National Transportation Safety Board

Marine Accident Brief

Contact of Crane Barge *Mr Ervin*, Pushed by Towing Vessel *Kristin Alexis*, with Sunshine Bridge

Accident type	Contact	**No.** DCA19FM003
Vessel name	*Kristin Alexis*	
Location	Lower Mississippi River, mile 167.4, St. James Parish, about 30 miles downriver of Baton Rouge, Louisiana[1] 30°05.86' N, 90°54.81' W	
Date	October 12, 2018	
Time	0141 central daylight time (coordinated universal time – 5 hours)	
Injuries	None	
Property damage	$7 million est.	
Environmental damage	None	
Weather	Clear skies with visibility at 10 miles, winds north-northeast at 6 mph; air temperature 62°F, water temperature 77.5°F	
Waterway information	The Mississippi River at the Sunshine Bridge is about 2,550 feet wide, bank to bank. At the time of the accident, the river gage at Donaldsonville was at 18.37 feet, and the current was about 3 mph. (Flood stage was in effect at 27 feet.)	

On October 12, 2018, about 0141 local time, the towing vessel *Kristin Alexis* was transiting with the crane barge *Mr Ervin* upbound on the Lower Mississippi River near St. James, Louisiana, when the crane struck the deck of the Sunshine Bridge while passing under the west channel span. No pollution or injuries to the six crewmembers on board the *Kristin Alexis* were reported. The bridge was completely closed to vehicular traffic for 49 days while repairs were made, which resulted in significant traffic impacts. Damage to the bridge was $6.7 million, while crane damage was estimated at $8,500.

Figure 1. The *Kristin Alexis* and crane barge *Mr Ervin* configuration. (Source: US Coast Guard)

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

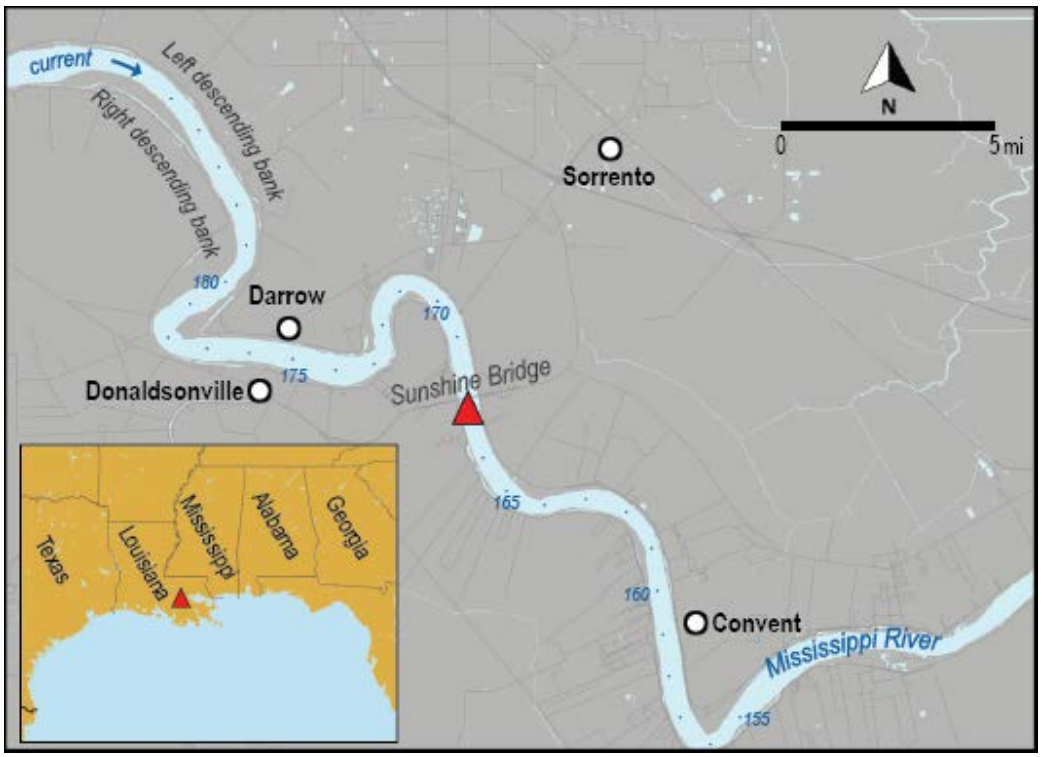


Figure 2. Location where the *Kristin Alexis/Mr Ervin* struck the Sunshine Bridge, marked by the red triangle. (Background source: Google Earth)

Background

The *Kristin Alexis*, a 61.8-foot-long, steel-hulled towing vessel used for general towing, was built in 1978 as the *Randy Eckstein* by Albert Ortis Boat Building Company, Inc., in Krotz Springs, Louisiana. The vessel was later renamed *Randy* and finally changed to *Kristin Alexis* in 1988. At the time of the accident, the vessel was owned and operated by Marquette Transportation Company Gulf-Inland, LLC.

The *Kristin Alexis* was working under a 13-month charter contract with Cooper Consolidated, a marine service provider.[2] Under this charter, Marquette Transportation Company Gulf-Inland, LLC, completed work orders for Cooper Consolidated, including moving crane barges and other barges from one work site to another in the vicinity of the Convent and Darrow fleets. The Convent fleet was located between mile 161 and 164 and primarily provided fleeting and shifting in support of the Zen-Noh Grain export elevator. Darrow fleet was located in Darrow, Louisiana, between miles 172 and 180, and serviced all docks and elevators in the area.

The Sunshine Bridge, a cantilever bridge that crossed the Mississippi River in St. James Parish at mile 167.5, carried Louisiana Highway 70 (LA-70), connecting Donaldsonville on the west side to Sorrento on the east side, both in Ascension Parish. The bridge had two navigable spans through which vessels could transit: a channel (main) span and a west span. The horizontal

[2] Cooper Consolidated provides services pertaining to stevedoring (the process of loading or discharging/offloading cargo to or from a vessel), cargo-handling, logistics, and barge movement along the Lower Mississippi River between the Southwest Pass and Baton Rouge, as well as throughout the US inland waterway system. Cooper Consolidated, LLC, "About," https://www.cooperconsolidated.com/about-overview (accessed October 31, 2019).

clearance for the channel span of the Sunshine Bridge was 750 feet. The minimum charted depth of the channel near the bridge was 58 feet.

Accident Events

On October 11, 2018, the *Kristin Alexis* was performing fleeting work with a crew of six, including a captain, pilot, and four deckhands (two per shift), at the Cooper Consolidated fleeting facility at Convent located at mile 161.5. About 2300, the Cooper Consolidated dispatcher informed the *Kristin Alexis* captain that their next job was to move the derrick-type crane barge *Mr Ervin* upriver to the Cooper Consolidated fleeting facility in Darrow, located at mile 175. This voyage required them to transit under the Sunshine Bridge. The *Mr Ervin* was 191 feet long and 75 feet wide, with a depth (main deck to the bottom of the barge) of 14.5 feet and a draft of about 7 feet. The air draft of the stowed crane and barge, measured from the waterline to the top of the A-frame of the crane, was about 136 feet.[3] In preparation for this job, the managing director of stevedoring and maintenance for Cooper Consolidated obtained the current river stage (18.37 feet) at Donaldsonville, Louisiana, and calculated the minimum vertical clearance of the Sunshine Bridge to be "151 or 152 feet," and, using the crane barge's air draft and the minimum vertical clearance, he concluded that the barge had sufficient overhead clearance to transit through the bridge's channel span.[4] None of these measurements were relayed to the Cooper dispatcher, who provided the work orders to the *Kristin Alexis* crew, and the captain and pilot did not request that information.

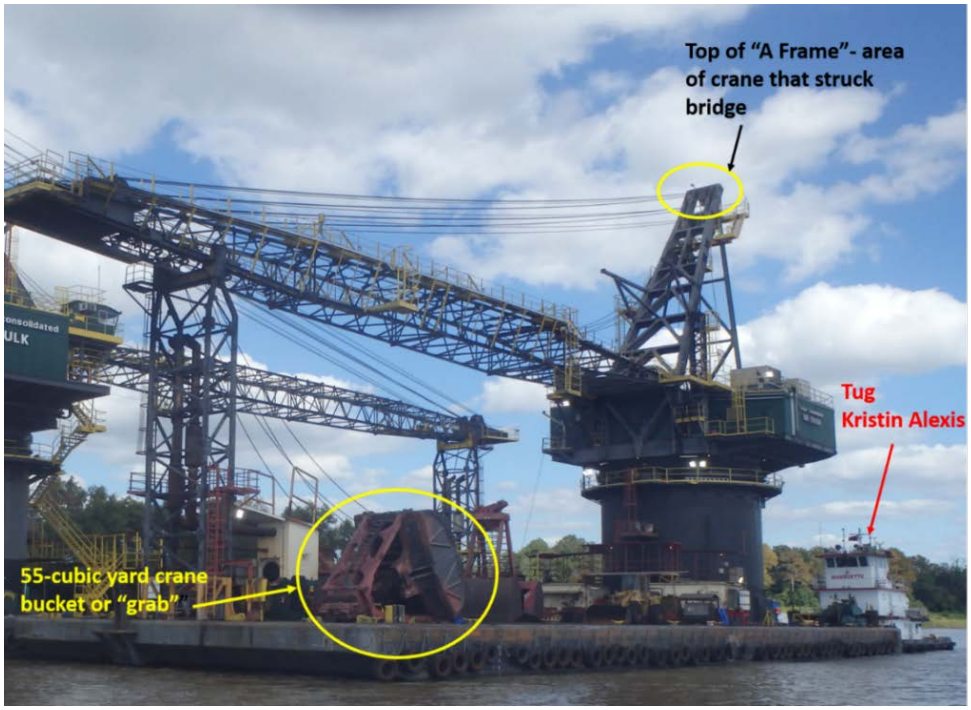


Figure 3. Photo of crane barge *Mr Ervin* faced up to the *Kristin* Alexis. (Source: Coast Guard)

[3] *Air draft* describes the vertical distance from the top of a vessel's highest point down to the waterline.

[4] (a) *Vertical clearance* is the distance from the water to the lowest point of the bridge or obstruction. (b) *Overhead clearance* is the amount of space, or clearance, between the lowest portion of a bridge or obstruction under which a vessel is transiting to the highest point of the vessel. Overhead clearance is calculated by taking the bridge's vertical clearance and subtracting the vessel's air draft.

About half an hour later, at 2330, the *Kristin Alexis* arrived alongside the *Mr Ervin*. The captain positioned the *Kristin Alexis* to "face up" to the barge's stern so that he could control its movement.[5] He stated that he chose to offset the towboat to the port side of the stern because it improved his visibility and was the area where he normally tied up to other similar crane barges. The captain testified that, about 2335, the Cooper shoreside crew began to release the *Mr Ervin's* mooring lines and that he directed them to stop because he was not ready yet. He proceeded towards the stern to begin to secure the towing vessel to the barge for transit. He then noticed a 55-cubic-yard grab-bucket, about 17.5 feet tall, on the port-side barge deck, one of three on board that were used to offload bulk materials. Though skies were reportedly clear, it was nighttime and dark, and the captain said that the grab bucket obscured his visibility and caused him concern. The captain requested that the Cooper shoreside crew move it. He then proceeded to have several conversations about the bucket both with his deckhand and the Cooper Consolidated supervisor, who was present on the dock. These conversations took place face-to-face, as well as over the radio and via cell phone.

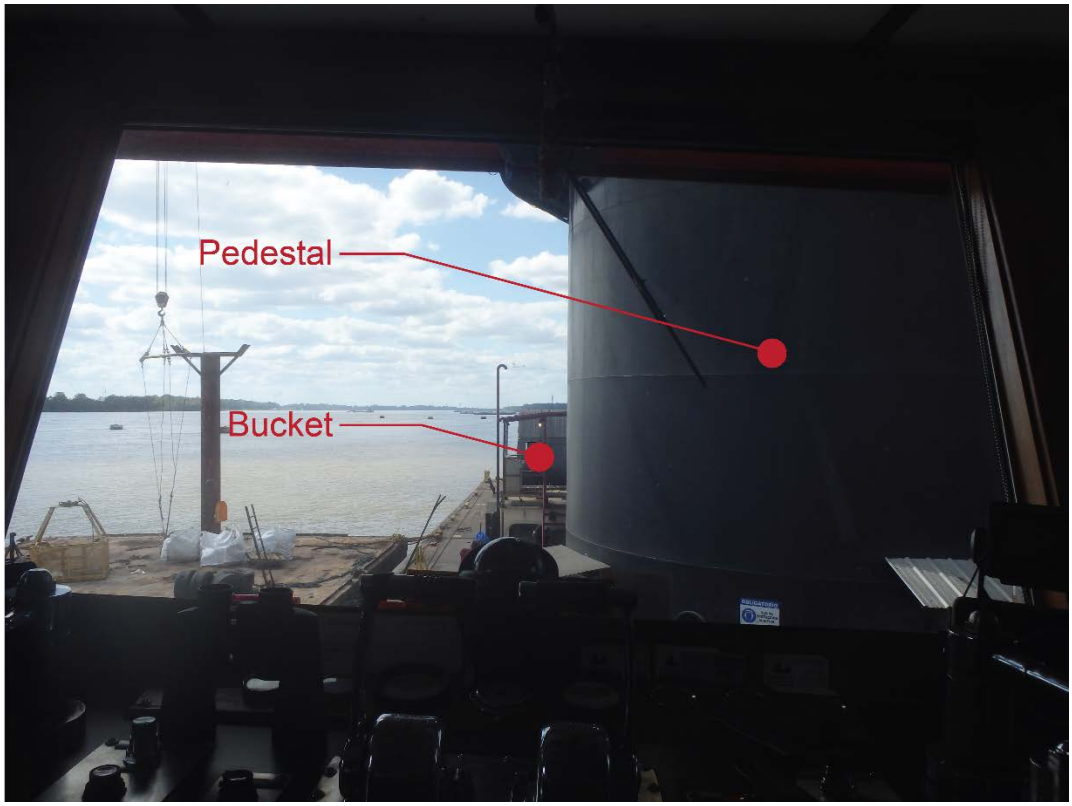


Figure 4. Forward view from the *Kristin Alexis*' wheelhouse. The crane's pedestal blocks most of the starboard view, while the crane bucket blocks a portion of the forward view ahead. (Source: Coast Guard)

The captain of the *Kristin Alexis* then completed Marquette's required Pre-Arrival and Assist Vessel Voyage Plan Information form (Short Voyage Plan), which included a space for "maximum air draft." He stated that he entered "37" in the allocated space and explained that this

[5] To *face up* is to position a towboat's pusher knees, located at the bow of the vessel, against the hull of the barge, and attach wires from the vessel to the barge to keep them snug against each other. For the *Kristin Alexis*, the pusher knees were to be faced up to the port side of the stern of the barge so that it could be pushed in a fore/aft direction.

measurement was the air draft (in feet) of the towboat. The captain did not enter the air draft of the crane barge.[6]

The Cooper dispatcher told the captain that he was working to get a crew out to move the bucket. Within the next 20 minutes, the decision was ultimately made by the on-call Cooper supervisor not to move any bucket aboard the *Mr Ervin*, though this decision was not communicated with the captain of the *Kristin Alexis*. The shoreside crew later stated that it would have taken several hours to do so and would require the tug and barge to return to the dock and use shoreside power to complete the operation. The Cooper Consolidated executive director testified that he supported his employees in refusing to move the bucket because (he believed) the tug could have made up to the starboard stern, whereby the towboat crew could have seen over the smaller bucket (as compared to the 55-cubic-foot bucket) positioned on the barge's starboard side.

About 2350, the captain maneuvered the tow off the dock and eventually proceeded upriver toward the Sunshine Bridge, about 6 miles away. The captain stated that he did not know the exact air draft of the crane but that someone at the dock told him it was 130 feet. He also stated that he did not know the "air gap" (overhead clearance) under the Sunshine Bridge but that he had previously navigated the *Mr Ervin* under the channel span without mishap. The pilot had also navigated other crane barges under the Sunshine Bridge, but never the *Mr Ervin*.

About the same time the tow started upriver, the pilot of the *Kristin Alexis* entered the wheelhouse to prepare to relieve the captain and assume the 0000–1200 watch.[7] Although the watch exchange normally occurred around midnight, the captain stated that he wanted to make sure the *Kristin Alexis* was clear of three southbound tows ahead before the watch change.

After passing the three tows about 0009, the captain and the pilot discussed the expected removal of the grab-bucket and completed their watch exchange about 0030, around mile 163. During the watch handover, both the captain and the pilot stated that they only discussed the placement and removal of the grab-bucket. According to the pilot, he and the captain typically did a thorough watch handover, which would include a discussion of the operations, the weather, the river conditions, and, if planned, a bridge transit, but this time was not typical because the captain was still "upset" about the placement of the grab-bucket. The pilot said that no information about the crane was provided during the handover, and he did not know the crane barge's air draft but, because of his experience with other Cooper cranes, believed it was about 130 feet. The captain told investigators that he did not know if the pilot had ever transited with a crane barge under the Sunshine Bridge but he expected that the pilot would choose the channel span, since Marquette vessels normally transited through that span.

While both the captain and pilot were still in the wheelhouse, the pilot completed the Fleet Crew Change Protocol form, checking off the mandatory items to be discussed during the handover, although both the captain and the pilot later disclosed that they did not discuss several

[6] According to Cooper Consolidated, the crane stood 128.25 feet high above the deck, and as such, would have had an air draft of around 135.75 feet high. Postaccident measurements by Coast Guard investigators determined the air draft to be 136 feet.

[7] *Pilot* is a term used aboard towing vessels on inland waterways for a person, other than the captain, who navigates the vessel. On the *Kristin Alexis*, the captain and the pilot alternated standing 12-hour watches. The pilot referenced in this investigation is different and distinct from a ship's harbor or bar pilot that would be hired on for a short duration to safely navigate a deep draft ship to or from the pier.

of those items. The pilot also conducted a safety meeting with the oncoming deckhands (with the captain still present in the wheelhouse) prior to relieving the captain about 0040 and completed the Job Safety Briefing form, which included the type of job, mitigations necessary, risk assessment, and names and signatures of the participating crewmembers.

The captain said that he made sure the pilot was comfortable with the tow, and then he left the wheelhouse. A senior deckhand (referred to as the mate) and another deckhand were also on watch with the pilot.

The *Kristin Alexis* was equipped with GPS, an automatic identification system (AIS), a radar, and a Rose Point electronic charting system. The pilot told investigators that the vessel's radar was normally his most accurate navigational tool; however, the pilot and the captain both stated that they could not use the radar to look ahead because the crane's pedestal caused radar echo and blocked the radar view. As the vessel proceeded upriver, the pilot used the vessel's Rose Point, which showed the vertical clearance of both the channel and west spans as 132.9 feet (see figure 5), to navigate the vessel and occasionally consulted National Oceanic and Atmospheric Administration (NOAA) nautical chart 11370 for the area (see figure 9), which showed the vertical clearance for the bridge as 133 feet. Believing the crane's air draft was 130 feet, the pilot stated that he thought the crane would clear either span of the bridge with "2 feet of clearance or 2.9…not taking into consideration the river stage," so he continued upriver toward the bridge.

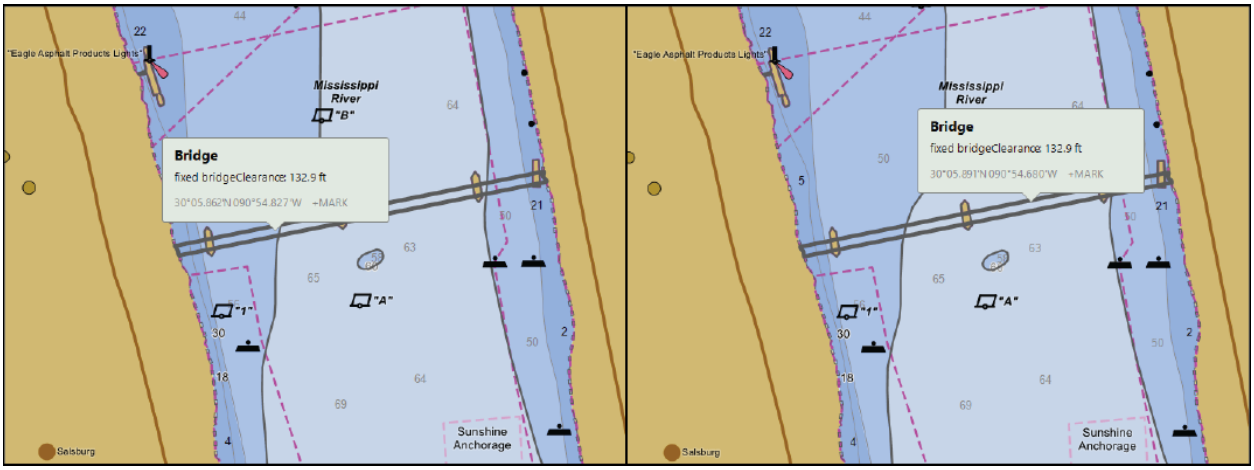


Figure 5. Vertical clearance of the Sunshine Bridge's west (left) and channel (right) spans, as indicated postaccident by the Rose Point display on board the *Kristin Alexis*, which showed the same clearance for each span (132.9 feet).

According to the *Kristin Alexis*' AIS information, at 0030, the vessel was near mile 163, close to the right descending bank, on a course of 280° at a speed of 4 knots.[8] The pilot stated that he chose that side of the river because the port side of the vessel, which faced the right descending bank, was the side where he had the best unobstructed visibility (forward). He described his visibility as a 10- to 15-foot window on the port side, with no visibility on the starboard side.

[8] The inland towing industry refers to the shorelines of western rivers as the left and right banks when traveling (facing) downstream. The left bank is called the *left descending bank*, and the right bank is called the *right descending bank*.

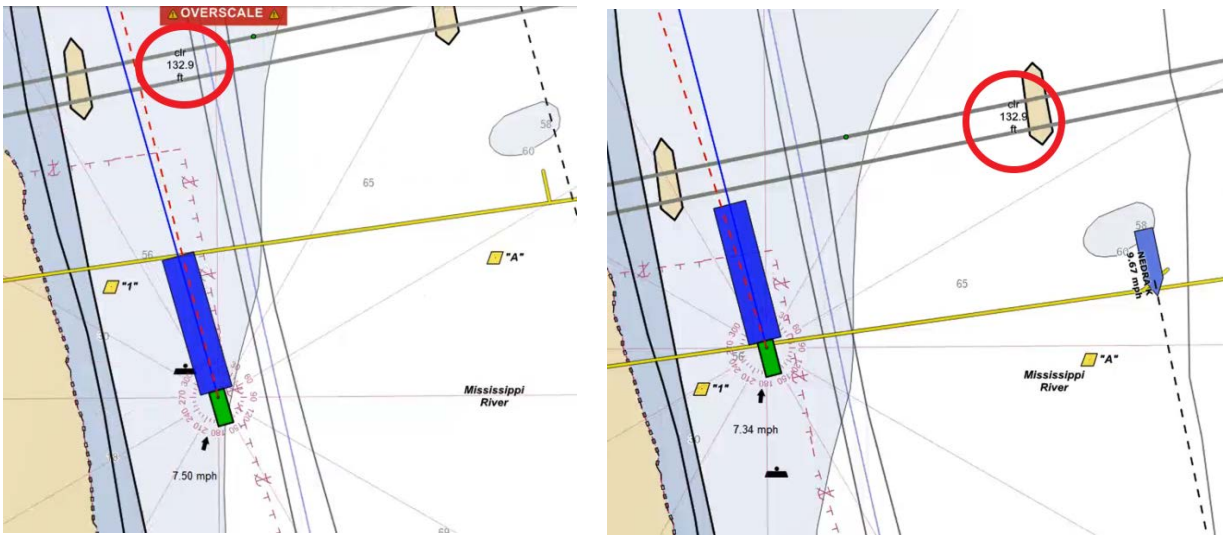


Figure 6. Screenshots of the *Kristin Alexis*' Rose Point at 0139 (left) and at 0140 (right). The vertical clearance for the Sunshine Bridge is circled in red.

The captain and the pilot stated that in addition to Rose Point and the NOAA navigational chart, they were using the *US Coast Pilot #5*, a Coast Guard Local Notice to Mariners, and the Coast Guard Light List on the accident voyage.[9] Another reference to the bridge elevation was the US Army Corps of Engineers map book (see figure 7).[10] However, the pilot stated that he had never seen the bridge elevation drawing in the map book, and the captain said he was unsure if the map book was aboard the towboat (investigators later verified that the map book was on the vessel).

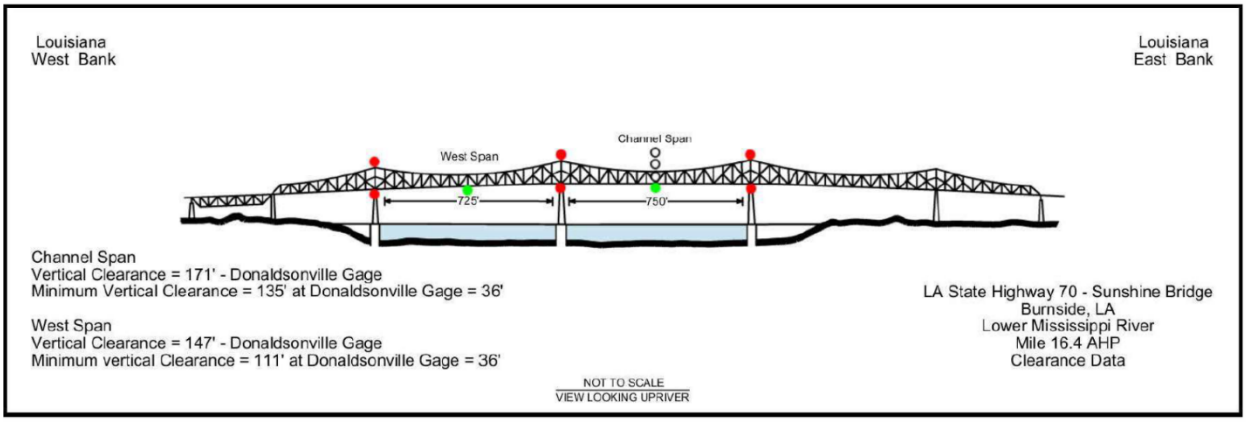


Figure 7. Sunshine Bridge span vertical clearances. The right descending bank is the west bank, and the left descending bank is the east bank. (Source: Corps of Engineers)

[9] A *Local Notice to Mariners*, transmitted weekly by the Coast Guard, contains updates for mariners to use on charts and publications that are currently in use, until a revision can be made to the applicable chart or publication.

[10] US Army Corps of Engineers, "Mississippi Valley Division 2015 Flood Control and Navigation Maps; Mississippi River; Cairo, Illinois to Gulf of Mexico, Mile 953 AHP [Above Head of Passes] to Mile 22 BHP [Below Head of Passes]," 2015. During a previous investigation, the NTSB found that the mile ("16.4 AHP") listed on this map was incorrect. The mile should be 167.4 AHP. See Contact of Tanker Dank Silver with Sunshine Bridge, MAB-20/23.

At 0123, the *Kristin Alexis* pilot made a radio broadcast on the VHF FM radio to all concerned traffic regarding his location and restricted visibility condition. After determining that he would meet the downbound tow *Nedra K* near the Sunshine Bridge, the *Kristin Alexis* pilot contacted the *Nedra K* at 0132 to make meeting arrangements and learned that the *Nedra K* would be using the channel span to pass under the bridge. The *Kristin Alexis* pilot stated that he "took the west side because that was the only side I could see." Since he was already on the right descending side of the river and had previously taken crane barges (though not the *Mr Ervin*) through the west span of the Sunshine Bridge roughly five times before during low-river conditions, he was comfortable with and agreed to a "two-whistle," or starboard-to-starboard, meeting with the *Nedra K*.[11] According to the *Kristin Alexis*' Rose Point, the vessels passed about one-tenth of a mile below the bridge without incident.

The pilot stated that, as the *Kristin Alexis* proceeded upriver, he discussed with the mate and deckhand his plan to maneuver the tow so that it would pass beneath the green light located at the center of the west span of the bridge. The pilot told investigators that when the tow was between half a mile to 1 mile from the bridge, he sent the mate and deckhand forward on the *Mr Ervin* to ensure the tow would horizontally clear the piers of the Sunshine Bridge's west span. As the tow approached the bridge, the mate and the deckhand assisted the pilot with centering the tow in the channel by calling out the lateral distances to the bridge trestles. The mate estimated that the tow was centered under the west span when they were about 600 feet away. However, when the crane barge was 300–400 feet away from the bridge, the mate informed the pilot that they were sliding to port. He then repositioned himself to the centerline of the barge and told the pilot that they were no longer centered on the west span's green light. The pilot stated that he still felt safe to take the tow through the bridge span.

When the bow of the crane barge was about 40–50 feet from the bridge, the pilot told the mate and the deckhand that "everything looked good" and directed them to return to the wheelhouse. About 0141, as they headed aft toward the wheelhouse, the top of the crane's A-frame struck the lowest horizontal support chord and lateral braces of the west span of the Sunshine Bridge. The tow stopped forward progress when the crane became lodged under the bridge about 260 feet to the west of the center (green light). The *Kristin Alexis* captain, still awake, said it felt "like we bumped something" and heard bells going off so he ran up to the wheelhouse, where he and the pilot discussed what happened and he relieved the pilot. The towboat was still faced-up to the barge, now sideways to the current, with water coming over the stern of the boat. The crew released the facing wires from the tow, repositioned, and tied back up to the barge underneath the bridge until assist vessels arrived.

Following the accident, the pilot called the Coast Guard's Vessel Traffic Service (VTS) in New Orleans, the company port captain for the *Kristin Alexis*, and Coast Guard Sector New Orleans and apprised them of the situation. A bridge inspector for the Louisiana Department of Transportation Development (LADOTD) arrived about 0230, viewed the underside of the bridge by boat, determined that the damage was extensive, and closed the bridge to vehicular traffic. The crew of the *Kristin Alexis* remained with the vessel and barge until Cooper Consolidated shoreside personnel arrived; the crew stood by on the port side of the crane barge while shoreside personnel ballasted the crane barge with river water so that it sank lower in the water and thus dislodged from

[11] Downbound vessels on the Mississippi River and Western Rivers have the right of way and can propose how they will meet another vessel.

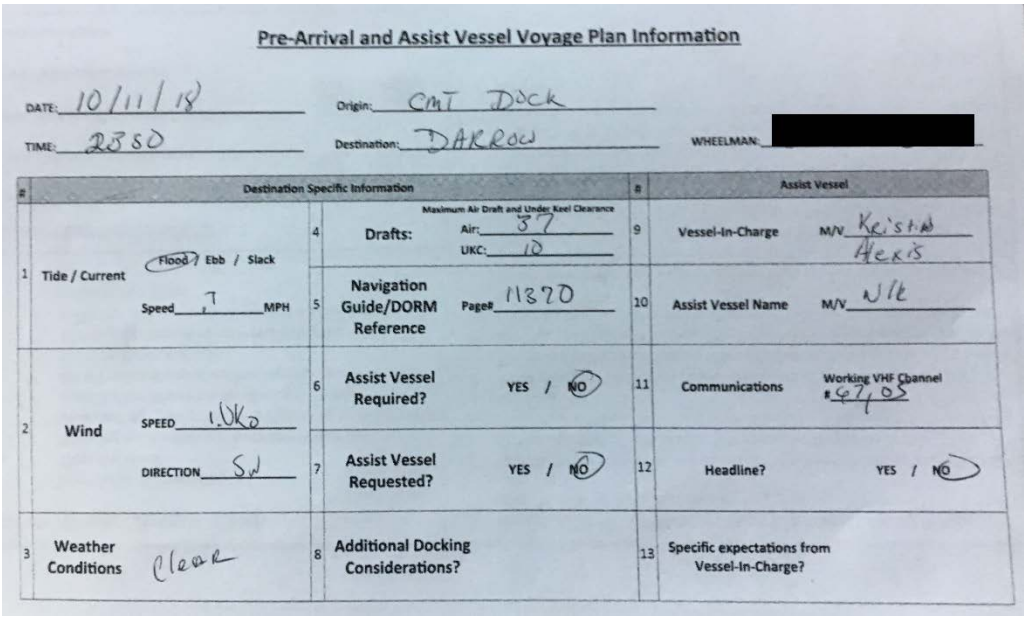
the bridge. Once the crane was cleared of the bridge, the *Kristin Alexis* was directed to return to the dock at mile 164, and about 0700, the towboat *Capt Whitey* began towing the *Mr Ervin* to Cooper Consolidated in Darrow.

Subsequent inspections and strength calculations of the damaged bridge areas found that the section struck by the crane could have collapsed, but, because of secondary load redistributions, catastrophic failure was avoided. The bridge was completely closed until December 2018, at which point single-lane, two-way traffic was permitted until March 2019, when all repairs were complete. The closure resulted in a significant traffic detour to other nearby bridges. The damages to the bridge and crane barge totaled about $6.7 million and $8,500, respectively.

Additional Information

Safety Management System. Marquette's safety management system (SMS) contained a bridge transit policy, which stated, "The wheelhouse person on watch for the transit will determine the following before making an approach to the bridge…Air draft of vessel and tow; strength and direction of current/tide; and the beam of the vessel and tow will adequately transit the bridge spans" (the policy did not mention how to determine the overhead clearance or the vertical clearance of the bridge). The company's port captain testified that, with "anything higher than our boat," it was a "rule of thumb" that Marquette vessels always go through the main channel span "because we don't want to make a bad habit of going with cranes, going through the alternate span." This guidance was not included in the SMS. The SMS navigation policy stated that "special attention must be paid" to bridge transits, the "air draft relative to the bridge or overhead obstruction," and the river stage at the mooring location and upon the route. It was the responsibility of the vice president of operations to ensure that wheelhouse personnel were aware of this policy. According to Marquette's director of compliance, during new employee orientation, captains and pilots were given printed copies of the pertinent navigation policies, including the bridge transit policy, so they had "as much time as they need to review them before they sign an acknowledgement that they have received them and will abide by them." The pilot had signed this acknowledgement form on September 7, 2018.

The regulations in 33 *Code of Federal Regulations* (*CFR*) 164.80 require voyage planning to include vertical clearances for all bridges along the transit before getting under way. For voyage planning, the company's SMS required a Short Voyage Plan to be completed for voyages of less than 30 miles. The form contained a block for "Maximum Air Draft and Under Keel Clearance." In this block were two spaces: one for "Air" and the other for "UKC," or under-keel clearance. The *Kristin Alexis*' Short Voyage Plan forms for all voyages for the previous year showed the value for "air" to be 37 feet, which the pilot explained was the air draft of the towing vessel. The port captain stated that the air draft on the accident voyage plan (see figure 8) was incorrect and should have had the air draft of the crane barge. The captain had been assigned to the *Kristin Alexis* for 11 months prior to the accident, and he stated that during that time, he had pushed the *Mr Ervin* and other crane barges "at least a dozen times" through the Sunshine Bridge. Additionally, from June to October of 2018, the *Mr Ervin* was towed by Marquette vessels for twelve round trips between Darrow and Convent, each time transiting under the Sunshine Bridge without incident.



Pre-Arrival and Assist Vessel Voyage Plan Information

DATE: 10/11/18 Origin: CMT Dock

TIME: 2350 Destination: AKRON WHEELMAN: [redacted]

#	Destination Specific Information		#	Assist Vessel	
1	Tide / Current: (Flood) / Ebb / Slack; Speed 7 MPH	4 Drafts: Maximum Air Draft and Under Keel Clearance — Air: 37; UKC: 10	9	Vessel-In-Charge	M/V Kristin Alexis
		5 Navigation Guide/DORM Reference: Page# 11870	10	Assist Vessel Name	M/V N/K
2	Wind: SPEED 10Kts; DIRECTION SW	6 Assist Vessel Required? YES / (NO)	11	Communications	Working VHF Channel #67,05
		7 Assist Vessel Requested? YES / (NO)	12	Headline?	YES / (NO)
3	Weather Conditions: Clear	8 Additional Docking Considerations?	13	Specific expectations from Vessel-In-Charge?	

Figure 8. Short Voyage Plan form, completed by the captain at the time of departure. (Source: Marquette Transportation Company)

The SMS required a voyage risk assessment to be completed prior to getting under way, regardless of duration of the planned voyage, in the form of a Job Safety Briefing. This form used a "green, amber, red" model to categorize the risk level of the operational tasks associated with the voyage as low, medium, or high (green, amber, or red, respectively) based on identified hazards. According to the SMS, if the crew categorized the operation as amber or red, the crewmembers were required to notify the port captain. The pilot completed a Job Safety Briefing form with the oncoming deckhands and categorized the voyage as "amber" (caution), since the voyage took place at night with restricted visibility, but the pilot did not contact the port captain. There was no record of the captain completing a Job Safety Briefing form for this voyage.

The SMS also contained a "stop work responsibility" policy, which empowered any person on board a vessel to "stop work when an unsafe condition or behavior exists that poses imminent danger or could result in an undesirable outcome to/for person(s), equipment or the environment." According to the policy, a person who noticed an unsafe operation, or otherwise had concerns about the operation, must call a "STOP WORK" (by using those words) and immediately notify the wheelhouse personnel of the action needed. The policy directed the captain or wheelhouse person on watch to contact the duty port captain any time an inherently dangerous vessel movement was anticipated. The SMS stated that, during each watch change, the captain and pilot were required to discuss stop work responsibility (they did not discuss this responsibility during the accident voyage).

Previous Bridge Strikes. According to a Coast Guard study, between 2004 and 2014, there were 205 reported bridge strikes (referred to as allisions by the Coast Guard) in the United States. Of those, 125 incidents involved barges and/or towboats. The study indicated that "the most common fault or reason that a bridge allision occurs is due to a loss of situation awareness, attention to detail, or tasks in voyage planning that needed to be completed during the transit to

ensure safe passage."[12] Additionally, the Eighth Coast Guard District, where this accident occurred, saw nearly three times as many bridge strikes as any other district.

About 6 weeks prior to the *Kristin Alexis* bridge strike, on August 30, the *Taylor Marie*, another Marquette towing vessel, was transiting upbound at mile 146 on the Lower Mississippi River, when the crane barge *Randy W* (owned by Associated Terminals) that it was pushing struck the west span of the Gramercy Bridge. The crane sustained damage to its tower and various other components. According to a Coast Guard report, the Gramercy Bridge sustained damage to both lower chords of the main truss and two lower braces. As a result of its investigation, the Coast Guard determined that the *Taylor Marie* captain did not verify the height of the *Randy W* crane and was not aware of the height of the Gramercy Bridge west span when he decided to transit under it. The company did not make all employees aware of that incident or provide direction on how to avoid this type of accident in the future. The pilot and the captain on the *Kristin Alexis* stated that they were not aware of the bridge strike 6 weeks earlier.

Towing Safety Advisory Committee. In 2015, a Coast Guard Towing Safety Advisory Committee (TSAC) put together a task force to provide to the Coast Guard recommendations to identify solutions for preventing allisions between towing vessels and tows with structures (such as bridges), and provide recommendations regarding standardization processes for 1) the documentation of air draft requirements and 2) to accurately determine and post air draft requirements of tows and cargo barges. In the TSAC's final report on air draft, dated May 10, 2016, the committee recommended that all towing safety management systems:

> "clearly state that it is the towing vessel master's responsibility to review properly published information on overhead clearance, and, based on this information determine and verify all overhead clearance issues along the intended route as part of Voyage Planning / Navigational Watch Assessment. The Master must be allowed to rely on the published height of any overhead clearances and has no duty to independently verify this information." [13]

The TSAC also recommended that when a third-party vessel (barge, crane, etc.) is being towed, the third-party owner should be responsible for providing accurate air draft information to the operator moving that tow.

Calculating Overhead Clearance. Overhead clearance is found by calculating the bridge's vertical clearance in relation to the nearest river gage and subtracting the vessel's air draft. The pilot stated that he knew how to calculate overhead clearance but "didn't know the river stage at the time."

River gage information is critical in calculating overhead clearance, since the Mississippi River experiences fluctuations in water levels during times of greater-than-average rainfall and snowmelt, or during drought conditions. River levels are monitored using gages, supplied by the Corps of Engineers, at specific locations along the river. The nearest gage to the accident site was

[12] US Coast Guard, "Vessel Casualty Allision Events Where Insufficient Air Draft Resulted in Overhead Strikes to Bridges, Cables, or Other Obstructions CY2003 to Mar 2014."

[13] US Coast Guard Towing Safety Advisory Committee, "Task 13-10: Recommendation to Establish Criteria for Identification of Air Draft for Towing Vessels and Tows [Short Title: Air Draft]," May 2016.

the Donaldsonville gage. Mariners can obtain hourly figures for a specific location's river level via the Corps of Engineers "rivergages.com" internet site.

According to the Corps of Engineers map book, the channel span had a maximum vertical clearance of 171 feet (minus the Donaldsonville gage), and the west span had a maximum vertical clearance of 147 feet (minus the Donaldsonville gage) (see figure 7). The pilot stated that he was not using the map book.

This portion of the Mississippi River was in the area of the VTS Lower Mississippi River (New Orleans), and the Sunshine Bridge was a check-in location for upbound vessels to call in and report their position before entering the 81-Mile-Point traffic management area, which covered the area from mile 167.5 at the Sunshine Bridge to mile 187.9. Personnel from VTS testified that vessels routinely call and request information regarding bridge clearance and river stage levels, and that this information is checked by the Coast Guard for accuracy. VTS logs for the day show that the *Kristin Alexis* did not call VTS to request bridge clearance or river stage information on the day of the accident.

Charts. Between the ports of New Orleans and Baton Rouge on the Mississippi River, four bridges have main and alternate navigational spans. According to NOAA guidance, "each span requires a clearance note," and "bridges with multiple spans may have their clearances charted with a block note, placed in close proximity to the bridges."[14] NOAA chart 11370, which depicted the Sunshine Bridge at mile 167.5 and which the crew used to navigate from Convent to Darrow, noted one vertical clearance of 133 feet and one horizontal clearance of 750 feet. The NOAA chart for the Hale Boggs Bridge at mile 121.6 showed separate vertical clearances for the two spans (132.9 feet for the main span and 116.8 feet for the auxiliary span). The Huey P. Long Bridge at mile 106.1 and the Highway 190 Bridge at mile 233.9 both have main and alternate spans, but the NOAA charts for these bridges showed the vertical clearance for only the main spans. The Corps of Engineers map book showed elevation drawings for each bridge and includes clearances for each navigable span.

The historic bridge plans and permit data for the Sunshine Bridge showed a minimum vertical clearance of 133 feet for the channel span, based on a high-river stage at Donaldsonville of 36 feet, which occurred during the 1927 flood. The vertical clearance is noted on the left descending bank of the NOAA chart as 133 feet for the "fixed bridge," with no note on the right descending bank. Clearance data issued by the Corps of Engineers indicated a minimum vertical clearance of 135 feet for the main span and 111 feet at the west span. This minimum clearance was based on a high-river stage of 36 feet. Investigators could not determine when and by whom the clearances for the two charts were calculated, but this two-foot discrepancy may be explained by the fact that the map book measures from the highest point of the bridge span, while the NOAA chart gives the measured bridge height closer to the piers.

[14] NOAA, "Nautical Chart Manual: Volume One: Policies and Procedures, version 2018.4," December 2018.

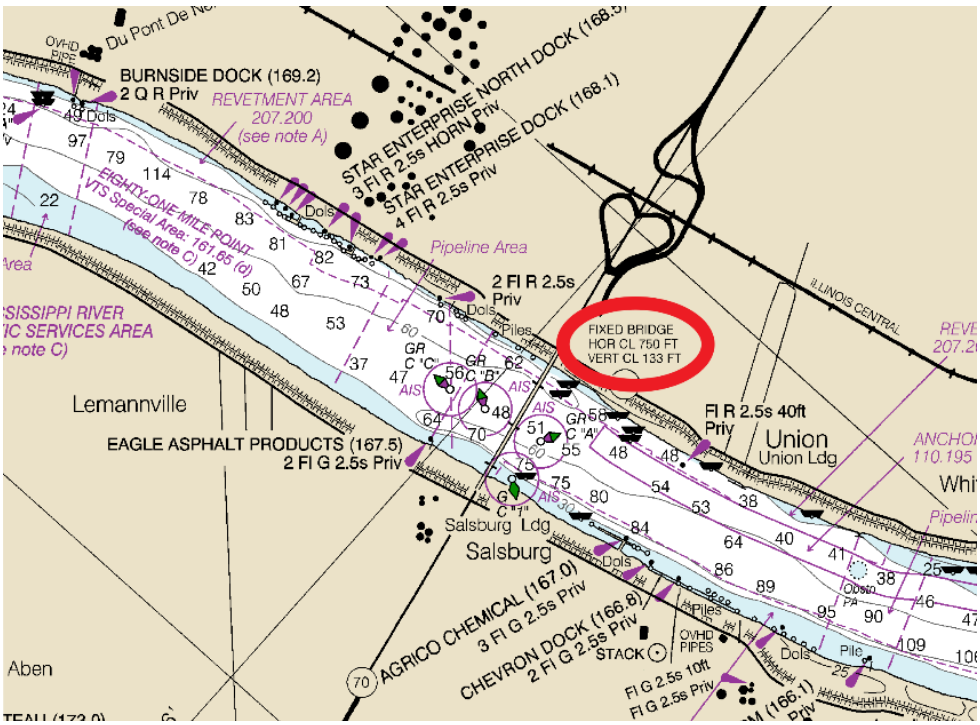


Figure 9. Excerpt of NOAA chart 11370 used by the crew. The vertical (133 feet) and horizontal clearances (750 feet) of the Sunshine Bridge are shown circled in red. (Source: NOAA, annotated by NTSB)

The *Kristin Alexis* was also required to have the VTS user manual aboard. Appendix B of the manual included the same graphic depiction of the Sunshine Bridge as shown in the Corps of Engineers map book (see figure 7). The crew did not use this manual during the accident voyage. According to a Coast Guard VTS coordinator familiar with river traffic on the Lower Mississippi River, alternate channels are typically used by vessels with shallower drafts—light boats, supply vessels, and tows—that can meet the overhead clearance requirements.

The vessel's Rose Point electronic charting system, which the crew stated they were using, provided vertical clearance information for the bridge when the cursor was placed over either span. The Rose Point provided the same vertical clearance of 132.9 feet for both the channel span and the west span. Rose Point also provided river stage information, though the pilot did not obtain this information from Rose Point or any other source at his disposal.

Postaccident Topographic Survey. Following the accident, a topographic survey that took into account the Donaldsonville gage river stage and water surface elevation was performed for the LADOTD.[15] Based on the Donaldsonville gage reading of 18.37 feet, the LADOTD report listed the minimum clearance for the channel and west spans at the time of the accident as 152.63 feet and 128.63 feet, respectively. The topographic survey, which took into account the water surface elevation, determined that the vertical clearance (minimum clearance at lowest point of bridge span) was actually 153.32 feet for the channel span and 128.8 feet for the west span. Based on a crane height of 135.75 feet, the LADOTD survey calculated the overhead clearance at the

[15] Russell J Coco Jr., P.E. with Forte and Tablada for the Lousiana Department of Transportation and Development, "Sunshine Bridge Clearance Investigation (Amended)," May 20, 2019. "Sunshine Bridge Clearance Investigation," May 20, 2019.

point of minimum vertical clearance for the channel span to be 16.88 feet, and for the west span to be (-)7.12 feet. As depicted in figure 10 (from the survey), the 5-percent bridge grade across the west span offered an increasing vertical clearance towards the center of the Mississippi River. At the point of impact, the survey-based vertical clearance was calculated to be 133.03 feet, indicating an actual estimated overhead clearance for the *Mr Ervin* of (-)2.72 feet.

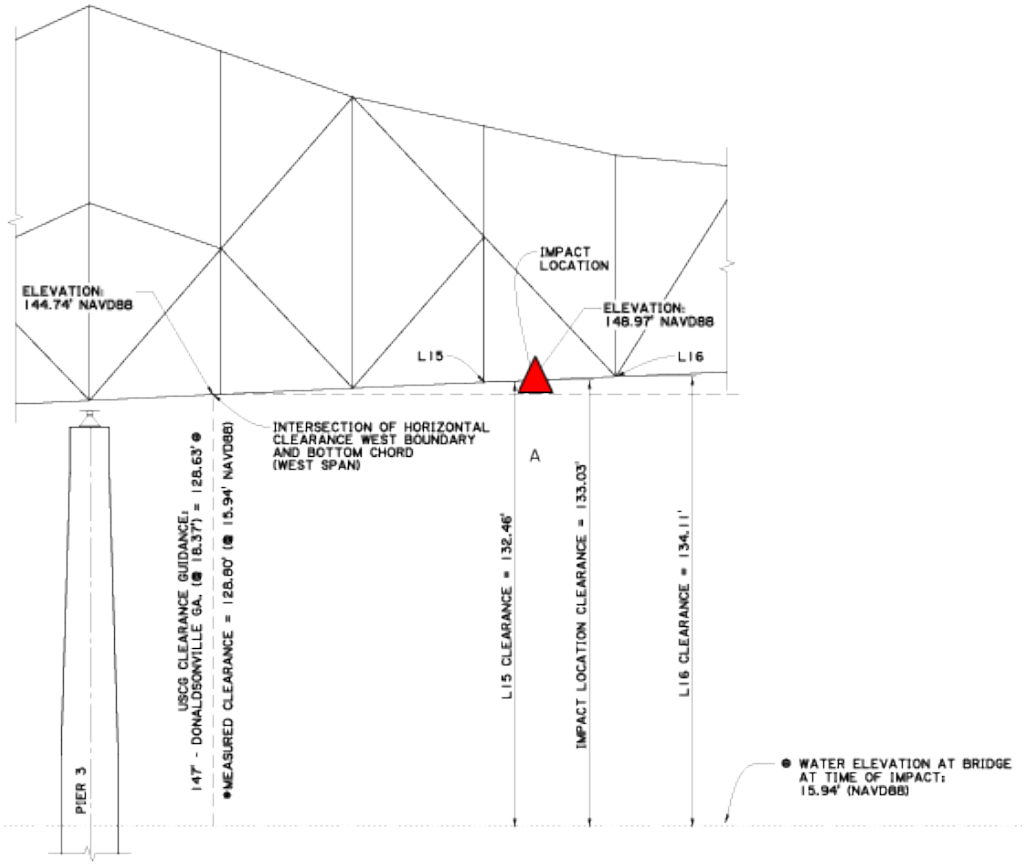


Figure 10. Vertical clearances of the Sunshine Bridge's west span measured shortly after the accident. The impact location is marked with a red triangle. (Source: Forte and Tablada, annotated by NTSB)

Vessel Information. The *Kristin Alexis* had yet to be issued a Coast Guard Certificate of Inspection (COI) per the new 46 *CFR* Subchapter M, which was effective in July 2018 for towing vessels. There was a phase-in period for vessels to obtain a COI per the new regulations. The first milestone of the phase-in period was in July 2019 (after this accident), when operators were required to have a COI for 25 percent of their fleet. The company had an SMS and their Document of Compliance, but they had yet to receive their Towing Safety Management System (TSMS) certificate, which they were required to submit along with other objective evidence in order to obtain their COI.

Subchapter M also required towing vessels/companies to undergo both company and vessel audits prior to obtaining their COI. The company elected the International Safety Management (ISM) method of compliance to conduct internal audits. An internal ISM audit was conducted on October 9, 2018, and, along with the lead auditor, included the pilot and the two deckhands who were on watch at the time of the accident. This audit was in the form of a checklist of ISM

procedures and policies with checkboxes at the bottom of each page to denote any non-conformities or observations. Several ISM policies and procedures had been circled in the left column, but no comments were included, and page one noted two deficiencies, though they were not described or explained. Additionally, an internal office audit report was completed in May 2018. In this report, the company maintained that they were in compliance with procedures and checklists through the vessel operating manual, safety, and emergency procedures.

In preparation for obtaining their COI, the company had chosen the American Bureau of Shipping to conduct external audits, which the regulations in Subchapter M required to be completed on an annual basis; however, the company had not yet begun the process of external auditing at the time of the accident.

Personnel. The captain and the pilot were both credentialed masters who had been working in the industry for 15 and 6 years, respectively. The captain had been assigned to the vessel for a total of 11 months and had towed the *Mr Ervin* once before. The pilot had been hired by Marquette in September 2018 and had spent only 3 weeks on board the *Kristin Alexis* but had about a year and a half of experience as a tugboat captain. The pilot stated that he spent all 6 years of his maritime career on tugboats. He had worked as captain on several crew boats off and on since obtaining his 100-gross-ton master's credential. The captain worked a regular schedule of 2 weeks on duty, followed by 1 week off, while the pilot and deckhands worked a regular schedule of 4 weeks on duty, followed by 2 weeks off.

The senior deckhand/mate, who was on watch at the time of the incident, had 4.5 years in the industry and had been working on board the *Kristin Alexis* for about 1 year. He was training the other deckhand, who was also on watch, and had only been on board for about 3 weeks but had worked for Marquette for about 10 months. Per Coast Guard regulations, the crew involved in the incident were tested for drugs and alcohol.[16] All six crewmembers tested negative for both.

Postaccident Action. The Coast Guard held a 6-day public hearing in Gonzales, Louisiana, starting on May 6, 2019, to gather facts about the accident. The National Transportation Safety Board (NTSB) fully participated in the hearing. Twenty-three witnesses were called to provide testimony. Parties to the investigation included Marquette Transportation Company, Cooper Consolidated, the LADOTD, and NOAA. Following the Kristin Alexis/Mr Ervin bridge strike, Cooper Consolidated required tow companies moving cranes to use only the Sunshine Bridge's main channel.

Analysis

The company provided clear instruction in the SMS regarding stop work responsibility, which gave the crewmember on watch the authority to stop the operation and notify the port captain of any unusual or hazardous conditions that would prevent a safe transit, such as the grab-bucket obstructing visibility. Both the captain and pilot were aware of this policy, but they both indicated

[16] Urine drug testing is limited to identifying urinary metabolites of amphetamine, methamphetamine, cocaine, codeine, morphine, heroin, phencyclidine (PCP), methylenedioxymethamphetamine (MDMA), methylenedioxyamphetamine (MDA), methylenedioxy-N-ethylamphetamine (MDEA), tetrahydrocannabinol (THC), oxycodone, oxymorphone, hydrocodone, and hydromorphone.

that they did not have any intention of stopping the transit. Additionally, a Marquette port captain was available 24 hours per day to whom they could report concerns regarding the bucket and their restricted visibility, but they did not contact him. The NTSB concludes that, prior to getting under way, the captain could have used his stop work authority to stop the transit until he was comfortable with the vessel and tow's configuration.

In preparation for transiting the Sunshine Bridge, the captain and pilot would have had to calculate the overhead clearance above the crane, which required accurate air draft and river gage measurements, to ensure that the tow could safely navigate through the bridge. However, neither the captain nor the pilot knew the accurate air draft for the crane barge on the day of the accident, and the pilot did not check the river gage. They also did not verify the vertical clearance of the bridge. The company's SMS did not provide clear guidance on how to calculate overhead clearance.

The company's port captain testified that he always instructed his captains to go through the Sunshine Bridge's channel span with crane barges and that it was a "rule of thumb," but the company's bridge transit policy did not state as much, and the pilot was unaware of the rule. The captain was aware that the company expected towing vessels to transit through a bridge's channel span, but he did not communicate this expectation to the pilot. Had the company shared, in writing, their expectation about which span to use when transiting with a crane barge, perhaps the pilot would not have considered using the west span. The NTSB concludes that the company's voyage planning guidance was insufficient. Therefore, the NTSB recommends that Marquette Transportation Company develop a detailed voyage plan with specific information concerning/about all known risks, including calculated overhead clearance limitations for tows.

The captain was required to complete a Job Safety Briefing form prior to getting under way, which could have identified the potential hazards for the voyage, including poor visibility. However, the captain did not complete this form.

The company's Fleet Crew Change Protocol checklist included several items that were checked off but not discussed between the pilot and captain during the watch handover. Two of these items included river stage and conditions, and upcoming operational procedures, such as bridge transits. During the watch handover, the captain and pilot did not discuss the actual transit under the bridge or any expectations the captain (or company) had as to which span the pilot should use. The captain and pilot also did not discuss the air draft of the crane, the bridge clearances along the route, or any other information regarding the voyage to Darrow fleet. Because the pilot relieved the captain after they had already begun the transit, he did not go back and verify the air draft of the crane or the vertical clearance of the bridge during the watch handover. The NTSB concludes that the captain and pilot did not complete a thorough watch handover, which could have identified the immediate risks/hazards along the vessel's route.

At the beginning of employment, the company provided each employee with information from the SMS that the company deemed pertinent to the employee's expected duties, and employees were required to acknowledge that they had received this information. However, the company did not provide any formalized training to ensure that employees adequately understood the information and the company's expectations. Instead, the company expected each employee to read and understand the provided information on their own time. According to company policy, it was the captain's responsibility to answer any additional questions that crewmembers may have

had, making the captain primarily responsible for new crewmembers' training. Though the company had policies and procedures for voyage planning and navigation, their bridge transit policy was not specific in that it did not identify which spans should be used when transiting with a crane barge.

The company SMS required the crew to complete a Short Voyage Plan form prior to getting under way, which included a space for the maximum air draft. However, it was unclear to the pilot and captain of the *Kristin Alexis* that the company expected the air draft of the tow's highest component to be noted there (barge or towboat). The captain said that he completed the Short Voyage Plan, which he said, "basically asks about just the weather conditions, if we had assist boats, if we needed assist boats, information about the boat, like the height of the boat, the draft of the boat. Nothing about the tow." He and the pilot both indicated that they believed the space was for the air draft of the *Kristin Alexis*, although the port captain stated it was meant for the crane (the captain believed the air draft of the crane was 130 feet, but did not verify the accuracy of that number prior to getting under way).

The captain stated that Cooper had three different crane barges and he had pushed them several times with the *Kristin Alexis* one just a month prior to this accident. Further, the *Mr Ervin* had also been towed several times over the past five months. However, the Short Voyage Plan forms for all of the vessel's voyages for the past year showed the value for "air" to be 37 feet, the air draft of the vessel. This indicates that company captains did not understand that the crane's air draft value should be ascertained and entered as the maximum air draft for the tow. It does not appear that the company routinely reviewed the completed checklists and voyage planning forms to determine whether they were being filled out in accordance with company policy. Had the company conducted routine spot checks on the voyage forms, they would have known that the forms were being filled out incorrectly.

Additionally, when the pilot came on watch, he and the deckhands completed the Job Safety Briefing form and rated the accident transit as "amber," due to the restricted visibility and the time of day they were transiting (nighttime). In accordance with SMS policy, the pilot was required to contact the port captain, but he did not, since he stated that he believed he only needed to do so if the job was rated as "red." The NTSB concludes that the company was not adequately verifying that crews understood and implemented the SMS on board the vessel. The NTSB recommends that Marquette Transportation Company develop a detailed audit plan to verify that the bridge transit procedures and watch handovers are understood and effectively used by captains and pilots.

Investigators believe that proper voyage planning and accurate overhead clearance calculations would have shown that the west span was not transitable with the crane barge. In this accident, the captain and pilot relied on information provided by Rose Point electronic charting software, which relied on NOAA data and NOAA paper charts. The Rose Point software inaccurately indicated that both the channel and west spans of the Sunshine bridge had a vertical clearance of 132.9 feet (only the channel span was 132.9 feet). NOAA chart 11370 listed only one vertical clearance for the bridge (133 feet). The pilot assumed that the air draft of the crane barge was 130 feet and he would therefore have 2–2.9 feet of overhead clearance and could transit under the west span. A postaccident survey of the bridge showed that the minimum vertical clearance (given the river stage) was 153.32 feet for the channel span and 128.8 feet for the west span (about 7 feet lower than the reported crane barge's 136-foot air draft). Although the pilot stated that he was aware that the west span had a lower clearance, the information (the NOAA vertical clearance

provided in chart 11370 and Rose Point) that he was using to make decisions proved inaccurate. The NTSB concludes that the pilot erroneously assumed that the tow had sufficient overhead clearance to transit the west span because the vessel's electronic chart system did not reflect the actual minimum vertical clearance for that span of the Sunshine Bridge.

Rose Point uses NOAA data for their electronic charts. The NOAA chart for the Sunshine Bridge listed only one vertical clearance (132.9 feet). The Rose Point software displayed the only available NOAA value: 1) automatically on the span as the vessel approached the bridge, and 2) as queried by the Rose Point user for either span. As seen in this accident, this can be misleading to mariners. NOAA's "Nautical Chart Manual" requires that their charts include a clearance note for each span, placed "in close proximity to the bridges." However, the NTSB reviewed the available data for the Sunshine Bridge and other bridges with multiple spans on the Lower Mississippi River and found inconsistencies in the vertical clearances provided for all navigable spans. For example, the NOAA chart for the Hale Boggs Bridge at mile 121.6 on the Mississippi River showed separate vertical clearances for the two spans (132.9 feet for the main span and 116.8 feet for the auxiliary span), but the charts for the Huey P. Long Bridge at mile 106.1 and the Highway 190 Bridge at mile 233.9 (both have two spans) showed the vertical clearance for only the main spans. Therefore, the NSTB concludes that, contrary to NOAA guidance, when there are multiple navigable spans for a bridge, NOAA navigational charts do not consistently list vertical clearances for each span.

Navigational aids should provide mariners with a simple and precise way to navigate and not increase workload or cause confusion. Mariners would be better equipped with the correct information if all of the information was included on the chart and any additional data sources were clearly stated so as to "steer" the mariner to the map books, river gages, and/or other Corps of Engineers information. Given that the NOAA data (and therefore the Rose Point software that draws from it) showed only the higher clearance of the channel span of the Sunshine Bridge, the NOAA data alone did not allow for the accurate determination of the vertical clearance under the west span. Therefore, the NTSB recommends that NOAA review and update bridge data and charts to include vertical clearance information for all navigable bridge spans.

Findings

1. Prior to getting under way, the captain could have used his stop work authority to stop the transit until he was comfortable with the vessel and tow's configuration.
2. The company's voyage planning guidance was insufficient.
3. The captain and pilot did not complete a thorough watch handover, which could have identified the immediate risks/hazards along the vessel's route.
4. The company was not adequately verifying that crews understood and implemented the safety management system on board the vessel.
5. The pilot erroneously assumed that the tow had sufficient overhead clearance to transit the west span because the vessel's electronic chart system did not reflect the actual minimum vertical clearance for that span of the Sunshine Bridge.
6. Contrary to National Oceanic and Atmospheric Administration (NOAA) guidance, when there are multiple navigable spans for a bridge, NOAA navigational charts do not consistently list vertical clearances for each span.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the *Mr Ervin* crane barge striking the Sunshine Bridge was the inadequate voyage planning and watch turnover between the captain and pilot, resulting in the pilot transiting beneath the bridge's west span instead of its channel span. Contributing to the accident was the lack of company oversight. Also contributing to the accident was the charted information for the bridge used by the pilot, which did not reflect the actual vertical clearance of the west span.

Recommendations

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

To Marquette Transportation Company:

Develop a detailed voyage plan with specific information concerning/about all known risks, including calculated overhead clearance limitations for tows. (M-20-7)

Develop a detailed audit plan to verify that the bridge transit procedures and watch handovers are understood and effectively used by captains and pilots. (M-20-8)

To the National Oceanic and Atmospheric Administration:

Review and update bridge data and charts to include vertical clearance information for all navigable bridge spans. (M-20-9)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Member

THOMAS CHAPMAN
Member

Adopted: July 16, 2020

Vessel Particulars

Vessels	*Kristin Alexis*	*Mr Ervin*
Owner/operator	Marquette Transportation	Cooper Consolidated
Port of registry	Jefferson, Louisiana	Belle Chase, Louisiana
Flag	United States	United States
Type	Towing	Derrick/crane barge
Year built	1978	2003
Official number (US)	596468	1282567
IMO number	N/A	N/A
Classification society	Misc/general	Misc/general
Construction	Steel	Steel
Length	61.8 ft	191.1 ft
Draft	9.7 ft	14.5 ft
Beam/width	75 ft	75 ft
Tonnage	146 GRT	2,008 GRT
Engine power; manufacturer	2 x 1,440 hp, Caterpillar, each driving a single propeller	Non-self-propelled crane barge
Persons on board	6	0

NTSB investigators worked closely with our counterparts from Coast Guard Sector Baton Rouge, Louisiana, throughout this investigation.

For more details about this accident, visit www.ntsb.gov and search for NTSB accident ID DCA19FM003.