



National Transportation Safety Board

Marine Accident Brief

Explosion and Fire aboard Articulated Tug and Barge *Buster Bouchard/B. No. 255*

Accident type	Fire/explosion	No. DCA18FM002
Vessel names	<i>Buster Bouchard, B. No. 255</i>	
Location	Aransas Pass Fairway Anchorage, 3.25 miles ¹ off Port Aransas, Texas 27°49.80' N, 096°59.40' W	
Date	October 20, 2017	
Time	0430 central daylight time (coordinated universal time – 5 hours)	
Injuries/fatalities	Two fatalities	
Property damage	>\$5 million est.	
Environmental damage	About 2,000 barrels (84,000 gallons) of crude oil released to the sea and atmosphere	
Weather	Visibility 8 miles, winds north at 6 knots, seas 3–4 feet, air temperature 75°F, water temperature 78°F	
Waterway information	Open waters of the Gulf of Mexico; charted depth at the accident site was 45 feet.	

On October 20, 2017, at 0430 local time, the crews of the articulated tug and barge (ATB) *Buster Bouchard/B. No. 255* were preparing to get under way from anchorage to proceed into the Port of Corpus Christi, Texas, when an explosion and subsequent fire occurred on the bow of the barge. Two barge crewmembers who were on the bow were killed in the explosion. The fire was extinguished about 1100 on the same day. Approximately 2,000 barrels (84,000 gallons) of crude oil were released from the barge into the water or were consumed in the fire. The barge sustained over \$5 million in damage and was scrapped after the accident. There was no damage to the tugboat.

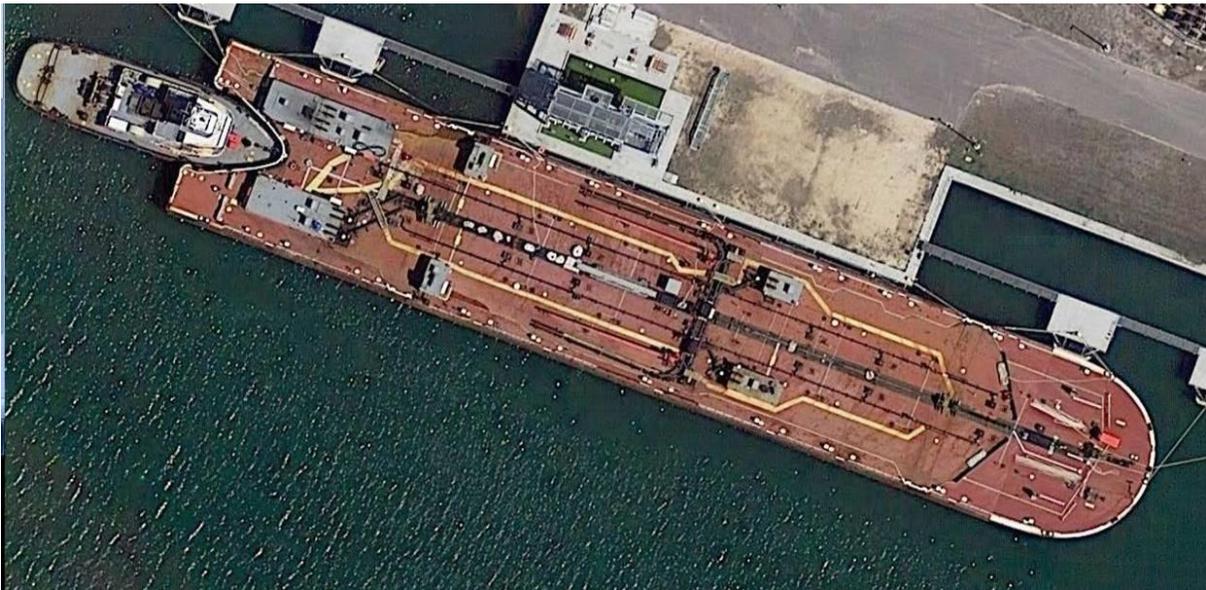


ATB *Buster Bouchard/B. No. 255*. (Photo courtesy of Bouchard Transportation Co., Inc)

¹ All miles in this report are nautical miles (1.15 statute miles).

Background

An ATB consists of an independent tugboat, acting as a detachable power module, that is connected by a rack and pinion or other types of connections into the stern notch of a cargo carrying barge designed specifically to fit the tugboat. When connected, the tugboat and barge operate and navigate as a single unit. The ATB in this accident comprised the tugboat *Buster Bouchard* and the tank barge *B. No. 255*. Although an ATB configuration operates as one unit, the *Buster Bouchard* and the *B. No. 255* each had their own crew. The two crews worked together to transport the cargo; the barge captain was responsible for the safe operation of the barge, and the tugboat captain was responsible for the safe operation of the tugboat. In addition, the tugboat and barge had separate budgets, maintenance schedules, and inspection regulations. Each vessel had its own accommodation spaces for its crews.

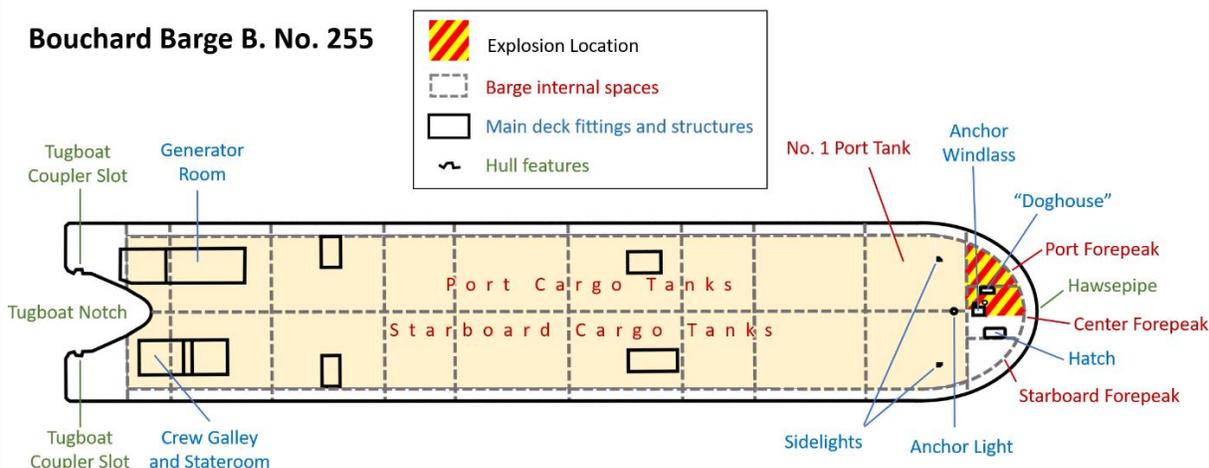


Overhead view of an ATB configuration. (Photo courtesy of Bouchard Transportation Co., Inc.)

The 468-foot-long barge *B. No. 255* was built in 1979 in Harvey, Louisiana. In 1999, the barge was extensively modified with the addition of a double hull in order to operate in accordance with new pollution prevention requirements. The barge had a total cargo capacity of 188,400 barrels (7.91 million gallons) in its 16 cargo tanks, as documented by the US Coast Guard. The forepeak area, which formed the bow of the *B. No. 255*, was divided into four sections: port, starboard, center, and lower level. The forepeak was classified as a void space, meaning it was not intended or designed to hold ballast water or liquid cargo, especially hazardous cargo such as crude oil, and it was supposed to remain empty. In the forepeak was an anchor chain locker, lighting circuits, and an electrical control box for the anchor winch. The barge crew did not routinely check the forepeak or sound ballast tanks for leaks, nor did the company require the crew to check these areas of the barge. There were no water level indicators, such as bilge sensors, in the voids, nor were they required. The *B. No. 255* was operated by Bouchard Transportation Co., Inc., classified by the American Bureau of Shipping (ABS), and regularly inspected by the Coast Guard under

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Title 46 *Code of Federal Regulations (CFR)*, Subchapter D.² There were two crewmembers on the barge during the accident: a barge captain and an alternate barge captain.



B. No. 255 simplified plan.

The 127-foot-long *Buster Bouchard* was a twin-propeller tugboat powered by two EMD 16-645-E7 diesel engines, each capable of producing 3,070 horsepower. The vessel was built in 1979 in New Orleans, Louisiana, homeported in New York City, New York, and operated by Bouchard Transportation. Six crewmembers were on board the tugboat during the accident: a captain, a mate, a chief engineer, an assistant engineer, and two able-bodied seamen.

Accident Events

On October 19, 2017, the *Buster Bouchard/B. No. 255* anchored in the western part of the Aransas Pass Fairway Anchorage about 3.25 miles offshore from Port Aransas, Texas. The barge was carrying 135,000 barrels (1.39 million gallons) of crude oil that had been loaded on October 16, 2017, at the NuStar Energy terminal located at mile 160 on the Lower Mississippi River in St. James, Louisiana. The cargo was distributed in all 16 tanks, with the no. 1 port cargo tank being about 90 percent filled. The cargo was going to be discharged at the Port of Corpus Christi, Texas.

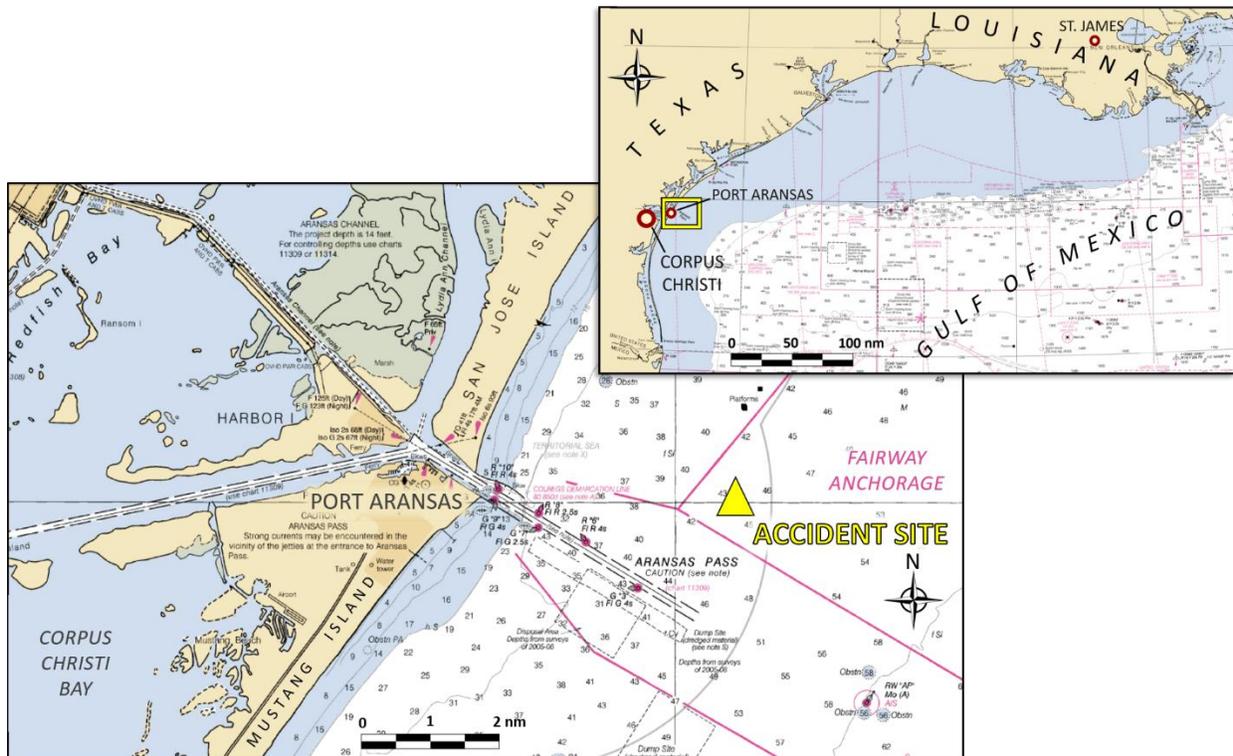
About 0430 the next morning, the mate on watch in the *Buster Bouchard* wheelhouse and the two barge crewmembers were preparing to raise the anchor on the bow of the barge and get under way for the inbound transit to Corpus Christi. In order to raise the anchor and the six shots of chain holding the ATB in place, the barge crew had to start one of the barge's diesel generators and switch the source of electrical power from the tugboat to the barge.³ Once electrical power was switched, the barge's crew proceeded to the bow. A small enclosure located on the bow,

² *Classification societies* such as ABS are organizations that: (i) publish classification rules (including technical requirements) in relation to the design, construction, and survey of ships, and have the capacity to (a) apply, (b) maintain, and (c) update those rules on a regular basis; (ii) verify compliance with the rules during construction and periodically during a classified ship's service life; (iii) publish a register of classified ships; (iv) are not controlled by, and do not have interests in, ship owners, shipbuilders or others engaged commercially in the manufacture, equipping, repair or operation of ships, and (v) are authorized by a flag administration as defined in the *Convention for the Safety of Life at Sea (SOLAS)* Chapter XI-1, Regulation 1 and listed accordingly in the International Maritime Organization (IMO) database, the Global Integrated Shipping Information System (GISIS). Source: International Association of Classification Societies (IACS), *Classification societies – their key role*, <http://www.iacs.org.uk/media/3784/iacs-class-key-role.pdf>.

³ One shot = 90 feet of chain.

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referred to as the “doghouse,” provided access to a stairway down to the forepeak. A crewmember opened the weathertight door and reached into the doghouse to retrieve the anchor windlass controller, which was attached via an umbilical cord to a control box in the doghouse. He returned to the vicinity of the windlass, started it, and began hauling in the anchor. At the same time, the tugboat’s assistant engineer started the main engines, and then the mate checked the running lights and steering and awaited maneuvering directions from the barge captain, who was supervising the raising of the anchor.



Location of the accident. (Adapted from National Oceanic and Atmospheric Administration [NOAA] charts 11307 and 411)

The mate on watch told investigators that initially the recovery of the anchor proceeded normally, with the barge crew reporting via handheld radio the amount of anchor chain remaining in the water and the strain on the chain. Occasionally, when the strain was heavy, the barge crew would stop heaving on the anchor chain, and the mate would clutch in one of the tugboat’s engines for a brief moment to move the ATB ahead, which relieved the strain.

When the barge captain reported to the mate on the *Buster Bouchard* that two shots (180 feet) of chain remained in the water, he also reported that the anchor was off the bottom. Following that notification, the barge captain informed the mate that the anchor winch was under heavy strain. According to the mate, these reports seemed to conflict, so he checked the water depth on the electronic charting display. The mate noted that the ATB was anchored in 45 feet of water and that the tugboat and barge were not moving as he would have expected if the anchor was off the bottom.

At some point after the last communication from the barge, the mate, who was facing to port in the tugboat’s wheelhouse, saw a flash out of his peripheral vision. As he looked forward, he saw blue flames on the bow around the area of the winch. The flames were immediately followed by an explosion. The mate sounded the tugboat’s general alarm and attempted to call the barge crew on the handheld radio. He received no answer, and he could no longer see the two

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crewmembers on the bow. The mate then sent a distress call via VHF radio, reporting to the Coast Guard that the barge was on fire and that two crewmembers were missing.

A second and third explosion followed, causing further damage to the bow of the barge, and a fire erupted in the area of the explosions. The crew of the *Buster Bouchard*, fearing further explosions, disengaged the tugboat from the damaged barge. After disengaging, the tugboat's crew initiated a search for the missing barge crew.

Coast Guard aircraft and response vessels from Corpus Christi, along with other vessels in the area, proceeded to the scene to assist. The Coast Guard coordinated search efforts for the missing crewmembers, while fire boats worked to extinguish the fire on the *B. No. 255*. The fire was extinguished about 1100.



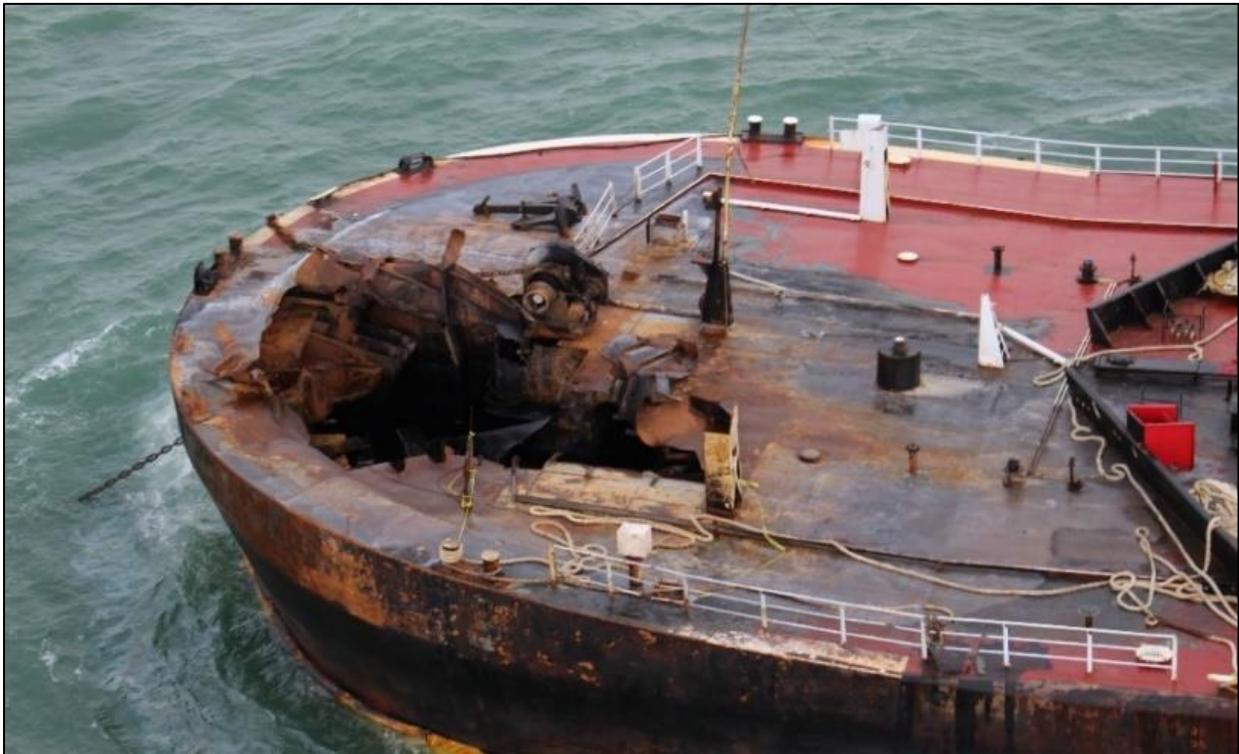
B. No. 255 bow on fire. (Photo by Coast Guard)

The no. 1 port and starboard cargo tanks each held 6,700 barrels (281,400 gallons) of crude oil; of that, an estimated 2,000 barrels (84,000 gallons) of cargo leaked into the Gulf of Mexico or were burned in the fire. A unified command, with representatives from the Coast Guard, the Texas General Land Office, and Bouchard Transportation, coordinated efforts to stop the cargo leak and clean up discharged oil. The entrance to Aransas Pass was closed for 3 days to prevent the spread of oil into the port. Some oil impacted the barrier islands in the vicinity of the pass, requiring environmental cleanup. The *B. No. 255* remained at anchor until it was salvaged and towed to port 5 days after the explosion.

Damage

As shown in the below photos, the blasts caused significant damage to the bow of the *B. No. 255*, primarily to the port side of the forepeak and to the no. 1 port cargo tank. A large hole was opened in the deck where the doghouse was located.

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Explosion and fire damage to port bow of *B. No. 255*. (Photo by Coast Guard)



Deck level views of damage to *B. No. 255* looking forward from the main deck (left) and aft from the bow (right). (Photos by Coast Guard)

Additional Information

Safety Management System

Marine safety management systems (SMSs) are programs designed to identify hazards and reduce risk in order to ensure safety at sea, prevent injury or loss of life, and avoid damage to the environment and to the vessel. An SMS provides procedures used aboard a vessel during normal operations and emergencies and includes procedures for conducting regular maintenance on the vessel and equipment. An SMS also includes an audit process to identify when the SMS is not followed and a system for implementing corrective actions.

For vessels sailing under the regulations of the International Convention for the Safety of Life at Sea (SOLAS), SMS requirements are delineated in the International Safety Management

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(ISM) Code.⁴ Per the ISM Code, a flag state issues a *Document of Compliance* to a company that complies with the requirements of the code and issues a *Safety Management Certificate* to each vessel after verifying that the company and its shipboard management operate in accordance with an approved SMS. Flag states may delegate the issuance of Documents of Compliance and Safety Management Certificates to “recognized organizations,” which are generally classification societies. ABS is a recognized organization authorized by the Coast Guard. As such, ABS issued ISM certificates and was required to inform the Coast Guard when either a Document of Compliance or Safety Management Certificate was rescinded.

Because the *B. No. 255* did not sail on international voyages, it was not required to comply with SOLAS regulations or the ISM Code. However, at the time of the accident, Bouchard Transportation voluntarily complied with the ISM Code. The company had a valid Document of Compliance, and the *B. No. 255* had a valid Voluntary Safety Management Certificate, which was issued by ABS on behalf of the Coast Guard on March 29, 2014. The safety management certificate was valid until February 26, 2019.

Barge Condition

During a postaccident internal examination of the barge on December 7, 2017, investigators discovered two horizontal through-cracks in the bulkhead separating the forepeak and the no. 1 port cargo tank. The cracks were approximately 15 feet from the bottom of the tank and about two inches above transverse framing welded to the forepeak side of the bulkhead. The horizontal length of the higher crack was 13.8 inches and the horizontal length of the lower crack was 13.5 inches. A 3-foot-by-4-foot section of the bulkhead containing the cracks was removed for further examination and testing by the NTSB Materials Laboratory.



Cracks in bulkhead separating the forepeak from the no. 1 port cargo tank, as viewed from the forepeak (left) and the cargo tank (right). (Photos by Coast Guard)

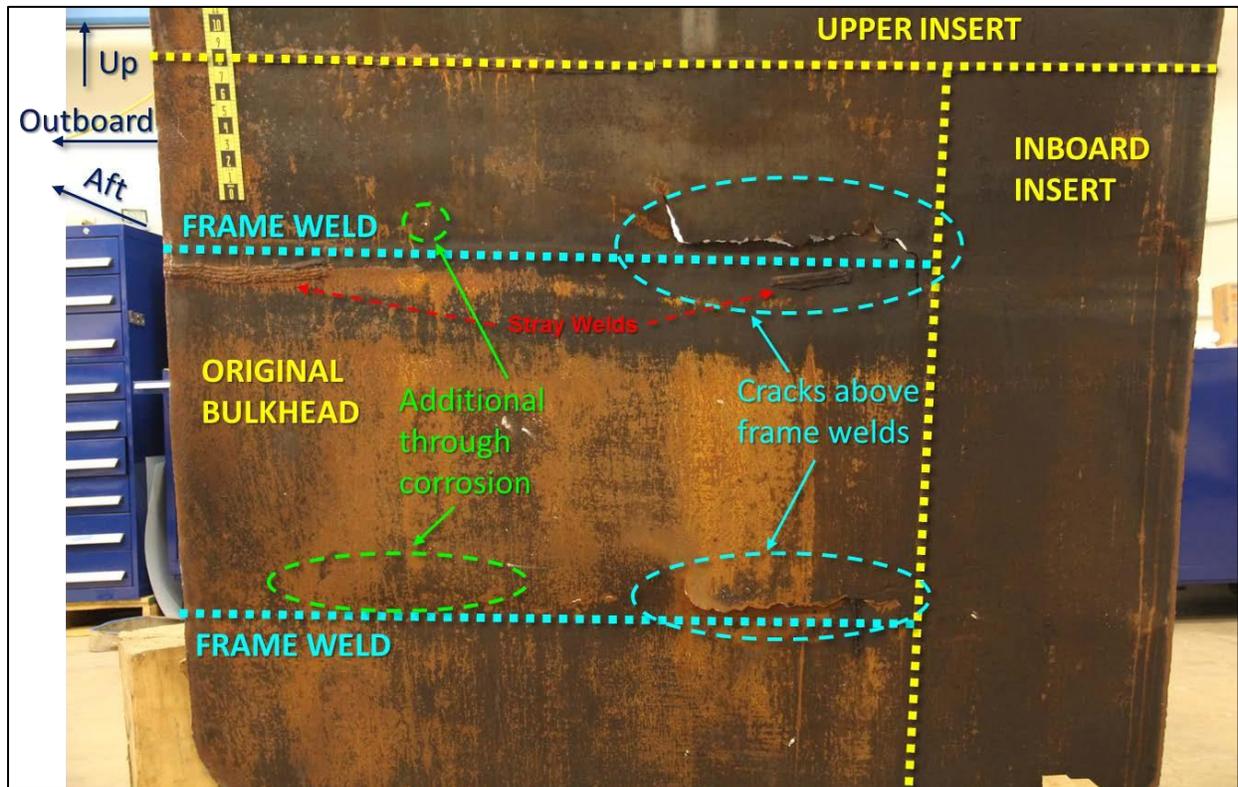
⁴ The SOLAS Convention is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The main objective of the convention is to specify minimum standards for the construction, equipment, and operation of ships, compatible with their safety. The first version of the SOLAS Convention was adopted in 1914 in response to the *Titanic* disaster. The current version in force is the 1974 Convention, as amended on numerous occasions. Source: International Maritime Organization (IMO), International Convention for the Safety of Life at Sea (SOLAS), 1974, [http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-\(SOLAS\),-1974.aspx](http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx).



Cracks in bulkhead separating the forepeak from the port no. 1 cargo tank. The dashed section was removed and sent to the NTSB Materials Laboratory for analysis. (Photo by Coast Guard)

As the barge's classification society, ABS conducted regular surveys of the *B. No. 255* to ensure that the vessel remained in compliance with standards for construction and operation. According to ABS records, portions of the forepeak/no. 1 port cargo tank bulkhead were removed in 2008 and in 2010 and replaced with new steel. A Special Periodical Survey was conducted on February 2015 and ultrasound gauging of the bulkhead did not indicate any need for renewals. The barge was not due to have its transverse bulkheads gauged again until September 30, 2017, with a survey window of December 30, 2016, to June 30, 2018.

During the NTSB Materials Laboratory examination, the inboard, lower and upper areas of the bulkhead section were found to be newer steel consistent with the repairs in the ABS records. The central portion of the bulkhead section, which contained the two cracks, was older steel. This steel was pock-marked and pitted on the forepeak side of the bulkhead, and the metal was corroded and thinned in the areas around the cracks. Two additional areas of through-corrosion, located outboard of the cracks, were discovered during the laboratory examination.



Bulkhead section between the forepeak and no. 1 port cargo tank, as viewed from the tank side.

In addition to the forepeak/no. 1 port cargo tank bulkhead cracks, investigators found several areas of material wastage and corrosion on the main deck of the barge. Of note, an ullage tube for the no. 1 starboard cargo tank had significant corrosion at the base and around the top, and an armored electrical wire conduit aft of the explosion area had wastage that left wiring exposed. The wasted areas discovered during the investigation were determined by the Coast Guard to predate the accident.



Postaccident photos of corroded no. 1 starboard cargo tank ullage tube (left) and wasted armored protected electrical cable with exposed wiring (right). (Photos by Coast Guard)

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Investigators also discovered epoxy compound that was utilized to fill in wasted areas in various locations on the cargo deck (main deck) plating as a temporary repair. These epoxy repairs were not approved by the Coast Guard or ABS. Other similar epoxy repairs had been previously identified on deck enclosures by ABS on March 14, 2017, and were allowed to remain until the next shipyard period in February 2018.

Coast Guard Inspection Requirements

As a tank barge carrying flammable or combustible liquids in bulk, the *B. No. 255* was required to complete a Coast Guard inspection for certification every 5 years. The scope of the inspection was to ensure that the structure, machinery, and equipment of the vessel were in satisfactory condition and fit for the service in which it was intended. During the inspection, all voids were to be “opened and checked from on-deck level for the presence of water or cargo indicating hull damage or cargo tank leakage. If water or cargo is present, an internal structural examination may be required.” The *B. No. 255* had a valid Coast Guard Certificate of Inspection (COI) with an expiration date of February 19, 2020.

Following issuance of a COI, the *B. No. 255* was subject to annual inspections by the Coast Guard. An annual inspection was required within 3 months before or after the COI anniversary date, and the scope was the same as the inspection for certification “but in less detail unless the cognizant marine inspector finds deficiencies.” If deficiencies were found, the marine inspector was to conduct a more detailed inspection. The *B. No. 255*’s last annual inspection before the accident was conducted on May 11, 2017.

The *B. No. 255* was also subject to drydock examinations, internal structural examinations, and cargo tank internal examinations. The drydock examinations focused on the hull of the vessel and were required every 5 years. The *B. No. 255*’s last drydock inspection was conducted on February 19, 2015. Internal structural examinations and cargo tank internal examinations were required every 2.5 years and 5 years, respectively, with the last examinations on the *B. No. 255* occurring on January 3, 2013, and February 5, 2015. The regulations at Title 46 *CFR* Subchapter D noted that “if, during an internal structural examination [or] cargo tank internal examination, damage or deterioration to the hull plating, structural members, or cargo tanks is discovered, the Officer in Charge, Marine Inspection, may require the vessel to be drydocked or otherwise taken out of service to further assess the extent of the damage and to effect permanent repairs.”

ABS Survey Requirements

Once a classification society such as ABS classifies a vessel, it will conduct regular surveys of the vessel to ensure that it continues to meet the standards, known as conditions of class, that it was built to. Classification societies are required to notify the Coast Guard when a vessel no longer meets the conditions of class or is removed from classification.

For vessels classified by ABS, hull surveys were designated Annual, Intermediate, or Special Periodical based on the interval and scope of the survey. According to the society’s *Rules for Survey After Construction*, during an Annual Survey “the weather decks, hull plating and their closing appliances together with watertight penetrations are to be generally examined as far as practicable and placed in satisfactory condition.” The *B. No. 255*’s last Annual Survey was conducted on May 2, 2017.

During an Intermediate Survey, which was conducted either at or between the second and third Annual Surveys after a Special Periodical Survey, the scope was expanded to an examination

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of at least three cargo tanks. The *B. No. 255* had not yet reached the required interval for an Intermediate Survey when the accident occurred.

Special Periodical Surveys were to be conducted no less than every 5 years, conducted while the vessel was in drydock, and determined the vessel's fitness for a new 5-year period of class. In addition to the requirements of an Annual Survey, the Special Periodical Survey required an examination of all spaces, including voids and their plating and framing. For barges, the *Rules for Survey After Construction* further directed:

During each Special Periodical Survey, the double bottom, deep, ballast, rake, cargo tanks/holds, adjacent void spaces...are to be examined together with cargo piping, ballast piping, anodes and coatings...Tanks are to be thoroughly freed of dangerous gas or hazardous chemicals and cleaned sufficiently to reveal corrosion, deformation, fractures, damages or other structural deterioration. Means are to be provided for access to the upper parts of the tanks, as required for examination and thickness measurement.

A Certificate of Classification was issued to the *B. No.255* by ABS on March 31, 2015, following its last Special Periodical Survey. The certificate's expiration date was March 31, 2020.

B. No. 255 Inspection, Survey, and Repair History

Investigators reviewed the records of inspections, classification surveys, and internal audits, as well as documentation of repairs conducted on the barge beginning on February 7, 2016. The review identified the following:

- **February 07, 2016:** ABS conducted an Annual Survey of the vessel. During the survey, numerous sections of the weather deck electrical conduit were found deteriorated and in poor condition including:
 - Forward deck lights
 - Port and starboard capstans
 - Mast flood light
 - Red running light
 - White running light
 - Green running light
 - Lighting and receptacles

As a result of the inspection, the owner was required to conduct an electrical insulation resistance test to determine the condition of the vessel's electrical system and if there was any further degradation.⁵ There are no indications that the Coast Guard was notified of this deficiency.

- **May 10, 2016:** (93 days after the ABS Survey) Coast Guard Marine Safety Unit Port Arthur, Texas, conducted an annual inspection; no deficiencies noted.

⁵ An *insulation resistance test* is a check that applies direct current (DC) voltage to cable or wire insulation to determine the condition of the insulation.

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- **June 24, 2016:** (45 days after the Coast Guard inspection) ABS conducted an Annual Survey; the following deficiencies were identified:
 - Hazardous Area Plan could not be located on board the vessel
 - Cargo vapor was blowing through a valve handle packing
 - Shaft seals/glands on the starboard ballast pump were split open
 - Forward starboard mooring bit was damaged
 - A three-phase motor controller in the forward bosun's locker was open
 - Holes in the generator room; Marine Safety Unit Port Arthur was notified by ABS that the holes were temporarily repaired by utilizing epoxy and the final repair was extended until the next drydock period
 - Damaged fire screen doors

ABS noted in its report that the forepeak, which was previously identified by ABS as having a fair coating condition, was not made accessible by Bouchard Transportation. As a result, the area was not entered by the attending ABS surveyor. Follow-on reports did not state whether this internal space was entered by ABS during subsequent surveys.

- **June 28, 2016:** (4 days after the ABS Survey) All items identified during the June 24, 2016, Annual Survey were corrected, with the exception of the holes in generator spaces, the damaged mooring bit, the damaged fire screen doors, and other items that were extended to the next drydock period. Additionally, completed repairs to the numerous sections of the weather deck electrical conduit found in deteriorated condition by ABS in February 2016 were approved.
- **July 06, 2016:** (8 days after the ABS deficiency check) The holes in the generator space were repaired, the damaged mooring bit was repaired, and the damaged fire screen doors were replaced.
- **September 09, 2016:** (67 days after the ABS follow-on deficiency check) While the barge was docked at a Sunoco facility in Nederland, Texas, facility personnel discovered an extensive amount of vapor leaking from the vessel. Due to the risk of ignition and explosion, the barge was ordered to depart the facility.
- **September 14, 2016:** (5 days after the barge was required to depart the Sunoco facility) All 16 cargo hatches and ullage cover gaskets were replaced. In addition, packing in 32 cargo tank valves were replaced. A pressure test was conducted, and the vessel satisfactorily passed.
- **March 14, 2017:** (181 days after the repairs and pressure test) ABS conducted an ISM Code audit of Bouchard Transportation, during which the auditors attended the *B. No. 255*. The following observations were made:
 - No documentation in the official logbook of the testing of restricted spaces, including the forepeak, prior to personnel entering
 - Emergency drill program schedule was not followed
 - No documentation was found on board for crew risk assessments

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- A review of the vessel's "NS Enterprise" (NS5), an ABS maintenance tracking program utilized by Bouchard Transportation, showed that annual servicing of the cargo pump engines and no. 2 generator was not conducted in December 2016 as scheduled
- Deck enclosures for forward no. 1 port pump and no. 2 starboard pump were both found wasted, and epoxy was utilized as a repair

All observations were corrected except for the epoxy on the pump enclosures, which was to be repaired at the next shipyard period in February 2018. The Coast Guard was notified of the conditions of class.

- **April 29, 2017:** (46 days after the ISM Code audit) Oil Companies International Marine Forum (OCIMF) conducted a Ship Inspection Report Program (SIRE) inspection.⁶ The report identified that 50% of the hull coating had failed, and corrosion was found where there was no coating.

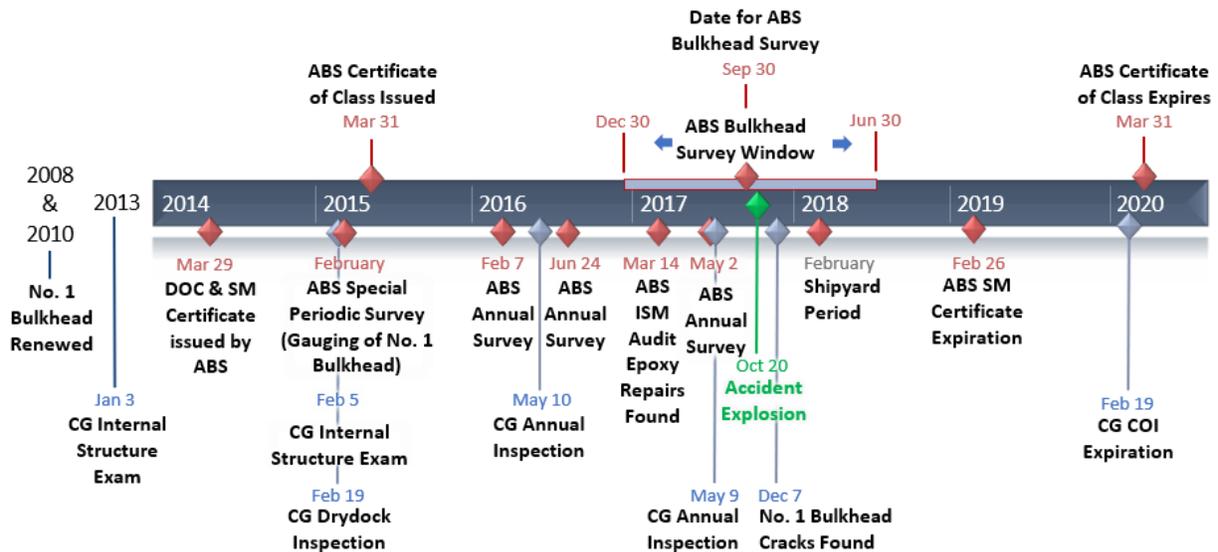
Bouchard Transportation conducted an internal audit of the *B. No. 255* during the same time period as the SIRE inspection and identified several areas of concern with the condition of the barge that required extensive repair, including the no. 1 port cargo pump well, which had a hole in it causing the pump to lose suction.

- **May 02, 2017:** (4 days after the OCIMF SIRE inspection) ABS conducted an Annual Survey; no deficiencies noted. Additionally, the barge's cargo thermal fluid heater was decommissioned while in the shipyard.
- **May 11, 2017:** (9 days after the ABS survey) Coast Guard Sector New York conducted an annual inspection; no deficiencies noted. At the time of the inspection the barge was docked at Caddell Dry Dock and Repair Co., Inc., in Staten Island, New York.
- **May 25, 2017:** (14 days after the Coast Guard inspection) A total of 23 items were identified for repair by the company including replacement of a 40-inch-by-40-inch section of deck over the no. 1 starboard cargo tank. Based on the documents provided by Caddell Dry Dock and Repair, the deck replacement was not conducted. All other work on the *B. No. 255*, including replacement of an 8-inch ballast valve in no. 4 ballast tank (the faulty valve had prevented the removal of 70,000 gallons of water from that tank), renewal of 14 feet of fuel supply and return lines on the boiler, and replacement of coamings for the cargo domes for no. 6 and no. 7 starboard tanks, was completed before the barge departed the Caddell shipyard on June 3, 2017.
- **July 11, 2017:** (8 days after the barge departed the shipyard) Following a spill of cargo which entered the water, Coast Guard personnel from Sector New Orleans issued a requirement that prior to the operation of the no. 3 cargo pump, the pump's relief valve and all associated valves were to be inspected and repaired as necessary, and the corroded cargo discharge line from the pump to the discharge manifold was required to be hydrostatically tested to the satisfaction of the attending marine inspector. This requirement was met on August 11, 2017.

⁶ OCIMF is a voluntary association of oil companies with an interest in the shipment and terminalling of crude oil, oil products, petrochemicals, and gas. One of the most significant safety initiatives introduced by OCIMF is the SIRE program. It is a tanker risk assessment tool that involves a uniform inspection protocol to specifically address concerns about sub-standard shipping. Source: <https://www.ocimf.org/>.

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- **September 08, 2017:** (29 days after the requirement for the no. 3 cargo pump was met) A vapor tightness test was conducted at Boland Shipyard; the barge was found to be in satisfactory condition.
- **October 11 and 13, 2017:** The vessel's deck log indicated that a mechanic was on board to fix the no. 2 generator. Two days later, a mechanic and an electrician were on board for repairs to the no. 1 generator. The explosion occurred 7 days afterward.



Barge B. No. 255 ABS and Coast Guard Survey and Inspection Overview

Postaccident Inspections of a Barges Operated by Bouchard Transportation Co.

Subsequent to the discovery by investigators of the poor material condition of the *B. No. 255* after the accident, the Coast Guard initiated a complete evaluation of the tank barges operated by Bouchard Transportation. Twenty-five barges were inspected, of which twenty-four were engaged in cargo operations. The remaining barge had been in the shipyard since August 2, 2017. Examples of what was discovered during these additional inspections follow:

- Three-quarters of every cargo tank bulkhead on board one barge had to be replaced;
- Coatings in ballast tanks of another barge were in poor condition and covered existing damage without proper previous repair;
- Extensive wastage of the hull and piping system was discovered in a third barge;
- The side-shell longitudinal of a fourth barge had sections of complete wastage and corrosion; additionally, areas of a cargo tank-side longitudinal of the same vessel were completely wasted; some lightening holes inside the vessel were down to “paper-thin steel.”

As a result of these expanded inspections, which were conducted from October 2017 to December 2018, the Coast Guard issued 251 deficiencies to 25 barges and placed operational controls on 10 barges, limiting or preventing their operation until the discrepancies were corrected. One barge was issued 66 deficiencies, and another was issued 33 deficiencies despite both being inspected by the Coast Guard and classified by ABS. In addition, 5 of the 10 barges that were issued operational controls were transporting oil in bulk and had extensive corrosion discovered within cargo tanks and along the hull.

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Prior Explosion of a Barge Operated by Bouchard Transportation Co.

On February 21, 2003, the tank barge *B. No. 125*, operated by Bouchard Transportation, exploded while offloading its cargo of gasoline at the Exxon Mobil Port Mobil facility on Staten Island, New York. The explosion resulted in the deaths of the two barge crewmembers, severe injuries to a dockside worker, and extensive damage to the facility. The Coast Guard investigation determined that the probable cause of the accident was the failure of the barge's port pump engine. The investigation also determined that Bouchard Transportation failed to implement appropriate management and preventive maintenance systems to ensure the safe operation of its barges.

Analysis

A majority of the damage to the *B. No. 255* was found in the forepeak of the barge, and photographs showed the post-explosion fire in the same location. This evidence aligns with the *Buster Bouchard* mate's statement about the explosion he witnessed. Based on these factors, the NTSB concludes that the initial explosion on board the *B. No. 255* originated in the forepeak of the barge.

The bulkhead between the forepeak and the no. 1 port cargo tank had previously experienced significant corrosion, as evidenced by the repairs documented by ABS to portions of the bulkhead that were conducted 8–10 years prior to the accident. During postaccident examination, through-cracks were found in the area of the original bulkhead that had not been previously repaired, and the steel in the areas around the cracks was pock-marked and pitted. Other areas of through-corrosion were also discovered during the NTSB's Materials Laboratory examination.

Examination by the Materials Laboratory of the tips of metal along the through-cracks revealed two broad categories of features: those with an enveloping oxide/corrosion layer and those without. Examined cross sections of the first crack tip category exhibited relatively thick (0.003 inch [75 μm]) layers. The thickness of this oxide layer was consistent not just over and around the crack tip, but also over the areas away from the crack tip. The fact that the oxide exhibited a consistent thickness over all the cross-sectioned areas of the crack tips and that the oxide was of a thickness of 0.003 inch indicate that this corrosion was present before the accident explosion.

Portions of the crack tips examined by the laboratory revealed areas where the oxide had fractured and spalled. These spalled and fractured oxide regions were consistent with having occurred from the explosion forces. Thus, some damage to the bulkhead likely occurred during the explosion. However, based on the presence of corrosion on the crack tips before the accident as well as the pitted and pock-marked metal around the cracks, the NTSB concludes that two through-cracks and other holes in the bulkhead between the forepeak and the no. 1 port cargo tank on barge *B. No. 255* were primarily a result of corrosion that existed prior to the accident and compromised the integrity of the cargo containment in the no. 1 port tank.

When cargo loading operations were completed on October 16, 2017, the no. 1 port cargo tank was 90 percent filled, which would have placed the level of crude oil above the cracks. Because the *B. No. 255*'s cargo thermal fluid heater was decommissioned at the Caddell shipyard in June 2017, any oil being carried by the barge had to have a low enough viscosity to be pumped by the *B. No. 255*'s cargo pumps without additional heating. The head pressure created by cargo levels above the cracks and other areas of through-bulkhead corrosion would have allowed the oil to seep through the openings in the bulkhead and collect inside the forepeak. The seepage would

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have flowed continuously for approximately 4 days prior to the accident. With oil continuously entering the space over 4 days, the crude oil vapor content in the atmosphere of the forepeak would have increased.

The forepeak was classified as a void space, meaning that it was not intended or designed to hold liquid cargo, especially hazardous cargo such as crude oil, which the *B. No. 255* was carrying on the day of the explosion. Inside this void area was an anchor chain locker, lighting circuits and cables, and an electrical control box for the anchor windlass. While raising the anchor on the morning of the accident, the wiring in the forepeak leading to the windlass's motor was energized and could have been a source of ignition in the space where the oil vapors had collected.

In addition, an exposed electrical wire on an energized circuit on the cargo deck could have created an electrical arc capable of igniting fuel vapor. Exposed wires had been identified by ABS and corrected during previous surveys; however, investigators found additional exposed wires during the postaccident examination of the vessel that were not the result of the explosion and fire. Because there was no flame protection on the vents into the forepeak and the door to the doghouse was open at the time of the accident (likely due to the anchor windlass controller umbilical cable being routed through the door), oil vapor escaping the forepeak could have been ignited by other sources on the cargo deck, such as metal-on-metal contact during the raising of the anchor. The specific ignition source for the explosion on the *B. No. 255* could not be determined. However, the NTSB concludes that the explosion in the forepeak of the barge was caused by the ignition of flammable vapor that formed from oil that had leaked into the space from the no. 1 port cargo tank through a corrosion-compromised bulkhead.

The maintenance and upkeep of a vessel is the responsibility of the owner and operator. The material condition of each space on the vessel should be assessed on a periodic basis and repairs conducted when discrepancies are discovered. Equipment and spaces known to have a higher failure rate or be prone to corrosion should be inspected more frequently, and safety hazards should be addressed immediately. As previously noted, the cracks in the bulkhead between the forepeak and the no. 1 port cargo tank on the *B. No. 255* were determined to be present before the accident. Sections of the bulkhead had been repaired previously, which should have been an indicator to Bouchard Transportation that the area was prone to wastage. Given that the bulkhead separated a void from a cargo tank, maintaining the integrity of the bulkhead should have been a priority. The two cracks and other through-corrosion points in the bulkhead steel, along with the overall condition of the *B. No. 255* as found by investigators after the accident, including significant wastage on the cargo deck, exposed wiring, and unapproved epoxy repairs, indicate that the barge was not being maintained properly.

At the time of the accident, Bouchard Transportation had a valid Document of Compliance, and the *B. No. 255* had a valid Safety Management Certificate. Although compliance with the ISM Code was voluntary because the vessel did not engage in international voyages, the certificates indicated that the company and the vessel had fully implemented an SMS in accordance with the code. According to the testimony of Bouchard managers and employees during the Coast Guard's Marine Board of Investigation into the accident, vessel crews were familiar with the company's *Safety Management Manual*. In addition, internal audits were conducted that were intended to ensure that policies and procedures were understood and followed. Those discrepancies identified during the audits were corrected, but the investigation found numerous additional discrepancies that were not documented.

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Despite the SMS and the company's maintenance program, the inspection and survey records indicate that the overall condition of the barge was historically poor and never improved. For example, on March 14, 2017, ABS discovered unapproved epoxy repairs to deckhouses (the unapproved repairs were later accepted by ABS as temporary repairs to be corrected at the next drydock). On July 11, 2017, the Coast Guard identified the poor condition of the no. 3 cargo pump, its relief valve, and all associated valves. The Coast Guard ordered Bouchard to cease operating the pump until it was properly repaired. Postaccident, investigators found extensive metal wastage, exposed wiring, and unapproved epoxy repairs on board the *B. No. 255*.

Per federal regulations, “no extensive repairs to the hull or machinery which affect the safety of a vessel shall be made without the knowledge of the Coast Guard Officer in Charge, Marine Inspection.” However, based on the testimony of company managers and employees, as well as Coast Guard marine inspectors during the Marine Board of Investigation, Bouchard Transportation did not inform the Coast Guard and ABS of known structural deficiencies, mechanical failures, and ignition hazards on the *B. No. 255* and the repairs undertaken to address these issues. While the barge was at the Caddell Drydock and Repair Co. shipyard in May and June 2017, extensive repairs were conducted, including the replacement of a ballast valve in a ballast tank, renewal of fuel supply and return lines on the boiler, and replacement of coamings on cargo domes for two tanks. In the month prior to the accident, a mechanic and electrician boarded the barge on at least two occasions, according to the vessel's log, to repair the vessel's generators. The nature and scope of repairs to the generators and electrical systems were not passed to ABS or the Coast Guard. The NTSB believes that, based on the scope of the work and the impact to the safety of the vessel, these repairs and the repairs conducted at the Caddell shipyard warranted notification to the classification society and the Coast Guard. An effective SMS would have identified applicable standards and regulations and put procedures in place to adhere to them. Had Bouchard Transportation's SMS included these procedures, the company would have likely shared its concerns and findings about the barge with ABS and complied with the regulation to notify the Coast Guard. A complete evaluation of the *B. No. 255*'s ability to safely transport crude oil in bulk may have then occurred, resulting in the removal of the risks that led to the accident.

The postaccident inspections of 25 other Bouchard Transportation barges resulted in 251 deficiencies and operational controls placed on 10 barges, limiting or preventing their operation until the discrepancies were corrected. Based on the results of these inspections and the condition of barge *B. No. 255* as found after the accident, the NTSB concludes that Bouchard Transportation's SMS and maintenance processes failed to ensure proper maintenance of the company's fleet of barges, including the *B. No. 255*. Additionally, the NTSB concludes that Bouchard Transportation management failed to promote and ensure a safety culture in the company, which compromised the safety of both the vessel and the crew. Therefore, the NTSB recommends that Bouchard Transportation evaluate the company's SMS with an independent third party to identify the areas that allowed for the poor mechanical and structural condition of the *B. No. 255* and revise the SMS to address identified deficiencies.

When the Coast Guard conducted its annual inspection of the *B. No. 255* in May 2016, no discrepancies were noted despite the fact that an ABS survey 3 months prior had found numerous discrepancies with the vessel's electrical system—discrepancies that were not documented as corrected until June 2016, a month and a half after the Coast Guard's inspection. In May 2017, the Coast Guard conducted the next annual inspection and again found no discrepancies. However, an OCIMF SIRE inspection conducted 9 days prior had found that 50% of the hull coating had failed, with corrosion occurring in the areas with no coating, and an internal audit conducted at the same time by Bouchard Transportation identified several areas of concern with the barge. Following the

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accident, investigators found areas of poor or unapproved maintenance, such as wasted conduit and the use of epoxy filler in wasted deck plating. Although annual Coast Guard inspections are intended to be smaller in scope than 5-year certification inspections, discrepancies such as these should have been found during annual inspections and should have prompted a more detailed and thorough inspection. Despite significant evidence suggesting that the *B. No. 255* was poorly maintained and unsafe, the Coast Guard inspection record prior to the accident indicated that the vessel was compliant with regulations and fit for service. As previously noted, the postaccident inspections of 25 other Bouchard Transportation barges identified 251 deficiencies (deficiencies that were not found during preaccident inspections), and operational controls were placed on 10 barges. The NTSB concludes that Coast Guard marine inspectors who examined barge *B. No. 255* prior to the accident failed to identify unsafe conditions, which allowed the vessel to continue to operate at increased risk to the crews, the environment, and port facilities.

ABS surveys of the *B. No. 255* in 2016 noted significant discrepancies with the barge, but it does not appear that these discrepancies raised concern about the overall maintenance and safety of the vessel. Then, in June 2017, during the last survey conducted before the accident (and 4 days after the OCIMF SIRE inspection that identified coating and corrosion issues), ABS found no discrepancies on the vessel. The condition of the *B. No. 255* and the condition of other Bouchard Transportation barges inspected postaccident point to substandard maintenance and hazardous conditions. The NTSB therefore concludes that the ABS's survey program was ineffective in ensuring the safety of barge *B. No. 255* and its crew.

The Coast Guard and classification societies typically work cooperatively to assess the condition of vessels for safety and fitness for service. Thus, investigators attempted to discern why there was a disparity between the numerous discrepancies found by ABS during its surveys and audits of the *B. No. 255* in 2016 and 2017, and the relatively few discrepancies found by the Coast Guard during its inspections of the vessel. Investigators found no indication that there was any detailed communication between ABS and Coast Guard regarding the deficiencies discovered by either organization prior to the explosion. This lack of direct communication between ABS and the Coast Guard prevented a coordinated effort to evaluate the structural condition of the tank barge. Had the Coast Guard marine inspector who conducted the annual inspection in May 2017 been in contact with the ABS surveyor who attended *B. No. 255* in March of that year and been aware of the previous survey findings, the inspector may have expanded the annual inspection. An expanded inspection could have identified discrepancies and improved the overall condition of the barge. Although both organizations individually found corrosion and maintenance issues throughout the vessel, the NTSB concludes that the lack of communication between the ABS and the Coast Guard limited each organization's ability to assess the overall condition of the *B. No. 255* and identify hazardous conditions, including the corrosion on the forepeak/port no. 1 cargo tank bulkhead. Therefore, the NTSB recommends that ABS and the Coast Guard establish joint policy and procedures to share information, including all results and findings from audits, surveys, examinations, inspections, and other applicable activities related to vessel safety.

Findings

1. The initial explosion on board the *B. No. 255* originated in the forepeak of the barge.
2. Two through-cracks and other holes in the bulkhead between the forepeak and the no. 1 port cargo tank on barge *B. No. 255* were primarily a result of corrosion that existed prior to the accident and compromised the integrity of the cargo containment in the no. 1 port tank.

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3. The explosion in the forepeak of the barge was caused by the ignition of flammable vapor that formed from oil that had leaked into the space from the no. 1 port cargo tank through a corrosion-compromised bulkhead.
4. Bouchard Transportation's safety management system and maintenance processes failed to ensure proper maintenance of the company's fleet of barges, including the *B. No. 255*.
5. Bouchard Transportation management failed to promote and ensure a safety culture in the company, which compromised the safety of both the vessel and the crew.
6. Coast Guard marine inspectors who examined barge *B. No. 255* prior to the accident failed to identify unsafe conditions, which allowed the vessel to continue to operate at increased risk to the crews, the environment, and port facilities.
7. The American Bureau of Shipping's survey program was ineffective in ensuring the safety of barge *B. No. 255* and its crew.
8. The lack of communication between the American Bureau of Shipping and the Coast Guard limited each organization's ability to assess the overall condition of the *B. No. 255* and identify hazardous conditions, including the corrosion on the forepeak/port no. 1 cargo tank bulkhead.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the explosion aboard the barge *B. No. 255* was the lack of effective maintenance and safety management of the barge by Bouchard Transportation, which resulted in crude oil cargo leaking through a corroded bulkhead into the forepeak void space, forming vapor, and igniting. Contributing to the accident were the ineffective inspections and surveys by the Coast Guard and the American Bureau of Shipping.

Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations:

To Bouchard Transportation Co., Inc:

Evaluate your company's safety management system (SMS) with an independent third party to identify the areas that allowed for the poor mechanical and structural condition of the *B. No. 255* and revise the SMS to address identified deficiencies. (M-19-1)

To the US Coast Guard:

With the American Bureau of Shipping, establish joint policy and procedures to share information, including all results and findings from audits, surveys, examinations, inspections, and other applicable activities related to vessel safety. (M-19-2)

To the American Bureau of Shipping:

With the US Coast Guard, establish joint policy and procedures to share information, including all results and findings from audits, surveys, examinations, inspections, and other applicable activities related to vessel safety. (M-19-3)

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Adopted: April 18, 2019

Explosion and Fire aboard Articulated Tug and Barge *Buster Bouchard/B. No. 255*

Vessel Particulars

Vessel	<i>Buster Bouchard</i>	<i>B. No. 255</i>
Owner / operator	Bouchard Transportation Co., Inc.	Bouchard Transportation Co., Inc.
Port of registry	New York, New York	New York, New York
Flag	United States	United States
Type	Tugboat	Bulk liquid cargo (tank) barge
Year built	1979	1979 single-hull 1999 converted to double-hull
Official number (US)	605961	603622
IMO number	7814591	8640519
Construction	Steel	Steel
Classification society	N/A	ABS
Length	127 ft (38.7 m)	468 ft (142.6 m)
Draft	20 ft (6.1 m)	38.1 ft (11.6 m)
Beam/width	37 ft (11.3 m)	85.5 ft (26.1 m)
Gross / net tonnage	196	9,834
Engine power; manufacturer	2 X 3,070 hp (4,118 kW) EMD 16-645-E7 diesel engines	None
Persons on board	6	2

NTSB investigators worked closely with our counterparts from Coast Guard Sector Corpus Christi, Texas, throughout this investigation.

For more details about this accident, visit www.ntsb.gov and search for NTSB accident ID DCA18FM002.

Adopted: April 18, 2019

The NTSB has authority to investigate and establish the probable cause of any major marine casualty or any marine casualty involving both public and nonpublic vessels under Title 49 *United States Code*, 1131. This report is based on factual information either gathered by NTSB investigators or provided by the Coast Guard from its informal investigation of the accident.

The NTSB does not assign fault or blame for a marine casualty; rather, as specified by NTSB regulation, “[NTSB] investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person.” Title 49 *Code of Federal Regulations*, 831.4.

Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by conducting investigations and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. Title 49 *United States Code*, 1154(b).