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NATIONAL TRANSPORTATION
SAFETY BOARD

SAFER SEAS DIGEST

2015

LESSONS LEARNED FROM MARINE ACCIDENT INVESTIGATIONS

Mission

The National Transportation Safety Board is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—marine, railroad, highway, and pipeline. The NTSB determines the probable cause of the accidents and issues safety recommendations aimed at preventing future accidents. In addition, the NTSB carries out special studies concerning transportation safety and coordinates the resources of the federal government and other organizations to provide assistance to victims and their family members impacted by major transportation disasters.

A Message from the Chairman

The year 2015 brought us another grim reminder of the importance of safety in marine transportation. The loss of all 33 crewmembers in the sinking of the *El Faro* in Hurricane Joaquin on October 1 turned our thoughts once again to how unforgiving the sea can be and the respect it demands. Our investigation of the *El Faro* sinking is still ongoing, but its toll underscores the indisputable importance of safety at sea.

The National Transportation Safety Board investigates accidents in all modes of transportation, determines probable causes, and makes safety recommendations as appropriate. In marine transportation, NTSB investigators work closely with our US Coast Guard counterparts to gather facts and evidence at the scene of an accident. I would like to thank the men and women of the Coast Guard not only for their collaborative investigative work alongside the NTSB, but also for their work to secure the scenes of accidents, and for the use of Coast Guard assets on which we rely in many cases. Once all the relevant facts have been gathered (both on scene and afterwards), the NTSB analyzes the information and publishes accident investigation reports so that mariners and others know the circumstances of an accident and what we recommend to avoid recurrences.

Safer Seas Digest 2015 is the third edition of this publication, our "one-stop shop" for mariners and others to review concise summaries of a full year's accident investigations. Since we first published *Safer Seas 2013*, we have heard that the yearly digests are used in crew training and safety meetings both on board and shoreside. Indeed, safety culture begins at the top; the lessons of *Safer Seas Digest* should be of interest not only at sea, but also in C-suites.

Safer Seas Digest 2015 represents our continuing commitment to sharing the lessons that we learn through our investigations. Many marine accidents can be prevented when crews know and respond to safety issues early and when crews work together effectively in the event of a crisis.

In this year's edition, you will find accidents involving multiple vessels grouped together for easier reference. We have also added a "Vessel Particulars" table, to give the reader quick access to more information about each accident vessel.

Following the accident summaries, you will also find an extended compilation of lessons learned from our many investigations. Finally, we have added an "Acknowledgments" section at the end of the publication listing the Coast Guard units that partnered with the NTSB in each investigation.

On behalf of the NTSB, I would like to take this opportunity to express our condolences to the families, friends, and colleagues of all those lost in the *El Faro* accident and indeed any marine accident. Sadly, our investigations cannot undo such tragedies; they can only provide signposts to safer voyages in the future.

We hope that *Safer Seas Digest 2015* continues to help those in the marine industry discuss and address the safety issues affecting their vessels and operations.

Sincerely,

Christopher A. Hart

Christopher A. Hart
Chairman



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TOWING VESSELS AND TOWS

Acronyms

ABS
American Bureau of Shipping

AIS
Automatic identification system

ASD
Azimuthing stern drive

CP
Controllable pitch

ECR
Engine control room

ECS
Electronic chart system

GPS
Global positioning system

HMCS
Her Majesty's Canadian Ship

ITB
Integrated tug and barge

MLB
Motor lifeboat

MSD
Marine Safety Detachment

MSU
Marine Safety Unit

VHF
Very high frequency

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Allision of Bulk Carrier *Anna Smile* with Louis Dreyfus Grain Elevator

Houston Ship Channel, Houston, Texas

Damaged area of Anna Smile*'s hull. OPPOSITE PAGE, east tower of Louis Dreyfus grain elevator, which was damaged in the allision.*

The bulk carrier *Anna Smile* allided with the Louis Dreyfus grain elevator in Houston, Texas, at 0504 on July 14, 2014, while maneuvering during docking operations. Damage to the grain elevator and its foundation was estimated at $2.5 million. The *Anna Smile* suffered minor insets on the hull plating for a length of about 30 feet, but a damage estimate was not provided.

The *Anna Smile*'s diesel engine was directly coupled to a fixed pitch propeller and could be remotely controlled from two locations during normal operations—the bridge or the engine control room (ECR). Typically, the engine was remotely operated from the bridge, but on the day of the accident it was being controlled from the manned ECR.

As the ship approached the pier, the pilot (one of two Houston pilots on board) ordered the engine to stop, which was properly executed from the ECR. The next order was dead slow astern, but the engine failed to start as expected. Two more astern commands were given, yet again there was no response.

The engine finally responded astern about 3 minutes after the first astern command was received. At the time, the *Anna Smile* was about 30 feet from the pier and moving very slowly, about 0.1 knots astern.

To bring the ship's astern movement to a stop, the pilot ordered dead slow ahead, and once again the engine failed to start from the ECR console. The pilot ordered more ahead commands, each with no response. The chief engineer, third engineer, and electrician all left the ECR without calling the bridge; went into the machinery space; and began switching the engine to local control. During this time, the engine crew did not advise the bridge team, nor were the pilots made aware of the engine status or control location.

After noticing that the engine was not responding to their commands, the pilot ordered the engine to stop. The second mate called the ECR to check the status of the engine, unaware that the chief engineer had left the ECR and that the engine was no longer being controlled from this location. The bridge team was not advised to call the phone at the local engine control, as opposed to the ECR, to reach the chief engineer directly.

The lack of communication between the engine room and the bridge led to a period of confusion on the bridge. The captain began speaking in his native Greek language, while the Filipino second mate and helmsman spoke to each other in their native language. The captain repeatedly shouted, "Stop the engine!" into the phone, while the engine order telegraph rang unanswered for 47 seconds.

After engaging the local control station, the chief engineer started the engine at dead slow ahead despite the current stop command. Dead slow ahead was the last command that he was aware of before leaving the ECR. The engine continued to run in the ahead direction for about 1 minute until the chief engineer was told to stop the engine by the second engineer who ran down from the ECR. The main engine was eventually stopped by the engineers at the local control, but not before the starboard aft side of the *Anna Smile* made contact with the pier.

Following the accident, the engineering staff found excessive moisture in the control air system, which prevented the pneumatic changeover valves from functioning properly and starting the engine.

Interviews with the crew indicated that communication between the bridge and engineering teams broke down when the engine failed to start as expected and the engineers took control of the engine locally. The teams had no established procedures or training to effectively deal with such an emergency. The managing company's safety management system did not provide specific guidance on how to deal with a failure of the main engine control system from the ECR, nor did it require training for emergency engine operations of this nature.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the allision of the bulk carrier *Anna Smile* with the Louis Dreyfus grain elevator while docking was a lack of communication from the engineering staff to the vessel's bridge team and pilots while the vessel was experiencing problems with the starting system of the main engine as well as the absence of specific procedures and training for emergency engine operations.

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Grounding and Subsequent Breakup of Dive Vessel *King Neptune*

Avalon Harbor, Catalina Island, California

Beached wreckage of King Neptune*. OPPOSITE PAGE, the vessel before the accident (photo courtesy of owner).*

On the evening of December 30, 2014, in severe weather conditions, the dive vessel *King Neptune* broke loose from its moorings in Avalon Harbor, Catalina Island, California. A harbor patrol officer, who later jumped on board the vessel to try to move it to a safe mooring location, died after falling into the water and becoming pinned between the vessel and a seawall. Under continuous wave action, the *King Neptune* broke apart and subsequently sank, resulting in a total loss valued at $1.5 million.

Earlier that day, at 1412, the National Weather Service issued a small-craft advisory for the waters around Catalina Island. At the time, the advisory was issued the *King Neptune* was secured to a mooring buoy in Avalon Harbor.

The *King Neptune* owner told investigators that during the early afternoon he and the vessel's part-time captain discussed the sufficiency of the vessel's moorings. They decided to increase the number of mooring lines and have the vessel remain in the harbor rather than put to sea, or seek a more protected mooring location for the evening.

At 1500, the *King Neptune* part-time captain reported for work at his second job as a patrol officer with the Avalon Harbor Department. He was assigned to work that evening as a deckhand on board patrol boat 3, along with two other harbor patrol officers.

About 2225, the *King Neptune* bow lines parted. The winds at the time were gusting to 39 knots, and the seas were 10–14 feet. When the crewmembers on board patrol boat 3 learned that the *King Neptune* had broken loose, they promptly proceeded toward the dive vessel and the part-time captain agreed to jump on board (or be the "jumper," as harbor patrol officers would call a fellow officer boarding a vessel in this manner). According to the other patrol boat deckhand, the *King Neptune* was still attached to two mooring buoys by its stern lines. The jumper boarded the dive vessel but did not take a radio with him or establish a communication plan (beyond shouting in the howling winds to the other patrol officers). He went below deck to start the engines but was unsuccessful in moving the vessel. The jumper then attached a towline from patrol boat 3 to the *King Neptune* bow; however, the line parted. About this time, the *King Neptune* stern lines also parted from their moorings.

The dive vessel drifted into the harbor and approached the dangerous breaking surf near shore. After the jumper attached another towline to the *King Neptune* stern, patrol boat 3 began to tow the dive vessel. However, believing their boat was about to capsize, the patrol boat captain ordered the towline cut. Neither he nor the other patrol officer informed the harbor master's office that one of their crewmembers was on board the *King Neptune*.

About 2245, the *King Neptune* drifted into the breaking surf near the shore. The jumper attempted to leap from the *King Neptune* onto the seawall on shore; however, he mistimed his jump and landed in the surf. Moments later, he was pinned against the seawall by the surging vessel and died as a result of his injuries. All that remained of the *King Neptune* after a night of pounding was a partially submerged hull and engines.

Neither the city of Avalon harbor regulations nor the Avalon harbor master had guidance addressing safe mooring in inclement weather. Also, no guidelines or formal training had been established regarding how Avalon Harbor Department patrol officers were to determine if a particular jump between vessels was safe, whether a patrol boat could tow a much larger vessel in high winds and rough seas, how to tow a vessel in severe weather conditions, or when and how to retrieve a harbor patrol officer from a vessel in severe weather conditions.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the breakup and subsequent sinking of the *King Neptune* was the failure of the vessel's mooring equipment in severe weather conditions and the Avalon Harbor Department's inability to prevent the vessel from drifting ashore. Contributing to the death of the patrol officer who jumped on board was the Avalon Harbor Department's decision to allow personnel to board a drifting vessel in severe weather conditions without a plan for communication and retrieval.

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Fire on board Saturation Diving Support Vessel *Ocean Patriot*

Gulf of Mexico, south-southwest of Port Fourchon, Louisiana

Damaged electrical cables and cable tray on Ocean Patriot. *OPPOSITE PAGE, the vessel after the fire.*

On the evening of November 28, 2013, a fire broke out in the forward machinery space of the saturation diving support vessel *Ocean Patriot* while under way in the Gulf of Mexico about 50 miles south-southwest of Port Fourchon, Louisiana, but was brought under control by the vessel's fixed fire suppression system without serious injury. Damage to the vessel was estimated at $9.8 million.

The *Ocean Patriot* was outfitted with a fire detection system as well as an oxygen monitoring system. At 2215, both systems sent alarms to the bridge and engine control room (ECR) alerting watchstanders of a situation in the machinery space. When the assistant engineer, who was on watch in the engine room, left the ECR to investigate, he encountered smoke on the mezzanine deck and reported the fire to the bridge.

According to the assistant engineer, the fire was located in a cable tray above an electrical motor control center; the area directly underneath the cable tray was used for storing items such as cardboard and air filters. As the first on scene, he attempted to fight the fire with a portable extinguisher but without success. On the bridge, the chief mate notified the captain, rang the general alarm, and informed the crew of the situation.

During the fire, the vessel's electrical generators began struggling to maintain power. An electrical safety device automatically tripped one engine offline when it sensed a reduction in engine speed. The chief engineer secured the other two generators as their speed and system voltage began dropping rapidly. After the main generators were secured, the emergency generator started and supplied limited power to the vessel. The vessel had no power to the auxiliary and propulsion systems but maintained power to the radars and radios.

Fire teams attempted to fight the fire but quickly reported excessive heat and smoke. At 2240, the *Ocean Patriot* captain ordered the release of the FM-200 (heptafluoropropane) fixed fire suppression system. The ECR monitoring system was equipped with an alarm point that would alert the watch engineer in the event FM-200 was released in any of the following five spaces: engine room, propulsion thruster room, emergency generator room, saturation generator room, and ECR. Although the crew did not receive an alarm via the engine room monitoring system (they believed the communication wires were severed by the fire), they were confident the system was discharged as they heard a "hissing roar" from the FM-200 system when it was activated.

About 15 minutes after the FM-200 release, the chief engineer found the steel deck above the fire smoking and buckled. He used a fire axe to break cement above the steel deck to allow cooling water to flow directly onto the steel. The FM-200 agent successfully extinguished the fire. Crewmembers continued to cool and monitor surrounding areas through the night and into the following morning until the vessel reached port.

Several vessels and a US Coast Guard helicopter arrived to assist. Twenty-seven nonessential personnel were transferred from the *Ocean Patriot* and taken ashore, including the assistant engineer who needed oxygen. The vessel was towed to Port Fourchon, from where it had departed earlier on the day of the accident.

An integrated forensic engineering investigation firm confirmed that the source of ignition was damaged electrical cables located in a cable tray that contained combustible material in storage racks just below. The fire damaged motor control centers and their associated cabling, helium storage bottles, a ventilation trunk, and various piping systems. Considerable smoke and soot damage was found in the machinery space, and the diving deck equipment stored there was also damaged. A main generator and frequency drive sustained water damage, and heat from the fire caused severe buckling to the main deck in the changing area.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the fire on board the *Ocean Patriot* was damage to electrical cables due to the tightly installed metal securing bands in a cable tray chafing the protective layers of the cables and creating an ignition point. Contributing to the extensive damage was the combustible material stored immediately below the cable tray area fueling the fire.

12

Sinking of Fishing Vessel *Blazer*

Pacific Ocean, off Siletz Bay, Oregon

Blazer, *loaded with crab pots in port, before sinking. OPPOSITE PAGE, the vessel in May 2013. (Photos by Coast Guard)*

On November 29, 2014, at 0611, the fishing vessel *Blazer*, loaded with Dungeness crab pots, sank in the Pacific Ocean about 8 miles west of Siletz Bay, Oregon. All five crewmembers abandoned ship; a few sustained minor injuries during the rescue. The *Blazer*, valued at $950,000, sank with 2,000 gallons of diesel fuel and mixed lube oil products on board; however, no pollution was sighted.

The *Blazer* departed its home port of Newport, Oregon, shortly after midnight on the day of the sinking carrying 500 Dungeness crab pots. The captain and four crewmembers intended to transit about 80 miles north to set the crab pots near a fishing site off Cape Falcon, Oregon. According to the captain, the vessel was on an even keel and had about 12–18 inches of freeboard when it departed.

As the voyage continued, the weather deteriorated, with winds and seas increasing to 25–30 knots and 10–14 feet, respectively. About 0345, the *Blazer* began listing about 5–7 degrees to starboard. The captain made a slight course change to port so that the vessel's bow would head more directly into the seas, but the starboard list remained. The captain indicated that the crab pots on deck did not appear to have shifted and that no bilge alarm had activated.

The captain thought that the list may have resulted from flooding in either the dry no. 2 fish hold (which held 50 crab pots) or one of the empty fuel tanks. In response, he went below deck to the engine room where he started the pumps for the no. 2 fish hold. He also instructed the other crewmembers to cut loose the crab pots on the starboard side of the main deck, as the list to starboard had increased to about 10–15 degrees. According to crew statements, the crew pushed about 50 crab pots overboard, but the list was not corrected. When the *Blazer* listed to nearly 20 degrees, the captain began turning the vessel in a circle to starboard to heel the vessel to port, but this attempt was unsuccessful. When the starboard list neared 30 degrees, the *Blazer* lost steerage ability. At this point, the captain concluded that he could not save the vessel and began preparations for all of the crewmembers to abandon ship.

At 0417, as the list increased, the captain broadcasted a Mayday call and provided the Coast Guard information on the *Blazer*'s position and the number of persons on board. About 0425, with the list increasing to 60–80 degrees starboard, the captain and the crew donned survival suits and boarded the inflatable liferaft. Later, a Coast Guard helicopter and motor lifeboat arrived on scene and rescued the *Blazer* crewmembers. At 0611, the *Blazer* disappeared beneath the waves. Coast Guard personnel reported a strong smell of diesel fuel but did not see any sheen.

To determine how seawater entered the *Blazer*, investigators evaluated the captain's description of the fuel tank piping system, among other factors. The system's fill lines, which were 2 inches in diameter, passed up through the main deck and were capped. However, the 1.5-inch-diameter vent lines had no check valves on deck. The rough seas, coupled with the heavily loaded vessel, may have allowed water to enter the vessel via these vent lines, but this could not be conclusively determined.

Because the *Blazer* was less than 79 feet long, it was not required to comply with the stability standards of the *Code of Federal Regulations* and therefore not required to have a stability test. Also, because the *Blazer* did not have to comply with stability standards, the loads being carried on board—crab pots, fuel, water, and oil—were accepted as satisfactory based solely on the captain and owner's assessment, which, in turn, was based on previous experience.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the sinking of the *Blazer* was flooding from an unknown point of ingress.

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Capsizing and Sinking of Fishing Vessel *Christopher's Joy*

Gulf of Mexico, near Southwest Pass, Louisiana

The stern of Christopher's Joy *after the rescue of two surviving crewmembers (photo by crew on responding vessel* Miss Anna*).*
OPPOSITE PAGE, the vessel in 2004 (photo by Vladimir Knyaz).

Two crewmembers were presumed dead after the fishing vessel *Christopher's Joy* capsized and later sank while trawling in the Gulf of Mexico near Southwest Pass, Louisiana, on September 23, 2014. The surviving master and crewmember suffered minor lacerations. Loss of the vessel was estimated at $460,000.

About 1430 on the day of the accident, the *Christopher's Joy* was fishing at a speed of about 3.3 knots when the master decided to turn the vessel to port. During the turn, the list became very heavy. The master reduced speed, but equipment holding the starboard outrigger to the gunwale failed, allowing the outrigger to move rapidly upward into its upright position. The vessel's angle of heel to port increased significantly, submerging the aft port section of the main deck. In response, the master brought the throttle back to idle and put the transmission in neutral.

While the vessel was heeling, the crew tried to stabilize it by attempting to release the fishing gear, but they were unable to do so. Water began to enter the interior of the vessel through a watertight door that had been left open to access winches for the fishing gear. The master radioed a nearby vessel and asked it to stand by to assist, but then the *Christopher's Joy* rapidly rolled further to port and capsized.

The master and one crewmember pulled themselves onto the overturned vessel. A second crewmember was seen attempting to swim toward the vessel but appeared unable to swim fast enough to keep up with the current as well as the movement of the vessel. He was last seen struggling to stay afloat about 40–50 yards from the vessel's hull.

The third crewmember was heard knocking on the hull from the engine room. The master and surviving crewmember communicated with him for about 45 minutes to explain to him how to escape from the engine room, but communications ceased afterwards.

The vessel sank below the surface at 2057. The Coast Guard launched a cutter, aircraft, and small boat to search for the missing crewmembers, and a nearby commercial helicopter assisted. The search effort continued for 2 more days, but neither of the missing crewmembers was located.

Given the wind, sea, and current conditions as well as the trawl arrangement, the *Christopher's Joy* heeling event was likely due to the master's operational inputs during the port turn—that is, either the excessive speed, excessive rudder angle, or both. The combined effect of these inputs increased the tension on the towline attached to the starboard outrigger, which could have caused the outrigger equipment to fail. The rapid, uncontrolled movement of the outrigger to its upright position then moved the *Christopher's Joy*'s center of gravity upward, compounding the heel and eventually capsizing the vessel.

The master said he felt that the angle of outriggers on the *Christopher's Joy*, about 25 degrees above the horizon, was higher than normal compared to other trawlers. A higher angle raises the towing point and thereby the effective center of gravity of the attached trawl weight, which reduces the vessel's stability.

During his tenure on the *Christopher's Joy,* the master did not perform training drills for emergencies involving fire, man overboard, or uncontrolled flooding. He also did not conduct safety orientations, presuming that all the crewmembers were familiar with their responsibilities and knew where the lifejackets were stowed. Federal regulations, however, require that these drills and safety orientations be conducted for all documented fishing vessels that operate beyond the boundary line.

Consequently, the *Christopher's Joy* master and crew were not prepared to take effective action to address the emergency situation that arose on the day of the accident. Although the master indicated he took action to prevent the capsizing, his decisions were ineffective in recovering the vessel from its port list. Furthermore, the master's failure to prepare the crew to don lifejackets immediately and abandon the ship may have contributed to the loss of two crewmembers' lives.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the loss of the fishing vessel *Christopher's Joy* was the master's disregard for the impact of the deployed fishing gear upon the vessel's reserve stability while performing turning maneuvers. Contributing to the loss of life were inadequate safety training and practices.

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Fire on board Fish Processing Vessel *Juno*

Grays Harbor, Westport, Washington

Juno *under way before the accident (photo by Florian Kainz). OPPOSITE PAGE, fire damage to the stack and aft end of the vessel's house structure.*

In the early morning hours of Saturday, December 28, 2013, the fish processing vessel *Juno* caught fire while moored at its pier in Grays Harbor, Westport, Washington. Shoreside firefighters extinguished the blaze, which caused an estimated $424,000 in damage. The master suffered minor injuries.

The *Juno* operated as a fish tender, transporting fish and related products between fishing vessels, processors, and shore-based facilities. At the time of the accident, the vessel

was moored in Westport for minor maintenance; the master was the only crewmember on board.

The master told investigators that prior to the fire he spent the evening in his cabin, which was located on the second deck on the starboard side. He fell asleep around midnight and awoke about 0130 to the smell of smoke. After climbing down the ladder to the main deck, he found the aft bulkhead in the crew lounge on fire above a built-in bench seating area.

The master was unable to suppress the fire using a fire extinguisher. Having determined the fire was out of control, he abandoned ship to the pier. The fire spread quickly through the house from the main deck up to the second deck and bridge.

The local fire department was notified at 0134, and firefighters arrived at 0140 backed up by a second engine unit at 0148. Firefighters requested Coast Guard assistance at 0228 to provide waterside firefighting, and a motor lifeboat from Station Grays Harbor arrived at 0255. The fire was extinguished at 0424, re-flashed at 0718, and was completely extinguished at 0819.

The master went to the hospital following the fire due to both smoke inhalation and chest pain; he was released the next day.

The fire department report stated, "A lack of built-in 'structural fire stops' in the vessel …created a chimney effect which allowed superheated gases to spread to the cabin areas." In addition, the report found that modifications made to the vessel using combustible interior finishes such as plywood and wood paneling contributed to the fire's propagation.

An insurance company surveyor examined the vessel after the incident and identified the source of the fire as an electrical short in a space heater built into the bench seating in the crew lounge. Used also for storage, the seating area contained multiple combustible materials that were kept near the heater, including a container of paint, paint thinner, and a propane cylinder. The surveyor concluded that "the combustible materials stowed in very close proximity to the heater resulted in excessive heat build-up and igniting of the combustible materials."

Probable Cause

The National Transportation Safety Board determined that the probable cause of the fire on the fish processing vessel *Juno* was a space heater that experienced an electrical fault (short circuit). Contributing to the extent of the fire's damage was the improper stowage of flammable materials near the heater. Also contributing was the vessel's lack of structural fire protection and use of combustible materials in interior finishes.

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Grounding and Sinking of Commercial Fishing Vessel *Pacific Queen*

Duncan Canal, near Lung Island, Alaska

Pacific Queen *before the accident. OPPOSITE PAGE, light oil sheen sighted in the area of the vessel's sinking. (Photos by Coast Guard)*

The *Pacific Queen*, a wooden-hulled commercial fishing vessel, ran aground about 0100 on August 14, 2013, subsequently flooding and sinking in Duncan Canal near Lung Island, Alaska. All three crewmembers abandoned ship and were rescued without injury. The Coast Guard reported a light sheen on the water in the vicinity of the vessel after the sinking, but no additional evidence of pollution was found. Loss of the vessel totaled an estimated $225,000.

On the night of August 13, the *Pacific Queen* got under way from Wrangell, Alaska, for a 40-mile transit to Petersburg, Alaska. The captain said that just after midnight he felt too tired to continue his watch and woke his relief, deckhand no. 1, an hour early. However, the deckhand stated that he did not remember the captain waking him.

The captain went to his room without waiting for the deckhand to arrive on the bridge and without conducting a face-to-face watch turnover. For about an hour, the *Pacific Queen* remained under way at 8 knots in Sumner Strait with no one on the bridge. The fishing vessel continued on its heading, missing a major course change, and about 0100 struck the rocky eastern shore of Lung Island.

Deckhand no. 1 stated that he went to the bridge after the impact, discovered it was unmanned, and saw on the computer navigation screen that the vessel was aground on Lung Island. He was not sure if the vessel was still under way so he put the engines in neutral, then in reverse, and back to neutral again.

Immediately after the impact, another crewmember, deckhand no. 2, went to the engine room to check for flooding and, seeing no sign of water ingress, then proceeded to the bridge. When the vessel's bilge alarm sounded and the engine room flooding light illuminated, all three crewmembers went to the engine room and found water flooding into the space faster than the two bilge pumps could dewater the area. The captain told the crew to prepare to abandon ship. He instructed deckhand no. 2 to secure the fuel vents on the sides of the pilothouse, before the crew abandoned ship into the vessel's skiff.

Five minutes after the crew abandoned ship, the *Pacific Queen* sank. The crewmembers were in the skiff for 20–30 minutes before being rescued by a Good Samaritan vessel.

A Coast Guard crew flying in a helicopter over the area soon after the sinking observed a silver sheen on the water about 0.75 miles long and 20–60 feet wide. However, oil spill response services found no indication of the vessel or oil release during searches over the next 2 days. Although the captain estimated that the *Pacific Queen* was carrying 2,000 gallons of diesel fuel, Alaska Department of Environmental Conservation personnel believed a minimal amount of fuel was released because the fuel vents were secured prior to the sinking.

Investigators determined that flooding was not apparent when deckhand no. 2 first checked the engine room, in spite of the severity of the damage to the hull, because the rocks struck by the *Pacific Queen* likely were preventing water ingress. The obstruction was cleared when deckhand no. 1 put the vessel's engine astern, which resulted in uncontrolled flooding into the vessel below the waterline.

The captain and crew had irregular work/sleep schedules, reporting sleep periods as short as 5 hours on some nights, as long as 8 hours on other nights, and ranging from 4 to 9 hours during the day. This type of sleep/wake schedule variation often leads to disruptions in circadian rhythm, resulting in physical and cognitive fatigue. On the night of the grounding, the captain had been awake for about 13 hours, which included 6 hours of physical labor that involved unloading cargo from the vessel.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the sinking of the commercial fishing vessel *Pacific Queen* was the fatigued captain leaving the bridge unattended before he was properly relieved of his watch, resulting in the vessel continuing on its heading without navigational control and then grounding.

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Grounding of Commercial Fishing Vessel *Savannah Ray*

Long Island, Alaska

Savannah Ray *after running aground (photo by Coast Guard). OPPOSITE PAGE, the vessel at its spring 2014 survey prior to the accident (photo by Resurrection Technologies).*

About 0048 on February 16, 2015, the commercial fishing vessel *Savannah Ray* grounded on the lee shore of Long Island, Alaska, while traveling in rough seas from fishing grounds off Ugak Island in the Gulf of Alaska to the vessel's home port at St. Paul Harbor, Kodiak Island, Alaska. The vessel then washed up on the beach about 5 miles from St. Paul Harbor. The four crewmembers were rescued by a helicopter from Coast Guard Air Station Kodiak. As a result of the grounding, the *Savannah Ray* was deemed a constructive total loss at an estimated value of $800,000.

The captain said that during the evening before the accident he set the autopilot to a northeasterly course from Ugak Island to a position off Cape Chiniak, Alaska, while en route to St. Paul Harbor. He chose a northeasterly heading to have a comfortable ride in rough 15- to 18-foot seas. The captain then turned over the conn (navigational control) of the vessel to a deckhand and left orders to wake him when the vessel arrived at the Cape Chiniak waypoint to start his watch.

The captain said a deckhand woke him to assume the watch about midnight, which was earlier than expected, because the vessel had made better time than anticipated. According to automatic identification system (AIS) information, about 0003 on the morning of the accident the captain altered the vessel's course to a northwesterly direction. The new course would bring the vessel to a position northeast of Humpback Rock, where the captain planned on changing the vessel's track to a course for entering St. Paul Harbor. The captain said that after setting the autopilot to the new course he sat down in a chair next to the helm and fell asleep. With no one minding the helm, the vessel continued past the waypoint off Humpback Rock and, according to AIS data, grounded at 0048 in the shallow water off the southeast coast of Long Island.

The captain fell asleep sometime between 0003, when AIS information showed the vessel's change of course, and 0048, when he awoke after the vessel grounded. His fatigue and inability to stay awake during the hours of darkness, when the body is typically used to getting sleep, likely resulted from an inadequate amount of sleep in the hours and days before the accident. On the evening prior to the grounding, the captain had slept only 2 hours. During the previous days, the captain's sleep/wake cycle was very intermittent, averaging 4.5 hours at night and 1–2 hours during the day when he was able to get sleep. Additionally, the physical labor required to perform his duties during the voyage, especially during poor weather conditions, added to his fatigue.

Although the *Savannah Ray* was equipped with a Watch Commander Pro watch alarm system, the captain remained asleep while the vessel was under way. However, proper use of the watch alarm, which includes setting an appropriate time interval, likely would have prevented this accident and could prevent similar accidents from happening.

In addition, the *Savannah Ray* had two GPS receivers and two depth sounders on board. Alarms on the depth sounders, if properly set and activated, would sound to warn of shallow water depth. The vessel's GPS units could also be programmed to sound alarms as the vessel approached a preprogrammed waypoint or if the vessel strayed from a preprogrammed course. The captain stated that he used none of those alarms. If the watch and navigation alarms had been used properly, they might have prevented this accident by alerting the captain and other crewmembers to take action to correct the vessel's track and avoid entering shallow water.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the grounding of the *Savannah Ray* was the vessel straying off course and entering shallow water because the captain fell asleep while navigating due to fatigue. Contributing to the grounding was the captain's failure to use all of the vessel's available alerting and navigation alarms.

22

Grounding and Sinking of Commercial Fishing Vessel *Titan*

Jetty A, off Cape Disappointment, Ilwaco, Washington

Titan*'s stern on the day of the grounding (photo by Coast Guard). OPPOSITE PAGE, the vessel under way before the accident (photo by HD Fisheries).*

About 0215 on December 5, 2014, while proceeding outbound on the Columbia River, the commercial fishing vessel *Titan* grounded at the southern end of Jetty A off Cape Disappointment, Ilwaco, Washington. The vessel sustained hull damage and began to flood. When efforts to dewater the *Titan* were unsuccessful, the five crewmembers abandoned ship after a Coast Guard motor lifeboat arrived on scene. The next day the vessel sank. The *Titan*

and its catch, an estimated 40,000 pounds of Dungeness crab, were declared a total loss estimated at $1.825 million. The vessel was not recovered.

The *Titan* was fishing for Dungeness crab in the offshore waters of Washington and Oregon from December 1 to the night of December 4, when one of the vessel's two owners requested to be dropped off in Hammond, Oregon. The other owner, who was working as the captain, told investigators that he went to sleep about 2200 while the co-owner navigated the vessel to Hammond. Just before midnight, the co-owner woke the captain so that he could bring the vessel into the Hammond basin. Once the co-owner disembarked, the vessel departed the basin outbound into the Columbia River for the fishing grounds.

After clearing the Hammond basin, the captain activated the vessel's autopilot system and set it to steer in a northwest direction back through the main shipping channel of the Columbia River. The autopilot was configured to steer by heading, not along a course line or preset route.

A bar pilot on board a car carrier nearby stated that as both vessels continued outbound through the main shipping channel of the Columbia River the *Titan* looked as if it was headed toward Ilwaco, a fishing port on the north side of the channel. As the car carrier approached buoy 11, the pilot told the bridge team that the *Titan*'s radar target had moved onto Jetty A. He attempted to contact the *Titan* via radio but was unsuccessful.

The captain said that immediately before the grounding he noticed that the pilings from Jetty A were about 150 feet ahead of the vessel. He tried to disengage the autopilot so that he could operate the rudder; he also moved the propulsion control lever to astern propulsion. Despite these efforts, the vessel grounded on the rocks, resulting in two hull penetrations and subsequent flooding in the engine compartment.

Because the flooding could not be contained the crew abandoned the vessel. The *Titan* stayed partially afloat by the stern through the next day, until about 0830 on December 6 when a salvage tug reported that the *Titan* had sunk completely. Oil sheens were seen on the water, due to the loss of about 4,600 gallons of diesel, hydraulic, and lubricating oils on board the vessel.

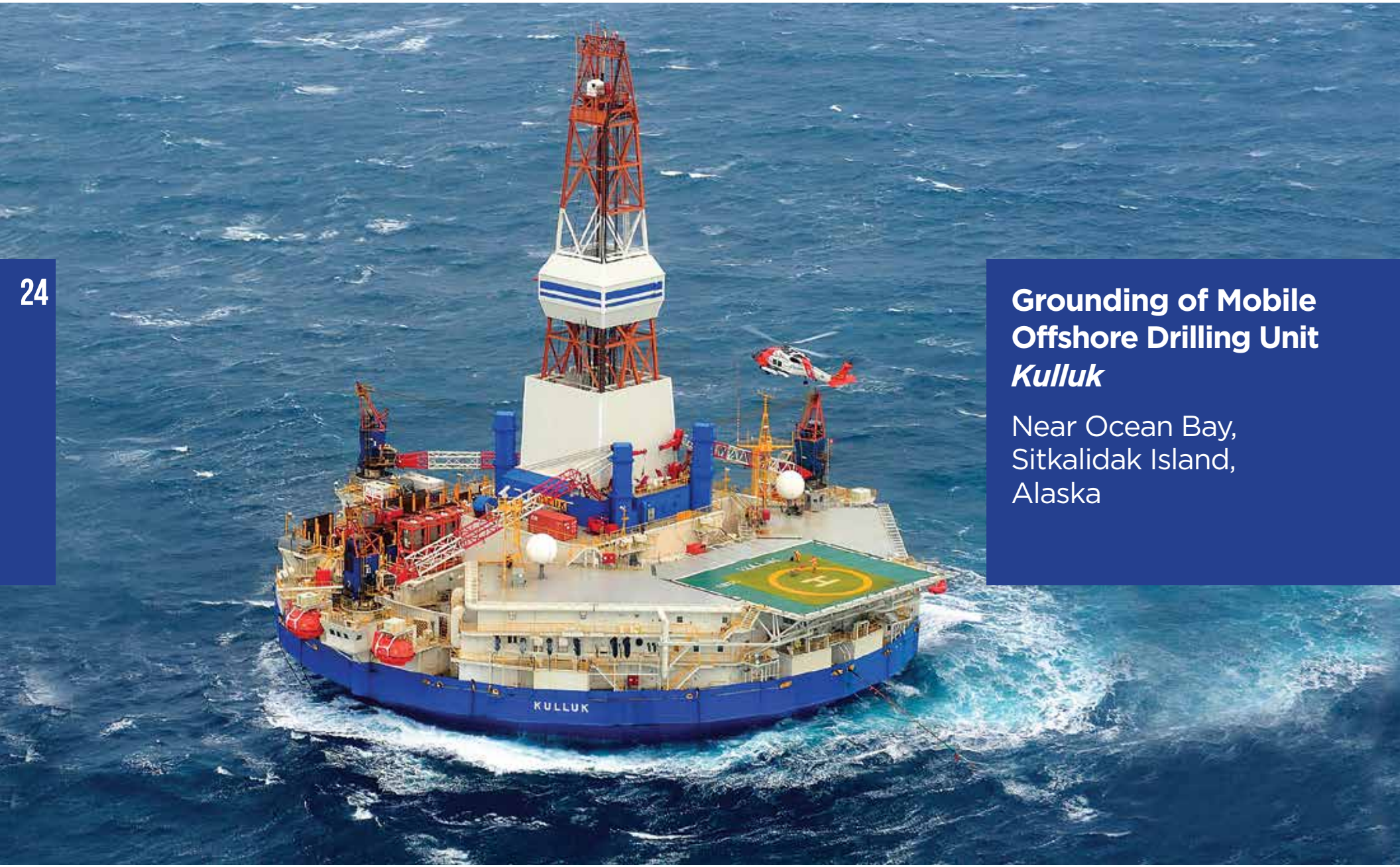
The *Titan* was equipped with a wheelhouse watch alarm that could sound loudly and flash a red light after a preset time had elapsed. The captain stated that the watch alarm was off at the time of the accident.

The captain could not recall any specific details of the transit before seeing the jetty pilings, likely because he had fallen asleep. He estimated that he had received a total of about 9–12 hours of sleep between December 1 and the time of the accident. The broken and intermittent sleep cycles within this timeframe would result in degraded performance, impaired judgment, and an inability to stay awake, particularly during hours of darkness when the body is typically used to getting sleep. Crewmembers worked an average of 16 hours per day, some days up to 20 hours.

The crewmembers and both owners indicated that it was normal to enter the Dungeness crab fishery with the intent to fish as much, and as fast, as they could, which is known as "derby-style" fishing. In both Washington and Oregon, the start of the fishery began on December 1. Although the fishery would be open for more than 8 months, both owners stated that most of the crabs were caught during the first two weeks, after which the quantity of their catches would drop quickly. Thus, there was economic pressure for the owners of vessels, such as the *Titan*, to operate continuously at the beginning of the season, which led to fatigue among crewmembers.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the grounding and subsequent sinking of the *Titan* was the failure of the captain to monitor the vessel's track as a result of falling asleep due to an accumulated sleep deficit after 4 days of continuous operations and the vessel owners' lack of measures to mitigate crewmember fatigue. Contributing to the accident was the nature of the derby-style Dungeness fishery in the states of Washington and Oregon, which results in continuous fishing operations at the beginning of the season.



24

Grounding of Mobile Offshore Drilling Unit *Kulluk*

Near Ocean Bay, Sitkalidak Island, Alaska

A Coast Guard helicopter approaches Kulluk *to airlift crewmembers to safety (photo by Coast Guard). OPPOSITE PAGE,* Aiviq *towing the drilling unit before the grounding (photo from www.pbase.com).*

The mobile offshore drilling unit *Kulluk*, owned by Shell Offshore Inc., grounded in heavy weather near Ocean Bay on the eastern coast of Sitkalidak Island off Kodiak Island, Alaska, about 2040 on December 31, 2012. The *Kulluk*, under tow by the anchor-handling tug *Aiviq*, departed Captains Bay near Unalaska, Alaska, 10 days earlier bound for Seattle, Washington. Four crewmembers on the *Aiviq* suffered minor injuries. The *Kulluk* sustained substantial damage, including portions of the underwater hull; however, no damage estimate was provided.

The voyage was the *Kulluk*'s first transit through the Gulf of Alaska in winter. Shell considered shipyard capabilities and equipment to be more suitable in the Seattle area than in Alaska, which was a primary factor in the decision to tow the *Kulluk* to Washington.

The potential hazards facing the transit were known. Although rough weather was anticipated, according to the *Kulluk* offshore installation manager, "None of us expected to have seas as rough as we had." The 5-day forecast beginning the day of departure was considered by Shell officials and onboard managers to be acceptable for the vessel's planned departure.

The tow gear between the *Aiviq* and the *Kulluk* had been used on three previous voyages to tow the *Kulluk*. According to the *Aiviq*'s owner, heavy weather was encountered during two of the tows. A warranty surveyor stated that he visually inspected the tow gear with the tow master and found it to be in good shape. The tow master explained that the industry standard for the life of towing gear was 5 years and, based on the age of the gear, a visual inspection therefore was appropriate.

The first few days of the voyage were uneventful. On the second day, the National Weather Service predicted winds increasing to 35 knots over the next 2–3 days and seas reaching 17 feet in 5 days. Four days into the voyage, gale warnings were issued, with a forecast of winds up to 40 knots and seas up to 15 feet.

Six days after the vessels departed, the tow connecting the *Aiviq* to the *Kulluk* failed. Winds were at 15–20 knots, and sea swells were 20–25 feet, occasionally reaching 30 feet. Shell put its incident management team in Anchorage on notice immediately after the tow failure and was regularly informed of the *Aiviq* and *Kulluk*'s situation. Other vessels were brought to the area to assist.

Over the following days, the effort to tow the *Kulluk* met with repeated towline failures and the shutdown of the *Aiviq*'s engines. On the seventh day, in the face of worsening weather, Shell asked the Coast Guard to evacuate the 18 persons on board the *Kulluk*.

Although replacement engine parts were brought to the *Aiviq* and engine power was restored, towline failures continued. As another tow vessel attempted to move the *Kulluk* to safety, winds reached 55–60 knots and seas were 30–35 feet. The tow vessel was ordered to release the *Kulluk*, which grounded off Ocean Bay, Alaska.

Given the risks associated with the transit, including the likelihood of the tow encountering severe weather, Shell, who reviewed and approved the tow plan, should have either mitigated those risks or departed at a time of year when severe weather was less likely. Although multiple parties were involved, the ultimate decision to design, approve, and implement the tow was Shell's.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the grounding of the mobile offshore drilling unit *Kulluk* was Shell's inadequate assessment of the risk for its planned tow of the *Kulluk*, resulting in implementation of a tow plan insufficient to mitigate that risk.

26

Collision between US Fishing Vessel *American Dynasty* and Canadian Naval Frigate *Winnipeg*

Esquimalt, British Columbia, Canada

Winnipeg *and* American Dynasty*, which sustained significant damage to its bow, shortly after the collision (photo by* The Canadian Press*).*
OPPOSITE PAGE, damage to Winnipeg*'s port side at the point of impact (photo by Transportation Safety Board Canada).*

On April 23, 2013, at 0817, while preparing to enter a graving dock in Esquimalt, British Columbia, Canada, the US-flagged fishing vessel *American Dynasty* collided with the Canadian Navy frigate HMCS *Winnipeg* moored nearby, after veering off course following a loss of electrical power and propulsion control. Both vessels and the naval pier sustained extensive structural damage totaling more than $500,000 in repair costs. Six shipyard workers suffered minor injuries.

On the morning of the accident, the *American Dynasty* made its approach to Esquimalt Harbour, where it was scheduled to undergo a dry dock inspection. At 0735, the master reduced the controllable pitch (CP) propeller system to zero thrust and maintained the vessel's heading using the bow thruster. A docking pilot assumed control of the *American Dynasty* and, about 0815, requested that the master shut off both main engines and the radars to prepare for entering the graving dock.

The master informed the engine room that he was transferring propulsion control but did not identify the person with whom he was speaking. The oiler, who had taken the call from the captain, had not previously accepted propulsion control (the chief engineer had momentarily stepped out of the engine room). The oiler consulted with the electrician, who advised him to accept the propulsion control by pushing a button on the CP panel. However, the main engines also needed to be shut off, which the oiler did not know. The CP system was set at zero pitch, but both main engines were turning the propeller shaft.

About 15 seconds after the propulsion control transfer, the *American Dynasty* experienced a complete loss of electrical power. The auxiliary generator was still running, but the breaker that tied the power to the main electrical power bus had been tripped open. The chief engineer tried unsuccessfully to reconnect the auxiliary generator to the main switchboard; eventually the generator shut down. In addition, because the emergency generator was in "harbor mode" instead of "emergency mode," it was not set to automatically start and provide emergency power.

Although the CP control system was designed to maintain the last ordered pitch due to power loss, a leak in the system's hydraulic oil distribution box enabled the propeller pitch to move to the ahead direction. With the main engines still turning the propeller shaft, the vessel began to move ahead.

The master realized that the vessel's speed was increasing and that it was turning toward the *Winnipeg*, which was moored starboard side at the Canadian Forces Base. The master ordered the anchor dropped and tried to sound the vessel's whistle, which had not been tested before the voyage and was not functioning.

When the *American Dynasty*'s speed increased to 5 knots and a collision became imminent, the crew abandoned the attempt to use the anchor. At 0817, the bow of the *American Dynasty* struck the port side of the *Winnipeg*. The collision caused the frigate's stern to pull away from the dock, allowing the bow to swing in towards the pier. The bow made contact with the dock, damaging the vessel's starboard side along with the pier.

The *American Dynasty*'s emergency batteries should have provided power to the CP control system in the event of a power loss. However, investigators found that the batteries, which were supposed to supply power to the vessel's essential systems, were incapable of holding a sufficient charge. All of the batteries were last replaced in 2009.

Investigators determined that the master and the chief engineer had not agreed on an arrival plan that identified risks or contingencies, such as procedures during a loss of power to the CP control system. Also, the vessel company's maintenance tracking system did not include procedures for critical components, such as the batteries and the whistle, nor original manufacturer recommendations.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collision between the *American Dynasty* and the *Winnipeg* was the insufficient planning between the *American Dynasty*'s master and chief engineer regarding vessel arrival procedures and emergency maneuvering and the poor crisis communications between the bridge and the engine room. Contributing to the accident was the status and condition of the *American Dynasty*'s emergency generator and emergency batteries, which were not prepared to supply power at a critical time.

28

Breakwater Pier Collapse in Eastport, Maine

Bay of Fundy, Eastport, Maine

The pickup truck that struck Medric II *rests near the vessel at the bottom of the Eastport pier (photo by Coast Guard). OPPOSITE PAGE, aerial view of the damaged pier (photo by Jim Lowe).*

A 200-foot section on the western side of the Eastport breakwater pier in Eastport, Maine, collapsed about 0200 on December 4, 2014, damaging several vessels that were moored alongside. Damages to the *Ada C. Lore*, the *Double Trouble 2*, and the *Medric II* totaled an estimated $700,000. Minor pollution was reported.

Located at the mouth of the Bay of Fundy, the pier was owned by the city of Eastport and

operated by the Eastport Port Authority. The pier was L-shaped, with one leg perpendicular to the shoreline and the outer leg parallel. The original 420-foot-by-50-foot section of the breakwater pier was built by the US Army Corps of Engineers in 1962 with a 20-year life expectancy. It was composed of an asphalt surface over a stone base surrounded by a steel sheet pile enclosure, which was supported by wooden pilings, horizontal tie rods, and turnbuckles. A 410-foot-by-40-foot section was added along the seaward side in 1985.

Several repairs had been carried out on the original section since the early 1980s, and inspections conducted after a structural failure on the north side of the pier revealed significant deterioration of the sheet piling. In August 2013, the Maine Department of Transportation contracted an engineering firm to design a replacement structure for the original pier. Reconstruction plans included demolishing the original section and replacing it with a new 400-foot-by-50-foot section to be built on concrete-filled steel pilings located outside the 1985 section; a single layer of sheet pile was designed to form a new breakwater inside. Composite materials would be used in place of steel in some parts to mitigate deterioration. The project was estimated at $14.95 million and would be funded by the federal government, the state of Maine, and Eastport Port Authority. Planning was still in progress at the time of the accident.

The collapse occurred on the original 1962 structure at the southern end on the west face at low tide on a calm, clear night. About 20 vessels were moored to floating docks alongside the pier; several broke free from their moorings after the section collapsed but were recovered. A pickup truck parked on the pier fell onto one of the boats and then into the water, where it was partially submerged. Three vessels were declared constructive total losses.

Just before 0200 on the morning of the collapse, a caretaker living on board the whale watching schooner *Ada C. Lore* was awakened by noises coming from the breakwater pier. When he went up on deck to investigate, he noticed the inner portion of the breakwater was bowing outward toward his vessel. He then went below deck to retrieve his dog and a few belongings before departing the vessel. But when he returned, he heard a loud crash as the inner portion of the breakwater pier collapsed onto the *Ada C. Lore* and other moored vessels.

As a result of the collapse, the wooden-hulled *Ada C. Lore* suffered extensive damage to its masts, rigging, and structural components of accommodation spaces. Two holes were found on the main deck, which was reported to be leaking significantly. The *Double Trouble 2*, a privately owned fiberglass fishing vessel, sank to the windows of the shelter deck, resulting in the flooding of the engine room. Fishing rigging, portions of the deckhouse, and the hull were damaged beyond repair. The *Medric II*, a multipurpose workboat constructed of high-density polyethylene, was hit by the pickup truck and large sections of the collapsing pier. The vessel suffered significant hull damage, the wheelhouse was completely destroyed, and two outboard engines were submerged for hours. Gasoline from the tanks below deck leaked out and damaged the Styrofoam flotation located inside the hull. After the incident, an engineering firm assessing the pier concluded, "The collapse was a result of failure of the lateral restraint system which consists of 2 levels of tie rods arranged to resist lateral earth pressure. The exact failure mode could not be determined."

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collapse of the Eastport Port Authority breakwater pier was the failure of the lateral restraint system due to the structure's long-term deterioration.

30

Collision of Bulk Carrier *Flag Gangos* with Oil Tanker *Pamisos* and Floating Pier

Lower Mississippi River, Gretna, Louisiana

Damage to the starboard quarter of Pamisos. *OPPOSITE PAGE, damage to the upper starboard side and bulwark of* Flag Gangos *near the bow.*

At 2215 on August 12, 2014, the outbound bulk carrier *Flag Gangos* collided with the berthed oil tanker *Pamisos* on the Lower Mississippi River at Gretna, Louisiana, before alliding with a floating pier, which then struck and damaged a fuel barge berthed behind the *Pamisos*. No one was injured, but about 1,200 gallons of slurry oil were spilled while being transferred, with some entering the river. The total estimated damage was more than $17.5 million.

About 2212, the *Flag Gangos* was downbound near mile marker 98 when the pilot ordered a 2-degree heading change to starboard. The helmsman applied 15 degrees of starboard rudder, and the rudder responded correctly. However, when the helmsman turned the wheel to port to ease the rudder input, the rudder did not respond. Realizing the ship's heading continued to swing to starboard, the pilot ordered 20 degrees to port to correct the heading. The helmsman turned the wheel accordingly, but again the rudder did not respond.

The pilot ordered the main engine full astern and then emergency full astern. The chief engineer responded with several astern starts of the engine, which made the propeller act as a brake by slowing forward movement of the vessel. Next, the pilot ordered the crew to drop the portside anchor and hold the brake on the anchor. At the time, the vessel's speed was about 8.8 knots and its heading was more than 30 degrees to the right of the intended course. After repeating his command to hold the brake on the anchor, the pilot began sounding short blasts of the ship's whistle to warn dockside personnel and crews on nearby moored vessels.

On the right-descending riverbank, the oil tanker *Pamisos* was loading a cargo of slurry oil. Aft of the *Pamisos* and shoreside of a floating pier was a towing vessel. Its crew was transferring fuel oil to the pier from a fuel barge, which was made up to the towing vessel. When the crew and the dockworkers heard the whistle blasts, they activated the emergency shutdowns for their respective oil transfers and prepared for impact.

As a result of the astern engine starts and the portside anchor drop, the bulk carrier's speed was reduced to about 2 knots; however, these efforts could not stop the ship in time. At 2215, the bow of the *Flag Gangos* struck the starboard quarter of the *Pamisos*. The *Flag Gangos* then allided with the floating pier before coming to a stop, and the floating pier subsequently made contact with the fuel barge.

Investigators discovered that a hydraulic solenoid valve and coil had failed in the *Flag Gangos*' port steering system. Nearly 1 year earlier, the steering system manufacturer emailed a service letter to the vessel's operating company warning about possible failures of this model of coil. The service letter stated, "MANDATED ACTION REQUIRED," and indicated that the manufacturer would replace the solenoid coils and power supplies.

The vessel's owner provided the manufacturer with dates during which the *Flag Gangos* would be in port to complete the upgrade. However, because of the bulk carrier's operating schedule, the upgrades were postponed and were not completed by the time the accident occurred.

From October 2013 to April 2014, onboard alarms indicating clogged steering system filters began repeatedly activating. In response, the engineering crew would open, inspect, and clean the filter inserts and put them back in service. When new, larger filters were installed in June 2014, the filter alarms no longer activated. However, the crew did not send samples of the hydraulic oil ashore for analysis to determine the cause of the filter alarms.

After the accident, investigators obtained oil samples and filters from the steering system and sent them out for laboratory analysis. The results were "critical" for the port side, with microscopic examination showing ferrous particles, oxides, sand, plastic particles, dust, and silt. The analysis of the starboard side resulted in a diagnosis of "caution."

Probable Cause

The National Transportation Safety Board determined that the probable cause of the accident was the delay by the *Flag Gangos*' operating company in completing a mandatory upgrade to the vessel's steering system and failure to routinely test the steering system's hydraulic fluid for debris as required by the manufacturer. Contributing was the failure of the steering system manufacturer to schedule and complete the mandatory upgrade.

32

Collision between Offshore Supply Vessel *Gloria May* and Fishing Vessel *Capt Le*

Gulf of Mexico, south of Pascagoula, Mississippi

Scraping and denting damage to the bow of Gloria May. *OPPOSITE PAGE,* Capt Le *before the accident (photo by owner).*

The offshore supply vessel *Gloria May* collided with the uninspected fishing vessel *Capt Le* in the Gulf of Mexico about 2240 on the evening of August 24, 2014. As a result of the collision, the *Capt Le* flooded and sank, while the bow of the *Gloria May* suffered minor damage estimated at $225,000.

The *Capt Le* departed its home port of Bayou La Batre, Alabama, on the morning of the accident and traveled about 4 hours to its planned fishing area 16 nautical miles south of Pascagoula, Mississippi. About 2000, it deployed its fishing gear.

The *Gloria May* was contracted to Chevron Energy to provide logistical support to a liftboat, which involved carrying cargo and supplies between the liftboat and its leased pier near Pascagoula. About 0945 on the day of the accident, the *Gloria May* departed its pier and engaged in cargo operations at the liftboat until about 2200, after which the vessel began its return voyage. About 2215, the second captain, who had the conn (navigation control), increased the speed to about 12.5 knots and engaged the autopilot. He did not detect any contacts ahead, either by radar or by sight.

About 5 minutes later, he moved to the chart table on the starboard aft side of the control station to fill out paperwork required for the voyage. Preoccupied with the paperwork and alone on the bridge, the second captain diverted his attention from his primary duty of maintaining a proper lookout.

After a few minutes, the second captain returned to the front of the bridge to verify everything was functioning correctly and to perform both a visual and a radar search for contacts. He observed bright deck lights from a nearby fishing vessel off his starboard bow at a range of about 2 nautical miles, but he believed the fishing vessel was headed away from him and did not pose a threat of collision. However, the captain of the *Capt Le* did not see—visually or by radar—the approaching *Gloria May*.

When the second captain on the *Gloria May* looked up from his paperwork shortly thereafter, he noticed bright lights shining into the bridge from the forward direction and determined a collision with the other vessel was imminent. As he was running to the operating station to take control, the bow of the *Gloria May* collided with the port side of the *Capt Le* at a speed of about 11.5 knots.

Approximately 10 minutes later, the captain of the *Capt Le* discovered the engine room and the fish hold were flooding, which led him to believe the vessel would sink soon. The captain and crew abandoned the sinking fishing vessel into their liferaft about 2305. About 2325, the crew of the *Gloria May* brought aboard the crew of the *Capt Le* from their liferaft and stood by the fishing vessel until the Coast Guard arrived. Later that night, the vessel sank in about 70 feet of water.

The safety management system manual for the *Gloria May* owner required the watch officer to complete three safety forms before the start of each voyage: the voyage plan, the pre-underway checklist, and the cargo load calculation. However, the second captain was filling out these forms just prior to the accident. Not only should the safety forms have been completed before the voyage began, but the second captain should not have diverted his attention from his navigation duties to complete the forms. Because the *Capt Le* was engaged in fishing operations, the *Gloria May* was burdened to keep out of the way of the fishing vessel according to the navigation rules.

The captain of the *Capt Le* was bound to comply with the navigation rules as well. He neither should have assumed that other vessels in the area would see him and divert their courses, nor have diverted his attention from his primary duty to safely navigate his vessel.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collision between the offshore supply vessel *Gloria May* and the fishing vessel *Capt Le* was the failure of both vessels' operators to maintain a proper lookout.

34

Allision of ITB *Krystal Sea/Cordova Provider* with US Coast Guard Cutter *Sycamore*

Cordova Harbor, Alaska

Damaged port bulwark plating and frames of Sycamore*. OPPOSITE PAGE,* Krystal Sea/Cordova Provider *departing Cordova a few days after the accident.*

The integrated tug and barge *Krystal Sea/ Cordova Provider* was maneuvering to dock in Cordova, Alaska, when the bow ramp of the barge struck the moored Coast Guard cutter *Sycamore* just after sunrise on Sunday, July 28, 2013. Damages were estimated at $248,884 for both vessels.

The tug *Krystal Sea* was designed to fit the dry cargo barge *Cordova Provider*. When mechanically locked together with the tug bow

pushed into a stern notch on the barge, the tug and barge functioned as a single unit known as an integrated tug and barge (ITB). The *Krystal Sea* was propelled by twin azimuthing stern drives (ASDs). Each ASD was shaft driven by its respective main engine and able to rotate 360 degrees. This rotation, used in conjunction with engine throttle control, allowed for variable thrust in any direction, thereby eliminating the need for rudders.

The Coast Guard cutter *Sycamore*, a buoy tender home-ported in Cordova, supported aids to navigation and conducted marine environmental protection, maritime law enforcement, icebreaking, and search and rescue operations in the region.

Prior to its approach to Cordova, the *Krystal Sea* captain employed the vessel's autopilot system while using its GPS and radars to augment his vision in foggy conditions. He told investigators that as he drew closer to the pier he could not see the dock until the bow of the barge was about 150 feet away. Although he could see the white superstructure of the Coast Guard cutter, its black hull was obscured.

Up to this point, the approach had been typical and routine, but the captain noticed that the ITB was not slowing at the rate he anticipated. He rotated both ASDs and increased throttle for more stopping power; the ITB slowed but not as much as expected. He realized then he had a problem with the vessel.

The captain was unaware at the time that, although the port ASD was thrusting as directed by his helm input, the starboard unit was not successfully disengaged from autopilot and remained thrusting in the forward direction.

Although the captain believed he had correctly pushed the sequence of buttons to gain manual control for both ASDs, he later said that because he was concentrating on piloting the vessel and monitoring the traffic he did not notice that the autopilot's "engaged" indicator button on the starboard ASD propulsion control panel remained lighted. In autopilot, the propulsion unit was unable to respond to manual steering commands.

The captain attempted to maneuver to avoid impact with the cutter, but the ITB's bow ramp struck the moored *Sycamore* and slid down the cutter's bulwark. The mate, who entered the wheelhouse shortly after impact, noted that the starboard autopilot light was lit. He pressed the button to disengage the autopilot, pressed another button for manual control, and then backed the ITB away from the cutter. He then returned control to the captain, who brought the tug and barge back around to the pier where they had intended to dock.

The *Krystal Sea* captain had been on board the ITB for 1 week before the accident; the vessel was the first he had operated with ASDs. He had about 14 years of experience operating maneuverable vessels with Voith-Schneider propulsion drives and 40 years of experience sailing.

At the time of the accident, the company's safety program included only general written guidance for operators fleet-wide to (1) disengage autopilot and (2) test manual controls when disengaging autopilot prior to docking. The company, which did not have ship-specific procedures for either, issued corrective actions following the accident that included expanding written procedures to address these two items and posting autopilot instructions in the wheelhouse.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the allision of the integrated tug and barge *Krystal Sea/Cordova Provider* with the US Coast Guard cutter *Sycamore* was the loss of directional control of one of two azimuthing stern drive propulsion units during an unsuccessful attempt by the *Krystal Sea*'s new captain to transfer from autopilot to manual control while approaching the intended dock. Contributing to the accident was the lack of function-testing of manual steering and propulsion control after disengaging the autopilot at a distance from the dock sufficient to allow time for corrective action.

Collision between Bulk Carrier *Mesabi Miner* and US Coast Guard Cutter *Hollyhock*

Straits of Mackinac, Michigan

Damage to the port quarter of Hollyhock. *OPPOSITE PAGE,* Mesabi Miner *shortly after the collision (photo by Coast Guard).*

On the morning of January 5, 2014, the Coast Guard cutter *Hollyhock* was breaking through ice west of the Straits of Mackinac to establish a path for six merchant vessels heading into Lake Michigan when it ran into thicker ice and had difficulty continuing ahead. The first merchant vessel in the convoy, the *Mesabi Miner*, was unable to slow down quickly enough and, at 1042, struck the stern of the *Hollyhock*. Both vessels sustained significant damage, an estimated $494,145 in total repair costs, but remained operational.

The day before the accident, the *Mesabi Miner* was beset in ice several miles west of the Straits of Mackinac and remained at that location with six other vessels awaiting an escort from the Coast Guard cutter.

The plan for the day's operations was for the *Hollyhock* to lead the convoy, for the first ship to follow about 1,000 yards astern of the *Hollyhock*, and for the navigational team on each of the remaining vessels to maintain a safe following distance from the ship ahead. The *Mesabi Miner* was the first vessel behind the *Hollyhock* as the convoy began their transit at 8–10 knots.

Both the commanding officer of the *Hollyhock* and the master of the *Mesabi Miner* felt comfortable with the scenario that day and agreed nothing seemed out of the ordinary or extreme about the day's icebreaking operations.

At 1039, the *Hollyhock*'s speed was reduced to 3.4 knots in thicker ice, and the bridge team contacted the *Mesabi Miner* to ask the bulker to reduce its speed also. The *Mesabi Miner* acknowledged: the master said he brought both main engines to zero pitch. At the time, the *Mesabi Miner* was 959 yards astern of the *Hollyhock* and traveling at a speed of 8.4 knots.

The *Hollyhock* then came into contact with ice that brought the vessel to a complete stop. A bridge officer said he radioed the *Mesabi Miner* about the cutter's status, but he did not recall hearing an immediate acknowledgment. The *Mesabi Miner* third officer alerted the master to the *Hollyhock*'s loss of forward progress, prompting the master to place both engine controls in full astern. Recorded data from the *Hollyhock* indicated the *Mesabi Miner* had closed to 821 yards astern and was still traveling about 8.4 knots.

About 1040, the *Hollyhock* commanding officer assumed control and issued a command to back and ram the ice patch, which, according to crew testimony, was communicated to the *Mesabi Miner* bridge via radio. The maneuver, however, was unsuccessful in breaking up the ice that beset the *Hollyhock*. By this time, the *Mesabi Miner* had closed to 465 yards astern and was traveling at 7.1 knots. The *Hollyhock* commanding officer determined a collision was imminent.

Although the *Hollyhock*'s throttle was at full ahead, the cutter was nearly stationary when the commanding officer ordered left full rudder to direct the vessel outward and to the port side of the *Mesabi Miner*. About 15 seconds later, at 1042, the bow of the *Mesabi Miner* made contact with the stern of the *Hollyhock*. The commanding officers of both vessels estimated the *Mesabi Miner*'s speed at impact was just under 2 knots.

The *Mesabi Miner* crew could not recollect the radio call from the *Hollyhock* stating that the cutter was stopped. Crewmembers from another vessel in the convoy confirmed during interviews that the *Hollyhock* crew did make the call. A procedure calling for confirmation and acknowledgment of radio calls during icebreaking operations could have improved the effectiveness of communications among all vessels in the convoy, particularly when standard minimum distances could not be maintained due to the nature of the icebreaking.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collision between the United States Coast Guard cutter *Hollyhock* and the bulk carrier *Mesabi Miner* was the lack of effective communications between the two vessels' bridge teams during icebreaking operations, which resulted in an insufficient amount of time to take action to avoid a collision.

Collision between Bulk Carrier *Summer Wind* and *Miss Susan* Tow

Houston Ship Channel, Lower Galveston Bay, Texas

Bow damage of Summer Wind. *ABOVE RIGHT, punctured hull on the starboard side of the lead barge in* Miss Susan *tow (photo by Coast Guard).*

During heavy fog about 1235 on March 22, 2014, the bulk carrier *Summer Wind* collided with the *Miss Susan* tow in the Houston Ship Channel in Lower Galveston Bay, Texas. The collision breached the hull of the forward tank barge in the tow, allowing about 168,000 gallons of fuel oil to spill into the waterway. Two crewmembers on the *Miss Susan* sustained minor injuries related to inhalation of fuel vapor. Damage to all vessels totaled over $1.378 million.

The *Summer Wind* was traveling in an area designated as the "Bolivar Roads Precautionary Area," which includes several intersecting waterways. At 1205, a Houston pilot on board the vessel announced via VHF radio channel 13 that the ship was inbound to Houston. Five minutes later, as the vessel was transiting at a speed of dead slow ahead (about 3 knots), the pilot made another radio call reiterating the ship's destination. He also conveyed information about the visibility to another vessel, stating that the fog was "socked in all the way to Morgan's Point" (a location about 25 nautical miles to the northwest). About 1215, the pilot ordered a speed of half ahead.

At 1217, the *Miss Susan* captain announced via radio that the vessel was exiting Texas City with two loaded tank barges bound for Port Bolivar on the other side of the Houston Ship Channel. However, the pilot on the *Summer Wind* told investigators he did not hear the announcement.

About 1221, the pilot ordered the bulk carrier's speed increased from approximately 7 knots to full ahead, which would eventually reach about 12 knots. Around the same time, the *Miss Susan* captain announced again that the vessel was exiting Texas City bound for Bolivar with "two loads." The pilot said he did not hear this announcement either.

Although the fog had improved to about 1 mile of visibility to the north and south, a thicker patch of fog lingered in the intersection between the Texas City and Houston Ship Channels where the *Miss Susan* tow was about to cross. The *Miss Susan* captain referenced her automatic identification system (AIS) about 1225 and noted the inbound *Summer Wind* about 3 nautical miles away at a speed of almost 10 knots. After mentally calculating the bulk carrier's speed and location in comparison to her vessel's, she concluded that she had "plenty of time to cross" the channel ahead of the ship.

About 1232, the *Miss Susan* captain radioed the *Summer Wind* directly, announcing her intention to cross the channel and asking how the situation looked on the pilot's navigation equipment. The pilot replied that if the *Miss Susan* continued her current course and speed the vessels would collide. The *Miss Susan* captain said that she would apply hard starboard rudder, then shortly thereafter she announced that she was backing her engine. According to the *Summer Wind*'s voyage data recorder, at 1233 the pilot ordered his speed reduced to dead slow ahead, but 30 seconds later he ordered full ahead again. Then at 1234, he ordered a 2-degree heading change to starboard. The *Summer Wind* pilot and the *Miss Susan* captain told investigators that around this time they visually sighted the other vessel at about 800 feet apart. About 1235, the *Summer Wind*'s bulbous bow struck the *Miss Susan*'s lead barge half way down its starboard side, puncturing the barge's double hull.

Among findings, the NTSB's investigation concluded that—

- given the restricted visibility and the bulk carrier's ability to navigate only within the confines of the channel, the *Miss Susan* should not have attempted to cross the Houston Ship Channel ahead of the *Summer Wind*;
- given the fog and the vessel traffic in the Bolivar Roads Precautionary Area, the pilot on the *Summer Wind* should not have given an order for full ahead, and the *Summer Wind* master should have questioned the pilot's decision to transit at that speed;
- although sufficient information existed via radar, AIS, and radio communications, neither the *Miss Susan* captain nor the *Summer Wind* pilot took early action to avoid the collision;
- VTS did not maintain an effective watch, diminishing its ability to both recognize a developing risk of collision and interact with the vessel operators; and
- the Coast Guard failed to develop and implement a vessel separation policy for the area.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collision was the *Miss Susan* captain's attempt to cross the Houston Ship Channel ahead of the *Summer Wind*, thereby impeding the passage of the bulk carrier, which could transit only within the confines of the channel. Contributing to the accident was the failure of the Houston pilot and the *Summer Wind* master to set a safe speed given the restricted visibility and nearby towing vessel traffic, and the failure of the *Miss Susan* captain and the Houston pilot to establish early radio communication with one another. Also contributing to the accident was the failure of Vessel Traffic Service Houston/Galveston to interact with the two vessels in a developing risk of collision, and the lack of a Coast Guard vessel separation policy for the Bolivar Roads Precautionary Area.

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Allision and Sinking of Offshore Supply Vessel *Celeste Ann*

Gulf of Mexico, southeast of Grande Isle, Louisiana

The area of the landing platform on the West Delta oil platform where Celeste Ann *allided after loading passengers (photo by Coast Guard). OPPOSITE PAGE, the vessel under way before the accident (photo from www.gcaptain.com).*

The offshore supply vessel *Celeste Ann* was receiving passengers from West Delta oil platform 73A in the Gulf of Mexico about 20 nautical miles southeast of Grande Isle, Louisiana, when it allided with the platform about 0836 on June 14, 2013. The allision punctured the hull, resulting in the flooding and subsequent sinking of the vessel; however, all 12 passengers and crewmembers evacuated without injury. Salvage and repair of the

Celeste Ann were estimated at $1 million.

About 0810, the vessel—with a crew of two credentialed masters (one senior and one junior) and two deckhands—arrived at the platform to pick up passengers. The junior master backed the vessel into the landing area and held position for the transfer. The vessel was stern to the platform with its bow into a northwest wind of about 15 knots in 2- to 4-foot seas. Shortly after eight passengers boarded between 0820 and 0830, the vessel's bow began to swing to starboard as the wind pushed the vessel sideways toward the platform.

The junior master attempted to maneuver away from the platform but was unable to overcome the wind on the vessel's beam. About 0836, the *Celeste Ann* allided with the platform on its starboard side, hitting the platform twice before the junior master was able to back the vessel away.

When a deckhand reported flooding in the engine room from a 2-foot gash on the starboard side, the junior master sounded the general alarm and went to assess the damage, passing through two watertight doors en route to the engine room. The junior master told investigators he saw water in the bilges approaching the deck plates and activated both dedicated bilge pumps along with a fire pump capable of bilge suction, but he did not close any of the watertight doors before returning to the bridge.

A few minutes later, the *Celeste Ann* lost electrical power and, as a result, lost steering capability. All passengers and crewmembers evacuated to another offshore supply vessel that had arrived to assist. With watertight doors left open, progressive flooding ensued, causing the *Celeste Ann* to sink about 1000.

About a month later, the *Celeste Ann* was salvaged and brought to Morgan City, Louisiana, for repairs. A damage survey found that the impact with the landing platform resulted in holes below the waterline near the pump room and in the engine room. The total flooding rate was estimated to be greater than 1,000 gallons per minute. According to the findings of the investigation, even if the pumps had been operating properly, the likely rate of flooding would have exceeded their combined capacity.

An underwater survey of the landing area on the West Delta 73A platform found that a clamp on a vertical pipe attaching the vessel landing to the platform had two horizontal protrusions that extended off the pipe, which likely punctured the hull of the *Celeste Ann*.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the allision of the offshore supply vessel *Celeste Ann* with West Delta 73A platform was the inability of the junior master to compensate for and overcome wind forces that pushed the vessel into the platform. Contributing to the hull breach and subsequent sinking of the *Celeste Ann* were underwater protrusions from the platform and open watertight doors on board the vessel.

42

Allision of Offshore Supply Vessel *Tristan Janice* with Natural Gas Platform

Gulf of Mexico, south-southwest of Houma, Louisiana

Displaced rails, catwalk, and risers on the natural gas platform. OPPOSITE PAGE, damaged bow of Tristan Janice. *(Photos by Coast Guard)*

About 0712 on February 18, 2014, the offshore supply vessel *Tristan Janice* allided with an unmanned natural gas production platform in the northern Gulf of Mexico about 54 miles south-southwest of Houma, Louisiana. Damages amounted to $545,000 for both the vessel and platform, and a substantial amount of natural gas escaped into the atmosphere from a ruptured supply pipe.

The *Tristan Janice* was powered by twin-diesel

engines, each driving a propeller. Before dawn the mate, who had the conn (navigational control), believed that the starboard engine was not maintaining full speed. He directed a deckhand to use a line to tie off the starboard engine throttle in the machinery space so that it would remain in the full ahead position.

Two crewmembers told the Coast Guard that the vessel owner, TRTB Inc., had tried to remedy the throttle problem a few days before the accident but did not have the correct part. Investigators found no log book entry about the throttle problem, even though entries about faulty or unsafe equipment were required by TRTB's safety management system.

The deckhand said that at 0615 the mate directed him to wake the other two crewmembers so that they could assume the watch. However, the captain told investigators he entered the wheelhouse at 0635 to assume the conn but found no one there. At the time, visibility was poor due to heavy fog. He then spotted the mate, who was on the aft deck, and walked aft to talk to him. During the discussion, the mate did not inform the captain about the starboard engine throttle that he had directed the deckhand to tie off. Shortly afterward, the captain and the mate entered the wheelhouse, where they remained until 0700. The captain told investigators he then walked to the port side of the wheelhouse to smoke, but, when he turned back to face the mate, the mate had exited the wheelhouse without a formal watch turnover. The captain then assumed control of the vessel.

Visibility remained poor, but no lookout was posted. Sometime between 0700 and 0711, the mate returned to the wheelhouse where he and the captain discussed nearby vessel traffic. No mention was made about oil or gas production platforms along the route. The captain said he then looked up from the radar and saw a gas platform about 200 yards ahead. He tried to slow the vessel but the speed "was entirely too fast for [the] clutch," he stated. Trying to avoid the allision, he turned the vessel while "throwing it into reverse," but his turn was initially unsuccessful because he had trouble disengaging the autopilot. Although the captain managed to take the vessel out of autopilot and alter course, his actions were too late. About 0712, the *Tristan Janice* allided with the platform at a speed of 9.3 knots.

Shortly after the allision, while the starboard engine was still engaged in the full ahead position, two deckhands entered the engine room and removed the line tied to the starboard engine throttle. About 0730, without reporting the allision, the crew navigated the vessel west-northwest toward Freshwater City, Louisiana, at 9 knots.

Crew statements were unclear as to whether the captain or the mate was the designated captain of the vessel. The person described as "captain" was the company-designated captain, according to a TRTB representative. However, the company-designated captain told investigators he did not believe he held the position of captain. TRTB's safety management system did not provide guidance regarding how captains were designated and assigned.

No records indicated that the vessel's position was being plotted during the voyage, and no lookout was posted, even though the vessel was transiting in restricted visibility. Also, wheelhouse control of the starboard engine's speed was intentionally defeated by its throttle being tied off in the engine room. Hence, *Tristan Janice* proceeded at full speed in restricted visibility without a proper lookout, a clearly identified person in charge, engines ready to maneuver, and regular monitoring of the vessel's progress.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the allision of offshore supply vessel *Tristan Janice* with a natural gas production platform was the poor watchkeeping and operational practices of the captain and the mate to ensure that the vessel was safely navigated, and the vessel owner's inadequate procedures and oversight of the vessel's safety management system.

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Partial Sinking of Passenger Vessel *Spirit of Adventure*

Seward Boat Harbor, Seward, Alaska

Spirit of Adventure*, partially sunk, at its winter layup pier (photo by* Seward City News*). OPPOSITE PAGE, the vessel under way on a sightseeing tour before the accident (photo by Major Marine Tours).*

The *Spirit of Adventure*, a catamaran small passenger vessel, flooded and partially sank before dawn on December 6, 2014, while alongside its pier in Seward Boat Harbor, Alaska. Given that the vessel was out of service for the winter, no one was on board. Damage to both the pier and the vessel, which was declared a constructive total loss, totaled an estimated $2 million.

When the operating season for the *Spirit of Adventure* ended, the vessel entered its winter layup period, during which company personnel conducted end-of-season maintenance and performed various repairs and upgrades. In October 2014, maintenance personnel removed a section of elbow piping from the exhaust systems of both propulsion engines because of leaks that could not be repaired by welding or patching. When the exhaust piping elbows were removed, the flanged end of the vertical section of exhaust piping was open to the sea. The mechanics covered the opening with a plywood blank bolted to the flange but did not install a gasket to prevent leakage. Also, 3/4-inch-diameter seawater cooling lines to the exhaust piping were disconnected when the exhaust elbows were removed. The disconnected seawater lines, which were neither capped nor plugged, were left loosely supported at an elevation above the waterline.

Mechanics also winterized the vessel, during which they drained water from equipment that held fluids susceptible to freezing. To remove the water, the mechanics opened drain plugs at low points, removed strainer covers, or disconnected piping connections from the equipment. Openings made in piping systems with connections to the sea were isolated by closed sea valves, but the valves were not locked or tagged to prevent their inadvertent opening.

Operator staff responding to the sinking found water in the machinery spaces. After the machinery spaces were dewatered, the responders checked the areas to determine the water's point of ingress. They found water flowing from the 3/4-inch-diameter seawater supply line to the exhaust system piping for the port main engine that had been disconnected along with the removal of the exhaust piping elbows. Additionally, the responders found the 3/4-inch-diameter ball valve at the shaft seal water connection partially opened and assumed that this partial opening was the point of ingress of the water flowing from the seawater supply line. The fire/bilge pump overboard discharge valves in the port and starboard generator spaces were also found open, which would have allowed seawater to enter through the discharge openings in the vessel's hulls. The discharge openings were above the waterline at normal draft but would have become submerged as the draft increased from flooding in the port engine room. The increased draft would have allowed seawater to backflow into the generator spaces through drain plugs in the fire/bilge pumps, which were opened during the winter layup process.

As a result of submergence in seawater for several hours, all mechanical and electrical equipment in the *Spirit of Adventure*'s machinery spaces was damaged, including its diesel generators, main engines, wiring, and electrical control equipment.

The vessel operator did not have a formal safety system that specified, among other things, the procedure to winterize each of the company's vessels at the end of the operating season. As a result of the absence of such a procedure or checklist, the mechanics performed the multistep winterization procedure based on verbal guidance from their supervisor, which made it more likely that errors could occur. In addition, the operator did not have a lock-out/tag-out policy, which is generally a component of a formal safety system. A lock-out/tag-out policy protects machinery spaces from flooding by preventing the inadvertent opening of sea valves. Such a policy might have prevented the inadvertent opening of the shaft seal water ball valve, the likely initiating event that caused the vessel to partially sink.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the partial sinking of the *Spirit of Adventure* was the failure to ensure watertight integrity during the vessel's winter maintenance period, which resulted from the operator's lack of a formal safety system, including a lock-out/tag-out policy and a vessel winterization procedure.

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Launch Capsizing of Yacht *Baaden*

Fidalgo Marina, Anacortes, Washington

Baaden *resting on the bottom the day after the accident (photo by Bowditch Marine). OPPOSITE PAGE, the vessel being towed toward the launch ramp (photo by New World Yacht Builders).*

The newly built yacht *Baaden* capsized at 2050 on May 18, 2014, while being launched down the Fidalgo Marina boat ramp in Anacortes, Washington. Although salvaged, the yacht was declared a constructive total loss estimated at $10 million. Three shipyard employees were treated for minor cuts and injuries at local hospitals.

The *Baaden* was custom designed as an 85-foot-long European-style, luxury, long-range, oceangoing expedition yacht with commercial fishing vessel roots, according to the builder, New World.

The safety coordinator for the launch described the operation as a three-step process. First, the vessel was pulled bow first from the builder's facility to an area just above the ramp. Next, the boat was turned 90 degrees from the street and lined up on the centerline of the ramp. Last, it was slowly rolled stern first down into the water on a dolly/cradle system designed specifically for launching the vessel.

Video footage and team members' statements indicated that the launch was proceeding according to plan until about 40 seconds after the *Baaden*'s front dolly completely submerged. About 2037, launch team members heard a sudden loud clank and crunching sound from the stern area. Then the boat shifted bodily on the front cradle and lurched to port where it remained heeled to about 12 degrees, a NTSB video study revealed. The launch was temporarily stopped; the team decided to proceed after assessing the vessel and equipment.

Upon resumption several minutes later, the cables between the dollies and the crane went slack, so the team used reverse propulsion to assist in pulling the yacht down the ramp and then off the rear cradle. As the vessel began to move into the water, the port stabilizer fin appeared to be dragging on the ramp, investigators were told.

About 2050, the vessel moved to port again and slipped off the front cradle while increasing its list to port, before it accelerated aft and continued to slowly roll. A few seconds later the roll rate increased and the boat quickly capsized, drifted into the marina, and began filling with water through its engine air intakes.

Standing on the starboard side of the hull, the launch captain and the deck crew began assisting the engine room crew trapped below decks. They broke a glass portlight above the waterline, allowing four crewmembers to escape. A fifth person, who could not fit through the portlight, was freed by local emergency responders.

Following the rescue, New World contacted a salvage company, which arrived later that night and deployed an oil boom around the vessel to mitigate potential pollution. The vessel eventually sank to the bottom of the marina basin at a 65-degree port list but did not completely submerge in the shallow water.

Although several launch team members stated that the *Baaden* appeared centered on the ramp during the launch, evidence suggested that the aft dolly tires rolled off the right side of the upper ramp into the mud causing the initial roll to port. At this point, the port stabilizer fin likely supported the yacht as it moved further down the ramp, until the fin dropped off the ramp edge into the mud. This sudden loss of support likely initiated the final roll of the vessel.

The investigation discovered that New World inadvertently supplied an incorrect value during pre-launch weighing to the stability naval architect, who used this incorrect weight in estimating launch stability. The error belied the vessel's center of gravity, which actually was further to port than had been estimated. In addition, the vessel's installed ballast weight had been overstated.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the capsizing of the yacht *Baaden* during its initial launch was the vessel's low margin of stability due to the combined effects of a recording error during the final vessel weigh, which resulted in an incorrect assessment of the vessel's center of gravity and an overestimation of the weight of installed ballast.

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Engine Room Fire on board Recreational Vessel *La Pietra*, with Subsequent Sinking

Pacific Ocean, southwest of Destruction Island, Washington

La Pietra *ablaze. OPPOSITE PAGE, the vessel before the accident. (Photos by Coast Guard)*

On July 4, 2014, at 1058, a fire broke out in the engine room on board the recreational vessel *La Pietra* when the vessel was near Destruction Island, Washington. The onboard vessel owners (husband and wife) were rescued by the Coast Guard; the husband was treated for smoke inhalation and minor burns. *La Pietra* burned to the waterline and sank with 600 gallons of diesel fuel on board, a total loss estimated at $360,000.

La Pietra departed Grays Harbor, Washington, at 0600 on the morning of the accident. The vessel owners intended to take an approximately 100-mile coastal voyage to Neah Bay, Washington. The husband told investigators that at 1058, when the vessel was near Destruction Island transiting at a speed of 10 knots, numerous audible and visual alarms activated in the wheelhouse, including an alarm for the rudder indicator and the autopilot. In addition, the vessel's battery monitor screen went blank. The vessel owners noticed smoke aft in the vicinity of the engine room, prompting the husband to investigate. Although no flames were visible at the time, the engine room was completely filled with black smoke.

After closing the engine room door, the husband returned to the wheelhouse where he activated the VHF radio distress alarm and broadcasted a Mayday emergency call on VHF channel 16. He then returned to the engine room with a portable fire extinguisher, which he discharged into the space from the doorway. He described the smoke as so thick that he could stay only for a second. In addition to the portable fire extinguisher, the vessel's onboard Halon fixed fire suppression system was deployed, but these efforts did not extinguish the fire.

The husband then realized that the engine room ventilation system was still running; however, he could not access the engine room to shut it off. Because fresh air continued entering the engine room, the fire continued to burn. The husband returned to the wheelhouse and again contacted the Coast Guard to provide his location and status. Next, he and his wife retrieved the portable VHF and moved to the top deck. From there, the husband discharged the vessel's three remaining portable fire extinguishers through the engine room vents, without effect.

The Coast Guard launched a helicopter from Air Station Port Angeles, Washington, and a motor lifeboat (MLB) from Station Quillayute River in La Push, Washington. The helicopter and the MLB arrived on scene about the same time (1135). Their crews reported seeing flames coming out of the starboard side vents and the husband fighting the fire with portable fire extinguishers. Both the husband and the wife had donned life jackets, but they did not yet believe they needed to abandon the vessel. The MLB crew provided the husband two additional portable fire extinguishers and, at 1159, reported to the Coast Guard that the flames appeared to be out. However, by 1209, the husband had resumed fighting the fire with the portable extinguishers, and the wife evacuated *La Pietra* and boarded the MLB. At 1236, with the fire out of control, the husband also abandoned ship to the MLB, having sustained smoke inhalation and minor burns to his foot. The couple was transported to La Push, where the husband received medical care.

The Coast Guard requested a salvage vessel, which arrived on scene at 1909. At 1948, the salvage vessel reported that *La Pietra* had sunk. An approximately 15-foot-by-15-foot oil sheen was initially sighted on the water but could not be confirmed.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the *La Pietra* accident was an engine room fire of unknown origin. Contributing to the loss of the vessel was the owners' inability to access and shut off the engine room ventilation system, which diminished the effectiveness of the fire suppression system and extinguishing efforts.

50

Allision of Crane Barge, Pushed by Towing Vessel *Cory Michael*, with the Florida Avenue Bridge

Industrial Canal,
New Orleans, Louisiana

The crane boom on top of Cory Michael*'s collapsed upper wheelhouse (photo by Coast Guard). OPPOSITE PAGE, the Florida Avenue Bridge, which was struck by the vessel.*

About 2355 on August 13, 2014, a crane barge transported by the towing vessel *Cory Michael* struck the raised lift span of the Florida Avenue Bridge while transiting on the Industrial Canal in New Orleans, Louisiana. The crane boom fell onto the towing vessel's upper wheelhouse fatally injuring the captain. Damage to the crane and the vessel was estimated at $2.3 million.

On the morning of the accident, the owner

of the crane barge, Boh Bros. Construction Co., placed a work order with the *Cory Michael*'s owner, ABC Marine Towing, to move construction barges and equipment from Boh Bros.' facility in east New Orleans to the International Matex Tank Terminal on the Lower Mississippi River.

Boh Bros.' practice was to push its cranebarges stern first, with the towing vessel configured to the barge's bow, to protect the boom from potential damage caused by contact with lock walls, bulkheads, or other structures. However, according to a deckhand on the *Cory Michael*, the captain expressed concern about the stern-first towing configuration. The Boh Bros. foreman informed the captain of the need to protect the end of the boom as well as the added benefit of better visibility that other vessel captains said this configuration provided. The foreman told investigators that the captain expressed no further reservations about the towing configuration and proceeded to make up his vessel's bow to the barge's bow with the crane boom positioned over the towing vessel's upper wheelhouse.

The boom was elevated above a cradle mounted on the barge's bow. When in use, the cradle provided the boom's frame with a solid resting point and prevented lateral movement of the boom. But for the accident transit, the boom was suspended above the cradle and not supported by it.

At 1720, the *Cory Michael* departed from the Boh Bros. facility with the crane barge. Boh Bros. personnel did not recall any ABC personnel, including the *Cory Michael* captain and crew, asking about the crane barge's air draft (maximum vertical height) before departure. During the transit, the tow held up at a seawall less than 300 yards north of the Florida Avenue Bridge to await clearance to enter the Industrial Canal Lock. Several hours later, at 2342, the *Cory Michael* received clearance and continued the transit toward the bridge.

About 2346, when the captain contacted the bridge operator, he stated that he was lined up for the passage and requested that the lift span be raised. The bridge operator recalled the captain asking for 68 feet of clearance to pass under the lift span; however, in reality, the *Cory Michael*'s air draft that evening was about 86 feet. While the span was still being raised, the bridge operator saw that the *Cory Michael* tow had already begun its approach toward the bridge and was close to the span. She raised the lift span to a height of 72 feet, higher than the captain reportedly requested, to allow for a margin of error. (Regulations required the lift span to be raised to its design height of 156 feet for all vessel passages. However, due to damage from Hurricane Katrina, which affected the alignment of the lift span and bridge structure, the span was raised according to clearance requirements provided by vessel operators instead of being raised to its full height.)

As the stern of the barge passed under the bridge, the crane mast struck the steel framing of the lift span. The impact caused a series of failures on the crane that resulted in 322,000 pounds of the crane's counterweight falling into the waterway and the crane boom dropping onto the *Cory Michael*'s upper wheelhouse. The overhead and supporting structural framing of the upper wheelhouse collapsed from the impact fatally injuring the captain.

Personnel overseeing bridge operations for the Port of New Orleans failed to ensure that the Florida Avenue Bridge was operated in compliance with existing Coast Guard regulations and internal guidance that required the lift span to be fully raised for each vessel passage. Also, the Coast Guard's oversight of the bridge failed to identify that the lift span was unable to be raised to the fullest extent as required by regulations.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the allision of the *Cory Michael* tow with the Florida Avenue Bridge was the captain's failure to establish the correct air draft of his tow and ensure that the bridge was raised to an adequate height before attempting the passage, and the failure of the bridge operator for the Port of New Orleans to raise the lift span to the fullest extent as required by regulations and port policy.

Engine Room Fire on board Towing Vessel *Dennis Hendrix*

Lower Mississippi River, northwest of Baton Rouge, Louisiana

Starboard main engine of Dennis Hendrix *with the crankcase door blown out. OPPOSITE PAGE, firefighting efforts on board the vessel. (Photos by Coast Guard)*

On October 31, 2014, the uninspected towing vessel *Dennis Hendrix* was transiting upbound on the Lower Mississippi River pushing 24 loaded barges. About 0742, a fire broke out in the engine room, about 10 miles northwest of Baton Rouge, Louisiana. As crewmembers fought the fire, other vessels in the area provided firefighting and towing assistance. The fire burned until mid-afternoon, which resulted in an estimated $3.8 million in damage to the *Dennis Hendrix*.

Just prior to the accident, the *Dennis Hendrix* was in the process of overtaking another vessel on the river. At the time, the on-duty chief engineer was in the lower engine room where he heard a "laboring" sound from the starboard engine. He went up the ladder to the upper engine room to check the fuel control. As he reached for the door, the starboard engine exploded and blew out the windows on the starboard side. When the captain of the *Dennis Hendrix* heard the explosion and saw flames and black smoke, he took all three engines out of gear and sounded the general alarm to alert the crew.

On hearing the general alarm, the crewmembers prepared to fight the fire. Initial firefighting efforts took place on the starboard side where the windows blew out. Once all 10 crewmembers were accounted for, the captain ordered the chief engineer to activate the carbon dioxide fixed-fire suppression system in the engine room.

The chief engineer went to the emergency fuel shut-off station, located on the outer deck by the starboard door to the engine room, to close the fuel supply valves to the engines. After the valves were closed, the *Dennis Hendrix* lost electrical power, which activated the vessel's emergency battery power for communications equipment and lighting. With the electrical power shut down, the crew had to use a portable engine-driven fire pump to draw firefighting water from the river.

According to the captain, eight vessels helped with either towing or firefighting. In the afternoon, two fireboats that arrived on scene about 1430 were able to extinguish the fire using foam. Shortly thereafter, the *Dennis Hendrix* crewmembers were transferred ashore in a small boat.

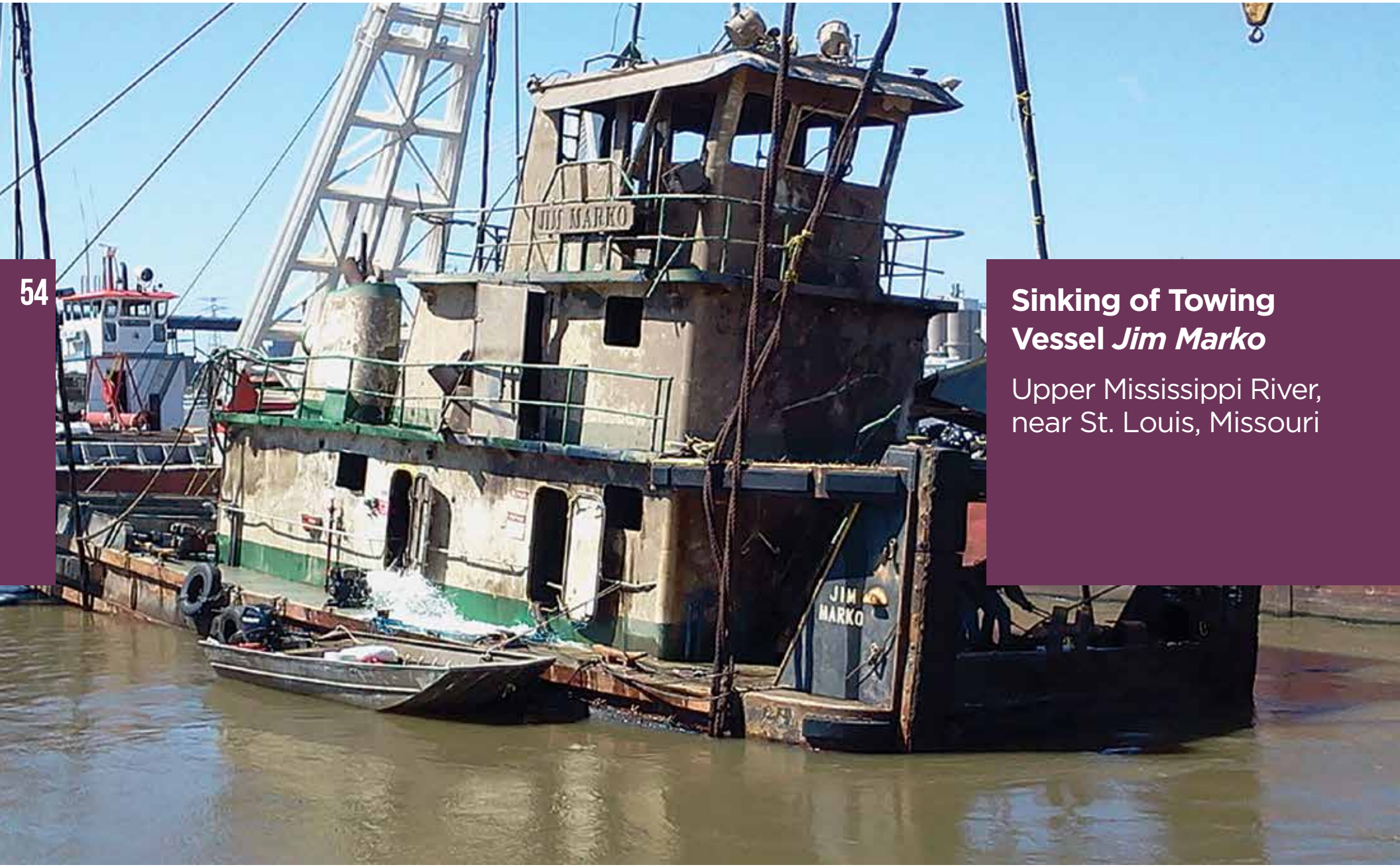
The engine room on board the *Dennis Hendrix* was significantly damaged as a result of the fire, and the remainder of the vessel's spaces suffered heat, smoke, and water damage. The most significant fire damage was in the starboard engine, which had one crankcase door blown out. Inside the door opening, parts of the bottom basket for the connecting rod for piston no. 5 were found; the bottom basket had separated from the rod. In addition, the piston and piston skirt were fragmented and deformed. On top of the engine, the rocker gear covers were melted.

The damaged no. 5 piston and the connecting rod assembly were removed from the starboard engine and sent to a mechanical and metallurgical consultant for examination. The consultant's report concluded that the piston and connecting rod assembly failed due to loose bolts on the lower basket, which led to fatigue failure of the blade rod and upper connecting rod bearing.

The vessel's owner/operator noted that the starboard propeller sustained minor damage at some point before October 21, 2014, from what was identified as "drift in the river." It was scheduled to be replaced after the completion of the accident voyage. Based on performance data from October 22 provided to investigators, the starboard engine needed full fuel delivery following the damage when operated at 901 rpm while pushing a load of barges. By contrast, 2 days earlier on October 20, the engine did not need full fuel delivery, even though it was operating at 905 rpm while pushing the same load of barges. As a result of the damage to the starboard propeller and the additional rpm required to overtake another towing vessel, the starboard engine was under greater load and needed more fuel just before the explosion.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the engine room fire on board the *Dennis Hendrix* was a catastrophic failure of the starboard main engine resulting from loose bolts on the no. 5 cylinder rod cap while the engine was operating at a high-load condition.



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Sinking of Towing Vessel *Jim Marko*

Upper Mississippi River, near St. Louis, Missouri

Salvage of Jim Marko *after the sinking (photo by Coast Guard). OPPOSITE PAGE, the cellphone photo taken by the mate of the hull breach on the forward starboard side of the vessel.*

About 1200 on July 1, 2014, the uninspected towing vessel *Jim Marko* sank at mile marker 181.6 on the Upper Mississippi River near St. Louis, Missouri. At the time, the vessel was transiting upriver to a barge fleeting area near Venice, Illinois, across the river from St. Louis. The sinking resulted in damage exceeding the vessel's insured value of $800,000, and an undetermined amount of oil was released into the river.

About 0600 on the morning of the accident, the crew of the *Jim Marko* arrived at the vessel and prepared to get under way for a 12-hour shift. The crew consisted of four people—a captain (pilot), a mate (unlicensed senior deckhand), and two deckhands. The *Jim Marko* had both a bow void, located immediately aft of the collision bulkhead, and a stern void. According to crewmembers, the stern void needed to be pumped frequently, sometimes twice a day. The mate told investigators he checked the voids that morning and found they were "pretty empty."

Crewmembers stated that about 1030 one of the deckhands noticed a hole on the *Jim Marko*'s starboard side below the rub rail and about 3 feet aft of the turn of the bow. The captain, who was operating the vessel at the time, asked the mate to photograph the hole with his cellphone so that he could see it. The captain looked at the photo, told the mate he would report the hole to the company, and continued operations. The mate said he checked the bow void and saw no water entering from the hole.

According to the captain, the vessel developed a slight list to port as it traveled toward the Venice, Illinois, fleeting area. About 1115, while it was still under way, the deckhand began pumping out the stern void to level the vessel out. After the stern void was pumped, the crewmembers noticed that the vessel felt like it was down by the bow. About 1130, they opened the bow hatch to check the bow void and found it quickly filling with water. They attempted to pump the void but were unable to keep up with the flooding. Water was soon coming over the bow and the vessel began listing to starboard. The crew of a nearby towboat saw that the *Jim Marko* had a large starboard heel and the port propeller was visible above the water. The towboat brought its tow alongside the sinking vessel's port bow, and the *Jim Marko* crew was able to abandon the vessel directly onto the barge.

The salvage report indicated that "at a point approximately 3 [feet] aft [of] the forward bulkhead of the bow void compartment and 36" below the deck, the starboard side plate in way of a triangular gusset bracket (which would normally be found on the end of a laminated rubber fender) was found to have been 'swiveled' and pushed into the compartment to create an 8" x 16" hole." In addition, the report noted pinhole leaks on the port side of the bow void and a leak where potable water piping penetrated the forward engine room bulkhead. Also, a number of watertight doors were found open, including the starboard and aft galley doors on the main deck, although the owner/operator told investigators that company policy required the watertight doors to be closed when the vessel was under way. Open watertight doors on the main deck allowed water to travel directly into the engine room once the bow was submerged. The rapid nature of the sinking indicated that water was able to quickly fill the spaces below deck.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the sinking of towing vessel *Jim Marko* was the captain's decision to continue operations with a known hull breach in the vicinity of the vessel's waterline. Contributing to the rapid sinking was a lack of watertight integrity due to watertight doors on the main deck left open while under way.

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Sinking of Towing Vessel *Nalani*

Pacific Ocean, west of Barbers Point, Oahu, Hawaii

The stern of Nalani *with the removal of its starboard aft peak cover (photo by crewmember). OPPOSITE PAGE, the vessel before the sinking (photo by William J. Cooke, www.marinetraffic.com).*

About 1510 on January 22, 2015, the uninspected towing vessel *Nalani* began taking on water while conducting sea trials off the southwest coast of Oahu, Hawaii, subsequently sinking in 2,200 feet of water. All 11 persons on board were rescued after abandoning the vessel. Crewmembers and responders sighted an oil sheen nearby. Due to the water depth, the vessel was not salvaged and declared a constructive total loss at an estimated $200,000.

Prior to the sea trials, the *Nalani* was at Marisco Shipyard at Barbers Point (west of Honolulu). That morning, an owner's representative directed a shipyard worker to cut out a 20-inch-diameter welded steel plate cover from the starboard side of the stern deck above the starboard aft peak tank. The shipyard worker was told to replace the plate with a raised-combing hatch cover, which had threaded bolts for securing.

After the steel plate was cut and removed, the shipyard worker went ashore to drill the new cover, but when he returned, about 1435, the *Nalani* had already departed for the sea trials. The crew on board the vessel temporarily placed a piece of gasket material over the 20-inch hole in place of the steel cover. This remedy, however, left the starboard aft peak tank vulnerable to water intrusion and progressive flooding. The captain told investigators that he was aware of the unsecured opening but decided nonetheless to get under way.

Once the *Nalani* cleared Barbers Point Channel, the captain completed autopilot tests on both the port and starboard steering pumps. The sea state combined with a low stern freeboard (which measured an estimated 3 inches) caused the stern deck to be awash with seawater as the vessel transit continued. When water flowed over the stern deck, the starboard aft peak tank began filling with water through the unsecured opening. A pilot on board for the trials became aware of the flooding and notified the captain. In response, the captain reduced speed and made a long 180-degree port turn back toward the shipyard. This direction put the sea swells on the stern, increasing the rate of flooding.

At 1513, the pilot radioed the Coast Guard, broadcasted a distress call, and reported that the *Nalani* was sinking. Suddenly, the *Nalani* began listing heavily to port, prompting the captain to sound the general alarm. The pilot ordered the engines to be stopped, the crew to move to the high side of the vessel, and all persons to abandon ship. After they entered the water, the pilot counted everyone and notified the Coast Guard via handheld radio that all persons were off the vessel. Crewmembers were able to board either the inflatable auxiliary boat or a liferaft that released from the vessel. About 1531, the *Nalani* listed 45 degrees to port and, shortly thereafter, 90 degrees to port. About 1533, the vessel sank.

The Coast Guard's Marine Safety Center Salvage Engineering Response Team (SERT) calculated the stability of the vessel with both the starboard aft peak tank and steering space flooded. The analysis indicated that the *Nalani*, in its calculated condition, would have met intact stability standards had the opening in the starboard aft main deck been sealed before getting under way. However, with the opening unsecured and included as a downflooding point, the vessel would not have met the stability standards.

The SERT also analyzed the impact of progressive flooding on the vessel. The calculations assumed that water entered through the opening in the starboard aft main deck and spread to the steering room. The analysis indicated that the aft deck edge would have been completely submerged and that the *Nalani* would have had minimal righting energy. In a static condition without the effects of wind, waves, water on deck, or additional flooding, the vessel might have remained afloat. However, in a dynamic environment, any or all of these factors could have contributed to the vessel sinking.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the flooding and eventual sinking of the *Nalani* was the captain's decision to get under way without sufficient freeboard at the stern and without ensuring proper watertight integrity.

Sinking of Tank Barge *Nash*, Towed by Towing Vessel *Calvin*

Pacific Ocean, west of Point Conception, California

Calvin *after the accident. OPPOSITE PAGE, a diving boat engaged in salvage operations of* Nash*, whose bow protrudes 15 feet above the surface.*

Loaded fully with liquid magnesium chloride, the tank barges *Nash* and *Kenny* were being towed from Mexico to Canada by the uninspected towing vessel *Calvin* on June 8, 2014, when the *Nash* began to list to its starboard side. The Coast Guard later directed the *Calvin* captain to tow the *Nash* to a nearby anchorage, but the barge sank stern first in the Pacific Ocean about 3 nautical miles west of Point Conception, California. The total loss of the barge along with its cargo was estimated at $1 million.

Six months prior to the accident, the *Nash* was towed to Ensenada, Mexico, where it underwent about $1 million in repairs. An American Bureau of Shipping (ABS) surveyor witnessed the shipyard's testing and approved all hull repairs.

Later, on May 27, the tug *Calvin*, with the barge *Kenny* in tow, arrived in Ensenada and stood by waiting for the drydock work to be completed on the *Nash*. After the *Nash* was re-launched, the *Calvin* took both barges to Guerrero Negro, about 275 nautical miles southeast of Ensenada, for loading of more than 8,000 metric tons of liquid magnesium chloride, of which more than 4,300 metric tons were loaded on board the *Nash*.

The captain and the mate of the *Calvin* checked the barges to ensure they were not loaded below their ABS load lines and were ready for sea. They also inspected the six cargo tanks to verify that no more than a 2-foot difference existed between any of the tank levels and that their hatch openings were securely closed. However, they did not ensure that the void tank hatches were securely closed as part of the ready-for-sea checks. The crewmembers were not aware of any written company procedures or checklists regarding barge loading or the steps needed to prepare the barges for sea.

The *Calvin* began the accident voyage on the afternoon of June 2 with the barges *Kenny* and *Nash* in a tandem-tow configuration, with the *Kenny* as the lead barge on one towline and the *Nash* about 400 feet behind on a second towline from a second winch. The first 5 days under way were uneventful.

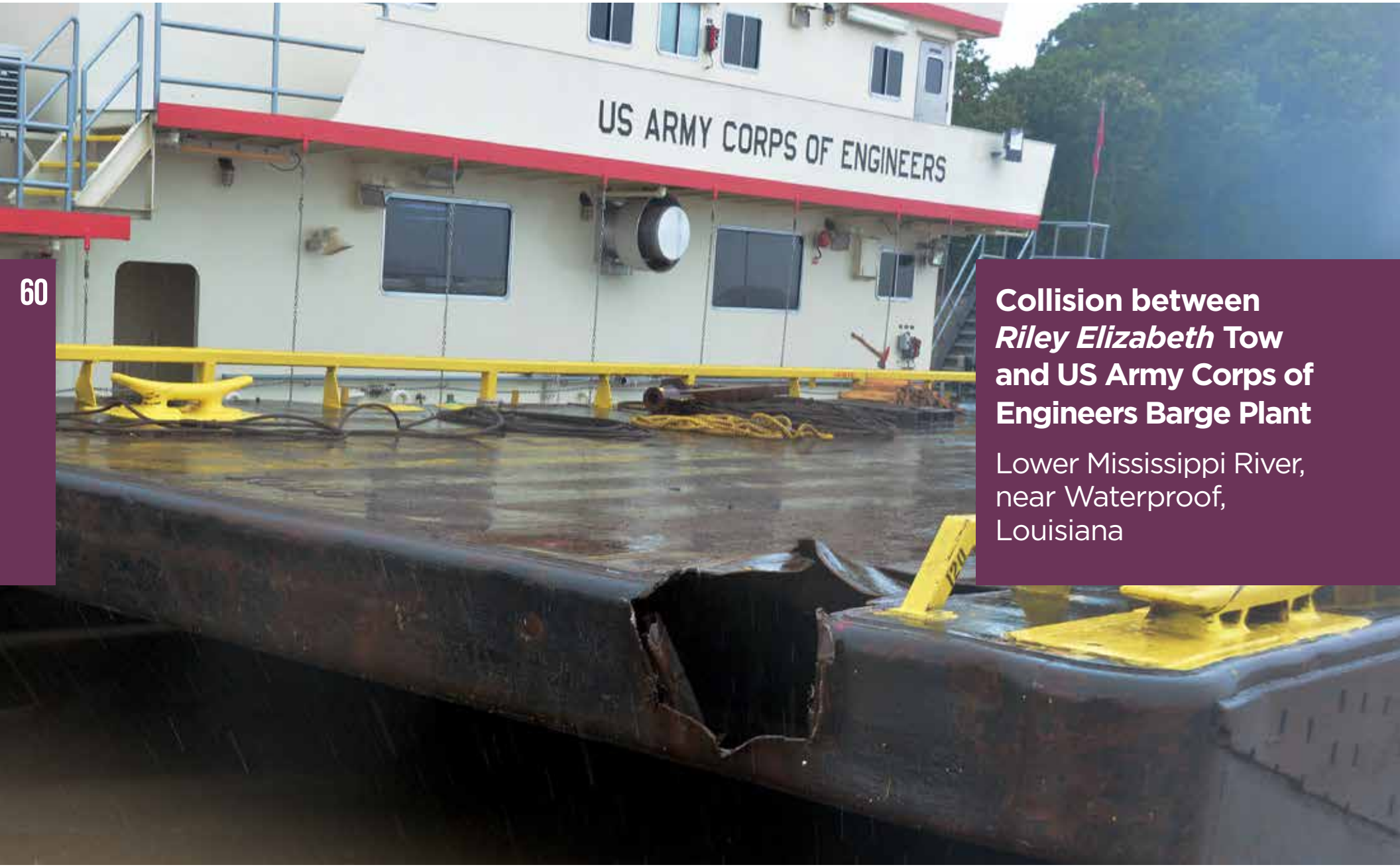
On the sixth day, June 8, the captain noticed that about 1130 the *Nash* was not recovering normally from its rolls and was listing to starboard. Fifteen minutes later, he alerted the Coast Guard, who directed him to take the barge to San Luis Obispo, California, about 40 nautical miles to the north. About 1430, the Coast Guard changed the destination to Cojo Anchorage, near Point Conception, about 20 nautical miles to the southwest. As the tow approached the anchorage, the *Nash*'s stern had become submerged. About 1805, the barge sank vertically in 240 feet of water about 3 miles west of Point Conception. As the *Nash* began to sink below the sea surface, the *Calvin* was pulled astern, so the captain released the winch brake to allow the towline to unspool from the winch. The stern of the barge came to rest on the sea bottom with its bow protruding 15–20 feet above the surface.

Salvage operations to refloat the *Nash* began the next day; however, due to the extent of the damage, the barge was declared a constructive total loss. The salvage operation therefore became an effort to partially refloat the barge and tow it to deep water for disposal.

The salvage company also performed a damage stability study and found that the barge would trim by the stern and then nearly sink if the port and starboard aft void tanks flooded; the buoyancy provided by the forward void tanks would prevent the vessel from sinking completely. A similar Coast Guard study found that with only the aft starboard void tank flooded from 95- to 100-percent capacity the barge would nearly sink.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the sinking of tank barge *Nash* was flooding of the aft starboard side void tank. The mechanism for entry of flooding water to this tank could not be determined because the barge was not salvaged and was not available for examination after it sank.



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Collision between *Riley Elizabeth* Tow and US Army Corps of Engineers Barge Plant

Lower Mississippi River, near Waterproof, Louisiana

Damage to the inshore end of a Corps of Engineers spar barge (photo by Corps of Engineers). OPPOSITE PAGE, Riley Elizabeth *on the Mississippi River postaccident (photo by Western Rivers Boat Management).*

On July 18, 2014, about 0355, the towing vessel *Riley Elizabeth* was pushing 30 barges on the Lower Mississippi River near Waterproof, Louisiana, when the vessel and two of its barges collided with a US Army Corps of Engineers barge plant conducting a revetment project on the riverbanks. The vessels and the barge plant sustained an estimated $300,000 in damages.

The revetment project involved one vessel

and 10 barges—five of which were used as spar barges to anchor other barges. The spar barges were positioned end to end perpendicular to the riverbank and extended about 600 feet into the waterway from the outer side of Kempe Bend, a nearly 90-degree left turn in the river. The barges reached about one-third of the distance across the channel.

The downbound *Riley Elizabeth* tow was approaching Kempe Bend about 0300. The mate, who had the conn (navigational control), radioed other vessel traffic in the area for information about the turn. The operator on one of the contact vessels for the Corps of Engineers that were positioned downriver responded. He said that he radioed the *Riley Elizabeth* to tell the mate where the barge plant was located.

The *Riley Elizabeth* mate told investigators that he proceeded at a speed of slow ahead. Electronic chart system (ECS) data showed that the tow held close to the left bank of the river as the turn around Kempe Bend began, but as the mate steered around the inside of the bend the tow began drifting across the river.

The Corps of Engineers barges were not electronically marked in any automatic identification system (AIS) and therefore were not visible on the *Riley Elizabeth* ECS. According to the mate, he did not perceive any barges extending into the river, based on his assessment of the radar. Moreover, he expected the barge plant to be "folded for the night," that is, moored alongside the riverbank and not extending perpendicularly into the river.

The mate said that as he maneuvered through Kempe Bend he did not see the spar barges that extended 200 feet beyond the deck lights of the mooring barge. From what he could see on radar, the barges "were sticking out just a little bit." He said he brought the engine throttles to full ahead to increase the rate of turn needed to get through the bend before the current set the tow toward the riverbank and the barge plant. Beginning about 0353 and for the next 2 minutes, the vessel speed increased by almost 1 mph as the vessel was turning at a rate of up to 30 degrees per minute to port. However, these efforts were not enough to avoid the barge plant.

At 0355:08, the *Riley Elizabeth* tow slid laterally across the river and collided with the barge plant. The second barge from the head of the tow on the starboard side struck the upriver corner of the outermost spar barge. As the *Riley Elizabeth* continued to slide through the turn, its aftmost barge and the starboard side of the *Riley Elizabeth* struck the upriver corner of the mooring barge.

The NTSB concluded the following: the information provided by the designated Corps of Engineers contact vessels and the Coast Guard-issued local notice to mariners did not adequately warn of the waterway obstruction posed by the barge plant; using the AIS to mark Corps of Engineers barges would significantly reduce waterway hazards; and the *Riley Elizabeth* mate should have determined the extent of the waterway obstruction posed by the Corps of Engineers barge plant before starting the turn at Kempe Bend, especially given the large size of the *Riley Elizabeth* tow and a 5-mph current pushing the tow from astern.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the collision of the *Riley Elizabeth* tow with the US Army Corps of Engineers barge plant was the incomplete information provided by the Corps of Engineers about the extent of the obstruction in the waterway, and the failure of the *Riley Elizabeth* mate to determine the extent of the obstruction before starting the turn at Kempe Bend.

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Subsea Pipeline Damage by Tug and Barge *Valiant/Everglades*

Gulf of Mexico, southeast of Galveston, Texas

Production platform EC321A, where the Coast Guard helicopter responds on deck (photo by crew on responding vessel Penny F*).*
OPPOSITE PAGE, Valiant/Everglades *under way (photo by Kirby).*

About 0600 on November 17, 2014, the articulated tug and barge unit *Valiant/Everglades* lost propulsion and drifted within about 20 yards of the East Cameron (EC) 321A production platform in the Gulf of Mexico forcing the shutdown of the platform and the evacuation of its 35 crewmembers. When the captain of the *Valiant* ordered the anchor dropped to slow the vessel until propulsion was restored, the anchor ruptured a subsea pipeline, causing

an estimated $2 million in damage, along with the release of about 249,800 mcf (thousands of cubic feet) of natural gas.

As the *Valiant/Everglades* transited toward Corpus Christi, Texas, on November 16, the weather deteriorated throughout the afternoon. Crewmembers estimated seas to be 6–10 feet and winds 30 knots from the southeast. About 1800, the captain contacted another vessel in the vicinity that was outside the safety fairway; the vessel's operator told the captain that the route their vessel was following had no hazards from any oil rigs or production platforms. Based on this information, the captain changed the voyage plan to proceed out of the safety fairway, toward the port of Galveston, in favor of better sea conditions.

About 0455 on November 17, the chief mate, who had the navigation watch, received a bow ram air pressure alarm, which indicated that the locking mechanism between the tug and barge was losing air pressure, thereby presenting a risk of the tug and barge separating. The chief engineer began working to determine the source of the loss of air pressure.

The *Valiant* was fitted with two reversible, medium-speed diesel engines. To change from ahead to astern, the engines had to be stopped and then started in the opposite direction. Two high-pressure air compressors supplied starting air as well as lower-pressure control air through a reducing station for the propulsion and the towing-winch engines. Given that these engines relied on control air to regulate engine speed, loss of control air pressure would result in an engine's pneumatic governor reducing engine speed to idle.

About 0500, the chief mate told the captain the engines had idled down to 200 rpm without any operator input. The captain then took the vessel out of autopilot and put the rudders hard to starboard to keep the bow to the seas. At the time, the *Valiant* was drifting towards production platform EC321A, about 2.4 nautical miles away.

The tug and barge continued to drift within about 1 nautical mile of the platform, but the captain, who was aware of the presence of pipelines in the area, delayed letting the anchor go. As the *Valiant/Everglades* closed in on the platform, the captain sounded five short blasts on the tug's whistle, sounded the general alarm on board the tug, and radioed the platform.

When the *Valiant* was only about 500 feet away, the captain ordered the anchor let go. The captain then noticed air pressure building up, which allowed him to start the port engine in astern propulsion, the best option for clearing the platform.

On EC321A, the crew donned survival gear and headed for their muster station. The platform manager notified the Coast Guard of the situation, and a helicopter from Air Station Houston was sent to assist. A civilian helicopter later evacuated the platform crew.

Once the *Valiant/Everglades* was clear of the platform, the captain ordered the anchor recovered, but the crew encountered a problem while heaving. After multiple attempts, the captain called the company to report the situation and the fouling of the anchor. He requested permission to cut the anchor chain, which was granted.

The vessel crew later found the source of the air leak: an air valve that supplied starting air to the towing-winch engine on the *Valiant's* aft weather deck. Postaccident inspection indicated the valve was operable but required only minimal force to open it, with no securing mechanism to protect it from unintentional opening. The investigation did not determine why the valve had moved to the open position.

A survey carried out by the pipeline owner stated that the anchor dragged across six subsea pipelines and completely severed one 16-inch natural gas pipeline. The pipeline owner reported that 223,000 mcf of natural gas was released as a result of the rupture. An additional 26,800 mcf was later released in a controlled manner to clear the line.

Probable Cause

The National Transportation Safety Board determined that the probable cause of the damage to the subsea natural gas pipeline was the anchor from the *Valiant/Everglades* dragging across the pipeline after the vessel lost starting air pressure and propulsion due to the opening of an unprotected air system valve on deck.

LESSONS LEARNED

The 29 marine accidents the NTSB investigated in 2015 reveal an array of safety issues that provide the following lessons learned.

VOYAGE PLANNING

Before getting under way, vessel crews should develop a voyage plan covering the entire voyage from dock to dock. The plan should outline courses, expected times of course changes, transit speeds, available aids to navigation, and alternative routes or areas of refuge. It should also identify hazards to navigation along the intended route, considering factors such as restricted waters, traffic separation schemes, expected seasonal weather conditions, and areas of extensive tidal effects. Accidents involving the *American Dynasty* and *Tristan Janice* may have been avoided or mitigated by a detailed voyage plan.

COMMUNICATIONS

Effective communications are essential to safe operations, particularly during emergencies or close maneuvering situations. Before each voyage, vessel crews should develop a communications plan to include both internal (i.e., between watchstanding locations) and external (i.e., between vessels) communications, primary and backup communication systems, a list of stations or vessels using the systems, and procedures for switching between the systems in the event of a failure. Also, before engaging in any operation that involves an increased risk, vessel crews should discuss information expected to be shared during the operation along with emergency procedures. Poor internal communications were factors in the *American Dynasty* and *Anna Smile* accidents, and a lack of effective external communications played a role in the accidents involving the *King Neptune*, *Mesabi Miner*, and *Riley Elizabeth* tow.

FATIGUE

Given that inadequate crew/operator rest is a significant factor in accidents among all transportation modes, the NTSB has ranked reducing fatigue-related accidents among the top ten safety improvements on its latest *Most Wanted List*. In the marine industry, poor watchstanding due to fatigue was responsible for the loss of three fishing vessels: *Pacific Queen*, *Savannah Ray*, and *Titan*. Effective ways to prevent fatigue include hours-of-service limits, predictable work/sleep schedules, and consideration of circadian rhythms in shift scheduling.

ALERTING AND NAVIGATION ALARMS

Alarms can be effective tools in ensuring alert and vigilant watchstanding. These alarms can be based either on time, by sounding at preset intervals that require action by the watchstander, or on proximity, such as depth sounders, GPSs, or radar indicators. To effectively employ these alarms, owners and operators should implement written procedures for their configuration and use, and watchstanders should be familiar with their functionality. The groundings of fishing vessels *Savannah Ray* and *Titan* might have been prevented through proper use of alerting and navigation alarms. However, these alarms should not substitute for the management and mitigation of fatigue.

WRITTEN PROCEDURES AND TRAINING

The failure to take proper action to prevent or mitigate an emergency can often be traced to the absence of specific written procedures and a lack of training. Inadequate emergency procedures and training for engineering systems were contributing causes in the allision of bulk carrier *Anna Smile* with a grain elevator. The absence of ship-specific procedures for the autopilot on towing vessel *Krystal Sea* factored in its collision with Coast Guard cutter *Sycamore*.

FISHING VESSELS AND STABILITY

A forum on fishing vessel safety the NTSB convened several years ago revealed that fishermen may not know how to apply principles of stability in the safe operation of their vessels. The NTSB recommended that all owners, masters, and engineers of commercial fishing vessels receive mandatory training and demonstrate competency in vessel stability, watertight integrity, subdivision, and the use of vessel stability information. The capsizing and sinking of fishing vessel *Christopher's Joy* was attributed to a disregard for the impact of deployed fishing gear on the reserve stability of the vessel.

WATERTIGHT INTEGRITY

Maximizing the watertight integrity of a vessel is critical to buoyancy and stability in the event of a marine casualty. A hole in the side shell of a vessel, especially near the waterline, poses an immediate risk. When a potential hull breach has been identified, operations should be halted until repairs are made or the crew determines that the damage does not affect seaworthiness. For systems that source from or discharge to the sea, an effective lock-out/tag-out program helps to prevent inadvertent flooding associated with repairs. In addition, watertight doors should be kept closed at all times when a vessel is under way, unless a crewmember is passing through. A lack of watertight integrity contributed to the complete loss of six vessels during this reporting period: *Celeste Ann*, *Christopher's Joy*, *Jim Marko*, *Nalani*, *Nash*, and *Spirit of Adventure*.

ABANDONING SHIP

Crewmembers should wear appropriate personal protective equipment for operations under way and always wear personal flotation devices when abandoning ship. When towing vessel *Jim Marko* sank in the Mississippi River, two crewmembers were barefoot and one did not wear a personal flotation device. The river was experiencing high-water conditions at the time, which would have posed a heightened risk had crewmembers been forced to abandon ship into the water.

VESSEL PARTICULARS

VESSEL	FLAG	TYPE	LENGTH	DRAFT	BEAM/WIDTH	PERSONS ON BOARD
Ada C. Lore	United States	Small passenger vessel	77 ft (23.5 m)	6 ft (1.8 m)	22.5 ft (6.9 m)	1
Aiviq	United States	Anchor-handling tug	360 ft (109.7 m)	28 ft (8.5 m)	80 ft (24.4 m)	18
American Dynasty	United States	Fishing vessel	240 ft (73.5 m)	28 ft (8.5 m)	54.1 ft (16.5 m)	12
Anna Smile	Marshall Islands	Bulk carrier	738.2 ft (225 m)	64.3 ft (19.6 m)	106 ft (32.3 m)	22
Baaden	United States	Yacht	85 ft (25.9 m)	7.17 ft (2.9 m)	20.75 ft (6.3 m)	8
Blazer	United States	Fishing vessel	73 ft (22.25 m)	11 ft (3.35 m)	21.6 ft (6.6 m)	5
Calvin	United States	Towing vessel	99.2 ft (30.24 m)	11.5 ft (3.51 m)	28.6 ft (8.72 m)	4
Capt Le	United States	Fishing vessel	73.9 ft (22.5 m)	8 ft (2.4 m)	21.8 ft (6.6 m)	3
Celeste Ann	United States	Offshore supply vessel	112 ft (34.1 m)	7.5 ft (2.3 m)	26 ft (7.9 m)	12
Christopher's Joy	United States	Fishing vessel	74.8 ft (22.8 m)	12.2 ft (3.7 m)	23 ft (7 m)	4
Cordova Provider	United States	Barge	209.8 ft (64 m)	4.5 ft (1.4 m)	65 ft (19.8 m)	0
Cory Michael	United States	Towing vessel	59.5 ft (18 m)	8 ft (2.4 m)	23 ft (6.9 m)	3
Dennis Hendrix	United States	Towing vessel	180 ft (55 m)	8.5 ft (2.6 m)	52 ft (16 m)	10
Double Trouble 2	United States	Fishing vessel	45 ft (13.7 m)	N/A	N/A	0
Everglades	United States	Barge	474 ft (144 m)	21 ft (6 m)	84 ft (25 m)	0
Flag Gangos	Malta	Bulk carrier	623 ft (189 m)	59.1 ft (18 m)	105.9 ft (32.3)	23
Gloria May	United States	Offshore supply vessel	130.6 ft (39.8 m)	9.3 ft (2.8 m)	36 ft (11 m)	5
Hollyhock	United States	Coast Guard cutter	225 ft (69 m)	13 ft (4 m)	46 ft (14 m)	50
Jim Marko	United States	Towing vessel	66.4 ft (20.2 m)	N/A	24 ft (7.3 m)	4
Juno	United States	Fish processing vessel	138 ft (42.06 m)	12 ft (3.66 m)	30.1 ft (9.17 m)	1
King Neptune	United States	Small passenger vessel	62.1 ft (18.9 m)	8 ft (2.44 m)	19.1 ft (5.82 m)	1

VESSEL	FLAG	TYPE	LENGTH	DRAFT	BEAM/WIDTH	PERSONS ON BOARD
Krystal Sea	United States	Tug	49.9 ft (15.2 m)	12.5 ft (3.8 m)	34 ft (10.4 m)	4
Kulluk	Marshall Islands	Mobile offshore drilling unit	265.7 ft (81 m)	35 ft (10.7 m)	N/A	18
La Pietra	United States	Yacht	78.7 ft (24 m)	6.5 ft (2 m)	17.7 ft (5.4 m)	2
Medric II	United States	Pilot boat	48 ft (14.6 m)	2 ft (0.6 m)	16 ft (4.9 m)	0
Mesabi Miner	United States	Bulk carrier	1,004 ft (306 m)	29 ft (8.84 m)	105 ft (32 m)	22
Miss Susan	United States	Towing vessel	70 ft (21.3 m)	9 ft (2.7 m)	28 ft (8.5 m)	6
Nalani	Panama	Towing vessel	95.3 ft (29 m)	17.3 ft (5.3 m)	34 ft (10.4 m)	11
Nash	United States	Barge	260 ft (79.25 m)	17.5 ft (5.33 m)	55 ft (16.76 m)	0
Ocean Patriot	United States	Offshore supply vessel	220.8 ft (67.3 m)	15.5 ft (4.7 m)	54 ft (16.5 m)	42
Pacific Queen	United States	Fishing vessel	71.5 ft (21.8 m)	8.2 ft (2.5 m)	20.8 ft (6.3 m)	3
Pamisos	Liberia	Tanker	750 ft (228.6 m)	48.9 ft (14.9 m)	137.8 ft (42 m)	22
Riley Elizabeth	United States	Towing vessel	128 ft (39 m)	9.5 ft (2.9 m)	42 ft (12.8 m)	7
Savannah Ray	United States	Fishing vessel	82 ft (25 m)	11.7 ft (3.6 m)	24 ft (7.3 m)	4
Spirit of Adventure	United States	Small passenger vessel	85.8 ft (26.15 m)	7.25 ft (2.21 m)	31.5 ft (9.6 m)	0
Summer Wind	Liberia	Bulk carrier	607 ft (185 m)	22 ft (6.7 m)	100 ft (30.5 m)	23
Sycamore	United States	Coast Guard cutter	225 ft (68.6 m)	13 ft (4 m)	46 ft (14 m)	11
Titan	United States	Fishing vessel	76.8 ft (23.4 m)	12 ft (3.7 m)	25.8 ft (7.9 m)	5
Tristan Janice	United States	Offshore supply vessel	100.5 ft (30.6 m)	8.6 ft (2.6 m)	26 ft (7.9 m)	4
Valiant	United States	Tug	129 ft (39 m)	21 ft (6 m)	43 ft (13 m)	10
Winnipeg	Canada	Navy frigate	439.8 ft (134.1 m)	16 ft (4.9 m)	53.8 ft (16.4 m)	Unknown

ACCIDENT LOCATIONS

BULK CARRIER

1. ***Anna Smile***
   Houston Ship Channel, Houston, Texas

DIVING VESSELS

2. ***King Neptune***
   Avalon Harbor, Catalina Island, California
3. ***Ocean Patriot***
   Gulf of Mexico, south-southwest of Port Fourchon, Louisiana

FISHING VESSELS

4. ***Blazer***
   Pacific Ocean, off Siletz Bay, Oregon
5. ***Christopher's Joy***
   Gulf of Mexico, near Southwest Pass, Louisiana
6. ***Juno***
   Grays Harbor, Westport, Washington
7. ***Pacific Queen***
   Duncan Canal, near Lung Island, Alaska
8. ***Savannah Ray***
   Long Island, Alaska
9. ***Titan***
   Jetty A, off Cape Disappointment, Ilwaco, Washington

MOBILE OFFSHORE DRILLING UNIT

10. ***Kulluk***
    Near Ocean Bay, Sitkalidak Island, Alaska

MULTIPLE VESSELS

11. ***American Dynasty/Winnipeg***
    Esquimalt, British Columbia, Canada
12. **Eastport**
    Bay of Fundy, Eastport, Maine
13. ***Flag Gangos/Pamisos***
    Lower Mississippi River, Gretna, Louisiana
14. ***Gloria May/Capt Le***
    Gulf of Mexico, south of Pascagoula, Mississippi
15. ***Krystal Sea-Cordova Provider/Sycamore***
    Cordova Harbor, Alaska
16. ***Mesabi Miner/Hollyhock***
    Straits of Mackinac, Michigan
17. ***Summer Wind/Miss Susan***
    Houston Ship Channel, Lower Galveston Bay, Texas

OFFSHORE SUPPLY VESSELS

18. ***Celeste Ann***
    Gulf of Mexico, southeast of Grande Isle, Louisiana
19. ***Tristan Janice***
    Gulf of Mexico, south-southwest of Houma, Louisiana

PASSENGER VESSEL

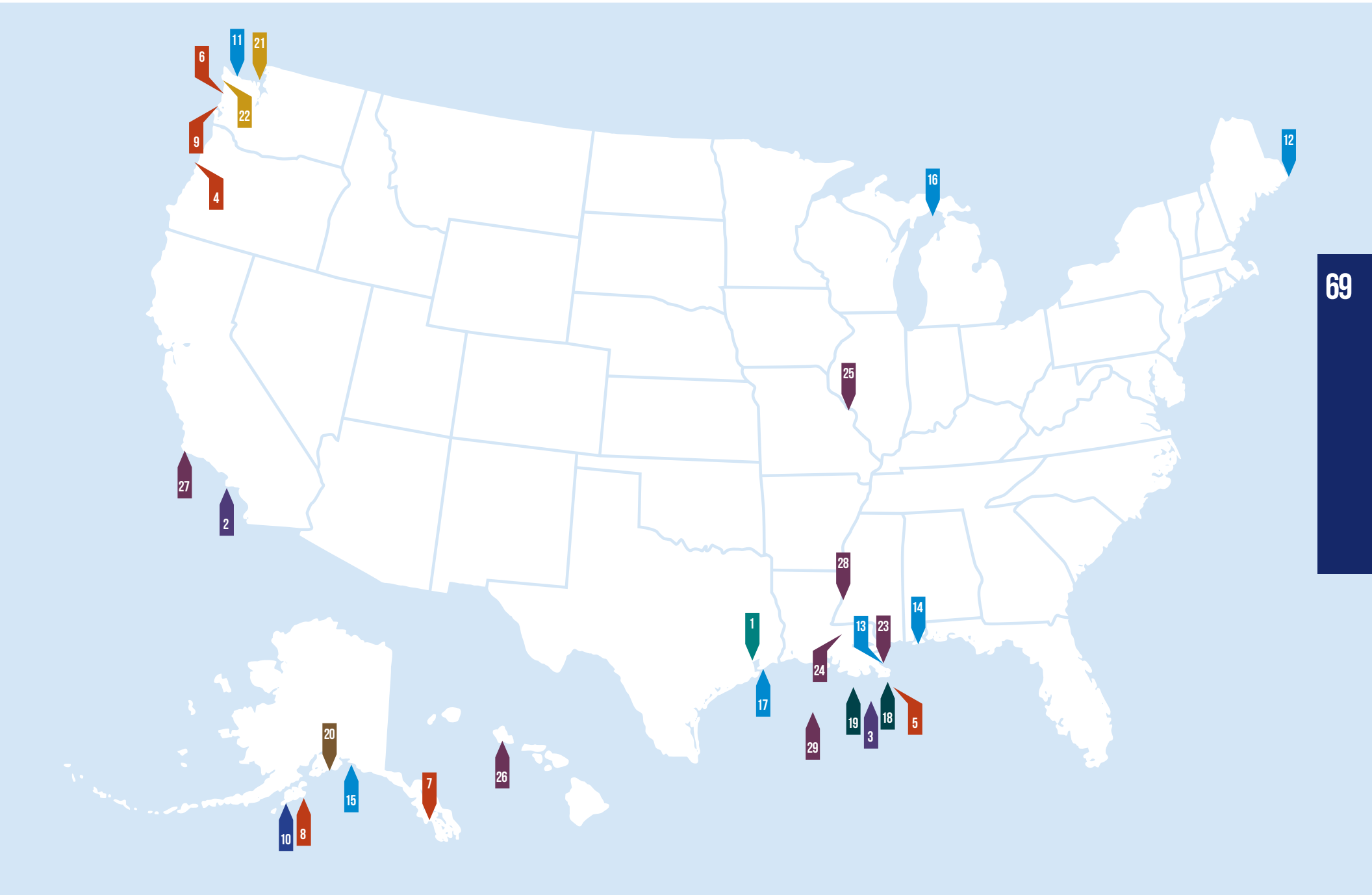
20. ***Spirit of Adventure***
    Seward Boat Harbor, Seward, Alaska

RECREATIONAL VESSELS

21. ***Baaden***
    Fidalgo Marina, Anacortes, Washington
22. ***La Pietra***
    Pacific Ocean, southwest of Destruction Island, Washington

TOWING VESSELS AND TOWS

23. ***Cory Michael***
    Industrial Canal, New Orleans, Louisiana
24. ***Dennis Hendrix***
    Lower Mississippi River, northwest of Baton Rouge, Louisiana
25. ***Jim Marko***
    Upper Mississippi River, near St. Louis, Missouri
26. ***Nalani***
    Pacific Ocean, west of Barbers Point, Oahu, Hawaii
27. ***Nash***
    Pacific Ocean, west of Point Conception, California
28. ***Riley Elizabeth***
    Lower Mississippi River, near Waterproof, Louisiana
29. ***Valiant-Everglades***
    Gulf of Mexico, southeast of Galveston, Texas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ACKNOWLEDGMENTS

For each marine accident the NTSB investigated, investigators from the Office of Marine Safety worked closely with the following Coast Guard units across the country.

ACCIDENT	COAST GUARD UNIT
American Dynasty/Winnipeg	Sector Puget Sound
Anna Smile	Sector Houston/Galveston
Baaden	Sector Puget Sound
Blazer	Sector Columbia River
Celeste Ann	MSU Morgan City
Christopher's Joy	Sector New Orleans, MSU Morgan City, and Sector Jacksonville
Cory Michael	Sector New Orleans
Dennis Hendrix	MSU Baton Rouge
Eastport	Sector Northern New England
Flag Gangos/Pamisos	Sector New Orleans
Gloria May/Capt Le	Sector Mobile
Jim Marko	Sector Upper Mississippi River
Juno	MSU Portland
King Neptune	Sector Los Angeles/ Long Beach

ACCIDENT	COAST GUARD UNIT
Krystal Sea-Cordova Provider/Sycamore	MSU Valdez
Kulluk	Investigations National Center of Expertise
La Pietra	Sector Puget Sound
Mesabi Miner/Hollyhock	Sector Sault Sainte Marie
Nalani	Sector Honolulu
Nash	MSD Santa Barbara
Ocean Patriot	MSU Morgan City
Pacific Queen	Sector Juneau
Riley Elizabeth	MSD Vicksburg
Savannah Ray	MSD Kodiak and Sector Anchorage
Spirit of Adventure	Sector Anchorage
Summer Wind/Miss Susan	MSU Texas City
Titan	MSU Portland
Tristan Janice	MSU Morgan City
Valiant-Everglades	MSU Port Arthur

For more information about the marine accident investigations featured in this publication, visit www.ntsb.gov.


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