposite channel bank. As a result, the tow nearly collided with an anchor-handling vessel moored along the port bank.

When the pilot looked forward again, he realized the tow was "not in a good position." He then put the engines in reverse. The Route 182 bridge was now ahead of the tow at close range to the port lead barge. The pilot said that initially he did not see the bridge.

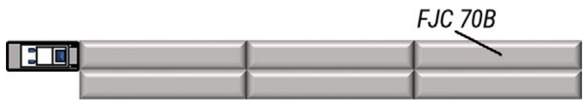
According to camera footage from the vessel, the bridge was not visible in the darkness; however, 23 seconds before the contact occurred, a vehicle with headlights and taillights illuminated crossed the bridge.

The momentum of the tow continued to move it forward, and, at 0326, barge *FJC 70B* struck the bridge. The pilot stated that he did not know that the tow had hit the bridge, but the sudden loss of speed and the visual indication of the barges pitching upward would have been clear indicators of the bridge strike. Further, the damage to the bridge was extensive and would have been apparent when the pilot spotlighted the bridge on two occasions immediately after the casualty. Finally, his radio transmission to the towing vessel *Philip*, stating that he was "trying to get [the tow] off of this," suggests that the tow was in contact with the bridge. Based on the evidence, it is apparent the pilot was aware that the tow hit the bridge, but he did not report the casualty to the relief captain or to the Coast Guard, as required by regulation.

The bridge was closed following the casualty, with the south lane remaining closed until repairs could be made. However, traffic over the bridge was not stopped until utility workers found the damage hours after the casualty occurred. Had the roadway failed and a vehicle crossed the bridge, or had gas and electric lines severed during the casualty ignited a fire before the damage was discovered, the consequences of this casualty could have been severe.

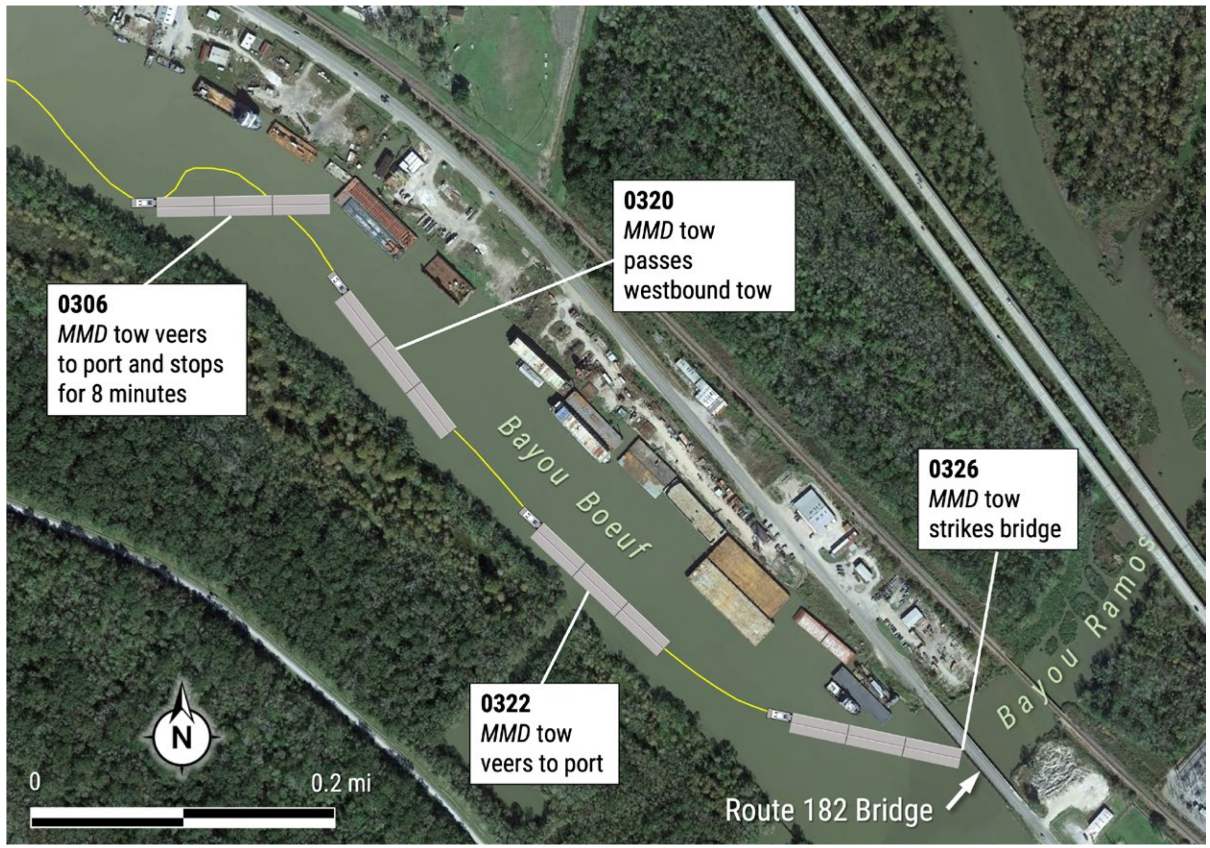
A likely explanation of the vessel's erratic movement and the pilot's actions before and after the casualty is impairment. Possible causes of impairment include fatigue or drug use. Because there were no other crewmembers in the *Miss Mollye D* wheelhouse during the events preceding the casualty, the impact of fatigue could not be conclusively determined. The pilot submitted to a urinalysis on the afternoon of the casualty, and the results were negative for all tested-for drugs. However, the urinalysis did not test for buprenorphine or fentanyl, and hair-sample testing conducted 5 weeks after the casualty indicated that the pilot used these drugs at some point in the preceding 1–2 months. Buprenorphine causes mental and physical impairment, and fentanyl causes confusion, drowsiness, and dizziness. While the use of either of these drugs could have caused the pilot to be impaired, the specific timing of the drug use could not be determined by the hair sample test.

THE PROBABLE CAUSE of the contact of the *Miss Mollye D* tow with the Route 182 bridge was a loss of control of the tow by the pilot at the helm of the towing vessel, likely due to impairment by factors such as fatigue or drug use.



***Miss Mollye D* tow arrangement.** SOURCE: NTSB

Track of the *Miss Mollye D* (*MMD*), shown in yellow, as it pushed the tow before the casualty. Photo is not from the time of the casualty. Vessels shown moored along the northern bank are typical for the waterway.
BACKGROUND SOURCE: GOOGLE MAPS



VESSEL GROUP
TOWING/BARGE

Contact of ***Robert Cenac*** and Tow with Houma Twin Span Bridge

Gulf Intracoastal Waterway, Houma, Louisiana

CASUALTY DATE	ACCIDENT ID
March 6, 2022	**DCA22FM012**
INJURIES	ESTIMATED DAMAGES
0	**$1.5–2.0 million**
REPORT NUMBER	ISSUED
MIR-23-06	**March 8, 2023**

***Clockwise from top*: The Houma Twin Span Bridge; eastbound span of the bridge showing damaged stringer; and extract of NOAA chart 11355, annotated by NTSB.** SOURCES: NTSB, NOAA

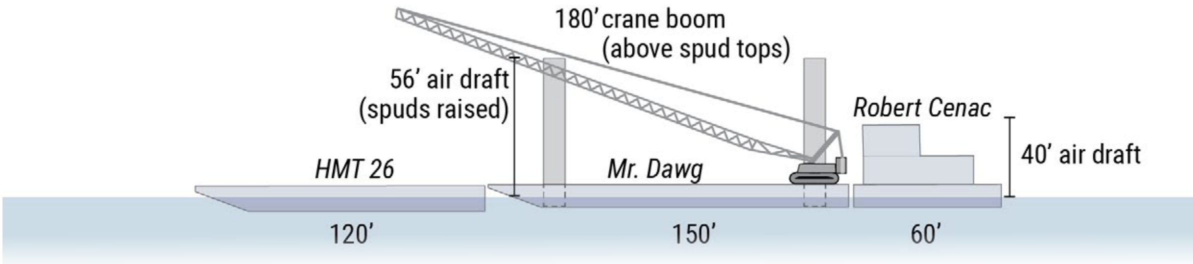
***Robert Cenac* before the casualty.**
SOURCE: JEFF L. YATES

On March 6, 2022, about 0038 local time, the towing vessel *Robert Cenac* was transiting the Gulf Intracoastal Waterway, in Houma, Louisiana, pushing ahead the crane barge *Mr. Dawg* and another deck barge. While passing beneath the Houma Twin Span Bridge, the crane aboard *Mr. Dawg* contacted the eastbound span of the bridge. Eastbound automobile bridge traffic was reduced from two lanes to one for 10 days. No pollution or injuries were reported. Damage to the bridge was estimated at $1.5 to 2.0 million.

About 2000 on March 5, Sealevel Construction verbally arranged to charter the *Robert Cenac* (operated by Al Cenac Towing) to tow the crane barge, *Mr. Dawg*, and a deck barge, the *HMT 26*, from Houma to a levee near Clovelly, Louisiana. About 2200, the *Robert Cenac* crew made up the tow with the towboat pushing the *Mr. Dawg* and the smaller *HMT 26* in the lead.

Both the towboat operator shoreside staff and the crew aboard the *Robert Cenac* were concerned about the height of the crane, and the captain observed that the head of the crane boom was higher than the crane barge spuds, contrary to what Sealevel had initially communicated to Al Cenac Towing. Unbeknownst to Sealevel staff, their last crew to use the crane aboard the *Mr. Dawg* did not lower the boom to an angle typically used for transport—with the boom lowered below the barge's raised spud tops. Despite being asked at least twice about the height of the crane by the towboat operator before departure, Sealevel staff did not provide Al Cenac Towing with a verified crane height.

Without a verified crane boom height, the captain of the *Robert Cenac* estimated the total air draft of the tow, assuming the spuds to be a standard 50 feet high and estimating the portion of the crane boom above the spuds at 10 feet, arriving at a total air draft of "roughly 60 feet," which would have allowed the tow to pass below all of the bridges on the passage (he understood each had 72 feet of vertical clearance). However, the raised spuds on the *Mr. Dawg* had an air draft of about 56 feet, not 50 feet as the captain assumed.



Tow arrangement of *Robert Cenac* and barges at the time of the casualty (scale approximate). SOURCE: NTSB

A spud length of 50 feet was very common for spud barges operating in the area and may have biased the captain's initial estimate. The captain's ability to accurately judge the height of the crane boom above the spuds was also likely affected by the dark nighttime conditions impacting his ability to make an accurate estimate of height from a distance given the 180-foot length of the crane boom. These factors resulted in an inaccurate and subjective assessment of the crane barge's air draft, which was the highest in the tow.

Tow operators are required to know the air draft of their vessel and tows. As the NTSB has recommended before, tow operators should have a detailed voyage plan, including calculated overhead clearance limitations for tows. Additionally, the Coast Guard has recommended that "assumptions are not made regarding a vessel or its cargo's 'air draft' or of 'bridge heights.'" In this case, the captain should have waited to get underway until the exact air draft of the tow was established. However, about 2330, after he told the operator he was comfortable, the captain got the tow underway.

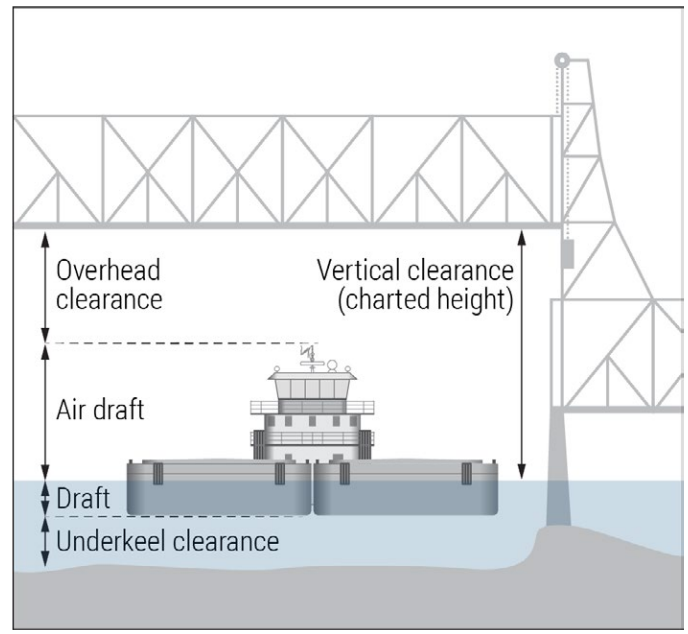
The tow transited the Houma Navigation Canal swing bridge without incident as it entered the Gulf Intracoastal Waterway. At 2340, the mate arrived in the wheelhouse for his watch, and when the vessel was a mile from the Houma Twin Span Bridge, the captain went to bed. From his vantage point in the wheelhouse, the mate saw the red and green navigation lights on the bridge but couldn't see how high the boom was.

At 0038, the crane boom head contacted the lower part of the bridge, damaging the steel girder and impacting vehicular traffic for 10 days. The bridge's vertical clearance was listed in charts as 72.8 feet, meaning that the captain's estimate of 60 feet was at least 12 feet short.

THE PROBABLE CAUSE of contact of the *Robert Cenac* tow with the Houma Twin Span Bridge was the tow captain's incorrect estimate of the crane boom height and his decision to depart before getting a confirmed height from the crane barge owner. Contributing to the incident was the crane barge owner not providing the accurate air draft information to the tow company.

Crane barge *Mr. Dawg* in operation.
SOURCE: HOUMA TIMES

Critical dimensions and terms for bridge transits.
SOURCE: NTSB



LESSON LEARNED: Navigation Assessments

When operating in higher risk conditions, operators should ensure that they have the most accurate and objective data before getting underway. Bridges pose a risk to vessels and tows with high air drafts. Owners and operators should develop voyage plans that assess operational risks and hazards, to include air draft relative to bridge vertical clearances along the intended route.

VESSEL GROUP
PASSENGER

Contact of Cruise Ship ***Radiance of the Seas*** with Sitka Sound Cruise Terminal Pier

The Sitka Sound Cruise Terminal pier on June 9, 2022, with barge alongside the damaged dolphin for repairs (with catwalk between dolphins removed). SOURCE: NTSB

***Inset*: Damaged dolphin piling.** SOURCE: HALIBUT POINT MARINE SERVICES

Sitka Sound, near Sitka, Alaska

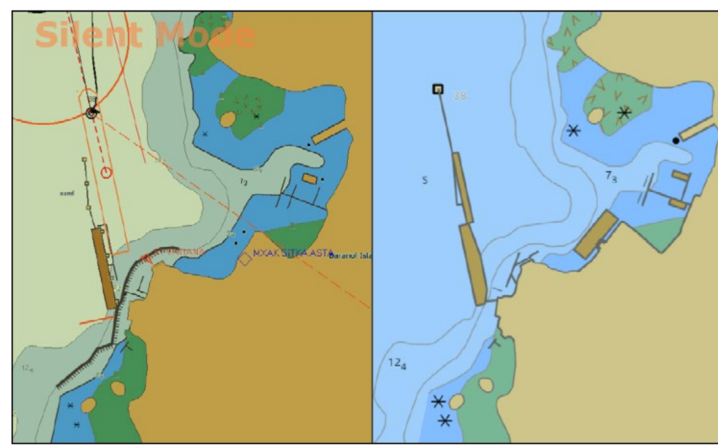
CASUALTY DATE	ACCIDENT ID
May 9, 2022	**DCA22FM018**
INJURIES	ESTIMATED DAMAGES
0	**$2.1 million**
REPORT NUMBER	ISSUED
MIR-23-10	**May 26, 2023**

***Radiance of the Seas* before the casualty.** SOURCE: NTSB

On May 9, 2022, about 0727 local time, the cruise ship *Radiance of the Seas* was maneuvering in Sitka Sound toward the pier at the Sitka Sound Cruise Terminal near Sitka, Alaska, when the vessel struck and damaged a mooring dolphin. No pollution or injuries were reported. Damage to the pier was estimated at $2.1 million.

On May 9, after the vessel passed the entrance to Sitka Sound, the bridge team discussed their planned approach to the Sitka Sound Cruise Terminal. Although the *Radiance of the Seas* had moored at the terminal the previous week with the same master, the officers and master stated that they were unaware that the pier had been extended northward by 395 feet over a year earlier (two dolphins and a connecting walkway were added in April 2021).

According to NOAA, the facility did not communicate the pier extension to the agency, and therefore, the navigational chart had not been updated. As a result, the *Radiance of the Seas* ECDIS showed the original, nonextended pier. As the vessel approached the terminal, the master planned to rotate the vessel about 180° before backing into the berth and mooring port side to the pier in the inboard (east side) berth, with the stern facing the terminal. The location chosen to start the rotation was based on the inaccurate ENC.



***Left to right*: ENC as seen on *Radiance of the Seas* ECDIS with the ship's outline after mooring shown in orange and updated postcasualty.**
SOURCES: ROYAL CARIBBEAN CRUISE LINES, NOAA

As the vessel approached the pier, the weather was clear, and visibility was good (10 miles). Therefore, the master (at the conn) and bridge team should have been able to see the extended pier and added dolphins. However, none of the bridge team members reported the extension as the vessel approached the pier. Instead, the master relied on the ECDIS—which showed the inaccurate ENC—to determine the vessel's position relative to the pier.

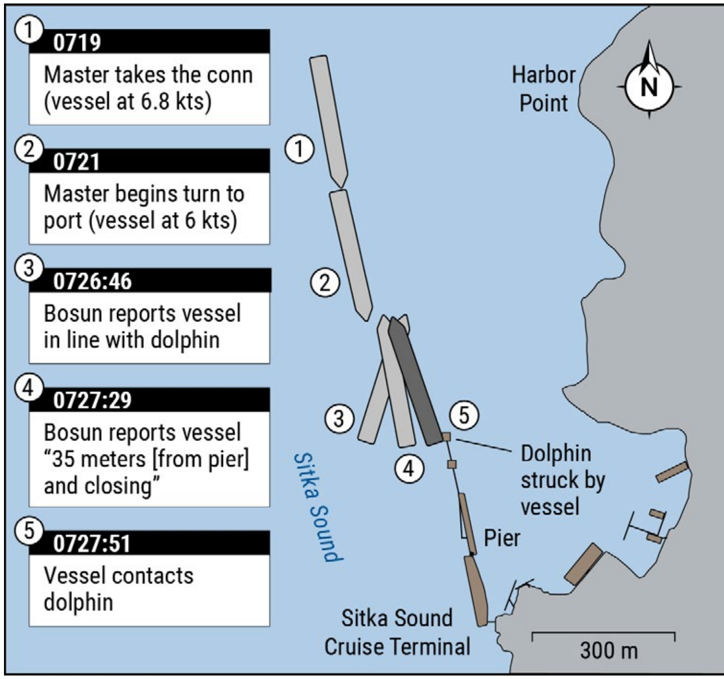
When the vessel was about 0.37 miles from the pier, the master began rotating it. Because the ship was still making headway (about 6 knots) at the time, it continued moving closer to the pier as it rotated to port. Because the master and bridge team were unaware of how close the *Radiance of the Seas* was to the pier and mooring dolphins as they began rotating the vessel, the vessel struck the dolphin at the end of the pier. Had the master slowed and stopped the vessel earlier in his approach, he likely would have been able to rotate the vessel with adequate space to avoid the contact.

The vessel was equipped with radar, and the bridge team was able to see the radar return on the vessel's ECDIS. During the vessel's approach, the radar showed the pier extending beyond its location on the ENC. The fact that the charted pier did not match the radar return should have raised concern amongst the bridge team. However, no one reported the discrepancy, indicating they either were not using the radar or were not paying attention to the radar returns.

A starboard bridgewing camera trained on the pier failed (due to a hardware problem) as the vessel was rotating, leaving the bridge team without a clear image of the pier and dolphins behind them. Once the vessel began turning, the primary radar would not have been available due to a radar shadow area astern. The ship had an additional radar scanner and camera on its stern, which could have been used by the bridge team to show objects—in this case, the pier and mooring dolphins—astern of the vessel, but the bridge team did not use these tools. Had the bridge team effectively used the technologies available to them to complete the turn and mooring maneuver, the casualty likely could have been prevented.

The bosun was stationed on the aft mooring deck to radio the distance from the vessel's stern to the pier. The bosun called out what were later determined to be accurate distances to the pier's northernmost dolphin from the ship's stern, but the master incorrectly assumed the bosun was calling out how much clearance the ship would have as the stern passed the dolphin. Had they clearly understood what distances were being communicated, the master and bridge team may have been aware of how close the vessel was to the dolphin and could have taken action to avoid the casualty.

THE PROBABLE CAUSE of the contact of the cruise ship *Radiance of the Seas* with the Sitka Sound Cruise Terminal pier was the master and bridge team's overreliance on an electronic chart to identify the pier's position relative to their planned rotation location, and the master's misunderstanding of the clearance distances to the pier being called by the crewmember on the stern while the vessel was rotating. Contributing was the Sitka Sound Cruise Terminal not reporting the extension of the pier into the waterway to the appropriate hydrographic authority in order to update the relevant navigational chart.



Radiance of the Seas **approach and turn in relation to the lengthened pier (scale approximate).**

VESSEL POSITION SOURCE: ROYAL CARIBBEAN CRUISE LINES

LESSONS LEARNED:

Voyage Planning

Proper voyage planning includes developing a complete plan for every phase of the voyage—from the vessel's starting port to its end port (berth to berth), including leaving the dock and mooring. Reference points for maneuvering should be identified, measured precisely, and reported clearly. Vessel bridge teams should also ensure that they have the most up-to-date data before getting underway and consult with the local pilot(s) on the accuracy of navigation charts to ensure depictions of ports and/or terminals are correct.

Reporting Port or Terminal Modifications

Ports and terminals should immediately report significant modifications to port or terminal configurations to the appropriate hydrographic authority (for example, NOAA) so that charts can be updated and the changes made readily available to vessel owners, operators, and crews/bridge teams.

Contact

VESSEL GROUP
PASSENGER

Contact of Passenger Vessel *Cathlamet* with Ferry Terminal Dolphin

Puget Sound near Fauntleroy, Washington

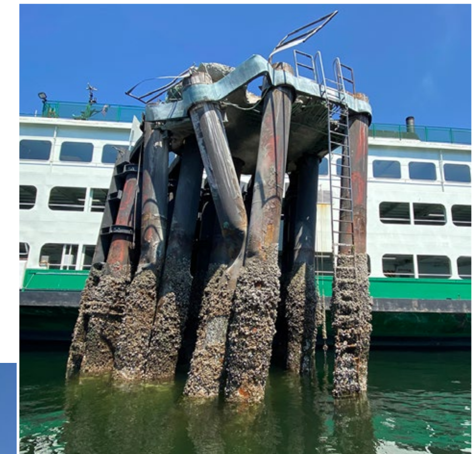
CASUALTY DATE	ACCIDENT ID
July 28, 2022	**DCA22FM032**
INJURIES	ESTIMATED DAMAGES
1 minor	**$10.3 million**
REPORT NUMBER	ISSUED
MIR-23-21	**September 27, 2023**

Still image from forward-looking camera footage on board the *Cathlamet* at the time the ferry's port bow struck the dolphin.
SOURCE: WASHINGTON STATE PATROL

On July 28, 2022, about 0814 local time, the passenger and car ferry *Cathlamet* was approaching the Fauntleroy Ferry Terminal when the vessel struck a ferry terminal dolphin. One minor injury was reported. The damage to the vessel was estimated at $10 million, and the dolphin damage estimate was $300,000.

On July 28, about 0810, the master assumed the helm of the *Cathlamet* from the quartermaster, before the vessel was a half mile from the Fauntleroy Ferry Terminal. As the ferry approached, the master contacted the engine room about 0812 to engage the no. 2 engine (the "bow" engine on this transit) so it was available to help slow the vessel, in accordance with docking procedures. Over the next few minutes, the master made a series of rudder commands before the stern rudder was ordered and reached midships at 0813:19.

After the rudder was midships, the heading continued to move to starboard—reaching 92° just before the vessel struck the dolphin at 0813:47. As the vessel approached the dolphin, the master did not take any action to correct the ferry's course, slow down, or sound the alarm to alert the crewmembers and passengers that something was wrong. At 0813:46, the Data Logger recorded a helm input (rudder order) of 35° to port. Investigators were unable to determine if the master recognized the impending collision and attempted to turn the vessel or if the order occurred as a result of the contact.



***Below*: The damaged *Cathlamet* after the contact with the dolphin. *Right*: The damaged dolphin.** SOURCE: WSF

The *Cathlamet* before the casualty. SOURCE: WSF

The master's statement to investigators showed that he seemed unaware of how the vessel had ended up striking the dolphin. Additionally, immediately following the contact, the quartermaster had to prompt the master three times to maneuver the ferry astern to avoid running aground. These statements, combined with the master's actions and inactions, indicate that the master experienced a lapse in attention, likely due to some form of progressive incapacitation after he placed the rudder midships as the ferry was approaching the dock.

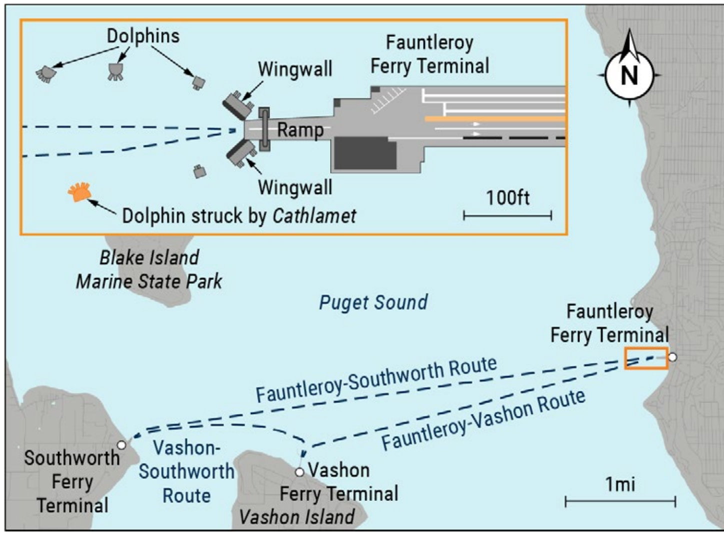
Investigators sought to determine why the master became incapacitated in the minutes before the attempted docking. The master declined interview requests after the day of the casualty; therefore, the analysis relied on other available data. The master's alcohol and other drug test results and cellular phone records indicated that he was not under the influence of an illegal substance or distracted by a portable electronic device at the time of the casualty.

In the days leading up to the casualty, the master reported receiving between 5–6 hours of sleep each night before arriving to the ferry around 0330 to 0345 each morning, and he did not sleep before assuming the watch about 0720. Individuals typically require 7–8 hours of sleep per night to avoid the effects of fatigue. A cumulative sleep debt can accrue over the course of several days when an individual consistently receives less than 8 hours of sleep. Additionally, his sleep quality was likely affected by personal stressors that further contributed to his fatigue.

Fatigued individuals exhibit decreased attention, reaction time, vigilance, and decision-making, and are susceptible to uncontrolled sleep episodes known as microsleeps—brief periods of sleep lasting a few seconds. It is possible for a person to experience microsleep without recognizing that it has happened. The investigation found that rudder commands were insufficient to line up the vessel for docking, and the master did not properly slow the vessel. The master also did not radio the terminal or ensure an arrival announcement was made over the public address system. Additionally, there were no rudder commands for 28 seconds before the contact. Finally, the master did not recall what had occurred. These events are all consistent with incapacitation from a microsleep. Therefore, beginning sometime after the master called the engine room, the master likely experienced a microsleep due to fatigue.

The repetitive nature of ferry operations requires operators to sustain a high level of vigilance to prevent complacency. The bridge team on the *Cathlamet* exhibited complacency through their noncompliance with WSF policies (the uncredentialed quartermaster was at the helm as it docked at Vashon Island, and as the *Cathlamet* approached the Fauntleroy Ferry Terminal, the quartermaster did not actively monitor the master as the ferry approached the dock). By not adhering to procedures, the watchstanders created a single point of failure.

THE PROBABLE CAUSE of the contact of the passenger vessel *Cathlamet* with the dolphin at the Fauntleroy Ferry Terminal was the master's incapacitation, likely due to a microsleep, while the vessel was docking, and the quartermaster not actively monitoring the approach to the ferry terminal and intervening before the contact.



WSF's routes for the North Vashon Triangle. The inset shows the area near the Fauntleroy Ferry Terminal.
BACKGROUND SOURCE: GOOGLE MAPS

LESSON LEARNED: Watchstanding, Fatigue, and Complacency

Fatigue is often a factor in casualties investigated by the NTSB. Fatigue affects all aspects of human performance, including decision-making, alertness, and reaction time. Mariners should understand the performance effects of sleep loss and recognize the dangers of fatigue, such as microsleeps. When affected by fatigue, mariners should arrange for a qualified watchstander to serve in their place and avoid being on duty when unable to safely carry out their responsibilities.

In addition, repetitive operations, such as ferry transits—back and forth on the same route—require operators to sustain a high level of vigilance to prevent complacency. Complacency occurs when operators repeatedly complete a task without consequence, desensitizing them to its inherent risk. As with any repetitive task, individuals become increasingly familiar and comfortable over time. To combat complacency, operators should comply with procedures, such as operating checklists, that are in place to prevent single points of failure, and companies should train operators on the importance of following procedures.

VESSEL GROUP
CARGO, GENERAL

Anchor Strike of Underwater Pipeline and Eventual Crude Oil Release

San Pedro Bay, near Huntington Beach, California

CASUALTY DATE	ACCIDENT ID
October 1, 2021	**DCA22FM001**
INJURIES	ESTIMATED DAMAGES
0	**$160 million**
REPORT NUMBER	ADOPTED
MIR-24-01	**January 2, 2024**

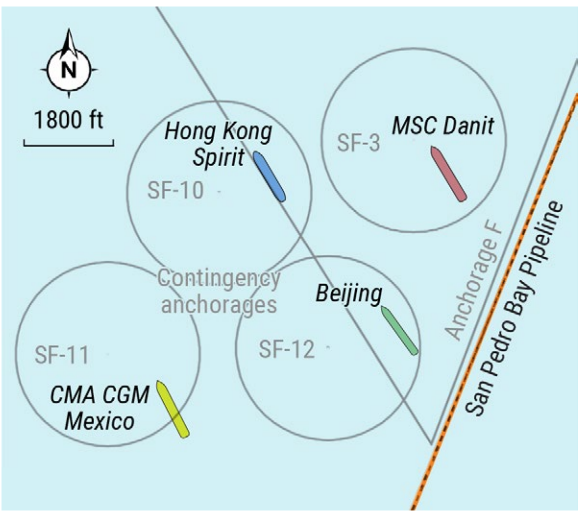
Crude oil in the Pacific Ocean off the California coast on October 3, 2021. Oil spill removal organization vessels are towing a skirted oil boom to contain the oil spill. SOURCE: COAST GUARD

On October 1, 2021, at 1610 local time, San Pedro Bay Pipeline controllers received the first of a series of leak detection system alarms for their underwater pipeline, which was located in San Pedro Bay, off the coast of Huntington Beach, California. Over the next 13 hours, the controllers conducted seven pipeline shutdowns and restarts during troubleshooting of the alarms. At 0604 on October 2, controllers shut down the pipeline for the eighth and final time. A pipeline contractor vessel crew visually confirmed a crude oil release at 0809, and Beta Offshore, the pipeline operator, then initiated an oil spill response. An estimated 588 barrels of oil leaked from the pipeline. Damage, including clean-up costs, was estimated at $160 million. There were no injuries. A postaccident underwater examination of the pipeline found a crack along the top of the pipeline within a section of the pipeline that had been displaced from its originally installed location. Additionally, scarring consistent with anchor dragging was identified on the seafloor near the crack location, which was 4.75 miles from shore. Postaccident investigation determined that the containerships *MSC Danit* and *Beijing* had dragged anchor near the pipeline months before the oil release, on January 25, 2021.

Simplified illustration of the San Pedro Bay Pipeline and supporting structures. BACKGROUND SOURCE: GOOGLE MAPS

***Left to right*: Containerships *MSC Danit* and *Beijing* at anchor in San Pedro Bay, postcasualty.** SOURCE: COAST GUARD

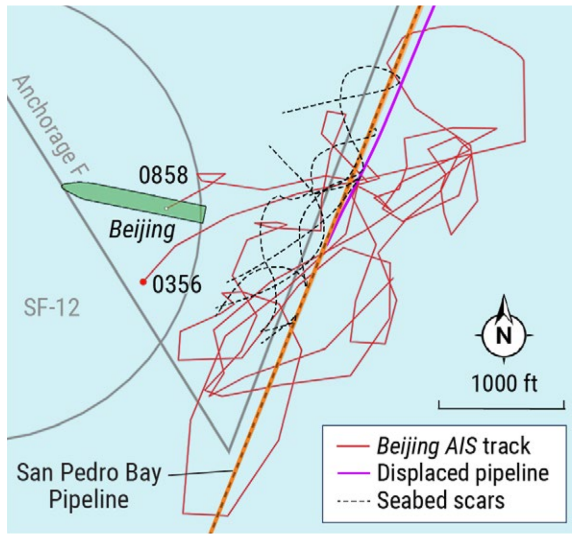
San Pedro Bay Pipeline, with locations of oil release, federal Anchorage F, and contingency anchorage positions near Anchorage F.
BACKGROUND SOURCE: GOOGLE MAPS



Anchorage AIS positions of *MSC Danit*, *Beijing*, and nearby vessels at 0001 on January 25, 2021. SOURCE: NTSB

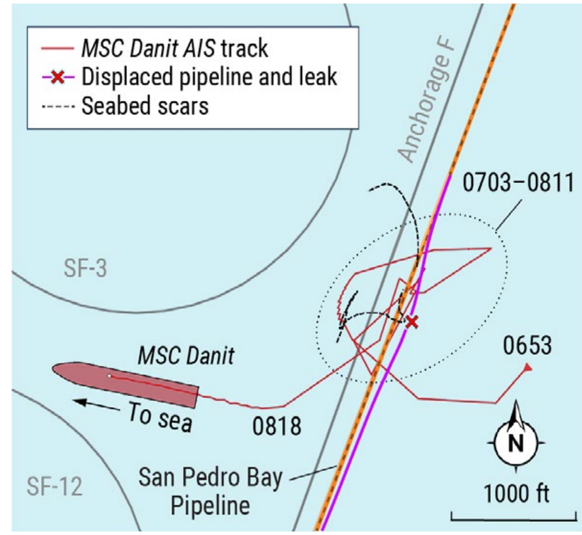
In the early morning on January 25, 2021, the *MSC Danit* and *Beijing* were anchored in designated federal anchorages in San Pedro Bay. The ships had been assigned to these anchorages by VTS LA-LB.

About 0230, winds and seas in San Pedro Bay began to increase after a strong cold front moved through the Southern California coastal areas overnight. About 0350, the *Beijing* started to drag anchor in the high winds and seas. Although the crew took action to start its engine and heave up its anchor, a problem with the vessel's port anchor windlass motor delayed them from heaving in the anchor, and the vessel drifted out of its assigned anchorage and over the San Pedro Bay Pipeline. After the *Beijing* had initially passed over the pipeline, it continued to maneuver nearby, with its AIS position passing over the charted location of the pipeline at least 10 times. The vessel's crew eventually switched out windlass motors and fully heaved in the anchor about midnight on January 26. The *Beijing* then departed San Pedro Bay.



Location data from anchor dragging scars on the seabed, when overlaid with the *Beijing*'s AIS data, indicate that the *Beijing* anchor likely struck the pipeline multiple times. SOURCE: NTSB

The *MSC Danit* also began dragging anchor in the high winds and seas on January 25. At 0549, a watchstander on the *MSC Danit* radioed VTS LA-LB to report that the vessel was no longer holding position, that the main propulsion engine was in use, and that the ship was starting to heave in its anchor. The watchstander further reported that the *MSC Danit* would be proceeding out of the anchorage to the south to drift. According to the ship's bell book, the crew began heaving in the anchor a minute later. As the containership dragged anchor in an easterly direction, its AIS position passed outside the anchorage boundary and, at 0553, it passed over the charted location of the San Pedro Bay Pipeline.



The *MSC Danit*'s AIS data indicated that the vessel maneuvered directly over the pipeline and remained there for over an hour. SOURCE: NTSB

At 0617, the *MSC Danit*'s eastward movement stopped, with the ship's bow about 842 feet southeast of the location where the leak in the San Pedro Bay Pipeline would eventually be found. Over the next 36 minutes, the vessel moved along a north/south axis but did not move appreciably to the east or west.

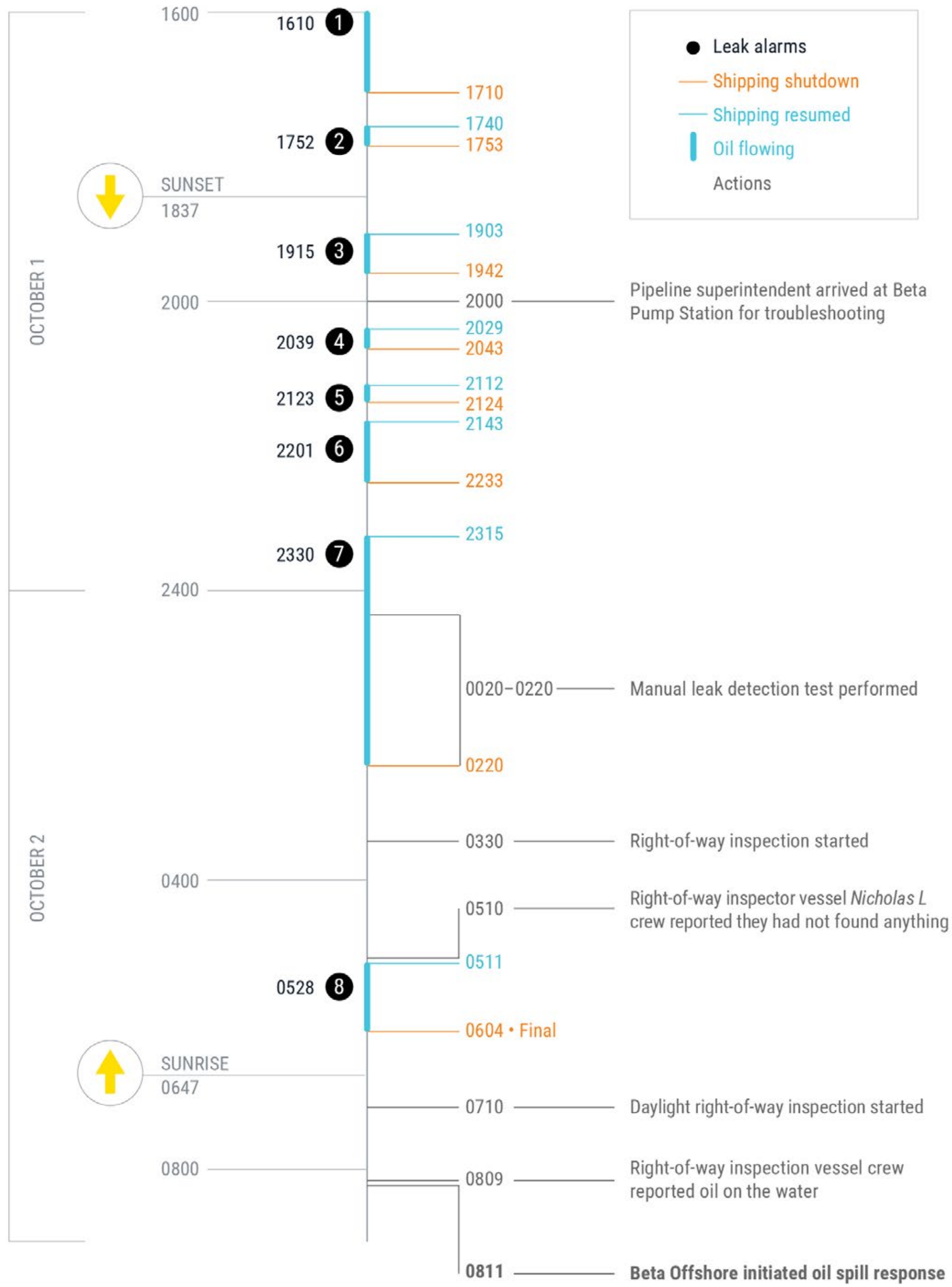
At 0655, the *MSC Danit* began moving forward again, toward the pipeline. However, 8 minutes later, the containership's forward progress halted, with the ship directly over the pipeline. For the next 1 hour and 8 minutes, the vessel's AIS position remained within an area about 600 feet in radius, centered on the eventual leak location on the pipeline. After 0811, the *MSC Danit* began moving to the west again. The ship's crew reported "anchor aweigh" to VTS LA-LB at 0816 and logged "anchor up" in the bell book at 0820. The *MSC Danit* then departed San Pedro Bay.

While the ***Beijing*** and ***MSC Danit*** were dragging anchor, VTS LA-LB watchstanders monitored the vessels' movements. However, the watchstanders did not recognize the hazard presented to the pipeline as the vessels dragged anchor southeast toward the pipeline. Consequently, they provided no warnings of the pipeline to the ***Beijing*** or ***MSC Danit*** crews.

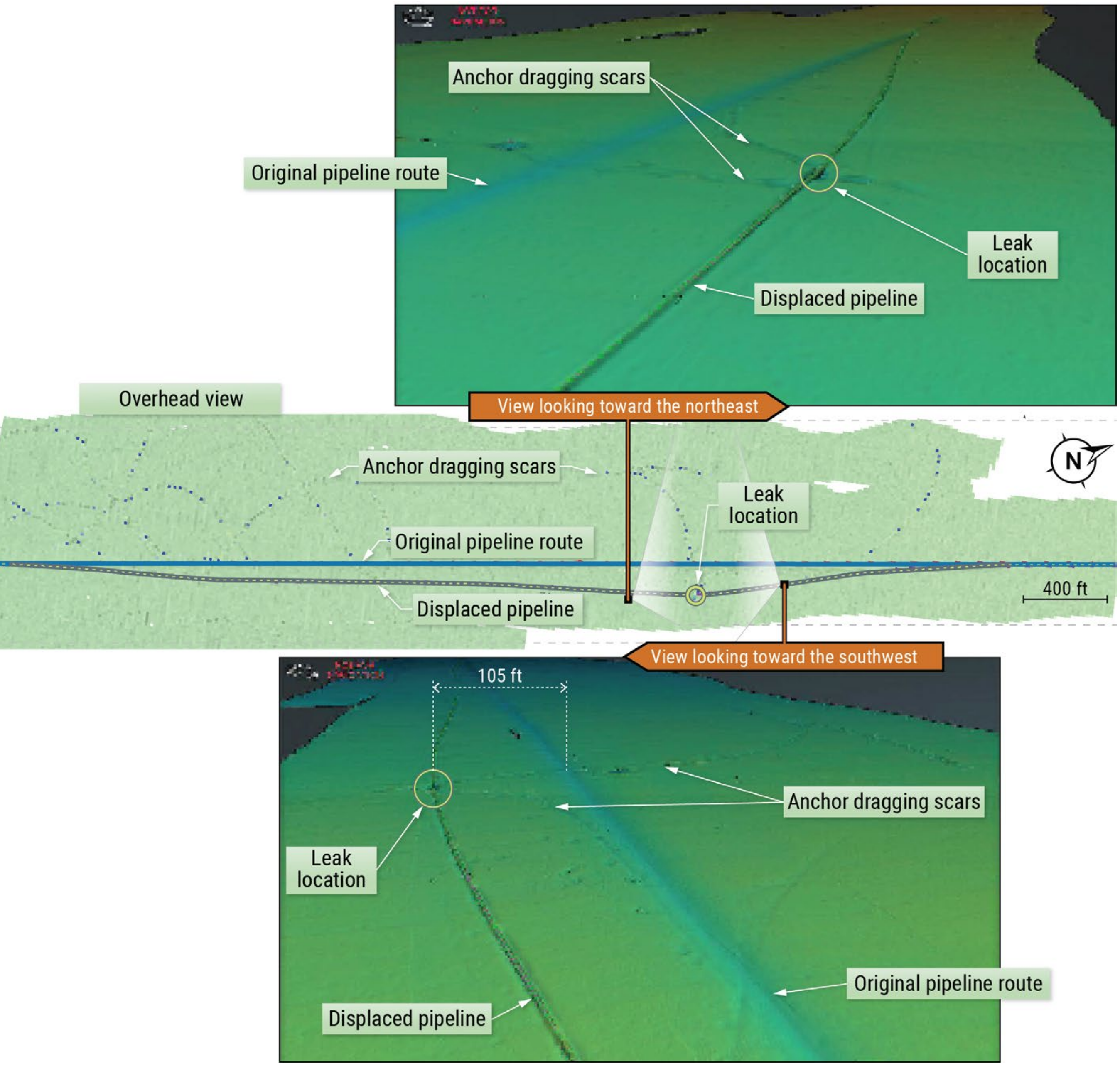
The NTSB determined that the ***Beijing*** and ***MSC Danit***'s dragging anchors struck, displaced, and damaged the San Pedro Bay Pipeline. Over the next 9 months, the deformation to the pipeline caused by the ***MSC Danit***'s anchor strike resulted in progressive cracks initiating and growing through the pipe wall until the pipe wall ruptured on October 1.

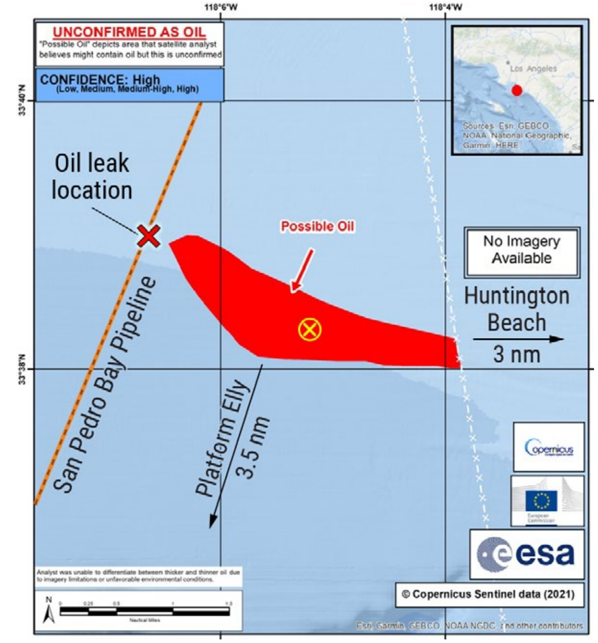
On the afternoon of October 1, the free water knockout tank on Platform Elly, which separated water from the oil/water emulsion coming from production wells, experienced problems that resulted in up to 100 times more water entering the San Pedro Bay Pipeline than normal. Operators spent several hours working on the issue, and they repaired the problem about 1600. Controllers also received multiple communication-loss alarms, indicating lost communication between Platform Elly and Beta Pump Station for at least 10 seconds, throughout the day on October 1. At 1610, the leak detection system alarmed. The control room console showed the leak location at "Mile 0," indicating a leak at the pipeline's origin at Platform Elly. From the afternoon of October 1 to the early morning on October 2, the controllers received eight leak alarms and performed various troubleshooting efforts, including stopping and restarting shipping pumps. About 14 hours passed from the time of the first leak alarm at 1610 until the controllers stopped shipping pumps for the final time, about 0604 the next day. Once an oil leak was visually confirmed about 0809, oil spill response efforts began.

Timeline of leak alarms and oil release discovery. SOURCE: NTSB



From top**: Results of the survey showing the San Pedro Bay Pipeline original location, leak location, pipeline displacement, and anchor dragging scars, viewed looking toward the northeast, from overhead, and looking toward the southwest.** BACKGROUND SOURCES: AMPLIFY, AQUEOS, FUGRO



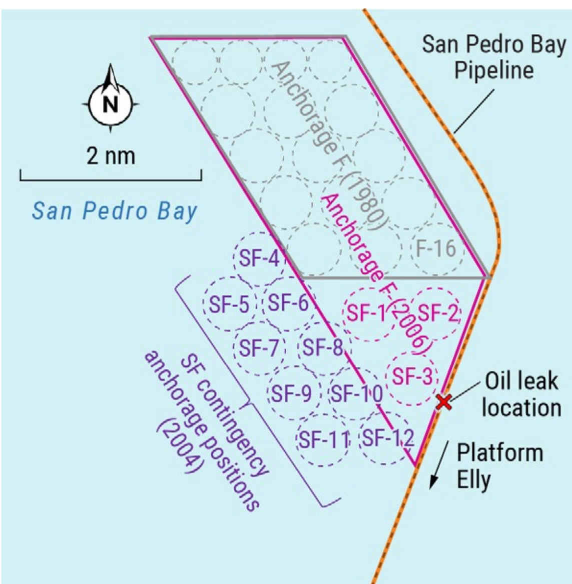


NOAA marine pollution surveillance report image from 1858 on October 1, 2021, showing the oil anomaly in red. The center point of the potential oil slick (indicated by the circled *X*) was less than 3 miles from the San Pedro Bay Pipeline. BACKGROUND SOURCE: NOAA

San Pedro Bay Pipeline underwater nondestructive testing showing a portion of the crack indication (dashed line) on the pipe on October 11, 2021.
BACKGROUND SOURCE: AQUEOS

THE PROBABLE CAUSE of the damage to and subsequent crude oil release from the San Pedro Bay Pipeline was the proximity of established anchorage positions to the pipeline, which resulted in two containerships' anchors striking the pipeline when the ships dragged anchor in high winds and seas. Contributing to the crude oil release was the undetected damage to the pipeline, which allowed fatigue cracks to initiate and grow to a critical size and the pipeline to leak nearly 9 months later. Contributing to the amount of crude oil released was Beta Offshore's insufficient training of its pipeline controllers, which resulted in the failure of the controllers to appropriately respond to leak alarms by shutting down and isolating the pipeline. Contributing to the pipeline controllers' inappropriate response to the leak alarms was the water buildup in the pipeline, an incorrect leak location indicated by Beta Offshore's leak detection system, and frequent previous communication-loss alarms.

Boundaries of Anchorage F, as originally drawn in 1980 (in gray) and as revised in 2006 (in magenta). Also shown are nine contingency anchorage positions established in 2004 (in purple).
BACKGROUND SOURCE: GOOGLE MAPS



Six segments of damaged pipeline removed for replacement. The leak site (circled) was observed on the segment shown wrapped in a tarp. SOURCE: NTSB

SAFETY ISSUES

- **Insufficient distance between anchorage locations and the pipeline.** We found that, because of the proximity of the anchorage positions that the *Beijing* and *MSC Danit* were assigned to and the pipeline, the crews had insufficient time and space to heave in their dragging anchors in high winds and seas before the anchors contacted the pipeline. The southeast boundary of the anchorage and the location of contingency anchorage positions southwest of the anchorage did not leave a sufficient margin of safety between anchored vessels and the pipeline.

- **Need for notification of potential pipeline damage to the pipeline operator.** Following the anchor dragging events, the pipeline operator was not notified by either the vessels or VTS Los Angeles-Long Beach. Had the pipeline operator been made aware of the *Beijing* and *MSC Danit* anchor dragging, the company could have conducted an underwater survey of the pipeline, identified the damage, and made repairs, preventing the eventual release of crude oil. Further, defined procedures for informing pipeline and other utility operators when possible pipeline incursions have occurred within the VTS area of responsibility would improve the pipeline or utility operator's ability to identify and respond to any damage.

- **Need for improvements to VTS vessel monitoring systems.** The VTS watchstanders did not recognize the danger presented to the San Pedro Bay Pipeline by the *Beijing* and *MSC Danit* dragging anchors because they lacked a visual indicator of the location of the pipeline and they were attending to exceptionally high vessel activity due to weather; a visual and audible alarm when an anchored vessel encroaches on a pipeline would increase their awareness.

- **Incorrect response by pipeline controllers to leak alarms.** We found that abnormal operating conditions contributed to the pipeline controllers' incorrect determination that the leak alarms were false. Had the controllers responded in accordance with company procedure for a leak by shutting down and isolating the pipeline, they would have significantly reduced the volume of crude oil released and the resulting environmental damage. We also concluded that the insufficient training of the pipeline controllers contributed to the 14-hour delay in stopping the pipeline's shipping pumps, which consequently increased the volume of crude oil released following the first leak alarm.

- **Lack of postaccident alcohol and other drug testing for pipeline controllers.** We found that Beta Offshore was not in compliance with regulations when the company did not drug-test the pipeline controllers following the accident.

- **Need for pipeline operators to implement pipeline safety management systems.** We found that pipeline safety would be enhanced if pipeline companies implemented safety management systems, and that Beta Offshore may have further evaluated their operations, identified continuous improvement opportunities, and better positioned their staff to respond and react to a leak had they implemented a pipeline safety management system.

Opposite ends of the pipe segment that contained the leak site, which had been temporarily repaired with a welded repair patch, visible in the right image. Damage signatures observed included lateral deformation, out-of-roundness deformation (a typical example indicated at the end of the segment in the right image), and missing concrete coating, especially north of the leak site.
SOURCE: NTSB

End of segment that had been located along the displaced length of pipeline to the south of the leak locations, showing out-of-roundness deformation.
SOURCE: PHMSA

SAFETY RECOMMENDATIONS

As a result of our investigation, the NTSB issued two new safety recommendations to the Pipeline and Hazardous Materials Safety Administration (PHMSA), three new safety recommendations to the Coast Guard, and one new safety recommendation to the Marine Exchange of Southern California.

We **recommended** that the Coast Guard implement the proposed VTS Los Angeles-Long Beach restructuring of the San Pedro Bay federal anchorages to increase the margin of safety between anchored vessels and the pipeline. In addition, we **recommended** that the Marine Exchange of Southern California, which jointly operates VTS Los Angeles-Long Beach with the Coast Guard, work with its vessel monitoring system provider to add audible and visual alarms for the system that alert the watchstander when an anchored vessel is encroaching on a pipeline. Further, we **recommended** that the Coast Guard implement this capability on all VTS vessel monitoring systems nationwide. Additionally, we **recommended** that the Coast Guard develop procedures for all VTSs to notify pipeline and utility operators following potential incursions on submerged pipelines within the VTSs' areas of responsibility.

To address the lack of drug testing of the pipeline controllers following the crude oil release, we **recommended** that PHMSA audit Beta Offshore's drug-testing program to ensure compliance with postaccident drug-testing regulations.

Finally, to enhance pipeline safety, we **recommended** that PHMSA issue an advisory bulletin to all PHMSA-regulated pipeline owners and operators, promoting the benefits of pipeline safety management systems and asking them to develop and implement such a system based on American Petroleum Institute Recommended Practice 1173.

VESSEL GROUP
PASSENGER

Engine Room Fire aboard Passenger Vessel ***Natchez***

Industrial Canal, New Orleans, Louisiana

CASUALTY DATE	ACCIDENT ID
May 3, 2022	**DCA22FM017**
INJURIES	ESTIMATED DAMAGES
0	**$1.5 million**
REPORT NUMBER	ISSUED
MIR-23-02	**February 1, 2023**

The *Natchez* on fire. SOURCE: UNIDENTIFIED WITNESS VIA COAST GUARD

On May 3, 2022, about 1945 local time, the inspected passenger vessel ***Natchez***, with one crewmember on board standing a security watch, was moored in the Industrial Canal in New Orleans, Louisiana, undergoing renovations, when a fire broke out. Local firefighters extinguished the fire at 2139. No pollution or injuries were reported. Damage to the vessel was estimated at $1.5 million.

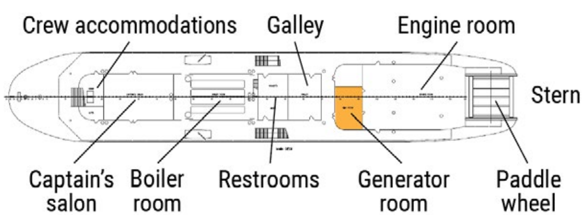
The *Natchez* had been undergoing an extensive overhaul, including the replacement of one of its two diesel-driven generators, for about 16 months. By May 3, the new diesel engine was installed, and the work scheduled for that day was the removal of the generators' electrical panel.

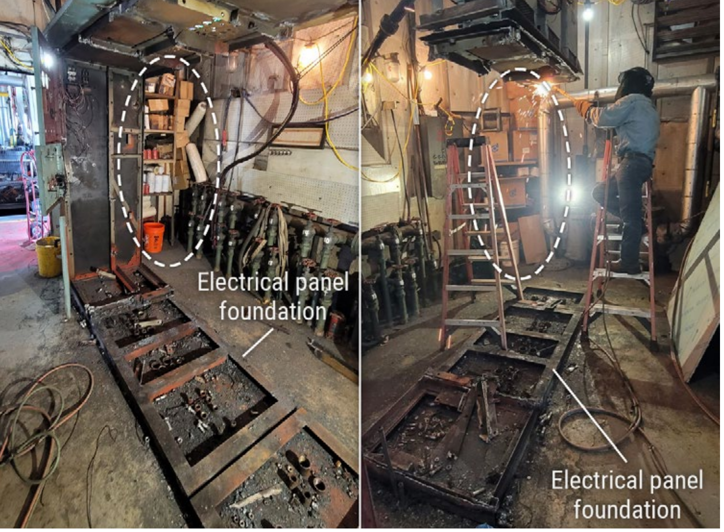
Once the space was determined safe for hot work, contractor employees used an acetylene torch to cut the panel's metal framing so it could be removed. While the hot work was underway, the vessel's chief engineer directed two *Natchez* crewmembers to place a piece of sheet metal along the side of the outboard (port) generator, about 3 feet from the hot work at the electrical panel, so that the sparks from the acetylene torch cutting would not damage it.

Hot work was completed at 1545. The first indication that there was a fire was at 1945, when the deckhand standing security watch saw smoke, went to investigate, and saw the fire within the engine room. He immediately called 911, and then called the captain and additional company personnel to inform them of the fire. The local fire department arrived and reported the fire extinguished at 2139. Most damage was contained within the generator space.

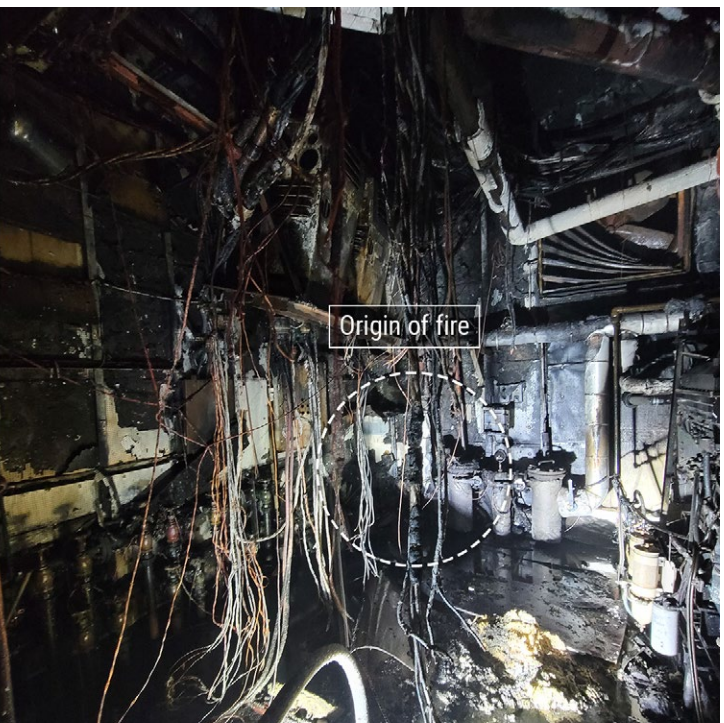
During the examination of the generator space following the fire, ATF fire investigators noted a distinctive V-shaped fire pattern on the forward bulkhead of the generator space, which indicated that this was most likely where the fire started. Combustible materials (cardboard boxes) were stored in the ignition area (forward storage area), which was located about 2 feet from where the hot work occurred. Although the electrical panel removal work had stopped about 1545, a smoldering hot spot had most likely formed within the boxes from the sparks generated from the acetylene torch cutting the metal panel. Between 1545 and when the fire was discovered at 1945, the hot spot expanded and eventually ignited. The combustible materials provided ample fuel for the fire as it expanded within the generator space.

***From top*: The *Natchez* before the casualty; main deck layout, annotated by NTSB.**
SOURCE: NEW ORLEANS STEAMBOAT COMPANY





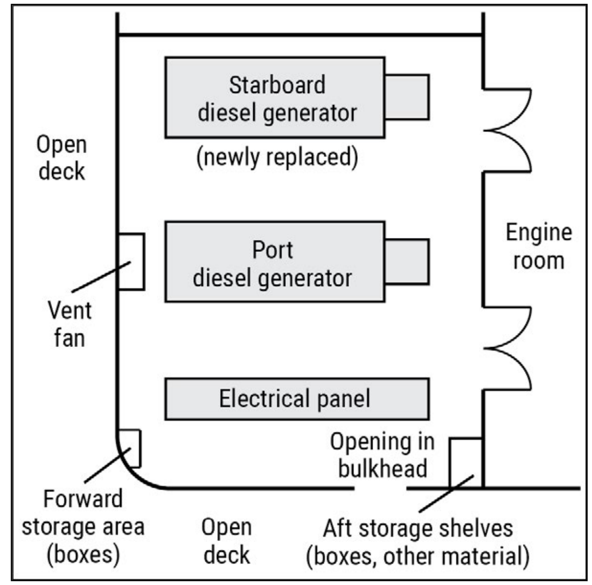
***Above, left to right*: The *Natchez* generator space before the fire. Left photo, looking aft, shows exposed boxes and plastics (circled) stored aft of the metal foundation for the electrical panel that was removed during the hot work. Right photo, looking forward, shows exposed boxes (circled) forward of the foundation. *Below*: The generator space postfire, looking forward, showing the location on the forward bulkhead (circled) identified by the ATF as the fire's origin.**
BACKGROUND SOURCE: NEW ORLEANS STEAMBOAT COMPANY



Mandated by OSHA regulations, fire safety plans are required to identify significant fire hazards. Having a fire safety plan in place and following the plan as instructed reduces risk of fire from hot work—protecting both the space and the people conducting the work. Although the contract workers had conducted a safety evaluation of the generator space before initiating the hot work and had a dedicated fire watch, and the vessel's chief engineer directed that sheet metal be placed between the port generator and the hot work area, neither the contractors nor the *Natchez* crewmembers identified the fire risk from combustible material within the generator space about the same distance from the hot work as the generator. According to OSHA regulations, all combustible material closer than 35 feet to the hot work in either the horizontal or vertical direction that cannot be removed had to be protected with flameproofed covers or otherwise shielded with metal or asbestos guards or curtains. This was not performed over known areas of combustibles.

The *Natchez* owner/operator, who had crew working on the vessel during the day and a security watch in the evening, did not maintain a safety plan for the work being conducted on the vessel but instead relied on the contractors to have and follow their own safety plans. However, the company that was conducting the hot work in the generator space did not have a fire safety plan for the work on board the *Natchez*.

THE PROBABLE CAUSE of the fire on board the passenger vessel *Natchez* was the failure of contractor and vessel personnel to identify and then either remove or adequately protect combustible material near hot work.



Layout of the *Natchez* generator space, located on the main deck in the forward port corner of the engine room (scale approximate). SOURCE: NTSB

LESSON LEARNED: Combustible Materials and Smoldering Fires

The NTSB has investigated multiple fires following the completion of hot work within a space that were determined to be caused by a smoldering fire. A smoldering fire is formed when combustible material ignites, but the combustion proceeds slowly and steadily on the material's surface with little heat and no smoke or flame. A smoldering fire is not easily detected, and, depending upon its surroundings, it can last for hours after the initial ignition and can quickly grow into a flaming fire with no warning.

A smoldering fire can long outlast the time a fire watch observes an area following hot work. Therefore, it is critical to evaluate work areas for fire hazards and ensure that combustibles are relocated or protected with flameproofed covers/curtains or otherwise shielded with sheet metal. In addition, crewmembers involved in hot work should be trained to identify hazards such as combustibles and to take action to remove or protect them from hot work.

Fire/Explosion

VESSEL GROUP
TOWING/BARGE

Fire aboard Scrap Metal Barge ***CMT Y Not 6***

Delaware Bay, about 12 miles east-northeast of Bowers, Delaware

CASUALTY DATE **May 23, 2022**	ACCIDENT ID **DCA22FM019**
INJURIES **0**	ESTIMATED DAMAGES **$7 million**
REPORT NUMBER **MIR-23-07**	ISSUED **April 24, 2023**

Portside view of *CMT Y Not 6* barge with cargo on fire. SOURCE: COAST GUARD

Towing vessel *Daisy Mae* pulling the *CMT Y Not 6* barge with scrap metal cargo on fire.
SOURCE: COAST GUARD

On May 23, 2022, about 0030 local time, the towing vessel *Daisy Mae* was towing the loaded, 300-foot-long scrap metal barge *CMT Y Not 6* northbound in the Delaware Bay when a fire was discovered on board the barge. The fire burned for 26 hours before it was extinguished by responding fire boats. No pollution or injuries were reported. Damage to the *CMT Y Not 6* was estimated at $7 million.

On May 21, at 1900, the tow departed the dock in Newark, New Jersey. The barge was loaded with more than 7,050 tons of a type of scrap metal referred to as “shredder feed,” a lower grade of ferrous scrap metal defined in the industry as heavy melting steel. After departing New York Harbor, the tow headed south into the Atlantic Ocean, hugging the coastline at 5–6 knots, with the tow wire let out to 700 feet. During the journey, seas were estimated at 3–4 feet and winds were out of the southwest at 15 knots.

On May 23, at 0030, having entered Delaware Bay, the tow was traveling in a northwestern direction adjacent to the Delaware River Channel when the AB on watch looked aft at the barge and saw smoke and a glow emanating from the pile of scrap metal in the darkness. The mate in the wheelhouse also saw smoke and a glow coming from the scrap pile and then flames coming from the same area. The mate sounded the vessel’s general alarm, and the captain immediately reported to the wheelhouse, where he noticed the fire on the barge getting larger “very, very fast.”

The mate navigated the vessel away from the shipping channel and shortened the tow wire to 300 feet to better control the barge. The crew quickly notified their company management of the fire.

At 0110, a Coast Guard small boat and two local municipality fire boats arrived on scene and began fighting the fire. The barge was towed into shallower water, and more tow wire was let out so that its weight lay on the bottom to hold the barge on location. Firefighting efforts continued for the next 24 hours before the fire was finally extinguished.

The scrap metal fire aboard the *CMT Y Not 6* on the morning of May 23. Inset shows molten metal leaking out of a starboard-side freeing port.
SOURCE: COAST GUARD

The postcasualty inspection of ***CMT Y Not 6*** revealed structural damage consistent with a high-temperature fire concentrated in the aft section of the barge. The scrap metal cargo in that area also exhibited signs of a high-temperature fire. Much of the scrap metal had melted from the heat and then solidified when the fire was extinguished, creating large metal pieces. The magnitude of the fire and the destruction of the cargo in the area where the fire was first identified prevented investigators from determining a conclusive origin of the fire. However, investigators found flammable nonmetallic materials, such as plastic, rubber, insulation, and electrical components, within the nondamaged cargo. It is likely that these materials were present throughout the cargo and, once exposed to an ignition source, caught fire and then fueled and sustained the fire.

Investigators considered several potential ignition sources. A spark between metal objects is one potential ignition source. Normal vessel motion during the *CMT Y Not 6*'s ocean transit could have been sufficient to cause the metal cargo to continuously shift and interact in a manner to create a spark between metallic objects. This spark may have ignited known combustible materials contained in the cargo.

Self-heating of metallic materials (metallic borings, shavings, turnings, and cuttings) or nonmetallic materials (linseed oil rags, coal dust, hay, wood chips, manure, and latex) is another potential ignition source. The risk increases if the material is stacked or piled and/or the material has been wet and not properly dried. Self-ignition is often indicated by more damage to the center of a stack or pile of the material than to the outside. Although none of these materials were identified following the fire, their potential presence in the scrap metal could not be ruled out.

The scrap metal cargo included end-of-life vehicles and appliances. Improperly prepared vehicles and appliances within the scrap metal that could have contained small amounts of flammable liquids or other prohibited materials also could have been an ignition source.

Another potential source of ignition was damaged lithium-ion batteries. Although suppliers screened the cargo for prohibited materials such as lithium-ion batteries before it was loaded on board the barge, these were difficult to identify during the screening process.

THE PROBABLE CAUSE of the fire aboard the deck barge *CMT Y Not 6* was the ignition of a combustible material by an undetermined source, such as sparking from shifting metallic cargo, self-heating of metallic or nonmetallic cargo, improperly prepared vehicles and appliances, or damaged lithium-ion batteries.

LESSON LEARNED: Monitoring Scrap Cargo

Although scrap metal cargo is typically nonhazardous and poses a low fire risk, there have been recent vessel fires involving such cargo. Even with supplier acceptance agreements and quality assurance personnel visually inspecting scrap metal, metallic and nonmetallic hazardous materials often are present within shoreside scrap metal piles and could be loaded onto vessels. These often-flammable materials elevate the fire risk and can lead to intense fires. Qualified cargo-surveying personnel can assist the vessel's captain before and during loading operations to limit the presence of hazardous, combustible material in scrap metal. Thermal imagery is an effective tool that could be used to identify hot spots in scrap metal cargo at shoreside facilities. Once scrap metal is loaded onto a barge, it is difficult for a towing vessel crew to visually inspect the cargo while underway.

Cargo removed from *CMT Y Not 6* postfire. *Left*: Scrap metal unaffected by the fire; rubber tires and other nonmetallic materials are visible. *Inset*: A washing machine drum shrouded in plastic. *Right*: Scrap metal exposed to the fire, with large metal pieces of solidified molten metal. SOURCE: NTSB

Photos from a Japan Transportation Safety Board report on a scrap metal fire in a moored vessel's cargo hold, showing the scrap metal raised from the cargo hold and the nonmetal material mixed in with the scrap metal.
BACKGROUND SOURCE: JAPAN TRANSPORTATION SAFETY BOARD

Fire/Explosion

VESSEL GROUP
YACHT/BOAT

Fire aboard Yacht ***Pegasus***

Peninsula Yacht Basin, Gig Harbor, Washington

CASUALTY DATE	ACCIDENT ID
July 15, 2022	**DCA22FM029**
INJURIES	ESTIMATED DAMAGES
0	**$1.5 million**
REPORT NUMBER	ISSUED
MIR-23-11	**June 7, 2023**

On July 15, 2022, at 0204 local time, the 79.9-foot-long yacht ***Pegasus*** caught fire while moored at the Peninsula Yacht Basin in Gig Harbor, Washington. No persons were on board, and the fire burned for about an hour before it was reported. By the time firefighters arrived, the fire had engulfed the aft section of the yacht, and the flames could not be completely extinguished. The fire was eventually doused when the vessel sank by its stern at its berth. The ***Pegasus*** was a total loss, estimated at $1.5 million. A vessel docked nearby also suffered minor damage.

The ***Pegasus*** was moored at the outer berth at the end of the Peninsula Yacht Basin pier and docks, which extended 600 feet into the Gig Harbor inlet. The floating docks were about 5 feet wide. There were no marina staff or other personnel on the docks overnight.

At 0204 on morning of the fire, marina security cameras first captured smoke and flames emanating from the aft section of the ***Pegasus***. The security cameras did not capture any activity around the ***Pegasus*** between 0059 (when the video began) and 0204, making it unlikely that undetected arson or accidental human interference, such as a lit cigarette or fireworks, could have caused the fire. In the video, the fire burned for about 45 minutes before intensifying and spreading forward.

At 0302, a bystander noticed the fire and called 911. Gig Harbor Police Department officers arrived at the marina at 0316, followed 4 minutes later by firefighting units. The police officers found the aft half of the ***Pegasus*** completely engulfed in flames, with the fire threatening a vessel moored nearby.

The narrowness of the docks and the distance between the fireplug ashore and the ***Pegasus***'s berth, at the end of the pier and docks, made firefighting efforts difficult. Firefighters knocked down the flames, but the fire was persistent and continued to flare up. At 0414, the stern of the ***Pegasus*** sank with the bow rising out of the water, and the last of the fire was extinguished at 0431, when the main deck cabin was inundated with seawater. Because the fire burned for an hour before being reported, allowing it to grow in intensity and spread throughout the vessel, it is unlikely that the ***Pegasus*** could have been saved.

Recreational yacht *Pegasus* before the casualty.
SOURCE: VESSEL OWNER

The Pierce County Fire Prevention Bureau fire marshal found extensive damage on the aft deck, including "mass loss of fiberglass" in that area and a wood table and bench that had been consumed by the fire. There was no evidence to suggest the fire was caused by an electrical system failure, and damage to engine room components indicated that the fire originated above the space and was not the result of a mechanical issue.

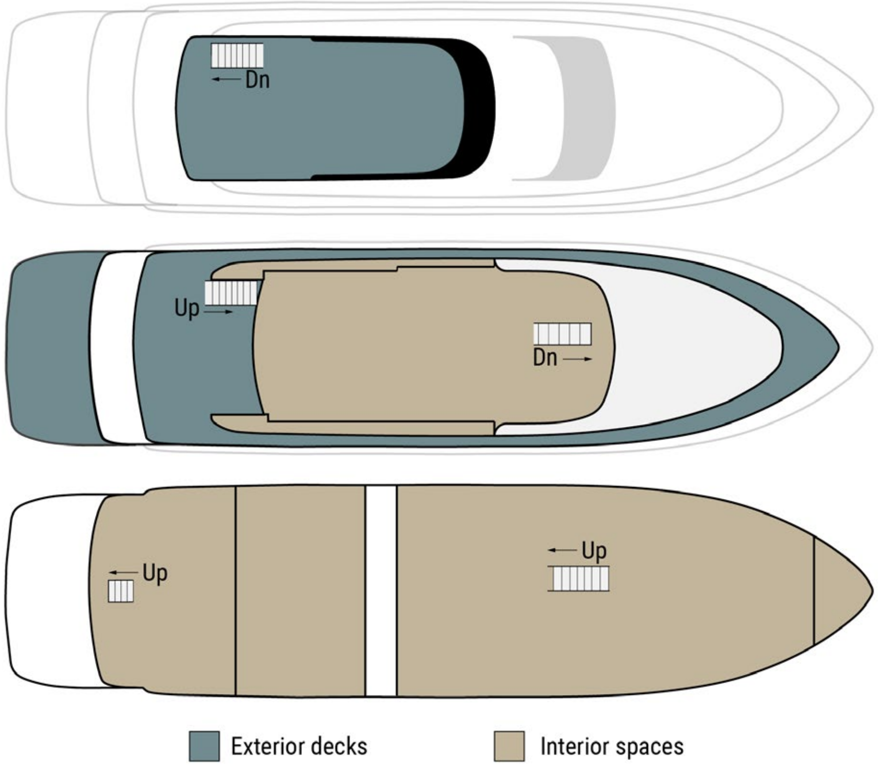
The day before the fire, the owner's employee had placed a bag with rags soaked with a raw-linseed-oil product under the table on the aft deck—the area where the fire originated. Rags soaked in oil-based finish are a risk for spontaneous combustion, and the product container included a warning of this hazard. The Pierce County fire marshal determined that, on a probable basis, the fire aboard the yacht *Pegasus* was caused by the spontaneous combustion of the oil-soaked rags that had not been properly discarded.

THE PROBABLE CAUSE of the fire aboard the recreational yacht *Pegasus* was spontaneous combustion due to the self-heating of used oil-soaked rags that had been improperly disposed of on the aft deck of the vessel.

Yacht *Pegasus* fire at 0322 local time, just before the arrival of firefighters at the vessel's berth.
SOURCE: GIG HARBOR POLICE DEPARTMENT

LESSON LEARNED: Fire Hazard with Oily Rags

Rags soaked with oil-based finishes, which are commonly used for painting and refinishing, pose a fire hazard if stored improperly. Because they generate heat as they dry, oily rags that are piled up, put together in a trash can, or bagged do not allow the heat to escape, creating a high risk for spontaneous combustion. To prevent a fire, users of oil-based products (or any chemical product) should carefully follow the manufacturer's instructions for cleanup and disposal of rags, steel wool, brushes, and other applicators.



General arrangement plan views of the yacht *Pegasus*. SOURCE: NTSB

Fire/Explosion

VESSEL GROUP
TOWING/BARGE

Fire aboard Towing Vessel ***Mary Dupre***

Gulf Intracoastal Waterway (mile 408), Freeport, Texas

CASUALTY DATE	ACCIDENT ID
June 26, 2022	**DCA22FM026**
INJURIES	ESTIMATED DAMAGES
0	**$1 million**
REPORT NUMBER	ISSUED
MIR-23-12	**June 15, 2023**

Fire aboard *Mary Dupre* minutes after crewmembers abandoned the vessel.
SOURCE: COAST GUARD

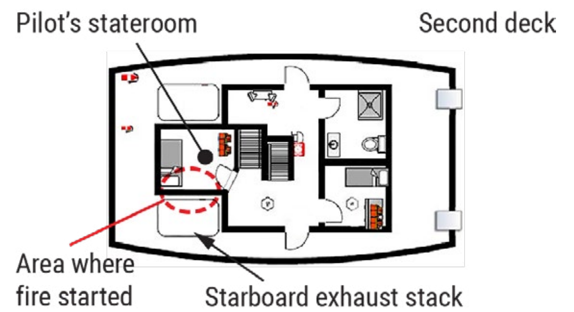
***Mary Dupre* underway before the fire.** SOURCE: DUPRE MARINE TRANSPORTATION

On June 26, 2022, about 0930 local time, a fire broke out in a stateroom on board the towing vessel *Mary Dupre*, which was pushing one barge of bio-diesel fuel (pyrolysis fuel oil) on the Gulf Intracoastal Waterway near Freeport, Texas. Nearby Good Samaritan towing vessels retrieved the barge from the *Mary Dupre*, extinguished the fire, and evacuated the four crewmembers. There were no injuries, and no pollution was reported. The towing vessel was deemed a total constructive loss estimated at $1 million.

On June 25, about 1415, the *Mary Dupre* departed Port Comfort, Texas, en route to Houston, pushing the barge *Kirby 28747*, which was loaded with the bio-diesel. The four-person crew consisted of a relief captain (referred to as the captain), a pilot, and two deckhands. The crewmembers stood rotating, two-person watches.

About 0930 on June 26, while the vessel was underway eastbound on the Gulf Intracoastal Waterway near Freeport, Texas, the off-watch pilot was awakened by a smoke alarm and the smell of smoke in his stateroom. About the same time, the captain, who was on watch in the wheelhouse, heard a smoke detector beep (but didn't smell smoke) in the wheelhouse, and the other sleeping deckhand woke up to "a burnt smell."

A fire had started behind the wood-paneled bulkheads in the pilot's stateroom, which was located between the vessel's two stacks, each containing engine exhaust mufflers and piping. Cracks in the welds on the upper section of the starboard muffler located inside the starboard stack—which may have been caused by a latent issue, such as a defect in the muffler during construction or the exhaust system design's allowance for thermal expansion and contraction of exhaust piping above the muffler outlet—allowed the hot exhaust gases from the operating starboard engine to escape into the stack area and increase the temperature of the space and its bulkheads.



Layout of the *Mary Dupre* second deck. The dashed oval identifies the area where fire started.
BACKGROUND SOURCE: DUPRE MARINE TRANSPORTATION

Crack in weld below the upper (outlet) flange of the starboard muffler aboard the *Mary Dupre*. SOURCE: NTSB

Additionally, the muffler's exhaust blanket was disconnected and not fully wrapped around its entire circumference, leaving a section of the muffler uninsulated—thereby allowing heat to radiate into the stack area. The inboard steel bulkhead of the starboard stack was common with the wood-paneled outboard bulkhead of the pilot's stateroom and was just 10 inches from the uninsulated part of the muffler radiating heat. Therefore, the elevated temperature of the stack's steel bulkhead increased the temperature of the wooden studs bolted directly to the shared bulkhead above that required to ignite wood by short term heating (about 480°F), causing the studs to smolder and ignite. In fact, the temperatures within the stack were likely much greater. The paint on the exterior bulkhead of the starboard stack began to blister, indicating that the temperature in the stack had risen above the maximum temperature resistance of the exterior paint (750˚F).

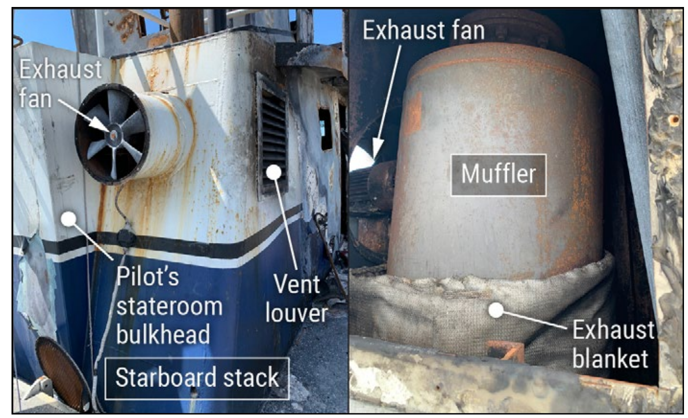
None of the crew were aware of the cracks or disconnected blanket. On the day of the casualty, they had inspected the vessel for fire hazards and completed a daily inspection form. However, the visual inspection did not include the exhaust muffler because the size of the stack space did not allow for personnel to enter, and it was only partially accessible after unbolting a vent louver, making it impractical for the crew to inspect it. Therefore, they were unable to identify the existence of the cracks and take steps to repair them. Additionally, none of the crewmembers reported seeing exhaust gases exiting the stack or smelling exhaust fumes—the only other indications they would have had that the exhaust was leaking—before the day of the casualty.

The crew attempted to fight the fire with an extinguisher but was unable to access the fire behind the stateroom bulkhead, and the interior spaces began to fill with smoke. The significant combustible load in the ***Mary Dupre***'s interior areas, including wooden framing, joinery, paneling, and other outfitting materials, indicated that the vessel was not designed with structural fire protection. As such, these materials served as both the ignition source and a fuel source for the fire. Once the wooden framing in the pilot's stateroom ignited, the fire spread to the attached wooden paneling on the bulkheads and overheads, then spread quickly throughout the vessel.

A Good Samaritan vessel arrived and took control of the barge from the *Mary Dupre*. The *Mary Dupre*'s wheelhouse filled with smoke, so the captain and crew abandoned the vessel using the onboard skiff. Several nearby towing vessels arrived on scene and applied water to the ***Mary Dupre***, and a team from a salvage company vessel extinguished the fire.

THE PROBABLE CAUSE of the fire aboard the towing vessel *Mary Dupre* was undetected cracks in the starboard muffler that allowed exhaust gases from an operating engine to escape and ignite wooden structures affixed to the common bulkhead of an accommodation space. Contributing to the extent of the fire damage was the substantial use of combustible materials in the joinery, outfitting, and furnishings in the accommodation spaces.

***Left to right*: Charred wooden framing attached to steel bulkhead and pilot's stateroom adjacent to the starboard stack where the fire started.** SOURCE: NTSB



***Left to right*: Exterior view of the starboard stack after the fire; the starboard muffler's outboard side, as seen through the removed vent louver, and upper exhaust blanket removed after the fire.** SOURCE: NTSB

LESSON LEARNED: Inspection of Exhaust Systems

Engine and other machinery exhaust systems generate heat—which can radiate from exhaust components—and are potential ignition sources. These systems often run through tight spaces that are difficult to access and inspect and are often located near materials or equipment that obstruct entry and direct observation. It is good practice to include these areas in periodic fire safety inspections. When conducting inspections of these systems, vessel owners and operators should consider using handheld equipment—such as inspection mirrors, video equipment, or thermal imaging equipment—to detect deficiencies.

Fire/Explosion

VESSEL GROUP
TOWING/BARGE

Crane Fire on board Barge *Kokosing V*

James River, Newport News, Virginia

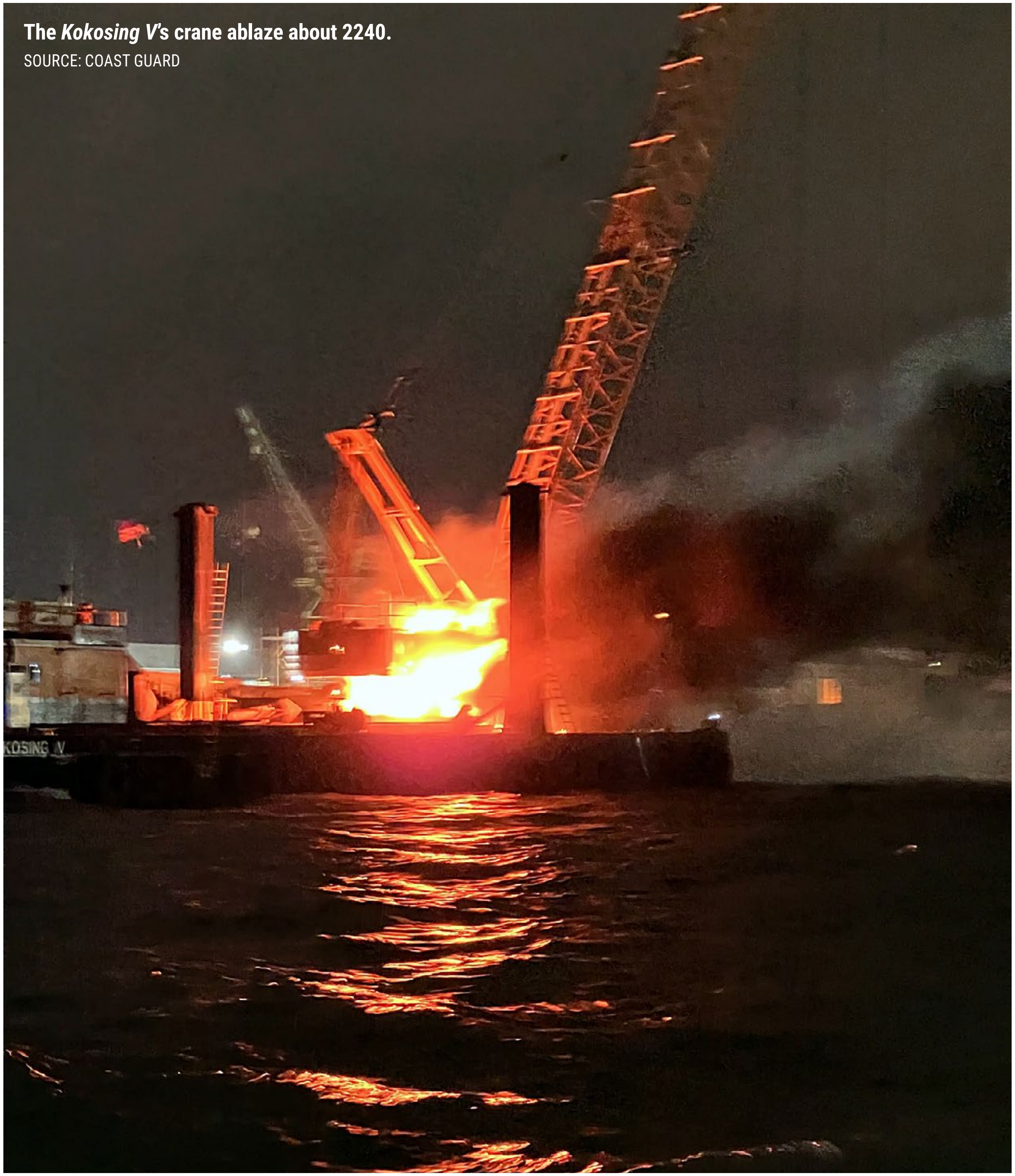
CASUALTY DATE	ACCIDENT ID
October 4, 2022	**DCA23FM001**
INJURIES	ESTIMATED DAMAGES
0	**$1.4 million**
REPORT NUMBER	ISSUED
MIR-23-20	**September 21, 2023**

The barge *Kokosing V*, with crane, before the casualty.
SOURCE: KOKOSING INDUSTRIAL

On October 4, 2022, about 2230 local time, the spud barge ***Kokosing V*** was dredging the James River near Newport News, Virginia, when the dredging crane on board the barge caught fire. The four crewmembers fought the fire unsuccessfully and abandoned the barge to the accompanying tug, ***Justin***. Crews from responding fireboats extinguished the fire later that evening. There were no injuries. The barge and crane held fuel and hydraulic fluid, but no sheen was reported. Damage to the crane was estimated at $1.4 million.

On October 4, about 2230, the ***Kokosing V***, accompanied by the tug ***Justin***, was dredging the James River about 75 yards away from the Northrup Grumman shipyard in Newport News, when the foreman stepped out of his office on board the barge and saw a burning liquid fire dripping from underneath the crane. He signaled the crane operator to stop work and exit the crane cab. The crew attempted to put out the fire with portable extinguishers and water, but they were unsuccessful, and they evacuated the barge to the ***Justin***. Municipal authorities and the Coast Guard were notified of the fire, and a responding fireboat crew eventually extinguished the fire.

The damaged crane postfire. SOURCE: COAST GUARD

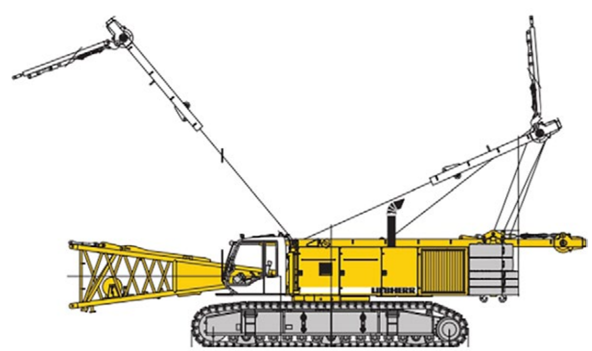


The *Kokosing V*'s crane ablaze about 2240.
SOURCE: COAST GUARD

About 8,900 gallons of diesel fuel were on board the *Kokosing V*. The crane held another 85 gallons of diesel fuel and 50 gallons of hydraulic oil, which were all reported to be burned or lost overboard. Investigators could not rule out a hydraulic or fuel leak as a cause of the fire. However, the crane's battery compartment, located behind the driver compartment on the left side of the crane, was destroyed, and fire patterns indicated that the fire spread from the left side under the crane.

There were no signs of fire around the crane's engine. Further, fire marshals also documented electrical "beading and fusing," indicating arc damage on the electrical cables under the crane. Therefore, it is likely that the fire originated in the crane's battery compartment and was electrical in nature. Potential ignition sources within the battery compartment include loose electrical connections and chafed or damaged wiring. The extensive damage to the compartment precluded examination of components, and therefore the ignition source could not be determined.

THE PROBABLE CAUSE of the crane fire on board the spud barge *Kokosing V* was an undetermined electrical ignition source in the crane's battery compartment.



Profile drawing of a Liebherr 895 crane, with similar configuration to the barge crane. SOURCE: LIEBHERR

VESSEL GROUP
PASSENGER

Engine Room Fire Aboard Passenger Vessel ***Spirit of Norfolk***

Elizabeth River, near Norfolk, Virginia

CASUALTY DATE	ACCIDENT ID
June 7, 2022	**DCA22FM022**
INJURIES	ESTIMATED DAMAGES
0	**$5 million**
REPORT NUMBER	ADOPTED
MIR-23-22	**September 29, 2023**

***Spirit of Norfolk* before the casualty.**
SOURCE: HORNBLOWER GROUP

Firefighters boarding the *Spirit of Norfolk*. SOURCE: COAST GUARD

On June 7, 2022, about 1204 local time, the Coast Guard received a report of an engine room fire aboard the 169-foot-long small passenger vessel *Spirit of Norfolk* while it was underway on the Elizabeth River near Naval Station Norfolk, Virginia. The vessel was on a 2-hour sightseeing cruise with 108 people (passengers, crew, and staff) on board. The crew determined they could not enter the smoke-filled engine room to fight the fire, the vessel lost propulsion, and the passengers and crew evacuated to one of the Good Samaritan vessels on scene. The *Spirit of Norfolk* was towed to a US Navy pier. The fire spread throughout the vessel before being extinguished 4 days later. There were no injuries, and no pollution was reported. The vessel, valued at $5 million, was a total constructive loss.

The *Spirit of Norfolk* got underway at 1113 for the cruise and headed north into the Elizabeth River, with a new-hire captain at the wheel and throttles and the captain in the pilothouse. Also aboard were two first mates and three deckhands, as well as 91 passengers and 10 hospitality staff.

At 1159, with the vessel abeam of Naval Station Norfolk, the new-hire captain moved the throttle controllers to turn the vessel around for its return leg of the trip when he noticed that the port engine rpm readout had dropped to zero. At the same time, an alarm indicating that the throttle controller “lost connection to port main engine” activated, and the console throttle lights flashed red and green, indicating an error. After seeing smoke from the portside engine room exhaust ventilation opening, at 1204, the captain contacted Coast Guard Sector Virginia on VHF radio and informed them of the emergency.

The crew found the engine room full of thick black smoke and flames and determined that the room would be unsafe to enter. Based on crewmember observations and a postcasualty damage assessment, the NTSB concluded that although a definitive ignition source of the fire could not be determined, the most likely cause of the fire was the ignition of combustible materials stored near the exhaust pipe of the operating port generator in the engine room.

The captain shut down the powered ventilation fan to the engine room, and the crew secured both the port and starboard engine remote fuel oil shut-off valves, thus stopping the generators and electrical power for the vessel.

Trackline of the *Spirit of Norfolk*. Data from the vessel's AIS. BACKGROUND SOURCE: GOOGLE MAPS

Coast Guard Sector Virginia broadcast an urgent call to all vessels alerting them of the fire and asking them to assist if possible, and the captain of the *Spirit of Norfolk* used VHF radio to broadcast a request for assistance. Multiple Good Samaritan vessels responded assisting with the passenger evacuation, towing the *Spirit of Norfolk* to Pier 4, and fighting the fire by spraying water on the vessel and into its engine room vents. Before evacuating the vessel, the captain placed the vessel's fire control plan outside the superstructure on the second deck so it would be readily visible to responders.

A vessel cremember spraying water to cool the *Spirit of Norfolk*. SOURCE: COAST GUARD

A child is lifted over the rails and handed to a crewmember. SOURCE: JUSTIN WAGNER VIA STORYFULORIGINAL

Smoke from the engine room starboard exhaust ventilation opening. SOURCE: COAST GUARD

At 1245, Navy and local on-scene fire chiefs formed the UC to coordinate firefighting and response operations. Local municipalities, as well as the Navy fire department and emergency response units, responded to Pier 4 with equipment and personnel and sprayed water into the engine room exhaust ventilation opening on the starboard side. However, heavy smoke continued to come from the vessel.

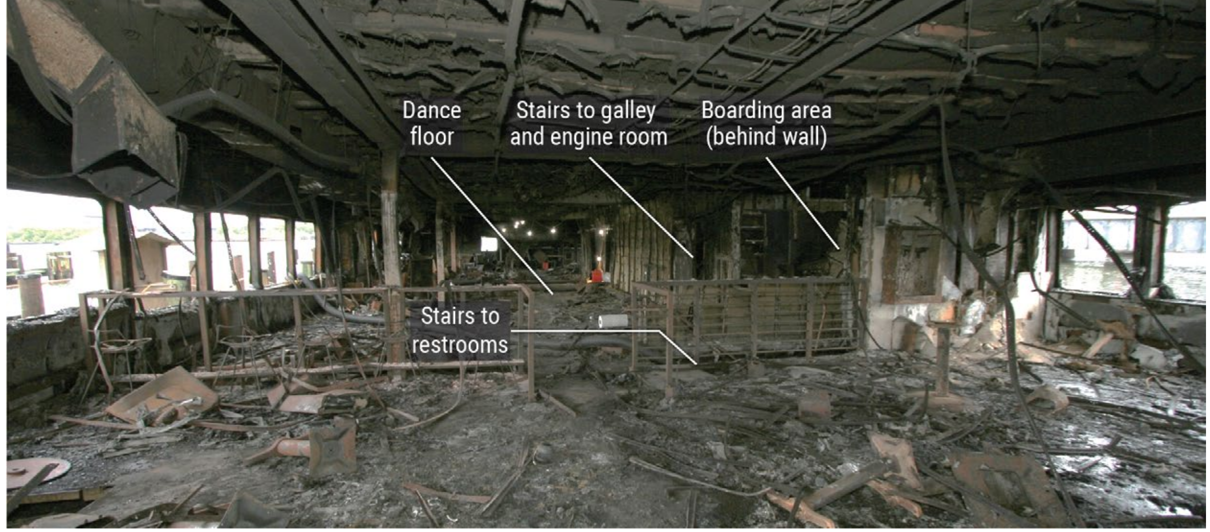
At 1335, the *Spirit of Norfolk* was secured with its starboard side to the pier. The captain told the UC the location of the fire control plan and described the location of the vessel's emergency engine room escape hatch, which led from the engine room up to the main deck, providing firefighters another means to access the engine room. The hatch was on the deck, mostly covered with a piece of carpet matching the rest of the deck.

The UC sent a four-person recon team (wearing full protective gear) onto the vessel to locate the emergency escape hatch, retrieve the fire control plan, and identify all locations of the fire. The recon team reported "visible conditions" on the main deck but could not locate the engine room emergency escape hatch. After noting that flames had spread across the overhead of the engine room, the recon team closed and secured the engine room door and disembarked the vessel.

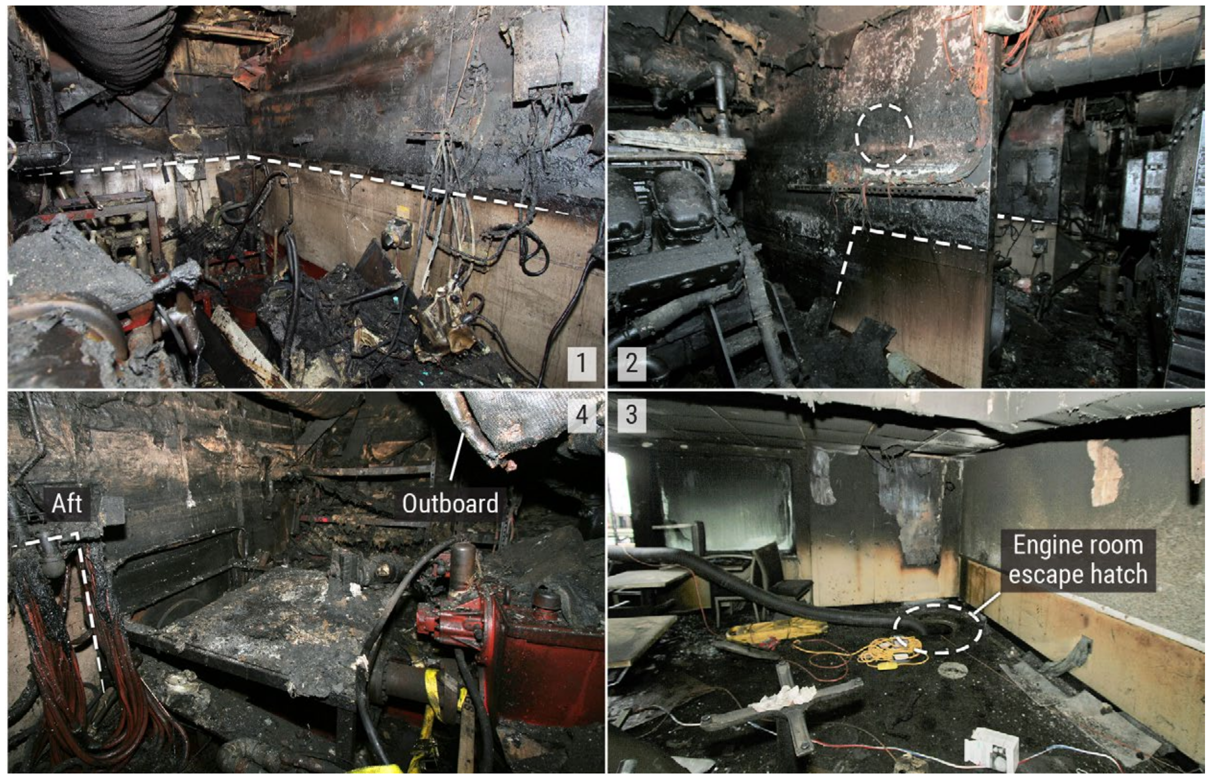
About 1437, the UC sent a four-person fire attack team to deploy foam into the engine room to put out the fire. Visibility on board the vessel had decreased, and the main deck above the engine room was hotter than when the first team had boarded. Unable to find the emergency escape hatch, the fire attack team went to the engine room door at the aft end of the galley. As a member of the team turned the wheel on the watertight door to the engine room, the door "exploded open causing…a minor back draft" into the galley, and "thousands of gallons of rapid water [from waterside and shoreside firefighting efforts] came rushing" out from the engine room, separating the team and trapping a team member behind the door. On shore, responders saw the vessel "shift to port hard…appear[ing] like it was going to roll."

The fire attack team called a Mayday, and at 1506, they departed the vessel. After the evacuation, all onboard firefighting operations ceased until a written stability assessment and a plan for the removal of contaminated bilge water could be provided. Towing vessels on scene continued to spray the vessel with water, off and on, for boundary cooling. Firefighters continued to apply foam into the engine room and galley exhaust vent openings periodically until, after several hours, foam operations were ceased because of a concern that the vessel could capsize or sink with the addition of the water in the foam solution. Shoreside and waterside boundary cooling continued for the rest of June 7 and into the morning of June 8; thus, water was still entering the vessel through the ventilation openings and main deck windows.

On June 8, after stability calculations for the vessel were provided and the Coast Guard Salvage Engineering Response Team approved the dewatering plan, dewatering began; an estimated 191,000 gallons of water were pumped off the *Spirit of Norfolk*.
On June 11 at 0959, the UC declared the fire "out."

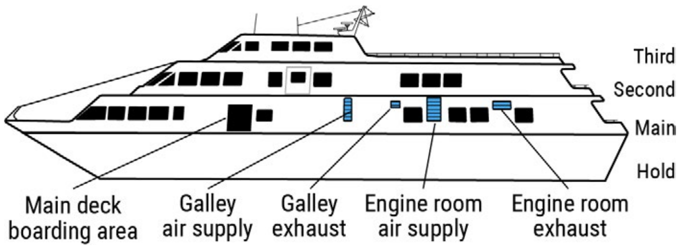


Main deck interior looking aft. SOURCE: NTSB



***Clockwise from top left*: (1) Portside engine room bulkhead exhibiting demarcation line (dashed line) between thermally damaged and undamaged area. (2) Bulkhead forward of port main engine with low-lying damage toward the outboard side. Demarcation line (dashed line) and original location of electronic throttle controller shown (circled).
(3) Engine room escape hatch on the main deck (circled). (4) Fire damage on the bulkhead aft (dashed line) and outboard of port main engine. The metal frames of the storage shelves are visible against the bulkhead.** SOURCE: NTSB

Exterior damage to the *Spirit of Norfolk* port side after the fire. The engine room ventilation openings are circled. SOURCE: NTSB



Profile view of the *Spirit of Norfolk*. Ventilation openings are shaded blue. SOURCE: NTSB

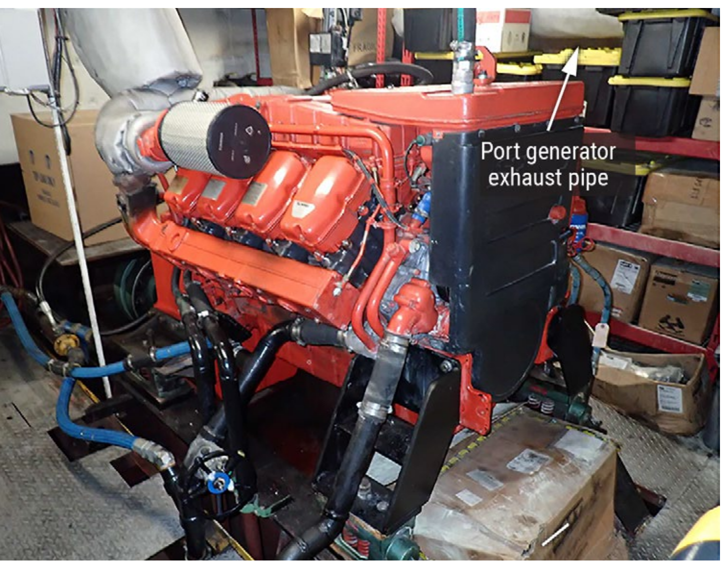


Photo from survey on June 2, 2022, showing port main engine (foreground) and storage shelf. The white port generator exhaust pipe is visible behind some of the boxes on the shelves.

SOURCE: KNOX MARINE SURVEYORS & CONSULTANTS

SAFETY ISSUES

◆**Lack of fire detection and fixed fire extinguishing systems in the engine room**. We found that the fire originated in the *Spirit of Norfolk*'s engine room. However, due to regulatory exemptions, the *Spirit of Norfolk* was not required to have an engine room fire detection system. The lack of a fire detection system in the engine room delayed the discovery of the fire and allowed for its growth. The *Spirit of Norfolk* was also exempt from requirements for engine room fixed gas fire extinguishing systems, which would have given the crew a safe method of fighting the fire.

◆**Ineffective response communications**. Although the actions of the *Spirit of Norfolk* crew and Good Samaritan vessels and crew resulted in a timely and effective evacuation with no injuries, the communications between the firefighting teams and the UC were ineffective: the UC was unaware that the firefighting teams were unable to locate the engine room emergency hatch. When the fire attack team opened the engine room door instead of the hatch, the fire was able to spread.

THE PROBABLE CAUSE of the fire on the *Spirit of Norfolk* was likely the ignition of combustible material stored near the exhaust piping from the operating port generator. Contributing to the severity of the fire was a lack of a fire detection system and a fixed fire extinguishing system in the engine room. Also contributing to the severity were ineffective communications between the unified command and firefighting teams that led to the fire attack team opening the engine room door, allowing the fire to spread.

SAFETY RECOMMENDATIONS

As a result of our investigation, the NTSB issued new safety recommendations to the Coast Guard. We found that, because the *Spirit of Norfolk* was exempt from small passenger vessel requirements for engine room fire detection and fixed fire extinguishing systems, the fire was able to spread undetected. Additionally, had the vessel been equipped with an engine room fixed fire extinguishing system, the fire could have been extinguished. As a result, we **recommended** that the Coast Guard require that existing exempted Subchapter K small passenger vessels that were in operation as of March 10, 1996, be fitted with a fire detection system and a fixed gas fire extinguishing system in their engine rooms.

Additionally, we identified several lessons learned from this casualty that could improve contingency planning for maritime firefighting, including mooring a vessel for best access, ensuring personnel familiar with a vessel are included in a unified command, accelerating a stability assessment and arrival of tanks or barges for contaminated water, and developing training plans to educate land-based firefighting departments included in Coast Guard contingency plans. As such, we **recommended** that the Coast Guard use the circumstances of this casualty to improve contingency plans related to fighting fires on vessels.

Exterior damage to the *Spirit of Norfolk*, starboard side.
SOURCE: NTSB

Fire/Explosion

VESSEL GROUP
CARGO, LIQUID BULK

Fire aboard Tank Vessel ***S-Trust***

Lower Mississippi River, mile 229, Baton Rouge, Louisiana

CASUALTY DATE **November 13, 2022**	ACCIDENT ID **DCA23FM005**
INJURIES **0**	ESTIMATED DAMAGES **$3 million**
REPORT NUMBER **MIR-23-23**	ISSUED **October 25, 2023**

***S-Trust* at anchor following the casualty.**
SOURCE: COAST GUARD

On November 13, 2022, about 1530 local time, a fire started on the bridge of the oil tanker *S-Trust* while the vessel was docked at the Genesis Port Allen Terminal in Baton Rouge, Louisiana. Fire teams from the vessel's crew extinguished the fire about 1550. There were no injuries, and no pollution was reported. The damage to the vessel was estimated at $3 million.

The day before the fire, the *S-Trust* docked at the terminal to offload high-sulfur fuel oil. During offloading, no one was stationed on the bridge. The next day at 1527, the bridge closed-circuit camera feed captured an orange flash immediately followed by a puff of smoke by the communications table where the rechargeable batteries and chargers for UHF hand-held radios assigned to the bridge were located. Following the initial flash, the video showed smoke rising and increasing in volume and thickness. At 1529:04, the footage showed another orange flash in the same area as the first one, followed by an object on fire flying from the area of the flash to the starboard side of the bridge. In the video, the fire on the communications table continued to grow until the camera lens became covered in ash and started to deform, preventing any further view of the fire within the bridge. The crewmembers' first indication of the fire was when the master, working in his office one deck below the bridge, noticed that the closed-circuit camera feed for the bridge was no longer visible.

***Left to right*: The bridge closed-circuit camera footage showing the bridge before the initial flash, followed by the flash and smoke at the communications table (circled).** BACKGROUND SOURCE: STALWART MANAGEMENT LT

The damage to the bridge. SOURCE: COAST GUARD

The master went up to the bridge to investigate. When he opened the door, smoke came out and activated the nearby smoke detector. He directed the crew to muster into two fire teams, who fought and extinguished the fire through the port and starboard bridge doors using hoses.

Investigators from the Coast Guard and the ATF discovered extensive fire damage throughout the bridge. When investigators examined the area around the communications table on the bridge where the video showed the orange flash, smoke, and fire, they found the remains of a lithium-ion battery charger and a nickel-metal hydride battery charger.

A closer examination found the remains of three batteries among the charger remains—one nickel-metal hydride battery (which contained six cells) and two lithium-ion batteries (each containing two cells). The single nickel-metal hydride battery (all six cells) was intact; one of the lithium-ion batteries (both cells) was found intact in the remains of the chargers. Investigators only found components of the second lithium-ion battery (a two-cell battery).

The ATF concluded that the fire was caused by one of the lithium-ion battery cells on the communications table exploding. Lithium-ion battery cell explosions are typically caused by a thermal runaway; as such, the initial orange flash and puff of smoke on the video feed was likely the result of one of the missing lithium-ion cells exploding due to a thermal runaway.

A Motorola DP4400e radio and lithium-ion battery used on the bridge of the *S-Trust*.
SOURCE: NTSB

The heat produced from a thermal runaway of a lithium-ion battery cell can exceed 1,100° F, which can easily cause any nearby combustible material to ignite, including adjoining cells of the same battery. As the fire expanded, the closed-circuit video captured a second flash, followed by a flaming object being propelled from the fire and landing on the deck of the bridge, where it continued to burn. This was most likely the other missing lithium-ion cell from the same battery. Based on the video, investigators determined that the second missing lithium-ion cell also experienced a thermal runaway, most likely initiated from the heat of the fire started by the initial battery cell thermal runaway.

It is possible, based on the battery remains' location among the charger remains, that one of the UHF radio batteries had been left in the charger, which could have led to overcharging. However, a crewmember told investigators that the batteries were not in the chargers before the fire. Further, investigators were not able to find the missing cells, and, due to the explosion, the extensive heat from the thermal runaway reaction, and subsequent fire on the bridge, the battery cells may have been completely consumed. Therefore, investigators could not examine the first cell that exploded to determine the exact cause of the initial thermal runaway.

THE PROBABLE CAUSE of the fire on the bridge of the *S-Trust* was the thermal runaway of one of the cells in a lithium-ion battery for a UHF handheld radio.

Remains of the lithium-ion and nickel-metal hydride battery chargers on the communications table.
SOURCE: ATF

***Left to right*: Remains of the nickel-metal hydride and the lithium-ion battery cells and components found on the communications table.** SOURCE: ATF

***Left to right*: The bridge closed-circuit camera footage showing (1) a second explosion, (2) an object on fire propelled into the air, and (3) the object, still on fire, landing on the floor (circled).**
BACKGROUND SOURCE: STALWART MANAGEMENT LTD

LESSON LEARNED: Lithium-ion Battery Fires

A lithium-ion battery cell, if damaged, shorted, overheated, defective, or overcharged, can spontaneously experience a thermal runaway, a chemical reaction that can cause the cell to ignite and explode. A cell that has exploded can be propelled from its initial position within a battery. Due to the potential for rapid expansion of a lithium-ion battery fire, detection, containment, and extinguishment are essential to prevent damage to a vessel.

Crews can help prevent thermal runaways and ensuing fires by doing the following:

- follow manufacturers' instructions for the care and maintenance of lithium-ion batteries,
- properly dispose of damaged batteries,
- avoid unsupervised charging, and
- keep batteries and chargers away from heat sources and flammable materials.

Additionally, companies should ensure that lithium-ion batteries and devices that use lithium-ion batteries are certified by Underwriters Laboratory or another recognized organization.

Should a lithium-ion battery fire occur, crews can attempt to extinguish the fire with water, foam, CO_2, or other dry chemical or powdered agents. However, if the battery fire cannot be extinguished, personnel should attempt to allow the pack to burn in a controlled manner; this includes watching for nearby cells that may also experience thermal runaway and extinguishing other combustibles that may catch on fire.

Fire/Explosion

VESSEL GROUP
CARGO, LIQUID BULK

Engine Room Fire aboard Tank Vessel *Endo Breeze*

Raritan Bay West Reach Channel, Raritan Bay, New Jersey

CASUALTY DATE	ACCIDENT ID
April 29, 2022	**DCA22FM016**
INJURIES	ESTIMATED DAMAGES
0	**$1.2 million**
REPORT NUMBER	ISSUED
MIR-23-25	**November 16, 2023**

The *Endo Breeze* underway after the casualty.
SOURCE: MARTIN KLINGSICK, SHIPSPOTTING.COM

On April 29, 2022, about 1913 local time, a fire started in the engine room of the 600-foot-long chemical tank ship *Endo Breeze* while the vessel was transiting outbound from Linden, New Jersey, through the Raritan Bay West Reach channel, to Bay Ridge Anchorage. The crew extinguished the fire using the engine room's fixed CO_2 fire extinguishing system. As a result of the fire, the vessel lost propulsion and was anchored in the channel. No pollution or injuries were reported. Damage to the vessel was estimated at $1.2 million.

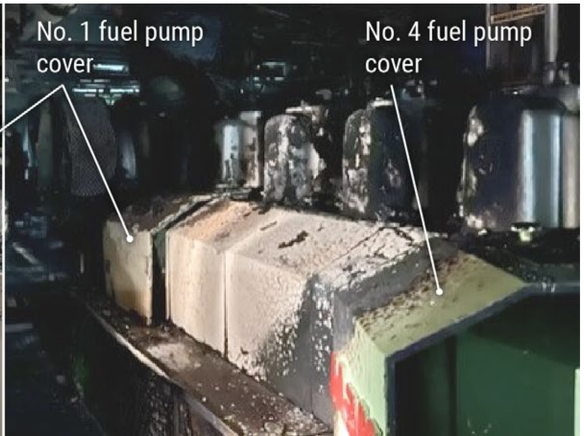
While the *Endo Breeze* was maneuvering outbound through the Raritan Bay West Reach channel, the second engineer, who was conducting a round of the engine room alongside the fourth engineer, smelled oil. The tanker had two main engines connected to a gear that drove a controllable pitch propeller, and when the second engineer opened the starboard main engine's no. 1 cylinder fuel injector pump cover to investigate, fuel oil sprayed into the air from the no. 1 fuel injector pump banjo tube, which was near the operating engine's exhaust manifold. To reduce the fuel spray, the second engineer placed a shop rag over the banjo tube, then he and the fourth engineer quickly proceeded to the engine control room to notify the chief engineer of the situation. Both fuel pump covers were left partially open.

As the engineers were calling the master to shut down the engine, a fire on the starboard engine was observed. The vessel's fire detection and alarm system activated, and the crew quickly activated the fuel pump shutoffs and ventilation shutdowns. The chief engineer activated the ship's fixed CO_2 system, which extinguished the fire effectively. Additionally, the crew kept the engine room sealed, which prevented reflash. The crew's effective response limited damage and prevented injuries.

Meanwhile, on the bridge, the pilot and master decided to emergency anchor and, at 1922, dropped an anchor on the inbound side of the Raritan Bay West Reach channel. The Coast Guard was notified of the emergency, and the pilot followed up with local fire boats and available tugs to assist the vessel.

Based on the fire damage and the engineers' observations, oil spray from the banjo tube leak made contact with nearby hot surfaces on the starboard engine's exhaust manifold and ignited. To determine the cause of the banjo tube leak, investigators examined the no. 1 cylinder fuel injector pump and discovered a slight offset (misalignment) on the affected banjo tube assembly. The second engineer had replaced the no. 1 fuel injector pump earlier that day. Investigators found an offset on the banjo tube assembly, so it is likely that the engineer did not follow the manufacturer's reassembly procedure for the fuel injector pump, which required components to be tightened in a specific order to maintain alignment.

***Left to right*: Location of the turbo charger relative to the no. 1 fuel pump cover and location of fire on the starboard engine with fuel pump covers nos. 1 and 4 left partly opened.** SOURCE: COAST GUARD

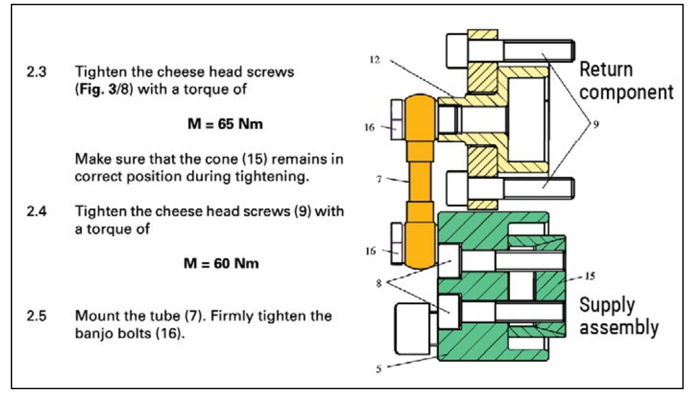


The banjo tube was sent for third-party metallurgical testing. The testing found that the banjo tube had bent to accommodate the offset; fractures on both ends of the tube where it connected to the sealing flange and lid were also found. Therefore, stresses associated with the offset likely caused the banjo tube to bend and fracture, causing the oil leak.

Banjo tube connected to the sealing flange and lid of no. 1 cylinder fuel injector pump assembly showing misalignment. *Below*: The fractured banjo tube.
BACKGROUND SOURCE: QC METALLURGICAL, INC.

After replacing the fuel oil pumps, the second engineer ran the starboard main diesel engine (under no load) to inspect for leaks and found no signs of leaks or other issues from the fuel oil pumps or associated piping. This is likely because the banjo bolts' sealing surfaces provided a sufficient seal during the short, no-load testing. But when the main engine was fully loaded with a full-ahead order, the expanding stresses (due to heat) caused the banjo tube to fracture. Therefore, although the second engineer properly tested the repair, the misalignment that led to the banjo tube failure only manifested once the engine was given a high load.

THE PROBABLE CAUSE of the engine room fire aboard the chemical tank ship *Endo Breeze* was a main engine fuel injector pump replacement that was not conducted in accordance with manufacturer procedures, which resulted in a high-pressure fuel spray that ignited off the engine exhaust components.



No. 1 fuel oil injector pump reassembly procedure and diagram of piping components. The banjo tube (orange) connects the fuel pump supply line assembly (green) to the return component (yellow).
BACKGROUND SOURCE: MAK

LESSONS LEARNED:

Diesel Engine Maintenance

The engine room fire in this casualty illustrates what can happen when equipment manufacturers' recommended maintenance procedures are not followed. In this case, not following the tightening sequence described in the diesel engine manufacturer's manual led to the misalignment and failure of a high-pressure fuel connection on an engine's fuel injector pump's assembly. Due to the high risk of fire associated with pressurized fuel, when working with diesel engine components, it's critical to carefully follow manufacturer assembly procedures and review manufacturer manuals and guidance on a regular basis to ensure familiarity with correct maintenance procedures.

Containing Engine Room Fires

The crew of the *Endo Breeze* effectively contained the spread of a main engine room fire by removing fuel and oxygen sources and communicating effectively. To prevent engine room fires and ensure they are effectively contained, operators should provide mariners realistic scenario-based training, including training that covers engine room emergencies. This training should also cover procedures for effectively shutting down machinery, fuel oil, lube oil, and ventilation systems, as well as boundary monitoring.

Flooding/Hull Failure

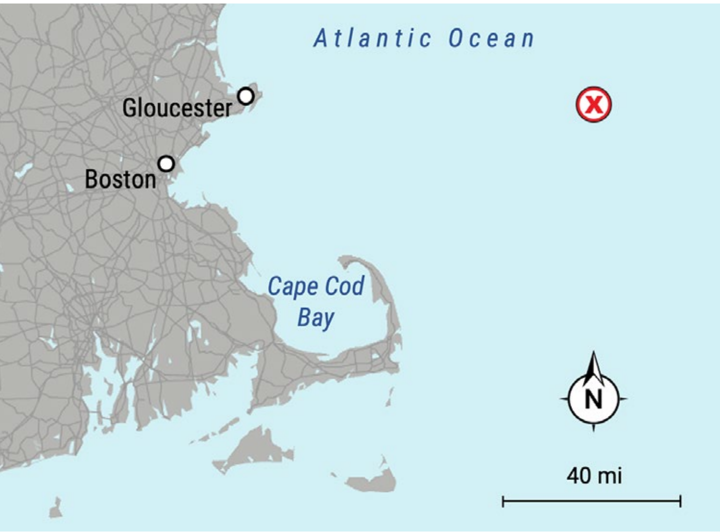
VESSEL GROUP
FISHING

Flooding and Sinking of Fishing Vessel ***Grace Marie***

Atlantic Ocean, 80 miles east of Gloucester, Massachusetts

CASUALTY DATE	ACCIDENT ID
July 8, 2022	**DCA22FM027**
INJURIES	ESTIMATED DAMAGES
0	**$650,000**
REPORT NUMBER	ISSUED
MIR-23-13	**June 16, 2023**

***Grace Marie* underway before the sinking.** SOURCE: PAUL SPILLANE

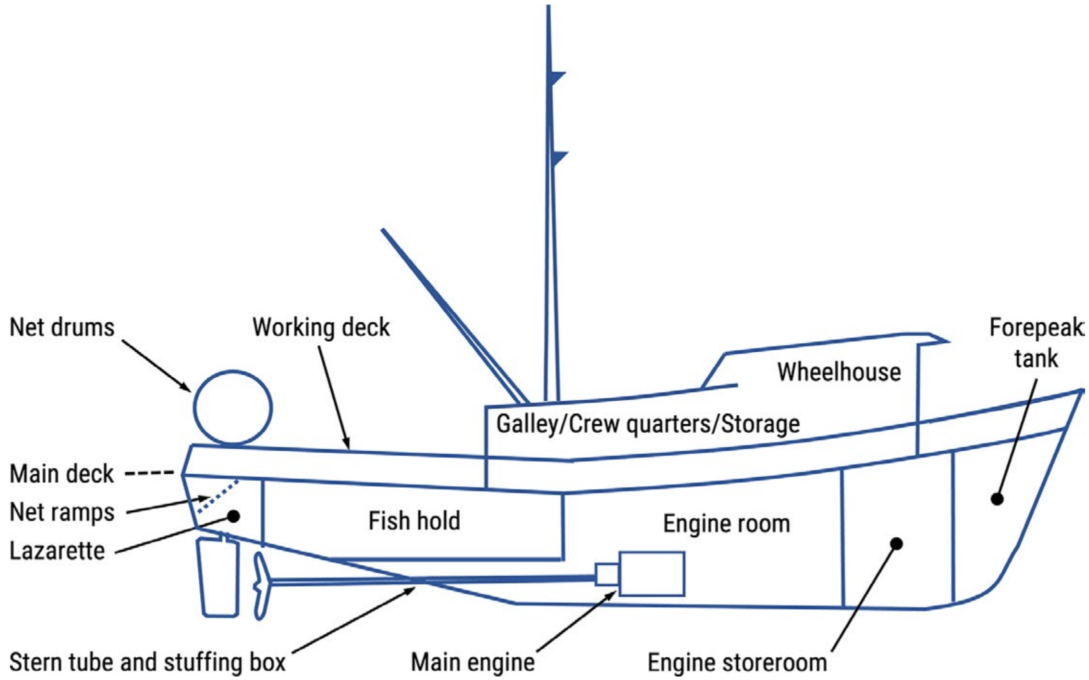


Area where the *Grace Marie* flooded and sank, as indicated by a circled *X*.
BACKGROUND SOURCE: GOOGLE MAPS

On July 8, 2022, about 2200 local time, the fishing vessel *Grace Marie* was about 80 miles east of Gloucester, Massachusetts, transiting to fishing grounds, when the engine room began flooding. The crew of seven was unable to pump out the water with the vessel's bilge pumping system, and they abandoned the vessel into an inflatable liferaft. A nearby Good Samaritan vessel rescued the crew, and no injuries were reported. An oil sheen was observed the next day in the area where the vessel was last seen. The *Grace Marie*, valued at $650,000, was a total loss.

On July 6, at 1600, the *Grace Marie* departed Gloucester and proceeded to fishing grounds located about 80 miles east. The crew fished for the next 2 days, from sunrise to sunset, deploying the net off the stern several times, dragging the net along the sea floor, and retrieving it using winches. The captain said that the fishing was good on the trip, and in 2 days of fishing, the crew caught and loaded 70,000 pounds of redfish into the vessel's fish hold, nearly reaching the vessel's 80,000-pound capacity.

At 2150 on July 8, while the captain was navigating from the wheelhouse, the engine room bilge high and high-high level alarms sounded. The captain and a deckhand went to the engine room to investigate and found the seawater level rising quickly and uncontrollably in the engine room bilge. The precise cause of the flooding could not be determined. Bilge alarms in the lazarette and fish hold did not activate while the crewmembers were on board the vessel, so it is unlikely those spaces were the source of the initial flooding. Also, it is unlikely that a problem with the vessel's running gear, such as a shaft failure, contributed to the initial flooding because the vessel was still able to navigate with propulsion and steering during the early stages of flooding.



Simple profile of the *Grace Marie*. SOURCE: NTSB

Potential sources of flooding included: (1) a failed stern tube due to material fatigue and (2) a packing failure in the stuffing box. Water flooding into the vessel from either of these two locations would not have been visible to the captain and deckhand while they were investigating the source of the rising water. In addition, depending on the level of failure, flooding from either location could cause the water level in the bilge to rise rapidly. However, these two flooding sources were unlikely because crewmembers regularly inspected the stern tube and stuffing box and did not observe anything concerning.

A more likely source of flooding was a hull failure under the engine room. The hull plating under the engine room could not be inspected visually unless the vessel was drydocked. Internally, the bilge under the main engine and other equipment would not have been easily visible to the captain and deckhand—due to floodwater, the bilge may not have been visible at all. The external area of the hull along the keel and under the engine room was covered with steel doubler plating that had been installed 8–10 years prior to cover and reinforce areas of deteriorated steel.

It is common for uninspected commercial fishing vessels such as the *Grace Marie* to use doubler plating as a means of repairing and reinforcing damaged or wasted underwater hull sections. However, doubler plate repair can lead to increased stress concentrated in the area of the repair, doubler plates are not suitable as a permanent repair for sections of the hull, and the use of doubler plating inhibits the ability to assess the true condition of the hull.

In an attempt to slow or stop the inrush of water, the captain secured the seacocks and started all available bilge pumps. Unable to stem the flooding, he ordered his crew to don immersion suits and broadcast a mayday call while he and another crewmember readied the liferaft. After they completed preparations, the captain ordered all crewmembers to abandon the vessel. The captain's early, quick, and effective decision-making led to the successful abandonment of the vessel by all crewmembers—without sustaining injuries or having to enter the water—and their prompt rescue by a Good Samaritan vessel.

The Coast Guard later received a signal from the vessel's float free, water-activated EPIRB and, as a result, conducted an overflight of the last known position of the *Grace Marie* and the EPIRB coordinates, where they observed an oil sheen, indicating the vessel had sunk.

THE PROBABLE CAUSE of the flooding and sinking of fishing vessel *Grace Marie* was uncontrolled flooding of the engine room from an undetermined source, likely a failure of the doubler-plated hull below the engine room.

LESSON LEARNED: Using Doubler Plates for Hull Repairs

Although doubler plating can be used as a temporary repair solution, it is not generally suitable as a permanent repair for a vessel's hull. Vessel owners should crop out wasted steel on the hull and replace it by inserting new plating instead of covering it up with doubler plating.

VESSEL GROUP
FISHING

Sinking of Commercial Fishing Vessel ***Carol Jean***

Atlantic Ocean, about 13 miles east of Tybee Island, Georgia

CASUALTY DATE	ACCIDENT ID
March 21, 2023	**DCA23FM021**
INJURIES	ESTIMATED DAMAGES
0	**$250,000**
REPORT NUMBER	ISSUED
MIR-23-24	**November 14, 2023**

Commercial fishing vessel *Carol Jean* before the casualty. SOURCE: COAST GUARD

Commercial fishing vessel *Having Faith* before the casualty. SOURCE: DREW MARTIN, *ISLAND PACKET*

On March 21, 2023, while anchored with no one on board, the commercial fishing vessel *Carol Jean* flooded and sank in the Atlantic Ocean near Tybee Island, Georgia. After the vessel's EPIRB activated at 1903, the Coast Guard responded and found a debris field where the beacon's signal originated. There was no pollution reported. The loss of the *Carol Jean* was estimated at $250,000.

The owner/captain of the *Carol Jean* purchased the commercial fishing vessel *Having Faith* on March 15 and planned to use the *Carol Jean* to tow the *Having Faith* to Valona, Georgia, with assistance from a friend. The captain anticipated that the voyage to Valona would take about 6 hours. When arranging the tow the following day, the captain chose to use a rope that had been stored on board the *Having Faith* as a tow line. The captain did not know the particulars of the rope, including how long it had been stored, what it was made of, or its diameter. Without knowing this information, the captain could not have known whether the towing arrangement was sufficient for the tow.

The captain and his friend connected the tow line to the aft boom on the *Carol Jean* and then passed the other end through the *Having Faith*'s anchor chute (chain pipe), into an open hatch, and tied it around two fuel tanks located within the forward compartment. The captain did not use chafing gear to protect the tow line during the casualty voyage, likely causing the line to chafe against a structure, such as the edge of the hatch entrance through which the tow line passed, causing it to fray and eventually part when the vessel was about 11.5 miles east of Tybee Island. Had the captain adequately planned the tow—by using chafing gear and ensuring the tow line was in good condition and of adequate strength to tow the *Having Faith*—the risk of a tow line failure would have been reduced.

The *Carol Jean* at anchor with the *Having Faith* secured by tow line about 2245 on March 16.
SOURCE: COAST GUARD

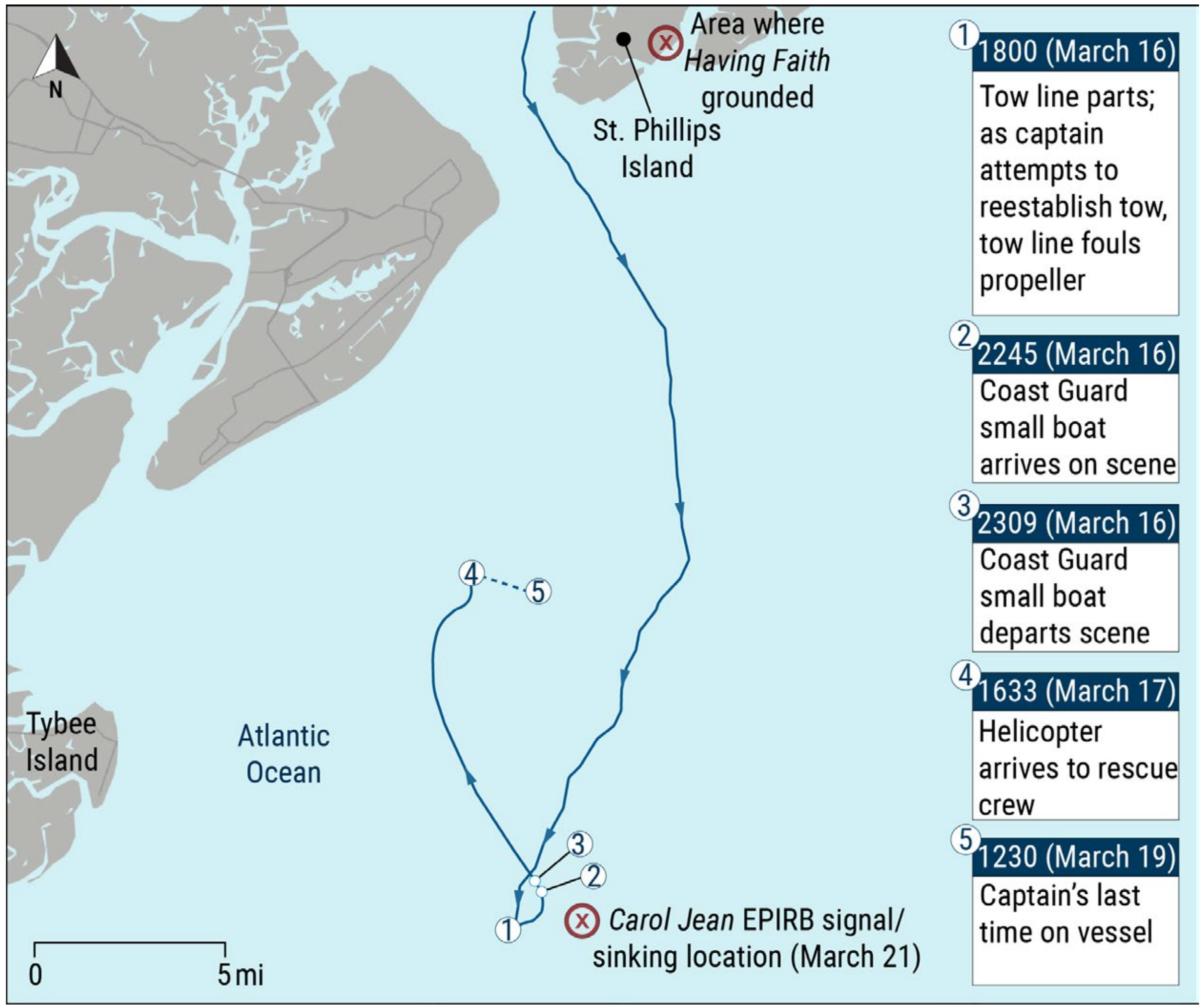
As the captain attempted to reestablish the tow on March 16, the tow line fouled the propeller of the *Carol Jean*. Unable to operate the vessel, the captain let go the *Carol Jean*'s anchor in about 17 feet of water and secured the *Having Faith* alongside. The following day, the weather deteriorated, the *Having Faith* broke free, and the Coast Guard evacuated the captain and his friend. On March 18, the *Having Faith* was found aground on a jetty (and broke apart the next day).

The captain returned to the *Carol Jean* on March 19 with a diver to untangle the tow line from its propeller. The vessel was in good condition, with no flooding noted before he departed again. The vessel remained unattended offshore until March 21, when the vessel's EPIRB activated. Because the Coast Guard found a debris field at the location of the EPIRB's signal, the vessel likely sank at some point between the captain's departure and the EPIRB's activation. Although the *Carol Jean* presumably flooded, because the vessel was not recovered, investigators could not determine how or why the vessel sank.

THE PROBABLE CAUSE of the sinking of the commercial fishing vessel *Carol Jean* was likely flooding from an unknown source while the vessel was anchored offshore and unattended. Contributing to the loss of the vessel was the captain's inadequate planning for a tow, leading to the *Carol Jean* being anchored after the tow line failed and fouled its propeller.

Aerial view of the *Carol Jean* from the responding Coast Guard helicopter on March 17 before the captain and his friend were rescued.
SOURCE: COAST GUARD

***Below*: Timeline showing events leading to the sinking of the *Carol Jean*.**
BACKGROUND SOURCE: GOOGLE MAPS;
TRACKLINE DATA: *CAROL JEAN* AIS



VESSEL GROUP
FISHING

Flooding and Sinking of Fishing Vessel ***Captain Alex***

Gulf of Mexico, 15 nautical miles south-southwest of Galveston, Texas

CASUALTY DATE	ACCIDENT ID
November 25, 2022	**DCA23FM008**
INJURIES	ESTIMATED DAMAGES
0	**$500,000**
REPORT NUMBER	ISSUED
MIR-23-29	**December 26, 2023**

The *Captain Alex* before the casualty. SOURCE: COAST GUARD

The *Captain Alex* with discharge stream from bilge system (circled) at 0317, just after *CG 45630* arrived on scene.
SOURCE: COAST GUARD

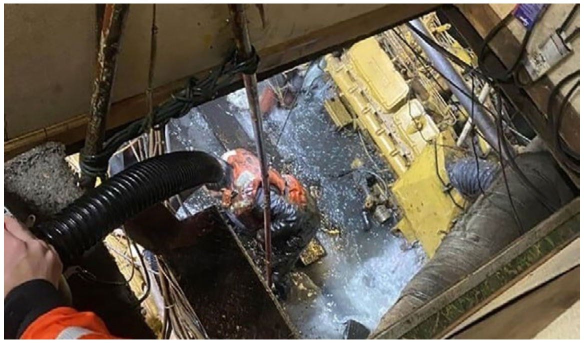
On November 25, 2022, about 0030 local time, the commercial fishing vessel ***Captain Alex*** was fishing in the Gulf of Mexico about 15 nautical miles south-southwest of Galveston, Texas, when the vessel began flooding. The four crewmembers on board were unable to stem the flooding, and they abandoned the vessel to a responding Coast Guard boat. The ***Captain Alex*** later sank, and an oil sheen and debris field were visible; a reported 17,000 gallons of diesel fuel were on board. There were no injuries. The ***Captain Alex***, with a value of $500,000, was a total loss.

The ***Captain Alex*** departed Galveston on November 22 and proceeded offshore to fishing grounds in the Gulf of Mexico. After midnight on November 25, the vessel was about 11 nautical miles south of Galveston Island. The captain told investigators that, sometime between 0015 and 0030, he heard an alarm sound from the engine room. He found that a "high-water alarm" had activated, and water was present. He informed the crew on deck of the flooding, and they hauled in the vessel's nets.

The captain returned to the engine room, where he found a 3- to 4-inch-wide hole in the bottom of the vessel, near the reserve fuel tank and underneath a fuel line, as the source of the water entry. He could not reach the hole with his arm, so he stepped on the hole with a rag under his foot to try and slow the water ingress, but the water level in the engine room continued to rise.

The vessel's two bilge pumps were operating and pumping water but could not keep up with the flooding. At 0057, the captain called the owner of the ***Captain Alex*** and informed her of the flooding. At 0101, the owner called Coast Guard Sector Houston-Galveston.

Coast Guard Station Galveston responded with a 45-foot response boat-medium (***CG 45630***), and personnel at Air Station Corpus Christi responded with an MH-65 helicopter (***CG 6514***). About 0315, ***CG 45630*** arrived at the ***Captain Alex***. The responding crew sent a portable P6 dewatering pump (gasoline engine-powered emergency pump) with instructions to the crew of the ***Captain Alex***. However, while the ***Captain Alex*** crew was able to get the engine to start, they could not get the pump to pull water from the engine room below it to discharge overboard. Two Coast Guard crewmembers went aboard the *Captain Alex* to assist and noted that the fishing vessel crew did not prime the pump. When the Coast Guard machinery technician tried to prime the pump, the priming handle broke. Since the pump was not recovered, investigators were unable to determine why the handle broke. The coxswain ordered his crew to pack up the pump and recommended that the crew of the *Captain Alex* evacuate the vessel.



Looking down into the engine room of the *Captain Alex* at 0326, with the water midway up the starboard main engine and the captain of the vessel on the stairs. The suction hose to the portable dewatering pump (on deck) is on the left. SOURCE: COAST GUARD

The coxswain saw the *Captain Alex* do a "really slow, sluggish roll," with water flowing onto the main working deck through its freeing ports. The Coast Guard crew stopped packing the P6 pump, the coxswain pulled up to the *Captain Alex*, and all on board stepped onto *CG 45630*.

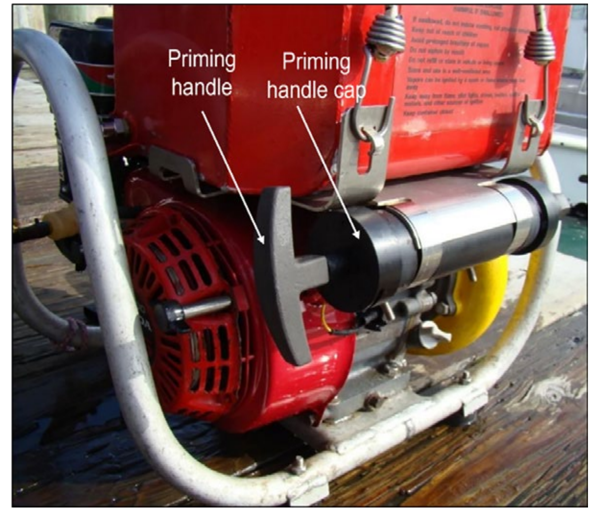
About 5 minutes later, the lights on the *Captain Alex* went out. At 0341, the coxswain, not knowing whether the vessel had sunk because it was dark, got underway to return to base.

At 0719, the *Captain Alex*'s float-free EPIRB activated, and a Coast Guard overflight showed that the *Captain Alex* had sunk.

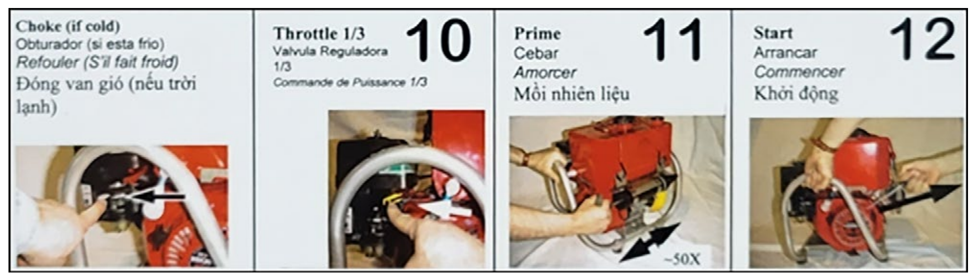
The *Captain Alex* was offshore in deep water at the time of the flooding. The captain told investigators the vessel had not hit anything, and there was no evidence of any other sources of flooding. The wreckage was not salvaged, so a postcasualty examination of the vessel did not occur.

The Coast Guard states in Navigation and Inspection Circular 7-68, Notes on Inspection and Repair of Steel Hulls, that "deterioration of the metal structure is probably the most common, single defect in steel vessels." According to the circular, the causes of deterioration include age, inadequate maintenance, and electrolysis. The Coast Guard notes that "the only practical way of determining the degree of deterioration is to measure the thickness of the member in question and compare it with the original thickness." Investigators were unable to obtain information about previous inspections, hull plate gaugings, or maintenance carried out on the hull. Further, a surveyor noted in a July 2021 condition valuation survey that no recent gauging report or maintenance records were available during the survey. Without evidence that the vessel was damaged or flooding originated from another source, it is possible that the flooding was caused by deterioration of the hull steel plating.

THE PROBABLE CAUSE of the sinking of the fishing vessel *Captain Alex* was uncontrolled flooding through a hole—possibly caused by steel hull plating deterioration—beneath the engine room.



A P6 pump like the one sent to the *Captain Alex* showing the priming handle and cap. SOURCE: COAST GUARD



An excerpt of the instructions included with the P6 pump like the one sent to the *Captain Alex*. The instructions show the priming sequence and include steps written in four languages: English, Spanish, French, and Vietnamese (the native language of the *Captain Alex* crew). SOURCE: COAST GUARD

LESSON LEARNED: Hull Examination and Maintenance

Periodic out-of-water examinations by qualified individuals such as a marine inspectors or surveyors can help determine the material condition of the vessel's hull and identify areas of corrosion and fatigue. For steel-hulled vessels, regular gauging of the hull using ultrasonic testing is an effective nondestructive testing method for identifying material deterioration of plating.

VESSEL GROUP
FISHING

Grounding and Capsizing of Fishing Vessel ***Challenger***

Shelikof Strait, Karluk, Kodiak Island, Alaska

CASUALTY DATE	ACCIDENT ID
August 7, 2022	**DCA22FM036**
INJURIES	ESTIMATED DAMAGES
0	**$600,000**
REPORT NUMBER	ISSUED
MIR-23-17	**August 17, 2023**

Fishing vessel *Challenger* on blocks before the grounding. SOURCE: FLEENOR

The *Challenger*'s sein net as crewmembers in the vessel's skiff removed it from the stricken vessel. *Inset*: The partly sunken *Challenger*. SOURCE: ALWARD FISHERIES

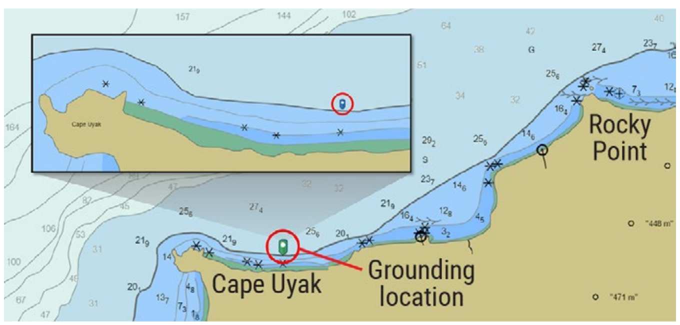
On August 7, 2022, about 0700 local time, while transiting along the northwestern shore of Kodiak Island, Alaska, the fishing vessel *Challenger* struck a submerged rock and began taking on water. The captain and three crewmembers used onboard pumps to remove the floodwater, but the pumps were unable to keep up, and the crew abandoned the vessel. A nearby Good Samaritan fishing vessel rescued them. The *Challenger* eventually capsized. There were no injuries, and no pollution was reported. Damage to the vessel was estimated at $600,000.

On August 7, about 0500, the *Challenger* got underway from the west side of Harvester Island, where it had anchored the night before, heading west in the direction of Cape Uyak (about 12 miles away).

As the vessel rounded Rocky Point, Kodiak Island, it encountered 4-foot seas and west-southwesterly winds gusting up to 15 knots. To minimize the effects of the prevailing weather on the vessel, the captain attempted to stay in the lee of Cape Uyak by navigating close to shore. The captain told investigators that this area close to shore was also where the fish typically could be found and he had been planning to set nets in this area. The *Challenger* had a draft of about 4.5 feet and was traveling in about 25–30 feet of water at low tide when it struck the submerged rock and came to a stop.

The captain of the *Challenger* had used an electronic navigation system that incorporated updated NOAA charts for the area he was navigating. The charts, however, did not include the location of the rock. The northwestern coast of Kodiak Island, like many parts of Alaska, is remote with a complex coastline. These areas are not surveyed as frequently as would be a harbor or inland passage. Because of this, mariners should not rely solely on their navigation systems and nautical charts but also use other references, as well as their experience and knowledge of the area. The *Coast Pilot* for the area where the ***Challenger*** grounded indicated that vessels should give the shore a berth of at least 1 mile, much more than the 220-yard (660-foot) distance from the shore where the vessel was operating when it grounded. Additionally, the captain had knowledge of a rock in the area, having seen it before during a low minus tide. The captain could have marked the uncharted rock on his charting software the first time he observed it but did not. He assumed the risk of operating close to shore so he could be in the area where the weather conditions and fishing were more favorable, which resulted in the grounding.

The captain discovered water rising through the plywood, nonwatertight hatch on the deck of the forepeak berthing area. The crew of the vessel attempted to stem the incoming floodwater by using onboard fixed and portable bilge pumps but ultimately was unsuccessful and forced to abandon the vessel into their skiff.



NOAA ENC for the area of the grounding. Annotations (circled markers) show the location of the uncharted rock as reported to investigators.
BACKGROUND SOURCE: NOAA

The hatch between the ***Challenger***'s forepeak and void was not watertight. The ***Challenger*** was not required by regulations to have watertight bulkheads. However, if the bulkhead comprising the aft side of the forepeak and void below it on the ***Challenger*** had been watertight and met the voluntary standards in Coast Guard NVIC 5-86—which stated that vessels should have a "watertight collision bulkhead between five and fifteen percent of the vessel's length aft from the bow" and the main machinery space should "be bounded by watertight bulkheads which extend up to the working deck"—the flooding into the void would have been contained, and the resulting progressive flooding, which ultimately led to the vessel's capsizing, would likely have been prevented.

THE PROBABLE CAUSE of the grounding of the fishing vessel *Challenger* was the captain's decision to navigate close to shore in an area known to him to have an uncharted rock. Contributing to the capsizing of the vessel was the lack of a watertight collision bulkhead and subdivision or compartmentalization below the main deck, which allowed for progressive flooding.

A fishing vessel using line to prevent the *Challenger* from sinking. SOURCE: ALWARD FISHERIES

LESSON LEARNED: Reporting Uncharted Hazards

In addition to marking hazards on their own charts and charting software, mariners can report issues (errors or omissions) with the NOAA's nautical charts and/or *Coast Pilot* through the Office of Coast Survey's ASSIST tool at: https://www.nauticalcharts.noaa.gov/customer-service/assist/ . . . .

To report an issue such as an uncharted rock, a user can enter the rock's position manually or drop a pin on the electronic navigation chart incorporated into the ASSIST tool. Users can access ASSIST from a computer or mobile device.

Coast Survey aims to follow up with all inquiries within two business days. Mariners should contact their regional navigation manager if they have questions about how to report a discrepancy. Contact information for regional navigation managers is posted at: https://nauticalcharts.noaa.gov/customer-service/regional-managers/index.html . . . .

Grounding/Stranding

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

Grounding of Tugboat *CC Portland*

Corpus Christi Ship Channel, Ingleside, Texas

CASUALTY DATE	ACCIDENT ID
August 7, 2022	**DCA22FM035**
INJURIES	ESTIMATED DAMAGES
0	**$1.3 million**
REPORT NUMBER	ISSUED
MIR-23-19	**September 7, 2023**

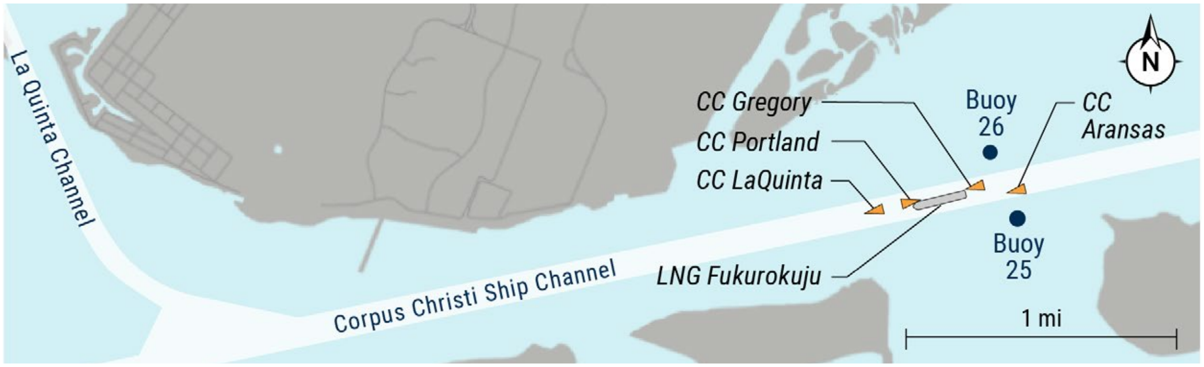
On August 7, 2022, at 1625 local time, the tugboat *CC Portland* grounded outside the Corpus Christi Ship Channel, near Ingleside, Texas, while repositioning to secure a tow line on the bow of the inbound liquefied natural gas carrier *LNG Fukurokuju*. No injuries were reported by the five crewmembers aboard the *CC Portland* or the 27 crewmembers aboard the *LNG Fukurokuju*. An estimated 4–5 gallons of diesel fuel were released from a hull breach on the tugboat. Damage to the *CC Portland* was estimated at $1.3 million.

On August 7, the *CC Portland* arrived on location near buoys 25 and 26 in the Corpus Christi Ship Channel to assist the inbound *LNG Fukurokuju* with navigating to the Cheniere Corpus Christi LNG Terminal. The *CC Portland* was one of four tractor tugs dispatched to assist the *LNG Fukurokuju*. For this assist, the *CC Portland* would secure its tow line through the center chock on the bow of the *LNG Fukurokuju* (center lead forward position).

The mate sat at the main operating station (conning chair) while the captain was positioned next to him and acted as training master. At the time, the mate was in the process of completing the company's tractor tug training program, which included bow-assist maneuvers in the center lead forward position. A review of his training sign-off sheet showed that the mate had inaccurately represented how much training he had completed. Because he did so, his training masters—including the captain on the day of the casualty—likely believed the mate was farther along in the training program and thus more advanced in his skillset than he actually was.

***CC Portland* before the casualty.** SOURCE: VESSELFINDER.COM

***LNG Fukurokuju* underway before the casualty.** SOURCE: TROPIC MARITIME IMAGES, SHIPSPOTTING.COM



Vessel positions when the *CC Portland* made up to the inbound *LNG Fukurokuju* (scale approximate).
BACKGROUND SOURCE: GOOGLE MAPS

***CC Portland* in drydock showing the missing starboard Z-drive unit.** SOURCE: COAST GUARD

To make up the ***CC Portland*** to the ***LNG Fukurokuju***, the mate maneuvered the tugboat into position along the starboard side of the bow of the ***LNG Fukurokuju***, which was transiting 8.5 knots. Once the ***LNG Fukurokuju*** crew began hauling up the tug's tow line, the mate increased the tug's speed astern, reaching 10.2 knots while repositioning the tug in line with and forward of the ***LNG Fukurokuju***'s bow.

Hydrodynamic forces created by a ship increase exponentially with speed and with decreasing distance to the bow. Consequently, the forces acting on the ***CC Portland*** were even greater as it approached the bow of the ***LNG Fukurokuju***, and these forces hampered the mate's ability to control the tugboat. When the mate increased the tugboat's speed to over 10 knots to pull ahead of the LNG carrier, the tugboat was operating at nearly 80% of its maximum speed—far greater than the 60% recommended in the textbook, *Bow Tug Operations with Azimuth Stern Drive Tugs: Risks and Effectiveness*.

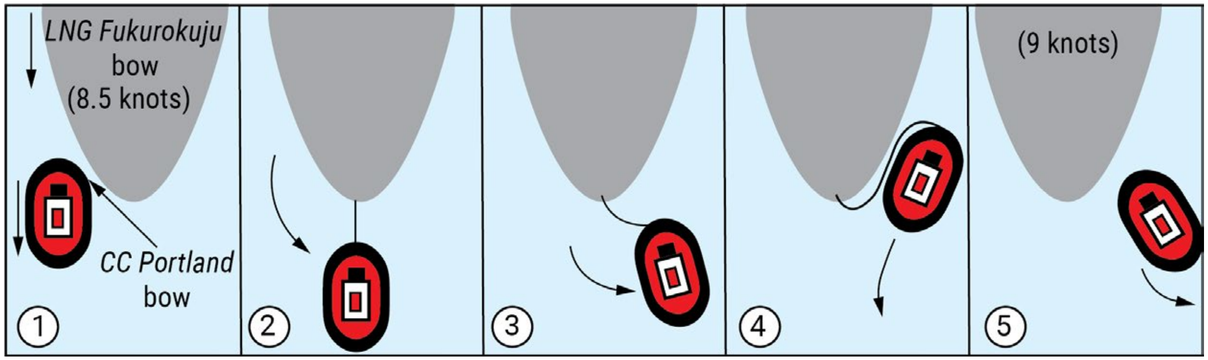
As speed increases, the margin of error decreases to the point where regaining position may be impossible. As the mate attempted to reposition the ***CC Portland***, his inputs directed more thrust laterally, and the tugboat therefore lost speed astern, causing the tugboat to move down the port bow of the ***LNG Fukurokuju.*** This movement pulled the tow line to the tugboat's stern, causing the heaving line to snap and sending the tow line into the water. The port Z-drive was fouled by the submerged tow line, and with only the starboard Z-drive operational, the mate was unable to regain position. As a result, the tug departed the channel and grounded.

The captain was "coaching" the mate through the maneuver and did not take direct action until after the ***CC Portland*** had grounded. Had the captain attempted to take over the conning chair, the time lost during the transfer could have been time the mate needed to successfully reposition the tugboat. Therefore, the captain likely did not have sufficient time between the loss of control and the grounding to safely switch positions with the mate and take control of the tugboat.

There was no company policy or guidance prescribing a safe speed for completing ship bow-assist maneuvers.

After the casualty, other company tugboat captains told investigators that they felt comfortable performing bow-assist maneuvers at much lower speeds (from 5 to 7 knots). Additionally, the NTSB previously investigated a similar casualty in 2022 in which the tugboat's company established a speed limit of 7 knots for performing these maneuvers. Had the ***CC Portland***'s operator established a similar policy, the captain and mate would have had to wait for the LNG carrier to reduce its speed in order to execute the maneuver, thus reducing the effect of the hydrodynamic forces acting on the tugboat.

THE PROBABLE CAUSE of the grounding of the *CC Portland* was the mate's attempt to make up bow to bow with a liquefied natural gas carrier while the tugboat and liquefied natural gas carrier transited at a speed that was excessive for the advanced harbor-assist maneuver. Contributing to the casualty was the lack of a company policy regarding maximum allowable speed for bow assist maneuvers.



Sequence of events in the *CC Portland* grounding (scale approximate). (1) The *CC Portland* took a position underneath the starboard bow of *LNG Fukurokuju* (while moving astern with the ship) as the heaving line was lowered and the tow line was passed up. (2) As the tow line was pulled in by the crew on the *LNG Fukurokuju*, the *CC Portland* accelerated to reposition the tug ahead of the *LNG Fukurokuju* along the centerline. (3) While attempting to maneuver to the centerline, the *CC Portland* moved out of position to the port side of the *LNG Fukurokuju*. (4) As the mate attempted to correct the *CC Portland*'s position to the centerline of the LNG carrier, the tug lost speed and stabilized along the port bow of the *LNG Fukurokuju*. The position of the tug pulled the tow line to the stern and into the water as the heaving line parted. 5) As the *CC Portland* accelerated astern to regain position, the tug lost speed and directional control as it continued moving to starboard before leaving the channel and running aground. SOURCE: NTSB

LESSON LEARNED: Speed During Bow-to-bow Harbor-assist Operations

The NTSB has previously noted the effect of speed on bow-to-bow harbor-assist operations in other investigations. The risk of a casualty during these operations with ASD tugboats increases with increasing speed. Hydrodynamic forces around an assisted vessel's bow increase exponentially with speed, while the amount of reserve propulsion power available to the tugboat operator decreases. Therefore, owners and operators of ASD tugboats that perform bow-to-bow harbor-assist operations should set speed limits for these maneuvers. These limits may vary for different classes of tugboats based on design. Tugboat operators should communicate these predetermined speed limits to pilots and ship masters in command of the vessels that they are assisting before engaging in these maneuvers.

VESSEL GROUP
OFFSHORE

Diesel Generator Engine Failure on board Offshore Supply Vessel ***Ocean Guardian***

Shilshole Bay, Seattle, Washington

CASUALTY DATE	ACCIDENT ID
May 27, 2022	**DCA22FM021**
INJURIES	ESTIMATED DAMAGES
0	**$1.1 million**
REPORT NUMBER	ISSUED
MIR-23-08	**May 9, 2023**

***Ocean Guardian* before the casualty.**
SOURCE: STABBERT MARITIME GROUP

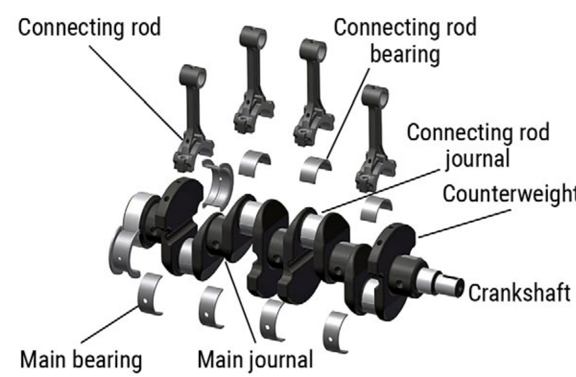
The walkway between the nos. 3 and 4 main engines after the engine failure and fire (looking forward). SOURCE: NTSB

On May 27, 2022, about 1435, the offshore supply vessel *Ocean Guardian* was conducting sea trials in Shilshole Bay near Seattle, Washington, when its no. 3 main diesel generator engine suffered a mechanical failure that resulted in a fire in the engine room. The crew extinguished the fire before it could spread throughout the vessel. There were no injuries reported for the 22 crewmembers and contractors on board, and there was no pollution reported. Damage to the *Ocean Guardian* totaled an estimated $1.1 million.

In August 2021, the *Ocean Guardian* arrived at the operating company's shipyard in Ballard, Washington, near Seattle, for maintenance. The vessel was powered by four 16-cylinder diesel-engine-driven main generators. During the maintenance period, service technicians identified a standard-sized connecting rod bearing on the no. 3 main engine that did not meet the service company's specifications and, in accordance with their policy, replaced all 16 connecting rod bearings with standard-sized bearings. The service technicians also removed and inspected the no. 6 main bearing, which, unbeknownst to the technicians, was undersized with a smaller inner diameter.

Because none of the connecting rod bearings they replaced had been machined, the service technicians used standard-sized bearings to replace the no. 6 main bearing, since it was the service company's expectation that both main bearing journals and connecting rod bearing journals would be machined at the same time. There was no record of the main bearing's part number in the service technician's notes; therefore, the technician likely did not identify and record the part number. The service company's standard practice was to replace any removed bearings with new bearings, so a new standard-sized bearing was ordered and installed.

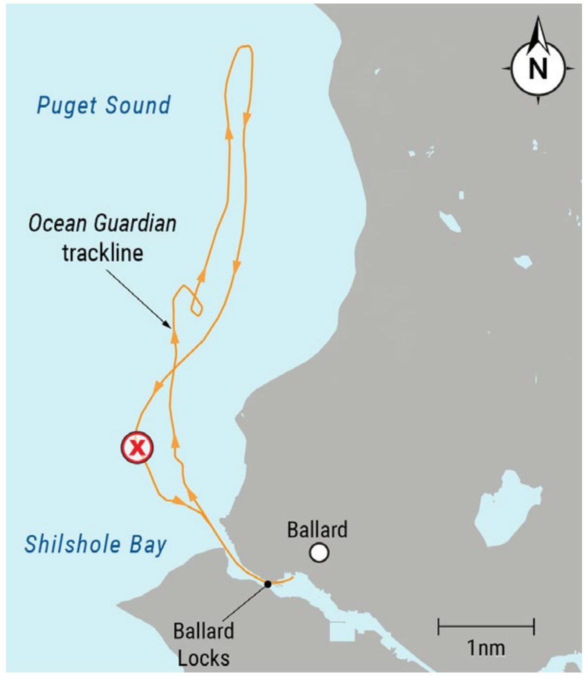
Typical components of a diesel engine crankshaft.
BACKGROUND SOURCE: ENGINELABS.COM



Part number on a typical Caterpillar main bearing.
SOURCE: STABBERT MARITIME

After maintenance was completed, the operating company scheduled a sea trial to test the vessel's engines, propulsion systems, and automatic power management system to ensure proper operation. On the morning of May 27, 2022, two tugboats towed the *Ocean Guardian* from the shipyard to Shilshole Bay for the sea trial.

About 1400, the crew began the trials. At 1435, with the two stern thrusters about 75% load, and the no. 3 main engine about 30% load, the engineering crew in the ECR heard a "large bang" and observed smoke in the engine room through the ECR window after the no. 3 main engine experienced a catastrophic mechanical failure. The no. 6 main bearing's incorrect size allowed lube oil to leak from the larger clearances of the bearing in the no. 3 main engine, thus decreasing the lube oil supply pressure to the adjacent nos. 9 and 10 connecting rod journal bearings. The loss of lube oil supply pressure resulted in a rapid temperature increase of the connecting bearings and subsequent fracturing of the bearing cap bolts on the nos. 9 and 10 connecting rods. As a result, several engine components broke free while the engine was running. These components were strewn about the crankcase, blew open the inspection cover and part of the engine block, and allowed hot oil and gas to ignite and start a fire in the engine room.



***Ocean Guardian* trackline during sea trials. The area where the vessel's diesel generator engine failed is indicated by a circled *X*.**
BACKGROUND SOURCE: GOOGLE MAPS; TRACKLINE SOURCE: *OCEAN GUARDIAN* ELECTRONIC CHARTING SYSTEM

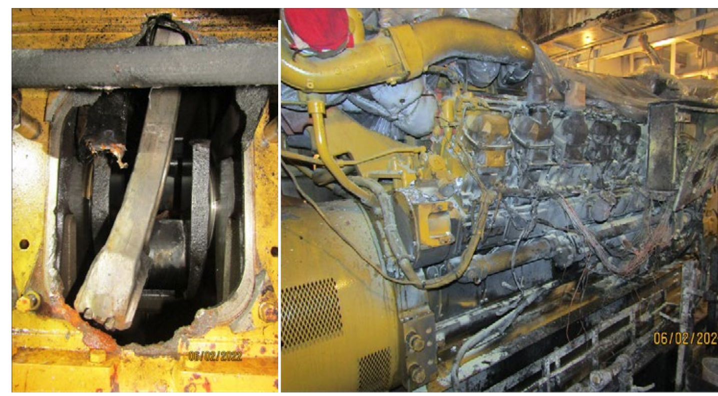
The crew's response to the fire was timely and effective. They quickly stopped the running engines, isolated all fuel supplies, shut down engine room ventilation systems, and closed the space's air dampers and watertight doors to effectively starve the fire of fuel and oxygen, thereby preventing its spread. After the captain called for help, the tugboats quickly returned to the *Ocean Guardian* to hold the vessel's position, ensuring it did not drift as the crew worked to suppress the fire. Additionally, the crew activated the vessel's fixed CO_2 fire extinguishing system, which effectively diminished and smothered the fire.

At 1509, the captain and chief engineer declared that the fire was out. After the fire was extinguished, the crew monitored the declining temperatures of the no. 3 main engine as well as the bulkheads surrounding the engine room.

About 1630, tugs began towing the vessel back to the shipyard, and at 1752, the *Ocean Guardian* was moored alongside the company's shipyard in Ballard.

THE PROBABLE CAUSE of the mechanical failure of the no. 3 main engine and resulting fire aboard the offshore supply vessel *Ocean Guardian* was the replacement of a crankshaft main bearing with an incorrectly sized bearing during an engine overhaul due to the engine service technicians not identifying the removed bearing's part number, which resulted in the loss of lube oil pressure in adjacent connecting rod bearings.

***Left to right*: Damage to crankcase and connecting rod of no. 3 main engine and the engine.** SOURCE: NTSB



LESSON LEARNED: Ensuring Correct Replacement Parts

When maintenance is performed, correct replacement of machinery components is critical to ensuring safe and reliable vessel operation. Vessel crews and equipment manufacturer technicians should carefully identify and document part numbers of all components removed from shipboard equipment. Tracking systems are an effective form of recordkeeping that can be used to ensure proper replacement part selection for reinstallation.

VESSEL GROUP
TOWING/BARGE

Loss of Crane on board Construction Barge ***Carolyn Skaves***

Willoughby Bay, Norfolk, Virginia

CASUALTY DATE **February 8, 2022**	ACCIDENT ID **DCA22FM010**
INJURIES **0**	ESTIMATED DAMAGES **$2 million**
REPORT NUMBER **MIR-23-03**	ISSUED **February 2, 2023**


***Left to right*: *Carolyn Skaves* moored before being leased to Seaward Marine Corporation; the *Carolyn Skaves* and its crawler crane (in the water), surrounded by a turbidity curtain (silt barrier), after the casualty about 0930 (crane boom is visible aft of the barge).** SOURCES: STERLING EQUIPMENT, COAST GUARD

On February 8, 2022, about 0725 local time, the construction barge *Carolyn Skaves* was spudded down in the Willoughby Bay area on the south side of the Hampton Roads Bridge-Tunnel in Norfolk, Virginia, when the crane operator shifted the position of the onboard crawler crane toward the stern, and the crane toppled off the barge into the water. The crane was later recovered and declared a total constructive loss. An oil sheen was visible after the casualty; there were no injuries reported. The value of the crane was estimated at $2 million.

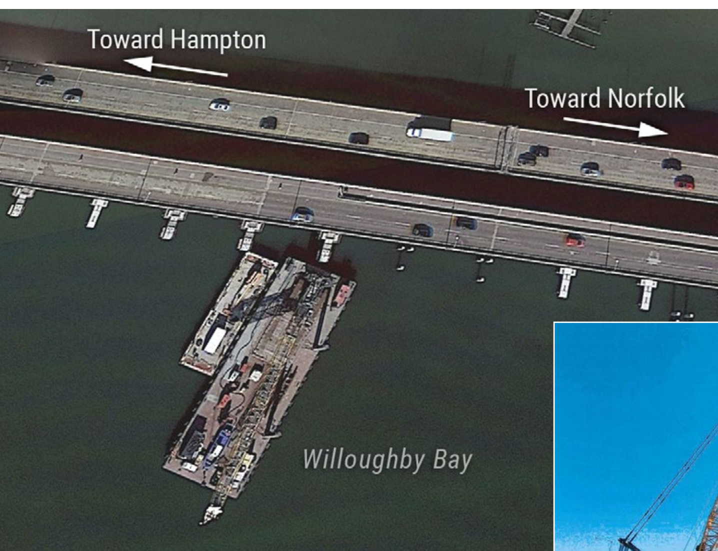
Beginning in September 2021, the Virginia Department of Transportation contracted Seaward Marine to install bridge substructure components for the Interstate 64 Hampton Roads Bridge-Tunnel in Norfolk. The company supplied the *Carolyn Skaves* and its onboard crawler crane to complete the work.

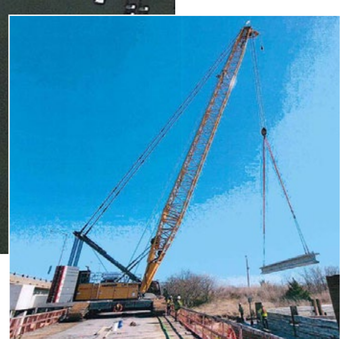
On February 8, 2022, four Seaward Marine workers, including a crane operator, arrived about 0700 on board the *Carolyn Skaves*, which was spudded down near the Hampton Roads Bridge-Tunnel. All four workers participated in a pre-work risk assessment (required by company policy) that focused on crane operations such as swinging the boom and lifting.

The first task of the day was to attach special rigging to the crane boom. The crane operator decided to move the crane—which faced the barge's bow and was near the aft end of a timber mat—farther aft to attach the rigging. The workers had not discussed shifting the crane during the pre-work assessment. Had they done so, they may have realized a spotter was needed (per company policy) to monitor the crane's movement. Instead, no spotter was assigned to the task.

Four turnbuckles that prevented the crane from moving or tipping over had to be detached to move the crane. The crane was also affixed to the barge using a centerline cable system that allowed longitudinal movement of the crane; the cable system, required by OSHA, prevented the crane from moving laterally or rolling off the barge ends. The centerline cable (wire rope) ran the length of the timber mat. After a worker detached the turnbuckles, the three workers sheltered inside a conex box located at the bow of the barge, leaving the crane operator alone to move the crane. After lowering the block to its desired height, the crane operator began moving the crane aft, using the pedals to move each track.

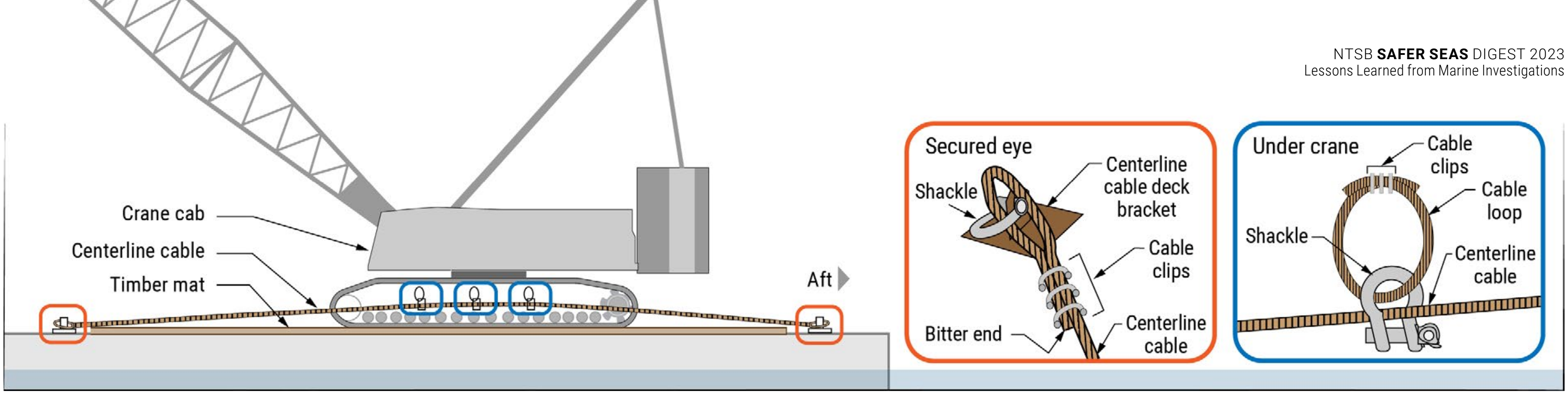
As he moved the crane aft, he heard a noise on his left. The noise was likely the centerline cable striking the underside of the body of the crane as it disconnected: investigators found the centerline cable's aft eye (loop) had opened, disconnecting it from the aft deck bracket, causing the cable system to fail.





***Below*: *Carolyn Skaves* spudded down near the Hampton Roads Bridge-Tunnel in November 2021.**
BACKGROUND SOURCE: GOOGLE EARTH

***Inset*: Casualty crane in operation before the loss.**
SOURCE: SEAWARD MARINE



Depiction of centerline cable system, including details of the cable loops securing the centerline cable to the underside of the crane and the two eyes, each secured to the barge's deck bracket (scale approximate). SOURCE: NTSB

The cable disconnected due to the tension exerted on it as the crane moved aft, causing the bitter end of the cable to slip through the cable clips that closed the loop. A centerline cable system of sufficient strength, as was required by OSHA regulations, would have prevented the crane from being driven off the barge.

The operator looked for the aft stop mark, which defined the permitted crane area and was painted on the timber mat near the forward end of his left track; however, he was behind the stop mark by the time he noticed it. From his line of sight, he would not have seen the stop mark until the crane had traveled about 2 feet off the 12-inch-high mat timbers. In addition, the operator was looking forward and monitoring the position of the crane's block as he moved the crane aft. Without a spotter (as was required by the company), it is likely that the operator lost situational awareness.

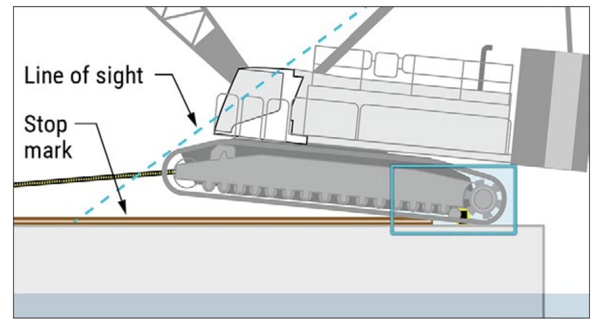
The operator felt the crane was "light in the toes," so he pushed the pedals to move the crane forward. However, the crane continued to travel aft. Feeling the crane "tipping over," he opened the cab door and jumped from the crane as it went into into the bay.

Following the incident, Seaward Marine found that the *Carolyn Skaves*'s crane had been shifted without a complete risk assessment or a spotter in other instances. The company was unaware that the crane operator and other workers were not following the company's written policy, as they did not directly observe the workers' performance or have other processes to ensure compliance. With more effective oversight, the company could have ensured that management policies and procedures were followed, thereby improving the safety of its crane barge operations.

THE PROBABLE CAUSE of the crane toppling off the deck of the construction barge *Carolyn Skaves* was the lack of a spotter during a crane movement and the failure of the centerline cable system used to secure the crane to the barge. Contributing was ineffective company oversight of barge operations.

LESSON LEARNED: Construction Barge Crawler Crane Movement

All repositioning of a crawler crane on a construction barge—no matter how routine—should be adequately planned and risk-assessed. All personnel involved in movement operations should be clearly identified and their duties understood, including spotting. A method such as a cable system or other physical attachment to prevent the crane from falling off the barge must also be in place before moving the crawler crane as required by OSHA regulations.



Simple representation of the *Carolyn Skaves* crane operator's line of sight from a seated position in the crane cab as the crane moved off the mat and began to topple (scale approximate). SOURCE: NTSB

Location of turnbuckles near timber mat and stop mark painted orange on the mat.
BACKGROUND SOURCE: COAST GUARD

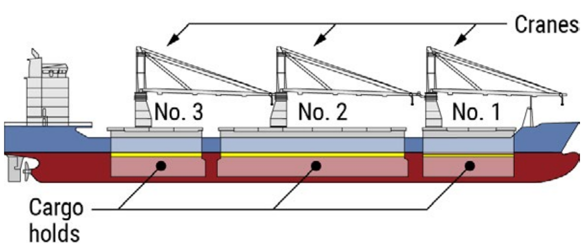
VESSEL GROUP
CARGO, GENERAL

Crane Wire Failure on Cargo Ship ***Thorco Basilisk***

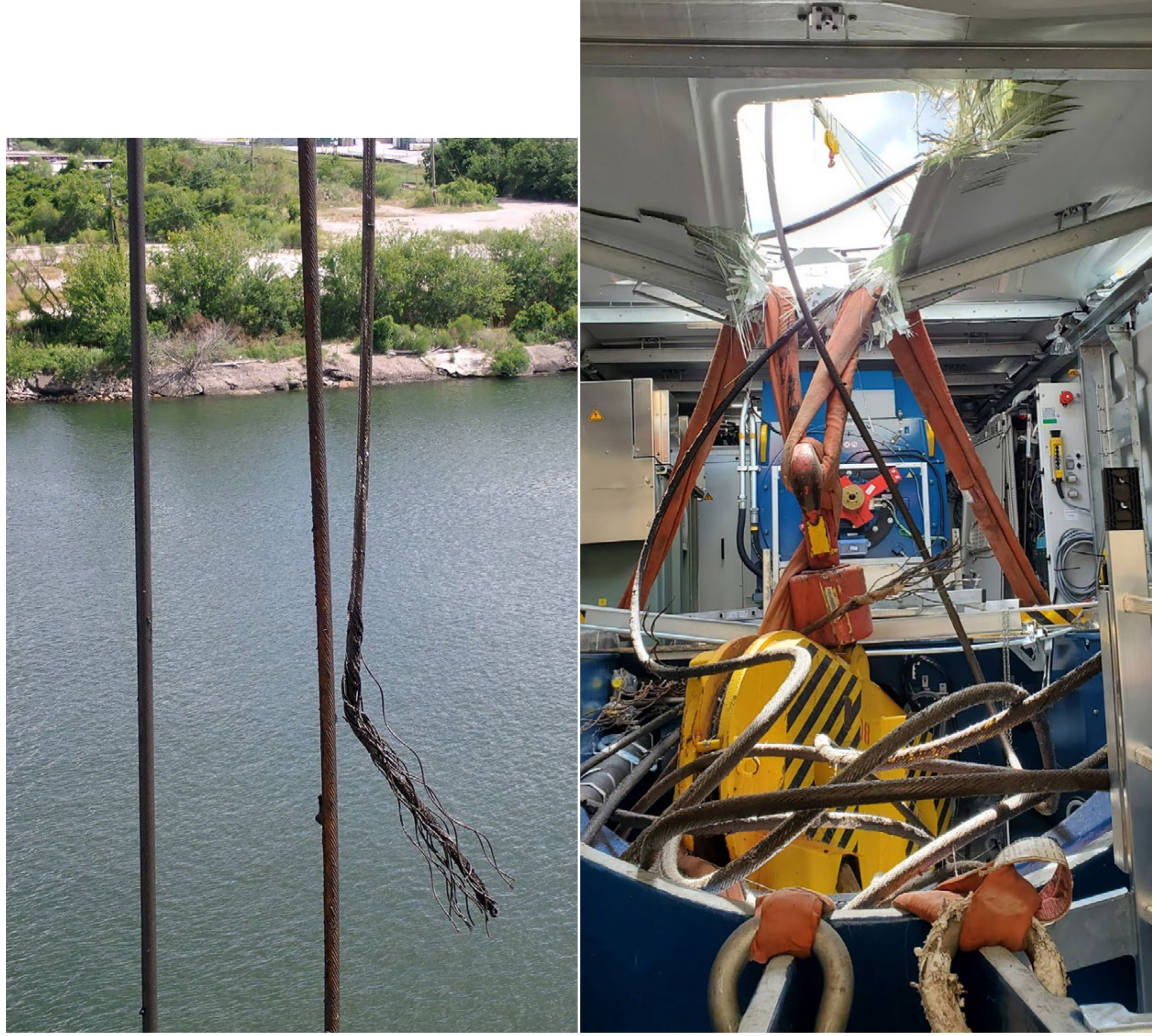
Greensport Terminal, Houston Ship Channel, near Houston, Texas

CASUALTY DATE	ACCIDENT ID
July 23, 2022	**DCA22FM031**
INJURIES	ESTIMATED DAMAGES
0	**$3–5 million**
REPORT NUMBER	ISSUED
MIR-23-26	**November 28, 2023**

***Thorco Basilisk* precasualty.** SOURCE: VESSELFINDER



Profile view of the *Thorco Basilisk*. Tween decks in each hold at the time of the casualty are shown in yellow. SOURCE: NTSB



***Left to right*: Crane no. 1's parted wire rope on the crane side and its block smashed into the top of the damaged nacelle.** SOURCE: COAST GUARD

On July 23, 2022, about 1440 local time, the cargo ship *Thorco Basilisk* was discharging cargo at the Greensport Terminal on the Houston Ship Channel near Houston, Texas. While offloading a wind turbine component, the hoisting wire rope on a shipboard crane failed, causing the component to drop onto the vessel's cargo hold tween deck. No pollution or injuries were reported. Damages to the ship and the component were estimated at $3–5 million.

On July 22, the *Thorco Basilisk* docked at the Greensport Terminal in Houston to offload wind turbine nacelles and other wind turbine components. The next day, a crew of stevedores arrived at the terminal and participated in a job safety analysis brief, which addressed the day's work plan and hazards. Before beginning operations, the stevedore superintendent and port captain reviewed the ship's three cargo crane certifications and determined that they were "good to go."

Exemplar Nordex Delta 4000 wind turbine nacelle in another vessel's cargo hold rigged in accordance with manufacturer-recommended guidance. SOURCE: NORDEX

While the stevedores were using crane no. 1 to offload a nacelle from the cargo hold no. 1 tween deck, the crane's hoisting wire rope parted, causing the nacelle to drop and fall onto the tween deck. The nacelle weighed 69 metric tons (76 US tons), or 86% of crane no. 1's SWL of 80 metric tons (88 US tons) at no greater than 19 meters (62 feet) from the crane base (as certified by DNV-GL in 2019). During the lift, the nacelle was not hoisted outside of cargo hold no.1 and was therefore within the 19-meter radius prescribed for the SWL by DNV-GL in the 2019 load test certificate. Additionally, crane no. 1 had completed two identical lifts just before the casualty lift without incident. A sample of the wire rope had previously been tested to a maximum breaking strength of 1,374 kilonewtons, or 140 metric tons (154 US tons). The manufacturer stated that the wire rope as originally installed had a safety factor of 4.44 at the crane's 80-metric-ton SWL. Therefore, crane no. 1 should have been able to complete the lift of the nacelle load.

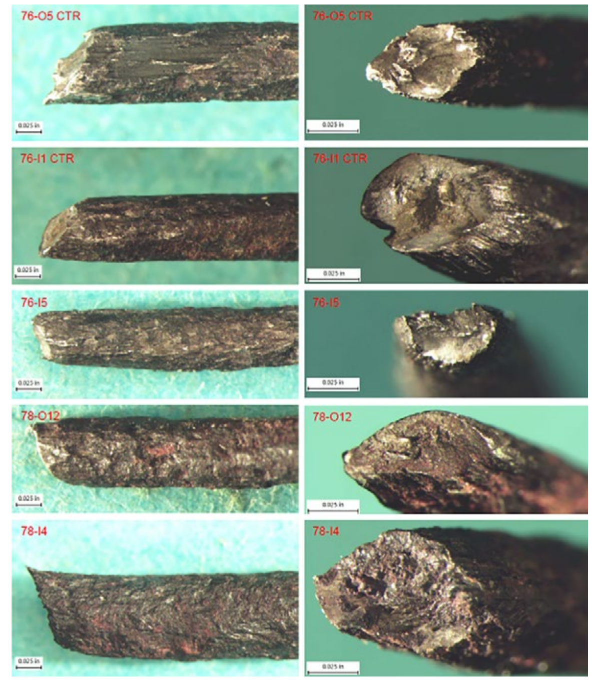
The crane operator did not note any issues with the crane, nor did he observe any sudden movements of the load. Additionally, immediately following the casualty, stevedores inspected the internal connections and rigging components for failures (which could have introduced a shock load) and found no issues with any of the equipment. Therefore, there was no evidence that the hoisting wire rope or the crane were shock-loaded—either through sudden crane movement or failure of nacelle rigging—in such a way as to create a dynamic load on the wire rope during the lift.

Samples of crane no. 1's hoisting wire rope were examined to determine what caused the wire rope to fail. The examination found significant external corrosion, as well as roughness and pitting, and "uniform corrosion of internal surfaces" of the hoisting wire rope. This corrosion and wear caused some of the individual wires comprising the strands of the hoisting wire rope to part (fail) when crane no. 1 lifted the nacelle unit, subsequently causing the strand and then the remaining wire strands to become overloaded and fail.

The postcasualty wire rope analysis report stated that visible signs of external corrosion could not be fully appreciated until the grease was removed. DNV-GL surveyors completed annual surveys of the *Thorco Basilisk* cargo cranes and their associated wire ropes, but these surveys primarily involved visual inspections limited to obvious indications of wear (such as broken wires, visible corrosion, or observable degradation to outer strands and surfaces) and therefore would not have identified the corrosion. The wire rope had been regularly maintained in accordance with the operating company's PMS, and the required daily and monthly checks had been performed according to maintenance records; however, the vessel's PMS did not require the removal of grease from the wire rope (as recommended by the manufacturer). Without removing the grease to examine the wire rope, the corrosion on the wire rope could not be detected.

THE PROBABLE CAUSE of the failure of the hoisting wire on the cargo ship *Thorco Basilisk*'s crane was undetected corrosion and wear in strand wires.

Thorco Basilisk **parted hoisting wire rope (crane side of fracture).** SOURCE: ENGINEERING SYSTEMS INC



Views of wire ductile fractures found in strands of the failed wire rope from the side (*left*) and perpendicular to the fracture surface (*right*).
SOURCE: ENGINEERING SYSTEMS INC

LESSON LEARNED: Maintenance of Wire Ropes

Saltwater and humid ocean air cause corrosion of metals, presenting challenges for the maintenance of high-strength steel wire ropes on vessels. A deteriorated wire rope directly affects a crane's ability to safely and reliably handle loads up to the crane's rated capacity (safe working load). Therefore, diligent inspection, maintenance, and management of wire ropes are essential. Working wires should be changed at recommended intervals, or more frequently, depending on operating conditions and use.

VESSEL GROUP
OFFSHORE

Tilting of Liftboat *L/B Robert*

Gulf of Mexico, 80 miles southeast of Lake Charles, Louisiana

CASUALTY DATE **November 20, 2022**	ACCIDENT ID **DCA23FM007**
INJURIES **0**	ESTIMATED DAMAGES **$6.9 million**
REPORT NUMBER **MIR-23-28**	ISSUED **December 19, 2023**

***L/B Robert* elevated and operating alongside a platform before the casualty.**
SOURCE: PETER DIETER JANSON, MARINETRAFFIC

***L/B Robert* toppled to port as seen on November 21, 2022, at 0914.** SOURCE: COAST GUARD

On November 20, 2022, at 1256 local time, the liftboat *L/B Robert* was reported to be listing (tilting) alongside a stationary oil platform in the Gulf of Mexico near South Marsh Island Block 137, about 80 miles southeast of Lake Charles, Louisiana. The crew had evacuated 2 days prior due to forecasted adverse weather in the area, leaving the vessel elevated out of the water and unattended. Following the casualty, vessel crewmembers, salvors, and personnel from the operating company assessed the damage and facilitated the tow of the vessel into port. No pollution or injuries were reported. Damage to the vessel and cargo was estimated at $6.9 million.

On October 3, the *L/B Robert* arrived at Structure A, a platform in South Marsh Island Block 137. After identifying a suitable location on the south side of the platform, the vessel was jacked up, and the crew completed an extended 17-hour preload test (14 hours longer than a standard preload, as an added precaution due to a can hole being just over 25 feet west of the vessel's port leg pad). Afterward, the crew further jacked the vessel out of the water to its maximum leg extension of 290 feet alongside Structure A in 217 feet of water. The three leg pads penetrated the seafloor about 25 feet, leaving the vessel about 48 feet of working air gap. For the next 6 weeks, the *L/B Robert* remained in position without incident.

On November 15, the captain and the vessel's shoreside operations manager discussed the forecasted weather, which predicted potential maximum wave heights greater than 20 feet on November 19 and November 20. Concerned that waves would exceed the vessel's elevated operating limits (15-foot waves while jacked up in water depths greater than 75 feet), the captain considered liberating and transiting away from the storm—a decision the captain and vessel owner had made and executed as recently as 2 months prior due to a forecasted hurricane. However, the immediate forecast called for seas greater than the operating limit of 8-foot waves while underway. Because it would take about 12 hours to liberate the vessel's legs from the seafloor and get underway, and the nearest safe refuge area was 9 hours away, the captain—in consultation with shoreside vessel management personnel—decided instead to evacuate the vessel on November 18. In the 2 days that followed, the unattended *L/B Robert* tilted to port, submerging its deck edge. Therefore, the decision to evacuate personnel and crewmembers from the vessel was appropriate for the forecasted conditions and eliminated the risk to personnel from continued vessel operations on board.

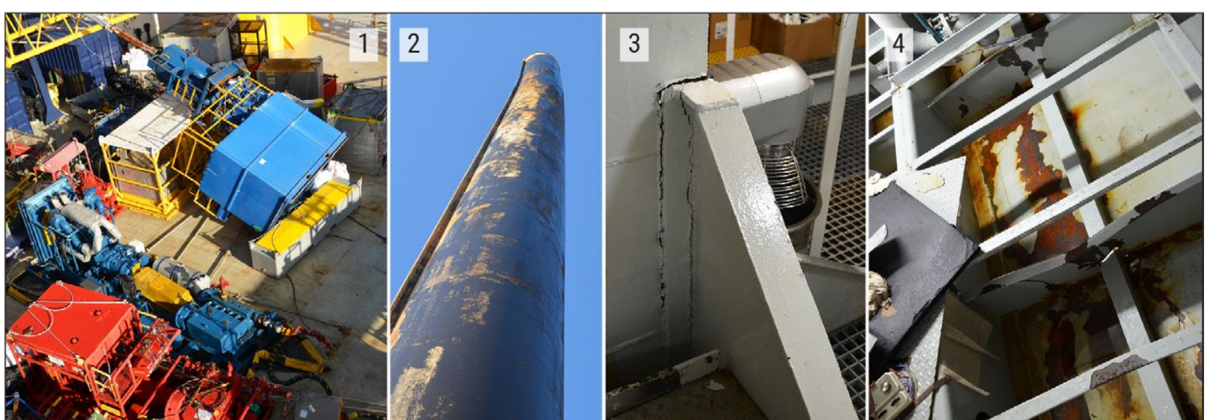
When the crew evacuated the *L/B Robert*, leaving it unattended, they had left an air gap about 25 feet above the water's surface per guidance from shoreside management personnel to stay just at the maximum wave heights predicted by the weather forecasts to maintain the vessel's greatest resistance to overturning from the combined forces of wind and waves. The elevated conditions were within the limits identified in the vessel's operations manual. A base map of the seafloor produced by a third-party survey company indicated no obstructions, debris, or can holes within 25 feet of the *L/B Robert*'s three leg pads.

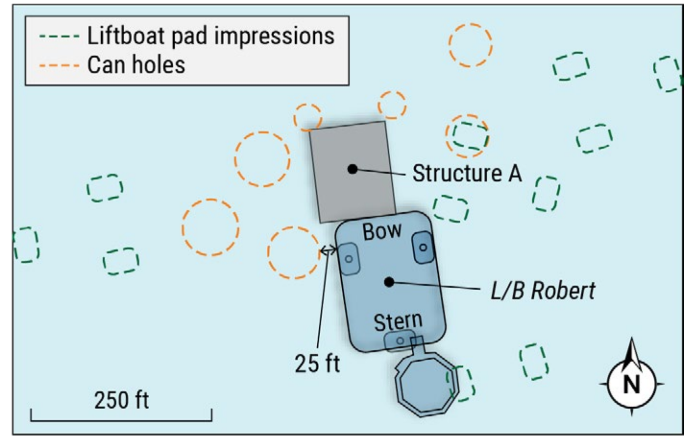
After the casualty, the vessel's onboard position monitoring system recorded the vessel had moved 19 feet to port from its original position. A postcasualty inspection of the legs and pads indicated no catastrophic failures that could have contributed to the tilting—although the vessel's legs were bent within the leg towers on the vessel, the legs and the leg pads were otherwise undamaged. Based on observations from the closest weather stations, gale-force winds (greater than 34 knots) began to occur at the casualty site around midnight on November 17 and increased in strength through the evening of November 19, with peak winds likely near 45 knots. Based on analysis completed by the Ocean Prediction Center, it is likely that the significant wave heights at the casualty site peaked early November 20, between 12 and 15 feet. Therefore, the vessel likely experienced waves as high as 24–30 feet, exceeding the 25-foot air gap, as well as the forecasts at the time the captain and shoreside personnel decided to evacuate the liftboat.

Overturning forces from the waves striking the elevated liftboat and gale-force winds would have transferred down the legs to the pads, causing the seabed foundation under and surrounding the leg pads to deteriorate. Although the vessel was originally positioned 25 feet from the nearest can hole, the deteriorated seabed foundation under the vessel's port leg likely gave way, causing the leg to slide into the can hole and the vessel to topple to port, submerging its deck edge.

THE PROBABLE CAUSE of the tilting of the elevated liftboat *L/B Robert* was gale-force winds combined with waves that exceeded the vessel's air gap, causing vessel movement, which led to a leg sliding into an adjacent can hole in the seafloor.

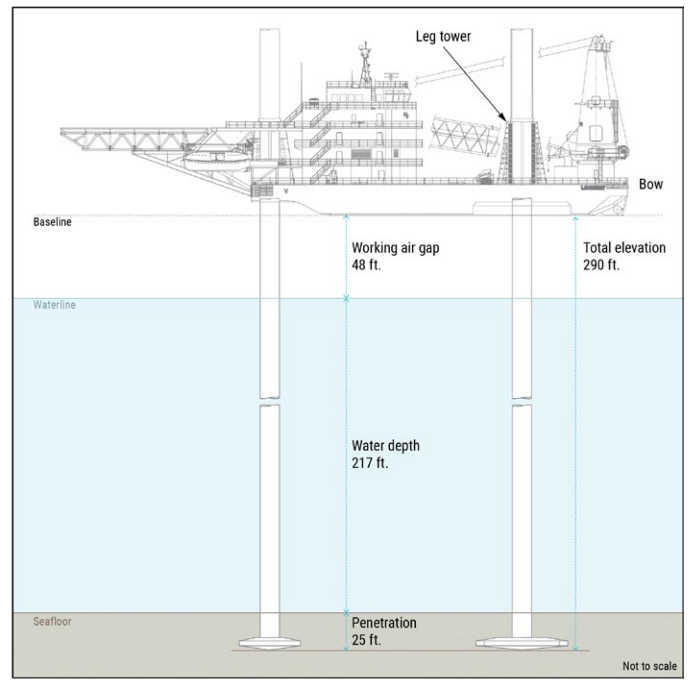
***Left to right*: Damage sustained during the *L/B Robert* casualty, including (1) shifted deck cargo, (2) leg deflections, (3) starboard Z-drive room damage, and (4) port Z-drive room damage.** BACKGROUND SOURCE: SEACOR MARINE





The *L/B Robert*, alongside the southern side of Structure A, and surrounding seafloor, including outlines of documented can holes and liftboat pad impressions from previous vessel jack-ups.
DATA SOURCE: SEACOR MARINE

***L/B Robert* approximate operating measurements at the casualty site after initially jacking up at Structure A in early October.** SOURCE: NTSB



Lessons Learned

The listing *L/B Robert*. SOURCE: COAST GUARD

The marine casualty investigations completed in 2023 illustrate the decisions and actions taken by operators and crews that led to costly, and sometimes tragic, casualties, resulting in injuries and lives lost. **Most of these casualties were preventable. By considering the lessons learned in each, it is our hope that mariners can make changes to avoid a casualty.**

We learned lessons about the importance of effective communication within a unified command when fighting vessel fires, as well as the need for land-based firefighters to have training on marine vessel firefighting tactics. As a result of the investigation into the fire aboard the passenger vessel ***Spirit of Norfolk***, we recommended that the Coast Guard use the circumstances of the casualty to improve contingency plans related to fighting fires on vessels.

We again saw how a failure to maintain a proper lookout can lead to tragedy. In response to the collision between the Coast Guard cutter ***Winslow Griesser*** and the center-console boat ***Desakata***, in which one person died, we recommended that the Coast Guard provide information to its cutter crews about the collision and emphasize the importance of maintaining a proper lookout and ensuring situational awareness when transiting at high speed.

We also learned about how the location of an anchorage near potential hazards such as an underwater pipeline can lead to damage if a vessel drags anchor. In response to the anchor strike of an underwater pipeline and eventual crude oil release in San Pedro Bay, we recommended that the Coast Guard implement a restructuring of anchorages to increase the margin of safety between anchored vessels and pipelines. We also recommended that the Coast Guard improve its vessel monitoring systems to help alert VTS watchstanders when an anchored vessel encroaches on a pipeline and develop procedures for VTSs to notify pipeline and utility operators following potential incursions on submerged pipelines and utilities.

We continue to see some of the same safety issues each year, such as the potential hazards of lithium-ion batteries, the fire risk posed by the presence of combustible materials, and the dangers of fatigue on human performance.

As you review these lessons learned, think about how each issue manifested into a safety problem and how you can avoid a similar situation in your operations.

We hope that these lessons learned help you view your own operations with a critical eye and that you apply this knowledge to your daily operations to prevent commonly encountered hazards.

As you review these lessons learned, think about how each issue manifested into a safety problem and **how you can work to avoid a similar situation.**

Detecting Small Vessels

Sometimes, mariners on board larger vessels cannot see small recreational or commercial vessels, increasing the risk of a collision. Fitting small vessels with equipment—such as radar reflectors or AIS—improves the opportunity for vessels with radar, when combined with a proper visual lookout, to detect these smaller vessels and take action to avoid a collision.

In the *Winslow Griesser* casualty two vessels—one of which was a small center-console boat—collided. Neither vessel saw the other before the collision.

Effectively Communicating

Effective communication—between firefighting teams and a unified command or between mariners making passing arrangements—is critical. Clear communication by the most prudent method, whether by radio or face-to-face, can be an effective measure in reducing damage or averting a casualty. Additionally, repeating orders or passing arrangements can help ensure everyone is on the same page.

Poor and ineffective communication between firefighting teams and the unified command reduced firefighting efficiency in the *Spirit of Norfolk* casualty. Unclear communication between mariners while making passing arrangements via radio—specifically a lack of repeat backs—was a potential factor in the *Big D/Carol McManus* casualty.

Proactively Inspecting Equipment

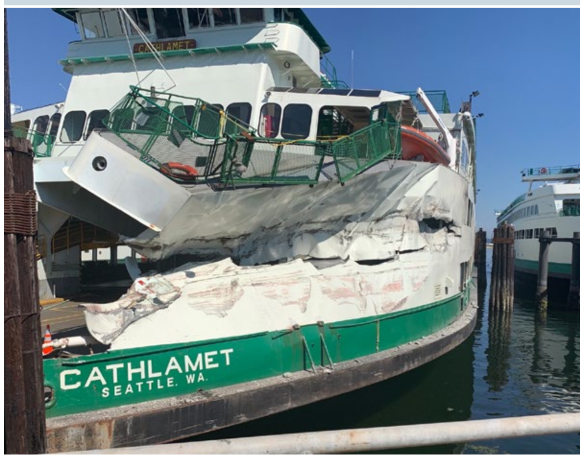
Inspection programs can identify deficiencies before equipment fails. For example, conducting periodic inspections is prudent for equipment at high risk for corrosion—such as pierside bollards or wire ropes used on vessels—especially when their location is in or near saltwater environments, which can significantly affect service life. It is also good practice to develop a means to periodically inspect equipment and vessel systems that are difficult to access, such as those that run through tight spaces or are located near structures, other equipment, or materials that obstruct direct observation.

A mooring bollard failure caused the *VALARIS DS-16* to break away from the pier and collide with another vessel. Undetected cracks in a difficult-to-access section of the muffler led to the *Mary Dupre* fire. Deteriorated wire rope on a shipboard crane caused a wind turbine component to drop and cause damage in the *Thorco Basilisk* casualty. These deficiencies could have been identified if included in a routine inspection program.

Mitigating Fatigue

Crew fatigue can increase the likelihood of a casualty, as it impacts all aspects of human performance. Inadequate sleep can lead to poor decision-making, decreased alertness, and slower reaction time. Mariners should understand the performance effects of sleep loss and recognize the dangers of fatigue. Company operational policies and requirements should incorporate and follow fatigue management best practices to ensure that crewmembers receive enough rest to adequately perform navigational, lookout, engineering, and other watchstander duties. Companies and vessel captains should also actively monitor watch schedules and any off-watch work performed by their crews to ensure adherence to fatigue mitigation policies. Further, they should adjust watch schedules to prevent crew fatigue.

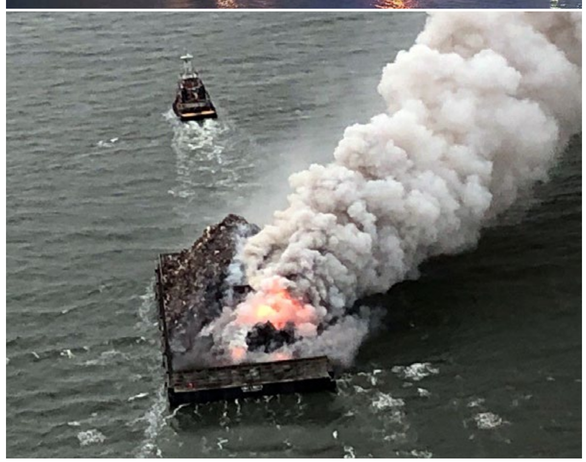
In the *Elliot Cheramie* casualty, the owner/operator did not adhere to their 12-hour work hour limit policy, resulting in the fatigued mate falling asleep on watch and the offshore supply vessel striking an oil and gas production platform. In the *Cathlamet* casualty, the vessel struck a dolphin at the ferry terminal due to the master's incapacitation, likely due to a microsleep, following several nights of limited sleep.



Anticipating Fire Hazards

Fire is a serious threat—and, unfortunately, common occurrence—on board vessels. Fires can cause significant damage to a vessel or its cargo, equipment, and personnel. It is critical to ensure that combustible materials such as cardboard boxes or oily rags are properly stored (or disposed of). In addition, crewmembers involved in hot work should be trained to identify potential fire hazards, such as combustibles, and take action to remove or protect them from hot work.

A smoldering fire following hot work occurred in the *Natchez* casualty. Improperly stored oily rags led to the fire on board the *Pegasus*. The *CMT Y Not 6* barge fire started from within scrap metal cargo. The most likely cause of the *Spirit of Norfolk* fire was the ignition of combustible materials stored near a generator's exhaust pipe in the engine room.



Improving Firefighting Training

Firefighters or crews untrained in the complexities of managing fires on vessels can increase the chance that fires will damage or destroy vessels, or even lead to injuries or deaths. To prevent engine room fires and ensure they are effectively contained, operators should provide mariners realistic scenario-based training, including training that covers engine room emergencies. This training should also cover procedures for effectively shutting down machinery, fuel oil, lube oil, and ventilation systems, as well as boundary monitoring. In addition, because mariners may need to work with shoreside firefighters to extinguish vessel fires, it is important to educate land-based firefighting teams that potentially respond to shipboard fires on marine vessel firefighting tactics, so they can avoid risks such as breaking a fire boundary or releasing accumulated firefighting water by opening watertight doors.

In the *Spirit of Norfolk* fire, land-based firefighters were unaware of the fire risks that lay behind the engine room door where the fire had been contained; they opened the door and the fire spread. The *Endo Breeze* casualty highlighted the criticality of effective fire response; the crew quickly activated fuel pump shutoffs and ventilation shutdowns then activated the ship's fixed CO_2 system—limiting damage and preventing injuries.

Conducting Timely Hull Maintenance and Repair

To protect vessels and the environment, it is good marine practice for vessel owners to conduct regular oversight and maintenance of hulls, including between drydock periods. An effective maintenance and hull inspection program should proactively address potential steel wastage, identify hull and watertight integrity deficiencies, and require the repair of corrosion issues in a timely manner by permanent means. Periodic out-of-water examinations and hull gauging by qualified individuals such as a marine inspectors or surveyors can help determine the material condition of the vessel's hull and identify areas of corrosion and fatigue.

The use of doubler plating as a permanent repair may have caused the *Grace Marie* to flood and sink. The crane barge *Ambition* capsized and sank due to the owner's lack of a hull inspection, maintenance, and permanent repairs. The sinking of the *Captain Alex* was possibly caused by steel hull plating deterioration beneath the engine room.

Maintaining an Effective Watch

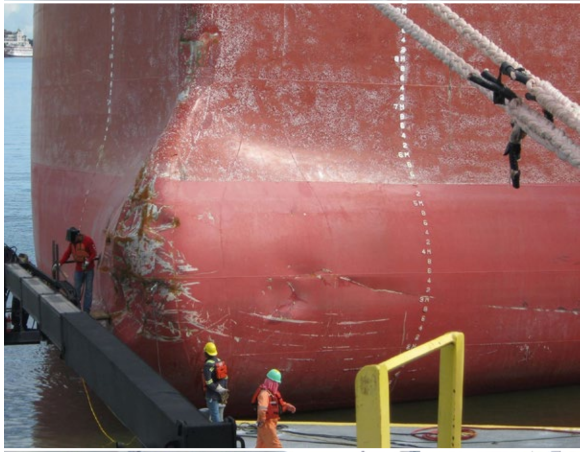
Regulations and long-standing prudent maritime practice require a proper lookout for safe navigation. Maintaining a proper lookout, by sight and sound, is a fundamental rule of the *Convention on the International Regulations for Preventing Collisions at Sea, 1972* (COLREGS) for vessels, regardless of their size or activity, and is essential in determining the risk of collision. Operators and crews should ensure that vessel bridge teams are staffed with certificated/credentialed mariners who are familiar with all bridge navigation equipment and able to independently take immediate action when serving as lookout. In addition, repetitive operations, such as ferry transits—back and forth on the same route—require operators to sustain a high level of vigilance to prevent complacency. To combat complacency, operators should comply with procedures, such as operating checklists, that are in place to prevent single points of failure, and companies should train personnel on the importance of following procedures.

In the *MSC Rita/Tremont collision*, the *Tremont* mate did not maintain a proper lookout and kept the autopilot engaged while troubleshooting the vessel's gyrocompass, and the *Tremont* struck the *MSC Rita*. The *Winslow Griesser/ Desakata* collision occurred due to failure by both vessels' crews to maintain a proper lookout. The *Bunun Queen/Thunder* collision was due to the *Bunun Queen* officer's distraction while performing non-navigational tasks and the *Thunder* officer's distraction when using a cell phone. Contributing to the *Cathlamet* striking a ferry terminal dolphin was the quartermaster not actively monitoring the approach to the ferry terminal.

Avoiding Nonoperational Cell Phone Use

Using cell phones and other personal electronic devices has been demonstrated to be visually, manually, and cognitively distracting. Nonoperational use of cell phones should never interfere with the primary task of a watchstander to maintain a proper lookout; personnel should follow established protocols regarding cell phone use.

The *Bunun Queen/Thunder* collision was due to the *Bunun Queen* officer's distraction while performing non-navigational tasks and the *Thunder* officer's distraction when using a cell phone.



Planning Appropriately

Lack of planning can lead to a disaster on the water. All operations—no matter how routine—should be adequately planned and all risks assessed. Planning can help prevent mishaps related to unforeseen circumstances. Voyage plans should include every phase of the voyage—from the vessel's starting port to its end port—including leaving the dock and mooring. The plans should account for any hazards, such as bridges, that pose a risk to vessels and tows with high air drafts.

In the *Carolyn Skaves* casualty, the lack of a risk assessment for the movement of a crane resulted in it falling off a construction barge. In another casualty related to a crane, the lack of accurate information about the crane boom height contributed to the *Robert Cenac* tow contacting the Houma Twin Span Bridge. Inadequate planning for a tow contributed to the sinking of the commercial fishing vessel *Carol Jean*. Inadequate voyage planning was a factor in the contact of the cruise ship *Radiance of the Seas* with the Sitka Sound Cruise Terminal pier.

Properly Maintaining Vessel Equipment and Machinery

Many casualties can be traced back to imprecise, incomplete, incorrect, or improper maintenance practices. Vessel crews and equipment manufacturer technicians should follow manufacturer assembly procedures and guidance and ensure correct replacement parts are installed. Additionally, vessel operators and crews should identify possible hazards or risks to maintenance being conducted, such as the effect of ambient conditions on machinery or how working on one piece of equipment may affect other equipment.

Incorrect replacement of machinery components caused the *Ocean Guardian* machinery damage and resulting fire. The failure to test and inspect the lubricating oil system for water intrusion or other contamination following maintenance was a factor in the *Damgracht/AP Revelin* collision. Not following the instructions in a manufacturer's manual contributed to the *Endo Breeze* fire. Inappropriately conducting simultaneous maintenance operations while underway was a factor in the *MSC Rita/Tremont* collision.

Reporting Chart Changes and Hazards

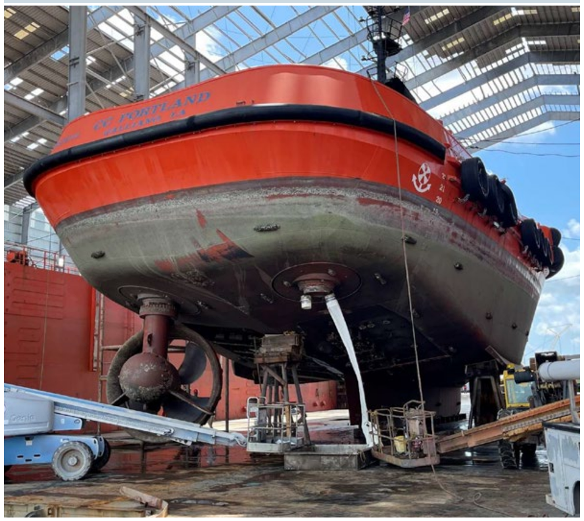
Accurate and up-to-date navigation charts are critical for crews to ensure the safe transit of a vessel while underway. Ports and terminals should immediately report significant modifications to port or terminal configurations to the appropriate hydrographic authority so charts can be updated and the changes made readily available to chart users. In addition to marking hazards on their own charts and charting software, mariners can report issues (errors or omissions) with NOAA's nautical charts and/or *Coast Pilot* through the Office of Coast Survey.

In the *Radiance of the Seas* casualty, the cruise terminal had not reported a recent extension of a pier into the waterway to the appropriate hydrographic authority so that the relevant navigation chart could be updated. The fishing vessel *Challenger* took on water and capsized after striking an uncharted rock.

Avoiding Excessive Speed during Bow-to-bow Harbor-assist Operations

The risk of a casualty during bow-to-bow harbor-assist operations with ASD tugboats increases with increasing speed. Hydrodynamic forces around an assisted vessel's bow increase exponentially with speed, while the amount of reserve propulsion power available to the tugboat operator decreases. Therefore, owners and operators of ASD tugboats that perform bow-to-bow harbor-assist operations should set speed limits for these maneuvers. Additionally, tugboat operators should communicate pre-determined speed limits to pilots and ship masters in command of the vessels that they are assisting before engaging in these maneuvers.

Vessels traveling at an excessive speed for the harbor-assist maneuver led to the *George M/ MSC Aquarius* and *CC Portland* casualties.



Preventing Vessel Damage from the Risk of Thermal Runaway of Lithium-ion Batteries

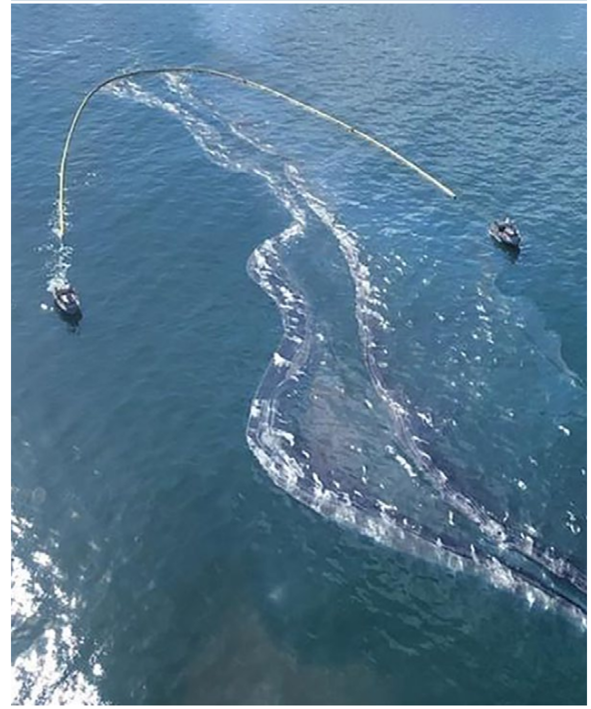
The risk of fire from lithium-ion batteries is a growing concern as their use becomes more prevalent in handheld radios and other devices. A lithium-ion battery cell—if damaged, shorted, overheated, defective, or overcharged—can spontaneously experience a thermal runaway, a chemical reaction that can cause the cell to ignite and explode. A cell that explodes can be propelled from its initial position within a battery and ignite combustible materials on a vessel. Due to the potential for rapid expansion of a lithium-ion battery fire, detection, containment, and extinguishment are essential to prevent damage to a vessel.

The *S-Trust* fire was caused by the thermal runaway of a lithium-ion battery cell for a handheld radio.

Reporting Potential Damage from Dragging Anchors

Underwater pipelines or other utilities can become damaged if anchorages are located too close and vessels drag anchor. Vessel crews should be aware of nearby underwater hazards while anchored and notify the appropriate authorities of an anchor-dragging event.

A leak occurred in the San Pedro Bay pipeline several months after two containerships, the *Beijing* and *MSC Danit*, dragged anchor in heavy winds and seas.



"It is our sincere hope that you apply the knowledge uncovered by our world-renowned investigators to prevent future marine casualties and save lives."
— Jennifer Homendy, NTSB Chair

Table of Vessel Particulars by Vessel Group

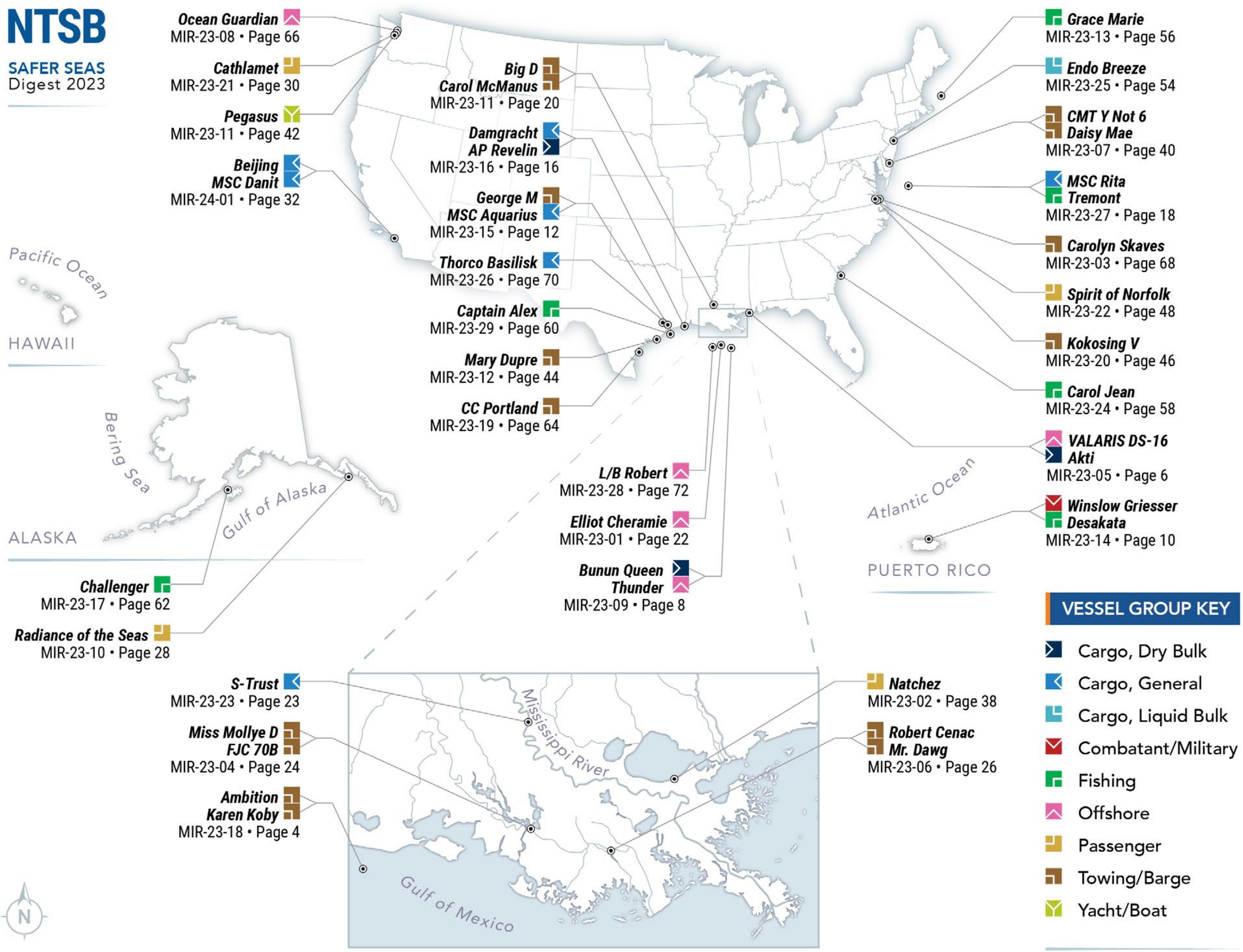
REPORT NUMBER	VESSEL NAME	VESSEL TYPE	FLAG	LENGTH	BEAM/WIDTH	DRAFT	PERSONS ON BOARD	SEE PAGE
Cargo, Dry Bulk								
MIR-23-05	***Akti***	Dry bulk carrier	Marshall Islands	623.3 ft (190.0 m)	106.0 ft (32.3 m)	19.4 ft (5.9m)	**22**	6
MIR-23-09	***Bunun Queen***	Dry bulk carrier	Liberia	590.2 ft (179.9 m)	98.4 ft (30.0 m)	20.4 ft (6.2 m)	**20**	8
MIR-23-16	***AP Revelin***	General cargo vessel	Croatia	590.4 ft (180.0 m)	104.9 ft (32.0 m)	31.2 ft (9.5 m)	**19**	16
Cargo, General								
MIR-23-15	***MSC Aquarius***	Containership	Cyprus	983.9 ft (299.9 m)	131.2 ft (40.0 m)	39.0 ft (11.9 m)	**31**	14
MIR-23-16	***Damgracht***	Dry bulk carrier	Netherlands	514.9 ft (156.9 m)	74.8 ft (22.8 m)	26.6 ft (8.1 m)	**16**	16
MIR-23-26	***Thorco Basilisk***	Multi-purpose	Switzerland	529.7 ft (161.5 m)	82.7 ft (25.2 m)	26.2 ft (8.0 m)	**31**	70
MIR-23-27	***MSC Rita***	Containership	Panama	1,065.6 ft (324.8 m)	141.0 ft (43.0 m)	44.6 ft (13.6 m)	**22**	18
MIR-24-01	***Beijing***	Containership	Malta	1,150.1 ft (350.6 m)	140.4 ft (42.8 m)	42.7 ft (13.0 m)	**22**	32
MIR-24-01	***MSC Danit***	Containership	Panama	1,199.0 ft (365.5 m)	168.0 ft (51.2 m)	52.5 ft (16.0 m)	**20**	32
Cargo, Liquid Bulk								
MIR-23-19	***LNG Fukurokuju***	Liquefied natural gas carrier	Bahamas	961.3 ft (293.0 m)	160.4 ft (48.9 m)	33.7 ft (10.3 m)	**27**	64
MIR-23-23	***S-Trust***	Oil tanker	Liberia	800.0 ft (243.8 m)	137.8 ft (42.0 m)	31.2 ft (9.5 m)	**23**	52
MIR-23-25	***Endo Breeze***	Chemical tanker	Malta	600.0 ft (182.9 m)	106.0 ft (32.2 m)	18.9 ft (5.8 m)	**20**	54
Combatant/Military								
MIR-23-14	***Winslow Griesser***	Coast Guard fast response cutter	United States	153.5 ft (46.8 m)	25.4 ft (7.7 m)	9.8 ft (3.0 m)	**21**	10
Fishing								
MIR-23-13	***Grace Marie***	Fishing vessel	United States	65.3 ft (19.9 m)	21.0 ft (6.4 m)	8.2 ft (2.5 m)	**7**	56
MIR-23-14	***Desakata***	Fishing vessel	United States	23.0 ft (7.0 m)	8.3 ft (2.5 m)	1.5 ft (0.5 m)	**2**	10
MIR-23-17	***Challenger***	Fishing vessel	United States	52.5 ft (16.0 m)	15.0 ft (4.6 m)	4.5 ft (1.4 m)	**4**	62
MIR-23-24	***Carol Jean***	Fishing vessel	United States	71.9 ft (21.9 m)	20.4 ft (6.2 m)	6.0 ft (1.8 m)	**0**	58
MIR-23-27	***Tremont***	Fishing vessel	United States	114.5 ft (34.9 m)	42.0 ft (12.8 m)	11.0 ft (3.4 m)	**13**	18
MIR-23-29	***Captain Alex***	Fishing vessel	United States	86.7 ft (26.4 m)	26.0 ft (7.9 m)	12.5 ft (3.8 m)	**4**	60

REPORT NUMBER	VESSEL NAME	VESSEL TYPE	FLAG	LENGTH	BEAM/WIDTH	DRAFT	PERSONS ON BOARD	SEE PAGE
Offshore								
MIR-23-01	***Elliot Cheramie***	Offshore supply vessel	United States	150.0 ft (45.7 m)	36.0 ft (11.0 m)	8.5 ft (2.6 m)	**9**	22
MIR-23-05	***VALARIS DS-16***	Mobile offshore drilling unit	Marshall Islands	752.0 ft (229.2 m)	118.1 ft (36.0 m)	28.2 ft (8.6 m)	**164**	6
MIR-23-08	***Ocean Guardian***	Offshore supply vessel	United States	260.8 ft (79.5 m)	60.0 ft (18.3 m)	14.7 ft (4.5 m)	**22**	66
MIR-23-09	***Thunder***	Offshore supply vessel	United States	96.0 ft (29.3 m)	34.0 ft (10.4 m)	17.1 ft (5.2 m)	**18**	8
MIR-23-28	***L/B Robert***	Liftboat	United States	185.1 ft (56.4 m)	135.1 ft (41.2 m)	N/A (elevated)	**0**	72
Passenger								
MIR-23-02	***Natchez***	Passenger vessel	United States	236.0 ft (71.9 m)	46.0 ft (14.0 m)	7.9 ft (2.4 m)	**1**	38
MIR-23-10	***Radiance of the Seas***	Cruise ship	Bahamas	961.7 ft (293.1 m)	105.6 ft (32.2 m)	27.9 ft (8.5 m)	**2161**	28
MIR-23-21	***Cathlamet***	Ferry	United States	328.0 ft (100.0 m)	78.8 ft (24.0 m)	16.6 ft (5.1 m)	**94**	30
MIR-23-22	***Spirit of Norfolk***	Small passenger vessel	United States	169.0 ft (51.5 m)	38.0 ft (11.6 m)	6.3 ft (1.9 m)	**108**	48
Towing/Barge								
MIR-23-03	***Carolyn Skaves***	Barge	United States	180.0 ft (54.9 m)	60.0 ft (18.3 m)	4.5 ft (1.4 m)	**4**	68
MIR-23-04	***Miss Mollye D***	Towing vessel	United States	86.0 ft (26.2 m)	34.0 ft (10.4 m)	9.2 ft (2.8 m)	**5**	24
MIR-23-04	***FJC 70B***	Barge (***Miss Mollye D*** tow)	United States	200.0 ft (61.0 m)	35.0 ft (10.7 m)	4.0 ft (1.2 m)	**0**	24
MIR-23-06	***Robert Cenac***	Towing vessel	United States	60.0 ft (18.3 m)	28.0 ft (8.5 m)	6.0 ft (1.8 m)	**4**	26
MIR-23-06	***Mr. Dawg***	Barge	United States	150.0 ft (45.7 m)	60.0 ft (18.3 m)	4.0 ft (1.2 m)	**0**	26
MIR-23-07	***CMT Y Not 6***	Barge	United States	300.0 ft (91.4 m)	100.0 ft (30.5 m)	12.0 ft (3.7 m)	**0**	40
MIR-23-07	***Daisy Mae***	Towing vessel	United States	140.0 ft (42.7 m)	42.0 ft (12.8 m)	11.5 ft (3.5 m)	**5**	40
MIR-23-12	***Mary Dupre***	Towing vessel	United States	67.3 ft (20.5 m)	24.1 ft (7.3 m)	9.2 ft (2.8 m)	**4**	44
MIR-23-15	***George M***	Tugboat	United States	98.5 ft (30.0 m)	42.7 ft (13.0 m)	20.0 ft (6.1 m)	**4**	14
MIR-23-18	***Ambition***	Barge	United States	195.0 ft (59.4 m)	70.0 ft (21.3 m)	4.5 ft (1.4 m)	**0**	4
MIR-23-18	***Karen Koby***	Towing vessel	United States	94.4 ft (28.8 m)	29.0 ft (8.8 m)	10.0 ft (3.1 m)	**4**	4
MIR-23-19	***CC Portland***	Tugboat	United States	102.5 ft (31.2 m)	42.6 ft (13.0 m)	19.0 ft (5.8 m)	**5**	64
MIR-23-20	***Kokosing V***	Barge	United States	150.0 ft (45.7 m)	55.0 ft (16.8 m)	11.0 ft (3.4 m)	**4**	46
MIR-23-30	***Big D***	Towing vessel	United States	133.4 ft (40.7 m)	42.0 ft (12.8 m)	10.2 ft (3.1 m)	**7**	20
MIR-23-30	***Carol McManus***	Towing vessel	United States	162.7 ft (49.6 m)	50.0 ft (15.2 m)	11.7 ft (3.6 m)	**9**	20
Yacht/Boat								
MIR-23-11	***Pegasus***	Yacht	United States	79.9 ft (24.4 m)	18.7 ft (5.7 m)	5.3 ft (1.6 m)	**6**	42

Table of Casualties and Location Map

VESSEL NAME	VESSEL GROUP AND TYPE	CASUALTY LOCATION	COORDINATES	PAGE
CAPSIZING/LISTING				
Ambition / Karen Koby	Barge / Towing vessel	Gulf of Mexico, 48 miles southeast of Cameron, **Louisiana**	29°17.21'N, 92°37.18'W	4
COLLISION				
VALARIS DS-16 / Akti	Mobile offshore drilling Unit / Dry bulk carrier	Bayou Casotte, Pascagoula, **Mississippi**	30°20.1' N, 88°30.57' W	6
Bunun Queen / Thunder	Dry bulk carrier / Offshore supply vessel	Gulf of Mexico, 66 miles south of Port Fourchon, **Louisiana**	28°0.58' N, 90°20.49' W	8
Winslow Griesser / Desakata	Coast Guard fast response cutter / Fishing vessel	Atlantic Ocean, near Dorado, **Puerto Rico**	18°32.3' N, 66°17.8' W	10
George M / MSC Aquarius	Tugboat / Containership	Houston Ship Channel, Upper Galveston Bay, **Texas**	29°39.58' N, 94°58.37' W	12
Damgracht / AP Revelin	General cargo vessel / Dry bulk carrier	Sabine Pass, Port Arthur, **Texas**	29°37.52' N, 93°49.3' W	16
MSC Rita / Tremont	Containership / Fishing vessel	Atlantic Ocean, 55 miles southeast of Chincoteague, **Virginia**	37°36.72' N, 74°14.71' W	18
Big D / Carol McManus	Towing vessel / Towing vessel	Lower Mississippi River, mile 312, near Fort Adams, **Mississippi**	31°03.31' N, 91°33.81' W	20
CONTACT				
Elliot Cheramie	Offshore supply vessel	Gulf of Mexico, 77 miles southwest of Port Fourchon, **Louisiana**	28°27.21' N, 91°27.34' W	22
Miss Mollye D / FJC 70B	Towing vessel / Barge	Bayou Boeuf, 1.3 miles southeast of Morgan City, **Louisiana**	29°40.66' N, 91°8.38' W	24
Robert Cenac / Mr. Dawg	Towing vessel / Barge	Gulf Intracoastal Waterway, Houma, **Louisiana**	29°35.87' N, 90°42.62' W	26
Radiance of the Seas	Cruise ship	Sitka Sound, near Sitka, **Alaska**	57°07.07' N, 135°23.72' W	28
Cathlamet	Ferry	Puget Sound near Fauntleroy, **Washington**	47°31.23' N, 122°23.48' W	30
Beijing / MSC Danit (anchor strike of underwater pipeline in San Pedro Bay)	Containership / Containership	San Pedro Bay, near Huntington Beach, **California**	33°34.20' N, 118°7.26' W	32
FIRE/EXPLOSION				
Natchez	Passenger vessel	Industrial Canal, New Orleans, **Louisiana**	30°1.58' N, 90°1.93' W	38
CMT Y Not 6 / Daisy Mae	Barge / Towing vessel	Delaware Bay, about 12 mi east-northeast of Bowers, **Delaware**	39°7.04' N, 75°11.25' W	40
Pegasus	Yacht	Peninsula Yacht Basin, Gig Harbor, **Washington**	47°20.32' N, 122°35.23' W	42
Mary Dupre	Towing vessel	Gulf Intracoastal Waterway (mile 408), Freeport, **Texas**	28°51.4' N, 095°29.36' W	44
Kokosing V	Barge	James River, Newport News, **Virginia**	36°59.16' N, 76°26.62' W	46
Spirit of Norfolk	Small passenger vessel	Elizabeth River, near Norfolk, **Virginia**	36°55.31' N, 76°20.48' W	48
S-Trust	Oil tanker	Lower Mississippi River, mile 229, Baton Rouge, **Louisiana**	30°26.47' N, 91°11.99' W	52
Endo Breeze	Chemical tanker	Raritan Bay West Reach Channel, Raritan Bay, **New Jersey**	40°30.15' N, 74°9.89' W	54
FLOODING/HULL FAILURE				
Grace Marie	Fishing vessel	Atlantic Ocean, 80 miles east of Gloucester, **Massachusetts**	42°41.31 N, 68°46.37' W	56
Carol Jean	Fishing vessel	Atlantic Ocean, about 13 miles east of Tybee Island, **Georgia**	31°56.6' N, 80°37.9' W	58
Captain Alex	Fishing vessel	Gulf of Mexico, 15 miles south-southwest of Galveston, **Texas**	29°02.48' N, 94°52.38' W	60
GROUNDING/STRANDING				
Challenger	Fishing vessel	Shelikof Strait, Karluk, Kodiak Island, **Alaska**	57°38.32' N, 154°19.16' W	62
CC Portland	Tugboat	Corpus Christi Ship Channel, Ingleside, **Texas**	27°49.28' N, 97°10.22' W	64
MACHINERY DAMAGE				
Ocean Guardian	Offshore supply vessel	Shilshole Bay, Seattle, **Washington**	47°41.2' N, 122°25.2' W	66
SHIP/EQUIPMENT/CARGO DAMAGE				
Carolyn Skaves	Barge	Willoughby Bay, Norfolk, **Virginia**	36°57.72' N, 76°16.5' W	68
Thorco Basilisk	Multipurpose	Greensport Terminal, Houston Ship Channel, near Houston, **Texas**	29°44.78' N, 95°11.11' W	70
OTHER				
L/B Robert	Liftboat	Gulf of Mexico, 80 miles southeast of Lake Charles, **Louisiana**	28°16.44' N, 92°6.25' W	72

Casualty Map



Acknowledgment

For each marine casualty 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:

REPORT NUMBER	VESSEL NAME(S)	UNIT
MIR-23-01	***Elliot Cheramie***	Coast Guard Marine Safety Unit **Houma**
MIR-23-02	***Natchez***	Coast Guard Sector **New Orleans**
MIR-23-03	***Carolyn Skaves***	Coast Guard Sector **Virginia**
MIR-23-04	***Miss Mollye D***	Coast Guard Marine Safety Unit **Morgan City**
MIR-23-05	***VALARIS DS-16 / Akti***	Coast Guard Sector **Mobile**
MIR-23-06	***Robert Cenac***	Coast Guard Marine Safety Unit **Houma**
MIR-23-07	***CMT Y Not 6 / Daisy Mae***	Coast Guard Marine Safety Detachment **Lewes** and Coast Guard Sector **Delaware Bay**
MIR-23-08	***Ocean Guardian***	Coast Guard Sector **Seattle**
MIR-23-09	***Bunun Queen / Thunder***	Coast Guard Marine Safety Unit **Houma**
MIR-23-10	***Radiance of the Seas***	Coast Guard Sector **Juneau**
MIR-23-11	***Pegasus***	Coast Guard Sector **Puget Sound**
MIR-23-12	***Mary Dupre***	Coast Guard Marine Safety Unit **Texas City**
MIR-23-13	***Grace Marie***	Coast Guard Sector **Boston** and Coast Guard Station **Gloucester**
MIR-23-14	***Winslow Griesser / Desakata***	Coast Guard Sector **San Juan**
MIR-23-15	***George M / MSC Aquarius***	Coast Guard Sector **Houston-Galveston**
MIR-23-16	***Damgracht / AP Revelin***	Coast Guard Marine Safety Unit **Port Arthur**
MIR-23-17	***Challenger***	Coast Guard Sector **Anchorage** and Coast Guard Marine Safety Detachment **Kodiak**
MIR-23-18	***Ambition/Karen Koby***	Coast Guard Marine Safety Unit **Houma**
MIR-23-19	***CC Portland***	Coast Guard Sector **Corpus Christi**
MIR-23-20	***Kokosing V***	Coast Guard Sector **Virginia**
MIR-23-21	***Cathlamet***	Coast Guard Sector **Puget Sound**
MIR-23-22	***Spirit of Norfolk***	Coast Guard Sector **Virginia** and Coast Guard **District 5** Formal Investigation Team
MIR-23-23	***S-Trust***	Coast Guard Marine Safety Unit **Baton Rouge**
MIR-23-24	***Carol Jean***	Coast Guard Marine Safety Unit **Savannah**
MIR-23-25	***Endo Breeze***	Coast Guard Sector **New York**
MIR-23-26	***Thorco Basilisk***	Coast Guard Sector **Houston-Galveston**
MIR-23-27	***MSC Rita / Tremont***	Coast Guard Sector **Virginia**
MIR-23-28	***L/B Robert***	Coast Guard Marine Safety Unit **Houma**
MIR-23-29	***Captain Alex***	Coast Guard Marine Safety Unit **Texas City**
MIR-23-30	***Big D / Carol McManus***	Coast Guard Marine Safety Detachment **Vicksburg**
MIR-24-01	***Beijing / MSC Danit***	Coast Guard Sector **Los Angeles-Long Beach**

Who Has the Lead:
USCG or NTSB?

In a memorandum of understanding signed June 17, 2021, the NTSB and the 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.

The NTSB may lead a major marine casualty investigation when, as defined in the memorandum of understanding, there is another transportation mode involved; 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.

NTSB marine investigator (*middle*) and Coast Guard personnel preparing to investigate the *Spirit of Norfolk* casualty. SOURCE: NTSB

NTSB Office of Marine Safety

The Office of Marine Safety (OMS) investigates marine casualties to determine the probable cause of each casualty and identify safety recommendations that will prevent similar events in the future. Investigated casualties include those classified by the Coast Guard as major marine casualties in US territorial waters or involving US-flagged vessels worldwide, and casualties involving both US public (government) and nonpublic vessels. In addition, the office investigates select catastrophic marine casualties, as well as those of a recurring nature.

These responsibilities are specified in the Independent Safety Board Act and Title 49 *Code of Federal Regulations* Part 850. Major marine casualties may include any one of the following:

- the loss of six or more lives.
- the loss of a mechanically propelled vessel of 100 or more gross tons.
- property damage initially estimated to be $500,000 or more.
- a serious threat, as determined by the Commandant of the Coast Guard with the concurrence of the NTSB Chair, to life, property, or the environment by hazardous materials.

After investigating each major marine casualty, OMS identifies safety issues and issues an investigation report, which may include safety recommendations to federal government agencies (such as the Coast Guard), state agencies, vessel owners and operators, vessel classification societies, or maritime industry organizations.

Under the International Maritime Organization's Casualty Investigation Code, OMS also participates with the Coast Guard as a Substantially Interested State in investigations of serious marine casualties involving foreign-flagged vessels in international waters. For example, the NTSB often participates in casualty investigations that involve foreign-flagged cruise ships with US citizens on board.

OMS also actively participates in US-based and international groups to improve marine investigations and promote maritime safety. This includes—

- reviewing US position papers related to marine casualty investigations,
- participating in International Maritime Organization meetings,
- staying abreast of the latest advancements, techniques, and technologies in marine casualty investigation and prevention, and
- collaborating with other marine casualty investigation organizations worldwide on investigations and other investigative activities aimed at improving safety.

OMS investigators at the scene of the *Spirit of Norfolk* casualty. SOURCE: NTSB

An OMS investigator (*middle*) with cadets after delivering a guest lecture at State University of New York Maritime College, Fort Schuyler, New York, April 2023.

Marine Safety Outreach and Advocacy

Advocating for our safety recommendations and promoting the lessons learned from our casualty investigations is a key part of NTSB's mission. OMS staff routinely engage with various marine stakeholders to share information about important safety issues. Here are some outreach highlights from 2023.

The OMS deputy director attended and presented at the Europe Marine Accident Investigators' International Forum, Copenhagen, Denmark, May 2023.

An OMS investigator presented "Lessons Learned from Marine Casualty Investigations" at the Coast Guard Sector Northern New England Annual Small Passenger Vessel Industry Day, South Portland, Maine, April 2023.

The OMS chief of investigations tested an immersive vessel simulator during the NOBRA and Maritime Pilots Institute vessel simulation program demonstration at NTSB headquarters, Washington, DC, September 2023.

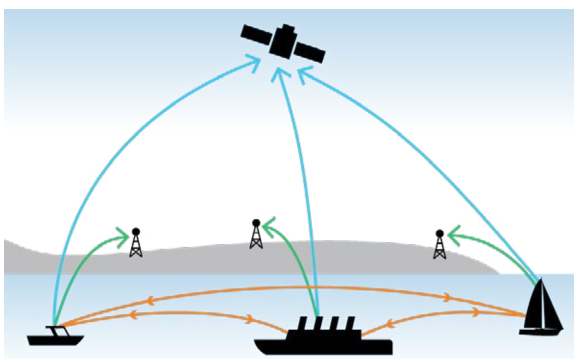
2023 Safety Alerts

NTSB **Safety Alerts** inform commercial and recreational vessel operators about safety hazards and practical remedies identified through NTSB accident investigations, safety studies, and recommendations. In 2023, OMS produced two Safety Alerts.

Reducing Collision Risk by Improving Small Vessel Detectability

Safety Alert 087 is a result of our investigation and report on the collision between Coast Guard Cutter *Winslow Griesser* and center-console boat *Desakata*, in which one person died. In this casualty investigation, we noted that small vessels constructed of wood or fiberglass are difficult to detect by radar. Even if producing a radar return, small vessels can be obscured by the trough of passing swells and make for intermittent radar targets. Early detection of a vessel is one of the best ways to avoid collision.

Owners of recreational boats and small commercial fishing vessels can use devices such as radar reflectors and AIS Class B or B+ to improve their vessels' detectability by enhancing nearby traffic's awareness of their position.



AIS provides digital positional awareness, ship to ship, ship to shore, and ship to satellite. SOURCE: NTSB

Personal Locator Devices: Improve Your Chance of Rescue

Safety Alert 089 is a result of our investigations of casualties in which crewmembers had to abandon a vessel without a means to communicate their individual locations to search and rescue assets. We found that currently available PLBs provide a location accuracy of about 300 feet and nearly instant search and rescue notification when activated.

Vessel owners and operators can enhance the safety of their crews by providing each crewmember with personal locator devices, such as PLBs or SENDs, to supplement EPIRBs.

***Clockwise from top*: PLB attached to lifejacket, exemplar PLB, and SEND.** SOURCES: VAREN, POWERANDMOTORYACHT.COM, AND BLUEWATERSAILING.COM

NTSB Safety Alerts can be accessed from the Safety Alerts page at ntsb.gov.

Marine Safety Recommendations

The NTSB issues safety recommendations to address safety concerns uncovered during investigations and to specify actions to help prevent similar casualties from occurring in the future. Safety recommendations are our most important product because they alert government, industry, and the public to the critical changes that are needed to prevent transportation accidents and crashes, reduce injuries, and save lives. We issue recommendations to the organizations best able to take corrective action, other federal and state agencies, manufacturers, operators, and industry and trade organizations. We also monitor the progress of action to implement each recommendation until it is closed, which usually takes several years.

- Since 1967, NTSB has issued more than 2,500 marine safety recommendations.
- As of the end of 2023, more than 100 marine safety recommendations remained open.
- Historically, we have issued about two-thirds of our marine safety recommendations to the Coast Guard.

NTSB Recommendations Closed in 2023

In 2023, we closed 30 marine safety recommendations acceptably, as follows:

- 11 to the Coast Guard from our 2016 VTS Safety Study, which examined the VTS system's ability to detect and recognize traffic conflicts and other unsafe situations, provide mariners with timely warning of such traffic conflicts and unsafe situations, and control vessel traffic movements in the interest of safety;
- 11 (one to the National Weather Service and 10 to the Coast Guard) from our investigation into the October 1, 2015, sinking of the freight vessel *El Faro* during Hurricane Joaquin, in which all 33 people on board perished; and
- 8 to industry groups and government agencies from various NTSB investigations covering topics such as waterway bridge safety improvements, weather forecasting, maintaining a proper lookout, and vessel stability.

Case Analysis and Reporting Online (CAROL)

CAROL is the NTSB's query tool to find information about our investigations and safety recommendations, including the latest status. **Ask CAROL at carol.ntsb.gov.**

NTSB National Transportation Safety Board

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