UNITED STATES COAST GUARD

Report of Investigation Into the Towing Vessel KRISTIN ALEXIS (O.N. 596468) and Crane Barge MR ERVIN (O.N. 1282567) Allision with the Sunshine Bridge Involving an Overhead Strike On October 12, 2018

MISLE Activity Number: 6560351

U.S. Department of Homeland Security

United States Coast Guard

Commandant
United States Coast Guard

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16732/IIA# 6560351
27 September 2022

THE ALLISION OF THE UNINSPECTED TOWING VESSEL KRISTIN ALEXIS' TOW, THE CRANE BARGE MR ERVIN, WITH THE SUNSHINE BRIDGE ON THE LOWER MISSISSIPPI RIVER NEAR DONALDSONVILLE, LA ON OCTOBER 11, 2018

ACTION BY THE COMMANDANT

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, and conclusions are hereby closed.

The investigation's safety recommendations remain under review and consideration by the responsible Coast Guard program offices. The response to the recommendations and any resultant actions will be documented separately.

[redacted]J. D. NEUBAUER
Captain, U.S. Coast Guard
Chief, Office of Investigations & Casualty Analysis (CG-INV)

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16732
July 21, 2020

TOWING VESSEL KRISTIN ALEXIS (O.N. 596468) AND CRANE BARGE MR ERVIN (O.N. 1282567) ALLISION WITH THE SUNSHINE BRIDGE INVOLVING AN OVERHEAD STRIKE

**ENDORSEMENT BY THE COMMANDER,
EIGHTH COAST GUARD DISTRICT**

The record, the report of investigation, and the endorsement by the convening Sector Commander have been carefully reviewed. The record and the report of investigation, including the findings of fact, analysis, conclusions, and recommendations, are approved, subject to the comments below. I recommend this marine casualty investigation be closed.

ENDORSEMENT ON RECOMMENDATIONS

Safety Recommendation 1: Electronic Sensors. Recommend Commandant establish and charter a formal working group to synchronize U.S. Government and other local/state/organizational entities' efforts to utilize and embrace eNavigation projects. Specifically, collaboration should be established with NOAA's program office for PORTS with Coast Guard Offices of CG-NAV, CG-BRG, NAVCEN, and also with USACE, U.S. Geological Survey, National Weather Service, and all other governmental offices that have electronic sensors available to provide information to mariners. This working group is necessary in order to have a collective and united front in advancing the use of technology within the marine transportation system. The PORTS program is up and running and seemingly favored and championed by most local port authorities and pilot associations. The USCG has also been beta-testing a "smart bridge" program on the western rivers with similar electronic sensors. I recommend a unity of effort to further standardize, synchronize, and provide a greater momentum and to avoid duplication of efforts. Getting this information in the wheelhouses and in the hands of the waterways users will be of great help in further reducing marine casualties, improving safety and gaining efficiencies in the marine transportation system. Broadcasting information via AIS (or other) signals, so that it be immediately available and viewable on systems like ECDIS or any Electronic Charting System would be of great value and needs to be a top priority.

Endorsement: I partially concur with this recommendation. The Coast Guard has a responsibility to ensure the safety of vessels operating on the Marine Transportation System (MTS), which in turn safeguards America's prosperity and security. New technology offers many opportunities to provide mariners with real time waterway information, which can enhance their decision making and prevent disruptions to the MTS. While the technology often exists, there are sometimes issues in identifying ways to make this information widely

available on a long term basis. I recommend Commandant (CG-5P) consider establishing a working group to synchronize public and private efforts to utilize, fund, resource and maintain eNavigation projects. Alternatively, I recommend Commandant (CG-5P) consider asking the National Navigation Safety Advisory Committee to examine this issue and provide recommendations to the Coast Guard.

Safety Recommendation 2: Vertical Clearance Gauges. Recommend Commandant require physical vertical clearance gauges be installed on all bridges. 33 CFR § 117.47 already grants authority to District Commanders to mandate these gauges for many drawbridges, however this should be expanded to capture all bridges over navigable waterways. 33 CFR § 118.160 appropriately describes the gauge particulars. If a gauge board was present on the Sunshine Bridge as noted in paragraph 4.6.2.3, it would have provided accurate and real-time information that would have alerted the Pilot on the KRISTIN ALEXIS of limitations and prevented him from transiting under the Sunshine Bridge. Given the upfront and reoccurring costs and other limitations with the PORTS system electronic sensors, we will likely never have all bridges fitted with those devices. But these physical clearance gauges will always provide the necessary data. It appears as if the regulatory structure already exists within 33 CFR Subchapter J to mandate this – each District office, through their representative Bridge Administrator, should work with bridge owners to implement it; I would suggest a 5 year phase in period to allow time to absorb the cost of implementation. European rivers have implemented an exemplary model similar to this that could be evaluated and implemented.

Endorsement: I concur with the intent of this recommendation. While the regulations do provide the District Commanders with the authority to require clearance gauges when necessary for reasons of safety of navigation, the benefits of installing a gauge on every bridge may not outweigh the costs. In the 15 years prior to this casualty, the Coast Guard did not record any overhead strikes at the Sunshine Bridge. The Eighth District Area of Responsibility includes 1,800 permitted bridges, and there are an average of nine overhead strikes each year. I recommend that Commandant (CG-5P) conduct a review of all Coast Guard overhead strike casualty investigations, in order to identify any common factors associated with the casualties and to determine possible measures to prevent future incidents.

Safety Recommendation 3: Chart Inconsistencies. Recommend Commandant establish a separate and distinct working group between USCG Office of CG-BRG, NOAA, LADOTD, and USACE Cartographers to collectively meet and review the issues identified in paragraph 4.6.1 and 5.7.1. It is very concerning that two U.S. Government mapping agencies, both producing charts of the same exact bridge have two completely different vertical clearances listed. This is confusing, distracting and dangerous to mariners. Of this joint working group, I recommend a standard baseline datum be identified for use when charting overhead clearances; NOAA currently uses the 1927 High Water Plan on the Lower Mississippi River and USACE uses a separate NGVD29 which is what the river gauges are set to.

In addition, not only have these agencies provided different charted values, but they end up with a two-foot disparity (133’ on NOAA chart and 135’ on USACE chart) for the calculated main channel minimum vertical clearance of the Sunshine Bridge. The NOAA Chart provides insufficient data for a mariner to calculate the real-time vertical clearance, taking into account current river stages; plus there is no information that actually describes that the available clearance information for the Sunshine Bridge is only for the main channel and not the entire bridge (alternate spans).

In addition to reviewing all of this, I recommend additional information like what is found in Figure 22 be added to the notes section of chart 11370, but also that Coast Pilot V be revised to discuss more of this information in detail. Figure 22 comes from the Sunshine Bridge file. A table similar to this should be added for both the Sunshine Bridge and the Huey P. Long Bridge in New Orleans, LA. Final information from this working group should be used to produce chart updates.

Endorsement: I partially concur with this recommendation. This investigation revealed how difficult it is to determine the real time vertical clearance for the Sunshine Bridge, and this is likely an issue throughout the country. The vertical clearance for any bridge is vital information, and it must be easy for mariners to calculate using a consistent method. It is my understanding that Commandant (CG-BRG) has already met with the National Oceanic and Atmospheric Association (NOAA), and has laid the groundwork for a working group. I recommend that Commandant (CG-5P) establish a joint working group with NOAA and the Army Corps of Engineers (ACOE) to establish a base measurement system for determining vertical bridge clearances on U.S. waterways. The District Eight Bridge Administration Branch Chief is available to chair this working group and/or participate in the working group. Once the group agrees on a standard system, the results could be documented in a Memorandum of Agreement.

Safety Recommendation 4: TSAC 13-10 Overhead Strike Study. Recommend Commandant review 33 CFR § Subchapter P – Ports and Waterways Safety, either in Towing of Barges or Navigation Safety Regulations (Parts 163 or 164) and/or possibly 46 CFR § Subchapter M – Towing Vessel Regulations for possible amendment. In that, it should be mandated that a vessel with a heightened air draft (e.g. crane barge, derrick, etc.) must have the maximum air draft permanently marked in a contrasting color, easily visible by the vessel pushing or towing it (or otherwise clearly posted in the towing vessel wheelhouse).
In addition, recommend Commandant review all items from TSAC Report 13-10 to determine if any other regulatory projects are appropriate for future rulemaking projects. The only noted changes originally made as a result of this TSAC Report and effectively implemented was an item that made it into the lengthy Subchapter M Towing Vessel Rule making process. It shows up in 46 CFR § 140.635 Navigation Assessment section had an item included that added the requirement to calculate air drafts relative to bridges, taking into account tides and river stages for the voyage.

Endorsement: I concur with the intent of this recommendation. I agree that maximum air draft markings for towing vessels and towed vessels with a heightened air draft, including crane barges and derricks, would provide an easy method of determining the height of the vessel prior to transit. However, I note that the Towing Safety Advisory Committee (TSAC) Air Draft Report 13-10 recommends that air draft information be addressed through the use of best practices in lieu of a regulatory change. I recommend that Commandant (CG-5P) consider drafting a Navigation and Vessel Inspection Circular (NVIC), policy letter, safety alert and/or a finding of concern to share the best practices listed in the TSAC Air Draft Report, Task 1 Paragraph C, Task 2 Paragraphs A and B, and Task 3 Paragraph A, with the owners/operators of all towing vessels and towed vessels with a heightened air draft.

Safety Recommendation 5: Navigation Operating Station [Bridge Visibility]. Recommend Commandant review 33 CFR § 164.15 for possible amendment to increase the scope of

applicability to include towing vessels. It is easy to regulate bridge visibility on a ship (a vessel greater than 1600 GT as the applicability states), but that is not the case on a towing vessel, as they could be moving, pushing, or assisting in an unlimited number of different barges and towing configurations. 33 CFR § 164.15 is exactly what was needed to prevent this casualty; however, a literal assessment of the applicability section would have one only apply this to vessels greater than 1600 GT. There are no regulations within Subchapter M for existing vessels that actually take you outside of the "boat" in this regard; meaning – there are no regulations that would prevent a towboat from pushing a crane barge that obstructed 100% of your view over an arc of 60 degrees of the horizon as was the case here. If necessary, caveats can be added that allow towing vessel operators to identify alternative solutions to mitigate risk. Those mitigating factors to allow for a safer operation in pushing large vessels that obstruct the operators view could be things like a combination of any or all of the following: placing an additional properly credentialed Pilot on the bow of the barge or otherwise in front of the object so you could see around it; using more than one towing vessel; or using remote cameras to see around the obstruction, employed in tandem with remotely placed radar scanners to avoid a blocked radar return; or some other equivalent risk mitigation scheme.

Endorsement: I concur with the intent of this recommendation. The visibility from the pilothouse of a towing vessel is a critical issue, especially when pushing a crane barge or a vessel with a tall or unusual configuration. While the provisions of 33 CFR 164.15 do not apply to most towing vessels, the towing vessel regulations, specifically 46 CFR 140.635, require the officer in charge of the navigational watch to consider the configuration of the vessel and tow, including handling characteristics and field of vision from the pilothouse in his navigational assessment before getting underway. Additionally, Rule 5 of the International Regulations for Prevention of Collision at Sea (COLREGS) and the Inland Navigation Rules both require a vessel to maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision. When the arc of visibility from the pilothouse of a towing vessel is obstructed by more than 60 degrees, as was the case prior to this casualty, the officer in charge of the navigational watch must identify alternative methods to make a full appraisal of the situation and the risk of collision. This could include, but is not limited to, using another towing vessel, placing another individual in front of the obstruction, or using remote cameras. I recommend that Commandant (CG-5P) consider drafting a finding of concern to remind towing vessel owners and operators of their responsibilities related to visibility under 46 CFR 140.635, the COLREGS and the Inland Navigation Rules.

Safety Recommendation 6: Voyage Planning. Recommend Commandant review 33 CFR § 164.80(c)(3) for amendment to remove the term "If any part of a towing vessel's intended voyage is seaward of the baseline (i.e. the shoreward boundary) of the territorial sea of the U.S., then the owner, master, or operator of the" be removed and replaced with "The owner, operator or master of any towing". This rule change will make the items of that paragraph (including items (i) through (ix)) applicable to any towing vessel. This rule is similar to the Navigation Assessment section, but is not entirely addressed in Subchapter M and will act to close that gap; 33 CFR § 164.80(c)(3) should not have originally been limited to vessels only going offshore (a boat is much more likely to have to navigate under a bridge on an inland passage than they would when traveling beyond the territorial sea baseline).

Endorsement: I do not concur with this recommendation. I agree that the requirements for a navigational assessment contained in 46 CFR Subchapter M do not exactly match the requirements for voyage planning in 33 CFR 164.80(c)(3). However, if the Subchapter M navigational assessment is properly completed with accurate information, then it should have the same effect as the voyage planning found in 33 CFR. This is consistent with the TSAC recommendation contained within the TSAC Air Draft Report 13-10, which states that the Subchapter M Navigational Watch Assessment would satisfy any voyage planning requirements for those vessels not already subject to voyage planning per 33 CFR 164.80. I recommend that Commandant (CG-5P) take no action on this recommendation.

Safety Recommendation 7: Mariner Training. Recommend Commandant perform a training needs assessment in order to determine if mariners seeking to obtain (or currently hold) any towing credential (Master, Mate/Pilot, or Steersman Apprentice) on Inland, Western Rivers or other routes, be required to have ECS training and a national credential endorsement. This would be something similar or otherwise equivalent to other training and qualification architectures already in place for things like ECDIS, RADAR Observer, or ARPA training, course approval, and credentialing – but this would be geared towards an ECS like Rose Point. If an ECS is onboard, the licensed operator should have training on its use. This training required should be approved by the NMC and delivered through approved training providers. Each approved course should be specific to each specific ECS manufacturer and created in collaboration with the manufacturer for accuracy of each system, and the course should include a voyage planning component, making full use of the ECS's capabilities.

Endorsement: I concur with the intent of this recommendation. I agree that if a towing vessel has an Electronic Charting System (ECS) onboard, then the licensed operators should have training on its use. The provisions of 46 CFR 15.405 already require a credentialed crew member to become familiar with the relevant characteristics of the vessel, which includes proper operation of the installed navigation equipment. However, there are a wide variety of ECS platforms available, and there are frequently new versions and new products introduced to the market, so it would be very difficult to produce approved ECS courses to cover every type of system. In the absence of individual ECS courses, towing vessel owners/operators and licensed mariners must take full advantage of the training, tools and instructions provided by the manufacturer in order to ensure the credentialed crew member is familiar with the ECS. I recommend that COMDT (CG-5P) consider drafting a finding of concern to remind vessel owners/operators and Third Party Organizations of the requirements to ensure that each credentialed crew member is familiar with the installed ECS and to document personnel training policies in the company's internal training program or Towing Safety Management System (TSMS).

Safety Recommendation 8: Company Specific SMS Training. Recommend Commandant review 33 CFR § Subchapter F – Vessel Operating Regulations (Part 96) and/or 46 CFR § Subchapter M – Towing Vessel Regulations (Part 140.515 and/or Part 138) for amendment to ensure this is written into company hiring processes to mandate that every newly employed credentialed mariner must undergo a thorough SMS training and evaluation period, before standing any solo officer in charge of navigational watch (Captain or Mate/Pilot). This would allow time necessary to become familiar with a company's safety management system before assuming control of a navigation watch. While this case was specifically involving towing companies, there is merit in applying this mandate to any company utilizing a SMS or TSMS.

Marquette Transportation implemented this recommendation fleet-wide following this casualty. They entered into a program with the Seaman's Church Institute to implement training school electronic technologies to provide training on their specific SMS, as well as ways to evaluate each employee with the pass/fail element associated. A similar process, either completed internal to a company or otherwise outside contracted should be considered.

Endorsement: I concur with the intent of this recommendation. Any new individual who is placed in charge of navigating a towing vessel, including the master, mate or pilot, should be required to demonstrate familiarity with company and/or safety management system procedures prior to assuming a solo watch. This is already required under 46 CFR 140.410(a), which points to 46 CFR 15.1105. This regulation requires any person serving as a part of the required crew complement to be familiar their duties and the vessel's arrangements, installations, equipment, procedures and characteristics. I recommend that Commandant (CG-5P) consider drafting a finding of concern to share with all towing vessel companies and third party organizations. This finding of concern could reiterate the importance of ensuring a master, mate, or pilot is familiar with company and/or safety management system procedures prior to assuming a solo watch. It could also provide Marquette's post casualty training efforts as an example of a best practice related to this topic.

Enforcement Recommendation 1: Recommend referral for enforcement actions to Sector New Orleans against the Master of the KRISTIN ALEXIS for possible Misconduct and Violation of Law/Regulation Suspension and Revocation (S&R) charges, as noted in paragraph 5.2.1 and 5.2.2 above.

Endorsement: I concur with this recommendation. I note that Sector New Orleans intends to pursue enforcement action against the mariner, as documented in their endorsement.

Enforcement Recommendation 2: Recommend referral for enforcement actions to Sector New Orleans against the Pilot of the KRISTIN ALEXIS for possible Negligence, Misconduct, and Violation of Law/Regulation charges, as noted in paragraph 5.2.3, 5.2.4, and 5.2.5 above.

Endorsement: I concur with this recommendation. I note that Sector New Orleans intends to pursue enforcement action against the mariner, as documented in their endorsement.

Administrative Recommendation 1: Recommend that this Report of Investigation be shared with all shipyards that construct crane barges and/or other vessels comprised of derricks or other heightened air drafts, along with their representative industry trade groups of that segment of industry to spread awareness of these issues.

Endorsement: I concur with this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents in the future. I recommend Commandant (CG-5P) evaluate the most expedient way to release this report to shipyards and industry trade groups that are associated with crane barges, derricks or other vessels with heightened air drafts, and take action, as appropriate.

Administrative Recommendation 2: Recommend that this Report of Investigation be shared with all marine construction, repair, stevedoring, and other similar companies along with their representative industry trade groups that operate crane barges or other vessels with a heightened air draft.

Endorsement: I concur with this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents in the future. I recommend Commandant (CG-5P) evaluate the most expedient way to release this report to marine construction, repair, stevedoring, and other similar companies that are associated with crane barges, derricks or other vessels with heightened air drafts, and take action, as appropriate.

Administrative Recommendation 3: Recommend this report, associated endorsements and final action memo be shared on the Coast Guard's Maritime Commons blog and also shared with other media and social outlets or trade publications for widest dissemination to the public.

Endorsement: I concur with this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents in the future. I recommend Commandant (CG-5P) evaluate the most expedient way to release this report to the public, and take action, as appropriate.

Administrative Recommendation 4: Recommend that this investigation be closed.

Endorsement: I concur with this recommendation.

[redacted]
J.P. NADEAU
Rear Admiral, U.S. Coast Guard
Commander, Eighth Coast Guard District

Enclosure: Investigating Officer's Report 16732 dtd August 16, 2019

Copy: Commander, Coast Guard Atlantic Area (LANT-54)
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16732
November 21, 2019

REPORT OF INVESTIGATION INTO THE TOWING VESSEL KRISTIN ALEXIS (O.N. 596468) AND CRANE BARGE MR ERVIN (O.N. 1282567) ALLISION WITH THE SUNSHINE BRIDGE INVOLVING AN OVERHEAD STRIKE ON OCTOBER 12, 2018

ENDORSEMENT BY OFFICER IN CHARGE MARINE INSPECTIONS SECTOR NEW ORLEANS

The record and the report of the investigation convened for the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments. It is recommended that this marine casualty investigation be closed.

COMMENTS ON THE REPORT

1. The overhead allision between the towing vessel KRISTIN ALEXIS with barge MR ERVIN and the Sunshine Bridge was a preventable accident. The incident impacted over 25,000 commuters daily and was of high media interest for several months. The investigation, report, and recommendations contain invaluable information which can be used to address casual factors, make changes, and potentially prevent similar incidents from occurring in the future.

2. Thank you to the members of the investigative team for their extensive efforts. This has been identified as the first Sector-level formal investigation since the Coast Guard's inclusion into the Department of Homeland Security. The investigation included a public hearing, of which video and audio was broadcasted online, ensuring the public's access to the proceedings.

3. The investigation identified several inconsistencies with published charting information, datum and bridge clearances. These inconsistencies have created additional challenges for mariners conducting navigational planning on federal navigable waterways. The creation of a working group containing key cartography agencies and the Coast Guard could help eliminate inconsistences in information that is provided to mariners.

4. The goal is to create the safest waterway possible to allow mariners and maritime organizations the ability to maximize their abilities to transit our waterways safely. The implementation of new electronic vertical clearance sensors on bridges would allow for real time information sharing to mariners and help improve the Maritime Transportation System.

ENDORSEMENT/ACTION ON RECOMMENDATIONS (if required)

Safety Recommendation 1. Electronic Sensors. Recommend Commandant establish and charter a formal working group to synchronize U.S. Government and other local/state/organizational entities' efforts to utilize and embrace eNavigation projects. Specifically, collaboration should be established with NOAA's program office for PORTS with Coast Guard Offices of CG-NAV, CG-BRG, NAVCEN, and also with USACE, U.S. Geological Survey, National Weather Service, and all other governmental offices that have electronic sensors available to provide information to mariners. This working group is necessary in order to have a collective and united front in advancing the use of technology within the marine transportation system. The PORTS program is up and running and seemingly favored and championed by most local port authorities and pilot associations. The USCG has also been beta-testing a "smart bridge" program on the western rivers with similar electronic sensors. I recommend a unity of effort to further standardize, synchronize, and provide a greater momentum and to avoid duplication of efforts. Getting this information in the wheelhouses and in the hands of the waterways users will be of great help in further reducing marine casualties, improving safety and gaining efficiencies in the marine transportation system. Broadcasting information via AIS (or other) signals, so that it be immediately available and viewable on systems like ECDIS or any Electronic Charting System would be of great value and needs to be a top priority.

Endorsement: I concur with this recommendation. The District Commander has released his Strategic Plan and the use of electronic sensors aligns with it.

Safety Recommendation 2. Vertical Clearance Gauges. Recommend Commandant require physical vertical clearance gauges be installed on all bridges. 33 CFR § 117.47 already grants authority to District Commanders to mandate these gauges for many drawbridges, however this needs to be expanded to capture all bridges over navigable waterways. 33 CFR § 118.160 appropriately describes the gauge particulars. If a gauge board was present on the Sunshine Bridge as noted in paragraph 4.6.2.3, it would have provided accurate and real-time information that would have prevented the Pilot on the KRISTIN ALEXIS from transiting under the Sunshine Bridge. Given the upfront and reoccurring costs and other limitations with the PORTS system electronic sensors, we will likely never have all bridges fitted with those devices. But these physical clearance gauges will always provide the necessary data. It appears as if the regulatory structure already exists within 33 CFR Subchapter J to mandate this – each District office, through their representative Bridge Administrator, should work with bridge owners to implement it; I would suggest a 5 year phase in period to allow time to absorb the cost of implementation. European rivers have implemented a good model for this that could be evaluated.

Endorsement: I concur with the intent of this recommendation. The implementation of fixed vertical Clearance Gauges on bridges over navigable waterways would be considered a low cost option when compared to electronic sensors. However, 33 CFR § 117 encompasses drawbridge operations regulations. The Sunshine Bridge and several other bridges in the District's area of responsibility do not meet this definition and therefore would not be subject to 33 CFR § 117. The implementation of the gauges may fall under 33 CFR 118.160(a) as it states "when necessary for reasons of safety of navigation, the District Commander may

require or authorize the installation of clearance gauges..." So if a history of overhead allisions is established for a particular bridge, then the District Commander has the option to require the installation of clearance gauges. I recommend an evaluation be conducted by District DPW into overhead allisions and which bridges would benefit from implementation of vertical clearance gauges.

Safety Recommendation 3. Chart Inconsistencies. Recommend Commandant establish a separate and distinct working group between USCG Office of CG-BRG, NOAA, LADOTD, and USACE Cartographers to collectively meet and review the issues identified in paragraph 4.6.1 and 5.7.1. It is very concerning that two U.S. Government mapping agencies, both producing charts of the same exact bridge have two completely different vertical clearances listed. This is both confusing and distracting to a mariner. Of this joint working group, I recommend a standard baseline datum be identified for use when charting overhead clearances; NOAA currently uses the 1927 High Water Plan on the Lower Mississippi River and USACE uses a separate NGVD29 which is what the river gauges are set to.

In addition, not only have these agencies provided different charted values, but they end up with a two-foot disparity (133' on NOAA chart and 135' on USACE chart) for the calculated main channel minimum vertical clearance of the Sunshine Bridge. The NOAA Chart provides insufficient data for a mariner to calculate the real-time vertical clearance, taking into account current river stages; plus there is no information that actually describes that the available clearance information for the Sunshine Bridge is only for the main channel and no the entire bridge (alternate spans).

In addition, I recommend additional information like what is found in Figure 22 be added to the notes section of chart 11370, but also that Coast Pilot V be revised to discuss more of this information in detail. Figure 22 comes from the Sunshine Bridge file. A table similar to this should be added for both the Sunshine Bridge and the Huey P. Long Bridge in New Orleans, LA. Final information from this working group should be used to produce chart updates.

Endorsement: I concur with this recommendation. A working group should be established to ensure that the most accurate and consistent information is being provided mariners.

Safety Recommendation 4. TSAC 13-10 Overhead Strike Study. Recommend Commandant amend 33 CFR § Subchapter P – Ports and Waterways Safety, either in Towing of Barges or Navigation Safety Regulations (Parts 163 or 164) and/or possibly 46 CFR § Subchapter M – Towing Vessel Regulations. In that, it should be mandated that a vessel with a heightened air draft (e.g. crane barge, derrick, etc.) must have the maximum air draft permanently marked in a contrasting color, easily visible by the vessel pushing or towing it (or otherwise clearly posted in the towing vessel wheelhouse).

In addition, recommend Commandant review all items from TSAC Report 13-10 to determine if any other regulatory projects are appropriate for future rulemaking projects. The only noted changes originally made as a result of this TSAC Report and effectively implemented was an item that made it into the lengthy Subchapter M Towing Vessel Rule making process. It shows up in 46 CFR § 140.635 Navigation Assessment section had an item included that added the

requirement to calculate air drafts relative to bridges, taking into account tides and river stages for the voyage

Endorsement: I concur with this recommendation. The Towing Safety Advisory Committee provided an excellent report into solutions to prevent overhead allisions. Amending 33 CFR § Subchapter P to require air draft be marked on vessels with heightened air draft would be beneficial to mariners navigating with pushing or towing vessels with large air drafts. This may have prevented some of the uncertainty associated with the crewmembers regarding the height of the MR ERVIN. I recommend Commandant review all items from TSAC Report 13-10 to determine if any other regulatory projects are appropriate for future rulemaking projects.

Safety Recommendation 5. Navigation Operating Station [Bridge Visibility]. Recommend Commandant amend 33 CFR § 164.15 to increase the scope of applicability to include towing vessels. It is easy to regulate bridge visibility on a ship (a vessel greater than 1600 GT as the applicability states), but that is not the case on a towing vessel, as they could be moving, pushing, or assisting in an unlimited number of different barges and towing configurations. 33 CFR § 164.15 is exactly what was needed to prevent this casualty; however, a literal assessment of the applicability section would have one only apply this to vessels greater than 1600 GT. There are no regulations within Subchapter M for existing vessels that actually take you outside of the "boat" in this regard; meaning – there are no regulations that would prevent a towboat from pushing a crane barge that obstructed 100% of your view over an arc of 60 degrees of the horizon as was the case here. If necessary, caveats can be added that allow towing vessel operators to identify alternative solutions to mitigate risk. Those mitigating factors to allow for a safer operation in pushing large vessels that obstruct the operators view could be things like a combination of any or all of the following: placing an additional properly credentialed Pilot on the bow of the barge or otherwise in front of the object so you could see around it; using more than one towing vessel; or using remote cameras to see around the obstruction, used in tandem with remotely placed radar scanners to avoid a blocked return; or some other equivalent risk mitigation scheme.

Endorsement: I concur with the intent of this recommendation. The goal of this recommendation is to have mariners take into consideration their field of view when conducting a navigational assessment and undertake appropriate mitigations to ensure safe transit, such as lookouts, CCTVs, or additional towing vessels. This is located in 46 CFR Subchapter M § 140.635(11), the navigational assessments must consider "configuration of the vessel and tow, including handling characteristics, field of vision from pilothouse, and activities taking place onboard". There is nothing in subchapter M establishing a minimum field of vision from the pilothouse, however it is to be considered and addressed by the officer in charge of the towing vessel.

Safety Recommendation 6. Voyage Planning. Recommend Commandant amend 33 CFR 164.80(c)(3) to remove the term "*If any part of a towing vessel's intended voyage is seaward of the baseline (i.e. the shoreward boundary) of the territorial sea of the U.S., then the owner, master, or operator of the*" be removed and replaced with "*The owner, operator or master of any towing*". This rule change will make the items of that paragraph (including items (i) through (ix)) applicable to any towing vessel. This rule is similar to the Navigation Assessment section,

but is not entirely addressed in Subchapter M and will act to close that gap; 33 CFR 164.80(c)(3) should not have been limited to vessels only going offshore (a boat is much more likely to have to navigate under a bridge on an inland passage than they would when traveling beyond the territorial sea baseline).

Endorsement: I do not concur with this recommendation. 46 CFR Subchapter M has an established navigational assessment section, 46 CFR § 140.635, and additional amendments to 33 CFR is not required in this case.

Safety Recommendation 7. Mariner Training. Recommend Commandant perform a training needs assessment in order to determine if mariners seeking to obtain (or currently hold) any towing credential (Master, Mate/Pilot, or Steersman Apprentice) on Inland, Western Rivers or other routes, be required to have ECS training and a national credential endorsement. This would be something similar or otherwise equivalent to other training and qualification architectures already in place for things like ECDIS, RADAR Observer, or ARPA training, course approval, and credentialing – but this would be geared towards an ECS like Rose Point. If an ECS is onboard, the licensed operator should have training on its use. This training required should be approved by the NMC and delivered through approved training providers. Each approved course should be specific to each specific ECS manufacturer and created in collaboration with the manufacturer for accuracy of each system, and the course should include a voyage planning component, making full use of the ECS's capabilities.

Endorsement: I concur with this recommendation. NMC should consider conducting a performance training needs assessment to determine whether or not knowledge of ECS should be a requirement for licensing.

Safety Recommendation 8. Company Specific SMS Training. Recommend Commandant amend 33 CFR § Subchapter F – Vessel Operating Regulations (Part 96) and/or 46 CFR § Subchapter M – Towing Vessel Regulations (Part 140.515 and/or Part 138) to ensure this is written into company hiring processes to mandate that every newly employed credentialed mariner must undergo a thorough SMS training and evaluation period, before standing any solo officer in charge of navigational watch (Captain or Mate/Pilot). This would be to allow time necessary to become familiar with a company's safety management system before assuming control of a navigation watch. While this case was specifically involving towing companies, there is merit in applying this mandate to any company utilizing a SMS or TSMS.

Marquette Transportation implemented this recommendation fleet-wide following this casualty. They entered into a program with the Seaman's Church Institute to implement training school electronic technologies to provide training on their specific SMS, as well as ways to evaluate each employee with the pass/fail element associated. A similar process, either completed internal to a company or otherwise outside contracted should be considered.

Endorsement: I partially concur with this recommendation. While SMS training should be a part of any new hire training and orientation process, we do not want to eliminate the ability of companies to hire experienced contract pilots/masters quickly, if they find themselves in crewmember shortage situation.

Enforcement Recommendation 1. Recommend referral for enforcement actions to Sector New Orleans against the Master of the KRISTIN ALEXIS for possible Misconduct and Violation of Law/Regulation Suspension and Revocation (S&R) charges, as noted in paragraph 5.2.1 and 5.2.2 above.

Endorsement: I concur with this recommendation. The investigation determined there is evidence the master of the KRISTEN ALEXIS may have committed violations of Misconduct and Violation of Law/Regulations

Action: Sector New Orleans will pursue administrative enforcement actions against the mariner's credential.

Enforcement Recommendation 2. Recommend referral for enforcement actions to Sector New Orleans against the Pilot of the KRISTIN ALEXIS for possible Negligence, Misconduct, and Violation of Law/Regulation charges, as noted in paragraph 5.3.1, 5.3.2, and 5.3.3 above.

Endorsement: I concur with this recommendation. The investigation determined there is evidence the pilot of the KRISTEN ALEXIS may have committed violations of Negligence, Misconduct and Violation of Law/Regulations.

Action: Sector New Orleans will pursue administrative enforcement actions against the mariner's credential.

Administrative Recommendation 1. Recommend that this Report of Investigation be shared with all shipyards that construct crane barges and/or other vessels comprised of derricks or other heightened air drafts, along with their representative industry trade groups of that segment of industry to spread awareness of these issues.

Endorsement: I concur with the intent of this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents from occurring in the future. I recommend Commandant evaluate the most expedient way to release all, or part of, this report to the public, and take appropriate actions based on that evaluation.

Administrative Recommendation 2. Recommend that this Report of Investigation be shared with all marine construction, repair, stevedoring, and other similar companies along with their representative industry trade groups that operate crane barges or other vessels with a heightened air draft.

Endorsement: I concur with the intent of this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents from occurring in the future. I recommend Commandant evaluate the most expedient way to release all, or part of, this report to the public, and take appropriate actions based on that evaluation.

Administrative Recommendation 3. Recommend this report, associated endorsements and final action memo be shared on the Coast Guard's Maritime Commons blog and also shared with other media and social outlets or trade publications for widest dissemination to the public.

Endorsement: I concur with the intent of this recommendation. This report provides important information and recommendations which could be used to prevent similar incidents from occurring in the future. I recommend Commandant evaluate the most expedient way to release all, or part of, this report to the public, and take appropriate actions based on that evaluation.

Administrative Recommendation 4. Recommend that this investigation be closed.

Endorsement: I concur with this recommendation.

[redacted]

K. M. LUTTRELL
Captain, U. S. Coast Guard
Sector Commander, Sector New Orleans

Enclosure: Investigating Officer's Report

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LIST OF ACRONYMS

ABS	American Bureau of Shipping
AIS	Automatic Identification System
ATON	Aids to Navigation
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Register
COI	Certificate of Inspection (Issued by USCG to a commercial vessel)
CWO	Chief Warrant Officer
eATON	Electronic Aids to Navigation
eNavigation	Electronic Navigation
ECS	Electronic Charting System
ECDIS	Electronic Charting and Display Systems
ENC	Electronic Navigation Chart
GPS	Global Position System
HWP 1927	High Water Plane of 1927
ITV	Inspected Towing Vessel
LADOTD	Louisiana Department of Transportation and Development
LCDR	Lieutenant Commander
LT	Lieutenant
MHW	Mean High Water
MLW	Mean Low Water
NMC	National Maritime Center – a USCG Office charged with issuing credentials
NOAA	National Oceanic Atmospheric Administration
NTSB	National Transportation Safety Board
NVIC	Navigation and Vessel Inspection Circular, guidance issued by USCG
PII	Parties in Interest
PORTS	Physical Oceanographic Real Time System (a NOAA Program)
S&R	Suspension and Revocation
SMS	Safety Management System
SOLAS	International Convention for the Safety of Life at Sea
TPI	Tons per Inch Immersion
TPO	Third Party Organization, referenced from 46 CFR Subchapter M
TSAC	Towing Safety Advisory Committee
TVNCOE	Towing Vessel National Center of Expertise, a USCG Office
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
UTV	Uninspected Towing Vessel
VHF-FM	Very High Frequency – Frequency Modulation radio voice communication
VHF-DSC	Very High Frequency – Digital Selective Calling voice and data communication
VTS	Vessel Traffic Service

LIST OF FIGURES

Glossary of Terms

Air Draft – A term used to describe the vertical distance from the top of a vessel's highest point down to the waterline.

Air Gap – The remaining distance below the lowest portion of the bridge or obstruction being transited under to the highest point of the vessel. This is the amount of space or clearance left between the vessel and the overhead obstruction (found by taking the bridge's vertical clearance and subtracting air draft).

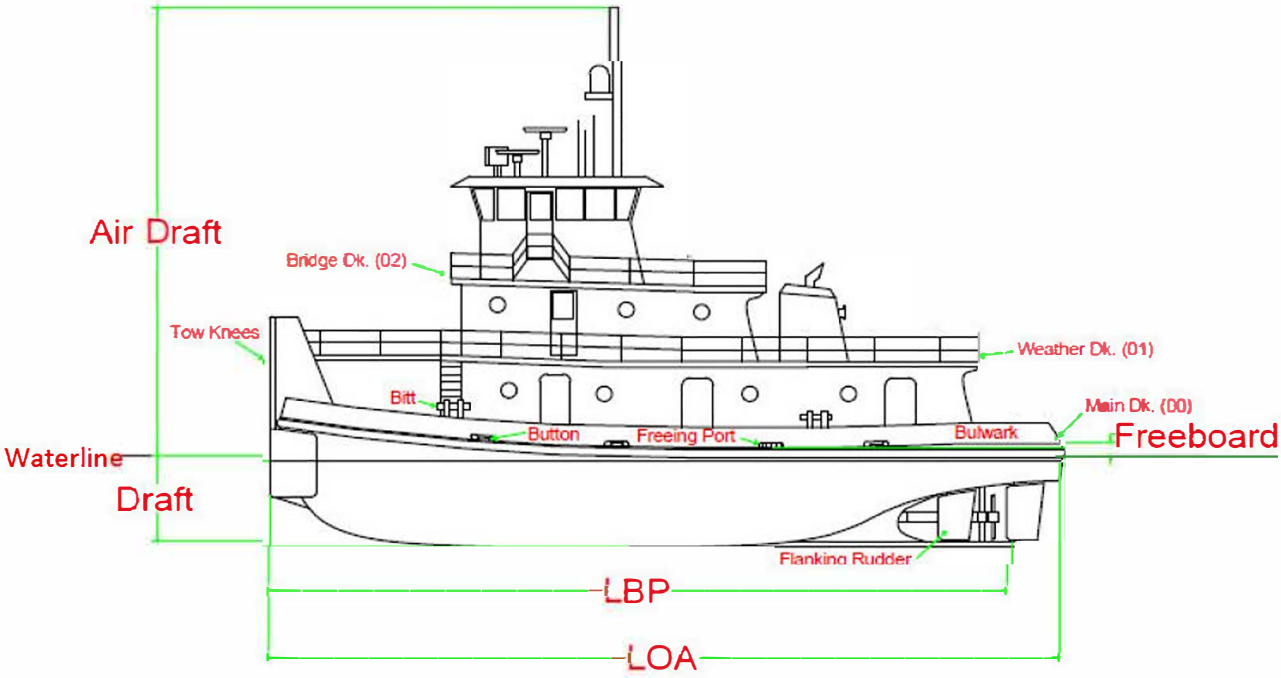

Figure 1. Image showing how the different measurements of a towing vessel are taken.
Source: TSAC Report 13-10.

AIS – An electronic navigation aid that assists in collision avoidance and can have inputs to electronic charting systems to help mariners identify what vessels are operating in the area.

Allision – Striking or hitting or running into a fixed object (separate and distinct from a collision, which would be when two moving objects run into each other).

Breast Line – A specific mooring line placement used when securing a vessel to a dock or fleeting area. This line generally extends from one vessel to an adjacent vessel or dock and runs athwart ship or perpendicular to the fore and aft aspect of the ship or barge.

Bridge Height or Vertical Clearance – The distance from the waterline to the lowest portion of the bridge or overhead obstruction. In the case of a bridge, this is the point of "lowest steel" over the entire width of the permitted span of which you can navigate.

Button – A secure fixture or deck fitting on a barge or vessel that is used to secure a wire rope or other line to. It is in a circular shape and has a recessed edge to help keep the wire from slipping off the top.

Captain – See Master.

Cartography – The production of maps or charts, including construction of projections, design, compilation, drafting, and reproduction.

Cavel or Kevel – A secure fixture or deck fitting on a barge or other vessel used to tie off a mooring line or other soft line to. It is the general shape of a cleat, however normally bigger.

Class Society -or- Classification Society – A Recognized Organization as defined by SOLAS, is generally a member of the International Association of Class Societies (IACS), and can be authorized to perform certain functions on behalf of the nation to which a vessel is registered.

Down river or down bound – Generally referring to the direction of the travel. For example, a vessel that travels with the current of the Mississippi River is said to be traveling down river.

Eddy – Defined as a current at variance from the main current in a stream of liquid. In this case, the Mississippi River has various currents and eddies that differ from the main downstream current of the flow of the river.

Face Wires – Wires coming from the towboat that securely connect it to the barges making up the tow. These facing wires are generally connected by a power winch, which can typically be operated either locally on the deck or remotely from the Pilothouse of the towboat.

Facing Up – The process where a towboat comes along the stern of the barge to become securely connected. To be faced up means to be securely connected to the barge(s) being pushed.

Flanking Rudders – These rudders, positioned forward of the propellers, assist the operator in maintaining directional control of the tow when operating astern propulsion. They help to control the thrust and direction of the vessel and allow the boat to maintain control.

Fleet Boat – A type inland river towboat used or intended to operate in a fleeting area in order to help make or break larger tows, and to move barges in and around a fleet or local facility.

Free Surface Effect – It is a dynamic force felt by a vessel that drastically impacts its stability. Free surface is a mechanism which can cause a vessel to become unstable and capsize and refers to the tendency of liquids or other substances to move in response to changes in condition. This effect is minimized when a tank is either nearly full or empty.

Freeboard – The measurement of a vessel from the waterline, up to the edge of the uppermost continuous deck or “main deck”; sometimes referred to as reserve buoyancy.

GPS – A satellite-based position fixing device that helps mariners to safely navigate their vessels.

Left Descending Bank – A way of determining location and orientation as you travel down river. In the case of the Mississippi River and its many bends and turns, you may not be heading in an easily describable compass direction. In simple terms, this is the bank that is on the left side of the vessel while the boat is traveling down river.

Levee – A man-made embankment to prevent river flooding and protect surrounding areas.

Line Haul Boat – A larger towing vessel with greater horsepower designed and intended to take larger tow sizes on longer routes.

Master – The Master of a vessel is the person in charge, and ultimately responsible for the safety of the crew, vessel(s), and cargo. A Master will hold a Merchant Mariner Credential issued by the U.S. Coast Guard for a specific rating and a specific type and/or size vessel. The term Master can be synonymous with the term Captain. For the purposes of this investigation, both the Master and Pilot of the KRISTIN ALEXIS held the same level credential that allowed them both to legally be the Captain of the vessel, however the company chose who served in what capacity.

Midstream Facility – A ship or sometimes barge facility that consists of little more than a few mooring buoys, located away from the dock/river bank but outside of the shipping channel.

Pilot – This term refers to a person who holds a USCG issued merchant mariner credential of a specific capacity. On the western rivers, this person is a crewmember who is second in command on the vessel and is in charge of their own watch. On the KRISTIN ALEXIS, the Captain and Pilot alternated standing 12-hour long watches. On other types of vessels, including ocean going ships, this credential or position would be referred to as a Mate. 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. NOTE: the term Mate on the Western Rivers generally refers to a lead/senior deckhand, not a licensed wheelhouse position.

Port Captain – A Company shore-side management employee, generally filled by an experienced towboat Captain and manages several boats in his/her fleet. They are the shore side representative for a boat, and generally the evaluator and supervisor of a boat Captain.

Port Side – The left side of a vessel when viewing the vessel from onboard, looking forward.

RADAR – Short for radio detection and ranging, it is an electronic navigation aid used for detecting the presence, direction, distance of ships or other objects by sending out pulses of high-frequency radio waves that are reflected off the object back to the source antenna scanner.

Revetment – A process of providing bank protection from the highly erosive nature of the Mississippi River. Revetment is normally made of rock or concrete mat lined along the inner portions of the levee to keep them strong and able to continue performing their function.

Right Descending Bank - A way of determining location and orientation as you travel down river. In the case of the Mississippi River and its many bends and turns, you may not be heading in an easily describable compass direction. If you refer to the constant flow of water from upriver to down river, you will always be able to determine which side you are referencing.

River Gauge – A system or measuring device used to determine the river stage. For purposes of this investigation, the river gauge referred to was located at Donaldsonville, LA.

River Stage – How high the river is at a certain point or location. For purposes of this investigation, we refer to the river stage recorded at the Donaldsonville river gauge.

Rose Point – Rose Point Navigation Systems© has become a common place electronic charting system used on towing vessels. It is a navigation tool that has many different overlays and inputs

to help a mariner safely navigate, including things like electronic charts, global positioning signals (GPS), automatic identification system (AIS) inputs, and more.

Soft Line – A line used to moor vessels up. Generally, this will be made from some sort of natural or synthetic material.

Spring line - A specific mooring line placement used when securing a vessel to a dock or fleeting area. This line generally goes from one vessel to an adjacent vessel or dock and some sort of fore and aft lead relative to the aspect of the vessel. This line will help to reduce any fore and aft surge at the dock.

Starboard Side – The right side of a vessel when viewing the vessel from onboard, looking forward.

Steering Rudder – This term refers to the rudders seen on most common vessels, generally a barn door type of appendage affixed behind the propeller that allows the operator to turn and control the direction of the boat and tow.

Stem the Current – A process of holding position facing into the direction of the current, but not making any forward way or progress over the ground. Essentially, being stopped, but still underway and in the river.

Stevedore – A person (or company) employed to load and unload cargo from ships or barges.

Sticks – On an inland river towboat, there generally is no steering wheels; it is a series of levers used to control the various steering or flanking rudders. Also, it is a term used to describe the licensed person operating a vessel "at the sticks".

Time Charter – A legal contract between two parties. It is the hiring of a vessel for a specific length of time where the owner or operator of the boat still manages the vessel, but the charterer can select where the vessel operates.

Tub – In the case of this investigation, the tub refers to the large cylindrical crane pedestal portion of the barge MR ERVIN that the crane is mounted to.

Upriver or up bound – Generally referring to the direction of travel. A vessel that travels upstream against the current of the Mississippi River is said to be traveling upriver.

Voyage Plan – A voyage plan or passage plan is an electronic or paper description of a vessel's voyage from start to finish that is developed by vessel personnel and approved by the Master. The plan includes leaving the dock and harbor area, the en route underway portion of a voyage, approaching the destination, and mooring and could be described as "berth to berth". Additionally, it includes how to determine dangers to navigation like river stages, bridge heights, air drafts, and other procedures critical to complete a safe transit.

Wheelhouse –or– Pilothouse – The operating station or upper deck of the towing vessel from where the Pilot or Captain navigate and control the vessel.

Wire – Wire rope is used to secure things together, like a barge to the dock or the towboat to the barge.

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16732
August 16, 2019

Report of Investigation into the Towing Vessel KRISTIN ALEXIS (O.N. 596468) and Crane Barge MR ERVIN (O.N. 1282567) Allision with the Sunshine Bridge Involving an Overhead Strike on October 12, 2018 on the Mississippi River, Mile 167.5

EXECUTIVE SUMMARY

On October 11, 2018, the towing vessel KRISTIN ALEXIS was performing barge fleeting work at the Convent Marine Terminal (CMT) at mile marker 161.5 on the Lower Mississippi River. At approximately 11:00pm, the KRISTIN ALEXIS received orders from the Cooper Consolidated dispatcher to move the crane barge MR ERVIN upriver to the Darrow fleeting area at mile 175. Approximately twenty minutes later, the KRISTIN ALEXIS proceeded towards Darrow with the MR ERVIN in tow. During the transit, MR ERVIN's crane boom was securely stowed in the down position. The winds were light with clear skies, and the gage reading at the Donaldsonville gauge was 18.37 feet. The vessel's transit would require passing underneath the Louisiana Highway 70 Sunshine Bridge, located at mile marker 167.5 on the Lower Mississippi River.

The Sunshine Bridge was designed in the late 1950s and opened to highway traffic in 1964. It is currently owned and operated by the State of Louisiana's Department of Transportation and Development (LADOTD). The bridge is one of the few Mississippi River crossings in this region, and connects Donaldsonville on the West bank with Sorrento to the East. According to the information published in the NOAA Coast Pilot and Nautical Chart, the bridge has a 750-foot-wide horizontal clearance and 133-foot-high vertical clearance.

The KRISTIN ALEXIS, pushing the MR ERVIN ahead with a 136 foot high air draft, navigated up bound maintaining a close transit on the West side of the river on the right descending bank. This segment of the river has heavy commercial traffic and is surrounded by levees on both sides, many of those areas further protected by revetment. As the tow approached the Sunshine Bridge, the river Pilot on watch directing the control of the towboat made passing arrangements with the down bound towing vessel NEDRA K, pushing a tow consisting of 11 barges. The NEDRA K took the main span of the bridge, while the Pilot on the KRISTIN ALEXIS purposefully decided to continue with the trip under the West span. The vessels met without incident below the bridge.

The initiating event of the accident occurred a few minutes later at 1:42am on October 12th, 2018 when the Pilot directing the movement of the KRISTIN ALEXIS caused an unintended allision of the bridge. The highest part of MR ERVIN's structure hit the overhead deck of the bridge above and became lodged in place under the bridge. The crane impacted the lowest horizontal chord and lateral braces of the alternate West span of the Sunshine Bridge and had the potential to cause a catastrophic collapse. As a result of the damage, the bridge was closed to all vehicular traffic for 49 days in order to conduct emergency repairs. The bridge partially reopened to highway traffic on December 1st, 2018. Final repairs were completed on March 22nd, 2019 and resulted in approximately $4 million in damage to the Sunshine Bridge.

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Report of Investigation into the Towing Vessel KRISTIN ALEXIS (O.N. 596468) and Crane Barge MR ERVIN (O.N. 1282567) Allision with the Sunshine Bridge Involving an Overhead Strike on October 12, 2018 on the Mississippi River, Mile 167.5

INVESTIGATING OFFICER'S REPORT

1. Preliminary Statement

1.1. This marine casualty investigation was conducted, and this report was submitted in accordance with Title 46, Code of Federal Regulations (CFR), § 4.07, and under the authority of Title 46, United States Code (USC) Chapter 63. Under 46 U.S.C. § 6308, no part of a report of a marine casualty investigation, including findings of fact, opinions, recommendations, deliberations, or conclusions, shall be admissible as evidence or subject to discovery in any civil or administrative proceedings, other than an administrative proceeding initiated by the United States.

1.2. The Lead Investigating Officer was Commander Matthew Meskun, United States Coast Guard Atlantic Area, Office of Inspections and Investigations, LANT-541. The assistant Investigating Officer was [redacted] from Coast Guard Marine Safety Unit Baton Rouge, Louisiana. The investigation's recorder was [redacted] from Coast Guard Sector New Orleans, and the legal advisor was [redacted], Coast Guard Investigation's National Center of Expertise. Technical Advisors to the investigation team were: Mr. [redacted], and [redacted], also from the Investigations National Center of Expertise. The media liaison was [redacted] from Coast Guard Sector New Orleans.

1.3. The following organizations were designated as Parties-in-Interest (PII) in this investigation: Marquette Transportation Company, Gulf-Inland, LLC, as the towing vessel's owner and operator; Cooper Consolidated, as the crane barge owner and operator.

1.4. The joint investigation team held a single 6-day long public hearing session in Gonzales, Louisiana beginning May 6, 2019 at Ascension Parish's Lamar Dixon Expo Center. During that time, 23 witnesses were called to provide testimony and 124 exhibits were reviewed and added to the record. All witnesses appeared as requested, and PII representatives participated throughout the hearings. PIIs and witnesses cooperated with all investigation requests.

1.5. The National Transportation Safety Board (NTSB) participated jointly in the investigation, however the U.S. Coast Guard was the lead federal agency for initial evidence collection activities and the public hearing. The NTSB participated in all hearing sessions, and the Coast Guard and NTSB shared all evidence and factual material gathered throughout the course of their investigations. However, the Coast Guard and NSTB worked separately

during the analysis phase of their respective investigations in order to prepare independent conclusions and recommendations.

1.6. Unless otherwise noted, all times are approximate, and in Central Daylight Savings Time, Coordinated Universal Time (UTC) offset, minus 5 hours.

1.7. Post Casualty Drug and Alcohol testing was satisfactorily performed. All results were negative and determined not to be a factor.

1.8. There were no deaths, injuries, or missing persons as a result of this casualty.

1.9. There was no pollution as a result of this casualty.

2. Vessel Involved in the Incident

Towing Vessel KRISTIN ALEXIS

Figure 2. Undated Photograph of the towing vessel KRISTIN ALEXIS provided by Marquette Transportation.

Official Name:	KRISTIN ALEXIS
Identification Number:	Official Number 596468
Flag:	US Flag
Vessel Class/Type/Sub-Type	Towing Vessel – Pushing Ahead (Towboat)
Build Year:	1978
Gross Tonnage:	146 Gross Registered Tons
Length:	61.8 Feet
Beam/Width:	24 Feet
Draft/Depth:	9.7 Feet
Main/Primary Propulsion: (Configuration/System Type, Ahead Horsepower)	Twin Screw conventional drive fleet boat with a total of 1440 Horsepower, affixed with 1 regular steering rudder and 2 flanking (backing) rudders for each propeller.
Owner:	Marquette Transportation Company, Gulf-Inland, LLC, Jefferson, LA, USA
Operator:	Marquette Transportation Company, Gulf-Inland, LLC, Jefferson, LA, USA

Crane Barge MR ERVIN

Figure 3. Photograph of the Crane Barge MR ERVIN. The photograph depicts the barge in operation working a ship moored to a mid-stream facility in the Mississippi River. Note also the Crane Barge HULK on the far side of the ship in the background of the picture; provided by Cooper Consolidated.

Official Name:	MR ERVIN
Identification Number:	Official Number 1282567
Flag:	US Flag
Vessel Class/Type/Sub-Type	Miscellaneous Vessel, General
Build Year:	2003
Gross Tonnage:	2008 GT ITC
Length:	191.1 Feet (200ft LOA). Barge length bow to stern on the hull was 191.1 feet, however the length overall was 200 because the crane boom extended out over the front of the barge when cradled.
Beam/Width:	75 Feet
Depth:	14.5 Feet
Main/Primary Propulsion: (Configuration/System Type, Ahead Horsepower)	N/A – non self-propelled Crane Barge
Owner:	Cooper Consolidated Belle Chase, LA
Operator:	Cooper Consolidated Belle Chasse, LA

3. Findings of Fact

3.1. The Incident:

3.1.1. On October 11, 2018, the KRISTIN ALEXIS was working to remove barges at the Convent Marine Terminal fleeting area in the vicinity of mile marker 161.5 on the Mississippi River for Cooper Consolidated.

3.1.2. On October 11, 2018, the MR ERVIN crane barge was in service, working at Convent Marine Terminal and had completed work earlier that day.

3.1.3. On the evening of October 11, 2018 and into the early hours of October 12, 2018 the weather was good and did not play a factor in this accident. The winds were light and variable with temperatures in the upper 60s with clear visibility.

3.1.4. The Mississippi River gage reading at Donaldsonville, Louisiana, nearest gauge to the Sunshine Bridge, indicated the river stage was 18.37 feet. Flood stage is at 27 feet and the record level recorded at that site was 36 feet high.

3.1.5. Earlier that day on October 11, the Cooper Consolidated Vice President, Managing Director of Stevedoring and Maintenance, made plans to move the MR ERVIN upriver to Darrow fleet. These preparations included looking at the current river stage at Donaldsonville, Louisiana which included performing the mathematical calculations to verify that there was enough clearance to safely pass under the Sunshine Bridge. These calculations were for the main channel span and revealed that they would safely make it through the bridge; calculations included the use of accurate measurements of the MR ERVIN. None of this information was ever relayed to anyone on the KRISTIN ALEXIS, the Cooper Consolidated Dispatcher or Marquette Transportation on October 11, 2018. Likewise, no one on the KRISTIN ALEXIS asked for this information on this day either.

3.1.6. That evening, at approximately 11:00pm, the Cooper Consolidated Dispatcher provided the orders to the Captain of the KRISTIN ALEXIS to move the MR ERVIN from Convent Marine Terminals to the Darrow fleet, roughly a 14-mile long transit upriver that would require them to transit under the Sunshine Bridge.

3.1.7. The KRISTIN ALEXIS arrived at the dock where the MR ERVIN was moored at approximately 11:30pm. The KRISTIN ALEXIS was directed to reposition the MR ERVIN from the current dock at Convent Marine Terminals to the Darrow fleet.

3.1.8. At approximately 11:30pm, the KRISTIN ALEXIS arrived on scene and transferred two deckhands on watch onto the deck of the MR ERVIN.

3.1.9. The following people were on the MR ERVIN: The two deckhands from the KRISTIN ALEXIS, and four Cooper Consolidated employees that worked on the crane. In addition, a Cooper Consolidated supervisor was also present on the CMT dock to assist in releasing the mooring wires and soft lines during the following sequence of events.

3.1.10. The KRISTIN ALEXIS' Captain testified that barge workers began to release MR ERVIN's mooring lines and he directed them to stop because he wasn't ready yet. The

Captain then proceeded towards the stern to begin to secure the towing vessel to the barge for transit.

3.1.11. The Captain of the KRISTIN ALEXIS noticed a large crane bucket on the MR ERVIN, and asked to have the bucket removed before starting the voyage. The 55-yard capacity bucket stood 17 and a half feet above the deck of the barge. The bucket was a spare bucket used by the crane for the loading and unloading ships; it was one of several possible grab buckets that could have been used.

3.1.12. Several conversations took place regarding moving this bucket. The Captain had stated that it impaired his visibility and it quickly grew to a big concern of his. The conversations took place between the Captain and his deckhand, the deckhand and the crane employees, and a shore-side Cooper Consolidated supervisor, along with internal Cooper Consolidated conversations. These conversations took place, face-to-face on deck, over VHF-radios, and also via cell phone.

3.1.13. During these conversations, Cooper employees were unsure what bucket the Captain was asking to have moved. Though unclear as to when the decision was made, eventually a decision was made by the on-call Cooper Consolidated supervisor not to move any buckets. In order to move the bucket, the process would take 2-4 hours in order to energize the crane equipment to full operating mode and move the equipment, not to mention time needed to securely moor or anchor the barge first. The Cooper Dispatcher told the Captain that he was working to get a crew out to move the bucket.

3.1.14. By approximately 11:35pm, the KRISTIN ALEXIS was at the stern of the MR ERVIN and beginning the process of facing up and securing the barge for the upriver transit. The Captain testified that barge workers continued to release the mooring lines; soon the MR ERVIN was only being held to the pier by the remaining 2 soft lines.

3.1.15. Moments later, the KRISTIN ALEXIS was attempting to secure the facing wires from the towing vessel to the barge, when one of the soft lines (on the stern) holding the barge tight to the dock had either broken or was released early. This action caused the barge to become partially free and started to move on its own. The Captain stated this forced him to have to take the barge in tow before he was fully secured to the barge and prepared to do so (conversations about the bucket were still ongoing at this time).

3.1.16. Next, the Captain on the KRISTIN ALEXIS testified he noticed the crane's boom drifting dangerously close to shore-side equipment as he finished tightening up his facing wires to the barge for transit. He stated he ordered the last remaining line to be released so he could pull the barge off the dock and not cause any equipment damage.

3.1.17. The KRISTIN ALEXIS, now underway with the MR ERVIN in tow, stopped and held position 60-80 yards away from the pier, as the Captain continued his efforts to have the same grab bucket in question to be moved. This bucket was stored on the portside forward deck area of the barge and impeded his field of view.

3.1.18. The design of the crane and way the towing vessel was made up to the tow caused the field of view from the KRISTIN ALEXIS's wheelhouse to be blocked by about 60 degrees out of the arc of the entire 360-degree horizon by the tub or pedestal of the crane. In this case, from dead ahead to 60 degrees on the right was blocked. This blockage was separate and in addition to the area of vision restricted by the crane bucket, which

reduced visibility by an additional 3-5 degrees of the horizon. The boat's position on the port stern of the MR ERVIN was consistent with the way this evolution normally occurs for crane barges of this type of design in general, and the MR ERVIN specifically.

3.1.19. Before approximately 11:50pm, the Cooper employees who had been working on the crane for their entire work shift, had disembarked the now underway the MR ERVIN and departed via crew launch boat.

3.1.20. Shore-side Cooper Consolidated supervisors who made the decision not to move the crane bucket did not tell the Captain of the KRISTIN ALEXIS of their decision not to move the bucket.

3.1.21. At approximately 11:50pm on October 11, 2018, the KRISTIN ALEXIS began its transit up bound on the Mississippi River with the MR ERVIN in tow, with the Captain still believing crane workers would eventually return via crew boat to move the bucket. The Captain filled out and completed the short voyage plan form at this time.

3.1.22. At 11:50pm, the Pilot came to the wheelhouse to relieve the watch. The Pilot completed certain required tasks, including a safety meeting involving a safety huddle, job safety brief, and completed a voyage risk assessment with the oncoming deckhands resulting in the voyage being in the amber level (caution) on a Green/Amber/Red scale.

3.1.23. The Captain remained in the wheelhouse and on watch for an additional 30 to 40 minutes past his normal watch period because of existing river traffic and meeting situations that were already agreed upon. The Captain wanted to keep the watch until after those meetings occurred. Watch relief took place at approximately mile 163.

3.1.24. At approximately 12:30 am on October 12th, the Captain turned the watch over to the Pilot; relief between the two included filling out and signing the log book and Safety Management System (SMS) forms including the Fleet Crew Change Protocol, which should have included things like river stage, orders, issues with the vessel, stop work authority, and other items, however mostly involved having discussions revolving around the issue with moving the crane bucket and traffic. There was no conversation about the short voyage plan or about MR ERVIN's air draft, vertical bridge clearances, or what span of the Sunshine Bridge to take.

3.1.25. Once the relief process was completed, the Pilot began to navigate on the western side of the river due to his restricted visibility and stated desire to remain well clear of other commercial vessel traffic.

3.1.26. At approximately 1:20am on October 12, 2018, the Pilot of the KRISTIN ALEXIS sent his two deckhands out forward on the bow of the barge to serve as lookout and assist the pilot in lining up the tow to pass under the centerline of the West span.

3.1.27. At 1:23am, the Pilot on the KRISTIN ALEXIS made a radio broadcast on the VHF-FM radio to all concerned traffic regarding his restricted visibility condition pushing the MR ERVIN.

3.1.28. At 1:32am, the Pilot of the KRISTIN ALEXIS made radio contact with the towing vessel NEDRA K, engaged in pushing an 11-barge tow down river. They agreed to a starboard to starboard meeting situation that will occur immediately down river from

the Sunshine Bridge. This maneuver placed the NEDRA K in the main channel span of the Sunshine Bridge.

3.1.29. At 1:40am, the Pilot of the KRISTIN ALEXIS commits to the up bound transit that would send them underneath the Sunshine Bridge's alternate West span. The Pilot's plan was to go through the center of this alternate bridge span; in doing so, he was aiming for the green light that was positioned in the middle of that span.

3.1.30. As the KRISTIN ALEXIS was approaching the bridge span, the Mate (lead deckhand) was calling off distances to the Pilot. The distances noted were in feet, and how far off in relation they were horizontally from the western bridge pier.

3.1.31. At 1:42am the MR ERVIN struck the Sunshine Bridge's highway deck structural framing that was overhead; in the process, the crane lodged itself under the bridge. During the salvage operations, the MR ERVIN needed to add extra water into its ballast tanks in order to safely remove it without causing further damage. This allision caused extensive damage to the main structural members of the bridge, which required custom repair parts that needed to be manufactured; there were no "off the shelf" parts available to effect the repairs.

3.1.32. The crane's structure hit the bottom frames of the Sunshine Bridge's highway deck which were high overhead, 260 feet to the west of the center (green light) of the alternate span. The amount of vertical clearance at the point of impact was determined to be 133.03 feet high, meaning the vertical clearance between the water level and the bridge at the site of the accident was 133.03 feet.

3.2. Additional/Supporting Information:

3.2.1. The Sunshine Bridge was built and opened to the public in 1964. This bridge spanned the Mississippi River, which had Coast Guard Aids to Navigation in the waterway intended to guide and inform mariners. Two buoys in the vicinity of this bridge were missing or otherwise discrepant. There were no electronic sensors on this bridge that supported electronic navigation, however these missing buoys did have AIS markers that allowed them to be visible on electronic charts. There were no physical gauge boards in use on the Sunshine Bridge.

3.2.2. On September 9, 2014, the Coast Guard issued Safety Alert 09-14 titled "Air Draft is Critical!" to draw mariners' and marine employers' attention to the importance of knowing the air draft of vessels operated and barges pushed. This safety alert was released after several major accidents caused the Coast Guard to assign TSAC to look into this concern and produce recommendations that were enclosed in their final report 13-10 "Recommendations to Establish Criteria for Identification of Air Draft for Towing Vessels and Tows."

3.2.3. This entire region of the Mississippi River where the vessels were operating in fell within the Coast Guard Sector New Orleans' Vessel Traffic Service area of responsibility, and the Sunshine Bridge was a check-in location for up bound vessels to call in and report their position before entering the 81-mile point traffic management area.

3.2.4. Cooper Consolidated purchased the MR ERVIN from Drummond Coal Company, a Columbian coal mining corporation in early May of 2018, and brought it into service in

the Mississippi River. The vessel began working out of the Darrow fleet in early June of 2018. From June to the time of the accident in October of 2018, the MR ERVIN had made twelve round trips between Darrow and Convent, each time transiting under the Sunshine Bridge without incident.

3.2.5. Cooper Consolidated had a time charter agreement with Marquette Transportation (for the KRISTIN ALEXIS and other towing vessels) to provide dedicated service to Cooper Consolidated.

3.2.6. Cooper Consolidated officials didn't know exactly how much fuel was onboard the MR ERVIN at the time of the accident, but estimated it had carried between 15,000 and 30,000 gallons of diesel fuel in each of its two tanks, for a total of 30,000 to 60,000 gallons out of a maximum capacity of roughly 120,000 gallons at the time of the accident; that fuel was used to supply the crane's equipment. That left the vessel with a draft of approximately 7 feet. The exact draft was unknown: the neither the Cooper Consolidated employees nor the Captain of the KRISTIN ALEXIS read or recorded the draft marks prior to departure, and the barge's draft will vary depending up on the amount of fuel onboard. 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. Post casualty measurements by Coast Guard investigators were 136 feet of air draft.

3.2.7. Interviews of several witnesses on scene after the accident revealed that employees and crew were commonly under the impression that the crane's height was 130 feet high. The Captain and Pilot of the KRISTIN ALEXIS misunderstood this 130 feet to be the maximum air draft of the MR ERVIN. The Captain of the KRISTIN ALEXIS stated that he had moved the MR ERVIN on his previous work assignment on this towing vessel just over one-week before and when he asked, was told by an unknown Cooper Consolidated employee that the crane's air draft was 130 feet high. The Captain did not ask for the air draft of the MR ERVIN on October 11, 2018.

3.2.8. The KRISTIN ALEXIS was being navigated with Rose Point in use, an electronic charting system. That system used NOAA electronic navigation charts and displayed a vertical clearance for the Sunshine Bridge of 132.9 feet and horizontal clearance of 750 feet. Also onboard were paper USACE river maps that indicated the main span of the Sunshine Bridge had a maximum vertical clearance of 171 feet, and a minimum vertical clearance of 135 feet when the Donaldsonville gage was 36'. Additionally, the USACE map published data on the alternate West span depicting a maximum vertical clearance of 147 feet, and a minimum air draft of 111 feet when the Donaldsonville gage was 36'.

3.2.9. Actual vertical clearance at the point of impact on the bridge at the time of the accident was 133.03 feet.

3.2.10. As a result of the accident, the bridge was shut down to vehicle traffic very shortly after the accident, and remained closed for 49 days causing severe impact to local commuters and businesses in the region. The damage and repair costs from the accident resulted in $3,271,188.45 dollars in damage. Professional Engineers used to perform bridge repair calculations and designs indicated that this accident occurred in the worst possible location on the bridge. A LADOTD witness testified that one of the structures damaged was a critical member; by calculations, with this structural piece damaged, the bridge should have ultimately failed and resulted in a bridge collapse. MR ERVIN suffered $8,648.00 in damage.

3 Analysis

4.1. *Decision made by the Pilot to take the alternate/West span of Sunshine Bridge*. The Pilot of the towing vessel KRISTIN ALEXIS was on watch during the accident. His duties and responsibilities placed him in charge of directing the movement of the towing vessel and tow during portions of this voyage. He relieved the Captain of the boat who had been on watch before the accident occurred. During the Captain's previous watch, the KRISTIN ALEXIS had picked up the MR ERVIN and began the trip north from Convent Marine Terminals en route to Darrow Fleet, which would take them through the Sunshine Bridge. Existing river traffic and severe visibility issues further compounded the faulty decisions made that resulted in the accident.

4.1.1. *Faulty Decision Making Prior to the Accident.* The most likely cause of this accident was the decision of the Pilot on the KRISTIN ALEXIS to take the alternate West span of the Sunshine Bridge. Lack of situational awareness directly contributed to that decision. Specifically, not knowing the actual air draft of the crane barge MR ERVIN; a lack of knowing the real-time river stage data at the Donaldsonville gauge; and the subsequent lack of awareness of the bridge's current or present vertical clearance. The Pilot also had a pre-existing knowledge that the crane had made it through the bridge safely during previous transits. That, along with the crane owner's direction to move the barge north under the bridge, left the KRISTIN ALEXIS crew with the false impression that it would be able to make a safe transit back through the Sunshine Bridge without issue.

Upon relieving the navigation watch, the Pilot decided to operate closely to the edge of the West side of the river (the right descending bank). This was done for two main reasons –

1) Severely restricted visibility, and

2) To stay clear of any commercial river traffic.

The Pilot could not effectively see what was in front of him due to the tow configuration along with the size and design of the crane; plainly stated: the crane obstructed his view. Additionally, the presence and physical location of an additional crane grab bucket that was stored on the deck of the MR ERVIN exacerbated that restriction. The overall visibility was obstructed badly enough to cause him the need to make a SECURITE call[1] on the VHF radio while transiting upriver, to alert the other vessels to his situation and general location.

The Pilot stated that his thought was that if he stayed close enough to the bank of river, he would be able to account for the area that he could see, and provide the widest berth possible for all other traffic. Or, in other words, he would open up the rest of the river for commercial traffic in the area and stay well clear of them.

[1] A Security Call - SECURITE (pronounced "SAY-CURE-A-TAY") is used to advise others about important navigation or weather warnings that may impact the safety of other vessels. Safety (SECURITE) messages have precedence over any and all routine radio communications.

Upon nearing the Sunshine Bridge, the KRISTIN ALEXIS observed and planned for a meeting situation[2] with the down bound NEDRA K and her 11-barge tow, which was still off in the distance. Accordingly, the KRISTIN ALEXIS hailed the NEDRA K on the VHF Radio and proposed a starboard to starboard meeting situation which the NEDRA K agreed to. This agreement placed the NEDRA K in the center main channel span of the Sunshine Bridge.

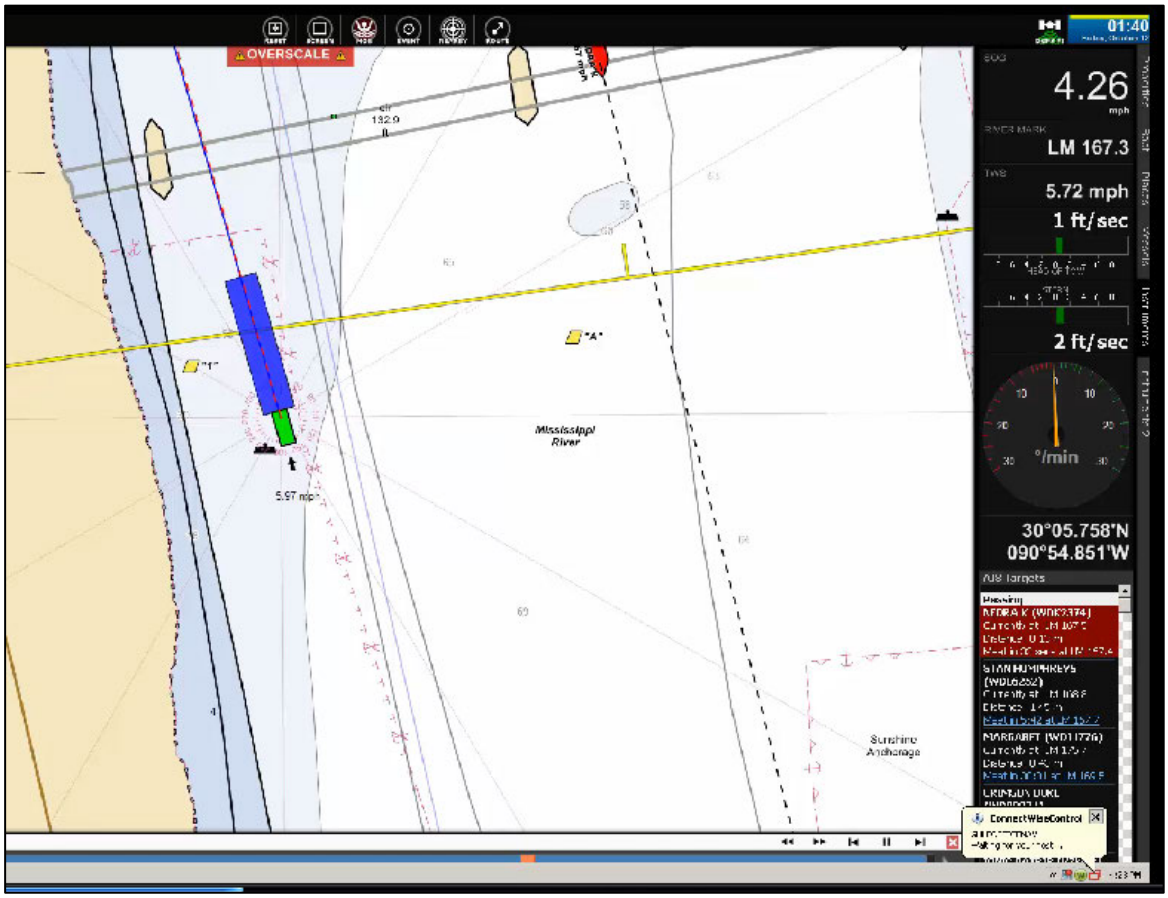


Figure 4. Image captured from the Rose Point screen from the towing vessel KRISTIN ALEXIS during the accident voyage. Image shows KRISTIN ALEXIS (green) pushing the MR ERVIN (blue), immediately before transiting under the Sunshine Bridge. You will note the down bound towing vessel NEDRA K (red) on the top right portion of the screen. NEDRA K's 11-Barge tow not depicted on image. Provided by Marquette Transportation

As a result, the Pilot on the KRISTIN ALEXIS had the following possible courses of action of which they were able to choose from:

1) Slow down, hold up, and wait for traffic to clear (at which point the KRISTIN ALEXIS could have then proceeded through the main channel span);

2) Proceed ahead under the alternate West span (as they ultimately decided to do); or

[2] The Inland Navigation Rules of the Road, rule 14(d) states: "Notwithstanding paragraph (a) of this Rule, a power-driven vessel operating on the Great Lakes, Western Rivers, or waters specified by the Secretary, and proceeding down bound with a following current shall have the right-of-way over an up bound vessel, shall propose the manner of passage, and shall initiate the maneuvering signals prescribed by Rule 34(a)(i), as appropriate.

3) Hold up and push into the bank [or stem the current – a process of essentially stopping in the middle of the river] and stop the forward progress of the intended voyage before arriving to the Sunshine Bridge until conditions improved[3][4].

The third course of action was not a viable option based upon the Pilot's testimony; he indicated there were no ideal places to stop on the river bank. In addition, the Pilot was concerned about USACE laws prohibiting pushing-in at certain areas. Furthermore, with no crew boat coming back to meet them to relocate the bucket, there was no prompt that caused him to stop; he was intending to keep traveling up bound until the crew boat came[5]. Testimony provided by the Captain of the KRISTIN ALEXIS revealed that returning to the pier was also not a viable option because of the strong eddy. Based upon this, course of actions one and two were the only possible choices for the Pilot to analyze and take for consideration.

Figure 5. Image captured from the Rose Point screen from the towing vessel NEDRA K as they passed KRISTIN ALEXIS underneath the Sunshine Bridge during their accident voyage. Provided by Excell Marine.

Some of the factors that went into the decision making to proceed onward with the transit of the alternate West span – Course of Action two (with the lower vertical clearance), was a lack of available information (as noted in the watch relief section in paragraph 4.1.3. and voyage plan information in 4.2.4.). This decision to choose the alternate West span was reaffirmed by the presence of marine traffic, and the Pilot's previous history of successfully pushing different crane barges through alternate spans of other bridges in the past. According to testimony, those previous transits all included pushing smaller cranes and occurred during times of lower water conditions. Restricted visibility played a factor

[3] The Pilot stated that "stopping" by pushing into the bank was not considered to be a good or viable option, due to congestion, existence of numerous fleeting areas, waterfront facilities, and ship anchorages, along with the presence of USACE levee and revetment in the area.

[4] USACE Laws and Regulations, specifically Section 7 of the River and Harbor Act of 1917, 33 USC § 408 and § 412, and 33 CFR § 207.200(a) make it illegal to push up and possibly damage certain areas of their facilities, including levees and revetment.

[5] The Cooper Consolidated Dispatcher testified that he told the Captain to call dispatch before arriving to the Sunshine Bridge to verify whether or not the crew boat was coming back to meet them to help move the crane bucket, however that information was never relayed from the Captain to the Pilot.

in influencing this decision as well, as noted in paragraph 4.1.1. Course of Action one never really entered the Pilot's mind for consideration at this time.

Further, the Pilot may have had a false sense of security by his previous practice of pushing crane barges through alternate bridge spans as he had done in the past without incident. Several experienced Captains interviewed testified that the best practice is to push crane barges through the main span of a bridge, and that they would never push a crane barge through an alternate span. As a mitigating and risk reduction mechanism, the Pilot had both of the deckhands on watch posted forward as lookouts and were calling off distances, but they were only focused on horizontal distances to the bridge piers and disregarded vertical clearances. This indicates they were most concerned with horizontal distances from the bridge piers at that time.

4.1.2. *Failed or Ineffective Defense Factors*. There were protections in place that could have prevented this accident from occurring such as established company policies. It is important to note that a risk analysis model was employed for this voyage. This useful tool is part of the towing company's SMS titled Voyage Risk Assessment and employs a Job Safety Briefing Worksheet that is referred to colloquially as the GAR (short for Green/Amber/Red) Model. Once completed, it categorizes the risk of a planned voyage into a "green", "amber", "red" traffic light type of measurement. Simply put, green means go, amber means caution, and red means stop.

The risk assessment performed for this voyage by the deckhands and Pilot, resulted in an amber categorization, meaning – take caution. Some of the factors that went into the score were because of visibility, bridge approach and an inexperienced second deckhand. The special note at the bottom of the document also requires that any risk assessment other than green, triggers a mandatory call to the Port Captain for further guidance. That phone call did not happen, and the Pilot appeared to be unaware of the notification requirement for an amber score. This may have been in part because of his short three weeks of employment as a Pilot with Marquette before the accident, not allowing him sufficient time to fully familiarize himself with the complex SMS. SMSs generally consist of multiple binders or are volumes in size and take significant amounts of time to become well versed in.

Calling the Port Captain could have initiated a conversation about the conditions and particulars of the voyage, and likely would have prevented the accident from occurring or this voyage from otherwise continuing as it did. According to this procedure within the SMS, there were two times during this trip when a call to the Port Captain should have occurred – when the Pilot took over the watch, and when the Captain first got underway and performed his own risk assessment. That said, navigating the waterway is a very dynamic evolution with many things occurring simultaneously; it may not be convenient or possible to simply stop in order to make a phone call to the shore side management.

4.1.3. *Insufficient Watch Relief*. The watch relief, which appeared proper and complete by using a company developed checklist, proved to be ineffective and did not provide the Pilot all of the information he needed to safely navigate. The use of this checklist has become so common and routine by the licensed crew that it may have lost its intended purpose. In the KRISTIN ALEXIS' case, the crew would move in and around a fleet constantly; it was more of a rare occasion to complete a traditional navigation voyage and move a barge away to a different fleet, for example.

The conversations of the Captain and Pilot associated with this specific watch relief were heavily focused on the relocation of the crane bucket on the deck of the barge that was obstructing a portion of the visibility from the pilot house. The Captain was under the false impression that shore side employees from Cooper Consolidated were going to return and meet the KRISTIN ALEXIS while underway, to remove this crane bucket on the MR ERVIN from in front of their view. While this was an important conversation to have, there was minimal discussions on river conditions/stages, air drafts, bridge clearances, bridge spans, voyage plans and other safety related areas of concern. At no point during the watch relief did the Captain direct the Pilot to navigate under a specific span of the Sunshine Bridge.

The Captain remained on watch an additional 30-40 minutes beyond a normal relief time. This was done in order to maintain the watch until previously existing river traffic that he had made passing arrangements with, had passed by. This likely occurred not just because there was traffic present, but also because the KRISTIN ALEXIS was pushing a unique tow… the MR ERVIN along with the extra crane bucket, both of which decreased their normal view. The Captain chose to keep the watch and not be relieved until they had passed that traffic and the tow was in a better, less densely populated portion of the river. The Captain felt as though he would turn the watch over to the Pilot in a place where he would have better options to hold up to wait for the Cooper Consolidated crew boat to return and move the crane bucket. Unfortunately, that crew boat never returned, and the Pilot had decided to continue with the voyage without having further tasking.

4.2. Decision made by the Captain to get the towing vessel KRISTIN ALEXIS underway. As with many operations within the maritime industry, this was not a simple or straight forward process. It was very dynamic, and many things unfolded in a very short period. The tow should not have gotten underway, due to visibility issues and lack of complete situational awareness. This is important to analyze because if the tow never got underway, or underway with the same conditions present, the accident would not have occurred.

The below details will describe the progression and sequence of events that were previously described in Section 3, Findings of Fact of this report. While paragraph 4.1 discusses the situation that occurred immediately before the accident on the Pilot's watch, this paragraph captures events that occurred immediately following KRISTIN ALEXIS' departure from the dock with MR ERVIN in tow. The following activities occurred before the Pilot had assumed the watch; the Captain of the KRISTIN ALEXIS was on watch and in control of the movement and direction of the vessel at this time.

4.2.1. *Situation and orders*. The towing vessel KRISTIN ALEXIS was owned and operated by Marquette Transportation; however, they were under a contractual agreement and in a time charter to solely conduct business for Cooper Consolidated. This meant the boat was working under a long-term agreement to service Cooper Consolidated, their fleeting areas, and needs. As such, the Cooper Consolidated dispatcher provided the day to day tasking and orders for the KRISTIN ALEXIS. On October 11th, 2018, Cooper Consolidated ordered the KRISTIN ALEXIS to "strip the fleet" at Convent Marine Terminals. This meant to remove all of the barges from the fleeting area. The last barge to be moved was the MR ERVIN which was going to be moved back to the fleeting area owned by Cooper Consolidated where it normally resides, the Darrow fleet.

The KRISTIN ALEXIS came along the side of the MR ERVIN to transfer their two deckhands on to the barge in order to help un-tie and release the barge from the pier. The

MR ERVIN had been made fast to the pier by a combination wire rope and soft lines. In order to accomplish the task of releasing the barge, the KRISTIN ALEXIS would have to transfer their deckhands onto the MR ERVIN to assist in this process. They would release the wire ropes first, which would allow them to then use the soft lines to hold the barge to the pier. This was necessary because they wouldn't have been able to otherwise release the tension that the wire ropes were under and while they went to face-up to the stern. Several personnel were involved in this evolution - the Marquette deck hands and four crane barge workers that were previously on the MR ERVIN, as well as a Cooper Consolidated supervisor on the dock to free the lines [when directed to do so]. According to testimony, the Captain stated the barge workers began to release the lines as he first came alongside, and had to tell them to stop because he wasn't ready for that yet. Originally held in place by 4 wire ropes, the MR ERVIN was then reduced to two remaining Blue-Dan Rope® soft lines.

Once the wire ropes were released and the soft lines were secured, the next step in properly securing the tow for transit, was for the towing vessel to go back to the stern of the barge and face-up to it. The barge had been moored to the dock, starboard side to the pier, facing upriver on the eastern side -or- left descending bank of the Mississippi River.

4.2.2. *Getting Underway*. Upon reaching the stern of the barge to face-up, and before the facing wires could be fully secured, there was some conflicting testimony as to what occurred next. The most plausible description of the scenario is that the soft line that was on the stern of the barge had parted [broke] and let go. Testimony by Cooper Consolidated employees supported this. There was however additional testimony by the KRISTIN ALEXIS' Captain and deckhand that the barge workers continued to release the mooring lines despite the Captain's previous testimony of him directing them to stop releasing the lines. The accusation was also made that the mooring lines continued to be released early despite the Captain telling them to stop, and that the Cooper employees working on the MR ERVIN didn't want to move the crane bucket noted below in paragraph 4.2.3. Cooper Consolidated testimony disputed the claims that the lines were released early.

This stern line in question, while holding the barge close to the dock, also served a purpose of arresting any forward and aft movement. That particular location of the river had a unique upriver eddy. The eddy, combined with the KRISTIN ALEXIS' propulsion thrust used to press them against the MR ERVIN's stern to secure the facing wires, caused the barge to begin floating up river before the Captain of the KRISTIN ALEXIS was fully secured and prepared for movement. Once finally secured, the towing vessel was situated on the stern of the barge, but intentionally offset to the port side so that the Captain could see around the crane as much as possible. This was the normal and desired place for the towing vessel to push from due to visibility, deck fittings (buttons and kevel) locations, and railings present.

The Captain saw the following situation rapidly unfolding. He quickly grew concerned that the crane boom of the MR ERVIN was going to strike and cause damage to some dockside structure and equipment. This caused him to order that the remaining soft line on the bow of the MR ERVIN be released so that he could take full control of the MR ERVIN and pull it off the dock in effort to prevent any damage to the equipment. Once off the dock, he assessed the situation and realized that he would not be able to safely return to the dock without assistance, because of the eddy and the crane's boom in relation to the pier side structure.

4.2.3. *The Additional Crane Bucket*. Prior to getting underway with the MR ERVIN, the Captain noticed that the crane bucket on the deck of the barge was severely obstructing his view, in addition to what the crane itself was blocking. The Captain requested Cooper Consolidated to move the bucket because he could no longer safely navigate in this condition. While the MR ERVIN was still moored to the dock and the deckhands were still onboard, there was several face-to-face, VHF radio, and cell phone conversations that occurred addressing the Captain's desire to move the bucket. Once underway as described above in paragraph 4.2.2, the Captain stemmed the current approximately 60-80 yards off the dock. Conversations continued with shore side employees to move the bucket. There were three different buckets on the barge at that time, and there was some confusion regarding which bucket the Captain was talking about. During this time, a decision was made by Cooper Consolidated employees not to move the bucket; at the same time, the crane workers departed the MR ERVIN by a crew boat that was sent out to retrieve them.

The entire evolution, to include the KRISTIN ALEXIS coming alongside the MR ERVIN at the dock, facing up, and getting underway and holding at a position 60-80 yards off the pier at Convent Marine Terminals took approximately 20 minutes. The Captain was under the impression that the crane workers would eventually be sent back on the crew boat to meet them and reposition the bucket. This bucket, a 55-yard capacity bucket standing over 17.5 feet tall above the deck where it rested, would have taken a few hours to completely move. The process to reposition the bucket so that it no longer restricted the Captain's visibility would have involved the following: energizing the on-deck crane and necessary machinery, removing the existing bucket already affixed to the crane, picking up the bucket that was blocking the view, then finally repositioning and securing the buckets. In order to safely do all of this, the barge would have to be moored or anchored. At this point, the Captain had decided his only option was to continue upriver, while he waited for communications from Cooper Consolidated Dispatcher and the workers to return.

4.2.4. *Voyage Planning Shortcomings*

4.2.4.1. *MR ERVIN Air Draft*. The crane barge MR ERVIN had been owned and operated in this service by Cooper Consolidated for approximately 6 months before this accident. There was information about the crane that had become circulated amongst Cooper Consolidated employees, which had filtered its way through the towboats assigned to work the fleeting areas. The general awareness and understanding for some dock workers and towboat crews was that the height of the crane was 130 feet. This crane purchase was a big deal; company personnel and local industry were excited about the new joint acquisitions of the MR ERVIN and HULK, the two largest AMCLYDE[6] cranes in the world. The problem however, was that the crane height was in fact <u>not</u> 130 feet high.

The actual height of the crane structure above the deck of the MR ERVIN was 128' 3" according to the approved general arrangement plans. It is possible that

[6] Clyde (standing for Cranes, Loggers, Yardarms, Derricks, and Equipment) Model 37, the MR ERVIN, was built by AmClyde in Pascagoula, Mississippi and entered into service in 2004 for Drummond Coal Company in Santa Maria Columbia where it operated until 2015. The cranes (MR ERVIN and HULK) were acquired by Cooper Consolidated in November of 2017 and put into service in late May of 2018; the crane has 133,000 pound capacity with two fuel tanks each with a 60,000 gallon capacity, and two dedicated ballast tanks.

employees became aware of this information and began to discuss it amongst themselves; this is one likely scenario as to how towboat crews came to know the incorrect height of the crane. However, what mattered most in the case of this accident, was the air draft, which is found by taking that height and adding it to the freeboard of the barge. This will tell you how high the crane stood above the surface of the water. In this case, the freeboard was approximately 7 and a half feet above the water.

The draft of the barge fluctuates based upon the amount of weight onboard; during the accident, the air draft was just shy of 136 feet high (128' 3" height above deck, plus 7' 6" freeboard equals a total 135' 9"). MR ERVIN's freeboard is affected by the amount of fuel onboard, equipment present, and if there is any ballast onboard. Notably, the owner did not know an exact amount of fuel onboard. The large fuel capacity of MR ERVIN could change the draft value by nearly a foot. This barge was not designed, intended, or even permitted to carry cargo. At certain times, underway hydrodynamic forces may also change the draft of a vessel.

During this voyage, neither the Captain nor the Pilot asked anyone at Cooper Consolidated what the air draft of the MR ERVIN was. The Captain had moved the MR ERVIN just over a week or so before the accident, and was told at that time by an unknown/unidentified employee that the air draft was 130 feet. As such, he stated that he felt no need to ask for the air draft again. In addition, the maximum air draft was not permanently marked anywhere on the MR ERVIN or otherwise posted or available in the wheelhouse of the KRISTIN ALEXIS. Neither the Captain, Pilot, or Cooper Consolidated employees noted the MR ERVIN's draft (and inversely, the freeboard) before getting underway. Noting the draft/freeboard, or having the maximum air draft permanently and conspicuously marked on the MR ERVIN, could have prevented this accident.

4.2.4.2. *Information on the Sunshine Bridge*. The other part of the equation is the information available to the Captain and Pilot on the fixed highway bridge. There was information available on the Sunshine Bridge, however it was from two different sources. The USACE River Map Flipbook, and the NOAA Nautical Chart. This will be discussed in greater detail in section 4.6.1 below, however the KRISTIN ALEXIS was using an electronic charting system that was displaying the approved NOAA ENCs at all points during this voyage.

The available information listed on the NOAA Chart included the horizontal clearance of 750 feet for the width of the navigation channel, along with the vertical clearance of 133 feet.[7] The existing company policy in place for this type of voyage, at the time of the accident, called for the vessel to complete what was referred to as a short voyage form due to the short length of this voyage. The Captain did fill out this short voyage form, but there was not a significant discussion about this voyage plan during the watch relief that occurred that night.

[7] The NOAA Paper Chart depicts 133 feet of clearance, while the ENC displayed on Rose Point was 132.9'. A note on the chart sends readers to Coast Pilot Volume 5 for additional information on this bridge, however there is only basic information provided that says "Just above Union, about 167.4 mile AHP, the Sunshine/SR 70 Bridge has a fixed span with a vertical clearance of 133 feet and a horizontal clearance of 750."

This SMS form was an abbreviated version of a longer SMS Voyage Plan form and did not have a place to add information on bridge clearances, but it did for air draft.

Unfortunately, the information that was documented on this section of the SMS form was for the towing vessel's air draft, not the air draft of the MR ERVIN which was nearly 100 feet higher than that of the towing vessel. The reason for this could not be determined, however like above in section 4.1.3 regarding watch relief, the repetitious nature and sheer volume of work associated with fleeting operations could be a cause. A person in charge of the watch on a busy fleet boat might be in the habit of only using the towing vessel's air draft information and not the barge's because seemingly hundreds of consecutive voyages would include pushing hopper or tank barges that have air drafts lower than the boat. The repetitious nature of that, coupled with rarely or never pushing a vessel with a high air draft, a Pilot or Captain could be under the misconception that that block on the form was only for the boat as appeared to be the case with the KRISTIN ALEXIS.

If all available information on the bridge's vertical clearance and the barge's air draft were present, readily at hand, and properly discussed, they would have noticed that the remaining air gap (133 feet of bridge minus 136 feet of air draft) would have resulted in a negative number, meaning they likely would not fit under the bridge. This should have raised enough question in their minds as to their ability to safely make the voyage. In this case, the pilot thought they had a 2.9 foot clearance; they saw the Sunshine Bridge's charted vertical clearance of 132.9 feet on Rose Point, and were under the assumption that the crane height was 130 feet.

4.2.4.3. *Information on river levels*. The Mississippi River is an extremely complex and fluid system. The water basin encompasses parts of 32 U.S. states and spans between the Rocky and Appalachian Mountain ranges, and covers 1,245,000 square miles, which is roughly 41% of the landmass of the continental U.S.

The River flow is constantly fluctuating, and the USACE, USGS, and NOAA have an elaborate system of reading and sharing the river stages at several gauge locations throughout the U.S. For the Sunshine Bridge, the closest gauge location is just upriver near the town of Donaldsonville, Louisiana. The USACE operates this gauge, and it is calibrated roughly one time per year, to account for any long-term change in elevation that occurs over time, known as subsidence. Precise measurements have tracked this elevation drop to fluctuate greatly by location, maybe even by a few centimeters over a period of 50 years in extreme locations; so, changes to the earth occur, but at a negligible amount.

The gage reading at the time of the accident at the Donaldsonville gauge was 18.37 feet. This measurement is taken from a specific datum and does not reflect how much remaining water is in the river at that point in time. In fact, at Donaldsonville, Louisiana, the river depth is deeper than sea level and if that reading was at "zero", deep draft ship traffic would still be able to navigate the river.

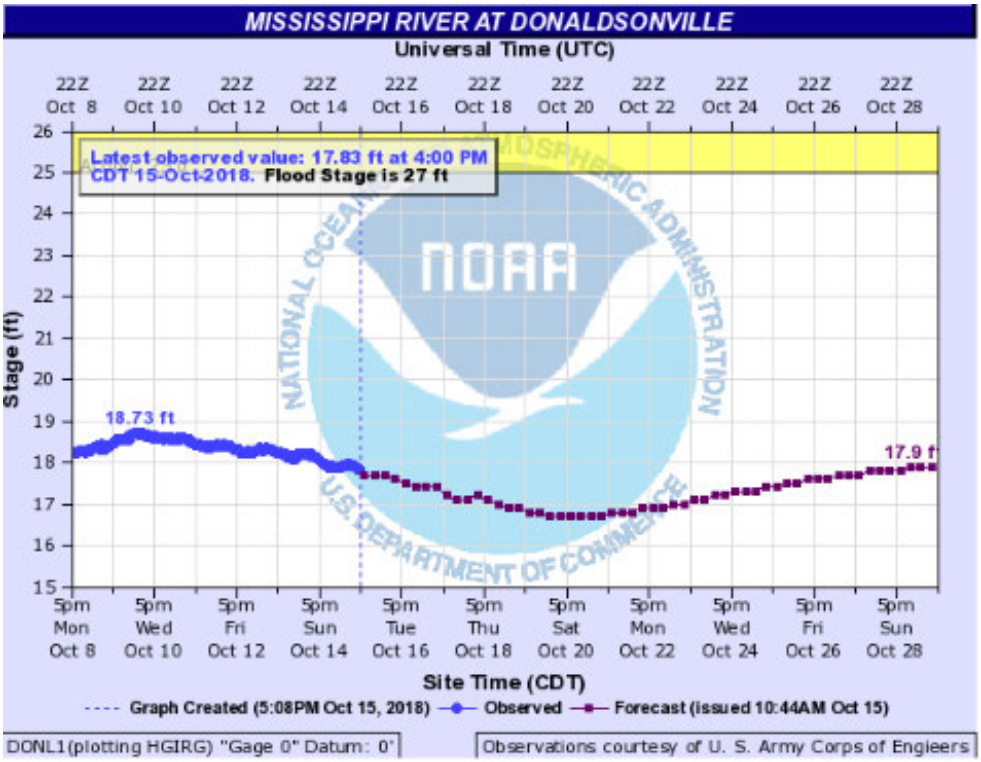


Figure 6. A graphic from NOAA's website, taken shortly after the accident occurred depicting the observed river stages before, and the predicted river stages after the accident at the Donaldsonville, Louisiana gauge, provided by NOAA

What is important to note, is that the USACE River Map Flipbooks provide a profile view of all bridges and lists a maximum and minimum clearance of the bridge. It also provides a way for mariners to calculate real-time bridge clearances, factoring in the river stage at the Donaldsonville gauge. This topic is discussed in greater detail in section 4.6; there was no evidence that any attempt was made to determine the most recent river stage information before getting underway on this voyage. This is critical information that is necessary for a complete and proper voyage planning.

4.2.4.4. *Insufficient Training on ECSs (Rose Point).* Numerous rules, standards and accepted industry practices establish that prudent seamanship dictates using all available means available to determine if a risk of collision (or allision in this case) exists. Over time, new technology has further enhanced the amount of information available to the watch officers, including new electronic equipment that has been developed to further enhance situational awareness in the wheelhouse and allow for better decision making. RADAR, VHF-DSC radio communications, GPS, AIS, and ECDIS and/or ECS amongst others, have been great additions on that front. In addition, international shipping regulations (SOLAS[8]), have mandated that ships carry ECDIS, and other ECSs have been developed and refined for use on other recreational and commercial vessels.

The KRISTIN ALEXIS was carrying an ECS product created by Rose Point Navigation Systems© at the time of the accident. In 2017, the USCG updated

[8] 1974 International Convention for Safety of Life at Sea, SOLAS74 (2014 Amended) Chapter V, Regulation 19.2.1.4

existing policy[9] allowing commercial vessels operating inside the territorial sea baseline to carry an ECS (e.g. Rose Point); ECSs do not have to meet environmental and performance standards expected of seagoing vessels. Their only two requirements are to be of a large enough scale to view details and safely navigate from; and have a GPS input that is of a certain accuracy with a 2-second periodicity position update. Also, these systems cannot be dependent upon a cellular signal. Systems like Rose Point offer an extremely large amount of data to the user and can overlay sensors and inputs to greatly aid in navigation. Neither the Captain nor Pilot of the KRISTIN ALEXIS had any formal training on the use of Rose Point. As such, they did not know how to access the full suite of possible features available to them.

Presently, use of these systems is learned on-the-job, and no formal training is mandated, or explicitly provided or otherwise expected by Marquette. The creator and developer of Rose Point does have several self-paced training videos on their company website that serves to train users on the system.

4.2.4.5. *Failed or Ineffective Defense Factors*. If the Captain never got the KRISTIN ALEXIS underway, or had somehow otherwise delayed their departure until all necessary information was known, then the Pilot would not have been placed in the position to make the decision of whether or not to use the alternate West span. However, given the sequence of events that occurred, it appears as though there was no way for the Captain to safely prevent the vessel from getting underway once the 4 wire ropes were removed that secured the MR ERVIN to the pier. Following the removal of those wires, the stern soft line either was released or broke which then allowed the barge to begin to drift. Then the Captain essentially took evasive actions to prevent damage to the equipment. Once they were sitting 60-80 yards off the dock, while they were disputing how to resolve the situation about the crane bucket, they should have called for an assist boat to help them safely overcome the eddy and moor the barge back up to the pier. It is unknown if this was an available option or not, however the voyage continued upriver which ultimately resulted in the bridge allision.

4.3. *Failure to Follow Company Safety Management System Procedures*. Marquette Transportation had implemented a safety management system[10]. As such, the SMS had numerous policies in place that were designed to enhance the safety of their operations and improve management practices. Several policies were in place that if followed properly, could have prevented or reduced the likelihood of this accident. Despite their existence, post casualty internal reviews led to subsequent revisions of these policies for continual improvement. Those changes will be discussed later in Section 6 of this report.

Marquette's SMS VOP-1.1 discussed the Captain's responsibilities and authorities. Section 6.3.5 discusses navigation underway, and it indicates the Captain must ensure that the towing

[9] NVIC 01-16, Change 1, Use of Electronic Navigation Charts and Publications in Lieu of Paper Charts, Maps, and Publications, Enclosure (1), paragraph B.1 and B.2 discusses the ENC Display

[10] 33 CFR § 96 list regulations for the Safe operation of Vessels and Safety Management Systems. Marquette Transportation is a towing company; new towing vessel regulations found in 46 CFR Subchapter M list inspection rules and dictate one of two inspection options for towing vessels: Coast Guard option or Third Party Oversight. Marquette chose the TPO route which is more flexible. They chose to go with the more traditional option employing SMS, and using the Recognized Organization (Class Society) ABS to be their TPO.

vessel and tow are operated in a manner that does not pose a threat to life, property, or the environment. It states "*special attention must be paid to several items like density of marine traffic, river stage upon the route, air draft relative to the bridges and overhead obstructions, and bridge transits."*

4.3.1. *Stop Work Authority*. Each new Marquette employee hired is provided with detailed instruction on the company's stop work policy – and every member's authority to stop work if they see an unsafe act. The policy states "*This responsibility is to utilize the judgment of a prudent mariner and stop operation when unusual conditions dictate. This may include operations that are, but are not limited to reduced visibility, severe weather, traffic restrictions or mechanical problems or failures."* There were several points along this voyage where they could have stopped, or possibly even refused to take the tow until they could reevaluate the situation and mitigate concerns. Generally, reduced visibility would be associated with weather related instances like fog or heavy snowfall, but there is no reason why obstructed visibility by a crane or cargo wouldn't also apply.

4.3.2. *Bridge Transit Policy*. The bridge transit policy's (SMS VOP-4.5) stated purpose was "*to provide guidelines for bridge transits and consistent navigation practices to help safeguard the crew, equipment and environment*." It goes on to indicate the Captain's responsibility was to ensure personnel on watch in the wheelhouse were aware of this policy, and the person on watch (Pilot or Captain) was responsible to follow it. The general procedure details that if there was a question regarding the safe transit of a bridge, "*the wheelhouse person responsible for the transit was to abort the approach and stop or turn the vessel around when it is safe to do so*." Also, while approaching a bridge, to do so at the minimum speed necessary to maintain steerage way and adequate control of the barge.

Further bridge transit procedures included the requirement to "*gather necessary information and properly plan for the bridge transit, including adequate, reliable and timely information, waterway conditions and considerations, and other traffic. The wheelhouse person on watch for the transit will determine air draft of the vessel and tow, strength and direction of current, and beam of the vessel and tow to adequately transit the bridge spans."* The Captain testified that he performed the air draft calculations to pass underneath the main span of the Sunshine Bridge on his previous transit moving the MR ERVIN, just over a week or so before this accident, using an air draft value of 130 feet high. This occurred onboard the KRISTIN ALEXIS during his previous work period.

4.3.3. *Management Pressure or Pride*. Also included in the Bridge Transit Policy (SMS VOP-4.5) was a statement that said *"under no circumstances will the wheelhouse person on watch responsible for the transit make the bridge due to management pressure or pride."* When the Pilot was asked if fear of reprimand or job loss played a factor in his decision of not using the stop work authority (meaning that he would be fired for delay), he responded that the thought came into his mind. There was no indication of this perceived pressure being present from company management during interviews or from any other witnesses, despite some of those witnesses no longer being currently employed by Marquette.

4.3.4. *Risk Management and Job Safety Briefing Worksheet*. As previously mentioned in this report, a proper assessment was made of the risk of the voyage using the job safety

briefing worksheet, and it resulted in an "amber" score, which meant to proceed with caution. Some of the factors that led to that score was visibility, the bridge transit, and an inexperienced second deckhand. That score also triggered a necessity to call the Port Captain to discuss the elevated risks that led to that score. Unfortunately, that conversation with the Port Captain never occurred. Due to the Port Captain's extensive knowledge and expertise, he could have possibly relayed enough information or direction that could have aided in making this an event free voyage.

4.3.5. *Voyage Planning*. SMS VOP-4.2 is Marquette's Voyage Planning Policy. The policy stipulated that a voyage plan be completed for every voyage, and it allowed vessels whose voyage was less than 30 miles in duration[11] to optionally complete a short voyage plan instead of the more detailed voyage plan used on longer voyages. The KRISTIN ALEXIS opted to use the short voyage plan, which is a paper bound flip booklet that gets filled out onboard and has minimal information on the particulars of the voyage, and includes air draft, under keel clearance, weather and conditions, and a few other items. There are a total of 13 blocks in total on the form.

The air draft listed on the form was marked as 37 feet, which was the air draft of the KRISTIN ALEXIS. This would have been sufficient, if they were pushing regular cargo barges, but not in this case of pushing the tall MR ERVIN. Paragraph 4.5 of VOP-4.2 requires the Captain or Pilot, upon receiving orders to commence a voyage, to *validate designation, tow configuration, drafts, vertical clearance, cargo, river stages along the route, and handling characteristics of the vessel and tow.* The policy also requires that *this short voyage plan form be updated throughout the voyage to keep all information correct and up to date*.

4.4. *Marquette Transportation Company, Gulf – Inland LLC.* Marquette Transportation, Gulf – Inland, LLC is one of three separate companies under the overall Marquette "brand" umbrella. It is comprised of just over 60 towing vessels that are mostly smaller towboats each less than or equal to 2000 horsepower. The nature of the work for Gulf – Inland involves 3 sections: fleeting operations like what the KRISTIN ALEXIS was involved in, as well as moving liquid tank barges, and various dry commodities on either a unit tow or ton-mile basis. The other Marquette divisions, each run as individual companies include Offshore and River division(s). Overall, Marquette owns and operates 131 towboats.

4.4.1. *Shortcomings or other areas for improvement*. Possible weaknesses that investigators discovered within the Marquette, Gulf – Inland division included an insufficient checks and balances. While they did have a robust SMS in place, it appeared as if it was not fully embraced or audited. For example, after reviewing historical records of Short Voyage Plan forms that were completed, every single one of them had listed the air draft for the towboat (as 37 feet high), even on the days that records indicated a crane barge was moved. There are no records of any management level reviews of those submitted plans, either. Another example comes with the internally performed "check ride" evaluation form. The Captain had a check ride in January of 2017 with good remarks, but a comment "*recommend he stay with 6 packs [6 barge tows on the canal] for now*," and no further assessment was performed to indicate he was cleared to work on the Mississippi River subsequent to that.

[11] The planned voyage for the KRISTIN ALEXIS was to push the MR ERVIN roughly 14 miles from Convent Marine Terminals, mile marker 161.5 ahead of passes on the lower Mississippi River to Darrow at mile marker 175.

4.4.2. *Communication of Lessons Learned*. Roughly 6 weeks before this accident, the Gramercy Bridge – the next bridge immediately down river from the Sunshine Bridge, was involved in another Marquette Transportation Company, Gulf – Inland LLC boat accident resulting in an overhead strike with some of the exact same factors as the Sunshine Bridge[12] accident. Of interest, no fleet-wide safety alerts or safety stand-downs were conducted to discuss the particulars of the accident. Raising awareness of this situation without delay could have increased vigilance and heightened awareness during bridge transits.

4.5. *Cooper Consolidated*. Cooper Consolidated is a stevedoring company, who owns and operates the MR ERVIN and other marine equipment, fleeting areas, and midstream facilities. In the case of MR ERVIN, it uses the MR ERVIN to load and unload ships and barges. Cooper entered into a 13-month long time charter agreement with Marquette Transportation for the KRISTIN ALEXIS and other vessels. Accordingly, the KRISTIN ALEXIS while still owned and crewed by Marquette, exclusively performed work at Cooper Consolidated fleeting areas. Work was assigned to the KRISTIN ALEXIS via the Cooper Consolidated dispatcher.

4.5.1. *Communications*. Cooper Consolidated management chose to only allow senior managers to know the particulars of the MR ERVIN (including air draft). The intention was that if anyone needed to know the information, they would have to ask. The result left a gap of desired information with employees; that void left a vacuum that was filled with incorrect data on the vessel's true air draft. With time, that incorrect air draft became circulated and made its way to the towing vessel crews and in turn became perceived to be factual, even though it was not accurate.

The air draft changes and is not static (due to change in draft of barge), but it only appreciably changes if they add or consume fuel, or take on a significant amount of equipment, or change ballast conditions. Another error in not advertising the maximum air draft was that if the towboat crews needed to find out what the air draft was, they were supposed to call the Dispatcher. When interviewed, the Dispatcher didn't know the crane data, but stated he would have asked a specific company employee who turned out to be one of the individuals who was not trusted with the air draft info. But not only did that employee not know the accurate information, he knew the inaccurate air draft. That left an area where the wrong air draft could have been relayed, even if the boat properly asked the Dispatcher for air draft information.

Prior to the accident, the Cooper Consolidated Vice President, Managing Director of Stevedoring and Maintenance performed bridge clearance calculations for the MR ERVIN. He considered the main span of the bridge using an accurate air draft of the MR ERVIN, and factored in the current Donaldsonville gage reading. This planning let them know that it was safe for the barge to make the transit. Unfortunately, this information was not provided to the boat. It may have been available to the boat, but nobody on the boat asked for it either. No information about which bridge span to take was relayed when tasking the KRISTIN ALEXIS to move the MR ERVIN.

[12] This Gramercy Bridge accident was less severe than the Sunshine Bridge; towboat crews were allegedly unaware of the overhead strike, and it wasn't until later on that the crane owner informed the authorities that Marquette management then became aware of the incident.

4.5.2. *Quality Systems*. Cooper appears to be a well-run and organized company; however, they are not a towing company. As a result, they are not required to possess a SMS. Quality Systems and/or quality programs like ISO 9001, six sigma and other management systems lead to continual process improvement are great alternatives. Large and complex organizations can be well served to participate in programs such as that. Tracking all the preventive maintenance tasks alone on a complex vessel such as the MR ERVIN would make the switch to a quality system worth the effort.

4.6. *Other Threats or Deltas at the Higher Organization Levels*. When looking at the entire marine transportation system at large, there are layers of responsibility or influence provided away from the towing company that fall outside of the towboat itself. Below, we will discuss a few of those items.

4.6.1. *Cartography Confusion*. During the early phases of this inquiry, investigators quickly realized that there was some ambiguous information or other irregularities with the charting systems that could have caused confusion for mariners navigating this portion of the river. Specifically, as noted below in this section 4.6.1, but also further expanded upon in detail in the Conclusions paragraph 5.7, was a difference in the charted bridge clearance information in the NOAA and USACE charts.

4.6.1.1. *Coast Guard Role/Involvement in Charting*. Each Coast Guard District office has a Bridge Administrator (in some cases there are more than one), in addition to a Coast Guard Headquarters Program management. The district Bridge Branches as they are commonly known, manage the day to day work as it pertains the bridges that fall within their geographic areas of responsibility. In the Sunshine Bridge's case, this was the District Eight office in New Orleans, Louisiana.

When a bridge owner wants to build a (or modify an existing) bridge, they would work with the Bridge Branch office to ensure the bridge is built in such a fashion that it doesn't impede safe navigation. They will also work to permit the bridge, which is a detailed and involved process that includes getting feedback from the public and waterway users to determine what is acceptable. When complete, they will have a permitted area that is safe for vessels to transit through when the bridge is built.

Testimony revealed that what the Bridge Branch permits is an area that is safe for vessels to transit through, given a horizontal clearance area and a vertical clearance limit. Important to note, this permitting process fixes the vertical clearance's point of measurement on the bridge to wherever the "low steel" point is on the bridge, within that horizontal clearance (the channel width). This essentially creates an invisible rectangle that, if viewed from the water while approaching a bridge, would be as wide as the channel and as high as the lowest point on the bridge within the reaches of the channel.

Every bridge is designed differently, however this gives the best safety margin for the mariner, to know that you can safety transit anywhere on that channel under a bridge and know that you will have that charted vertical clearance for the entire channel span. It was also noted, that they only permit the main channel; any alternate or auxiliary channels are not permitted in this same manner. The only key variable that the mariner would need to focus on when performing vertical clearance calculations in this case is the river stage.

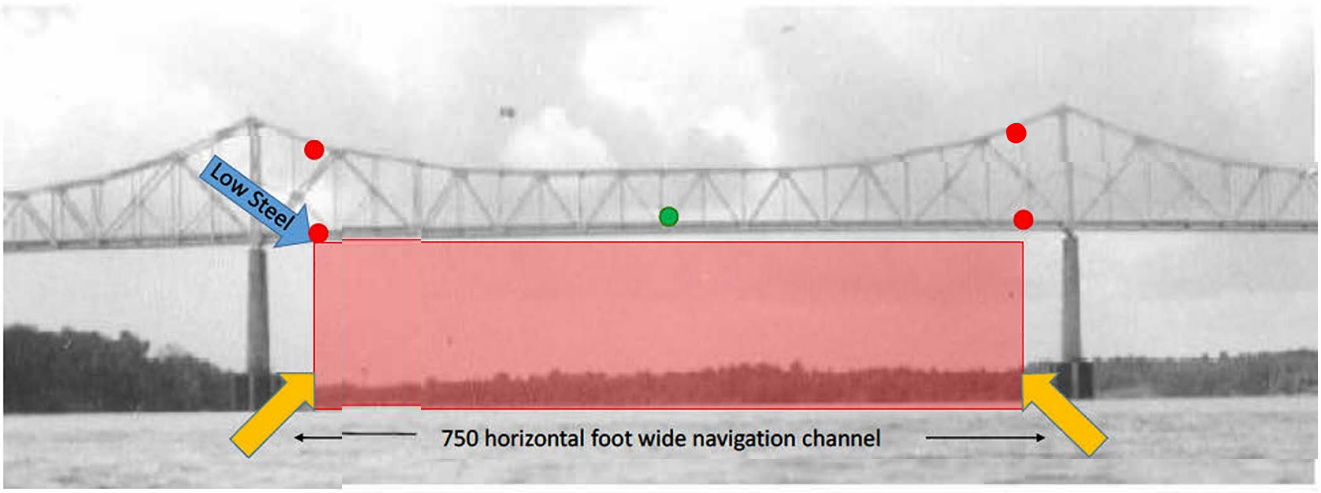
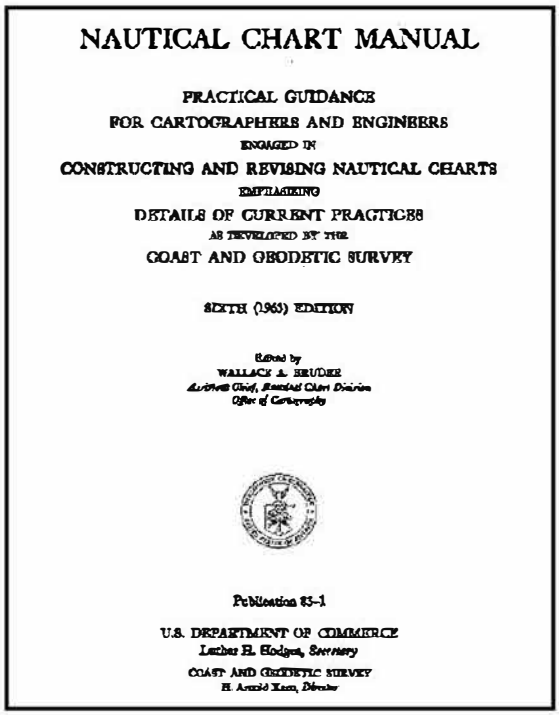


Figure 7. Not to scale, and for demonstrative purposes only. This picture is intended to depict the concept of a safe navigation "box" or area *permitted* by the Coast Guard. Yellow arrows depict the extent of the navigation channel; Green light marks center channel while red lights mark outer extend of navigation channel. Blue arrow shows where the "low steel" could be on the bridge; if you were to go across the channel width, you would see that there are some areas where one portion of the bridge could be higher than the "low steel". Photo provided by USCG D8 Bridge Branch.

The Coast Guard also works with the other mapping agencies. Once a bridge is completed, the bridge owner is required to submit a Bridge Completion Report, which is sent to the Coast Guard, who then forwards it on to other mapping agencies, in this case NOAA and USACE. Once these agencies receive the Bridge Completion Reports, they will update their charts with the appropriate information (Note: Information is shared and charted before bridge construction begins, so that waterway users know that a bridge is being constructed and there may be certain obstructions or distractions in place).

4.6.1.2. *NOAA Role/Involvement in Charting*. NOAA is responsible for maintaining, updating, and producing the Coast Pilot as well as the Nautical Charts, in this case chart number 11370 and Coast Pilot Volume V. They also create the ENC, which goes as far north and upriver to Baton Rouge, Louisiana. NOAA is currently the only producer of ENCs for the Mississippi River from Baton Rouge and points southward. The NOAA Raster or Paper Chart lists the vertical clearance of the Sunshine Bridge simply as 133 feet.

NOAA follows the Nautical Chart Manual for direction and instruction on how to chart bridges and overhead obstructions. The version of this manual that was in effect when the Sunshine Bridge was completed was the 1963 version. The guidance from the current version of this manual states "*regarding the clearances and vertical datum for bridges over non-tidal waters, has the clearance shown at high water referring to the stage at which navigation generally ceases, although there are exceptions*." In this case, the Sunshine Bridge was based upon the 1927 High Water Plane[13].


NAUTICAL CHART MANUAL

PRACTICAL GUIDANCE
FOR CARTOGRAPHERS AND ENGINEERS
ENGAGED IN
CONSTRUCTING AND REVISING NAUTICAL CHARTS
EMBRACING
DETAILS OF CURRENT PRACTICES
AS DEVELOPED BY THE
COAST AND GEODETIC SURVEY

SIXTH (1963) EDITION

Edited by
WALLACE A. BRUDER
Assistant Chief, Nautical Chart Division
Office of Cartography

Publication 83-1

U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary
COAST AND GEODETIC SURVEY
H. Arnold Karo, Director

Figure 8. Image of the cover of the 1963 version of the Nautical Chart Manual, provided by NOAA Office of Coast Survey.

4.6.1.3. *USACE Role/Involvement in Charting*. USACE maintains the paper river map flip book and the iENCs, which are electronic charts of the river system. The paper maps cover the length of the entire river system, however the USACE does not produce iENCs south of Baton Rouge. Their river map shows the map of the river on one page, and on the opposite page depicting the area where the Sunshine Bridge is, showing a profile view of the bridge with more detailed information. This is the case with all the bridges on the river. The drawing provides vertical and horizontal clearances as well as gage references and how to calculate vertical bridge clearances based upon real time river stages.

The USACE map that shows the profile view of the Sunshine Bridge, lists details for two spans – the Main span showing a 171 feet maximum vertical and minimum clearance of 135 feet when the Donaldsonville Gauge reads 36 feet; and this bridge also has additional clearance information for the alternate West span. The alternate span shows a maximum clearance of 147 feet and a minimum of 111 feet when the gage is 36 feet. Given that and a river stage, one can mathematically determine a true clearance. For the river map of the Lower Mississippi River, the only other bridge you see that same situation with two spans listed is the Huey P. Long Bridge in New Orleans.

4.6.2. Available Information

4.6.2.1. *NOAA's Physical Oceanographic Real Time System (PORTS)*. The NOAA PORTS system is a complex array of electronic sensors that aggregates and displays numerous sensors, designed to put information necessary for safe

[13] National Weather Service historical archives show that the historic crest and highest recorded flood stage for Donaldsonville, Louisiana was set on May 15, 1927 at a stage of 36.01 feet.

navigation directly into the hands of the waterway users. It is a great way to integrate electronic information and to bolster the new initiatives towards eNavigation practices. The program objectives of PORTS is to promote navigation safety, improve efficiency of the U.S. ports and harbors, and ensure the protection of coastal marine resources. Studies performed to date have shown a significant reduction to marine casualties[14]. According to this study, accident rates have dropped drastically in areas where PORTS is established. The accident rate per vessel transit has gone from .035 accidents per voyage down to .014 an overall reduction in accidents by 51%. When specifically focusing on allisions, the rate reduction was an astounding 54%.

It is currently in place to some degree in 34 U.S. harbors and waterways (77 locations in all as of 2016 reports), and consists of sensors like winds, tides, currents, air and water temperatures, barometric pressures and bridge air gaps, amongst others. Information is currently available on the NOAA PORTS website and through certain connections or relays to harbor and bar pilots. Future plans and improvements would ideally transmit information through AIS signals to be made available in every wheelhouse with an ECDIS and/or ECS.

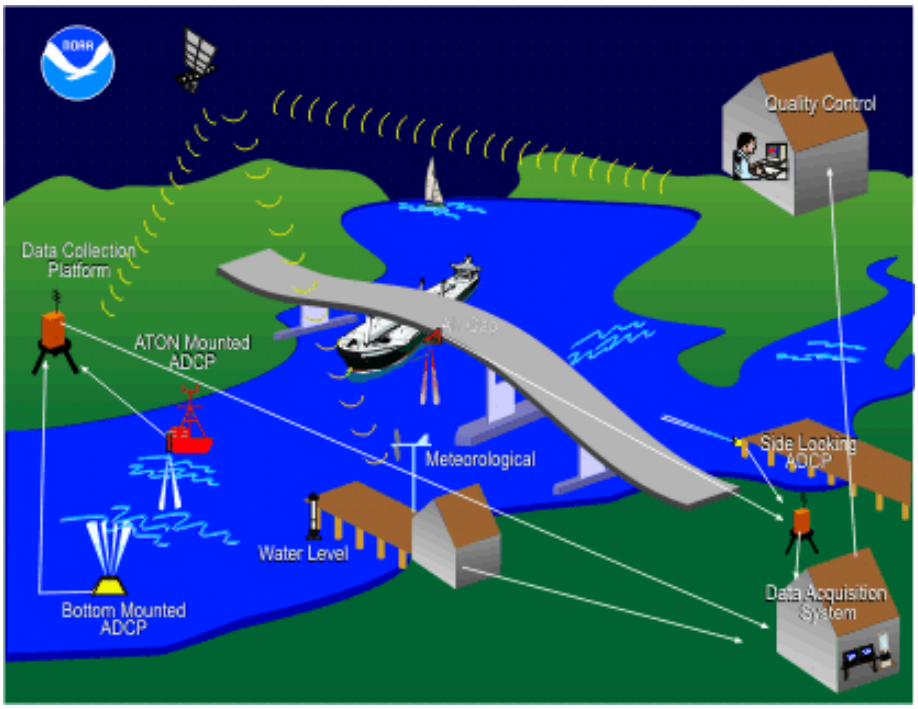


Figure 9. A graphic designed to show the different available sensors and communication flow of the PORTS system, provided by NOAA

Of the available sensors, the Huey P. Long Bridge in New Orleans has an air gap sensor. This sensor has been extremely helpful to the local harbor pilot associations and waterway users. In addition, it has been used by the VTS New Orleans, and data provided upon request, numerous times per day. Because of its reliability and ease of use, the local industry trade associations have been seeking to have these sensors installed on all the local bridges. This information is

[14] September 8, 2017 Report by [redacted], NOAA titled Vessel Allision, Collision, and Grounding Incidents: Estimated Impact of PORTS (2005-2016).

extremely critical for safe ship passages, and for that of other vessels with taller structures.

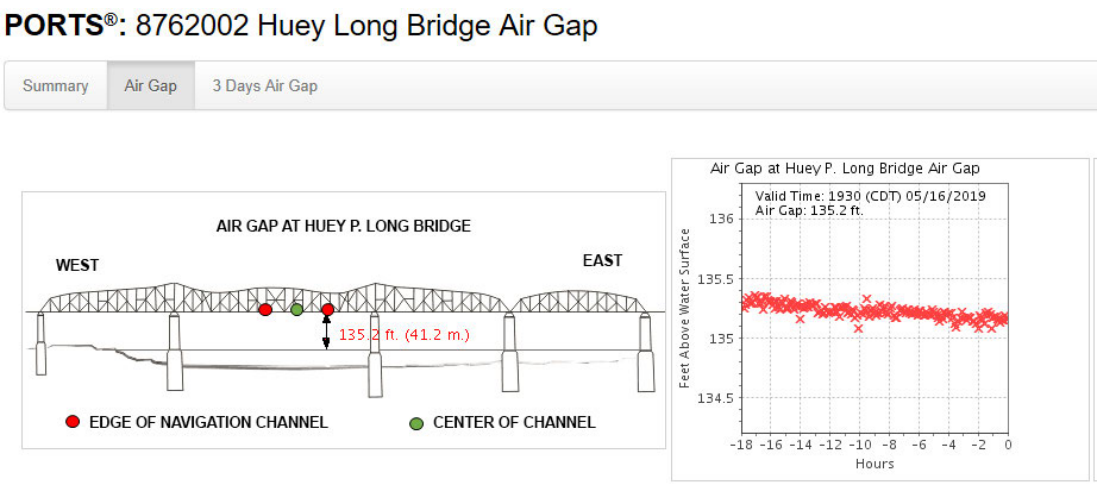


Figure 10. An image of NOAA's PORTS website that shows the image and data provided to waterway users for the air gap sensor on the Huey P. Long Bridge in New Orleans, Louisiana; provided by NOAA.

4.6.2.2. *Waterways and Gages (USACE).* The Army Corps of Engineers play a crucial role with waterways management. They have consistently been involved in managing the waterway and protecting the public from the Mississippi River. Over years and through numerous projects, the USACE has built complex levee systems and later reinforced them with different revetment materials to keep them strong and intact. Along with that has come the need to track the various river stages and share that information to the public.

Through partnerships with USGS, and NOAA/NWS who each have gauges in place to read the river stages at hundreds of different locations, river stage information is collected and shared electronically to mariners, the public, and other government agencies. This information is extremely important. Without it, you would not be able to calculate how much vertical clearance there is under a bridge or other overhead obstruction.

4.6.2.3. *Vertical Gauge Boards*. Having real time information available in the wheelhouse of a vessel is critical. The Captain (or Pilot in this case) must have accurate and up to date information in order to make operational decision safely and quickly. The question becomes: how is that information available? There are a few available ways.

4.6.2.3.1. First, the electronic PORTS sensors mentioned above is one way, but it comes with up front and reoccurring costs and other maintenance and website management expenses. The Sunshine Bridge did not have any PORTS sensors at the time of this accident.

4.6.2.3.2. Secondly, the tried and true way that is available to determine vertical clearances are that you could rely on the charting systems in place to provide you with information. With this, you would mathematically calculate how much vertical clearance you have, given the current river stages (or tidal ranges in coastal waters). This way is effective, and relies on prudent seamanship and good voyage planning, and would be completed in advance of getting underway. If making a longer duration voyage, this could be done before getting underway, however should always be recalculated before attempting to transit the bridge in case the river stage or tides have changed, especially if your voyage is days or weeks in duration. In this case, you would have to have a very firm grasp on how the different datums work in order to understand what the NOAA Chart measurements really mean.

4.6.2.3.3. Thirdly, you could employ a device that some bridges already use – called a vertical gauge board. A vertical gauge board is a fixed board, sometimes affixed to the bridge pier or otherwise near the bridge, has the actual true air draft displayed for you. The mariner would read the board and wherever the water level was, it would tell you exactly how much vertical clearance you had at that exact moment in time. The Coast Guard is the agency that has the authorities over bridges and ability to determine whether one would be required to be installed on a particular bridge. The Sunshine Bridge did not have one of these boards at the time of the accident.

Figure 11. Drawing of what a vertical gauge board looks like. It would be in the water, and the waterline would cross a number and would provide the actual real-time vertical clearance at that bridge or overhead obstruction.

4.6.3. *Risk Reduction Measures – Previous Actions Intended to Reduce Overhead Strikes*.

4.6.3.1. *Towing Safety Advisory Committee*. The Coast Guard uses a Federal Advisory Committee[15], in this case TSAC, to help assist in advising and properly developing rules that effect the towing industry. An example of this is TSAC's work in helping to develop the new 46 CFR Subchapter M towing vessel inspection regulations.

The Coast Guard has historically tracked marine casualties and noted an unwanted trend of "overhead strikes", where you have a situation where a boat navigating

[15] Federal Advisory Committee Act (Public Law. 92–463, 86 Stat. 770, enacted October 6, 1972), is a United States federal law which governs the behavior of federal advisory committees.

hits an obstruction above them [as in this Sunshine Bridge accident]. As such, in 2013 the Coast Guard tasked TSAC with the following:

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

TSAC set to work studying the casualty trends and coming together to provide information back to the Coast Guard. Their work was completed in November 5th, 2015 and produced Final Report 13-10 Recommendation to Establish Criteria for Identification of Air Draft for Towing Vessels and Tows with their recommended actions[16]. That report's recommendations were partially addressed in 46 CFR Subchapter M rulemaking project, but that didn't capture all of them. The timing of the report did allow a minor change to be added to the final rule in the navigation assessment portion of the regulations[17] to clarify the wording on air drafts. The TSAC recommendations also describe how a towing vessel's SMS should also address air draft concerns. One very sound recommendation made that was not acted on, was a proposal that would mandate maximum air draft be permanently marked/posted in a place where easily visible from the operating station.

4.6.3.2. *Safety Alert*. Another notable action to mention was the Coast Guard's release of Safety Alert 09-14. This came out following the creation of this TSAC Overhead Strike subcommittee, and appropriately timed in conjunction with some other high-profile bridge allisions of this same nature. It too publicized best practices when approaching bridges and overhead obstructions as it pertains to knowing your air draft and remaining air gap. The key points to take away from this Safety Alert were:

Due to the frequency of overhead bridge allisions in the recent past, the Coast Guard **strongly recommend** owners or operators of vessels ensure that:

1. Every officer in charge of a navigational watch know the air draft of his/her vessel and tow and also know how to apply that knowledge using

[16] This and other TSAC Reports can be found on the Coast Guard's Homeport website located here: https://homeport.uscg.mil/missions/ports-and-waterways/safety-advisory-committees/tsac

[17] 46 CFR § 140.635 states that (a) the officer in charge of a navigational watch must conduct a navigation assessment for the intended route and operations prior to getting underway. The navigation assessment must incorporate the requirements of pilothouse resource management of §140.640, assess operational risk, and anticipate and mange workload demands. At a minimum this assessment must consider [thirteen things, including]: (6) Air draft relative to bridges and overhead obstructions taking tide and river stage into consideration; (b) At each change of navigation watch, the oncoming officer in charge of the navigation watch must renew the current navigation assessment; (d) the assessment must be recorded in the towing vessel record or log.

the resources available to him/her regarding the height and location of bridges, power lines, pipe lines and other elevated objects located within the navigable channel.

2. Assumptions are not made regarding a vessel or its cargo's "air draft" or of "bridge heights". Specific data must be known when planning transits.

4.6.3.3. *Operation BIG TOW and Bridging Program Phase I and II*. Again, following major marine casualties that occurred involving towing vessels, the Coast Guard launched a nation-wide operation knows as Operation Big Tow, a marine safety focused operation, on Nov. 1, 2008. This included at least two surge operations with the intent of identifying areas of Uninspected Towing Vessel (UTV) concentrations and examine the vessels to ensure UTV operators hold a valid Coast Guard license that is appropriate for the size and route of their vessel.

The Bridging Program was a strategy designed to help the towing industry span the gap for the from the previous uninspected voluntary examination program to an upcoming mandatory inspection regime. The Bridging Program was very extensive and consisted operationally of two phases. Phase I involved outreach, education, and the performance of voluntary exams that were performed at industry's request. Phase II's intent was to perform the exams on the other vessels that had not yet received or otherwise asked for a voluntary exam. Operation Big Tow, Bridging Program Phase I and Phase II were huge, resource intensive programs that were devoted to going onboard towing vessels to verify compliance with the existing 46 CFR Subchapter C uninspected vessel regulations.

4.6.3.4. *Inspection mandate and regulations*. In 2004, Congress mandated towing vessels to become inspected vessels in the Coast Guard and Maritime Transportation Act of 2004. The Coast Guard worked with the industry and the public for years to create the necessary rulemaking process that was eventually published in the Federal Register as a Final Rule in 2016.

The program came with a two-year implementation period to give industry and the Coast Guard time necessary to prepare before applying the regulations and commence actual inspections in 2018. In addition, the Coast Guard allowed a 4-year phase period to distribute the workload evenly. While a majority of the companies are using a Third-Party option with the associated SMS, many of the boats should have policies in place that would include performing necessary navigation assessments. As a result, the full effect and benefit of this new inspection regime won't be fully realized until roughly the year 2022, when all the towing vessels have been inspected.

Despite all the Coast Guard's efforts, as you can see from the graph below, there has not been a significant reduction in overhead strikes. The chart below includes the data that was used in the 2013 TSAC subcommittee. The statistics have been renewed and extended out to the date of this casualty in order to see how well industry has performed since the TSAC recommendations were made. It portrays how effective the Coast Guard's major risk reduction efforts have been in lowering the occurrence rate.

To date, there is a positive downward trend in reductions, however that number is not as reducing as quickly as one would ideally come to expect. It started out with an occurrence rate of roughly 20 overhead strikes per year, and has improved to an average of 18.25 incidents per year. While that is an improvement, 15 years in time has elapsed which is more than enough time to reduce the occurrence rate a greater amount than that. At the equivalent reduction/improvement rate without any additional changes, it would take roughly 4 more decades to eliminate all overhead strikes[18].

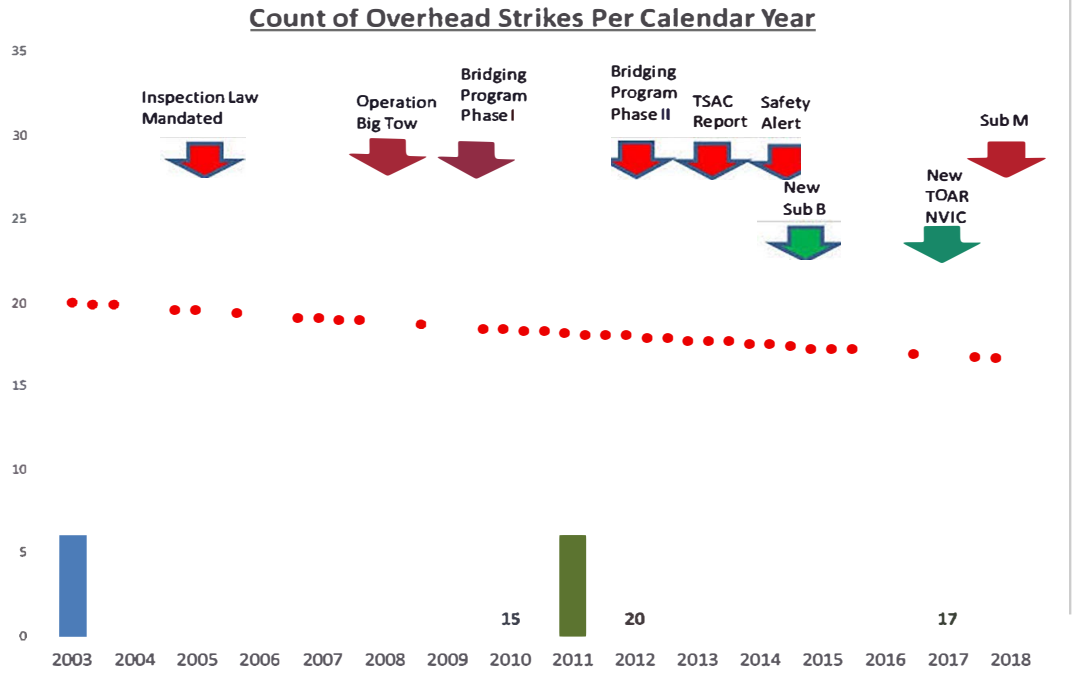


Figure 12. This is a graph that shows the number of marine casualties that were allisions and involved an overhead strike. This data runs 16 years, and includes the information provided to TSAC for their 13-10 Report as well as new information on those same type of incidents since then. A trend line has been added as well as arrows indicating a place in time where those major Coast Guard initiatives took place, provided by USCG Office of Investigations.

As noted with this casualty and documented in a report produced by the Coast Guard's Research and Development center in 2000[19], human error is either the cause or contributing factor to over 89%-96% of all marine casualties involving collisions, and 75% of allisions. The report indicates that "*the previous 40 years had improved ship structure and reliability in ship systems in order to reduce marine casualties and increase efficiency and productivity. Yet, the marine casualty rate remained high because that is a relatively small part of the safety equation. The maritime system is a people system, and human errors figure prominently in casualty situations*." Along that same line of thinking, it is hard to see how the human element would be changed or reduced by implementing inspection standards on the boat (referring to Subchapter M regulations). While the inspection regulations will go a long way in making the industry safer, additional steps need to be taken above and beyond simply implementing

[18] 2018 was not a complete year, only to the date of this casualty.

[19] Human Error and Marine Safety, b USCG R&D Center Report No. CG-D-21-00

Subchapter M in order to reduce marine casualties and ensure mariners stop having bridge allisions or overhead strikes.

This report goes on to mention nine different types or primary reasons of human error in casualties. Of those nine listed, astonishingly six are found in this casualty. They include Inadequate Communications, Inadequate General Technical Knowledge (e.g. ECS use), Inadequate Knowledge of Own Systems (Air Draft), Poor Design of Equipment (Crane design blocking view), Decisions Based on Inadequate Information, and Faulty Practices (choosing, or having a history of choosing the alternate span).

Two large initiatives the Coast Guard has implemented regarding personnel are also highlighted above on figure 12 and displayed with Green Arrows. In 2010, the International Convention of Standards, Training, Certification and Watch-keeping (STCW) that was originally held in 1978 and again in 1995, had a significant update in 2010. This 2010 amendment was very far reaching, and required the Coast Guard to make a significant change to its regulations for merchant mariners and licensing, found in 46 CFR Subchapter B. That rulemaking process affected both its mariners traveling internationally as well as its mariners working domestically. The change was so vast that it had to issue over 2 dozen Navigation and Vessel Inspection Circulars to help successfully implement the regime. Of that, came a NVIC for towing vessel certification in 2016[20] that improved and clarified how Designated Examiners were required to perform their role. These two items constituted significant changes to the program. Over time, we should start to see continued improvement as the new mariners that are now beginning to earn their credentials through this new oversight come up through the ranks.

4.6.4. *Overall Coast Guard Marine Transportation System Management*.

4.6.4.1. *ATON Off station or missing*. There were Aids to Navigation in this portion of the river. Of the aids present, the Sunshine Bridge was marked by #14840 Sunshine Bridge Approach Buoy "A", and #14835 Sunshine Bridge Approach Buoy "1", however "A" was categorized as adrift and "1" was categorized as missing. Mariners were notified of these discrepancies through local notice to mariners that are published weekly. "A" had been discrepant since the 12th week of 2018, and "1" had been since the 50th week of 2016. Despite these being missing and adrift, they were considered synthetic aids as a part of the eATON program, and their positions had an electronic marker painted over their locations. Once the buoys became discrepant, they remained virtual aids to navigation because the AIS signal continued to transmit and placed electronic signals where they were supposed to be, and continued to show up in the wheelhouse of a boat on their ECS, even though the physical buoy may not have been there at the time of the accident.

[20] Navigation Vessel and Inspection Circular 03-16, Change 1 titled Guidelines for Credentialing Officers of Towing Vessels released September 28, 2017 after original release June 23rd, 2016. Enclosure (4) has the new Towing Officer Assessment Record (TOAR) for Western Rivers.

There was plenty of testimony that revealed the Pilot knew exactly where he was in the river and what his relation and bearing was on the bridge. Despite the buoy's absence, it played no role in this casualty.

4.6.4.2. *VTS New Orleans*. While VTS New Orleans' area of responsibility goes all the way to Port Hudson, roughly 20 miles above Baton Rouge, this accident did not occur within a Check-in area, or within one of the few areas that are active vessel management areas. No actions or in-actions on any part of any VTS employee had any bearing on the occurrence of this casualty.

VTS is a great resource, and had the KRISTIN ALEXIS called and asked for information, the VTS could have provided information on things like vertical clearances, river stages, and other information on nearby vessels.

4.6.4.3. *Merchant Mariner Credentialing and Training*. The Coast Guard National Maritime Center and program office CG-MMC have the responsibility to administer the mariner credentialing program. This is probably one of the most important and critical components needed to properly ensure the safety of our marine transportation system and includes issuing credentials (formerly referred to as licenses) and documents to American mariners.

Another key component to this program is in providing oversight and course approvals of the training providers that train and educate mariners. This is to ensure training is done effectively and yields a well-trained and a competent workforce. Regarding towing vessels, this process also includes the use of designated examiners (DE) for training and instruction. DEs are seasoned and experienced mariners, able to observe apprentices seeking credentials during the actual performance of duties. This portion is critical because the underway aspect of navigating a towing vessel is so dynamic and challenging that not all of it can be learned or evaluated in a classroom type setting.

While the credentialing program largely appears to be running smoothly and efficiently, this casualty highlights a new area of needed focus. There is currently no mandate for a mariner to have any training on electronic charting systems outside of the international STCW mandate that requires an Officer in Charge of a Navigation watch to have ECDIS training, if the ship is outfitted with an ECDIS. The KRISTIN ALEXIS was operating with Rose Point, an ECS. This system, and others like it, offer many advanced electronic capabilities that enhance navigation and situational awareness. Unfortunately, there are no mandates that require one to be trained on how to use it; any commercial vessel outfitted with an ECS should have a credentialed operator that is trained on how to use it.

In addition, it appears if an analysis should be performed to determine if a towing vessel wheelhouse team management course needs to be implemented. The dynamics and interactions between relieving people on watch, as well as interactive use with simulator experience like other established bridge resource management courses should be required.

5 Conclusions

5.1. Determination of Cause:

5.1.1. Initiating Event – Allision with Sunshine Bridge. The initiating event of this incident occurred when the upper portions of steel structure of the MR ERVIN crane barge, being pushed by the KRISTIN ALEXIS, struck the Sunshine Bridge's structural members on the underneath side (resulting in an overhead strike or allision) of the alternate span. As a result, the crane became lodged underneath the bridge until it was safely ballasted down and removed the following morning. Below, Figure 13 depicts the bridge piling on the immediate West side of the alternate span along with the western portion of the 725' wide horizontal clearance charted on the USACE map. It also shows the point of impact right next to chord #15. Measurements show that at the time of the accident, there was 128 feet of vertical clearance at the lowest steel portion of that span, and that there was 133.03 feet of vertical clearance available at the point of impact.

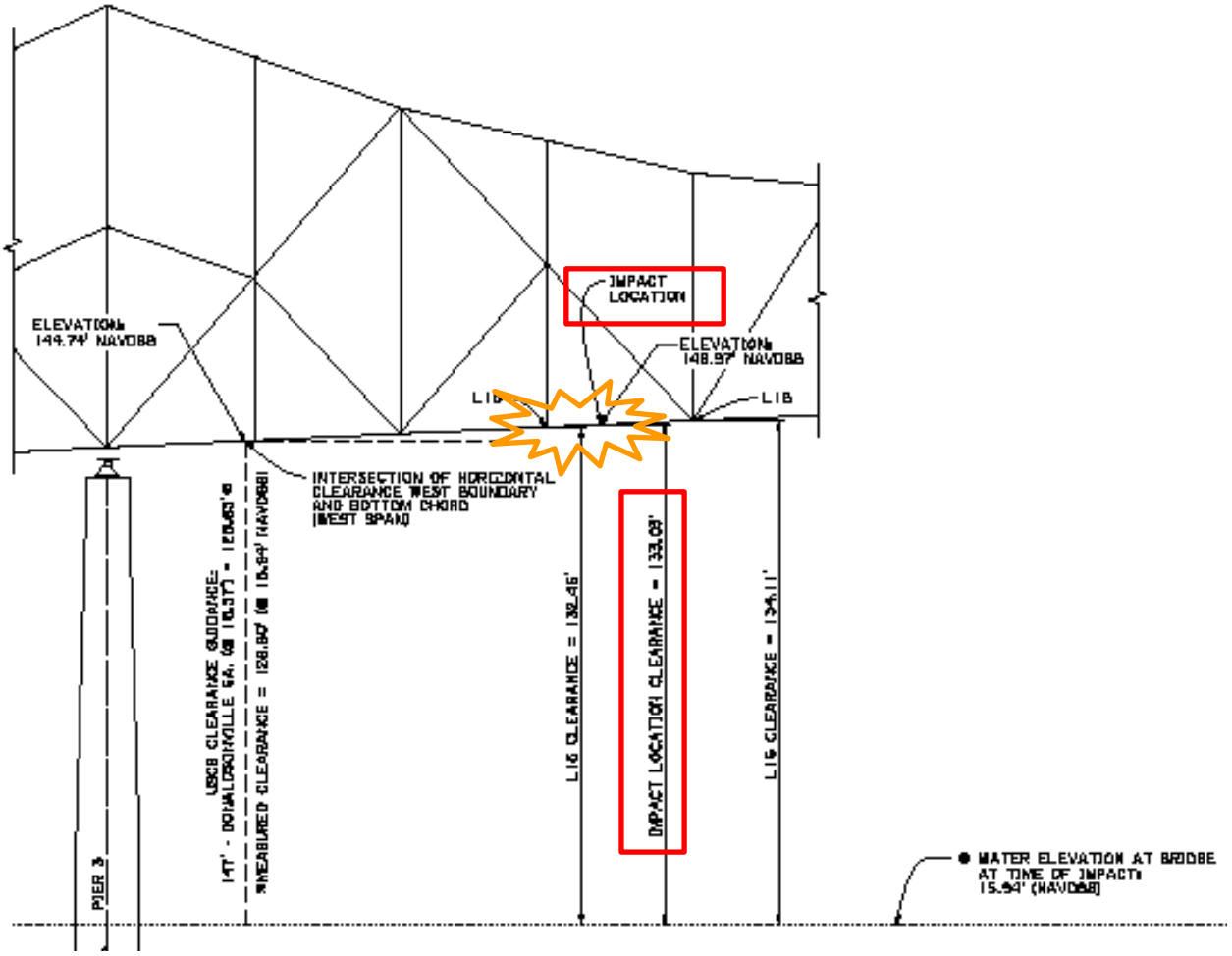


Figure 13. A plan drawing of the Sunshine Bridge, showing the point of impact for the allision. It also shows the actual vertical clearance of 133.03 feet at the spot on the bridge where impact occurred, provided by LADOTD.

Other measurements taken after the accident by LADOT surveyors (not depicted above) revealed that there was 140 feet of vertical clearance at the center of this alternate West span, meaning they would have safely cleared the bridge if they were at the center of the alternate West span. It is very interesting to note that the NOAA Chart listed the vertical clearance as 133 feet, and the actual point of impact was also 133 feet. Even though those numbers were the same, the reference point was different because the impact was far to the West on the alternate span, whereas NOAA's measurement was taken from the 1927 High Water mark of the main channel span.

There was an assortment of causal factors that lead to this incident's occurrence, but the *primary factor* was the Pilot of the KRISTIN ALEXIS' **decision** to go through the alternate West span of the Sunshine Bridge. Based upon testimony from several seasoned towboat Captains, the most prudent action would have been to pass under the bridge's main channel span. If that meant holding up and waiting for the traffic to pass first, that should have been done instead of proceeding up the lower Western span.

There were four other *contributing factors* that directly came into play in this decision making. First, was a **lack of accurate information** (or more appropriately worded – an inaccurate understanding of the crane height that was incomplete or otherwise wrong information) of the actual air draft of the crane. Specifically, the general arrangement plans of the MR ERVIN showed the crane's height above the deck to be 128 feet and 3 inches. In order to get the total air draft, you would need to add the barge's freeboard, which was roughly 7 feet and 6 inches, giving you 135 feet and 9 inches. Following the accident, investigators measured the air draft and came up with roughly 136 feet high. Interviews conducted by Coast Guard investigators following the accident revealed that towboat crews and employees misunderstood that the crane's height was 130 feet, when in reality, the MR ERVIN was approximately 136 feet of total air draft as stated above.

In addition, neither the Captain nor the Pilot on the KRISTIN ALEXIS had any discussions or information pertaining to the current river stage. That data is critical, and a necessary mathematical component to determine the actual vertical bridge clearances and understanding remaining air gaps. As such, no calculations of bridge clearance, air gap, or which span to take were properly factored into the voyage plan on the night of the accident.

Secondly, **reduced navigation visibility** from the operating station on the KRISTIN ALEXIS' wheelhouse was a significant factor in this accident**.** That was as a result of the Pilot's visibility being obstructed by the crane's structure; the Pilot opted to navigate the tow as closely as possible to the right descending bank…his left side of the channel. This was done because he knew what he could see on his left, and he just stayed as closely as he safely could to the bank, giving the widest berth possible to the other traffic in the center of the river. The Captain and Pilot both took prudent measures by sending deckhands forward on the barge to serve as lookouts, and making radio broadcasts of their reduced visibility, but other measures should have also been taken in order to compensate for the reduced visibility. Testimony revealed that while pushing the MR ERVIN, the view from the pilot house of the KRISTIN ALEXIS was 100% blocked by the steel structure of the crane on an arc of the horizon from dead ahead to 60 degrees on their starboard (just forward of the starboard beam is where they could see again). This structure also served to nullify and block the usefulness of their RADAR as well.

Figure 14. Image taken from the KRISTIN ALEXIS as it was made up to push the MR ERVIN on the accident voyage, looking out the wheelhouse window from the Captain's Chair observing the view being blocked by the MR ERVIN Crane. Image taking by Coast Guard Investigators.

Operating so closely to the West bank of the river while approaching the bridge made it appear like an easy and logical choice for the Pilot of the KRISTIN ALEXIS, to keep going straight through the alternate West span of the Sunshine Bridge with the MR ERVIN, especially given the presence of the down bound NEDRA K. The Pilot of the KRISTIN ALEXIS had testified that he had transited through the alternate spans of other bridges while pushing different crane barges in the past, even if during low water. These previous successful trips may have provided a false sense of security in making this same transit with MR ERVIN.

Figure 15. Photograph of the towing vessel KRISTIN ALEXIS as it was made up to the MR EVIN, with crane buckets still present. Note the crane barge HULK also in the background, Image taken by Coast Guard Investigators.

The third contributing factor was extra **crane equipment on deck that further decreased the field of view from the operating station**. The MR ERVIN had three spare buckets stowed on deck during transit and when not in use. On the night of the accident, there was a large 55-yard capacity bucket standing 17' 6" in height on the forward port side of the deck of MR ERVIN. That height, plus the freeboard forward which was roughly 7' 6", gives approximately 25' in height of obstruction. The height of eye of the wheelhouse on the KRISTIN ALEXIS was approximately 26' 4". This means that the operators of the towing vessel were roughly 16 inches in height of eye above the grab bucket. Calculations performed based upon known measurements taken after the accident, revealed that the Captain and Pilot could see the horizon in front of them. However everything closer than .75 miles, or 3,800[21] feet directly in front of them where the bucket was, created a blind spot where they couldn't see. This obstructed view created by the bucket further exacerbated their restricted visibility and compounded the difficulty in safely navigating and may have further influenced the Pilot's reasoning and decision making that took place.

Figure 16. Photograph of the crane bucket on the forward portion of the deck of the MR ERVIN following the accident. Image taken by Coast Guard Investigators.

Figure 17. Photograph depicts the height of eye of an operator of the KRISTIN ALEXIS and shows how far the blind spot would be in front of the crane bucket. Image taken and calculations performed by U.S. Coast Guard

[21] These calculations are very rough numbers. The results of the distance of blind sector changes drastically, in excess of 1,000s of feet of distance further when adjusting the height of eye by even a few inches. The Pilot was at least 6 inches shorter than the Captain, which would increase his blind spot by over 2,000 feet.

Figure 18. Photograph of the MR ERVIN taken from the water, looking at the forward end of the crane with the towing vessel KRISTIN ALEXIS barely visible in between the crane bucket and crane. Image taken by Coast Guard Investigators.

The KRISTIN ALEXIS was moored up to the port side on the stern in order to see around the crane; this positioning put them directly in line with the spare bucket in question. The width of the bucket was no more than 3-5 degrees over the arc of the horizon, and on its own wasn't that much of a concern, but when compounding that obstruction with an already existing 60 degree arc of visibility being obstructed, this became a big issue for the Captain and took him out of the zone of what he was comfortable with. This obstruction increased their amount of reduced visibility and made the transit more difficult. As such, the Captain requested to have the bucket removed, but that request was never acted upon.

The fourth and final contributing factor was the Pilot's **lack of full awareness and understanding of the safety management system**. While the Pilot had been a previous employee, his time away from the company and time as a deck hand and Apprentice Steersman did not properly prepare him to have a full and complete understanding of all the safety policies. He had only recently been hired on as a Pilot for the company, serving roughly 3 weeks of time with Marquette at the time of the accident. While he did review and sign an acknowledgement form attesting to viewing the SMS policy, it was evident that the existing SMS was not fully implemented the evening of the accident voyage. Amongst others, the risk assessment tool completed for that voyage and that watch resulted in an "amber" score. That score triggered a phone call with the Port Captain, but the call never occurred. If that conversation would have occurred, the Port Captain could have provided further advice or guidance on how to best proceed with the voyage – possibly causing a deviation from the intended plan to use the alternate West span for the Sunshine Bridge.

5.1.2. Subsequent Event – Materiel Failure (Bridge and Crane Damage). Knowing and understanding all of the above information, had the Pilot continued on and proceeded forward with the intended voyage to use the alternate West span of the Sunshine Bridge regardless, the KRISTIN ALEXIS and MR ERVIN could have safely traversed the bridge if they had stayed on the center of the span (under the green lights) as was originally intended. The LADOTD surveyed the bridge immediately following the accident, and the resulting survey determined that at the time of the accident, given the river stage at

that time, there would have been roughly 4 feet of available air gap to safely make the trip. As it turns out, the vessel ended up being set off the desired course and was approximately 260 feet off the centerline and closer to the West / right descending bank and near the edge of the navigation channel. Due to the steep slope of the bridge's design, the KRISTIN ALEXIS impacted the bridge at one of the lowest points on the bridge.

5.2. Evidence of Act(s) or Violation(s) of Law by Any Coast Guard Credentialed Mariner Subject to Action Under 46 USC Chapter 77:

5.2.1. Master, KRISTIN ALEXIS: The actions described in 4.2.4 represent violations of company safety management systems, which are established rules and procedures, and can be viewed as acts of *Misconduct*.

5.2.2. Master, KRISTIN ALEXIS: The actions described in 4.3.5 represent *violations of law or regulation,* namely 46 CFR § 140.635(a)(2) and (a)(6), namely failing to account for navigation assessment items including accounting for the river stages along the route, along with the air draft for bridges and overhead obstructions taking the aforementioned river stage into account.

5.2.3. Pilot, KRISTIN ALEXIS: The actions described in 4.3.2 represent violations of company safety management systems, which are established rules and procedures, and can be viewed as acts of *Misconduct*.

5.2.4. Pilot, KRISTIN ALEXIS: The actions described in 5.1.1 represent *negligence*. Existing case law and numerous Commandant's Decision on Appeals show that alliding with fixed, charted objects in a waterway, such as a bridge, is sufficient prima facie evidence that show a presumption of negligence exists.

5.2.5. Pilot, KRISTIN ALEXIS: The actions described in 4.3.5 represent *violations of law or regulation,* namely 46 CFR § 140.635(a)(2) and (a)(6), namely failing to account for navigation assessment items including accounting for the river stages along the route, along with the air draft for bridges and overhead obstructions taking the aforementioned river stage into account.

5.3. Evidence of Act(s) or Violation(s) of Law by U.S. Coast Guard Personnel, or any government employee or other person: There was no evidence uncovered that showed any acts of misconduct, incompetence, negligence, unskillfulness, or violations of law by members of the Coast Guard, other government agencies, or other person that contributed to this casualty.

5.4. Evidence of Act(s) Subject to Civil Penalty: There was no evidence uncovered that showed any violation of any law or regulation that would be subject to civil penalty.

5.5. Evidence of Criminal Act(s): There was no evidence uncovered that showed any violations of criminal law as a result of this investigation.

5.6. Need for New or Amended U.S. Law or Regulation:

5.6.1. The action(s) described in this report regarding towing vessels and bridge visibility while pushing a barge represent the potential need to amend 33 CFR § 164 – Ports and

Waterways Safety, Navigation Safety Regulations, specifically the applicability of subpart 164.15, and also the scope of intended audience (applicability) of 164.80(c)(3) to prevent the reoccurrence of a similar casualty. The specific changes recommended are addressed below in Section 7 of this report.

5.6.2. The action(s) described in paragraphs 4.6.3.1, recommendations made by TSAC, are especially noteworthy, and represent the potential need to amend 33 CFR § Subchapter P – Ports and Waterways Safety, Towing of Barges and Navigation Safety Regulations (Parts 163 and 164) and/or 46 CFR § Subchapter M – Towing Vessel Regulations, to prevent the reoccurrence of a similar casualty. The specific changes recommended are addressed in Section 7 of this report.

5.6.3. The action(s) described in paragraphs 4.6.2.1 and 4.6.2.3, discuss ways of providing real-time vertical clearance information to waterway users, and represent the potential need to increase application of current regulations by amending 33 CFR § Subchapter J – Bridges, Drawbridge Operations and Bridge Lighting and Other Signals (Part 117.47 and 118.160), to prevent the reoccurrence of a similar casualty. The specific changes recommended are addressed in Section 7 of this report.

5.6.4. The action(s) described in paragraphs 4.6.4.3, represent the potential need to increase training and understanding in the use of ECS displays, and also that of a company's safety management system before assuming control of a navigation watch, by amending 33 CFR § Subchapter F – Vessel Operating Regulations (Part 96) and 46 CFR § Subchapter M – Towing Vessel Regulations (Part 140.515 or Part 138) to increase the applicability to prevent the reoccurrence of a similar casualty. The specific changes recommended are addressed in Section 7 of this report.

5.7. Unsafe Actions or Conditions that Were Not Causal Factors:

5.7.1. Nautical Charting. This investigation uncovered possible charting inconsistencies that need to be addressed. I feel they are not causal factors in this case, solely because the voyage planning and navigation aspects of this transit were not fully completed. Had the Pilot or Captain of the KRISTIN ALEXIS known the air draft of the MR ERVIN or current river stage; these charting inconsistencies may have played a greater role. The voyage was made based upon the knowledge and understanding that MR ERVIN crane barge had been shifted between the Convent Marine Terminal and Darrow Fleet which included traveling beneath this bridge safely on 12 different round trips within the previous (and first) six-months of service of Cooper Consolidated' s ownership. None of those trips included traveling through the alternate West span.

The two U.S. Government mapping agencies, NOAA and USACE, both produce charts (NOAA's nautical chart and ENC, and USACE's river map book) for this area and both include the Sunshine Bridge. A side-by-side comparison will show any novice user different and confusing bridge vertical clearance information. The difference between the two charts is that the NOAA chart only gives you the vertical clearance (133 FT), and additional information that overhead clearances were derived from the 1927 High Water Plane. No other clarification, detail, or information is provided on how that number is derived, nor how one would calculate to find out what the real-time vertical clearance is when factoring in river stage. There is, however, a separate special note that sends readers to Coast Pilot 5 for supplemental information, but only has very minimal details about the bridge including the width of the channel, and nothing on vertical clearance.

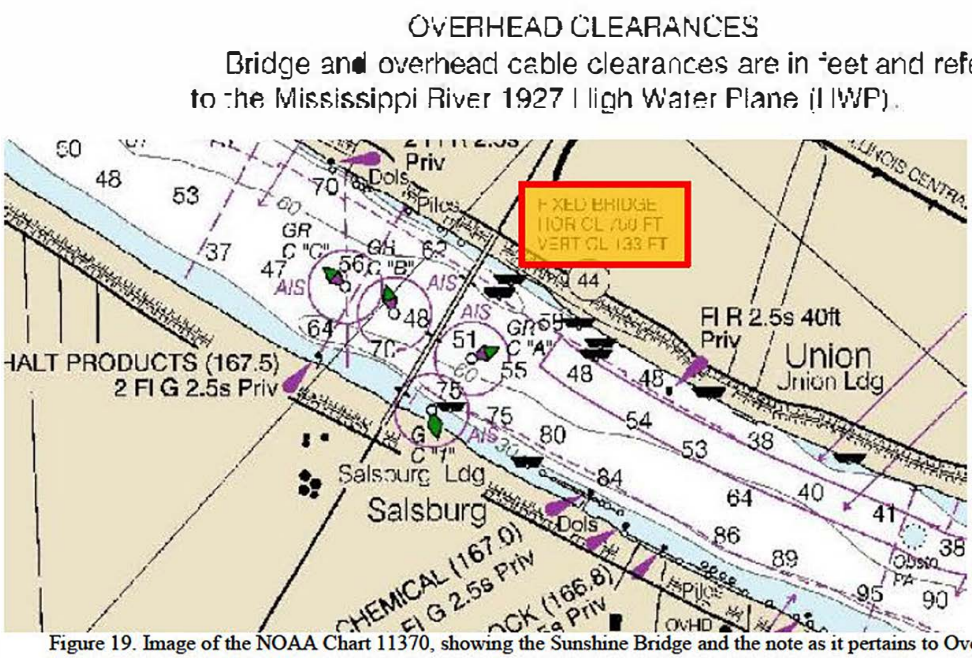


Figure 19. Image of the NOAA Chart 11370, showing the Sunshine Bridge and the note as it pertains to Overhead Clearances, provided by NOAA.

In contrast, the USACE River Map Book gives a profile view of the bridge which shows both the main channel and alternate West span(s), providing vertical and horizontal clearances with both the maximum and minimum air drafts with the source datum at the Donaldsonville gauge, which would allow readers to calculate the real-time bridge clearances.

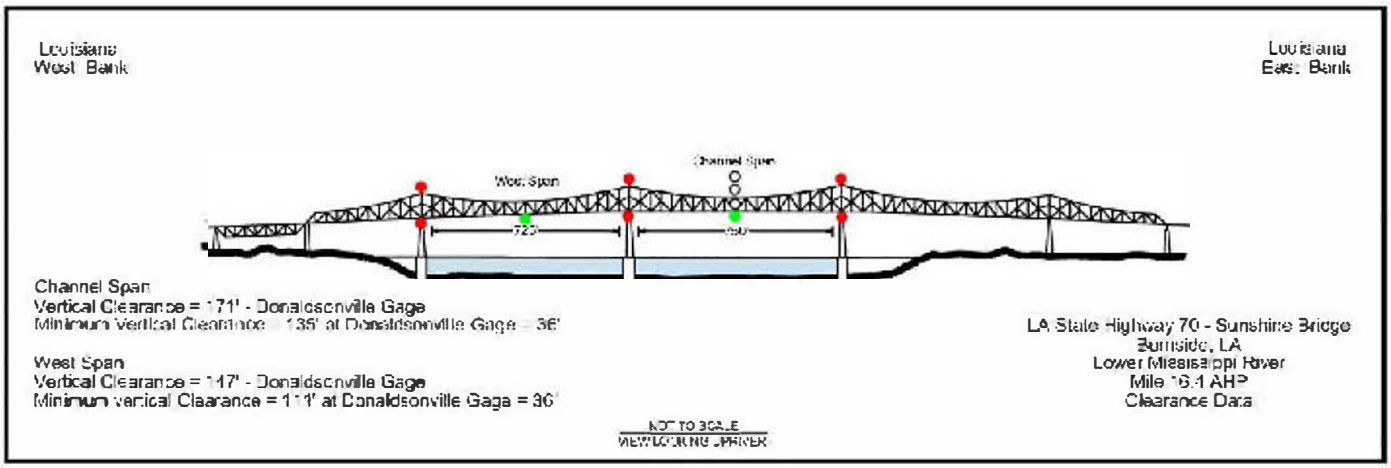


Figure 20. Image of the Sunshine Bridge profile view as displayed in the USACE River Map Flip Book, provided by USACE.

While the NOAA chart doesn't provide the baseline reference information, if one were to somehow know it was based on the Donaldsonville gauge, and that 36' was the high water mark from 1927, you would still have a **two foot difference in vertical clearance** between the two charts (133' at the highest water level possible on the NOAA chart, and 135' at the highest water level possible on the USACE chart).

One point that is interesting to note: the NOAA chart doesn't expressly state which span the vertical clearance is listed for, or if it is for the whole bridge. The Rose Point system used on the KRISTIN ALEXIS to display the NOAA ENC showed the bridge height of 132.9 feet for the whole length of the bridge, including "floating" over what would be the alternate West span causing possible confusion for a mariner. Through testimony of the Branch Director at the USCG District Eight Bridge Administration office, we learned that the permitting process, including what makes it to the NOAA chart, is only for what is the main channel and not for any auxiliary or alternate avenues. As indicated above, the USACE charts the vertical clearance of both the main channel and alternate West spans of the Sunshine Bridge. In the entire Lower Mississippi River System of the USACE River Map Book, this situation only occurs on two bridges that investigators could locate – the Sunshine Bridge and the Huey P. Long Bridge in New Orleans, where you have two different bridge clearances charted.

6 Actions Taken Since the Incident

6.1 Marquette Transportation.

6.1.1. Port Captain and Senior Vice President (SVP) of Operations Review of Bridge Clearances. Created a requirement for vessel masters to review bridge clearance calculations with on-duty Port Captain for any moves involving a crane barge, and also for calculations to be verified with the SVP of Operations, or his designee, if air draft of any tow is reasonably expected to exceed the height of the tow boat. Requirement includes a minimum air draft clearance of four feet (4').

6.1.2. Changed Short Form Voyage Plan to add additional detail on air draft calculation requirements.

6.1.3. Changed policies to require standard (long form) Voyage Plan for any movements involving non-routine cargo.

6.1.4. Port Captains provided a specific checklist to review with wheelmen for each transit reviewed to provide consistency.

6.1.5. Incorporated practices as formal policies as a part of SMS revision (see below).

6.1.6. Launched a Heels on Steel "Blitz" in October 2018 which included a Port Captain visit to each of the 62 vessels then operated by Marquette Gulf-Inland with a structured script which covered:

6.1.6.1. Importance of proper voyage planning and proper watch change protocols.

6.1.6.2. Importance of knowing our cargo (dimensions, hazards, etc.) prior to taking possession.

6.1.6.3. Importance of Stop Work Responsibility and how it could have prevented recent incidents.

6.1.7. Issued an internal Safety Alert reiterating Stop Work Responsibility to all vessels in the fleet on October 24, 2018.

6.1.8. Redistributed Marquette Gulf-Inland navigation policies and required each wheelman to re-certify fresh review and understanding. Certifications provided by 182 Gulf-Inland wheelmen from 11/19/18 through 2/22/19.

6.1.9. Changed wheelmen new hire process to provide the navigation watch standers with more time to familiarize themselves with the company's policies and procedures before requesting signed acknowledgements, including the development of a new SMS eLearning course and test in conjunction with Seaman's Church Institute.

6.1.10. CEO letter to all vessels and shore-side teams distributed on November 20, 2019. Letter reinforced messages from Heels on Steel campaign, including:

6.1.10.1. Importance of maintaining focus on safe execution of our business.

6.1.10.2. Excellence in safety as the foundation of our operational excellence.

6.1.10.3. Stop Work Responsibility = single most important tool.

6.1.10.4. Risks of man overboard.

6.1.10.5. Ownership and responsibility of our own safety.

6.1.11. Verified dimensions of all customer crane barges expected to be moved by Marquette and provided this information to Port Captains and wheelhouse personnel.

6.1.12. Changed contract standards for newly executed contracts to require customer notification to Marquette shore-side personnel to approve movement of non-standard barges.

6.1.13. Changed process for onboarding new wheelmen to require a more detailed Navigational Assessment at the time of hiring vs. prior practice of conducting "Check Rides." As a supplement to existing Near Miss and Stop Work Responsibility programs, added a risk assessment program which requires each boat working in the fleeting trade to submit at least two Job Safety Briefings ("JSBs") per watch to a shore-based team which is reviewing them and providing additional training where appropriate.

6.1.14. Developed and implemented a wheelhouse policy exam to test competency of Marquette's SMS with an on-line test administered through Seamen's Church's e-learning platform. Passing grade required for all wheelmen and shore side managers involved in vessel navigation, safety and compliance.

6.1.15. In addition to pre-existing access through "Gulf Docs" drive, added Marquette Gulf-Inland navigation policies to Seamen's Church online portal to provide real-time remote access to wheelmen so they have the ability to review policies when not on a vessel.

6.1.16. Completely revise and integrate the Gulf-Inland SMS with the goal of significantly reducing complexity and increasing effectiveness. Goal was to reduce total page count by at least 30% while increasing compliance with regulatory, industry standard and customer requirements. End product to result in a single top-tier manual, single shore-based manual, and a single vessel manual. Changes to be approved by Marquette's third-party auditor (ABS) and gap analyzed for ISM.

6.1.17. Created and filled a Vice-President of Operational Excellence position to help drive continuous improvement in Marquette Gulf-Inland operations / processes.

6.1.18. Promoted a seasoned and experienced Port Captain to fill a recently vacated Director of Compliance for the Gulf-Inland division.

6.1.19. Created and filled a Manager of Training position by a person with extensive industry experience including a deep technical background in electronic navigation tools, specifically including Rose Point.

6.1.20. Worked with ABS to establish a roundtable session on common lessons learned and best practices related to bridge allisions with other industry leaders. ABS to facilitate

this session on May 1, 2019.

6.1.21. Restructuring vessel audit process to drive audit frequency based on specific vessel risk ratings to increase audit frequency on lowest performing vessels. Framework in development, expect to launch in the third quarter of 2019.

6.2 Cooper Consolidated.

6.2.1. Cooper Consolidated Fleeting Rules and Regulations: Section 9 updated and provided and required to be onboard all vessels chartered to Cooper Consolidated:

6.2.1.1. When shifting cranes north or south bound all cranes should pass through the main channel span under any bridges. The chart below is the air draft of the Cooper Consolidated cranes/rigs from the waterline to the top of the equipment while in a “travel” position.

6.2.1.2. The new fleeting rules and regulations has a table of all 16 of Cooper Consolidated’s oversized barges that includes their names, dimensions, and air drafts.

6.3 Louisiana Department of Transportation.

6.3.1. LADOTD has surveyed and inspected the Sunshine Bridge.

6.3.2. Repairs made to the damage as a result of this accident have been completed. The bridge continued to remain partially open to vehicle traffic after repairs were completed in order to effect longer term maintenance projects that had been planned before the accident.

6.4 Government Agencies.

6.4.1. NOAA has contracted hydrographic surveys in the Lower Mississippi River. This work is underway as of the time of writing this report and bridge vertical clearances are being surveyed as part of this project.

6.4.2. This effort is managed by the Office of Coast Survey's Hydrographic Surveys Division.

6.4.3. Based upon NOAA Marine Chart Division’s current charting policy, changes to the bridge clearances cannot be authorized using data from this survey. NOAA would forward the air gap information to the USCG for possible updates. If USCG updates the official clearances based upon this information for the surveyed bridges, NOAA would then change the chart.

7 Recommendations

7.1. Safety Recommendation(s).

7.1.1. Electronic Sensors. Recommend Commandant establish and charter a formal working group to synchronize U.S. Government and other local/state/organizational entities' efforts to utilize and embrace eNavigation projects. Specifically, collaboration should be established with NOAA's program office for PORTS with Coast Guard Offices of CG-NAV, CG-BRG, NAVCEN, and also with USACE, U.S. Geological Survey, National Weather Service, and all other governmental offices that have electronic sensors available to provide information to mariners. This working group is necessary in order to have a collective and united front in advancing the use of technology within the marine transportation system. The PORTS program is up and running and seemingly favored and championed by most local port authorities and pilot associations. The USCG has also been beta-testing a "smart bridge" program on the western rivers with similar electronic sensors. I recommend a unity of effort to further standardize, synchronize, and provide a greater momentum and to avoid duplication of efforts. Getting this information in the wheelhouses and in the hands of the waterways users will be of great help in further reducing marine casualties, improving safety and gaining efficiencies in the marine transportation system. Broadcasting information via AIS (or other) signals, so that it be immediately available and viewable on systems like ECDIS or any Electronic Charting System would be of great value and needs to be a top priority.

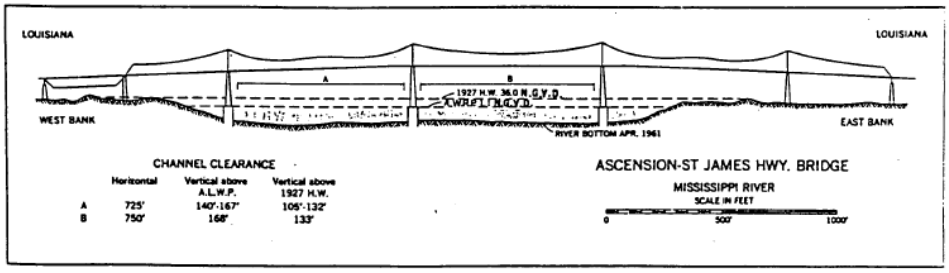
7.1.2.Vertical Clearance Gauges. Recommend Commandant require physical vertical clearance gauges be installed on all bridges. 33 CFR § 117.47 already grants authority to District Commanders to mandate these gauges for many drawbridges, however this should be expanded to capture all bridges over navigable waterways. 33 CFR § 118.160 appropriately describes the gauge particulars. If a gauge board was present on the Sunshine Bridge as noted in paragraph 4.6.2.3, it would have provided accurate and real-time information that would have alerted the Pilot on the KRISTIN ALEXIS of limitations and prevented him from transiting under the Sunshine Bridge. Given the upfront and reoccurring costs and other limitations with the PORTS system electronic sensors, we will likely never have all bridges fitted with those devices. But these physical clearance gauges will always provide the necessary data. It appears as if the regulatory structure already exists within 33 CFR Subchapter J to mandate this – each District office, through their representative Bridge Administrator, should work with bridge owners to implement it; I would suggest a 5 year phase in period to allow time to absorb the cost of implementation. European rivers have implemented an exemplary model similar to this that could be evaluated and implemented.

Figure 21. Photograph of a vertical gauge board in service marking how much vertical clearance there is at a bridge.

7.1.3. Chart Inconsistencies. Recommend Commandant establish a separate and distinct working group between USCG Office of CG-BRG, NOAA, LADOTD, and USACE Cartographers to collectively meet and review the issues identified in paragraph 4.6.1 and 5.7.1. It is very concerning that two U.S. Government mapping agencies, both producing charts of the same exact bridge have two completely different vertical clearances listed. This is confusing, distracting and dangerous to mariners. Of this joint working group, I recommend a standard baseline datum be identified for use when charting overhead clearances; NOAA currently uses the 1927 High Water Plan on the Lower Mississippi River and USACE uses a separate NGVD29 which is what the river gauges are set to.

In addition, not only have these agencies provided different charted values, but they end up with a two-foot disparity (133' on NOAA chart and 135' on USACE chart) for the calculated main channel minimum vertical clearance of the Sunshine Bridge. The NOAA Chart provides insufficient data for a mariner to calculate the real-time vertical clearance, taking into account current river stages; plus there is no information that actually describes that the available clearance information for the Sunshine Bridge is only for the main channel and no the entire bridge (alternate spans).

In addition to reviewing all of this, I recommend additional information like what is found in Figure 22 be added to the notes section of chart 11370, but also that Coast Pilot V be revised to discuss more of this information in detail. Figure 22 comes from the Sunshine Bridge file. A table similar toe this should be added for both the Sunshine Bridge and the Huey P. Long Bridge in New Orleans, LA. Final information from this working group should be used to produce chart updates.



Vertical Clearances versus River Stage Gage Reading

Mile 175.5 Donaldsonville Gage	Mile 167.5 Sunshine Bridge
0.0	170.0
2.0	168.1
4.0	166.2
6.0	164.3
8.0	162.4
10.0	160.6
12.0	158.7
14.0	156.8
16.0	154.9
18.0	153.0
20.0	151.1
22.0	149.2
24.0	147.3
26.0	145.5
28.0	143.6
30.0	141.7
32.0	139.8
34.0	137.9
36.0	136.0
38.0	134.1
40.0	132.2

Vertical clearance for the mid 500 feet. For the vertical clearance throughout the 750 foot span, subtract 1.0 foot from the clearances shown.

Figure 22. A table provided for the Sunshine Bridge that shows bridge clearances at different river stages on the Donaldsonville gauge. A table like this clearly depicting necessary data for safe transit should be considered for inclusion on the chart or in the Coast Pilot. Sunshine Bridge File, USCG.

7.1.4. TSAC 13-10 Overhead Strike Study. Recommend Commandant review 33 CFR § Subchapter P – Ports and Waterways Safety, either in Towing of Barges or Navigation Safety Regulations (Parts 163 or 164) and/or possibly 46 CFR § Subchapter M – Towing Vessel Regulations for possible amendment. In that, it should be mandated that a vessel with a heightened air draft (e.g. crane barge, derrick, etc.) must have the maximum air draft permanently marked in a contrasting color, easily visible by the vessel pushing or towing it (or otherwise clearly posted in the towing vessel wheelhouse).

In addition, recommend Commandant review all items from TSAC Report 13-10 to determine if any other regulatory projects are appropriate for future rulemaking projects. The only noted changes originally made as a result of this TSAC Report and effectively implemented was an item that made it into the lengthy Subchapter M Towing Vessel Rule making process. It shows up in 46 CFR § 140.635 Navigation Assessment section had an item included that added the requirement to calculate air drafts relative to bridges, taking into account tides and river stages for the voyage.

7.1.5. Navigation Operating Station [Bridge Visibility]. Recommend Commandant review 33 CFR § 164.15 for possible amendment to increase the scope of applicability to include towing vessels. It is easy to regulate bridge visibility on a ship (a vessel greater than 1600 GT as the applicability states), but that is not the case on a towing vessel, as they could be moving, pushing, or assisting in an unlimited number of different barges and towing configurations. 33 CFR § 164.15 is exactly what was needed to prevent this casualty; however, a literal assessment of the applicability section would have one only apply this to vessels greater than 1600 GT. There are no regulations within Subchapter M for existing vessels that actually take you outside of the "boat" in this regard; meaning – there are no regulations that would prevent a towboat from pushing a crane barge that obstructed 100% of your view over an arc of 60 degrees of the horizon as was the case here. If necessary, caveats can be added that allow towing vessel operators to identify alternative solutions to mitigate risk. Those mitigating factors to allow for a safer operation in pushing large vessels that obstruct the operators view could be things like a combination of any or all of the following: placing an additional properly credentialed Pilot on the bow of the barge or otherwise in front of the object so you could see around it; using more than one towing vessel; or using remote cameras to see around the obstruction, employed in tandem with remotely placed radar scanners to avoid a blocked radar return; or some other equivalent risk mitigation scheme.

7.1.6. Voyage Planning. Recommend Commandant review 33 CFR 164.80(c)(3) for amendment to remove the term "*If any part of a towing vessel's intended voyage is seaward of the baseline (i.e. the shoreward boundary) of the territorial sea of the U.S., then the owner, master, or operator of the*" be removed and replaced with "*The owner, operator or master of any towing*". This rule change will make the items of that paragraph (including items (i) through (ix)) applicable to any towing vessel. This rule is similar to the Navigation Assessment section, but is not entirely addressed in Subchapter M and will act to close that gap; 33 CFR 164.80(c)(3) should not have originally been limited to vessels only going offshore (a boat is much more likely to have to navigate under a bridge on an inland passage than they would when traveling beyond the territorial sea baseline).

7.1.7. Mariner Training. Recommend Commandant perform a training needs assessment in order to determine if mariners seeking to obtain (or currently hold) any towing credential (Master, Mate/Pilot, or Steersman Apprentice) on Inland, Western Rivers or other routes, be required to have ECS training and a national credential endorsement. This would be something similar or otherwise equivalent to other training and qualification architectures already in place for things like ECDIS, RADAR Observer, or ARPA training, course approval, and credentialing – but this would be geared towards an ECS like Rose Point. If an ECS is onboard, the licensed operator should have training on its use. This training required should be approved by the NMC and delivered through approved training providers. Each approved course should be specific to each specific ECS manufacturer and created in collaboration with the manufacturer for accuracy of each system, and the course should include a voyage planning component, making full use of the ECS's capabilities.

7.1.8. Company Specific SMS Training. Recommend Commandant review 33 CFR § Subchapter F – Vessel Operating Regulations (Part 96) and/or 46 CFR § Subchapter M – Towing Vessel Regulations (Part 140.515 and/or Part 138) for amendment to ensure this is written into company hiring processes to mandate that every newly employed credentialed mariner must undergo a thorough SMS training and evaluation period, before standing any solo officer in charge of navigational watch (Captain or Mate/Pilot). This would allow time necessary to become familiar with a company's safety management system before assuming control of a navigation watch. While this case was specifically involving towing companies, there is merit in applying this mandate to any company utilizing a SMS or TSMS.

Marquette Transportation implemented this recommendation fleet-wide following this casualty. They entered into a program with the Seaman's Church Institute to implement training school electronic technologies to provide training on their specific SMS, as well as ways to evaluate each employee with the pass/fail element associated. A similar process, either completed internal to a company or otherwise outside contracted should be considered.

7.2. Enforcement Recommendation(s).

7.2.1. Recommend referral for enforcement actions to Sector New Orleans against the Master of the KRISTIN ALEXIS for possible Misconduct and Violation of Law/Regulation Suspension and Revocation (S&R) charges, as noted in paragraph 5.2.1 and 5.2.2 above.

7.2.2. Recommend referral for enforcement actions to Sector New Orleans against the Pilot of the KRISTIN ALEXIS for possible Negligence, Misconduct, and Violation of Law/Regulation charges, as noted in paragraph 5.2.3, 5.2.4, and 5.2.5 above.

7.3. Administrative Recommendation(s).

7.3.1. Recommend that this Report of Investigation be shared with all shipyards that construct crane barges and/or other vessels comprised of derricks or other heightened air drafts, along with their representative industry trade groups of that segment of industry to spread awareness of these issues.

7.3.2. Recommend that this Report of Investigation be shared with all marine construction, repair, stevedoring, and other similar companies along with their representative industry trade groups that operate crane barges or other vessels with a heightened air draft.

7.3.3. Recommend this report, associated endorsements and final action memo be shared on the Coast Guard's Maritime Commons blog and also shared with other media and social outlets or trade publications for widest dissemination to the public.

7.3.4. Recommend that this investigation be closed.

[redacted]

MATTHEW J. MESKUN
Commander, U.S. Coast Guard
Lead Investigating Officer