



UNITED STATES COAST GUARD

INVESTIGATION INTO THE CIRCUMSTANCES
SURROUNDING THE ALLISION OF THE

M/V ANNE HOLLY

WITH THE EADS BRIDGE, AND SUBSEQUENT
ALLISION WITH THE ADMIRAL CASINO, IN ST. LOUIS
HARBOR, MISSOURI, ON 04 APRIL 1998, WITH
MULTIPLE INJURIES AND NO LOSS OF LIFE



U.S. Department
of Transportation

United States
Coast Guard



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16732/MC98004086

JUN 23 2000

**ALLISION OF THE M/V ANNE HOLLY WITH THE EADS BRIDGE, AND
SUBSEQUENT ALLISION WITH THE ADMIRAL CASINO, IN ST. LOUIS
HARBOR, MISSOURI, ON 04 APRIL 1998 WITH MULTIPLE INJURIES AND
NO LOSS OF LIFE**

ACTION BY THE COMMANDANT

The report of the Investigating Officer and forwarding comments of the Commanding Officer, Marine Safety Office St. Louis Missouri and the Commander, Eighth Coast Guard District, have been reviewed. The report is approved subject the following comments.

ACTION ON RECOMMENDATIONS

Recommendation 5: In addressing improvements to safety of personnel aboard substantially moored land structures, Commandant (G-MOA) should also consider recommendations concerning safety described in the U.S. Coast Guard Marine Safety Office Pittsburgh's marine casualty investigation report.

Action: We concur. The lessons learned from the marine casualty report MC97012019 were incorporated into the Permanently Moored Vessel Quality Action Team (QAT) report. This report was published in December 1999 and is available Coast Guard wide in addition to being available to the public.

Recommendation 6: The time is right for Commandant (G-M) to strengthen the strategic partnership between the U.S. Coast Guard and the American Waterways Operators (AWO). The AWO recently voted to require participation by all its members in their Responsible Carrier program; this requirement should also extend to non-member companies under contract with AWO companies. The next revision of the U.S. Coast Guard Marine Safety Business Plan should expand and align regional efforts like the USCG Eighth District's Voluntary Towing Vessel Examination Program more closely with AWO Responsible Carrier objectives and goals. The Coast Guard and AWO must also address human factors, like fear and geographic familiarity, which may have contributed to the Anne Holly casualty.

Action: We concur with the intent. The Responsible Carrier Program (RCP) is an American Waterways Operators (AWO) project, and the Coast Guard encourages participation by members in the RCP program. The Coast Guard along with the AWO is addressing human factor issues

through groups such as the "Crew Alertness Dialogue Group," which documents the research and recommendations in this area. In addition, the executive steering committee of the Partnership, which is designated to seek solutions for aids to navigation problems, is briefed on a regular basis. Harbor Safety Committees are an ideal forum for addressing issues related to geographic familiarity. The Coast Guard continues to work with these committees and established partnerships such as the AWO to reduce these risks.

Recommendation 7: Recommend that Commandant (G-M) consider seeking a formal role in safety to people on platforms designated as "substantial land structures" which are located adjacent to busy commercial waterways. Insight obtained during the formal hearings phase of this investigation suggest that the public expects traditional Coast Guard protections and oversight of safety on floating structures that "look like boats." Guidance could be published for distribution to external customers as a Navigation and Vessel Inspection Circular (NVIC), which would address evacuation procedures, emergency communications, emergency power, central warning alarms, firefighting, guest orientation briefings, security patrols and mooring plans.

Action: We concur with the intent. A Quality Action team (QAT) has reviewed and evaluated the Coast Guard's policy on "substantial land structures," and provided recommendations to reduce risk of casualty to these vessels. In December 1999, the QAT report was issued and distributed to all interested parties in addition to being available to the public. In addition to the QAT report, the Coast Guard developed a Memorandum of Agreement with the Army Corps of Engineers establishing a formal process through which the Coast Guard provides input during the evaluation process for issuing permits, including permanently moored vessels and facilities on safety standards, emergency equipment, and other safety condition are outlined in the Marine Safety Manual revision which will be published on the Internet in June 2000.

Recommendation 8: Recommend Commandant (G-LMI) clarify in writing the legal definition of a "vessel" to facilitate Coast Guard Captain of the Port responsibilities in risk management activities that transcend the water-shore interface shared by overlapping regulatory jurisdictions. This definition could be incorporated into the guidance discussed in recommendation 7 above.

Action: We concur. The Office of Maritime and International Law (G-LMI) assisted the Office of Compliance (G-MOC) and the Office of Planning and Policy (G-MWP) in clarifying the definition of a "vessel." A Quality Action Team (QAT) report reviewed and evaluated the Coast Guard's policy on "substantially land structures," and provided recommendations to reduce the risk of casualty to these vessels. In December 1999, the QAT was issued and the recommendations were incorporated into a revision to Volume II, Chapter 10, of the USCG Marine Safety Manual, which will be published on the Internet in June 2000.

Recommendation 9: Recommend that Commandant (G-M) consider developing a Memorandum of Understanding (MOU) with the Army Corps of Engineers that would allow the Coast Guard to play a greater role in the process of siting permanently moored vessels determined to be "substantially moored land structures," as described in Marine Safety Manual, Vol. II, Paragraph 10.1.1 (exhibit G-21). This MOU could encompass periodic Coast Guard safety reviews of Army Corps of Engineers permits every five years by the Captain of the Port based on a commercial third-party certification risk assessment report.

If this is deemed insufficient, then Commandant (G-MVI) should consider a more formal approach by preparing a written request to the Army Corps of Engineers proposing expansion of the permitting regulations found in 33 CFR Parts 320 and 325 that incorporates a "Coordination with the U.S. Coast Guard" provision similar to that cited in 33 CFR 277.7 for bridges. Provisions promoting Coast Guard coordination with the Army Corps of Engineers during the permitting process would greatly enhance the Captain of the Port's position to address safety concerns for situations where large numbers of people use substantially moored land structures in hazardous locations.

Action: We concur with the intent. A Memorandum of Agreement between the Army Corps of Engineers and the Coast Guard, pertaining to permanently moored vessels, was signed in June 2000. This agreement establishes a formal process through which the Coast Guard provides input into the Army Corps of Engineers including permanently moored vessels and facilities on the navigable waters of the United States. In addition, changes to Coast Guard policy regarding the process of siting permanently moored vessels are contained in revision to Volume II, Chapter 10, of the USCG Marine Safety Manual which will be published on the Internet in June 2000.

Recommendation 10: Recommend that Commandant (G-M) and (G-LMI) work in partnership to develop supplemental guidance to support COTP oversight responsibilities for "substantially moored land structures" found in Marine Safety Manual, Vol. II, section 10.I. In particular, guidance should reduce ambiguity by discussing specific actions and limitations under the Ports and Waterways Safety Act mentioned in Section I.1.a. The last paragraph of this section is particularly vague. Marine Safety Manual guidance should also encourage Coast Guard Captains of the Port to address safety concerns and regulatory limitations to the local or state entity with the greatest ownership over the commercial activity taking place (e.g. Missouri Gaming Commission).

Action: We concur. A memorandum of Agreement (MOA) between the Army Corps of Engineers and the Coast Guard, pertaining to permanently moored vessels was signed on June 2, 2000. This agreement establishes a formal process through which the Coast Guard provides input during the evaluation process for issuing permits, including permanently moored vessels and facilities on the navigable waters of the United States. In addition, changes to Coast Guard policy regarding the process of siting permanently moored vessels are contained in revision to Volume II, Chapter 10 of the Coast Guard Marine Safety Manual, which will be published on the Internet in June 2000.

Recommendation 12: Recommend that a copy of this final report (with exhibits and enclosures) be provided to the National Transportation Safety Board and MSO St. Louis.

Action: We concur. We will forward a copy of this report to the National Transportation Safety Board and Marine Safety Office St. Louis.


W. D. RABE
By direction

moa
16732
02 March 99

FIRST ENDORSEMENT on Investigating Officer's Letter 16732/MC98004086 dated 10 Jul 98

From: Commander, Eighth Coast Guard District
To: Commandant (G-MOA)

Subj: ONE-MAN FORMAL INVESTIGATION INTO ALLISION OF M/V ANNE HOLLY WITH THE EADS BRIDGE, AND SUBSEQUENT ALLISION WITH THE ADMIRAL CASINO, IN ST. LOUIS HARBOR, MISSOURI, ON 04 APRIL 1998 WITH INJURIES AND NO KNOWN LOSS OF LIFE

1. Forwarded. I concur with the conclusions and recommendations.
2. A point of clarification. Section 4.3, Coast Guard Waterway Management Efforts, mentioned "a Captain of the Port Order in effect" due to the increased river stage. Actually, a safety zone was in effect vice a Captain of the Port Order. (Encl. P-11)
3. Suspension and revocation action has been taken against the license of Mr. John Johnson, operator of the M/V Anne Holly.
4. By copy of this endorsement, Captain of the Port St. Louis has been directed to take recommendations 2-4 for action and provide a written report to the Eighth District Marine Safety Division.
5. The substantive issues raised in recommendations 7-10 have been addressed by the Permanently Moored Vessel Quality Action Team. One outcome of the QAT is a matrix to assess risks associated with operation of vessels in permanently moored status. This matrix will be an additional tool for the OCMI's use to determine the level of risk and the appropriate CG response.



C. T. DESMOND
By direction

Copy: MSO St. Louis

Commanding Officer
U. S. Coast Guard
Marine Safety Office
Houston-Galveston

P.O. Box 446
Galena Park, TX 77547-0446
Phone: (713)671-5100

16732/MC98004086
July 10, 1998

From: CDR Robert E. Acker, USCG
To: Commandant (G-MOA)
Via: Commander, Eighth Coast Guard District

Subj: ONE-MAN FORMAL INVESTIGATION INTO ALLISION OF M/V ANNE
HOLLY WITH THE EADS HIGHWAY BRIDGE, AND SUBSEQUENT
ALLISION WITH THE ADMIRAL CASINO, IN ST. LOUIS HARBOR,
MISSOURI, ON 04 APRIL 1998 WITH INJURIES AND NO KNOWN LOSS
OF LIFE

Ref: (a) 46 United States Code, Chapter 63
(b) COMDTINST M16000.10, Marine Safety Manual, Vol. II,
Section 3.D.1.b
(c) CCGD8 ltr 16732 of 6 April 1998

Preliminary Statement

A formal hearing was conducted 9 and 10 April 1998 at the Robert A. Young Federal Building in St. Louis, Missouri. The purpose of this hearing was to publicly examine evidence gathered by Marine Safety Office (MSO) St. Louis marine casualty investigators and obtain formal testimony from witnesses to ascertain facts, draw conclusions of proximate cause, and support recommendations intended to improve safety.

This formal investigation was conducted in accordance with the precept described in, and under the authority of, references (a) through (c). Three parties in interest were designated. Designated parties in interest were represented at the hearing and afforded opportunity to cross-examine witnesses.

A two-volume transcript from the public hearing has been provided as Enclosure (1). Thirty "exhibits" that were entered into the record are listed in Volume I and II of the transcript (pages 3 and 4). These exhibits have been referenced throughout this report to support findings of fact and conclusions. Post hearing "enclosures" to this report are identified in Section VI. Background documents, identified in the transcript by "official notice", are also listed in Section VI. Copies of official notice items are not included with this case file; instead, they have been retained by Marine Safety Office St. Louis.

For clarification of the record, it should be noted that transcript exhibits G-19 (Vol I, page 3) and G-30 (Vol II, page 3) are identical items introduced erroneously as separate exhibits. Additionally, testimony did not reveal the identity of the document discussed in Vol I, page 43 of the transcript that was to be included as party exhibit E-1. Consequently, there is no such exhibit included with this report.

One photograph, listed as exhibit G-5, is provided with this report. Other post-casualty photographs have been retained by MSO St. Louis with the MSIS case file. Two videotapes of the casualty have been provided as exhibit G-6. One other videotape, viewed during the hearing, remains with its owner: KMOV, St. Louis.

The MSO St. Louis Senior Investigating Officer, Lieutenant Dennis Branson, assisted with all phases of this investigation on behalf of the Officer in Charge, Marine Inspection.

It is important to recognize the contributions of the late Lieutenant (junior grade) Stephen Alvarez, who worked diligently as the Eighth Coast Guard District's legal counsel assigned to assist with the public hearing phase of this investigation. He greatly facilitated the collection of facts needed to address safety issues. His efforts will yield great benefits to those served by the Coast Guard.

A note of appreciation is also due to CAPT Bob Luchun, USCG (Retired), who spent many years in various marine safety assignments on the western rivers. He provided valuable insight about historic events and local risk management perspectives involving St. Louis Harbor, as well as instilling a high regard for the river mariner (transcript Vol I, page 108).

Marine Safety Information System (MSIS) work hours estimate:

Investigation (includes hearing, site visits, evidence collection): 654
Travel (includes formal investigator & CG legal counsel): 20
Administrative (includes case prep): 133
Other (includes media events & legal support): 58

Executive Summary

Several barges being pushed upriver on the evening of 4 April 1998 broke loose from the towing vessel M/V ANNE HOLLY in the vicinity of the Eads Highway Bridge, which connects Illinois with Missouri in St. Louis Harbor at Upper Mississippi River Mile 180. High river conditions had been observed at the St. Louis river level gage for several days, significantly increasing the hazard to vessels navigating through St. Louis Harbor, which is characterized by four bridges concentrated within a narrow 1.2 mile navigable channel. Captain of the Port St. Louis high water navigation horsepower and transit restrictions were in effect.

The M/V ANNE HOLLY (Official Number D553021) is a 154-foot long, 1,099 gross ton vessel classified for service as a towboat. The vessel is diesel-propelled with free stream twin propellers (not shrouded) rated to generate 5,600 horsepower at maximum engine rpm. The towing vessel maneuvers with the aid of dual steering rudders and a flanking rudder for downbound transits.

After successfully clearing the downtown harbor area's two bridges (MacArthur and Poplar Street), the ANNE HOLLY's licensed pilot, John O. JOHNSON, maintained full ahead propulsion, proceeded north, and positioned his 1,100-foot long tow for passage beneath the Eads and Martin Luther King Jr. (MLK) bridges. The river stage at the time was approximately 31.5 feet. (1.5 feet over the identified St. Louis flood stage)

Captain JOHNSON is licensed (Coast Guard license number _____) to serve as "Operator of Uninspected Towing Vessels upon Great Lakes and Inland." He has more than 38 years experience in the industry, and has operated the M/V ANNE HOLLY for over four years. He had been on watch, serving as pilot of ANNE HOLLY for about two and one-half hours during the transit of St. Louis Harbor on 4 April 1998.

As the tow's lead barges passed successfully beneath the Eads Bridge, the pilot began steering to port to ensure that ANNE HOLLY would complete the Eads Bridge passage with her pilot house positioned directly beneath the centerline of the span. This maneuver was also necessary to properly align the tow for passage beneath the MLK Bridge and continue the upbound transit.

As Captain JOHNSON attempted to maneuver the ANNE HOLLY for a centerspan towboat passage, she lost most of her 3-knot forward momentum. Cross currents in the vicinity of the Eads Bridge (flowing predominately from the Missouri side to the Illinois side of the river) applied unanticipated forces on the tow's port side, probably increasing the rate of turn beyond that intended by the pilot.

Deprived of her forward momentum with her stern swinging toward the Illinois support structure, the tow's lead barges began moving toward the steel abutment on the St. Louis side of the Eads Bridge center channel span. As the swing increased, the downward flow of the river acted with increasing force on the starboard side of the 950-foot long, 14-barge unit.

The lead barges on the tow's port side struck the Eads Bridge, snapping wires and allowing four barges loaded with a variety of non-Coast Guard regulated commodities (urea, fertilizer, cotton seed) to drift down the right descending bank on the St. Louis side of the Mississippi River toward the permanently moored ADMIRAL Casino.

The force of the four adrift barges in the strong currents was sufficient to break free the ADMIRAL Casino's five upriver mooring lines. The force of the river on the casino and barges then caused the three mooring wires and access ramps to break free from the bank. Members of ADMIRAL Casino's security force and a Missouri State Trooper (on assignment to the Gaming Commission) successfully evacuated the ramps before they were broken free under the weight of an adrift barge.

The casino structure then swung out into the current with more than 2,200 guests aboard and broke one of its two remaining downriver mooring wires before coming to rest, held in position by a single line secured to a 12,000-pound anchor.

During this time, Captain JOHNSON attempted to contact ADMIRAL Casino on the radio, but was unsuccessful. He then sounded warning blasts on ANNE HOLLY's whistle, broke free from the remaining barges in the tow, and took station holding the ADMIRAL Casino to the bank.

The St. Louis Fire Department (SLFD) immediately mobilized and established a joint mobile command post. MSO St. Louis COTP representatives activated the St. Louis Harbor Emergency Response Plan (Official Notice #3) and began working in cooperation with other agencies to facilitate evacuation of more than 2,200 guests from the ADMIRAL Casino. The evacuation was accomplished in less than three hours with 23 apparently minor injuries and no known fatalities.

I. FINDINGS OF FACT

1. Subject Vessel Data:

1.1	Name:	ANNE HOLLY
	Flag:	U.S.
	Official Number:	553021
	Service (Documented):	Towing (Inland)
	Gross Tons:	1099
	Net Tons:	747
	Reg. Length:	154 feet
	Reg. Breadth:	40 feet
	Height:	46 feet (top of radar equip) with 9 foot draft
	Propulsion:	Diesel (twin screw)
	Horsepower:	5600 (total)
	Operator:	American Milling P. O. Box 5005 Cahokia, Illinois 62226
	Owner:	American Milling Company
	Since:	1989
	Date Built:	1973
	Place Built:	Greenville, Mississippi
	Certificate of Documentation:	Expires April 30, 1999
	Certificate of Inspection:	Not Applicable
	Stability Letter:	Not Applicable

1.2. M/V ANNE HOLLY is a U.S. Coast Guard-documented towing vessel endorsed for coastwise trade (exhibit #G-14). It is subject to U.S. Coast Guard regulations under 46 Code of Federal Regulations (CFR) Part 26 for towing vessels over 26 feet in length.

1.3 The vessel is not subject to U.S. Coast Guard inspected vessel requirements. At the time of the casualty, the vessel was engaged in barge towing (referred to in the river industry as "line haul") operations on the Upper Mississippi River (hereafter referred to as the UMR), a navigable water of the United States.

1.4 The Coast Guard documented owner/operating company of the vessel is American Milling L.P. It has been the owner of the vessel since 14 April 1993 (exhibit #G-14). American Milling was not a member of the American Waterway Operator's association.

2. Tow of ANNE HOLLY:

2.1 M/V ANNE HOLLY's tow configuration at the time of the casualty included 14 total dry cargo barges. There were 2 empty and 12 loaded barges (see tow diagram attached as enclosures #G-13 & G-15). This configuration left a "notch" (empty space) on the upper starboard corner. JOHNSON later stated he received no manifest of the cargoes of each barge, which was according to him, is standard procedure with dry cargoes (exhibit #G-29).

2.1 (cont'd) Using the standard barge length of approximately 200 feet, the tow (excluding vessel) was approximately 1,000 feet in length. The Coast Guard Form 2692 (Report of Accident) listed the length of 1140 feet (exhibit #G-2).

3. Bridge Data:

3.1 Historical Information: Comprehensive information regarding navigational information regarding the Eads and MLK bridges was primarily obtained from the 1985 U.S. Coast Guard Marine Safety Office St. Louis "Analysis Bridge Collision Accidents in St. Louis Harbor" (Official Notice #1). This study identified many of the risk elements in transiting St. Louis Harbor bridges and included a simulation study of navigating the bridge areas. A secondary reference was the 1986 NTSB "St. Louis Harbor Study" (Official Notice #2). This study incorporated much of the information in the previous reference.

3.2 The volume of data available on the Eads and MLK Bridges necessitated an informal update of the aforementioned studies. Information on marine casualties involving the Eads and MLK bridges came from the marine casualty database found in the USCG Marine Safety Information System (MSIS). Additional data was obtained from the Eighth Coast Guard District Bridge Branch (Enclosures P-4 & P-6) and the St. Louis Harbor Emergency Response Plan (Official Notice #1). An analysis of these casualties with reference to the risk factors identified in the 1985 study is attached as Appendix A. The most noteworthy element identified was the marked increase in northbound collisions in the years since completion of the studies.

3.3 Information regarding the bridge structure and history was obtained in large part from the U.S. Coast Guard Director of Western River Operations Bridge Branch in St. Louis (enclosures #P-5 and P-7). This entity is the primary source of information regarding bridges over federal navigable waters. The Bridge Branch maintains files on all such bridges, Eads and MLK included. The following is a brief description of the bridge structures.

3.4 Eads Bridge: Begun in 1867 and completed in 1874, the Eads Highway and Railroad Bridge was the first bridge to span the Mississippi in St. Louis and is listed as a National Historic Landmark. Currently, the bridge serves as a rail bridge for the Metrolink, the St. Louis light rail mass transit system. It is owned and operated by Bi-State Development Commission of St. Louis.

3.4.1 Center Channel Span: The Eads Bridge has a main navigable channel span of 520 feet of horizontal clearance (measured from inside the span supports).

3.4.2 Vertical Clearance: The Eads Bridge has historically been one of the most difficult navigation areas on the Western Rivers due primarily to the diminishing vertical clearance to each side of the centerline of the convex steel arch. The center channel

span has three measurements of vertical clearance: center, right channel mark and left channel marks. During high water periods (which were present at the time of the casualty), vessels with superstructures must typically use the centermost point of the center channel span to ensure safe clearance beneath the span.

3.4.3 All river measurements used by the USACE are based on elevations at "Mean Sea Level" (MSL); or height above sea level (see enclosure 6). Zero (0) on the St. Louis gage equates to 379.94 MSL. As stated in fact section #4.2.2, the river gage reading was approximately 31.5 feet at the time of the casualty. By adding 31.5 feet to the zero gage 379.94, the actual MSL at the time of the casualty was 411.44 feet.

3.4.4 According to enclosure #10, the elevation of low steel at the very center of the Eads Bridge is 469 feet MSL. Subtracting the actual river MSL elevation of 411.44 feet from center span MSL elevation of 469.0 feet yields a total clearance of 57.56 feet between the water surface and the bridge. As described in the vessel information section (and detailed in enclosure #11), at the time of the casualty, ANNE HOLLY had a total height above the waterline of 46.0 feet (assuming an average 9 feet of draft). This would have given ANNE HOLLY 11.56 feet of clearance from the top of the radar to the bottom of the Eads Bridge center most point.

3.4.5 Eads Bridge Lighting The upriver (north side) of the bridge has navigation lights placed on the lower bridge structure bridge to assist mariners in night navigation. These lights were installed following the 1969 M/V ELAINE JONES casualty. This accident (listed in Appendix A) resulted in the fatality of the operator when the pilothouse struck the bridge.

3.5 Martin Luther King Bridge (MLK) (Originally the Veteran's Bridge) Although not directly involved in this casualty, the effects of the MLK Bridge were identified as having a bearing on this case. The bridge is approximately 0.2 miles above the Eads, and is intimately related from a navigation standpoint. These elements are also addressed in Appendix A.

4. Environmental Factors:

4.1 Weather Conditions: The National Weather Service Center in St. Charles, Missouri, provided official weather conditions for April 4, 1998 (exhibit #23). The National Weather Service took hourly checks at 55 minutes after the hour for a 24 hour period. The weather and environmental conditions checks for 6:55 p.m. and 7:55 p.m. were as follows:

	<u>6:55 p.m.</u>	<u>7:55 p.m.</u>
Air temperature:	46° F	43° F
Winds:	Calm	West @ 3 mph
Visibility:	Partly Cloudy	Partly Cloudy

4.2 River Data: River stages are taken by the U.S. Army Corps of Engineers, St. Louis District (USACE) on continuous hourly intervals at the Poplar Street Bridge (mile 179.2 UMR). This area is approximately 0.8 miles downriver from the Eads Bridge. Flow rates are taken in cubic feet per second (cfs).

4.2.1 River flow rates for around the time of the casualty were (exhibit # G-19a):

Time	Stage	Flow (cfs)
1900	31.4	533,000
2000	31.6	536,000

4.2.2 Taking the above data, USACE estimates for the river stage and current speed are as follows:

River Stage: 31.5 feet (1.5 feet above flood stage)
Current Speed: 8-10 ft/sec (5.5-6.8 mph or 4.7-5.9 knots)

4.2.3 The USACE provide a "flow net" (magnitude and direction of flow velocities) for April 6 and April 7, 1998 (exhibit G-19b). River velocity measurements encompassed the area from the Eads Bridge upriver to the MLK Bridge.

On April 7, 1998, a USACE survey vessel took measurements of the water velocity angles and rates. According to testimony by Mr. Claude STRAUSSER, the USACE St. Louis District Chief of Potamology, the depth of samples taken was approximately 6 feet below the water surface (transcript Vol II, page #94). This depth was chosen due to the fact that barges typically have drafts of 9 feet, therefore 6 feet would be the approximate 2/3 mark or theoretically; the resultant of the forces acting on barges (transcript Vol II, page #94).

4.2.4 Historical river stage (taken since 1861) information, was also provided by the USACE (exhibit #G-19 c & d). That information validated a trend in river stages from month-to-month. The information clearly reflected that stages were highest in the month of April (exhibit G-19 c & d).

4.3 Coast Guard Waterway Management Efforts: Due to the increased river stage, the USCG Captain of the Port, St. Louis had a Captain of the Port Order, under the authority of the Ports and Waterways Safety Act (PWSA), in effect on the date of the casualty (enclosure #P-11). This order was in effect for UMR miles 184 to 179. It was broadcast via VHF channel 16 from April 2, 1998 (two days prior to the casualty) until the river stage fell below the 25 foot mark on the St. Louis gage several weeks later.

In summary, it required that tows:

Have a minimum of 250 horsepower per standard loaded barge (1500 tons cargo).

Southbound tows over 600 feet (excluding towing vessel) be restricted to daylight hour operation.

4.3.1 There was also an MSO advisory regarding the labor strike (as detailed in the analysis section). This COTP advisory required all towing vessels to have two licensed pilots aboard per the U.S. Code Title 46 (enclosure #P-2).

4.4 Similar Vessel Transits: The Melvin Price Lock and Dam "Lock Queue Log" for the date of the casualty was obtained from the USACE (enclosure #P-4). This log (identified as the "Done List") listed six towing vessel lockages from 1005 on April 4, 1998 until 0405 on April 5, 1998. Typically, vessels that lock through have transited (northbound) or will transit (southbound) the Eads and MLK bridge area.

This log listed four northbound vessels with tows that locked through Melvin Price Lock & Dam from 10:05 a.m. on April 4, 1998 until 4:05 a.m. on April 5, 1998. Only one of the four appeared to have a tow that was similar to the ANNE HOLLY. Below is a breakdown of that vessel's information:

<u>Vessel Name</u>	<u>HP</u>	<u>Start Time</u>	<u>Size of Tow</u>
BROTHER COLLINS	4300	1425	11 loads / 5 empties

M/V BROTHER COLLINS was the only upbound tow with a similar arrangement of loaded and empty barges to ANNE HOLLY on April 4, 1998. BROTHER COLLINS successfully completed the upbound transit through St. Louis Harbor with 4300 horsepower; however, it should be noted that this transit took place during daylight hours.

Note: The start time referenced above indicates the time the vessel began its lockage. It can be estimated that it was approximately 2 hours after the vessel transited the harbor/bridge area.

5. VESSEL PERSONNEL DATA:

- 5.1 **Name:** John O. JOHNSON
Position: Operator
Address:
- Date of Birth:**
Location (at time of casualty): Pilothouse
Employer: Winterville Marine
Time with Company: 6 years
Time in Industry: over 38 years
Licensing History: Received 5th renewal as "Operator of Uninspected Towing Vessels upon Great Lakes and Inland" on 13 Dec 93 from REC New Orleans, Louisiana.
- On Duty (prior to casualty):** 1.5 hours
- 5.2 **Name:** Martin O'CONNOR
Position: Deckhand
Date of Birth:
Location (at time of casualty): Bow of ANNE HOLLY
Employer: Winterville Marine
Time with Company: 2 years
Time in Industry: 23 years
On Duty (prior to casualty): 1.5 hours
- 5.3 **Name:** Chris DAVIS
Position: Deckhand
Address:
- Date of Birth:**
Location (at time of casualty): Bow of vessel
Employer: Winterville Marine
Time with Company: unknown
Time in Industry: 23 years
On Duty (prior to casualty): 1.5 hours
- 5.4 **Name:** Charles BROWN
Position: Chief Engineer
Address:
- Date of Birth:**
Location (at time of casualty): Pilothouse
Employer: Winterville Marine
Time with Company: unknown
Time in Industry: 23 years
On Duty (prior to casualty): 1.5 hours

5.5 Although the vessel was owned and operated by American Milling, the crew was provided by Winterville Marine in Greenville, Mississippi.

Note: See "Analysis" section II, item 3 for an examination of human factors.

6. Casualty Description:

Referenced times are approximate Central Daylight Savings Time

6.1 On April 4, 1998, at 1710, Captain JOHNSON came on watch and assumed operational vessel control from the [relief] pilot, Mr. Bob HOELSCHER. The ANNE HOLLY was completing configuring a composite tow of 14 total barges at the Paragon "George Street" fleet located at approximately mile 178 of the Upper Mississippi River on the right descending (Missouri side) bank. The vessel added 1 loaded and 2 empty barges to the (11) barges already in tow. Following this evolution, the on watch deck crew of the vessel were securing all lines and ensuring the tow was properly made up prior to getting underway (exhibit #G-29).

6.2 Captain JOHNSON contacted the engine room and spoke with the Chief Engineer on watch, Mr. Charles BROWN, to ensure that all propulsion and engine room equipment was operating satisfactorily. BROWN assured JOHNSON that all was satisfactory (exhibit #G-29).

6.3 At or about this time, Kenneth SIMMONS, operator of the fleeting vessel M/V FRANCES, (operated by Paragon Marine Services, Inc.) stated he contacted Captain JOHNSON via radio before the ANNE HOLLY departed the George Street fleet. SIMMONS asked JOHNSON if he needed any assistance in leaving the fleet and JOHNSON stated that he was "getting faced up and could turn loose."

6.4 -- 1830: the ANNE HOLLY got underway northbound with (14) barges in tow (ahead) (see fact section #2.1 and enclosures G-13 & G-15 for details of the tow configuration).

6.5 -- 1915: ANNE HOLLY met M/V FRANCES underway just below the MacArthur Bridge. Shortly thereafter JOHNSON contacted SIMMONS, the acting dispatcher for Paragon vessels, on VHF channel 7. SIMMONS stated that JOHNSON then requested one or two assist towing vessels to assure the ANNE HOLLY's safe transit through the downtown bridges. SIMMONS advised JOHNSON that he was the only vessel working and could not respond to the request. JOHNSON replied that he "seemed to be moving OK and would keep going". (enclosure #P-10).

6.6 After requesting tow assistance and finding none available, JOHNSON proceeded uneventfully through the MacArthur and Poplar Street bridges (exhibit #G-29).

6.7 -- 1920: the vessel cleared the Poplar Street Bridge, JOHNSON and began to prepare for the approach to the Eads Bridge. (mile 178.9) The vessel's engines were both full ahead and JOHNSON stated he experienced no maneuverability or control problems (exhibit #G-29).

6.8 Captain JOHNSON continued on full ahead with both engines through the center preferred channel span of the Eads Bridge. (exhibit #G-29)

6.9 -- 1929: As the head of the tow passed underneath the bridge, the tow's headway stalled and, according to JOHNSON, the tow began to "top around" [or fall back] toward the Missouri side. This was confirmed by personnel on watch at the time (DAVIS & O'CONNOR). Within seconds, the forward end of the vessel's tow began to lose headway against the current. (exhibit G-29).

6.10 -- 1930: The second barge port side landed against the right descending bridge support breaking the tow coupling between the second and third barges in the port string. Eleven of the barges of the tow broke apart with the three in the aft (horizontal) row remaining attached to the vessel. This was attributed to the double [referred to in the industry as head] wires that attached this row to the vessel.

6.11 Captain JOHNSON immediately sounded the danger signal of 6 short blasts of the vessel's horn. He made at least two other such soundings of the horn as confirmed by two crew members. He also tried unsuccessfully to hail the ADMIRAL Casino gaming facility via radio on VHF channel 16. At, or about this time, he alerted ANNE HOLLY's crew with the vessel's general alarm (exhibit G-29).

6.12 -- 1945: SIMMONS heard JOHNSON call for assistance from any harbor towboat via VHF channels 7 and 13. SIMMONS stated that JOHNSON said that his tow "was breaking up in the Eads bridge and that part of the tow was topping towards the Missouri shore" (enclosure P-10). SIMMONS proceeded north to the MacArthur Bridge and witnessed the gaming facility ADMIRAL Casino swinging out into the channel. He attempted to contact ANNE HOLLY unsuccessfully. SIMMONS then broadcasted (via VHF channel 7) to ANNE HOLLY recommending that they turn loose the remaining barges in the tow and catch the adrift casino (enclosure #P-10).

6.13 Captain JOHNSON immediately proceeded to release the remainder of the tow by backing down hard, breaking the wires to the remaining three barges (which were recovered by local fleet towboats). Following this, he proceeded downriver in pursuit of the ADMIRAL Casino gaming facility, which was swinging out into the channel. JOHNSON stated that as he passed the ADMIRAL, he observed several passengers through the casino's windows still gaming with no apparent urgency to evacuate. (exhibit #G-29)

6.14 -- 1949: Barges (perhaps two) allided with upriver bow of the moored facility ADMIRAL. The security supervisor on duty for the ADMIRAL, Michael BENDER, testified that he went to the bow area as the barge struck the facility. He was not able to identify the hull numbers.

Note: Three videotapes of the incident were critical in recreating the accident scenario (exhibit G-6 a thru c). These videos were primarily used in determining fact section 6.15.

6.15 -- 1950: An adrift barge (later identified as the ABC 767), traveling between the Missouri bank and the port side of the ADMIRAL, collided with the center entrance ramp and breaks the walkway loose from its moorings. Emergency evacuation efforts by ADMIRAL security personnel, led by the State Trooper assigned to the Missouri Gaming Commission, prevented any injury or loss of life. Several passengers (number unknown) were on the ramp and egressed through the walkway to the Missouri bank seconds before it sank. An initial report of a person overboard (as stated in exhibit G-3) was later determined through testimony to be invalid.

6.16 - 1951: The facility, deprived of its walkways and all but one shore mooring line, is observed swinging away from the Missouri bank in a videotape taken by a shoreside bystander (exhibit #G-6a).

6.17 -- 1952: Videotape taken by the M/V CASINO QUEEN (exhibit G-6b) shows the lights of the ADMIRAL Casino de-energize, indicating the break with shore power. In less than a minute the emergency power re-energizes the lights.

6.18 -- 1957: After swinging downriver approximately 500 feet, the ADMIRAL Casino's momentum is stopped by ANNE HOLLY, Employees of the ADMIRAL Casino assisted ANNE HOLLY's deck crew in securing the towing vessel to the casino (exhibit G-6a).

6.19 Mr. SIMMONS, holding position aboard M/V FRANCES beneath the center span of the MacArthur bridge, began to stop adrift barges coming downriver. He was able to stop several (number unknown) barges while other harbor vessels proceeded to assist. He estimated that all adrift barges were secured (put into fleets or pushed into the bank) by 2100. One of the barges he recovered was the ABC 767. (enclosure #P-10)

7. Post Casualty Information:

7.1 ADMIRAL Evacuation Efforts: Following the allision of the adrift barges with the ADMIRAL Casino, immediate efforts were begun by President Casino and Gateway Riverboat Cruises (a subsidiary of President Riverboat Casinos, Inc.) to remove all guests and crew.

7.1.1 This evacuation was coordinated by the USCG Captain of the Port, St. Louis (acting as on-scene coordinator) in conjunction with Commander, USCG Group Upper Mississippi River (Keokuk, Iowa). (exhibit #G-3)

7.1.2 Personnel from multiple agencies assisted with the evacuation and control of the area. Such agencies included: the St. Louis Fire Department, St. Louis Police Department and the Missouri Water Patrol. (exhibit #G-3)

7.2 **Personnel Injuries:** According to post-hearing figures obtained by National Transportation Safety Board (NTSB), there were approximately 31 injuries reported to President Casino from ADMIRAL Casino guests. Sixteen of these guests were taken to the hospital, with only 1 held for observation. There were no injuries to the crew of ANNE HOLLY or other involved vessels.

7.3 **Pollution:** At the time of the casualty, the ADMIRAL had no propulsion machinery. Due to this, pollution potential was minimal and no pollution associated with this casualty was observed (exhibit #G-3).

7.4 **Initial Casualty Investigation:**

7.4.1 MSO St. Louis marine inspectors boarded the ADMIRAL Casino to check watertight integrity of the structure and assess damage. Considerable structural damage was observed on the forward section of the casino.

7.4.2 Casualty investigators from MSO St. Louis boarded ANNE HOLLY to perform interviews of the pilot and crew. The operator was removed from the vessel and breath tested for alcohol by the St. Louis Police Department.

7.5 **Damages:**

7.5.1 **M/V ANNE HOLLY:** There was no damage to the ANNE HOLLY itself as a result of the casualty (exhibit G-2).

7.5.2 **Tow of ANNE HOLLY:** All barges in ANNE HOLLY's tow were successfully recovered within an hour of the incident. The barges were temporarily secured in fleeting areas throughout St. Louis Harbor by responding towing companies. Initial surveys of all barges indicated damage (structural and cargo) as follows:

<u>Barge Number</u>	<u>Est. Structural Damage</u>	<u>Est. Cargo Loss</u>
F/B ABC 767	\$150,000	\$ 15,000
F/B PIN 348B	100,000	125,000
F/B SB 15B	35,000	30,000
F/B MWO 211	10,000	0
F/B CGB 219B	20,000	0

7.5.3 Eads Bridge: An immediate assessment of the bridge by the bridge owner/operator determined no structural damage as a result of the incident (exhibit #G-3).

7.5.4. ADMIRAL Casino: Damage to the ADMIRAL Casino from the initial barge(s) impact is depicted in photographs. All three guest/employee entrance ramps were torn from their moorings (exhibit #G-5).

8. Formal Casualty Investigation: A marine casualty case, Marine Safety Information System (MSIS) case number MC98004086, was generated by the Officer in Charge, Coast Guard MSO St. Louis. A copy of this formal investigative report chartered in accordance with exhibit #G-1, is included as part of the MSIS case file.

8.1.1 On April 6, 1998, the Coast Guard Eighth District Commander initiated a formal investigation into the cause of the accident (exhibit #G-1). The formal hearing convened on April 9, 1998 and concluded on April 10, 1998. Sworn testimony was taken of 11 witnesses and 30 documentary exhibits were entered into the record (see transcript, enclosures P-1 a & b).

8.1.2 Following the incident, the National Transportation Safety Board (NTSB) initiated an investigation under its federal authority. Prior to assignment, it was determined at an executive level to conduct independent NTSB/USCG investigations. NTSB conducted their preliminary investigation during the week following the casualty. A copy of the USCG's formal hearing transcript was provided to NTSB investigators by authority of Commandant (G-MOA) and Commander(dl), Eighth Coast Guard District.

II. ANALYSIS

1. M/V ANNE HOLLY:

1.1 Pre-casualty Condition: MSO St. Louis marine investigators focused attention on ANNE HOLLY's ability to safely transit the bridges under conditions existing on the evening of the casualty. Examination of the vessel's primary propulsion, steering and navigation systems were the focus of this investigative phase.

1.1.1 In his initial statement (exhibit #G-29) and testimony (transcript Vol I, pages 52-54, 76 and 81), Captain JOHNSON indicated that all propulsion, steering and other vessel operating equipment was functioning satisfactorily up to, and at, the time of the casualty.

1.1.2 Further, although not required by regulation, it was customary for ANNE HOLLY to maintain a "Daily Engine Room Log" (exhibit #G-16). This log, in use on the night of the casualty, indicated multiple items such as pressure readings, temperatures and engine hours to date. Testimony from the vessel's Chief Engineer, Mr. Charles BROWN, confirmed JOHNSON's testimony that all equipment was operating properly up to, and at, the time of the casualty. BROWN logged that both port and starboard main [diesel] engines (referred to as PME and SME) were turning at approximately 900 rpm (transcript Volume I, page 163) during ANNE HOLLY's transit of St. Louis Harbor.

1.2 Post-casualty Condition: MSO St. Louis marine investigators determined that a simulation of the transit with the actual vessel and similar tow arrangement would serve to validate ANNE HOLLY's operational condition (exhibit #G-18). By confirming this, a thorough and extensive analysis of previous repair history or equipment condition would not be necessary. The investigation could then re-focus on other issues.

1.2.1 A simulated upbound voyage, conducted during daylight under similar high river conditions, was conducted through St. Louis Harbor on April 8, 1998 (exhibit #G-18). ANNE HOLLY made up a nearly identical* tow and proceeded upriver through the Eads and MLK bridges with MSO personnel and vessel representatives onboard. The vessel, under the command of another operator, transited both bridges without incident.

* Note: The only difference in the test tow configuration from the night of the night of the casualty was the presence of an additional empty barge on the starboard side of ANNE HOLLY.

2. ADMIRAL Casino Facility:

2.1 History: The S.S. ADMIRAL has a long history with the Mississippi River and the St. Louis waterfront. The "substantially moored structure" was originally an operational, 300-foot vessel launched in Dubuque, Iowa, in 1908 as the M/V ALBATROSS. It ferried freight and railroad passenger cars across the Mississippi River in Vicksburg, Mississippi until a railroad bridge put it out of business in 1937. In 1938, Streckfus Marine, Inc. bought and rebuilt ALBATROSS, retaining only the original hull.

2.1.1 In June 1940, Streckfus Marine launched the rebuilt vessel under the new name of S/S ADMIRAL. For nearly 40 years ADMIRAL, which was capable of carrying up to 4,000 passengers, operated as a river excursion boat at the St. Louis waterfront.

2.1.2 In 1979, the U.S. Coast Guard Marine Safety Office St. Louis cited deterioration of ADMIRAL's hull and suspended its certificate of inspection. S/S ADMIRAL departed St. Louis two years later. In 1981, the vessel was moved to Paducah, Kentucky where it was used briefly as a family entertainment center until that venture failed. During this time frame the propulsion machinery was removed.

2.2 U.S. Army Corps of Engineers Involvement: Under Section 10 of the River and Harbor Act of 1899, the USACE is responsible for issuing and maintaining permits regarding structures on the navigable waterways of the U.S. The USACE also ensures that the provisions of Section 404 of the Clean Water Act are met. The cognizant USACE review authority is the St. Louis District Engineer.

2.2.1 In 1983, S.S. Admiral Ltd., filed for a U.S. Army Corps of Engineers permit to operate the ADMIRAL as "a permanently moored floating showplace and family entertainment/dining center" in the ADMIRAL's original location south of the Eads Bridge. This permit (P-1550) was issued on October 5, 1983 (enclosure #P-8). An environmental impact assessment was completed as part of this process. According to the permit, the exact location of the ADMIRAL was "the right descending bank of the Mississippi River at approximately 179.9 and approximately 50 feet south of the eastern prolongation of the south line of Washington Avenue in St. Louis Missouri."

2.2.2 On December 23, 1996, a subsequent permit was issued to President Riverboat Casino-Missouri, Inc. as permit number P-2027. The project description was to moor a support barge and casino riverboat vessel on the Mississippi River (same location as permit P-1550). In a Public Notice, the USACE listed several modifications to the 1983 permit. This, in essence, was the permit in place at the time of the ANNE HOLLY casualty (enclosure #P-9).

2.3 Coast Guard Involvement: The U.S. Coast Guard Marine Safety Manual states that, "A floating fuel dock ... restaurant, museum, etc., is not a 'vessel' for inspection purposes if it is permanently moored and thus taken out of navigation." (exhibit #G-21)

2.3.1 On June 22, 1994, the USCG Captain of the Port, St. Louis issued a letter to the USACE, St. Louis District regarding the ADMIRAL (enclosure #P-14). This letter referenced a recent towboat casualty* involving the ADMIRAL that "indicates the vulnerability of that vessel [ADMIRAL] to possible future casualties." The letter requested "a review of the ADMIRAL's permit to determine if additional conditions are necessary to assure public safety."

*Note: This referenced towboat casualty was most likely the allision of the M/V ROBERT Y. LOVE in June 1994 as detailed in Appendix A.

2.3.2 On July 10, 1995, the USCG Captain of the Port, St. Louis, issued a letter to the USACE St. Louis District regarding the request for consideration of "a protection/deflection cell upstream of the ADMIRAL casino" (enclosure #G-22c). This letter detailed meetings with river industry safety committees and also spoke of a potential "future move from the current site under port authority review." It concluded that "the allision risks associated with continued operations at the site are such that a deflection cell would not significantly improve the public's safety. This conclusion is particularly valid given the probability of a change in the vessel's location in the near future".

2.3.3 On August 13, 1996, the Captain of the Port, St. Louis issued a response letter to President Casino (exhibit G-22b) to answer casino operations questions presented in a letter dated August 8, 1996 (enclosure #P-15). This letter commented on several fire fighting and egress requirements. The issue of a protection cell was addressed and the letter stated that "the issue was investigated earlier (referencing the aforementioned 1995 letter) with the resultant finding that a cell is not necessary. We see no need to revisit the issue".

2.4 State of Missouri Involvement: The Missouri Gaming Commission is the overseeing authority for gaming on Missouri waters. At the time of the casualty, the commission had approved ADMIRAL for gaming under Missouri statues. As addressed in the fact section, gaming personnel assigned aboard the vessel on the date of the casualty played a major role in the successful evacuation of guests and staff from the casino.

2.5 American Bureau of Shipping (ABS) Involvement: ABS, an internationally recognized classification society, was contracted to certify the watertight and structural integrity of the structure (transcript Vol II, page 9) to satisfy Missouri Gaming Commission licensing requirements.

2.6 Mooring Arrangement: Mooring integrity was a subject of inquiry during the hearing. Broken mooring cables allowed the ADMIRAL Casino to swing 180 degrees until ANNE HOLLY arrived to hold the structure to shoreline. Exhibit G-26 is the ADMIRAL Casino's "Mooring Plan" dated September 16, 1996. This plan indicated existing, new and replaced mooring cables as drawn and completed by Ashton-Barnes Engineers, Inc. According to this plan, there were nine mooring lines in place at the time of the casualty.

2.6.1 The Chief Engineer for the ADMIRAL, Lee SORENSON, confirmed that there were nine mooring lines in place that securing the casino structure to the Missouri shore at the time of the incident (transcript Vol II, pages 10-12). Sorenson stated that the ADMIRAL was originally moored according to plans by the former owner, Six Flags Amusement Company.

2.6.2 Exhibit G-26, and USACE permit number P-2027 (enclosure #P-9) diagram the ADMIRAL mooring arrangement on April 4, 1998. The following is a description of the cable arrangement:

No.	Location	Winch Size	Attached to
#1	Bow	75 Ton	Anchor under Eads Br.
#2	Bow	50 Ton	Anchor under Eads Br.
#3	Bow	35 Ton	Deadman on levee
#4	Port Quarter	35 Ton	Deadman on levee
#5	Port Quarter	35 Ton	Deadman on levee
#6	Stern	50 Ton	Deadman downriver
#7	Stern	75 Ton	Anchor downriver

2.6.3 According to a June 5, 1998 post-hearing* interview with SORENSON, two more wires were added by President Casino in approximately 1992-1993. Both of these wires were from the forward portion of the ADMIRAL to deadmen supports beneath the Eads Bridge. Exhibit G-26 indicate these wires as "Admiral Lead" and "Admiral Head".

*Note: SORENSON clarified conflict in the transcript regarding the total number of original mooring cables. During questioning, he erroneously indicated that eight cables were in the original mooring configuration.

2.7. **Lifesaving Devices**: Following the casualty, discussion arose as to the lack of Personal Flotation Devices (PFDs) found on the casino (approximately six). It was, and currently is, the position of President Casino that PFDs would be detrimental to guest safety. The scenario of guests donning life jackets and jumping into swift river currents surrounded by great quantities of floating debris is considered to pose greater peril than the current "shelter-in-place" approach, which relies on rescue by vessels operating in close proximity.

2.8 **Risk Assessment**: During the hearing, inquiry into a "risk study" or "risk assessment" of the ADMIRAL Casino was conducted.

2.8.1 Although discussed at length during the hearing during testimony of President Riverboats Casino's Director of Marine Development (transcript Volume II, page 30), MSO St. Louis investigators were unable, through the Officer in Charge, Marine Inspections's subpoena authority, to obtain a copy of any formal or written risk assessment**.

**It is believed that testimony about a "risk assessment study" was actually reference to several letters between President Casino, the U.S. Army Corps of Engineers, and Ashton-Barnes Engineers, Inc. during 1994. This information, which was made available to Coast Guard investigators, remains in Army Corps of Engineers permit files.

2.8.2 The President Riverboats Casino Director of Marine Development testified that "a [protective] cell up there would not have done any good", and that this conclusion was made by government and industry (transcript Volume II, page 45).

2.9 Post Casualty Conditions:

2.9.1 Bow: Significant damage was sustained to the bow area of the casino (exhibit G-5). This damage was attributed to the impact of the barge as witnessed by Mr. BENDER (detailed in fact section 6.14)

2.9.2 Entrance Ramps: All three entrance ramp walkways were separated by the downbound adrift barges, as discussed previously in fact section 6.15. (exhibit G-5)

3. Human Factors:

3.1 Physiological: Breath test results were conducted by the St. Louis Police Department mobile breath test unit on Captain JOHNSON. The results were negative (exhibit #G-11a).

3.1.1 Chemical tests for illegal drugs on JOHNSON were also negative. JOHNSON stated he did not drink alcohol (transcript Vol I, page 85) or smoke cigarettes (exhibit #G-29). He indicated he had received an adequate amount of rest on the voyage, and prior to taking over control of the vessel at 1710 on April 4th, 1998 in the George Street fleet (transcript Vol I, page 84).

3.1.2 Captain JOHNSON revealed he was using prescribed medications at the time of the incident (transcript Vol I, page 84); however, there is nothing in the investigation to suggest physical impairment played a role in this casualty.

3.2 Psychological: The 1985 U.S. Coast Guard "Analysis of Bridge Collisions in the St. Louis Harbor" (referenced as Official Notice #1 in the formal hearing) included a detailed discussion of the "Psychological Effects of the Low Vertical Clearance of the Eads Bridge on Towing Vessel Operator's Confidence." This factor was listed as a contributing factor in the 1969 allision of the M/V ELAINE JONES with the Eads Bridge which resulted in the death the vessel's pilot.

3.2.1 Within that analysis, one towing vessel operator (not identified), whose tow [had] recently struck the Eads Bridge stated "that it is not uncommon for operators to worry about the Eads Bridge from the time they depart Minneapolis/St. Paul, Minnesota downbound; a distance of over 650 miles."

3.2.2 Clearance at the Eads Bridge could presumably cause concern to both north and southbound operators. Although Captain JOHNSON did not mention this specific concern in his initial interview or hearing testimony, it may have been a factor. As presented in fact section 3.4.2, ANNE HOLLY had approximately 12 feet clearance between the top of his vessel's radar and the highest part of the bridge's structure, and considerably less on each side of the bridge span's center point.

3.2.3 Captain JOHNSON's testimony confirmed that he made an inquiry regarding availability of a "helper" boat during the transit of St. Louis Harbor, which he decided he did not need after clearing the Poplar Street Bridge. (transcript Volume I, page 93).

3.2.4 Captain JOHNSON's testimony revealed that he felt night transits through the St. Louis Harbor bridges were more challenging than daylight transits (transcript Vol I, pages 57 and 85). He considered the Eads Bridge "a bad place in the river" (transcript Vol I, page 78).

3.3 **Operator Experience**: Discussion within documents listed in "Post Hearing Enclosures" as Official Notice items #1 and #2 recognize the importance of the operator's experience level during transits of St. Louis Harbor.

3.3.1 Captain JOHNSON had over 30 years of licensed commercial vessel operating experience. He had been employed with Winterville Marine for more than 6 years. He had been the assigned as the Captain of ANNE HOLLY for four years prior to the casualty. He was experienced in piloting St. Louis Harbor (transcript Vol I, page 46). His last voyage through the Eads Bridge was the same date on a southbound transit (exhibit #G-29); His last transit during high water conditions similar to that of April 4, 1998 was two years earlier (transcript Vol I, page 144).

3.3.2 Captain JOHNSON's testimony revealed that he believed the current "set" direction between the Eads and Martin Luther King Bridges to be running from the Illinois to Missouri shore (transcript Vol I, pages 59, 66 and 119). This point conflicted with U.S. Army Corps of Engineer's Potamology Section Chief (Claude Strausser), who testified that historic current set direction flows in the opposite direction, from the Missouri to the Illinois shore (transcript Vol II, pages 61-63 and exhibit 19c).

3.3.3 Captain JOHNSON's testimony acknowledged that to avoid damaging the wheelhouse after lead barges clear the Eads Bridge, a course change and proper repositioning of tow alignment is critical to success (transcript Vol I, pages 59, 67 and 120). He also acknowledged that rudder changes at slow speed reduce forward momentum (transcript Vol I, page 77), and that steering too close to the Missouri side of the Eads Bridge center span would leave too little maneuvering room for the towboat to clear the bridge (transcript Vol I, page 74).

3.3.4 Captain JOHNSON's testimony acknowledged that to avoid missing the approach, a steering adjustment must be made before arrival at the Eads Bridge (transcript Vol I, page 71). His testimony suggests that he properly considered navigation lights, markers, and shapes to assess ANNE HOLLY's position prior to passage beneath the Eads and Martin Luther King Bridges on April 4, 1998 (transcript Vol I, pages 60-61). He also acknowledged that he was alone in the pilothouse at the time of the incident (transcript Vol I, page 64).

3.3.5 Testimony by Captain JOHNSON suggests that despite proper barge and tow alignment, ANNE HOLLY began to experience an unusual current set after the lead barges entered the center span of the Eads Bridge (transcript Vol I, pages 72 and 126). **Note:** Testimony from the U.S. Army Corps of Engineers, St. Louis Potamology Division Chief verified that flow at St. Louis Harbor varied by no more than one foot between 8 a.m. and 9 p.m. on April 4, 1998 (transcript Vol II, page 64).

3.3.6 Although Captain JOHNSON stated he made no rudder changes after ANNE HOLLY experienced a loss in forward momentum, testimony describing the vessel's position at the point of the "stall" as "sitting over real hard" suggests he may have oversteered prior to entry into the Eads Bridge (transcript Vol I, page 77).

3.4 **Labor Struggle:** At midnight on the day prior to the casualty, the labor organization known as "Pilot's Agree" ordered a labor walkout throughout the western rivers system. At several points during the initial investigation, this issue was raised as a potential contributing factor by both the industry and the media. Captain JOHNSON emphatically stated in his initial interview with MSO investigators that he was in no way affiliated with Pilots Agree. This, combined with the fact that the ANNE HOLLY was the vessel he typically operated, ruled out the labor struggle as a contributing factor.

III. CONCLUSIONS

1. The proximate cause of the allision of ANNE HOLLY's tow with the Eads Bridge was the failure of the vessel's operator to properly account for the prevailing currents and set of the Upper Mississippi River between the Eads and MLK Bridges (analysis section 3.3). During a critical point in the transit, Captain JOHNSON misinterpreted current set and over-steered. The steering maneuver to port, which was executed to ensure room for ANNE HOLLY's pilothouse to clear the Eads Bridge (analysis section 3.2), diminished forward momentum. As the lead barges in the unit responded to the steering maneuver, the main downriver current acted with increasing intensity on the unit's starboard side. Meanwhile, the cross current at the Eads Bridge, flowing in a direction opposite to that expected by Captain JOHNSON (analysis section 3.3), intensified the rate of turn beyond that anticipated. With more than half the length of the tow and barge unit being forced toward the span support, Captain JOHNSON was unable to back the tow out and avoid an allision with the Eads Bridge.

2. Operator's concern over night transit with limited vertical clearance beneath the Eads Bridge during high water conditions is likely a contributing factor (fact section 3.4 and analysis section 3.2).

3. Evidence exists to support a charge of negligence under 46 Code of Federal Regulations Part 5, against the ANNE HOLLY's licensed operator, John O'Neil JOHNSON. A "presumption of negligence" clearly exists when a vessel strikes a known fixed object. Specific issues of negligence to be considered include (analysis section 3.3):

- * failure to ensure adequate lookout on M/V ANNE HOLLY
- * failure to ascertain the direction of currents between the Eads and MLK Bridges in St. Louis Harbor

Except as indicated above, there is no evidence of actionable misconduct; inattention to duty; or willful violation of law or regulation on the part of any Coast Guard licensed or documented person; no evidence of failure of inspected material or equipment; and no evidence that any personnel of the Coast Guard, or any other government agency, contributed to the cause of the casualty.

4. As discussed in analysis section 3.3, a review of pertinent operator experience indicators indicated no lack of expertise on the part of Captain JOHNSON. The operator did not indicate in his testimony or initial statements that he lacked confidence; however, lack of recent experience during high water conditions may have had some influence on his decision making (analysis section 3.2).

5. The breakaway of the ADMIRAL gaming facility from its moorings was caused by the impact of at least two, possibly three loaded barges from the port string of ANNE HOLLY's tow (fact section 6.14).

6. The "Pilots Agree" labor struggle was ongoing; however, it was not a direct contributing factor in this casualty. There was a reduced number of available assist (fleeting) vessels in St. Louis Harbor on April 4, 1998 (analysis section 3.4). Although not required under the existing USCG MSO St. Louis Captain of the Port advisory, ready availability and astern use of an assist vessel may have prevented the casualty.

7. Captain JOHNSON's immediate and voluntary actions after the casualty (fact section 6.13) were commendable, and likely played a large role in minimizing injury or loss of life and further damage to property. An adrift, non self-propelled ADMIRAL Casino carried downstream by the river's swift current would have likely struck the two downriver bridges (MacArthur and Poplar Street) and caused more injury, and possibly loss of life and extensive damage to property.

8. Historic St. Louis high water navigation restrictions on southbound tows was based in part on the findings in "Analysis of Bridge Collisions" study (Official Notice #1). The Captain of the Port Order in effect at the time of the casualty (fact section #4.3) limited southbound tows over 600 feet in length to daylight transit only. However, examination of local Coast Guard marine casualty statistics from 1985 to present (Appendix A), suggest that there is actually a greater risk of allision at the Eads and MLK bridges for northbound tows than for southbound tows.

9. The Missouri State Trooper assigned to the Missouri Gaming Commission played an exemplary role in evacuating casino patrons from the immediate area of the center (main) shoreside walkway at the time of the casualty (fact section 6.15). Their swift actions prevented any loss of life and helped minimize further injury.

10. There is no evidence that alcohol or drugs contributed to the cause of this casualty (analysis section 3.1).

11. Anticipation that ADMIRAL Casino would probably change location was an important factor in the decision not to install a protective cell (analysis section 2.3).

IV. RECOMMENDATIONS

1. Recommend that the U.S. Coast Guard Marine Safety Office St. Louis, consider initiating administrative Suspension & Revocation (in accordance with 46 CFR 5.29) charges for negligence against the license issued to Mr. John O. JOHNSON, with appropriate consideration included to address mitigating issues (conclusions 3 and 7).
2. Recommend that the U.S. Coast Guard Marine Safety Office St. Louis consider conducting a navigational risk assessment of the Eads and MLK Bridges areas. Accident information derived in Appendix A to this report could prove especially useful in the development of such an assessment. Such a study may also help in reassessing the risk associated with continued operation of the ADMIRAL (or other facilities) in the area currently permitted by the U.S. Army Corps of Engineers and the State of Missouri.
3. Recommend that the U.S. Coast Guard Captain of the Port, St. Louis consider adding daylight-only transit restrictions for northbound tow and barge transits for river stages at, or above, 25 feet on the St. Louis gage. Furthermore, to address concerns cited by Captain JOHNSON during the hearing (transcript Volume I, page 96), the Captain of the Port should also initiate discussion on the value and feasibility of requiring assist vessels to ensure safe barge and tow transits of St. Louis Harbor during high river stages.
4. In light of this nearly catastrophic event, it is highly recommended that the U.S. Coast Guard Captain of the Port, St. Louis re-address in writing specific safety concerns to the U.S. Army Corps of Engineers, St. Louis District regarding USACE Permit No. P-2027. Special attention should be given to a re-evaluation of the ADMIRAL Casino's mooring arrangements. In particular, the issue of installing protective mooring cells (discussed in analysis section 2.8.2) should be reconsidered.
5. In addressing improvements to safety of personnel aboard substantially moored land structures, Commandant (G-MOA) should also consider recommendations concerning safety described in the U.S. Coast Guard Marine Safety Office Pittsburgh's marine casualty investigation report #MC97012019.
6. The time is right for Commandant (G-M) to strengthen the strategic partnership between the U.S. Coast Guard and the American Waterways Operators (AWO). The AWO recently voted to require participation by all its members in their Responsible Carrier program; this requirement should also extend to non-member companies under contract with AWO companies. The next revision of the U.S. Coast Guard Marine Safety Business Plan should expand and align regional efforts like the USCG Eighth District's Voluntary Towing Vessel Examination Program more closely with AWO Responsible Carrier objectives and goals. The Coast Guard and AWO must also address human factors, like fear and geographic familiarity, which may have contributed to the ANNE HOLLY casualty.

7. Recommend that Commandant (G-M) consider seeking a formal role in safety to people on platforms designated as "substantial land structures" which are located adjacent to busy commercial waterways. Insight obtained during the formal hearings phase of this investigation suggest that the public expects traditional Coast Guard protections and oversight of safety on floating structures that "look like boats." Guidance could be published for distribution to external customers as a Navigation and Vessel Inspection Circular (NVIC), which would address evacuation procedures, emergency communications, emergency power, central warning alarms, firefighting, guest orientation briefings, security patrols and mooring plans.

8. Recommend Commandant (G-LMI) clarify in writing the legal definition of a "vessel" to facilitate Coast Guard Captain of the Port responsibilities in risk management activities that transcend the water-shore interface shared by overlapping regulatory jurisdictions. This definition could be incorporated into the guidance discussed in recommendation 7 above.

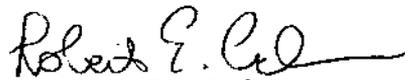
9. Recommend that Commandant (G-M) consider developing a Memorandum of Understanding (MOU) with the USACE that would allow the Coast Guard to play a greater role in the process of citing permanently moored vessels determined to be "substantially moored land structures," as described in Marine Safety Manual, Vol. II, Paragraph 10.I.1 (exhibit G-21). This MOU could encompass periodic Coast Guard safety reviews of USACE permits every five years by the Captain of the Port based on a commercial third-party certification risk assessment reports.

If this is deemed insufficient, then Commandant (G-MVI) should consider a more formal approach by preparing a written request to the USACE proposing expansion of the permitting regulations found in 33 CFR Parts 320 and 325 that incorporates a "Coordination with the U.S. Coast Guard" provision similar to that cited in 33 CFR 277.7 for bridges. Provisions promoting Coast Guard coordination with USACE during the permitting process for would greatly enhance COTP's position to address safety concerns for situations where large numbers of people use substantially moored land structures in hazardous locations.

10. Recommend that Commandant (G-M) and (G-LMI) work in partnership to develop supplemental guidance to support COTP oversight responsibilities for "substantially moored land structures" found in Marine Safety Manual, Vol. II, Section 10.I. In particular, guidance should reduce ambiguity by discussing specific actions and limitations under the Ports and Waterways Safety Act mentioned in Section I.1.a. The last paragraph of this section is particularly vague. Marine Safety Manual guidance should also encourage Coast Guard Captains of the Port to address safety concerns and regulatory limitations to the local or state entity with the greatest ownership over the commercial activity taking place (e.g. Missouri Gaming Commission).

11. The unified response of emergency agencies to this incident was outstanding; however, difficulty in accurately accounting for guests in the ADMIRAL Casino at any point could seriously complicate evacuation. Under more urgent conditions, this could needlessly place rescuers at risk. The St. Louis Harbor Emergency Response Plan (Official Notice #3) should be revised to incorporate lessons learned from the April 4, 1998 evacuation process in order to further reduce the potential risk of catastrophic loss of life and property.

12. Recommend that a copy of this final report (with exhibits and enclosures) be provided to the National Safety Transportation Board and MSO St. Louis.



Robert E. Acker
Commander, U.S. Coast Guard
By direction of the District Commander