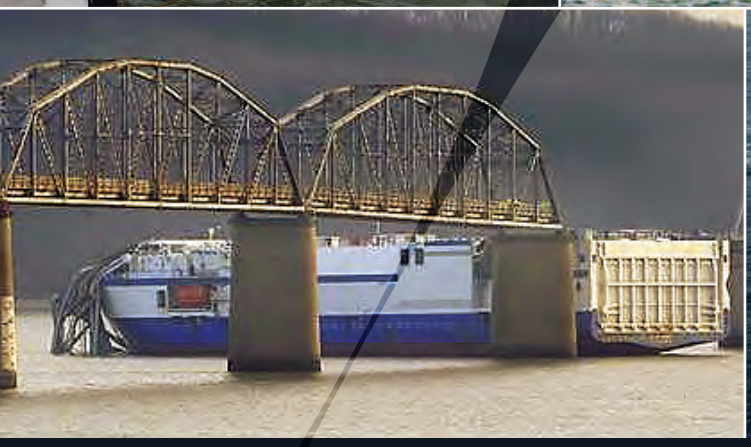
NTSB/SPC-14-01

Safer Seas 2013

LESSONS LEARNED FROM MARINE ACCIDENT INVESTIGATIONS



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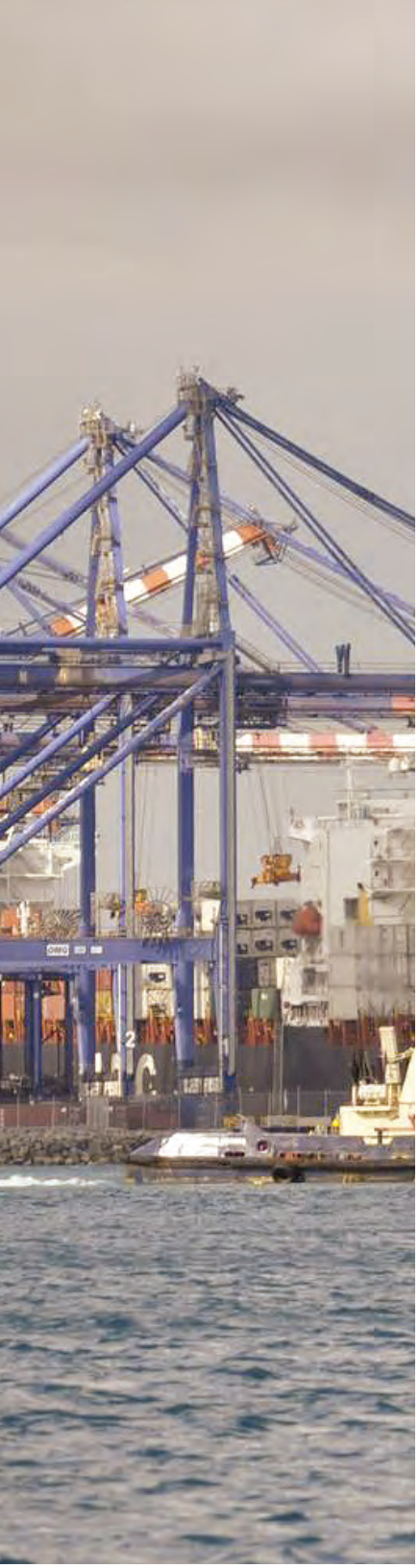
lessons learned from marine accident investigations



Safer Seas 2013

LESSONS LEARNED FROM MARINE ACCIDENT INVESTIGATIONS

Office of Marine Safety 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.

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MESSAGE FROM THE DIRECTOR

What Could Go Wrong?

In Safer Seas 2013 we have summarized and compiled marine accident investigations conducted by the NTSB and published in 2013. Our goal, as always, was to determine the cause of each accident, and recommend ways to make marine transportation safer. Hence our title, Safer Seas 2013.

Safer Seas 2013 is a "one stop shop," and is designed to be a quick and easy read. But Safer Seas also contains links to our detailed investigative reports for each of the year's marine accidents — 21 of them in 2013.

Safer Seas is also consolidated by vessel type, so that readers can more easily find reports relevant to their area of interest. We hope that this document gives operators and others such as safety professionals an easy-to-use tool to find the circumstances closest to those they encounter in their own area of interest. At the same time, Safer Seas should serve to inform and remind mariners of lessons learned in all areas, and increase awareness of the safety issues identified.

As many of these accident reports demonstrate, constant vigilance is critical to improving safety. Of all the systems on board a vessel, a human being is the most complex, and perhaps the most difficult one to integrate into a system of safer transportation. So long as human beings serve in marine transportation, however, the human element is also the only one that can never truly be replaced.

But if mariners are not constantly vigilant and if their organization's culture does not reinforce their respect for marine safety, humans themselves can cause incidents, accidents, and even tragedies.

Whether it's a fire resulting from a crewmember ignoring procedures, or a navigational accident caused by an error in judgment (such as the loss of the *HMS Bounty* in Superstorm Sandy), too often people put themselves and others at risk. We hope

that by reading and using these reports in the field, operators will improve their awareness and learn from others' misfortunes.

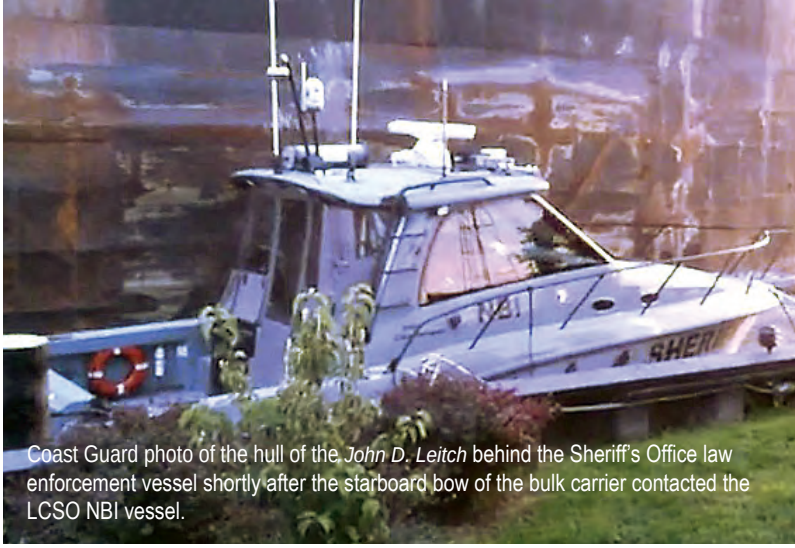
Most of all, we hope that "What Could Go Wrong?" becomes a literal question on every mariner's mind, not a rhetorical exercise. Flexible formats, including an e-book format, will help make these lessons more available to more mariners.

The NTSB's investigators see "What Could Go Wrong" with every accident we investigate. We hope to provide mariners a tool that they can read at home or at sea, so they can apply the lessons proactively rather than becoming a story for other mariners to learn from.

TRACY MURRELL

Director, Office of Marine Safety

Collision of Canadian Bulk Carrier *John D. Leitch* with Law Enforcement Vessel



Coast Guard photo of the hull of the *John D. Leitch* behind the Sheriff's Office law enforcement vessel shortly after the starboard bow of the bulk carrier contacted the LCSO NBI vessel.

Vessel Identification

Vessel	*John D. Leitch*	350 Challenger
Flag	Canada	United States
Construction	Steel	Fiberglass reinforced plastic
Crew complement	5	Moored

On October 3, 2012, about 1912, the 730-foot-long Canadian flag bulk carrier *John D. Leitch*, loaded with furnace coke, was outbound in the Black River at Lorain, Ohio, when the vessel collided with a 35-foot-long fiberglass-reinforced plastic law enforcement vessel and piling structure.

The *John D. Leitch* departed Hamilton, Ontario, Canada, on October 1, 2012, in ballast condition bound for the Jonick Dock & Terminal on the Black River at Lorain, Ohio. The vessel transited east across Lake Ontario, navigated through the eight locks separating Lake Ontario from Lake Erie, and by afternoon was crossing Lake Erie toward Lorain.

The next morning, the *John D. Leitch* was upbound in the Black River channel under the control of the master. The master relied heavily upon the vessel's bow thruster as the waterway narrowed in width from 800 feet to 200 feet and required a series of turns both port and starboard while passing through three bridges. He also stationed two watch officers on deck to act as spotters and to call out distances off critical points and objects using portable VHF (very high frequency) radios. The master maneuvered the vessel almost 3 nautical miles (nm) to the Upper Black River turning basin, swung the bow around, and then proceeded back downstream just over 1 nm and through one of the three bridges to his destination.

The *John D. Leitch* was all secure at the Jonick Dock & Terminal on the east side of the Black River at 0900.

The vessel began loading coke about an hour later. Coke is a solid carbonaceous material derived from distillation of bituminous coal used primarily as fuel and in smelting of iron ore. Over the next 30 hours, more than 25,877 metric tons of coke was loaded on the bulk carrier.

After loading, the vessel's drafts were recorded as 24 feet 3 inches forward, 24 feet 8 inches amidships, and 24 feet 10 inches aft. The controlling depth at that section of the Black River channel was reported to be 27 feet at that time.

At 1750, the vessel departed the Jonick Dock & Terminal bound for Port Cartier, Quebec, Canada. The vessel's master was in the wheelhouse and providing conning directions to an able-bodied seaman (AB) acting as helmsman. The first mate and third mate were on deck providing the master with distances off critical points and objects using portable VHF radios. The vessel's third engineer was on watch and in the engine room.

The outbound transit required an immediate port turn from the vessel's general heading of 356°, and the master then steadied up briefly on a heading of about 292° to pass through the railroad lift bridge. The speed of the vessel ranged between 0.4 and 1.2 knots for this segment of the transit. Once the vessel safely cleared the bridge, the master maneuvered starboard to a heading of 341° before initiating a second turn to port to a heading of 284° to allow passage under the highway bridge. When the master began that port turn, the vessel's speed was about 0.6 knots.

John D. Leitch

As the vessel's bow cleared the bridge supports on the channel's east side, the master noticed that the bow was not swinging to port as intended, so he applied more engine thrust and pitch to the vessel's propeller but with no effect. The master had allowed the stern of the vessel to transit close enough to the west bank of the channel that the stern was influenced by bank suction. As a result, the stern was pulled toward the west bank and the vessel's bow sheered to starboard, toward the east bank where the Lorrain County Sheriff's Office (LCSO) law enforcement vessel was moored at Coast Guard Station Lorain. At 1912, the forward starboard bow of the *John D. Leitch* made slight contact with a piling structure and the sheriff's office vessel.

After contact with the piling structure and the LCSO NBI (Northern Border Initiative) vessel, the master of the *John D. Leitch* maneuvered the vessel to the retaining wall on the west bank of the Black River and moored it. Following the accident, five crewmembers on the *John D. Leitch*—the master, first mate, third mate, AB, and third engineer—were tested for illegal drugs and alcohol. All test results were negative.

The allision between the *John D. Leitch*, the piling system, and the LCSO's NBI vessel resulted in the following damages:

- *John D. Leitch*: Small scrapes along portions of the forward starboard hull, with no plate inset.
- LCSO NBI vessel: Total damages exceeded $500,000.

No injuries were reported on board the *John D. Leitch*, and the LCSO's NBI vessel was unmanned at the time of the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the allision was the failure of the master of the *John D. Leitch* to properly account for bank effect while maneuvering in the confined waters of the Black River.

The *Star Grip* under way. Visible immediately forward of the superstructure at the stern of the ship are two gray-colored gantry cranes. In this photo, the cranes' cantilever arms are folded inward toward the center of the ship. (Photo by Frank Katzer, available at www.marinetraffic.com)

Collision Between Bulk Carriers *Mary Ann Hudson* and *Star Grip*

Vessel Identification

Vessel	*Mary Ann Hudson*	*Star Grip*
Flag	United States	Norway
Engine power and type	2 Delaval, 7,800 hp	1 Mitsui B&W diesel, 10,120 hp
Crew complement	20	N/A

On June 6, 2012, at 0530 central daylight time, the underway bulk carrier *Mary Ann Hudson* collided with the moored bulk carrier *Star Grip* while the *Mary Ann Hudson* was being moved from City Dock 21 to City Dock 29. No one was injured and no pollution resulted from the accident; however, both vessels sustained damage totaling more than $500,000.

About 45 minutes earlier, a pilot with the Houston Pilots Association boarded the *Mary Ann Hudson*, moored port side to at City Dock 21 in the Houston Ship Channel. The pilot was on board to shift (relocate) the vessel to City Dock 29, about a half mile down the channel. While awaiting the arrival of assistance tugboats, the master conducted the master pilot exchange, discussing the vessel particulars and the route. Two tugboats, the *Mars* and the *Andrew K*, arrived about 0450. The pilot positioned the *Mars* on the bulk carrier's starboard quarter and the *Andrew K* on the starboard bow.

On the bridge of the *Mary Ann Hudson* were the pilot, the master, and a helmsman. The vessel's chief mate was positioned on the bow of the vessel along with the boatswain and two able-bodied seamen. The weather was clear, the winds calm, and darkness prevailed in the early morning hour. At 0521, all lines were in and the pilot ordered the tugs to move the *Mary Ann Hudson* away from the dock towards the center of the channel. Once the pilot confirmed that the vessel was clear, he instructed both tugs to slack their lines and lie alongside before he ordered slow ahead with 20 degrees of port rudder. Once the ship was on centerline in the channel, he eased the port rudder command.

Another bulk carrier, *Star Grip*, was moored port side to at City Dock 23, directly forward of the *Mary Ann Hudson*. The *Star Grip* had two gantry cranes on board, and at the time, the cranes' cantilever arms were extended out over the side of the vessel. The pilot told investigators that, as the *Mary Ann Hudson* proceeded down the channel, he felt like the stern of the ship was drifting toward the *Star Grip*.

At 0528, the chief mate on the bow of the *Mary Ann Hudson* radioed the master and informed him that the aft gantry crane on the *Star Grip* was overlapping the *Mary Ann Hudson* (the crane's cantilever arm was passing over the *Mary Ann Hudson*'s deck). The master told investigators that he saw the crane arm over his vessel's deck somewhere between the No. 2 and No. 3 cargo hatches.

The pilot ordered 20 degree port rudder and half ahead, and ordered the *Andrew K* (on the starboard bow) to back easy, intending to lift the vessel away from the *Star Grip*. However, these actions were not enough to move the *Mary Ann Hudson* clear of the crane. At 0530, the *Mary Ann Hudson* struck the cantilever arm on the *Star Grip*'s aft crane. As the *Mary Ann Hudson* passed by, its port stores crane and the forward port corner of the superstructure were damaged, and railings were knocked down. The pilot told investigators that, in his opinion, the reason the *Mary Ann Hudson* did not move clear of the crane was that the *Mars* was alongside on the starboard quarter.

After the collision, the *Mary Ann Hudson* continued toward its intended berth. Once docked, at 0601, the pilot called the US Coast Guard vessel traffic service (VTS) to report the collision. The tug masters were unaware that the *Mary Ann Hudson* had hit the crane on the *Star Grip* until after they had docked the vessel at its new location, and the pilot informed them.

Personnel on board the *Mary Ann Hudson*, including the pilot, and on board both tugboats held appropriate merchant mariner's credentials issued by the Coast Guard for the route, scope of operation, and service of each vessel. Following the collision, these personnel were tested for illegal drugs and alcohol. All test results were negative.

The damage amount to the *Mary Ann Hudson* and the *Star Grip* was estimated to be at least $250,000 for each bulk carrier.

No one was injured on board either vessel, and no pollution or loss of cargo resulted from the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision between bulk carriers *Mary Ann Hudson* and *Star Grip* was the pilot's ineffective handling of the *Mary Ann Hudson* and his ineffective use of the two tugboats to maneuver the vessel around the *Star Grip*'s crane arms, which were extending into the navigable waterway.

Mary Ann Hudson

Fire on Board Vehicle Carrier *Alliance Norfolk*

Vehicle carrier *Alliance Norfolk*. Photo by Jeffrey J. Kunce, http://marinetraffic.com.

Vessel Identification

Vessel	*Alliance Norfolk*
Flag	United States
Cargo	Cars, trucks, motorcycles, boats; industrial and manufacturing parts and equipment; boxes and containers
Crew complement	23

On the morning of March 10, 2012, while transiting between Malta and Sicily, Italy, in the Mediterranean Sea, the *Alliance Norfolk*, a roll on/roll off vehicle carrier, encountered rough weather and heavy seas resulting in damage to its cargo and a subsequent fire on a cargo deck. The fire was extinguished at sea, but 2 days later while in port, the damaged cargo deck was ventilated, and the fire reflashed, causing further damage to the vessel and its cargo.

The vessel was on a voyage from Jacksonville, Florida, bound for ports in the Arabian Gulf via the Suez Canal when it experienced rolls up to 30 to 35 degrees during its passage through the Mediterranean. While experiencing rough seas, the main engine tripped and was subsequently restarted. During this time the crewmembers checked the status of cargo, which included military containers, commercial vehicles, motorcycles, small boats, and electrical and other equipment. During one of these checks, a crewmember observed large engines, generators, air conditioning chillers, and 20 foot containers adrift on cargo deck 5. Cargo items were shifting with the rolling of the vessel, being thrown against each other and the main deck supports of the cargo deck. The crew was unable to safely secure the cargo.

At 1030, the fire detection and alarm system activated on cargo deck 5. The chief mate and chief engineer investigated and saw flames and heavy smoke coming from the area. Ventilation and boundaries for the area were secured in preparation for release of the fixed carbon dioxide (CO_2) fire extinguishing system, which was activated at 1050. Adjoining spaces were monitored for heat or fire, and the master reported that the fire was extinguished at 1250.

Coast Guard investigators could not determine the initial source of ignition. However, the dynamic environment of the vessel rolling in heavy seas and shifting cargo in the presence of various flammable liquids (held within the mixed cargo and containers) could have produced an ignition source.

The vessel changed course to Piraeus, Greece, as a port of refuge, and anchored there 2 days later at 1200 on March 12, 2012. A marine chemist boarded the vessel and at 1700 declared cargo decks 4, 5, and 7 safe for mechanical ventilation. However, at 2000 that evening, heavy black smoke was seen escaping from the ventilation system, indicating that the smoldering fire had reflashed when ventilation reintroduced sufficient oxygen to feed the fire. The space was again secured, and the local fire department boarded the vessel and brought the fire under control nearly 9 hours later, at 0445 on March 13, 2012.

Following the accident, test results for illegal drugs and alcohol were negative for *Alliance Norfolk* crewmembers. Three crewmembers reported minor injuries.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board the *Alliance Norfolk* was ignition of flammable material by an undetermined ignition source on deck 5 due to shifting cargo while the vessel was rolling in heavy seas after losing power. Contributing to the severity of the damage was the reflash of the smoldering fire when the vessel was in port.

Allision of *Delta Mariner* with Eggner's Ferry Bridge

Eggner's Ferry Bridge with *Delta Mariner* anchored after striking span E. The stern of the vessel is visible between the piers of the downed span E. Photo by www.wired2fish.com.

Vessel Identification

Vessel	*Delta Mariner*
Flag	United States
Construction	Steel
Crew complement	16 crewmembers; 2 pilots, 2 representatives of cargo owner

The *Delta Mariner,* a US flagged roll on/roll off cargo vessel, departed Decatur, Alabama, on January 25, 2012, carrying rocket components to Cape Canaveral, Florida. The next day, the vessel allied with Eggner's Ferry Bridge on the Tennessee River.

The ship's intended route was along the Tennessee River to the Ohio River at Paducah, Kentucky, then south down the Mississippi River to the Southwest Pass and the Gulf of Mexico to Florida. The voyage typically took 8 to 10 days.

On the day of the accident, the *Delta Mariner* transited in rain, heavy at times, and reduced visibility. By evening the rain had subsided, and crewmembers reported that the visibility was good.

Sixteen crewmembers were on board, along with two contract pilots and two representatives of United Launch Alliance (ULA), a space industry manufacturing and assembly operation and owner of the cargo. The *Delta Mariner* is owned by Foss Maritime Company and operated by Foss Atlantic.

In the pilothouse as the vessel approached the Eggner's Ferry Bridge were the master, chief mate, third mate, an able-bodied seaman (AB), and one of the contract pilots. Although the chief mate was the senior officer on watch, he was acting as helmsman at the time of the allision. The third mate was the other deck officer on watch. The master arrived in the pilothouse about 10 minutes before the accident for a routine visit but was not on watch at the time. The AB was serving as lookout.

At 2001 local time, the *Delta Mariner* allided with a bridge span that provided insufficient vertical clearance for the vessel's passage (the lowest of Eggner's Ferry Bridge's four navigable spans). The *Delta Mariner* was traveling at a speed of about 11.5 mph when it struck the bridge and tore away a 322 foot long span, including a portion of US Highway 68. Bridge debris lodged across the bow of the ship. The vessel sustained minor damage to its bow area, but its cargo was undamaged. Traffic was light on the bridge at the time of the accident, and vehicles traveling on the highway stopped before reaching the missing span. No injuries were reported on the vessel or on the highway, and no pollution was reported.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the allision of the *Delta Mariner* with Eggner's Ferry Bridge was the bridge team's exclusive reliance on the contract pilot's incorrect navigational direction as the vessel approached the bridge and their failure to use all available navigation tools to verify the safety of the vessel's course. Contributing to the accident was Foss Maritime Company's failure to exercise effective safety oversight of the *Delta Mariner*'s operations and the failure of the Kentucky Transportation Cabinet to effectively maintain bridge navigation lighting.

Collision between Maersk Wisconsin and Tug and Barge Unit *Ruth M. Reinauer*

The *Maersk Wisconsin* at anchor. (Photo by Jeff Byrd, available at www.shipspotting.com)

Vessel Identification

Vessel	*Maersk Wisconsin*	*Ruth M. Reinauer*	*RTC 102*
Flag	United States	United States	United States
Type	Freight ship	Uninspected towing vessel	Double-hulled tank barge, ocean service
Crew complement	22 crew and 2 pilots	7	Unmanned

The container ship *Maersk Wisconsin*, assisted by two tugs, left Port Elizabeth, New Jersey, in the early morning hours of December 5, 2011, to begin its transit south toward Kill Van Kull, through New York Harbor, and then to sea. At 0213, with fog reducing visibility to about 0.25 miles, the container ship collided with a tug and barge unit in Kill Van Kull channel near Bergen Point, New Jersey.

The tug *Ruth M. Reinauer* was pushing barge *RTC 102* westbound in Kill Van Kull, a narrow, busy waterway connecting New York Harbor Upper Bay to the east and Newark Bay and Arthur Kill about 3 miles to the west near Bergen Point, New Jersey. The *Ruth M. Reinauer* and barge *RTC 102* formed an articulated tug and barge unit—the tug and barge locked together to form one vessel allowing hydrodynamic efficiencies resulting in greater sea speed and sea keeping.

About 0120, the *Maersk Wisconsin* was approximately 1 nautical mile from the point at which Newark Bay joins the Kill Van Kull channel. One tug was positioned off the starboard bow, the other tug off the port quarter. With fog developing and visibility diminishing, the docking pilot reduced the speed of the vessel to about 2 knots and sounded the vessel's fog signal.

Radio communications were obtained from voyage data recorder audio included in the Coast Guard accident investigation report. At 0158, the docking pilot was positioning to make a port turn to shape up for passing under the Bayonne Bridge in Kill Van Kull when he asked the second pilot on board to radio the *Ruth M. Reinauer* to request the tug and barge to hold back. The mate of the *Ruth M. Reinauer* responded that a flood current off his vessel's stern prevented him from holding back. The *Maersk Wisconsin* docking pilot acknowledged and suggested instead that the tug and barge stay "tight on the reds," referring to the red buoys on the New Jersey side of Kill Van Kull. The mate on board the tug agreed to this port-to-port meeting arrangement and continued his westbound course at 6 knots.

About 9 minutes later, at 0207, the *Maersk Wisconsin* docking pilot told the mate of the *Ruth M. Reinauer* that the two vessels would meet on the west side of the bridge and that the *Maersk Wisconsin* was proceeding slowly (about 1–2 knots) and would give the tug and barge space to pass. At 0208, the docking pilot radioed the tug to say the *Maersk Wisconsin* would be "closer to the reds [red buoys] than we want to be." He received no response from the *Ruth M. Reinauer.*

At 0211, the docking pilot ordered the *Maersk Wisconsin*'s engine to slow astern. About the same time, the mate on board the *Ruth M. Reinauer* radioed the docking pilot and said, "You're turning right into me, captain." The docking pilot responded that the *Maersk Wisconsin* was all stop. The mate on the *Ruth M. Reinauer* replied that his tug and barge were right up against the red buoys, and the docking pilot instructed the mate to keep coming and to proceed around the *Maersk Wisconsin*. Less than a minute later, the *Ruth M. Reinauer* mate radioed, "Hey captain, have your tugs push you

away" but received no reply. On the *Maersk Wisconsin,* the pilot ordered, "Start thrusters and [engine] full astern." The mate of the *Ruth M. Reinauer* attempted to use engines to maneuver his vessel to avoid a collision. About 0213, the bow of the *Maersk Wisconsin* contacted the port side midships of the barge *RTC 102*. At the time of the collision, the speed of the *Maersk Wisconsin* was less than 1 knot, and the speed of the *Ruth M. Reinauer* was about 5 knots.

No one was injured on board either vessel, and no pollution or loss of cargo resulted from the accident. Following the accident, three crewmembers on the *Ruth M. Reinauer*, nine crewmembers on the *Maersk Wisconsin*, and the docking pilot were tested for illegal drugs and alcohol. All test results were negative.

Both the container ship *Maersk Wisconsin* and the barge *RTC 102* were damaged in the collision. On the *RTC 102*, two portside ballast tanks were holed at the deck level and sustained side shell plate damage and upset of internal framing. Some frame and plate damage was also noted in a cargo tank. The bow of the *Maersk Wisconsin* sustained shell plate damage and was holed about 23 feet above the waterline. Internal framing of that compartment was also distorted.

The initial total estimated damages to the *Maersk Wisconsin* and the *RTC 102* exceeded $500,000.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision was the failure of the docking pilot on board the *Maersk Wisconsin* to position his vessel according to the meeting arrangement with the *Ruth M. Reinauer* to allow adequate separation for passage of the tug and barge in the navigable channel.

Maersk Wisconsin

Allision of Container Ship *Rickmers Tokyo* with Pier 11

The *Rickmers Tokyo* under way with varied cargo. (Photo by www.rickmers-linie.com)

Vessel Identification

Vessel	*Rickmers Tokyo*
Flag state	Marshall Islands
Construction	Steel
Crew complement	27

While transiting outbound in the Delaware River north of downtown Philadelphia, a river pilot conning the multipurpose container ship *Rickmers Tokyo* missed the turn in the channel and allided with Pier 11 about 1909 on December 23, 2011. The pilot, who was not wearing his required corrective eyewear, lost situation awareness with regard to the vessel's location and did not use all available navigation equipment to fix its position.

The *Rickmers Tokyo* arrived in Philadelphia on December 22, 2011, and docked port side to the Tioga Marine Terminal, facing up the Delaware River. On completion of cargo operations, the vessel got under way to Antwerp, Belgium.

A river pilot was on board. After he issued several rudder commands at 1907 that failed to adjust the vessel's heading for the first course change in the channel, which called for a 17.5° turn to port, the vessel left the navigation channel to starboard. Noticing a dark shape ahead, the pilot and then the master ordered port rudder commands to move the ship away from the right bank, but the *Rickmers Tokyo* struck Pier 11 about 1909.

Prior to and during the allision, both the bosun and the second officer were stationed on the foredeck near the anchors. The bosun commented to the second officer that the vessel was approaching the shore too closely, and when about 50 meters from contact the second officer radioed the master with this warning. About the same time, the second officer heard the master command "hard port" over his handheld radio.

By 1938 the crew reported to the master that the vessel had a large hole at the waterline and had ruptured a ballast tank. The master wanted to anchor, and the river pilot suggested the Marcus Hook Anchorage below downtown Philadelphia. At 2205, the vessel anchored at this location, about 22 miles from the allision, and the river pilot disembarked the vessel.

The *Rickmers Tokyo* had centerline cranes forward of the bridge. To allow for an unobstructed view directly forward, the bridge was offset to starboard, which partially obstructed the view to port but not to starboard. The bridge console included two radar/automatic radar plotting aid (ARPA) displays designated port and starboard and located directly to each side of the helm position. The crew reported that from 1859 to the allision, the river pilot remained seated in front of the port radar display and navigated by looking out the bridge windows and using his personal piloting unit (PPU), a laptop computer loaded with navigational software. The pilot said the night was "pitch black and moonless" but also commented in an interview that "visibility was perfect."

Neither Pier 11 nor adjacent piers had any installed lighting and therefore lacked contrast with the river and the shore. Additionally, the city lights of downtown Philadelphia were directly behind this pier set when proceeding downriver, producing background lighting. With the exception of the trees on the pier, which the master noticed before taking evasive action, the piers had a relatively low profile against the city lighting.

After taking the conn and transiting the Harbor Range at 260.5 degrees, the river pilot issued only course

changes to 254 degrees before taking action to avoid Pier 11, but a change to at least 243 degrees was required to begin the next channel leg.

The pilot commented in an interview the day after the accident that he thought they struck Pier H, which was about 1,200 yards upriver from Pier 11. The pilot's perception that the allision location was about 0.5 nautical mile from the actual accident site indicates a significant error on his part, especially considering that he was navigating a narrow channel within a constrained river.

Following the accident, nine *Rickmers Tokyo* crewmembers, including the bridge and bow teams, and the river pilot were tested for illegal drugs and alcohol. All test results were negative.

Although the river pilot had prescription corrective lenses for nearsightedness, he did not wear them at any time during the transit up to the allision. As the river pilot's uncorrected vision was 20/50, not using his glasses when looking ahead reduced his ability to perceive distant visual cues on a dark night.

According to the vessel operator, the initial repair cost for damage to the vessel was $546,391. A surveyor's report estimated the damage to the pier was $121,800.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the allision of *Rickmers Tokyo* with Pier 11 in the Delaware River was the river pilot not executing the turn at Port Richmond due to his lack of situation awareness regarding the vessel's position in the channel and his inadequate use of all available navigation equipment. Contributing to the allision was the river pilot's failure to wear his corrective eyewear, which was required and would have assisted with distant visual cues on the dark evening.

Rickmers Tokyo

Grounding and Loss of the *Chevelle*

The abandoned fishing vessel *Chevelle* on the Yaquina Bay entrance north jetty the day after grounding. (Photo by Ed Chauvaud)

Vessel Identification

Vessel	*Chevelle*
Flag	United States
Propulsion type	Single engine, 4-blade propeller
Crew complement	4 persons and 1 dog

The fishing vessel *Chevelle* was returning to its homeport of Newport, Oregon, when a series of large breaking waves on its stern resulted in a loss of maneuverability and grounding on the Yaquina Bay entrance north jetty on March 10, 2012. The crew was hoisted to safety by a US Coast Guard helicopter before the vessel broke apart and sank more than a day later, resulting in an estimated loss of $625,000. No one was injured.

Two days earlier, the *Chevelle* had completed a Dungeness crabbing trip near Point Arena, California, and was heading north to unload its catch in Newport, a voyage of about 360 nautical miles. On board the vessel were the master and three deckhands, accompanied by a dog. The master told investigators that, before the vessel departed Point Arena, he checked all bilge alarms and found them to be functional. He estimated that at the time of the accident, the vessel had 3,000 to 4,000 gallons of diesel fuel remaining.

To reach Newport harbor, vessels must transit from the Pacific Ocean into the Yaquina River and Yaquina Bay. As in many coastal northwest harbors, vessels arriving and departing Newport must cross a "bar" where the deep waters of the ocean meet the shallower waters near a river mouth. North and south jetties 990 feet apart protect the 40-foot-deep entrance channel to Yaquina Bay.

At 1344 on March 10, Coast Guard Station Yaquina Bay issued a bar report restricting "all recreational vessels and uninspected passenger vessels" from operating in the channel from the middle of the north jetty to the ocean due to hazardous conditions. Although these reports provide all mariners information regarding bar conditions, as a commercial fishing vessel, the *Chevelle* was not subject to these restrictions.

Shortly after 1700, the master turned the *Chevelle* east to cross the Yaquina Bay bar and lined up the vessel on the center of the entrance channel. He later stated that although there was some wave and chop on the bar, he had crossed it in worse conditions and did not hesitate to proceed. On the other hand, a crewmember indicated that these were the worst conditions in which he had attempted to cross a bar.

As the vessel began the transit, swells were increasing. After the accident, at 1906, the Coast Guard expanded the bar restriction to include a larger area of the channel.

Just before the *Chevelle* crossed the jetty tips, the vessel took a large breaking wave over its starboard quarter, resulting in a severe heel and turning the vessel toward the north jetty. Another wave over the starboard quarter rolled the vessel again, leaving the *Chevelle* heeled further over and down by the head, and it did not recover. A witness said crab pots located on the deck appeared to shift. Such a redistribution of weight, along with water on the deck from the breaking wave, could have contributed to the severity of the heel and the inability of the vessel to right itself. The wave left the vessel touching the north jetty boulders bow-first but the vessel was not hard aground.

The master initially attempted to back down but was unable to free the vessel as subsequent waves drove it further against and up onto the jetty. At 1725, the master contacted the Coast Guard for assistance, and two 47-foot-long motor lifeboats (MLBs), designed for operation in heavy surf, launched to respond. At 1739, the *Chevelle* lost propulsive power, but its generator continued to operate. By 1948, a hull breach caused the vessel engine room and forepeak tank to begin flooding, and a stream of diesel oil was leaking from the hull.

The crew donned survival suits, and the MLBs attempted to tow the vessel off the jetty. The Coast Guard took the vessel under a 100-foot tow but had to cut the line at 1805 because the vessel was hard aground and conditions were hazardous. The rough conditions prevented the MLBs from conducting a rescue, and one crewman jumped off the vessel to the jetty. At 1823, a Coast Guard helicopter arrived, and all four crewmembers and the dog were hoisted to a safe location on the south jetty where they were able to walk ashore.

After the *Chevelle* broke apart and sank, the forward half of the vessel was later located inside the north jetty tip and salvaged in August 2012, but the stern was not located. The monetary loss due to the sinking was estimated to be $625,000.

Aerial view of accident location at entrance jetties to Yaquina Bay near Newport, Oregon. Inset map shows location of Newport in the Pacific Ocean. (Satellite images by Google Earth)

After the accident, the master was tested for both alcohol and drugs with negative results. He stated he was very familiar with transiting the Yaquina Bay bar and had done so "hundreds" of times. The other three deckhands had from 2 to 20 years of fishing vessel experience.

Regardless of precautions taken, crossing a bar in large swells is inherently hazardous, and mariners should take steps to reduce risk.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the grounding and subsequent loss of the *Chevelle* as it crossed the Yaquina Bay bar was the master's loss of control of the fishing vessel after a series of breaking waves on the stern heeled the vessel to a severe degree from which it did not recover.

Sinking of the *Heritage*

Vessel Identification

Vessel	*Heritage*
Flag	United States
Year built	1977
Construction	Steel
Gross tonnage	109
Engine	Diesel

The 67-foot-long fishing vessel *Heritage* was returning to Lazy Bay to unload a cargo of fish to the fish tender vessel *Tuxedni*. The seven-person complement on board the *Heritage* had been fishing south of Sitkinak Island, about 25 miles south-southeast of Lazy Bay. During the return, which took place in a storm, ice built up on the vessel, causing it to list, flood, and sink. The crew abandoned the vessel about 0600 on January 25, 2012.

The master stated that, while en route to Lazy Bay, the *Heritage* encountered northwest winds in excess of 50 knots and heavy freezing spray. The master stopped the vessel in Russian Harbor, about 12 miles southeast of the port in Lazy Bay, so the crew could remove ice from the vessel. After ice removal and waiting for slack tide, the master resumed the return voyage across Alitak Bay toward Lazy Bay.

As the vessel transited toward Lazy Bay, the crew continued to remove ice. One of the crewmembers said, "The final time we beat ice we didn't make a lot of progress and it seemed like we made ice as fast as we could clear it." The master said that, while crossing Alitak Bay, the vessel experienced 90 mph wind gusts, 10- to 15-foot seas, snow, and fog. Eventually, the crew took a break from ice removal. One of the crewmembers told investigators that, about 20 minutes after the break began the vessel started listing to port. Another crewmember said that after the vessel began to list he saw the engine room fill with water.

Map of the area in which the *Heritage* transited and sank.

The master made a radio distress call, and then he, the crew, and the onboard National Marine Fisheries Service (NMFS) observer donned their immersion suits and entered the water about 3.5 miles from Lazy Bay. The master and four of the crewmembers made it into the vessel's liferaft and were picked up by the crew of the Tuxedni, with which they were to rendezvous in Lazy Bay. The crew of a US Coast Guard helicopter rescued the final crewmember and the NMFS observer from the water.

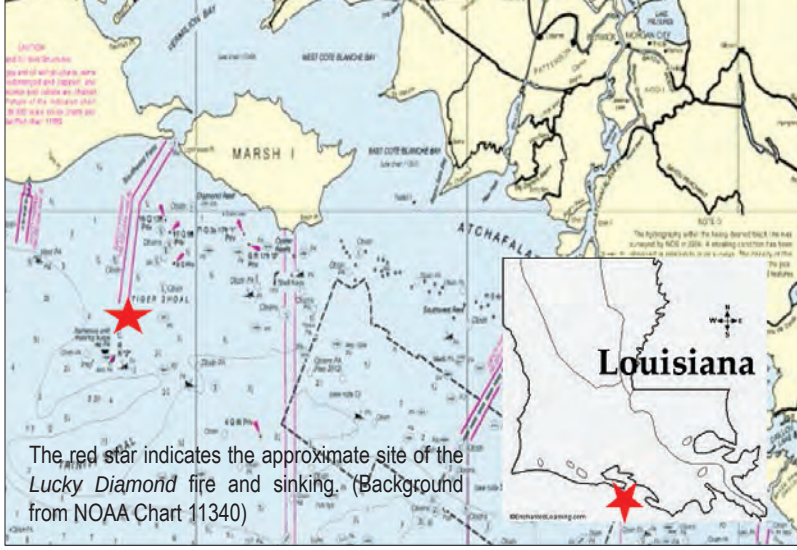
Each of the National Weather Service marine forecasts for the area where the *Heritage* operated included a "heavy freezing spray warning" beginning at 0400 on Sunday, January 22, 2012, when the vessel departed Lazy Bay, to the time of the sinking. Sea spray icing occurs when cold, wave-generated spray comes in contact with exposed surfaces and the air temperature is below freezing. Higher wave heights produce more sea spray, which results in greater vessel icing.

Following the accident, the master was tested for illegal drugs. The result was negative. None of the men were tested for alcohol.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the sinking of fishing vessel *Heritage* was the master's decision to proceed with the voyage despite known weather conditions that would adversely affect the safety of his vessel. Specifically, the weather conditions caused icing on the vessel resulting in a loss of stability due to added weight on the decks and superstructure.

Fire on Board and Sinking of the *Lucky Diamond*



The red star indicates the approximate site of the *Lucky Diamond* fire and sinking. (Background from NOAA Chart 11340)

Vessel Identification

Vessel	*Lucky Diamond*
Flag	United States
Construction	Steel
Engine power and type	2 Caterpillar 3412 diesels at 600 hp (447 kW) each
Crew complement	4

On April 28, 2012, the *Lucky Diamond* departed its homeport in Sabine Pass, Texas, for a month-long shrimping trip. On board the vessel were a master and three crewmembers. About 1600 on May 10, 2012, the men stopped fishing for the day and moored the *Lucky Diamond* stern-to-stern with the anchored fishing vessel *Miss Carol*, whose master was a friend of the *Lucky Diamond*'s. After a final check of the engine room, the master of the *Lucky Diamond* confirmed that everything looked good. The crew had dinner and went to sleep. Later that night at 2200, the master awoke to the smell of smoke and went to the galley area to investigate. He observed heavy smoke in the galley area and in the vicinity of the crew quarters. In addition, he saw fire coming up through the deck area near the crew quarters. The electrical supply cables from one of the vessel's diesel generators passed directly underneath this area.

The master shouted to alert the crew and opened the door to the crew accommodation space, but heavy smoke prevented him from seeing inside.

The master tried unsuccessfully to fight the fire with onboard firefighting equipment. In his effort, the fire lashed back at him and he sustained first-degree burns to his face and eyes. He then abandoned the vessel via the stern where he boarded the *Miss Carol*. At that time, the entire accommodation space of the *Lucky Diamond* was engulfed in flames, and the crew of the *Miss Carol* cut the mooring lines to the *Lucky Diamond*, setting the vessel adrift. The *Lucky Diamond* burned for several hours and then sank in about 40 feet of water.

On May 17, 2012, divers with T & T Bisso, LLC, performed a penetration dive on the hull and remaining structure of the *Lucky Diamond*, which was resting on its keel and starboard side shell. The divers identified extensive fire and heat damage, including warped steel bulkheads, decks, and a watertight door. They could not locate any human remains.

The status of the navigational, mechanical, propulsion, steering, and other vital systems on board the *Lucky Diamond* at the time of the accident could not be determined, but the master stated they were operational before the accident. The investigation could not determine which electrical generation system was energized at the time of the fire's ignition.

The fire and subsequent sinking of the *Lucky Diamond* resulted in the total constructive loss of the vessel. In addition, oil sheening was observed in the area of the Gulf of Mexico where the vessel sank.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the loss of the uninspected fishing vessel *Lucky Diamond* was a fire of unknown origin in the engine room followed by downflooding of the interior compartments and eventual sinking of the vessel.

Flooding and Sinking of the *Mary Kay*

Mary Kay during its 2012 shipyard period in Port Townsend, Washington, (Photo by Port Townsend Shipwrights Co-Op)

Vessel Identification

Vessel	*Mary Kay*
Flag	United States
Engine type	Diesel
Crew complement	4

On July 26, 2012, about 2300 Alaska daylight time, the commercial fishing vessel *Mary Kay* sank as a result of flooding in the starboard fish hold, the lazarette, and the engine room. The sinking took place in Dixon Entrance, near Cape Chacon, Prince of Wales Island, Alaska. The four crewmembers safely abandoned the vessel and were rescued.

Almost a month earlier, on July 1, 2012, the *Mary Kay* had returned to service following a 3-month shipyard period at Port Townsend, Washington. During this time, extensive modifications were made, which included adding a third fish hold, replacing wornout bottom planking, removing a hydraulic bilge pump, and installing a refrigerated sea water circulation pipe. The addition of the third fish hold nearly doubled the vessel's capacity and likely changed its center of gravity.

When the *Mary Kay* departed the Port Townsend shipyard facility on July 1, 2012, the vessel returned to service without a sea trial. After getting under way toward the first scheduled stop of Bellingham, Washington, the crew detected a leak on the bottom of the starboard fish hold and another leak in the lazarette. On arriving in Bellingham, the *Mary Kay* lost operational control and consequently allided with a dock in port. The damage to the hull of the *Mary Kay* was not investigated, perhaps because the estimated damage was less than the required reportable amount.

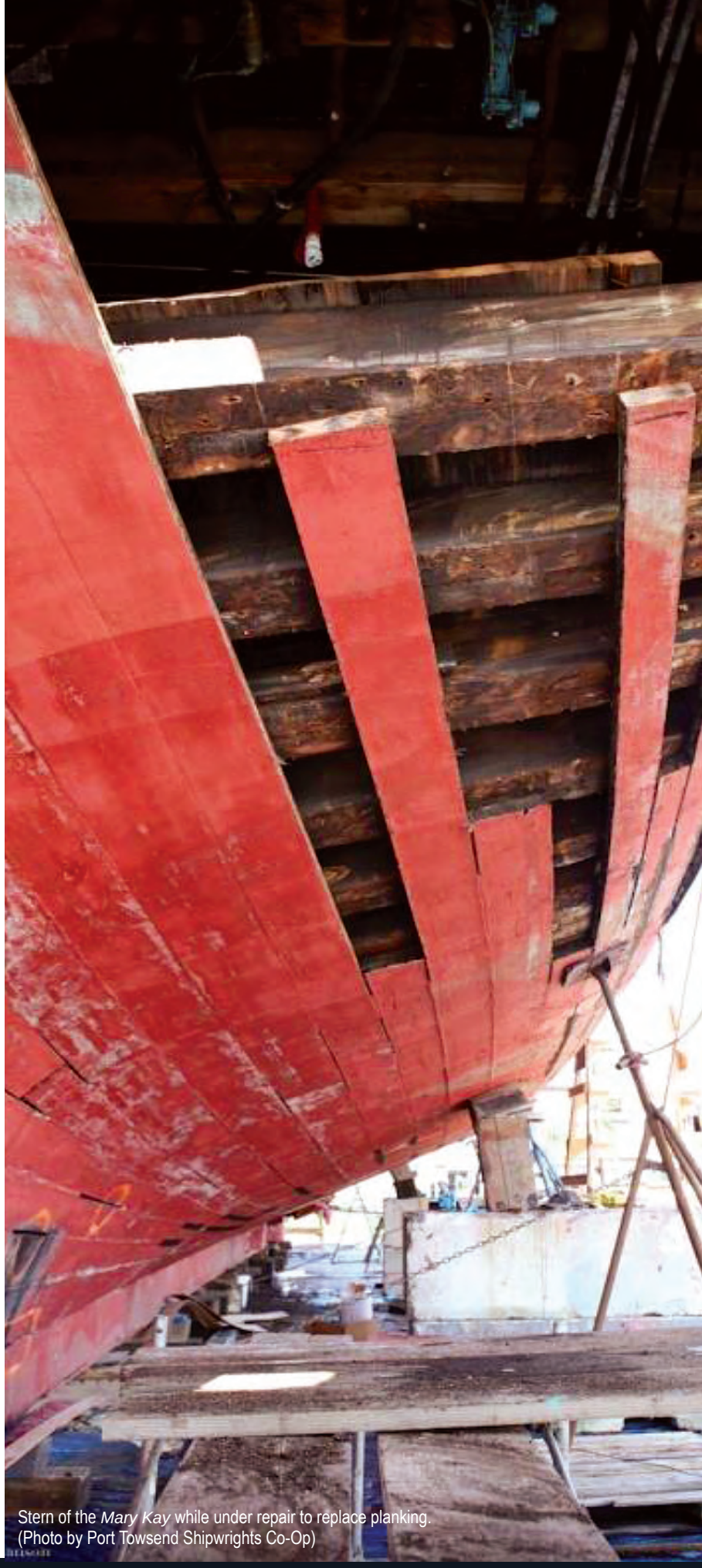
The *Mary Kay* next visited Sitka, Alaska, on July 9, 2012, where the vessel grounded twice on the boat launch (made of cement) in Sitka harbor. It is unknown whether these groundings caused any damage to the hull, because, like in Bellingham, the incident was never reported and no formal damage inspection completed. Later that same month, on July 22, the *Mary Kay* was under way and returning to Sitka when water began leaking from the starboard fish hold and lazarette into the vessel's bilges. The helmsman set the vessel on autopilot, left the pilothouse, and went to the engine room to pump the bilges. The autopilot failed, and the vessel struck a floating aid to navigation in Saginaw Channel. Any vessel damage is unknown, as this incident was not reported either.

On July 26, 2012, at 1800 local time, the *Mary Kay* departed the fuel dock in Ketchikan, Alaska, headed for Craig, Alaska, to offload about 130,000 pounds of salmon that the crew had retrieved at a nearby cannery. After getting under way, a highlevel alarm sounded and the crew had to pump the bilges. As the voyage continued, the leaks from the lazarette and the starboard fish hold activated the bilge alarm about every 45 minutes. About a third of the way to Craig, as the vessel approached Cape Chacon, the *Mary Kay* began experiencing large waves and the crew noticed that the bilges were filling with water. The captain activated a gasoline-powered 300-gallon-per-minute (gpm) pump, an electric-powered 300-gpm-pump, and a hydraulic-powered 250-gpm-pump in the engine room.

The captain issued an urgent call (PAN-PAN) for assistance and returned to the engine room a few minutes later to find that the pumps were not keeping up with the water ingress. He then issued a distress call (MAYDAY) and directed his crew to don survival suits and launch the skiff and the liferaft. The crew successfully abandoned the *Mary Kay* and, moments after the captain as the last person on board left the vessel, it sank bow first. About an hour later, the crew of another fishing vessel rescued the *Mary Kay* crew. The *Mary Kay* sank in deep water and was a total constructive loss. Its value, together with the 130,000 pounds of salmon lost with the vessel, was estimated as $625,000.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the sinking of the *Mary Kay* was the captain's failure to identify and correct the source(s) of the through-hull leaks.



Stern of the *Mary Kay* while under repair to replace planking. (Photo by Port Towsend Shipwrights Co-Op)

Flooding and Sinking of the *Plan B*

The *Plan B* listing to port before sinking. (Photo by Coast Guard)

Vessel Identification

Vessel	*Plan B*
Flag	United States
Engine power and type	Single-screw marine diesel engine
Crew complement	2

On February 21, 2012, the uninspected fishing vessel *Plan B* was in the Gulf of Maine, en route to Gloucester, Massachusetts. The captain and deckhand were in the process of draining water from the fish tanks when a pipe broke, allowing water to flood into the engine room. Attempts to stop the flooding were unsuccessful, and at 0720, the vessel sank in about 290 feet of water 10 nautical miles southeast of Kennebunkport, Maine. The captain and the deckhand were rescued and sustained no injuries.

About 0430 that morning, the *Plan B* departed its berth in Portland, Maine. The crew had returned from a shrimping trip on February 17 and offloaded all shrimping gear and nets in preparation for the herring purse seine season. The purse seine gear was located in Gloucester and would be loaded on board once the vessel arrived there. The vessel was operated by Plan B Fisheries Inc., Gloucester; the captain owned 49 percent of the company.

The vessel was on a southerly course in the Gulf of Maine, making about 8 knots. Both outriggers were down for the transit, which the captain stated was standard for operating under way (the vessel's stability was better when the outriggers were down than when they were topped, or retracted). The captain also stated that keeping the fish tanks full of water helped to settle the vessel down. However, the captain told investigators that, on this particular transit, he wanted to arrive earlier in Gloucester. Therefore, he said he intended to drain the water from the fish tanks to reduce the vessel's weight and increase speed by about 1 knot.

While opening the starboard fish-hold tank valve (located in the main engine room) to dewater the fish tank, the pipe broke and allowed seawater to flood into the engine room through the 4-inch pipe. The captain attempted to run the vessel's pumps to remove the water; however, the pumps could not keep up with the ingress of water. He tried to plug the pipes to stop the flooding, but they failed to hold. About 30 minutes later, when the engine room was flooded about 3 feet deep, the captain called the US Coast Guard and said that the water had reached "almost to the engine, with secondary alarms starting to sound."

As the flooding increased, the captain was soaked by water and received shocks as electrical panels and wires were shorting. The continued flooding and the inability of the crew to arrest it led to the eventual sinking and total loss of the vessel and equipment. (The loss of a mechanically-propelled vessel of 100 gross tons or more is classified as a major marine casualty.) The crew of a nearby good samaritan vessel, the lobster boat *Cameron Lee*, assisted the captain and the deckhand as they departed the sinking *Plan B*.

Neither the captain nor the deckhand was required to hold a Coast Guard license or any other mariner credentials. Both were tested for drugs and alcohol, and all results were negative.

The status of *Plan B*'s navigational, mechanical, propulsion, steering, and other vital systems before the sinking could not be determined, but the captain stated that they were operational at the time of the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the *Plan B* sinking was the inability of the crew to control flooding from the broken PVC (polyvinyl chloride) pipe, which was in open communication with the sea.

Flooding and Sinking of the *Viking II*

The *Viking II* at sea. (Photo provided by the Coast Guard)

Vessel Identification

Vessel	*Viking II*
Flag	United States
Construction	Wood
Crew complement	3

About 0900 on October 7, 2012, the 64-foot-long fishing vessel *Viking II* sank about 75 nautical miles off Cape May, New Jersey, following several hours of uncontrollable flooding in the engine room. The three crewmembers on board (a captain and his two sons) were rescued unharmed.

Early in the morning the previous day, October 6, the *Viking II* had departed Point Pleasant, New Jersey, to assist in a cable-laying project. That evening, after having transited about 75 nautical miles offshore and after shutting down the main engine for the night, the three crewmembers went to bed. About 2225, they were awakened by a high bilge level alarm, which had activated due to flooding in the engine room. The crew used two onboard pumps in an attempt to stem the flooding, but the rate of water ingress exceeded the pumps' capacity. The captain was not able to determine the source of the flooding and got the vessel under way headed for shore. He radioed the crewmembers of a nearby fishing vessel, the *Miss Suzanne*, advised them of the situation, and requested that they stand by to assist if needed.

About 2330, as the water level in the engine room reached the deck plates, the captain radioed the Command Center at Coast Guard Sector Delaware Bay that the vessel was taking on water and needed immediate assistance. The Command Center alerted its air and surface response assets, and at 0016 a rescue helicopter from Air Station Atlantic City was en route to the scene. On arrival at 0052, the helicopter crew lowered a dewatering pump to the *Viking II* crew. About 0142, the 87-foot-long Coast Guard cutter *Ibis* got under way from Cape May, New Jersey, with an estimated 4-hour transit time. A second helicopter was sent to relieve the first one as its low fuel level required it to return to base. Finally, a C-130 aircraft was also dispatched and its crew dropped a second dewatering pump into the water near the vessel; however, the *Viking II* crew was not able to locate and recover it from the sea.

When the onboard bilge pumps failed as the water level continued to rise in the engine room, the crew attempted to use the dewatering pump provided by the Coast Guard helicopter. After the crew resolved some technical difficulties with getting the dewatering pump started and functioning, the pump began pumping, but it could not keep up with the incoming seawater, and the water level in the engine room reached 7 feet. The vessel lost all electrical power, and the captain made the decision to abandon ship. About 0245, the crew donned survival suits and entered the vessel's liferaft. Shortly thereafter, the crew of the nearby *Miss Suzanne* rescued the uninjured men from the liferaft and brought them on board. The Coast Guard cutter *Ibis* arrived at 0350, and at first light about 0530, the rescued crew was transferred from the *Miss Suzanne* to the Ibis. About 0900, the *Viking II* capsized and sank. The *Ibis* returned the *Viking II* crew to Cape May, where they arrived later that afternoon. During the transit to Cape May, the Coast Guard tested the *Viking II* crew for alcohol; the results were negative. The crew also submitted samples for drug testing, and one of the crewmembers tested positive for tetrahydrocannabinol (the active ingredient in cannabis); the others had negative results.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the sinking of fishing vessel *Viking II* was uncontrolled flooding of the engine room from an undetermined source.

Photo of the fire, taken on January 17, 2012. The charred remains of the *Mako* are visible in the foreground, to the right of the flames. Photo provided by the US Coast Guard.

Liftboat *Mako*

Vessel Identification

Vessel	*Mako*
Flag	United States
Engine power and type	Diesel reduction
Crew complement	28

About 0503 on January 16, 2012, the US liftboat *Mako* caught fire while supporting oil drilling operations about 6 miles off the coast of Nigeria. No one on board the *Mako* was injured, but two workers on the nearby drilling rig *KS Endeavor* died. The *Mako* was a total loss.

The *Mako* was operating in the Funiwaw oil field off the coast of Bayelsa State, Nigeria. Beginning November 18, 2011, the *Mako* was positioned next to the *KS Endeavor*, a Panama-flagged jackup drilling rig. The *Mako* had been taking on drill cuttings from the *KS Endeavor*. Drill cuttings are small pieces of rock created when a well is drilled through rock to reach an oil or gas reservoir. The cuttings were pumped into containers on the liftboat. Once filled, the containers were lowered to offshore supply vessels and taken to shore for disposal.

The crew on board the *Mako* included a licensed master and a licensed mate, both US citizens. The vessel carried 26 additional personnel including crew and offshore workers, all Nigerian citizens.

Similar to other liftboats, the *Mako* had jacking legs designed to rest on the seafloor and raise the hull above the sea surface to create a stable work platform. The level of elevation above the surface of the water would depend on the sea state and the type of work being done. The *Mako*'s three 175-foot-long legs were arranged in a triangular pattern with two legs positioned at the forward outboard sides of the hull and a single leg positioned at the stern on the centerline of the hull. The length of the legs was fixed, that is, the legs did not have sections that slid or passed within one another to extend or contract the legs.

In the Funiwaw oil field, the *Mako* was jacked up in about 25 feet of water and had a clearance of about 50 feet from the surface of the water. The liftboat was located about 150 feet from the *KS Endeavor*'s blowout preventer (BOP, an inline mechanical safety device with a valve or series of valves designed to secure the flow of oil and gas in the event of an unintended high-pressure pipeline release from the well being drilled).

About 0500 on January 16, 2012, as the master was getting ready to take over the watch from the mate, he heard a loud noise. He went to the bridge where he observed a spray of mud, oil, and gas coming from the *KS Endeavor*'s BOP. The mixture coated the *Mako*'s decks and superstructure. The master sounded the general alarm and ordered the mate to muster the crew and offshore workers at the liferaft muster station on the lower deck. The master said to abandon ship if the rig caught fire. All personnel mustered with their lifejackets.

The master stayed on the bridge and began to jack down the *Mako* toward the surface of the water. The *Mako* was limited in how quickly it could get under way from a jacked-up position. The vessel was capable of jacking down at a maximum speed of 7 feet per minute. Then the legs would have to be raised from the seafloor, requiring additional time. As the *Mako* began to jack down, gas from the *KS Endeavor*'s BOP ignited. When the liftboat was about 10 feet above the water's surface, flames melted a hydraulic hose for one of the forward jacking legs. The system lost hydraulic pressure, and as a result the master was unable to lower the vessel further. He then gathered survival equipment, including the global maritime distress and safety system

(GMDSS) survival craft radio, search and rescue transponder (SART), and the emergency position indicating radio beacon (EPIRB), and headed toward the muster station.

The mate and crewmembers launched two liferafts on the *Mako*'s port side and one on the starboard side. When the fire started on board the *KS Endeavor* and quickly spread to the *Mako*, the mate gave the order to enter the water, and all personnel did so successfully by lowering themselves using the escape rope. They did not attempt to fight the fire. Once in the water, the personnel tried to pull the rafts away from the burning rig and vessel, but were unsuccessful. The liferafts melted from the heat and became unusable. While in the water, the crew used the survival craft radio to call for help. About 0700, the security vessel *Janis I* recovered the master and 27 other personnel from the water (26 from the *Mako* and one from the *KS Endeavor*). One offshore worker from the *Mako* was recovered by another vessel.

The *Mako* was consumed by the fire and eventually sank. The fire at the well continued to burn for about another month and a half, until March 2, 2012, when a portion of the well sealed itself.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board and sinking of the liftboat *Mako* was a blowout of the wellhead under the adjacent jackup drilling rig *KS Endeavor*, which resulted in an uncontrollable gas fire that rapidly spread to the liftboat.

Personnel Abandonment of *Trinity II*

Photo of the adrift *Trinity II*, taken while Mexican Navy personnel boarded the vessel.

Vessel Identification

Vessel	*Trinity II*
Flag	United States
Engine power and type	Diesel reduction at 800 horsepower (hp)
Crew complement	10

On Thursday, September 8, 2011, about 1225 central daylight time, the 78.5-foot-long liftboat *Trinity II*, while elevated and at work about 15 miles offshore in the Bay of Campeche, Gulf of Mexico, sustained damage to its stern jacking leg from severe weather associated with Hurricane Nate. Four US crewmembers and six non-US contractors were on board the vessel.

Similar to other liftboats, the *Trinity II* had jacking legs designed to rest on the seafloor and raise the hull above the sea surface to create a stable platform. On Sunday evening, September 4, the personnel received a report forecasting the possibility of a surface low pressure system forming nearby. In his postaccident interview, the *Trinity II* master stated that he discussed the weather forecast with one of the two onboard navigators from Geokinetics, the chartering organization, who directed the vessel during positioning. Together, the master and the navigator assessed whether they should move the *Trinity II* closer to shore.

Jacking down and moving a liftboat can be a complex and time-consuming process, commonly taking about 3–6 hours. Moreover, in the *Trinity II*'s location, the three jacking legs were penetrating about 10 feet into the seafloor. This amount of penetration was substantial and would make the moving process even more time-consuming. Further, the personnel and the vessel had operated during low pressure systems before, and the wave heights predicted for the next day were moderate, about 1–4 feet. Therefore, the personnel determined that the Trinity II would stay in its present location.

On Tuesday morning, September 6, the National Hurricane Center (NHC) reported that the surface low pressure system would strengthen further due to a cold front approaching from the northwest. Using the vessel's anemometer, the *Trinity II* personnel noted that the winds increased further and appeared worse than the forecast. By noon that day, the vessel could no longer be safely moved. On Tuesday evening, the weather deteriorated further and the crew jacked up the Trinity II three times to stay clear of the waves.

On Wednesday afternoon, the *Trinity II* personnel noted that the sustained wind speed increased from 40 mph to more than 50 mph. The weather system was now a tropical storm, which the NHC named "Nate." The rough seas were striking the *Trinity II*'s jacking legs.

The master later told investigators that, on this night, the stern leg penetrated an additional 6 feet into the seafloor in a matter of minutes, causing the vessel to become further trimmed down by the stern. The stern leg's jacking mechanism had also jammed at this point, which prevented the crew from further elevating the vessel, even though the two forward legs still had 12 feet of jack-up capability remaining.

On Thursday morning, September 8, the personnel on board the *Trinity II* prepared for the possibility of abandoning the vessel. The *Trinity II* carried a variety of lifesaving equipment, including two 25-person inflatable liferafts, which were located in cradles on the main deck on the port and starboard sides.

Due to the chaos, one of the liferafts inflated on deck. The high winds caught it and took the liferaft out to sea. The stern jacking leg also began to fail, causing the

vessel to list. The master placed a Mayday call over the radio and ordered everyone on board to abandon ship.

The survivors told investigators that, after a large wave crashed onto the port liferaft canister, the other liferaft inexplicably inflated while still in the cradle, and was stuck. The vessel's cook and the "QC 2" (one of two quality control technicians) retrieved a lifefloat from the stowage location.

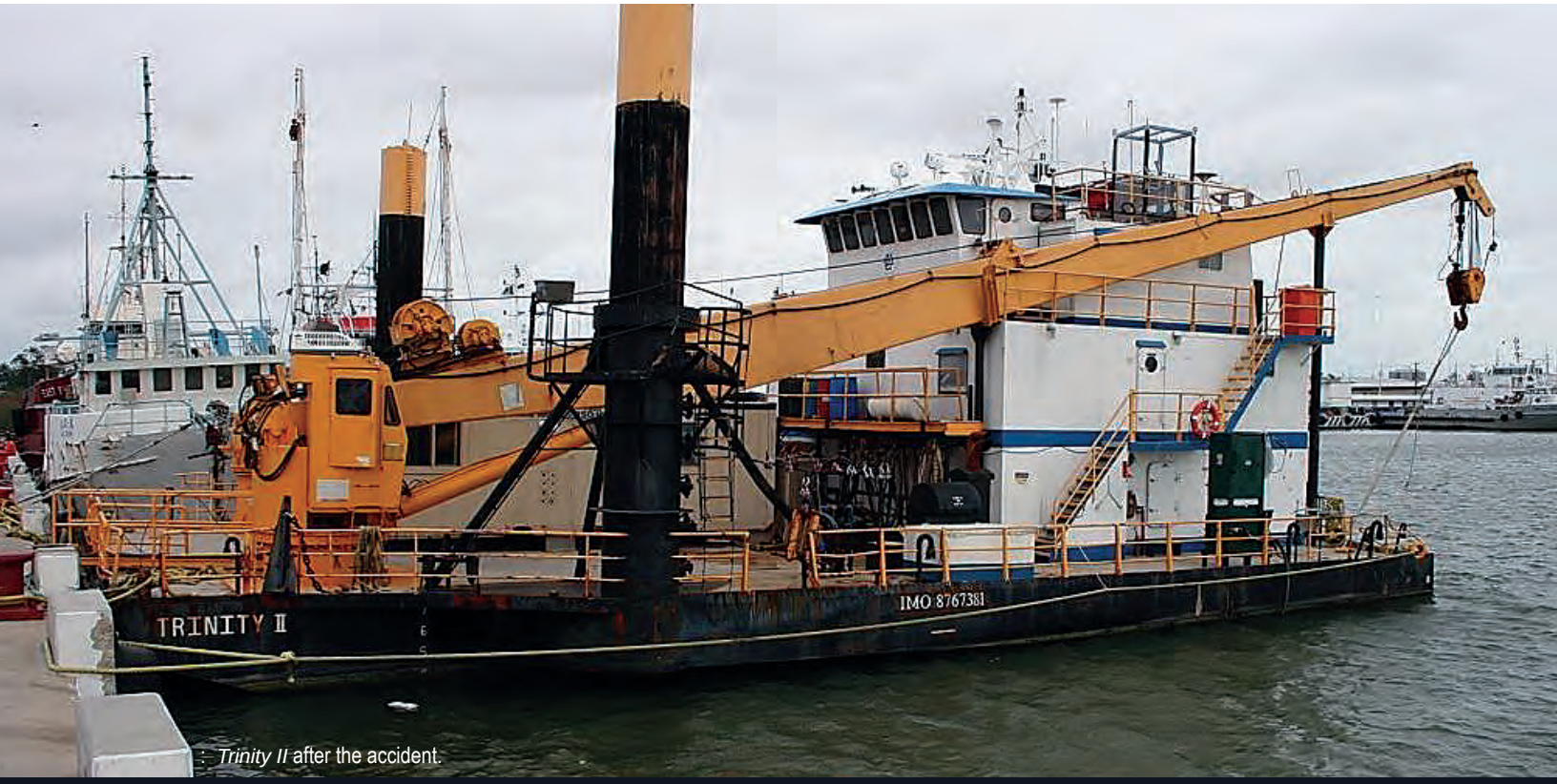
Throughout Thursday night into Friday, all 10 personnel clung to the single lifefloat as it drifted in heavy seas and high winds. The personnel did not bring any of the provisions they had prepared earlier. About 2330 on Friday evening, the night navigator drifted away and became permanently separated from the group. On Saturday, the weather improved but the condition of the personnel began to deteriorate. One crewmember, an ordinary seaman, was found with his face underwater, and the other personnel were unable to revive him.

On Sunday, the remaining personnel were rescued by assets dispatched to help in the search. They were transferred to the hospital, where the day navigator later died. A week after the accident, the body of the night navigator was recovered.

The total damage to the *Trinity II* was estimated to be $1.5 million.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of Trinity Liftboats (the vessel owner/operator) and Geokinetics (the chartering organization) to adequately plan for the risks associated with a rapidly developing surface low pressure weather system, which ultimately subjected the elevated liftboat to hurricane-force conditions, causing the stern jacking leg to fail and the onboard personnel to abandon the vessel. Contributing to the injuries and fatalities was the failure of the *Trinity II* crewmembers to make effective use of the vessel's available lifesaving equipment, resulting in the personnel's prolonged exposure to the elements while awaiting rescue.



Trinity II after the accident.

Collision of *FR8 Pride* with *Rowan EXL I*

The *FR8 Pride* shortly after the collision. Photo provided by the Coast Guard.

Vessel Identification

Vessel	*FR8 Pride*	*Rowan EXL I*
Flag	Republic of Marshall Islands	Republic of Marshall Islands
Type	Oil tanker, double hull; 15, 153-hp direct drive diesel	Mobile offshore drilling unit
Crew complement	24 crew and 1 pilot	56

On May 2, 2012, at 0718, the oil tanker *FR8 Pride* collided with the mobile offshore drilling unit (MODU) *Rowan EXL I* in Aransas Pass, Corpus Christi, Texas. No one was injured in the collision, but the two vessels sustained an estimated $16–17 million in damage.

Earlier that morning, the 750-foot-long double-hulled oil tanker *FR8 Pride* got under way from an offshore fairway anchorage, inbound to Corpus Christi. At 0704, about 14 minutes before the collision, a local pilot boarded the *FR8 Pride* to take the ship into port. At 0714, as the *FR8 Pride* was increasing to full-ahead speed on a northwesterly course in the Aransas Pass channel, the ship's main propulsion engine suddenly slowed down significantly. The slowdown was automatically triggered by the main engine's electronic control system in order to protect the engine from damage. As a result of the engine slowdown, the *FR8 Pride*'s steering ability was greatly reduced, and the ship began an unintended swing to starboard, causing it to sheer out of the channel.

Meanwhile, the MODU *Rowan EXL I*, also inbound to Corpus Christi, was about 400 feet outside the channel, on the starboard side and ahead of the approaching *FR8 Pride*. The non-self-propelled *Rowan EXL I* was being towed at 1 to 2 knots by three tugboats at its bow. As the *FR8 Pride* began to swing to starboard, the pilot ordered hard starboard rudder in an attempt to make the ship's bow pass astern of the *Rowan EXL I*. However, at 0718, about 4 minutes after the engine slowdown began, the starboard-side bow of the *FR8 Pride* collided with the portside of the *Rowan EXL I* at about 8 knots. Shortly after the collision, which punctured the *FR8 Pride*'s hull below the waterline, the ship's forepeak tank flooded and the vessel grounded at its bow.

After the collision and within the timeframes required by Coast Guard regulations, the *FR8 Pride* pilot and crew, and the pilot on board the lead tugboat for the *Rowan EXL I*, were tested for drugs and alcohol. All results were negative.

The reason for the automatic slowdown of the *FR8 Pride*'s engine was that the cooling jacket on the engine's cylinder No. 5 had suddenly cracked. Jacket water began leaking from the cracked cooling jacket, and the main engine control system—detecting the resulting pressure loss in the jacket water cooling system—protected the engine by reducing its speed.

After cylinder No.5's cooling jacket failure, which led to the collision, the crew called on the assistance of the engine manufacturer's service engineer, who identified several possible causes for the cracked cooling jackets. According to the service engineer's report, the cracks likely resulted from excessive thermal stresses imposed by rapid application of engine load when the ship's speed was increased from slow ahead to full ahead. In addition, the cooling jackets were metallurgically tested in an attempt to determine why they had cracked. The test found no abnormal conditions such as flaws or defects, preexisting cracks, unusual metal composition, corrosion, or manufacturing defect. The metallurgical test report did express the opinion that the material used in manufacturing the cooling jackets (gray cast iron) might be inappropriate for this design application.

However, according to the engine manufacturer, there had not been an unusual number of failures of this engine component within the population of this model engine, suggesting that no design deficiency exists.

During the months before the collision, the engine's jacket water temperature control valve could not automatically maintain a steady water temperature in the engine when load changed appreciably. The crew had, therefore, been manually controlling the jacket water temperature during ship maneuvering. The crew's manual control appeared to have been effective before the failure of the No.5 cooling jacket; according to the engine alarm system record, no high or low water temperature condition had occurred during the maneuvering period leading up to the collision. Therefore, the cause of the cracked cooling jackets remains undetermined.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision of oil tanker *FR8 Pride* with MODU *Rowan EXL I* was the failure of the *FR8 Pride*'s main propulsion engine, which resulted in reduced maneuverability of the ship.

The extensive damage to the port side of the *Rowan EXL I*, including its destroyed survival crafts (orange-colored) near the center of the photo. Photo provided by the Coast Guard.

Allision of *Overseas Reymar* with San Francisco–Oakland Bay Bridge

The *Overseas Reymar*. (Photo by Kamal Wanniarachchi, at www.vesseltracker.com)

Vessel Identification

Vessel	*Overseas Reymar*
Flag	Marshall Islands
Construction	Steel
Crew complement	18 crew and 1 pilot

On January 7, 2013, at 1118 local time, the 752-foot-long tanker *Overseas Reymar* allided with the fendering system of the San Francisco–Oakland Bay Bridge's Echo tower. The vessel was outbound in San Francisco Bay. No one was injured and no pollution was reported. Damage to the vessel was estimated at $220,000, and the cost to repair the Echo tower's fendering system was estimated at $1.4 million.

That morning, the pilot awoke about 0600 and checked his duty status with the San Francisco Bar Pilots Association. He learned that he was scheduled to pilot the tanker *Overseas Reymar* for an estimated 1100 departure. He reported to the pilot station about 0930–0945 to allow sufficient time for departure preparations. The pilot informed the master that he intended to transit through the Charlie-Delta (CD) span of the San Francisco-Oakland Bay Bridge ("Bay Bridge"), and the master agreed.

The CD span is 1,079 feet wide; the adjacent Delta-Echo (DE) span is more than twice as wide, 2,210 feet. Watchstanders with the US Coast Guard's San Francisco Vessel Traffic Service (VTS) indicated that 80–90 percent of vessels transit through the wider DE span. The pilot told investigators that, nevertheless, he typically chose the CD span when departing Anchorage 9.

At 1044, the pilot reported to VTS that he and the crew were preparing to get the ship under way and that they would transit through the CD span. At 1054, the master ordered the anchor heaved, and the vessel began its transit shortly thereafter. VTS asked the pilot to report the visibility, and the pilot responded that it was about half a mile. Meteorological data indicate that visibility at the time of the allision was about one-eighth of a mile near the bridge.

The pilot, who was using both visual cues and vessel radar for navigation, soon realized that the return from the RACON, or RAdar beaCON, on the CD span was not displaying on the vessel's radar screens. The RACON, a transponder that responds to radar interrogations, identifies the center of the span. Caltrans, the California state agency that oversees the Bay Bridge, installed three RACONs on the bridge; in addition to the CD span, the Alpha-Bravo (AB) and DE spans are equipped with RACONs. RACONs have become one of many tools mariners rely on when operating in reduced visibility. Caltrans personnel learned after the accident that the CD-span RACON was out of service.

According to the pilot, shortly after he realized that the CD span RACON did not display on the vessel's radar screens, the visibility decreased further, and he lost visual sight of the bridge. The pilot told investigators that he decided to change his path and instead transit through the DE span; its RACON was functioning and visible on the vessel's radar screens. At that point, the vessel was about one and a quarter mile south of the bridge on an approximate heading of 010 degrees and a speed of about 10 knots. The ebbing tide was about 3 knots at the time, pushing the vessel in a northwest trajectory toward the bridge. The pilot called for a 015-degree heading, and the vessel began a slight turn to starboard, toward the east, to line up for the DE span.

At 1111:02, the pilot ordered full ahead on the main engine. The master conducted two separate phone calls during this time, both of which involved operations-related information. The second phone call from his company was a long conversation that did not end until 2 seconds before the allision.

At 1117:25, VTS contacted the pilot and informed him that the vessel was proceeding directly toward the Echo tower. Seconds later, the vessel's aft starboard side allided with the Echo tower's fendering system.

The pilot reported the allision to VTS personnel and said that he would take the vessel to Anchorage 7 just past the bridge. The master declined tug assistance. The pilot, the master, the third officer, the helmsman, and the VTS supervisor and watchstanders were all tested for drugs and alcohol. All results were negative.

The pilot initially selected the CD span because he anticipated encountering reduced visibility. Familiarity with a route facilitates a pilot's ability to recognize deviation from a planned course, an important factor to consider when transiting waterways in challenging conditions. When the nonfunctioning RACON on the DE span did not display, the pilot appears to have seen no other alternative than to choose another span with a functioning RACON. Yet marine safety depends on mariners being sufficiently prepared and "ahead of the vessel" so that the loss of a single navigational aid, despite its criticality, does not jeopardize safety.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the *Overseas Reymar* allision with the San Francisco–Oakland Bay Bridge was the pilot's decision to alter course from the CD span to the DE span without sufficient time to avoid alliding with the bridge's Echo tower and the master's failure to properly oversee the pilot while engaging in a phone conversation during a critical point in the transit.

Allision damage to the *Overseas Reymar*'s aft starboard side. (Photo provided by the Coast Guard)

Fire on Board Ferry Vessel *Malaspina*

The passenger vessel *Malaspina* under way.

Vessel Identification

Vessel	Passenger vessel *Malaspina*
Flag	United States
Construction	Steel
Gross tonnage	2,928
Engine power and type	8,000 hp / 5,965 kW diesel

The passenger vessel *Malaspina* was in dry dock in Ketchikan, Alaska, for scheduled repairs when a fire broke out on February 7, 2012, resulting in damage estimated between $500,000 and $750,000. No one was injured. The *Malaspina* was undergoing duct repair which required "hot work"—cutting, grinding, and welding.

The fire began in the sewage treatment room, also known as the marine sanitation device space, about 1155 local time. A shoreside work crew employed by Alaska Ship and Drydock (ASD) was on board the *Malaspina* to repair a ventilation duct located in a crewmember stateroom with fire watch personnel present. ASD's permit to perform the work did not call for the fire watch to remain on scene for any length of time once the work was completed.

The sewage treatment room was located directly below the stateroom in which the repair work was taking place, and the open ventilation duct directly exposed the rooms to one another. The workers placed a welding curtain horizontally at the opening of the exposed duct to collect slag, the waste produced during high-temperature metal work, and other hot material to keep it from falling into the room below. About noon, after the workers had been cutting away steel tabs inside the duct, they and the fire watch departed for lunch. As they were leaving the vessel, shipyard and vessel personnel noticed smoke coming from the sewage treatment room. The local fire department was notified, and the fire was extinguished.

In the sewage treatment room, the fire burned spare rubber fan belts and hoses; severely damaged the sodium bisulfate injection system, which protects carbon filters from premature exhaustion; and damaged overhead insulation, sewage piping, and electrical power cabling. The fire also caused smoke and soot damage to nearby spaces.

The US Coast Guard investigation revealed that the welding curtain the workers had placed over the ventilation duct was intended to be used only on a vertical plane to shield against sparks. It was not designed to withstand continuous contact with slag and other hot material as it did when placed horizontally. The hot material burned through the curtain and fell down the duct into the sewage treatment room below, where it ignited combustible material.

Although the curtain was improperly placed, had the workers remained on site to ensure that the hot materials had cooled sufficiently, they could have detected and quickly extinguished any small flames before the fire spread.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board the passenger vessel *Malaspina* was the failure of the shoreside work crew and fire watch to ensure that proper cooling had occurred before leaving the area where the repair work was conducted. Contributing to the accident was the work crew's improper use and application of a welding curtain, placed horizontally as opposed to vertically, which allowed molten material to burn through the curtain and fall into the space below.

Fire on Board *Safari Spirit*

Vessel Identification

Vessel	*Safari Spirit*
Flag	United States
Construction	Aluminum
Built	1981

On April 27, 2012, about 0100 local time, a fire broke out on the aft deck of the passenger vessel *Safari Spirit* while the vessel was docked at Pier 9 of Fisherman's Terminal in Seattle, Washington. The vessel was off charter but soon to start its seasonal cruising schedule in Alaska.

Two company personnel, the chief executive officer (CEO)and the vessel's chief engineer,were on board and asleep at the time of the fire. The CEO stated that he awoke to a popping or crackling sound,got up to investigate, and discovered the fire. After escaping the vessel hand-over-hand across the bow lines to the dock,the CEO and chief engineer tried to fight the fire with small water hoses located on the pier. They also released the mooring lines of nearby vessels to allow them to float away from the fire engulfing the *Safari Spirit*. Local fire units arrived on scene within about 10 minutes and extinguished the blaze. The Seattle Fire Department maintained a fire watch with the vessel until daybreak to monitor hotspots and observe the vessel's structural integrity.

The day before the fire, two contract workers were on board to oil the teak deck, located aft on the vessel's main deck. The workers also painted newly fabricated kayak storage racks further aft and on the deck below. Rags used to apply and clean up the oil from the teak wood treatment were laid across rails to dry. The workers stated they removed all the oiled rags and painting equipment from the vessel at the end of the work day. To their recollection, all paint and oil cans were sealed and stowed on the back deck near the completed work.

The CEO and the chief engineer returned to the vessel later that night about an hour apart to spend the night

Safari Spirit ablaze at Fisherman's Terminal in Seattle, Washington. (Photo by Joshua Lewis, KOMO News)

on board. The CEO recalled turning on overhead lighting on the aft deck to illuminate a "Do Not Enter" sign that identified the freshly oiled decks. A security camera located in the port captured an unidentified person walking on Pier 9 near the *Safari Spirit* shortly before the estimated time of the fire's ignition; however, no evidence was found to indicate this person had any connection with the fire.

The fire was estimated to have started about 0100, with the Seattle Fire Department arriving shortly thereafter. The bow of the vessel was pointed north and the ignition location was on the aft deck, so the southerly 10-knot wind helped to push the flames forward on the vessel. The forensic fire investigation concentrated on the self-heating of the flammable oil and paint cans left on the aft decks in the area of the freshly oiled decks. However, no final determination was made regarding the source of ignition of the fire. (See box below for more information on selfheating and fire ignition.)

In an open letter to company personnel, the CEO alerted staff to the circumstances of this accident, precautions in dealing with the materials that were in use on board the *Safari Spirit* that day, and the location of the ignition point of the fire. At the time of the fire, the *Safari Spirit* was operated by Inner Sea Discoveries, which managed a fleet of eight passenger vessels, each carrying from 22 to 88 passengers, with total seasonal staff ashore and afloat ranging up to 250 personnel.

A marine survey estimated the cost of rebuilding the vessel to be $4 million. A prefire fair market value survey in January 2011 estimated the value of the vessel at $1.5 million.

Probable Cause

The National Transportation Safety Board determines that the fire on board the passenger vessel *Safari Spirit* ignited due to unknown causes and was accelerated by the flammable materials stored on the aft portion of the main deck.

Self-heating and fire ignition

Self-heating is a process in which heat is created within a material through a biological or chemical process and without the application of an external heat source. If self-heating increases the temperature of the material above its ignition point with sufficient oxygen present, self-ignition can occur. Sufficient air must be present to sustain the combustion reaction, but not so much air that the heat is dissipated. Common examples of materials that can self-heat or self-ignite are linseed oil rags, coal dust, hay, wood chips, manure, and latex.

Charred wreckage of the *Safari Spirit*. (Photo from Bowditch Marine, Inc.)

Capsizing of *Invader*

Vessel Identification

Vessel	*Invader*
Flag	United States
Construction	Steel
Persons on board	None

On March 18, 2012, about 0630 Pacific standard time, the uninspected towing vessel *Invader* capsized in Port of Everett, Washington, after the floating Dry Dock #3 on which the vessel was positioned flooded and began listing. Both the *Invader* and Dry Dock #3 initially sank, but were later refloated. The accident happened while the *Invader* was undergoing its annual inspection, maintenance, and repair at Vigor Industrial Shipyard at Port of Everett.

Dry Dock #3 had eight symmetrical ballast tanks, four on each side of the centerline, with similar design and capacity. Each of these eight tanks had an access manhole from the floor of the dry dock pontoon. The tanks were equipped with independent electric pumps, valves for flooding and discharge, and piping for pumping single or multiple tanks. Each tank had an overboard discharge for the pumps. The discharge line included a cast iron check valve bolted directly to, and inboard of, a manually-operated discharge valve located about 8 feet above the keel in the dry dock's side shell.

During the day on March 17, 2012, pumping activities had taken place on board Dry Dock #3. That evening, water leaked past the check valve of Tank #5 on the dry dock's starboard side; debris in the check valve prevented it from closing. In addition, the 4-inch discharge valve had been left open (even though the dock master told investigators it was customary to close the discharge valves after use), and this allowed ingress of water. The weight of the water gradually caused the dry dock to list to starboard. Further, the cover plates to the access manholes on Tanks #1 and #7 had been left open and unattended. As the dry dock

The capsized Invader and Dry Dock #3. (Photo by KCPQ, Seattle, Washington)

continued listing to starboard, water began flooding through the open manholes into Tanks #1 and #7, causing additional listing. As the flooding progressed, the *Invader* fell off its support blocks placed on the dry dock's floor, set heavily against the dry dock's starboard wall, and then partially sank. Dry Dock #3 also sank as a result of the flooding; however, both the Invade rand the dry dock were later refloated. Fuel and liquids were pumped from both the *Invader* and Dry Dock #3 during salvage operations and pollution was minimal.

The damage to Dry Dock #3 was estimated to be $818,000. The *Invader* was a total constructive loss at over $5 million.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the capsizing and sinking of the towing vessel *Invader* and Dry Dock #3 was Vigor Industrial Shipyard's lack of operational oversight in ensuring that the discharge valves and manholes were closed after use, and its failure to continuously monitor the condition of the dry dock.

Fire on Board *Ivory Coast*

Vessel Identification

Vessel	*Ivory Coast*
Flag	United States
Engine power and type	2 main engines, EMD (Electro-Motive) model 16-567-BC; max. power 1,350 hp (2,354 kW) each
Crew complement	Docked: 2 crewmembers, 1 shipfitter, and 1 supervisor/competent person acting as fire watch

On October 10, 2011, the uninspected US towing vessel *Ivory Coast* was moored at General Ship Repair (GSR) in Baltimore's Northwest Harbor while undergoing cutting and welding—or "hot work"—on the starboard-side hull plating in the engine room when a fire ignited and spread to the main deck galley. Damage to the engine room, associated machinery, and galley on the main deck was extensive, with repairs estimated to cost more than $1 million.

The *Ivory Coast* arrived at the GSR facility 4 days earlier, on October 6, 2011,to undergo repairs including the replacement of rub rails, which protect the vessel's hull when made up to a barge or another vessel. Most of the crew left the ship, while the engineer and ordinary seaman remained on board in a caretaker status.

About 1630 that afternoon, Upper Chesapeake Chemist Co. Inc. issued a marine chemist certificate indicating that the atmosphere near the port and starboard diesel fuel tanks and the engine room space was safe for workers and for limited hot work. When ship repair and construction may result in fire, explosion, or exposure to toxic vapors or chemicals, a marine chemist is required to ensure that the work can be conducted safely. After initial certification by a marine chemist, a competent person conducts follow-up routine monitoring of the space and adjacent areas.

Ivory Coast starboard side showing area of hot work for replacement of rub rails. (Photo: US Coast Guard)

A competent person is trained and experienced in atmospheric sampling and monitoring and qualified to apply workplace standards and identify potential hazards with authority to correct them.

The marine chemist certificate stated that hot work to be performed on the *Ivory Coast* was limited to replacement of the rub rail on the starboard side while maintaining a fire watch and ventilation. A competent person was required to check the atmosphere daily before hot work could begin to confirm that the atmosphere was safe.

Repair work began on Friday, October 7, and continued Monday, October 10. The repairs planned for Monday morning included conducting hot work in the engine space, which involved cutting with an acetylene torch along the starboard hull to remove the vessel's rub rails.

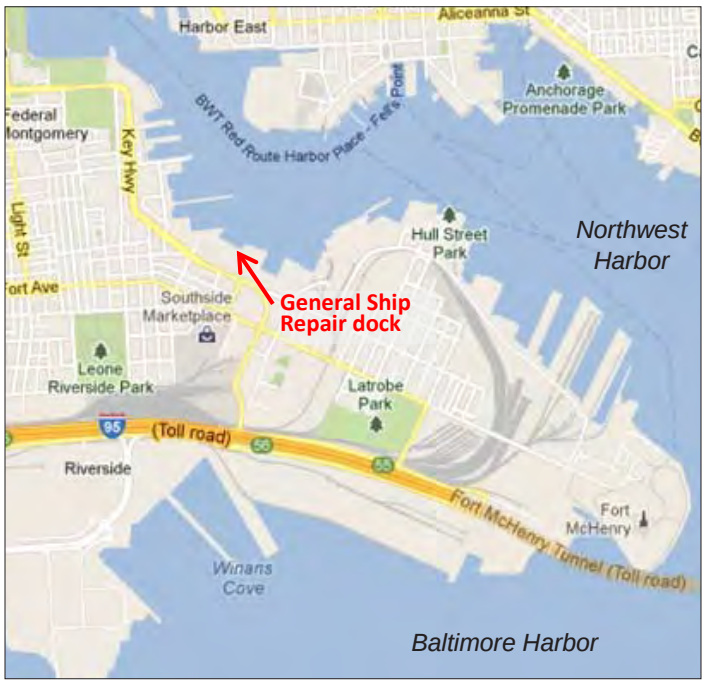
The shipfitter started work at 0740 and secured the cutting torches before taking a break at 1130. A supervisor/competent person acting as fire watch was stationed nearby in the engine room throughout the hot work and was spraying water from a fire hose to cool the hull plating.

When the shipfitter and fire watch resumed work, the vessel's engineer was working in the engine room on the exhaust manifold of the starboard generator. Less than 2 hours later, the shipfitter felt intense heat on his safety jacket and pants, removed his face shield, and realized that a fire had broken out and the fire watch was spraying water toward the flames with the fire hose, but the water intensified the flames. The shipfitter told Coast Guard investigators he secured the torch, relieved the fire watch of the fire hose, and a short

time later located a portable CO_2 fire extinguisher and discharged it at the deck plates but with no effect.

The shipfitter, fire watch, and vessel chief engineer realized the fire was out of control, and all personal evacuated the tug; the shipfitter then asked the supervisor/fire watch to call 911. The fire was extinguished by the Baltimore City Fire Department early that afternoon.

The chief engineer stated that before starting hot work he drained and disconnected the diesel oil manifold so the shipfitter could gain access for the repairs. He also said that below the manifold was a wooden tool box, which over time had become saturated with diesel oil. This was confirmed by testing of a sample of residue from the wooden box by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). Therefore, a possible ignition source of the fire could have been a shipfitter's spark igniting the unprotected diesel oil–soaked wooden tool box below the area of the hot work.



Except from National Oceanic and Atmospheric Administration Chart 12281 showing accident site in Baltimore's Northwest Harbor. (Background by Google maps)

No injuries were sustained by those on board or the responding fire department personnel. No alcohol or drug testing was performed on the vessel crew or the GSR workers.

Although the marine chemist certificate was completed on October 6, 2011, the day the vessel arrived at GSR, the *Ivory Coast* was subsequently moved within the repair facility after the certificate was issued. National Fire Protection Association standards specify that "the prescribed work [be] carried out at the original location within the facility for which the certificate was issued, unless movement is authorized within the facility by the responsible marine chemist...." The marine chemist certificate did not authorize vessel movement; therefore, the certificate was voided. However, a competent person performed required daily monitoring to ensure that the atmosphere was safe for hot work.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the fire on board the uninspected towing vessel *Ivory Coast* was sparks from welding and cutting repair work conducted with an oxygen-acetylene torch igniting unprotected combustible material in the engine room.

Fire on Board *Patrice McAllister*

The fire-damaged *Patrice McAllister* after being towed to port. Photo by Transportation Safety Board, Canada.

Vessel Identification

Vessel	*Patrice McAllister*
Flag	United States
Engine power and type	Twin 3516B Caterpillar diesels, 16 cylinders each, 4,400 hp/3,278 kW
Crew complement	6

On March 27, 2012, at 0229 eastern daylight time, the uninspected towing vessel (UTV) *Patrice McAllister*, with six crewmembers on board, experienced an engine room fire. The crew released CO_2 from the vessel's fire suppression system into the engine room and extinguished the fire; however, the fire later reflashed and burned out of control. The vessel's chief engineer was fatally injured, and the five remaining crewmembers suffered minor injuries.

On March 23, 4 days before the accident, the *Patrice McAllister* departed the Ironhead Shipyard in Toledo, Ohio, where the vessel had undergone a complete overhaul. The accident voyage was to transfer the vessel to McAllister Towing's fleet in Staten Island.

After midnight on March 27, the *Patrice McAllister* was transiting at 10–12 knots through Canadian territorial waters on Lake Ontario. It was powered by the vessel's portside main engine, which was running at about 1,630 rpm at the time; the crew had shut off the starboard main engine to repair a leak in the lubrication oil cooler line.

About 0229, a small hairline fracture in the port engine's prelubrication oil pump discharge line began spraying lubrication oil into the engine room. The oil spray made contact with the hot portside engine manifold and flashed into an oil spray fire.

The chief engineer was in the engine room when the fire broke out. The only exit was an accommodation ladder leading to a watertight door onto the fiddley deck, a partially raised deck located directly above the engine room near the smokestack. Because the ladder was in the path of the oil spray fire, the chief engineer had to exit through the fire, igniting his clothing. He collapsed on deck after exiting. The other crewmembers, who had been alerted to the fire moments earlier by heat and smoke coming through a galley range hood vent, discovered the chief engineer and extinguished the flames in his clothing. The chief engineer suffered burns on more than 90 percent of his body. The oil spray fire also ignited combustible material on the fiddley deck.

The crewmembers prepared to release the CO_2 into the engine room from the vessel's fixed fire suppression system. They secured the vessel's centerline passageway by closing its aft watertight door leading to the weather deck and its forward door leading to the galley. However, the crewmembers did not close the watertight door onto the fiddley deck, through which the chief engineer had escaped, before the master released the CO_2. In addition, no means existed to mechanically isolate the engine room's exhaust and supply ventilation.

On receiving word that the engine room was secured, the master released the CO_2, which, as expected, caused the portside main engine to shut down, followed by the generator and ventilation system. The vessel lost all power and began drifting in an easterly direction. At 0346, after observing a noticeable reduction in heat and smoke, the master reported to the Canadian Coast Guard that the fire was extinguished. During this time, crewmembers opened the doors to the vessel's superstructure and began desmoking it. However, this action allowed CO_2 to escape and fresh air to enter the interior of the vessel, which caused the fire to reflash. Because the vessel had lost power, crewmembers were unable to run the main fire pump, and they had already released all of the CO_2. The fire also blocked access to the portable fire pump. The crewmembers were unable

to fight the fire, which now raged out of control. It spread into the accommodation space and consumed all combustible material up through the upper wheelhouse. The vessel's two liferafts, stowed on the bridge deck, were inaccessible because of the flames and intense heat. Unable to abandon ship, the crew huddled in survival suits at the stern of the vessel, waiting to be rescued.

At 0456, a Canadian Coast Guard rescue helicopter evacuated the chief engineer, who later died from his injuries. An hour later, the remaining five crewmembers, who sustained minor smoke inhalation injuries, were evacuated to the Canadian Coast Guard ship *Cape Hearne*. The *Patrice McAllister* was salvaged later that afternoon by the UTV *Bowditch* and towed to Clayton, New York.

The fire caused extensive damage to the entire vessel. According to the surveyor's report, total estimated cost for repair and towage to New York was about $3,569,000.

Following the accident, the five surviving *Patrice McAllister* crewmembers and the body of the chief engineer were tested for illegal drugs and alcohol. All test results were negative.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the engine room fire on board the *Patrice McAllister* was the ignition of lubricating oil that sprayed from a fatigue-fractured fitting on the portside main engine's prelubrication oil pump onto the hot surface of the portside main engine's exhaust manifold. Contributing to the extent of the fire damage was the crewmembers' compromise of the fire boundaries when they prematurely began desmoking the vessel's superstructure, the inability to completely secure the engine room's fire boundaries, and the abundance of flammable material throughout the vessel.

Lake Ontario, including the location where the *Patrice McAllister* crew reported the fire. (Background by Google)

INVESTIGATIONS COMPLETED IN 2013

Alliance Norfolk – Onboard fire in the Mediterranean Sea, about 30 miles NE of Malta, on March 10, 2012
Published May 10, 2013

Chevelle – Grounding and loss in Newport, Oregon, on March 10, 2012
Published July 18, 2013

Delta Mariner – Allision with Eggner's Ferry Bridge, Tennessee River, Kentucky, on January 26, 2012
Published May 14, 2013

Heritage – Sinking in Alitak Bay, Alaska, on January 25, 2012
Published February 1, 2013

Invader and Dry Dock #3 – Dockside capsizing and sinking in the Vigor Industrial Shipyard, Port of Everett, Washington, on March 18, 2012
Published July 16, 2013

Ivory Coast – Onboard fire in Baltimore, Maryland, on October 10, 2012
Published May 6, 2013

John D. Leitch – Collision with law enforcement vessel in Black River, Lorain, Ohio, on October 3, 2012
Published May 28, 2013

Lucky Diamond – Engine room fire and eventual flooding and sinking in the Gulf of Mexico, Louisiana, on May 10, 2012
Published February 1, 2013

Maersk Wisconsin – Collision with tug and barge unit in Kill Van Kull, New Jersey, on December 5, 2012
Published April 23, 2013

Mako – Onboard fire and sinking in the Gulf of Guinea, Nigeria, on January 16, 2012
Published July 16, 2013

Malaspina – Onboard fire in Ketchikan, Alaska, on February 7, 2012
Published February 1, 2013

Mary Ann Hudson and ***Star Grip*** – Collision in Houston Ship Channel, Texas, on June 6, 2012
Published December 18, 2013

Mary Kay – Sinking near Cape Chacon, Prince of Wales Island, Alaska, on July 26, 2012
Published October 31, 2013

FR8 Pride and ***Rowan EXL I*** – Collision in Corpus Christi, Texas, on May 2, 2012
Published June 27, 2013

Overseas Reymar – Allision with San Francisco–Oakland Bay Bridge in San Francisco Bay, California, on January 7, 2013
Published November 7, 2013

Patrice McAllister – Engine room fire, about 4 miles SE of Point Petre, near Prince Edward Point, Ontario, on March 27, 2012
Published June 6, 2013

Plan B – Sinking about 10 nautical miles SE of Kennebunkport, Maine, on February 21, 2012
Published May 28, 2013

Rickmers Tokyo – Allision with Pier II at Port Richmond, Philadelphia, Pennsylvania, on December 23, 2012
Published May 28, 2013

Safari Spirit – Onboard fire in Seattle, Washington, on April 27, 2012
Published July 3, 2013

Trinity II – Personnel abandonment of vessel, with loss of life, in the Bay of Campeche, Gulf of Mexico, on September 8, 2011
Published May 9, 2013

Viking II – Sinking in Atlantic Ocean, 75 nautical miles SE of Cape May, New Jersey, on October 7, 2012
Published June 14, 2013

INVESTIGATIONS COMPLETED IN 2012

Elka Apollon and ***MSC Nederland*** – Collision in the Houston Ship Channel, Upper Galveston Bay, Texas, on October 29, 2011
Published September 25, 2012

Andrew J. Barberi – Allision with St. George Terminal, Staten Island, New York, on May 8, 2010
Published May 24, 2012

Natures Way Commander/ACBL 3111 and ***Barge CE-858*** – Collision in the Gulf Intracoastal Waterway, Port Allen Lock, Louisiana, on February 1, 2012
Published April 20, 2012

Alliance/MMI 3024 and ***Naticina***– Collision in Texas City Channel and Gulf Intracoastal Waterway, Galveston, Texas, on August 17, 2011
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LESSONS LEARNED FROM MARINE ACCIDENT INVESTIGATIONS