Allision of Crane Barge, Pushed by Towing Vessel *Cory Michael*, with the Florida Avenue Bridge New Orleans, Louisiana August 13, 2014

Marine Accident Report
NTSB/MAR-15/02
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National Transportation Safety Board

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National Transportation Safety Board

490 L'Enfant Plaza, SW
Washington, DC 20594

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Abstract: This report discusses the August 13, 2014, accident in which a tow involving the vessel *Cory Michael* and a crane barge struck the raised lift span of the Florida Avenue Bridge in New Orleans, Louisiana. The crane boom, which was transported in an unsupported manner over the vessel's upper wheelhouse, fell down, crushing the wheelhouse and fatally injuring the captain.

The report identifies the following safety issues: inadequate oversight of bridge and towing vessel operations, and inadequate and complacent safety management practices.

As a result of this investigation, the National Transportation Safety Board makes new safety recommendations to the US Coast Guard, the Port of New Orleans, Boh Bros. Construction, and the Occupational Safety and Health Administration.

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Acronyms and Abbreviations

ABC	ABC Marine Towing, LLC (vessel owner)
AOR	area of responsibility
CEM	Crew Endurance Management (Coast Guard program)
CFR	*Code of Federal Regulations*
IMTT	International-Matex Tank Terminal
JSA	Job Safety Analysis (Boh Bros.)
LLC	limited liability company
NTSB	National Transportation Safety Board
OSH Act	Occupational Safety and Health Act of 1970
OSHA	Occupational Safety and Health Administration
SMS	safety management system
TSAC	Towing Safety Advisory Committee (Coast Guard)

Executive Summary

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

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

Safety issues identified in this investigation include:

- **Inadequate oversight of bridge and towing vessel operations:** Investigators learned that the US Coast Guard's Bridge Administration did not know that the lift span of the Florida Avenue Bridge was not being raised to its fullest extent for vessel passage since Hurricane Katrina damaged the bridge in 2005.

- **Inadequate and complacent safety management practices:** Although the operating company of the towing vessel had a safety policy in place, it was not being successfully implemented on board. Further, the crane boom was transported in an unsupported and dangerous manner, and the correct air draft of the tow was not established before the attempted transit under the Florida Avenue Bridge.

As a result of this investigation, the National Transportation Safety Board makes new recommendations to the US Coast Guard, the Port of New Orleans, Boh Bros. Construction, and the Occupational Safety and Health Administration.

1. The Accident

On the morning of the accident, August 13, 2014, the owner of the crane barge, Boh Bros. Construction Co., LLC (Boh Bros.) placed a work order with ABC Marine Towing, LLC (ABC) to move construction barges and equipment from Boh Bros.' facility in east New Orleans to the International-Matex Tank Terminal (IMTT) at mile marker 97.2 on the lower Mississippi River.[1] To conduct this work, ABC dispatched two of its towing vessels, the *Cory Michael* (figure 1) and the *Troy Jacob*, from its facility in Belle Chasse, Louisiana, about 20 miles from Boh Bros.

Figure 1. Towing vessel *Cory Michael*. (Photo by ABC Marine Towing)

The *Cory Michael* departed ABC at 1231 with a captain and two deckhands on board.[2] During the transit to Boh Bros., the vessel transited on the Intracoastal Waterway, passed through the Algiers Lock and entered the Mississippi River, then passed through the Industrial Canal Lock and entered the Industrial Canal. It passed under both the Claiborne Avenue Bridge and the Florida Avenue Bridge and arrived at the Boh Bros. facility at 1548 (figure 2). There, the *Cory Michael* crew helped move some of the other waterborne equipment around the facility before attaching towlines to the crane barge *BBCCI 901.012*.

[1] The miles in this report are statute miles.

[2] Unless otherwise noted, all times in this report are central daylight time (coordinated universal time – 5 hours), based on the 24-hour clock.

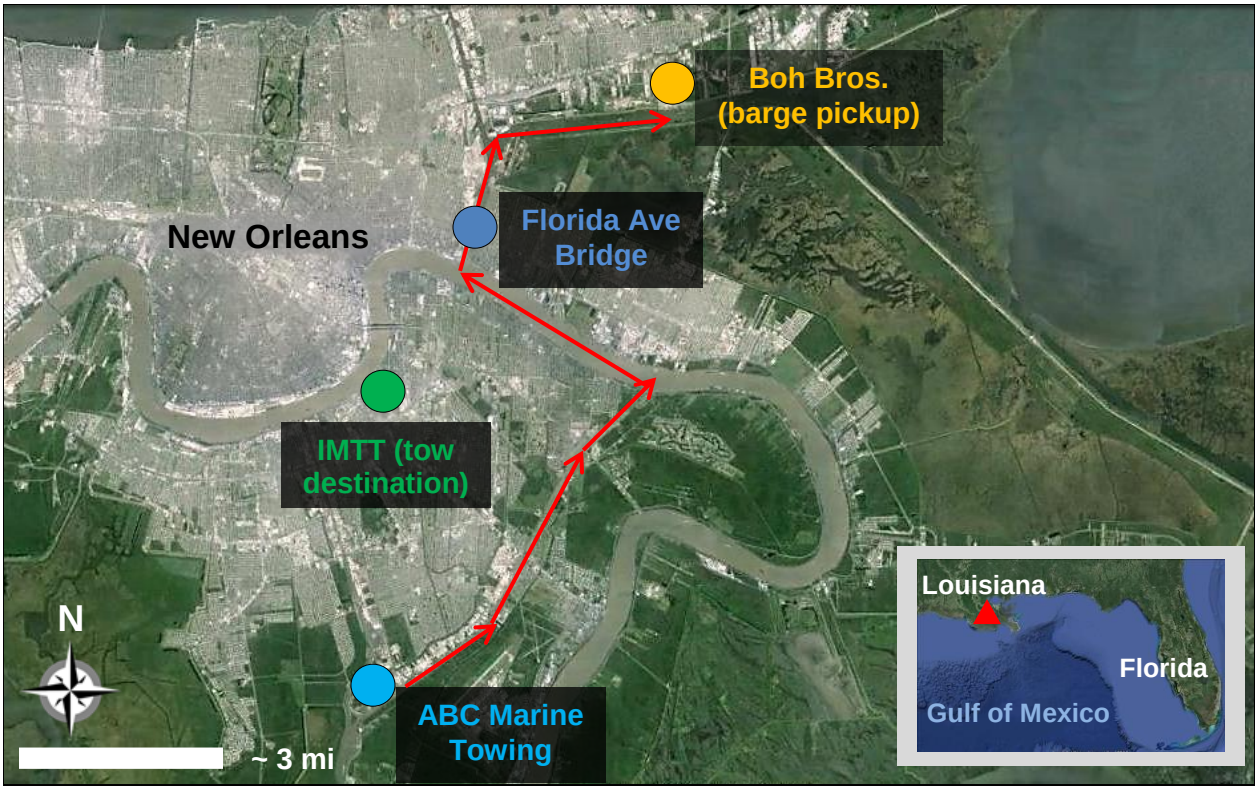

Figure 2. Satellite image, overlaid with various locations on the *Cory Michael*'s transit. The vessel's trackline is overlaid in red arrows. The allision with the Florida Avenue Bridge occurred on the vessel's return from Boh Bros. after picking up the crane barge.

Boh Bros. preferred that its crane barges be transported by towing vessels with wheelhouses at a height-of-eye of 32 feet above the waterline, so that operators in the wheelhouse would have sufficient visibility over the equipment on the barge's deck. In addition, because the crane boom on these types of barges extended beyond the forward edge of the barge's bow, Boh Bros.' practice was to push these crane barges stern-first; that is, with the towing vessel made up (configured) to the barge's bow. Doing so would protect the boom from potential damage caused by contact with lock walls, bulkheads, or other similar structures. According to Boh Bros.' marine dispatcher and other company personnel, several towing vessel companies who did or were seeking to do business with Boh Bros. had reviewed and concurred with the stern-first towing configuration.

However, according to the senior deckhand on the *Cory Michael*, on the day of the accident, the captain expressed concern about the stern-first towing configuration. The senior deckhand told investigators that when the Boh Bros. foreman informed him of the stern-first towing configuration and he subsequently conveyed this instruction to the captain via radio, the captain exited the wheelhouse and questioned the configuration. The Boh Bros. foreman told investigators that he informed the captain of the need to protect the end of the boom from damage and that, in addition, other vessel captains had indicated that this towing configuration also provided better visibility. According to the Boh Bros. foreman, the *Cory Michael* captain expressed no further concern about the towing configuration. He said that the captain proceeded to make up his vessel's bow to the barge's bow with the crane boom positioned over the vessel's upper wheelhouse. However, the senior deckhand told investigators that the captain agreed to the stern-first towing configuration only because he did not want to lose the towing job.

In preparing to transport the crane barge on the day of the accident, Boh Bros. personnel completed a Job Safety Analysis (JSA), addressing risk (such as pinch points, slips and falls, welding activity, and so on).[3] The personnel developed an action plan to mitigate each specific risk and signed the JSA indicating that they understood the needed actions to safely perform the work. According to Boh Bros.' corporate safety officer, the preferred method of controlling hazards in the workplace was to use engineering controls, of which the primary concept is to design work environments and job tasking to reduce or eliminate exposure to hazards.

The Boh Bros. foreman and other personnel secured the crane on the barge to prevent lateral (side-to-side) movement and locked the boom into the stowed position using a mechanical safety retaining mechanism inside the boom hoist gear case to prevent downward motion. The tip of the boom extended about 14–16 feet beyond the barge's bow, and the boom was at a 14-degree angle of elevation off the barge's deck. At this angle, the boom was elevated above the cradle permanently mounted on the barge's bow. The cradle is a four-legged tower system, which, when in use, provides the boom's frame with a solid resting point, relieving tension from the wire cables and associated block-and-tackle used to raise and lower the boom (figure 3). In addition, when in use, the cradle prevents lateral movement of the boom. However, for the accident transit, the boom was suspended above the cradle and not supported by it.

Figure 3. Postaccident photo of the cradle on barge *BBCCI 901.012*. In this photo, the crane boom is resting in and supported by the cradle. However, during the accident transit, the boom was suspended unsupported above the cradle, relying instead on the crane's own mechanisms for support.

[3] Welding activity on board a barge can include temporarily affixing certain equipment to the barge's deck, both pre-transit and/or while under way.

Investigators spoke with the Boh Bros. marine dispatcher, the foreman, the assistant general superintendent, and other yard personnel. None of them recalled any ABC personnel, including the *Cory Michael* captain and crew, asking about the crane barge's air draft (maximum vertical height) before starting the transit. Further, none of the Boh Bros. personnel recalled conveying this information on their own accord to the *Cory Michael* crew or any other ABC personnel before the transit. The Boh Bros. marine dispatcher told investigators that he normally provided only barge length and width on work orders to towing vessel companies, not air draft. He said the reason was that other Boh Bros. personnel who prepared the barges for transport—such as the foreman—may have loaded additional equipment onto the barge and increased the air draft. In the marine dispatcher's opinion, height information of each individual barge was to be exchanged and finalized between the Boh Bros. foreman and the vessel captain.

The Boh Bros. foreman who oversaw the barge's preparation for transit on the day of the accident told investigators that if vessel personnel ever inquired about the barge's total height, he would usually tell them 89 feet, even though the height was closer to 86 feet (the distance from the waterline to the main deck was about 10 feet, and the distance from the main deck to the top of the crane mast was about 76 feet, for a total of 86 feet). However, the foreman said that, in the *Cory Michael* case, he was not asked for the height nor did he provide it to the crew on his own accord.

The ABC owner and manager told investigators that Boh Bros. had never conveyed to him the height of this barge or any others, but that Boh Bros. would routinely provide the other dimensions with job orders. He further stated that he learned the crane barge's height only after the accident when Boh Bros.' assistant general superintendent told him it was 86.5 feet.

The *Cory Michael* departed with the crane barge from the Boh Bros. facility at 1720, taking the same route as earlier that morning. The tow held up at a seawall about 4.5 miles from the Boh Bros. facility and less than 300 yards north of the Florida Avenue Bridge (figure 4) to await clearance to enter the Industrial Canal Lock. The *Troy Jacob* tow (the other vessel assigned to the towing job) also held up at this same location.

Figure 4. Postaccident photo of the Florida Avenue Bridge, seen from the northeast looking toward the southwest.

Several hours later, at 2342, the *Cory Michael* crew received the clearance and continued the transit toward the Florida Avenue Bridge. According to the bridge operator, the *Cory Michael* captain first contacted the bridge at 2332. At that time, he was still aligning the tow for passage under the bridge, and once he had completed the alignment, he would reestablish contact to request the lift span be raised.

About 2346, the captain contacted the bridge operator, stated he was lined up properly for the passage, and requested that the lift span be raised. According to the bridge operator, the captain stated that he needed 68 feet of clearance to pass under the lift span. The bridge operator sounded the bridge's horn to signal that she was acting on the captain's request, and began to raise the span. While the span was still being raised, the bridge operator saw that the *Cory Michael* tow had already begun its approach toward the bridge and was close to the span. She raised the lift span to a height of 72 feet, 4 feet higher than the captain had reportedly requested, to allow for a margin of error.

The captain was operating the vessel from the upper wheelhouse, and he sent the junior deckhand to the head of the tow (that is, the stern of the crane barge) to assist him via radio during the approach to the bridge. The senior deckhand was off duty at the time and resting in his stateroom.

As the stern of the barge passed under the bridge's lift span, the crane mast struck the steel framing of the lift span (figure 5).

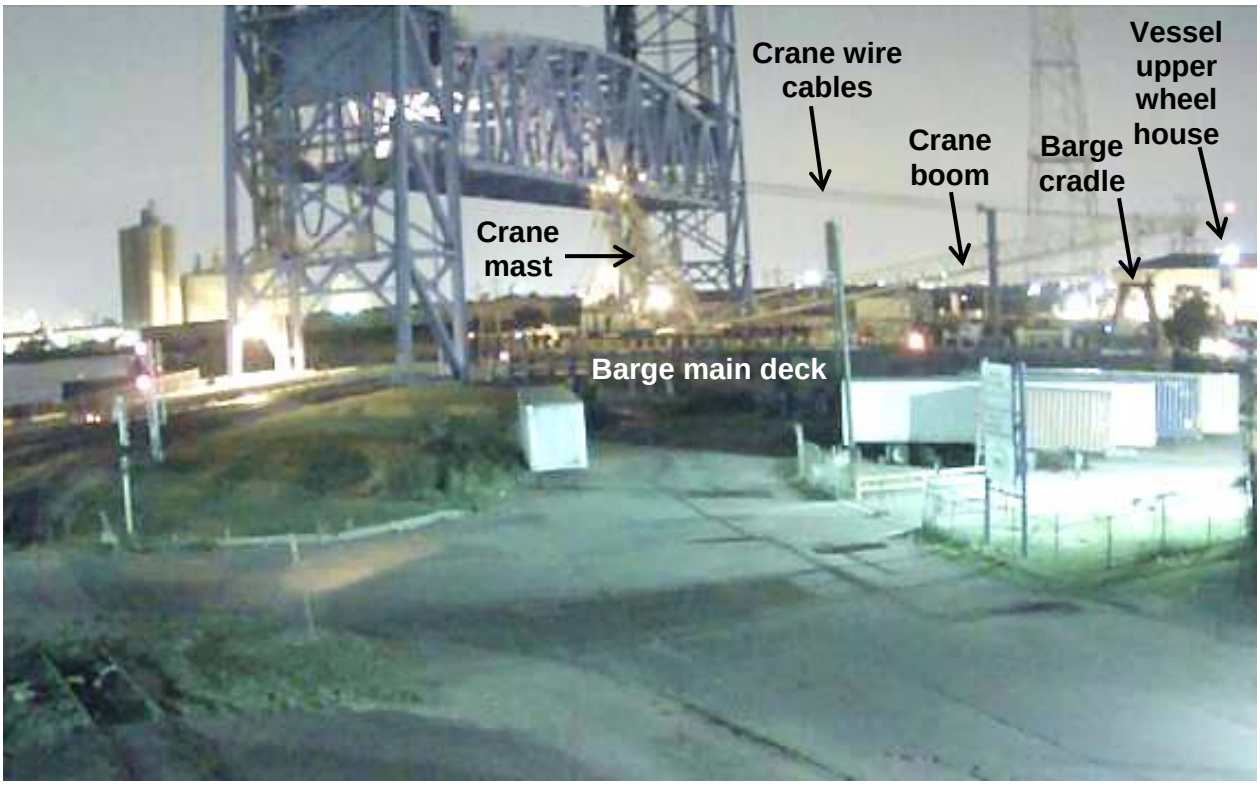

Figure 5. Still image, captured from security video footage, of the moment just before the crane mast struck the lift span of the Florida Avenue Bridge, about 2355. The impact initiated a series of failures on the crane, including release of tension on the wire cables between the crane mast and boom, which allowed the boom to drop onto the *Cory Michael*'s upper wheelhouse.

The impact caused a series of failures on the crane that resulted in 322,000 pounds of the crane's counterweight falling into the waterway and the crane boom dropping onto the *Cory Michael*'s upper wheelhouse. The overhead and supporting structural framing of the upper

wheelhouse collapsed from the impact, fatally injuring the captain. The barge cradle stopped the crane boom from dropping further onto the vessel (figure 6).

Figure 6. Postaccident photo of the crane boom on top of the *Cory Michael*'s collapsed upper wheelhouse.

The junior deckhand who was stationed forward on the tow ran back toward the *Cory Michael* when the failures began, and was uninjured. The senior deckhand rushed from his stateroom to the upper wheelhouse and tried to obtain a response from the captain, to no avail. He then ran down to the lower wheelhouse and radioed the nearby *Troy Jacob* captain for assistance; this captain guided the senior deckhand via radio in assuming control of the vessel and maneuvering it back to the earlier mooring location north of the bridge. The bridge operator notified the US Coast Guard and the harbor police.

Shortly thereafter, the harbor police arrived on scene, followed at 0028 by emergency medical services. Personnel from Boh Bros. also learned of the accident and responded to the location to assist the first responders in ensuring that the crane structure was stable. Together, they used the crane on the barge being towed by the *Troy Jacob* to hoist a rescue litter up to the crushed upper wheelhouse of the *Cory Michael*. About 0044, the captain was extricated from the debris, placed into the litter, and taken ashore to awaiting transport units. About 0050 on August 14, 2014, the captain was pronounced dead.

Later that morning, the *Cory Michael* and *BBCCI 901.012* were shifted (moved) back to the Boh Bros. yard for damage assessment. Personnel involved in separating the two vessels were concerned about the potential of causing further damage by lifting the boom off of the upper wheelhouse. Therefore, they instead removed enough ballast water from the barge to increase its freeboard (the distance between the waterline and the deck) and thus reduce the barge's draft (depth below the waterline) by about 3 feet. The increased freeboard allowed the *Cory Michael* to be maneuvered away from the crane barge.

1.1 Vessel Information

1.1.1 *Cory Michael*

The *Cory Michael*, built in 1970, is an uninspected 93-gross-ton towing vessel owned and operated by ABC Marine Towing in Belle Chasse, Louisiana. The vessel is 59.5 feet long, 23 feet wide, and has a draft of about 8 feet. The original upper wheelhouse was constructed from steel, added in 1995, and brought the operator's height of eye to between 30 and 34 feet. That upper wheelhouse was replaced in May 2014 with an aluminum structure that raised the operator's height of eye to about 38 feet.

The *Cory Michael* was operated as a daytrip vessel and used mainly for towing services in the local area. Per ABC Marine Towing's request, the Coast Guard performed a safety examination on the vessel in March 2011, found it to be in compliance with regulations applied to uninspected vessels, and issued a towing vessel safety examination decal.[4] That decal expired in March 2014 and had not been renewed by ABC Marine Towing at the time of the accident.

1.1.2 Crane Barge

The *BBCCI 901.012* is a 2,540-gross-ton steel-hulled barge with a Manitowoc 4600 lattice boom crawler crane installed on the deck.[5] The barge is 249.6 feet long and 72 feet wide, with a draft of about 10 feet. The barge is outfitted with two spuds (heavy steel shafts used as mooring devices) that can be lowered to hold the barge in position.

1.2 Company Information

1.2.1 ABC Marine Towing

ABC Marine Towing was established in 2004 and located on the Gulf Intracoastal Waterway in Belle Chasse, Louisiana. At the time of the accident, the company had four full-time employees with the remaining staff considered part-time; they worked when towing jobs became available. In addition to the *Cory Michael* and the *Troy Jacob*, which were in service on the day of the accident, the company owned and operated a third vessel, the *Todd Michael*. This vessel ran aground and subsequently flooded in Lake Pontchartrain on April 15, 2014, and was undergoing repairs on the

[4] This voluntary examination program serves as a basis for vessel owners and operators to ensure that the vessel meets minimum safety requirements for uninspected vessels.

[5] Like other cranes, a crawler crane is mounted on a base and has a rotating superstructure with power plant, operating machinery, and boom, and its function is to hoist and swing loads. However, a crawler crane is also equipped with crawler treads that allow the crane to travel across the ground using its own power. When placed on the deck of a barge, the crawler crane must be affixed to the deck (per Title 29 *Code of Federal Regulations* 1910-180 [a][1]).

day of the *Cory Michael* accident. In the 16 months preceding the accident, ABC vessels transported barges and other afloat equipment for Boh Bros. about 36 times, including 6 times with crane barge *BBCCI 901.012*.

ABC did not have a safety management system (SMS) in place, nor did existing regulations require the company to have one. The company did have a printed safety manual that outlined safe operations and expectations for its employees. The manual stated that the captain of each vessel was responsible for all cargo carried on board barges. It also stated that the towing vessel should not depart the dock until the captain ensured that the deck cargo was properly and safely secured. The ABC safety manual did not specifically require the captain to do any voyage planning and did not address his or her responsibility for obtaining accurate data related to air draft on barges or other equipment that may be towed by the vessel.

1.2.2 Boh Bros. Construction Co.

The company that owned crane barge *BBCCI 901.012* was established in 1909 as a general contracting organization and at the time of the accident had more than 1,300 employees. The company performs a variety of services in the southeastern United States, including road paving, pile driving, utilities installation, and marine and shore-side heavy construction. The company had a contractual agreement with ABC, signed December 9, 2013, to provide towing services as needed.

1.3 Florida Avenue Bridge

The Port of New Orleans owns and operates the Florida Avenue Bridge and three other bridges within the boundaries of the port. The Florida Avenue Bridge spans the Inner Harbor Navigational Canal, known locally as the Industrial Canal, and has two vehicle lanes and one rail track. The existing structure was completed in 2005 and replaced the original bridge built in the 1920s, which in 2000 was deemed a hazard to navigation. The vertical clearance of the lift span when fully raised is 156 feet; when down, the clearance is an average of 5 feet. The horizontal clearance for vessel traffic passing under the bridge is fixed at 300 feet.

The bridge is attended full time by an operator in a control station located at the base of the bridge on the west side. Vessel operators use sound signals, visual signals, or VHF radio to request the bridge be raised. The bridge control station was not equipped with a recording device. A security camera located at a scrap metal yard near the bridge's north approach captured the accident, and yard personnel provided the video footage to investigators (see figure 5).

The north and south sides of the bridge's lift span are equipped with red and green navigational lights, visible 180 degrees. The lights mark the center of the navigational channel and inform mariners of the status of the lift span. When the lift span is in its lowest position, and when the lift span is in the process of being raised or lowered, the red light is illuminated. When the lift span has been fully raised to its design height of 156 feet, the green light is illuminated.[6]

According to existing regulations in Title 33 *Code of Federal Regulations* (*CFR*) Part 117, all US drawbridges including the Florida Avenue Bridge are required to be opened/raised to the fullest extent to allow for safe waterborne passage. In January 2005, the Port of New Orleans Facility Services department issued an interoffice communication to the

[6] For more information about lighting on lift bridges, see Title 33 *Code of Federal Regulations* 118.85.

Florida Avenue Bridge operators reminding them, "It is imperative that you open the bridge to its fullest extent" during vessel transits to "avoid any bridge and/or vessel damage." The Port of New Orleans deputy director for port development, who was responsible for operations and maintenance of the port's bridges, had been copied on that interoffice communication. However, during her interview, she told investigators that she was unaware of the regulatory requirement to open/raise drawbridges to the fullest extent. She stated that shortly after Hurricane Katrina hit New Orleans in 2005, engineers informed her office of an alignment problem with the Florida Avenue Bridge's lift span and the bridge structure itself. She said that, as a result, the engineers instructed her office that the lift span should be raised only to within 2 feet of its maximum height. She stated that the alignment problem had been orally reported to the Eighth Coast Guard District's Coastal Region Bridge Branch, but because the port was without e-mail services during Katrina's aftermath, no followup e-mail was sent to the Coast Guard on the matter.

As time went by, the Florida Avenue Bridge operators developed a practice of obtaining and accepting a specific height request from vessel operators. They would then raise the lift span an additional 15–20 feet beyond that height as a margin of safety. This practice was not written; Port of New Orleans staff had orally conveyed it to the bridge operators. When investigators examined the bridge control station, they found a recent handwritten note reminding bridge operators not to raise the lift span to its fullest extent (figure 7). As a result, the green light on the lift span did not illuminate post-Katrina, including on the day of the accident.

Figure 7. Photo of handwritten note, posted in the Florida Avenue Bridge's control station, instructing bridge operators not to raise the lift span to its fullest extent.

After the accident, the Port of New Orleans instituted several measures designed to improve the training of bridge operators and mitigate the risk of similar incidents:

- Bridge operators are given a copy of the updated Bridge Operations Procedures Manual and are required to watch a safety presentation on bridge operations. A supervisor also reviews the presentation with the bridge operators to emphasize key aspects.

- Operators sign an acknowledgment form attesting that they reviewed and understood the Bridge Operations Procedures Manual. They also take a written test to demonstrate that they retained critical information.

- Bridge operators are trained and tested annually on the operational procedures in the Bridge Operations Procedures Manual.

- Port of New Orleans officials periodically review and update the Bridge Operations Procedures Manual to ensure that it contains the most recent information.

As of the date of this report, the alignment problem with the Florida Avenue Bridge has been repaired and the lift span can now be raised to its fullest extent (156 feet).

1.4 Personnel Information

1.4.1 *Cory Michael* Captain

The captain held a Coast Guard-issued merchant mariner credential as master of steam or motor vessels of not more than 100 gross tons upon inland waters, and master of towing vessels of not more than 100 gross tons upon inland waters and western rivers, with inland radar observer endorsement. He had worked on towing vessels and crew boats for many years and had held a Coast Guard-issued credential since 1995. He last renewed his credential on February 1, 2011 (see section "1.5 Toxicological Information"). He had been employed by ABC on an as-needed basis since October 2006.

1.4.2 Bridge Operator

The bridge operator started working for the Port of New Orleans in August 2011, about 3 years before the accident, and began the bridge operator orientation and training program at that time. The training program consisted of on-the-job training, where new bridge operators would stand watch for 1–2 weeks with each of the four most senior bridge operators on different shifts. New bridge operators were also required to complete a review of two separate manuals. One of those manuals addressed operational aspects of the bridge control system, vehicle gates, and procedures associated with vehicle and vessel traffic. The second manual addressed the aspects of the rail system. When the bridge operator completed her job training and the associated orientation and training signoff sheets, the superintendent for the Florida Avenue Bridge performed a final assessment of her training and qualifications and deemed her qualified to stand watch alone. On the day of the accident, the bridge operator started her 8-hour work shift at 2300.

Investigators examined both the bridge operator's and the *Cory Michael* captain's personal cellular telephones. They also subpoenaed records from the service provider for each

device. No evidence suggests that use of either device may have been a causal or contributing factor in this accident.

1.5 Toxicological Testing

Postaccident toxicological testing was conducted on urine specimens from the bridge operator and the two deckhands. The results from the bridge operator and the senior deckhand were negative for the presence of alcohol and illegal drugs. The specimen from the junior deckhand, who was at the head of the *Cory Michael* tow when the allision occurred, tested positive for tetrahydrocannabinol carboxylic acid, a metabolite of marijuana. The New Orleans Coroner's Office/Forensic Center performed an autopsy on the captain's body on August 14, 2014. Postmortem blood and urine specimens, tested by the St. Louis University's toxicology laboratory, were positive for the prescription opioid pain medication oxycodone (0.42ug/ml) and the over-the-counter antihistamine/sedative doxylamine (0.11ug.ml). When the captain renewed his merchant mariner credential in 2011, he disclosed that he had a prescription for the pain medication hydrocodone and the antibiotic amoxicillin. However, he did not disclose his use of either oxycodone or doxylamine.

1.6 Weather Information

The weather at the time of the accident was clear with visibility of about 10 miles, calm winds, and air temperature of about 84 degrees F.

2. Investigation and Analysis

2.1 Regulations

2.1.1 Lift Bridges

By existing regulations in 33 *CFR* Part 117, all drawbridges, including the Florida Avenue Bridge, are required to be opened/raised to the fullest extent to allow safe passage of all vessel traffic. As noted previously, in January 2005, the Port of New Orleans Facility Services department issued an interoffice communication to the Florida Avenue Bridge operators, reminding them, "It is imperative that you open the bridge to its fullest extent" during vessel transits to "avoid any bridge and/or vessel damage." The reason for issuing this communication is unknown.

2.1.2 Coast Guard Bridge Administration

According to the Coast Guard's Bridge Administration Manual (Commandant Instruction M16590.5C, dated March 26, 2004), the bridge administration program is responsible for the administration of the various bridge statutes, pertinent regulations, and policies applied to bridges that cross the navigable waters of the United States. The fundamental mission of the agency is to protect freedom of navigation using a balanced approach that promotes the safe and efficient movement of both maritime and shoreside transportation. The program is managed at the Coast Guard Headquarters level by the Office of Bridge Programs, under the Director of Marine Transportation Systems (CG-5PW). Each Coast Guard district office has a branch office staffed specifically to perform these oversight functions; the Eighth Coast Guard District has two such branch offices—the Western Rivers Bridge Branch located in St. Louis, Missouri, and the Coastal Region Bridge Branch located in New Orleans, Louisiana.[7] The responsibility for the oversight of the Florida Avenue Bridge fell within the jurisdiction of the Eighth Coast Guard District's Coastal Region Bridge Branch.

According to the Coast Guard's Bridge Administration Manual, the term "drawbridge" is a general term used for all bridges intended to be opened/raised for the passage of waterway traffic and includes vertical lift bridges such as the Florida Avenue Bridge where the bridge span is raised vertically. The owner, operator, or organization controlling such a bridge is required to maintain and operate it in accordance with regulations pertaining to lighting and operational requirements. Should any bridge be unable to meet those requirements, the owner, operator, or organization is required to notify the appropriate bridge administration office so that a broadcast notice to mariners or local notice to mariners can be issued.[8]

[7] The Eighth Coast Guard District is the largest of all Coast Guard districts, covering all or part of 26 different states, including an estimated 10,300 miles of the inland waterway system. The district has about 2,400 bridges under Coast Guard permit; of those, about 300 are lift/drawbridges.

[8] Broadcast notices to mariners are transmitted by the Coast Guard via Coast Guard and Navy radio stations. These notices, broadcast on maritime frequencies, are navigational warnings that contain important information related to navigation safety. They include reports about deficient or altered aids to navigation, positions of ice and obstructions/debris, and other important hydrographic information. The notices are published weekly by individual Coast Guard districts and cover matters such as channel depth, events affecting the local waterway, new chart editions, and so on. Local notices to mariners can be obtained through the Coast Guard's navigation center website.

Coast Guard district personnel are instructed to periodically inspect each drawbridge when they are "near, or at locations where these drawbridges are situated." The manual does not specify an expected bridge visitation frequency or recurring time period for inspection, nor does it establish parameters to clarify what is meant by the term "near." In addition, district personnel should periodically request each drawbridge owner to verify the settings of light controls and controls that show bridge operators that the bridges are opened/raised to the fullest extent. Records of these verifications should be kept in the appropriate district files.

Investigators interviewed the bridge administrator in charge of the Eighth Coast Guard District's Coastal Region Bridge Branch. He stated that his office does not inspect the Florida Avenue Bridge or any other bridge. He further stated that the Port of New Orleans had not notified his office that the Florida Avenue Bridge was not being raised to its fullest extent, so no notices to mariners had been issued. The Eighth Coast Guard District's Coastal Region Bridge Branch had never issued a letter of warning, notice of violation, or other written correspondence to the Port of New Orleans for non-compliance with the applicable regulations on the Florida Avenue Bridge.

2.1.3 Air Draft Accident Statistics and Regulatory Information

In the wake of two high-profile towing vessel bridge allisions (South Padre Island, Texas, September 2001, and Webbers Falls, Oklahoma, May 2002), the Coast Guard and the American Waterways Operators formed a work group to address the causes of air draft accidents. That work group, which was composed of Coast Guard personnel and towing industry experts, studied towing vessel bridge allisions from 1992 to 2001. On May 21, 2003, the work group issued a report that included six preventive recommendations for implementation:

(1) Identify vulnerable bridges where measures to prevent and/or mitigate allisions should be applied.

(2) Develop navigation best practices for transiting bridges vulnerable to allision.

(3) Train vessel operators in the application of navigation best practices.

(4) Require route familiarization, posting, or a check ride before a vessel operator is permitted to navigate alone under a vulnerable bridge.

(5) Improve Coast Guard/industry information-sharing on near misses.

(6) Require the implementation of Crew Endurance Management (CEM) throughout the towing industry as a means of improving decision-making fitness.[9]

As of the date of this report, the Coast Guard has taken certain steps toward implementing recommendations 4 and 6 but no action as a direct response to recommendations 1–3 and 5.

More recently, the Coast Guard Office of Investigations and Casualty Analysis studied 16,962 vessel accidents from calendar year 2003 through March 2014, which involved a vessel striking a bridge, overhead cable, or similar obstruction. Of those accidents, 205 involved a

[9] The CEM program, developed by the Coast Guard and the towing vessel industry, seeks to identify and control crew endurance risk factors—such as mariner sleep quality, work- and home-life stress, and overall personal health—in maritime work environments.

vessel striking an overhead bridge, and of those, 96 (more than 47 percent) occurred in the Eighth Coast Guard District's area of responsibility (AOR). Of the total fleet of 5,939 uninspected towing vessels subject to Coast Guard oversight nationwide, about 3,955, or 66 percent, fall within the Eighth Coast Guard District's AOR.

On September 9, 2014, the Coast Guard's Towing Vessel National Center of Expertise and the Office of Investigations and Casualty Analysis jointly issued Safety Alert 9-14, titled "Air Draft is Critical!" That safety alert pointed out that, statistically, towing vessels and barges are the most likely vessels to be involved in bridge strikes where air draft is a factor. Barges equipped with portable cranes and barges fitted with improperly-adjusted mooring spuds make the most frequent contact with overhead bridges. The primary causal factor in these accidents was that the vessel captain or mate had inaccurate air draft information pertaining to the towing vessel itself or to the tow as a whole. Safety Alert 9-14 noted that these accidents have resulted in loss of life, millions of dollars in property damage, and inconvenience to entire communities who rely on the bridges and power cables.

Presently, the Towing Safety Advisory Committee (TSAC), a federal advisory committee that advises the Coast Guard on matters related to towing vessels, is working on recommendations to establish criteria for the identification of air drafts as applied to towing vessels and their tows. The specific task statement (Task #13-10) given to the TSAC advisory committee members was:

1. Provide recommendations to the Coast Guard to identify potential solutions to prevent allisions between towing vessels and tows with structures due to the lack of accurate air draft information available to the Master or Mate.

2. Provide recommendations to the Coast Guard regarding establishing standardized processes for the documentation of air draft requirements aboard towing vessels when operating in US waters.

3. Provide recommendations to the Coast Guard regarding establishing standardized practices to accurately determine and post air draft requirements of tows and cargo barges when operating in US waters.

The TSAC members are actively addressing these recommendations, which are expected to be provided to the Coast Guard in October 2015. The Coast Guard will need to review these recommendations for merit and determine whether or not to initiate rulemaking to include them in regulation.

2.1.4 Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA), which falls under the US Department of Labor, is the federal agency charged with assuring safe and healthful working conditions and enforcing regulatory standards associated with workplace safety. OSHA exercises authority over maritime employers predominantly for the working conditions of non-mariner employees who are exposed to occupational hazards while working on vessels and facilities on or adjacent to US navigable waters and the Outer Continental Shelf. These include workers conducting longshoring (loading and unloading vessels), shipbuilding, ship repair, shipbreaking (vessel demolition for parts or scrap), general industry, or marine construction operations. However, OSHA's authority and many of the enforceable work place requirements also extend to both inspected and uninspected vessels, and even include vessels that operate on waters not

subject to Coast Guard jurisdiction. To prevent duplication of regulatory effort in the maritime sector, the Coast Guard and OSHA have two current memoranda of understanding in place.

Regarding uninspected vessels such as the *Cory Michael* and crane barge *BBCCI 901.012*, all working conditions not already addressed in Coast Guard regulations are subject to OSHA authority. Recognized hazardous situations that can cause death or serious physical harm to marine employees for which no specific OSHA or Coast Guard regulations exist are cited under Section 5(a)(1) of the Occupational Safety and Health Act of 1970 (OSH Act). In addition, OSHA standards at 29 *CFR* Parts 1910 and 1926 can be applied in the marine industry and pertain to safety on crawler cranes and land cranes mounted on vessels, barges, or other floating structures. Part 1926 can be applied only if the floating crane is engaged in construction activities (such as longshoring or shipyard construction). If the barge is not involved in construction work, only Part 1910 applies. These standards address some of the risks unique to crane operations, and, in the case of Part 1926, include requirements for vessel list and trim measurement devices in the crane control station, wind speed, and direction indicators. However, 29 *CFR* Parts 1910 and 1926 apply only when the marine employer and crane are involved in materials handling and storage activity, or actually engaged in marine construction. Neither of these standards specifically addresses the securing or placement of a crane boom in scenarios outside those noted activities, such as preparing a crane for waterborne transit, as was the case with the *Cory Michael* tow.

2.2 Safety Oversight

2.2.1 *Cory Michael* Captain

According to studies conducted by the American Bureau of Shipping and others (see for example Baker 2004), a large percentage of marine accidents are attributed in whole or part to human error. In most cases, those accidents do not involve a single error; rather, a series of errors made by the same individual or by multiple individuals in safety-sensitive positions ultimately result in the adverse event. If any of the individual errors had not occurred, significant probability exists that the adverse event would have been avoided. This is the case in the allision of the *Cory Michael* tow with the Florida Avenue Bridge.

The acceptance by the *Cory Michael* captain to configure the tow stern-first, as proposed by Boh Bros, was a serious error. This arrangement allowed the crane's boom to be suspended, and unsupported, over the upper wheelhouse where he was operating the vessel. That decision placed the captain's life in danger. Because he died in this accident, the rationale he used and the exact factors that influenced his acceptance of the towing configuration will never be known. Based on the statement of the senior deckhand, the captain's concern about potentially losing the towing job likely influenced him the most and therefore resulted in his acceptance of the unsafe towing configuration. The NTSB concludes that the *Cory Michael* captain made a flawed decision by agreeing to configure the towing vessel's bow to the bow of the crane barge in a manner that allowed the crane boom to be suspended, and unsupported, over the towing vessel's upper wheelhouse.

In addition, equipment placed on the *BBCCI 901.012* and similar barges at the Boh Bros. facility was regularly modified to suit each specific job. Therefore, it was crucial for the *Cory Michael* captain to obtain and verify the correct air draft for the cargo on deck before departing Boh Bros. However, none of the onboard documentation, including the vessel's logbook, indicated that he did so.

Because the VHF radio contact between the bridge operator and the captain was not recorded or overheard by anyone outside of the conversation participants, the source of the incorrect air draft could not be determined with accuracy. It is possible that the captain had obtained the correct air draft from a source not located by investigators, or that he had prior experience with the barge that investigators were unable to determine, and that he knew the correct air draft was 86 feet. If so, he may actually have requested at least 86 feet of clearance, but the bridge operator may have misunderstood or transposed the height to only 68 feet. However, based on the content of the bridge operator's log and her testimony, investigators do not believe that this is likely. It is more likely that the captain relied either on prior experience with that particular barge (and inadvertently transposed the air draft) or his visual assessment of the height of the crane as compared with the height of the *Cory Michael* to develop his own estimate of the needed clearance.

The *Cory Michael* captain was obligated to navigate in a safe and prudent manner. This included reducing the risk associated with all known hazards and activities that could negatively impact the safe movement of the vessel. The captain certainly knew the risk of unintended contact with the bridge structure, both overhead and on the waterway banks, yet he did not adequately address it. Instead, he began the approach well before the lift span had reached a sufficient height to clear the crane boom. Further, although the captain sent the junior deckhand forward on the tow to assist with the approach via radio, he did not use this person effectively. The NTSB concludes that the *Cory Michael* captain failed to establish the correct air draft of his tow and did not navigate in a safe and prudent manner, which resulted in the tow's allision with the Florida Avenue Bridge.

Postmortem toxicological testing identified oxycodone and doxylamine in the captain's blood. The level of oxycodone in the captain's blood was above the usual therapeutic level and the doxylamine at a therapeutic level; both of these medications can cause significant impairment. However, it could not be determined how much postmortem redistribution had altered the levels. The NTSB concludes that the *Cory Michael* captain likely experienced some level of impairment from his use of a sedating antihistamine and a prescription pain medication, but the extent to which his impairment contributed to the circumstances of this accident could not be determined.

2.2.2 ABC Marine Towing

As noted in the NTSB's recent marine accident report on the March 22, 2014, collision between bulk carrier *Summer Wind* and towing vessel *Miss Susan* in the Houston Ship Channel, Texas (NTSB 2015), the failure of the Coast Guard to finalize towing vessel inspection regulations more than 4 years after publishing the notice of proposed rulemaking "Inspection of Towing Vessels" has delayed the implementation of several critical safety requirements for towing vessels.[10] One such requirement in those pending regulations known as "Subchapter M" obligates companies that operate towing vessels to implement a comprehensive safety management system to address all risk associated with vessel operation. The pending regulations also require periodic audits against which companies can evaluate their performance.

ABC Marine Towing was not required by regulations to have an SMS, and as such, did not have a comprehensive risk management system in place addressing voyage planning or air

[10] *Federal Register*, Vol. 76, No. 155, August 11, 2011.

draft calculations in any detail. The company's safety manual did, however, adequately outline fundamental concepts of onboard safety and conveyed the expectation that the vessel captains had final authority on all matters affecting the safety of the vessel, the crew, and the cargo, as well as the protection of the environment. The *Cory Michael* captain had a signed attestation in his personnel record that he had read and understood that safety manual; however, the NTSB found no evidence that on the day of the accident he performed his shipboard responsibilities according to company expectations. Neither of the deckhands indicated that the captain conducted a safety briefing before getting under way that day. Further, multiple elements on the vessel's pre-transport equipment inspection checklist were simply crossed out in a manner suggesting that the form was completed hastily, and entries in the official logbook were limited and incomplete. The NTSB concludes that, aside from random drug testing, the owner and manager of ABC Marine Towing performed insufficient oversight of this vessel captain and the vessel in ensuring that the company's safety policy was successfully implemented on board.

2.2.3 Boh Bros. Construction Procedures and Job Safety Assessments

Most programs for managing safety on job sites incorporate three fundamental steps. The first step is identifying each specific risk that may be involved in an activity; the second step involves properly assessing any identified risks; and the third step implements change, mitigation strategies or other measures to control and manage the risks. All three steps are crucial and must be robustly applied, or the effort will not serve the intended purpose to protect life and property. Risk not identified by the stakeholders involved in any job activity is risk not properly assessed, and by default, not managed or controlled.

Boh Bros.' JSA incorporated these principles and, during the pre-transport preparation of the *BBCCI 901.012*, Boh Bros. yard personnel performed each of these steps with the intent to protect the safety of each team member and the company's crane and associated equipment. However, each individual who participated in this JSA process failed to identify the serious risk of suspending the crane boom above the cradle and over the upper wheelhouse. The cradle is an engineering control mechanism that prevents the boom from dropping below that resting point. If any of the Boh Bros. yard personnel had truly understood the fundamentals of risk identification, they should have realized that their positioning the boom above the cradle bypassed this engineering control. Further, they should have recognized that this positioning introduced a new risk; specifically, the potential for the boom to fall down onto the wheelhouse, irrespective of what might cause such a failure. And finally, Boh Bros. personnel should have realized that the potential consequence of the boom falling down, regardless of whether the probability of occurrence was low or high, could be catastrophic.

Although it has long been established that a captain has the ultimate responsibility for the vessel, including decisions involving cargo operations, it is also well established that vessel safety is not the responsibility of only the captain. Rather, vessel safety is a responsibility shared by all those who are involved, including the vessel owner(s), operator(s) management, cargo owner(s) and the shipper(s). The NTSB concludes that Boh Bros. Construction's Job Safety Analysis program, as applied by the Boh Bros. yard personnel, was ineffective in identifying, assessing, and controlling all risk while preparing the barge for transit. The NTSB therefore recommends that Boh Bros. review its Job Safety Assessment program and the training of all personnel involved in the pre-transport preparation of crane barges and similar afloat equipment to ensure that each individual understands and is able to apply the elements of this accident prevention program.

2.2.4 Port of New Orleans, Bridge Operations

In addition to existing Coast Guard regulations that required the lift span of the Florida Avenue Bridge to be fully raised for each vessel passage, the Port of New Orleans had internal written policy and procedure in place reinforcing this regulatory requirement. Irrespective of whether the *Cory Michael* captain asked for only 68 feet of clearance before the accident, the bridge operator did not follow the internal guidance of the port when she raised the lift span to only 72 feet of clearance.

Not following established procedures, if considered alone, could easily be attributed to human error given that the bridge operator's actions deviated from the written guidance. In this accident, however, investigators found that, for quite some time before the accident, other bridge operators did not follow the directives either, nor did supervisory personnel responsible for safe bridge operations at the Port of New Orleans implement and enforce the directives. These shortcomings are symptomatic of failures at the organization level and surpass the unsafe actions of an individual bridge operator. The NTSB therefore concludes that supervisory and management personnel overseeing bridge operations for the Port of New Orleans failed to ensure that the Florida Avenue Bridge was operated in compliance with existing Coast Guard regulations and internal guidance, which require the lift span to be fully raised for each vessel passage.

As noted earlier, the Port of New Orleans promptly instituted multiple postaccident measures and organizational changes intended to mitigate the risk of another similar incident. Although the NTSB believes that those actions can improve port operations, the newly instituted procedures did not include control mechanisms, such as periodic safety audits, that validate and measure the effectiveness of those changes. When conducted objectively, periodic safety audits can also reveal other operational practices that present risk and identify areas where future organizational improvements may be needed before another tragedy occurs. The NTSB recommends that the Port of New Orleans conduct periodic safety audits to ensure that personnel involved in bridge operations perform their duties according to expectations.

2.2.5 Coast Guard Bridge Administration

The Eighth Coast Guard District's AOR is the largest of all nine Coast Guard districts; nevertheless, the NTSB is concerned that almost half of vessel casualties involving contact with a bridge, overhead cable, or other such obstruction have occurred there.[11] Following the January 26, 2012, allision of cargo vessel *Delta Mariner* with the Eggner's Ferry Bridge near Aurora, Kentucky—also in the Eighth Coast Guard District's AOR—the NTSB raised concern that although the Coast Guard had authority to inspect bridges to ensure compliance with applicable regulations, the Coast Guard did not exercise that authority (NTSB 2013). Instead, the Coast Guard relied on notifications from mariners, the bridge owners themselves, or other entities about operational shortcomings or outages.

In the *Cory Michael* case, the NTSB found further evidence that the Coast Guard had not exercised its authority to inspect a bridge in its jurisdiction to ensure compliance with applicable regulations. Although inspections of lift bridges are required by existing Coast Guard policy, the guidance to field personnel is not clear regarding performance expectations, and as a result, the

[11] According to the recent Coast Guard Office of Investigations and Casualty Analysis study, covering 2003–March 2014.

policy is ineffectively implemented. Neither the bridge administrator for the Eighth Coast Guard District's Coastal Region Bridge Branch office nor his staff had inspected the Florida Avenue Bridge or any other bridge to ensure proper operation and maintenance. As a result, the Coast Guard was unaware that the Florida Avenue Bridge had not been raised to the fullest extent for the last 9 years and that a dangerous practice had developed where mariners would request the bridge be raised to a specific height based on their air draft assessment. The NTSB concludes that the Coast Guard's oversight of the Florida Avenue Bridge failed to identify that the lift span of the bridge was unable to be raised, and was not being raised, to the fullest extent as required by regulations for the safe passage of vessels.

The NTSB believes that the Coast Guard should use its authority to periodically inspect all bridges under its jurisdiction to identify deficient operational practices, improperly maintained lighting, or other dangerous shortcomings. Without these oversight inspections, no effective system is in place to ensure that bridges are operated safely and in full compliance with applicable regulatory requirements. The NTSB recommends that the Coast Guard revise its existing guidance to define inspection requirements clearly, including the frequency of inspection, for each bridge in its jurisdiction. The NTSB further recommends that the Coast Guard evaluate the activities and performance of each branch office in the bridge program to identify areas that need improvement; then take the actions necessary to ensure the effectiveness of existing policy, procedures, and regulations related to drawbridge operations and the overall safety of navigation.

2.2.6 Occupational Safety and Health Administration

OSHA and the NTSB share a common goal of bringing continuous improvement to safety in the workplace. To achieve that goal, ongoing effort must be made to identify areas where existing processes, procedures, and regulations can be enhanced. Marine construction is an industry with significant hazards that span a wide range of activities. The NTSB extensively reviewed the existing OSHA standards that address the risk associated with crane usage in the marine workplace. These include the general industry standards at 29 *CFR* Part 1910 and the standards at 29 *CFR* Part 1926, the latter which address the safety of land cranes mounted on vessels, barges, or other flotation devices. Based on this review, the NTSB determined that the regulations address a significant amount of risk associated with marine work platforms and with the marine industry overall. However, the NTSB concludes that current OSHA regulations pertaining to land cranes mounted on vessels, barges, or other flotation devices do not address the risk associated with failure to secure crane booms when the cranes are not actively engaged in marine construction, such as during waterborne transportation. The NTSB therefore recommends that OSHA revise existing regulations at Title 29 *CFR* Part 1910 to address the placement and securing of crane booms on barges for transit to and from marine construction and other sites.

3. Conclusions

3.1 Findings

1. The *Cory Michael* captain made a flawed decision by agreeing to configure the towing vessel's bow to the bow of the crane barge in a manner that allowed the crane boom to be suspended, and unsupported, over the towing vessel's upper wheelhouse.

2. The *Cory Michael* captain failed to establish the correct air draft of his tow and did not navigate in a safe and prudent manner, which resulted in the tow's allision with the Florida Avenue Bridge.

3. The *Cory Michael* captain likely experienced some level of impairment from his use of a sedating antihistamine and a prescription pain medication, but the extent to which his impairment contributed to the circumstances of this accident could not be determined.

4. Aside from random drug testing, the owner and manager of ABC Marine Towing performed insufficient oversight of this vessel captain and the vessel in ensuring that the company's safety policy was successfully implemented on board.

5. Boh Bros. Construction's Job Safety Analysis program, as applied by the Boh Bros. yard personnel, was ineffective in identifying, assessing, and controlling all risk while preparing the barge for transit.

6. Supervisory and management personnel overseeing bridge operations for the Port of New Orleans failed to ensure that the Florida Avenue Bridge was operated in compliance with existing Coast Guard regulations and internal guidance, which require the lift span to be fully raised for each vessel passage.

7. The Coast Guard's oversight of the Florida Avenue Bridge failed to identify that the lift span of the bridge was unable to be raised, and was not being raised, to the fullest extent as required by regulations for the safe passage of vessels.

8. Current Occupational Safety and Health Administration regulations pertaining to land cranes mounted on vessels, barges, or other flotation devices do not address the risk associated with failure to secure crane booms when the cranes are not actively engaged in marine construction, such as during waterborne transportation.

3.2 Probable Cause

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

4. Recommendations

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

To the US Coast Guard:

Revise your existing guidance to define inspection requirements clearly, including the frequency of inspection, for each bridge in your jurisdiction. (M-15-8)

Evaluate the activities and performance of each branch office in the bridge program to identify areas that need improvement; then take the actions necessary to ensure the effectiveness of existing policy, procedures, and regulations related to drawbridge operations and the overall safety of navigation. (M-15-9)

To the Port of New Orleans:

Conduct periodic safety audits to ensure that personnel involved in bridge operations perform their duties according to expectations. (M-15-10)

To Boh Bros. Construction Co., LLC:

Review your Job Safety Assessment program and the training of all personnel involved in the pre-transport preparation of crane barges and similar afloat equipment to ensure that each individual understands and is able to apply the elements of this accident prevention program. (M-15-11)

To the Occupational Safety and Health Administration:

Revise existing regulations at Title 29 *Code of Federal Regulations* Part 1910 to address the placement and securing of crane booms on barges for transit to and from marine construction and other sites. (M-15-12)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Chairman

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Member

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Vice Chairman

EARL F. WEENER
Member

Adopted: September 22, 2015

Appendix

Launch Information

The NTSB's Office of Marine Safety launched an investigator to New Orleans on August 15, 2014, 2 days after the accident. The investigator remained on scene for 4 days and interviewed ABC management, the junior and senior deckhands, and the Port of New Orleans bridge operator and her supervisor. In addition, the NTSB investigator interviewed five persons employed by Boh Bros. who had helped prepare and dispatch the barge for transport on the day of the accident. He also interviewed the program manager for the Eighth Coast Guard District's Bridge Administration.

In addition, while on scene, the investigator examined damage to the towing vessel, the crane barge, and the Florida Avenue Bridge. He also located a security camera that had captured video footage of the accident, and reviewed Coast Guard records of the bridge and the towing vessel.

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