UNITED STATES COAST GUARD

INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE LOSS OF PROPULSION ON THE BULK CARRIER

BRIGHT FIELD

AND ALLISION WITH THE RIVERWALK SHOPPING COMPLEX ON DECEMBER 14, 1996, NEW ORLEANS, LOUISIANA, WITH MULTIPLE INJURIES AND NO LOSS OF LIFE

U.S. Department of Transportation

United States Coast Guard

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16732/MC97000078

COMMANDANT'S ACTION
ON
THE MARINE BOARD OF INVESTIGATION

CONVENED TO INVESTIGATE THE CIRCUMSTANCES SURROUNDING THE M/V BRIGHT FIELD, LLOYD'S NO. L8715302, LOSS OF PROPULSION AND ALLISION WITH THE RIVERWALK SHOPPING COMPLEX, MISSISSIPPI RIVER, MILE 95.2 ABOVE HEAD OF PASSES, NEW ORLEANS, LOUISIANA ON 14 DECEMBER 1996 WITH NO LOSS OF LIFE AND MULTIPLE INJURIES

ACTION BY THE COMMANDANT

The record and the report of the Marine Board of Investigation convened to investigate the subject casualty have been reviewed. The record and the report, including the findings of fact, conclusions, and recommendations, are approved subject to the following comments.

CAUSE OF THE CASUALTY

I concur with the Marine Board's conclusion that the proximate cause of this casualty was the loss of main engine lubricating oil pressure to the main bearings which resulted in a main engine trip, causing the loss of propulsion and steerageway.

The root cause of this casualty was ineffective management and oversight of the vessel's machinery condition and operational and maintenance practices. Long standing and recurrent problems with the main engine were not adequately diagnosed or remedied by shipboard officers. Shoreside managers failed to pay sufficient attention to the machinery performance and maintenance reports to assure that problems were corrected and that the vessel would perform safely.

The International Safety Management Code becomes mandatory for most vessels including bulk cargo carriers such as the BRIGHT FIELD on 1 July 1998, and requires both the company and the vessel to have a safety management system in place. A properly implemented and followed safety management system will help to prevent occurrences such as the BRIGHT FIELD's loss of propulsion.

ACTION ON RECOMMENDATIONS

Recommendation 1: The International Maritime Organization should amend Chapter II-1, Part E of the International Convention for Safety of Life at Sea (SOLAS Convention) to require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board integrated automation test procedures which are approved by the vessel's flag administration or classification society.

Action: I concur with this recommendation. The faults identified are the consequence of inadequate, non-existent, or poorly documented policy and procedures for assessing and determining system integrity. There is a need for well-documented test procedures that demonstrate the correct function and proper integration of the automation system's software and hardware elements. However, international guidelines or standards governing the integration and proofing of automation are not available. Commandant (G-MSE-3) will incorporate this recommendation into a position paper for submission as a future agenda item for consideration by the International Maritime Organization to amend the SOLAS Convention and will propose guidelines on the development of automation test procedures.

Recommendation 2: The International Maritime Organization should amend Chapter II-1, Part E, Regulation 52 of the SOLAS Convention to require a standard operating procedure addressing the use of override arrangements and automatic slowdown and shutdown functions of the automation system. This standard operating procedure should address conducting periodic drills and training in use of the override arrangements and maintaining appropriate records of drills and training aboard the vessel. These records should be examined during port state control boardings and, if not available, the vessel should be detained until drills and training are conducted to the satisfaction of the flag administration or classification society.

Action: I concur with the intent of this recommendation. However, there is no indication in the report that any member of the bridge or engineering staff was unaware of an option to override the automation system, or that being unaware of this option contributed to this casualty. There is no indication in the report that a member of the bridge or engineering staff attempted to use an override arrangement and was unable to do so due to a lack of training. There is, however, evidence that the bridge crew did not inform the engineering crew of the seriousness of the navigation situation at the time of the main engine trip. To ensure that a vessel's crew is trained and able to exercise override arrangements on automated engineering plants, we should concentrate our efforts on bridge management. The most appropriate venue to exercise the judgment and response necessary in a situation similar to the one presented in this casualty is a bridge management exercise that includes interaction between the bridge crew and the engine crew. Competence in bridge teamwork procedures and engineering emergency procedures is required by the STCW Convention. We will emphasize the importance of competence in bridge teamwork procedures and engineering emergency procedures in our Port State Control activities.

Recommendation 3: The International Maritime Organization should revisit Chapter V, Regulation 12 of the SOLAS Convention to evaluate the cost/benefit of requiring vessels navigating in restricted waters to be equipped with a Vessel Event Recorder.

Action: I concur with the intent of this recommendation. However, the IMO does not evaluate cost/benefits. The IMO Assembly, at its 20th session in 1997, adopted a resolution containing performance standards for voyage data recorders (VDR). Establishing a VDR carriage requirement in SOLAS Chapter V is on the agenda of the Sub-Committee on Safety of Navigation. The U.S. delegation to the Sub-Committee on Safety of Navigation will actively pursue this agenda item.

Recommendation 4: The Coast Guard should modify 33 Code of Federal Regulations 164.11 to require that the owner, master, or person-in-charge of each vessel navigating in restricted waters ensure that the engineroom is adequately manned by crewmembers competent to respond to alarms and emergencies.

Action: I concur with the intent of this recommendation. A similar regulation was proposed when the navigation safety regulations were originally drafted. The proposed regulation was withdrawn because of the many difficulties associated with maintaining a complete, up to date list of confined or congested waters in 33 CFR Part 164 and because it was determined to be more appropriate to include such requirements, where applicable, in the regulated navigation area rules in 33 CFR Part 165. Commandant (G-MSR) will initiate a regulatory project to review this issue in the navigation safety regulations. In addition, a copy of this report will be provided to Coast Guard District Commanders for use in reviewing the Regulated Navigation Areas (RNA) in their zones, as appropriate. Commander, Eighth Coast Guard District issued similar regulations for the Lower Mississippi River RNA on October 30, 1997.

Recommendation 5: The Coast Guard should modify 33 Code of Federal Regulations 164.11(k) so that a pilot is made aware of the status of and method of activation for any override arrangement for the automatic slowdown and shutdown functions of the automation system.

Action: I do not concur with this recommendation. There is no indication in the report that the pilot's knowledge, or lack of knowledge, of the override arrangements on the BRIGHT FIELD played any part in the casualty. Whenever a pilot has any concerns about a vessel's propulsion or steering, the pilot should immediately express those concerns to the master. It is the master's responsibility to determine whether or not to use any override arrangements to maintain vessel power or control.

Recommendation 6: The Coast Guard should modify 33 Code of Federal Regulations 164.11(o) to require vessel owners and operators to maintain a bow lookout and/or anchor detail while navigating in restricted waters. Prior to enactment of this regulatory change, each Captain of the Port should assess the risk posed by loss of propulsion and/or steering casualties to the port and the appropriateness of requiring an anchor detail when vessels are underway on the navigable waters of the United States.

Action: I concur with the intent of this recommendation. A similar regulation was proposed when the navigation safety regulations were originally drafted. The proposed regulation was withdrawn because of the many difficulties associated with maintaining a complete, up to date list of confined or congested waters in 33 CFR Part 164 and because it was determined to be more appropriate to include such requirements, where applicable, in the regulated navigation area rules in 33 CFR Part 165. Commandant (G-MSR) will initiate a regulatory project to review this issue in the navigation safety regulations. In addition, a copy of this report will be provided to

Coast Guard District Commanders for use in reviewing the RNA's in their zones, as appropriate. Commander, Eighth Coast Guard District issued interim final regulations for the Lower Mississippi River RNA on October 30, 1997.

Recommendation 7: The Coast Guard should modify 33 Code of Federal Regulations 164.25(a)(2) to clarify the requirement for testing of the audible and visual extension alarms for the automation system.

Action: I concur with this recommendation. All audible and visual vessel control alarms, whether primary or extension, are required to be tested. Commandant (G-MSR) will initiate a regulatory project to review the navigation safety regulations to ensure that the regulations require all essential alarms to be tested.

Recommendation 8: The Coast Guard should modify 33 Code of Federal Regulations 164.33 to require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board automation test procedures similar to those required in Coast Guard regulations (46 Code of Federal Regulations 61.40 and 62.20) which are approved by the vessel's flag administration or classification society. Documentation showing these procedures have been followed must be available on board the vessel and should be examined during port state control boardings.

Action: I concur with the intent of this recommendation. Appropriate action on this recommendation will be taken after completion of our actions in response to recommendation 1 to ensure that the U.S. approach reflects international standards.

Recommendation 9: The Coast Guard should modify 33 Code of Federal Regulations 165.810 to require vessels operating within the Regulated Navigation Area to identify the VHF-FM radiotelephone as the preferred method of contacting the Governor Nicholls or Gretna Light Operators, with whistle signals and telephone as secondary methods.

Action: The authority to issue regulations for Regulated Navigation Areas has been delegated to the Coast Guard District Commanders. This recommendation has been referred to the Commander, Eighth Coast Guard District for action as appropriate. Commander, Eighth Coast Guard District issued interim final regulations for the Lower Mississippi River RNA on October 30, 1997.

Recommendation 10: The Coast Guard should consider installing a Vessel Traffic Service at the Port of New Orleans as soon as possible due to the high volume of vessel traffic and the potential for marine casualties within the Port of New Orleans.

Action: I concur with this recommendation. Installation of a Vessel Traffic Service in the New Orleans area will begin in 1998 as the first port installation of the Port and Waterways Safety System.

Recommendation 11: The Coast Guard should ensure that the development of the Marine Safety Network, the follow-on system to the Coast Guard's Marine Safety Information System, allows access to certain portions so that waterways users can determine current vessel safety histories and apply this knowledge to their involvement with the vessels.

Action: I concur with this recommendation. One of the considerations in development of the Marine Safety Network (MSN) is public access to appropriate MSN data. The Coast Guard has already established the Port State Information Exchange (PSIX) which provides limited vessel histories for public reference. As MSN is developed, the data available via PSIX (or an improved version) will be expanded.

Recommendation 12: The Coast Guard should revise Sections 1.G and 3.A of Volume V of the Marine Safety Manual to emphasize the importance of taking prompt and effective action to secure the casualty scene and preserve evidence crucial to the investigation.

Action: I concur with this recommendation. Commandant (G-MOA) will revise the Marine Safety Manual as recommended.

Recommendation 13: The Republic of Liberia should conduct a suspension and revocation investigation of the BRIGHT FIELD's licensed engineers for negligence and misconduct while under the authority of their licenses and documents in that they apparently: failed to maintain an appropriate level of lubricating oil in the main engine sump, failed to properly set the #2 main engine lubricating oil pump for automatic operation and provided false sworn testimony to the Marine Board.

Recommendation 14: The Republic of Liberia should conduct a suspension and revocation investigation of the BRIGHT FIELD's prior Chief Engineer, Liu Qing Zhu, for negligence and/or incompetence for his failure in maintaining the vessel's main engine in a satisfactory condition and failure to maintain an appropriate volume of lubricating oil in the main engine sump.

Action: I concur with recommendations 13 and 14. A copy of the report will be provided to the Republic of Liberia for their information and action as deemed appropriate.

Recommendation 15: Det Norske Veritas should amend the Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" to require, in conjunction with all automation surveys, verification of the proper calibration of all temperature and pressure sensors providing inputs to the automatic slowdown and shutdown functions of the automation system. Other classification societies should take action to amend their rules to the same end.

Recommendation 16: Det Norske Veritas should amend the Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" to require the vessel to maintain the DNV-approved test program aboard the vessel and use it as the plan for systematic maintenance and function testing of the automation system. Other classification societies should take action to amend their rules to the same end.

Recommendation 17: Det Norske Veritas should amend their rules requiring vessel owners and operators to notify them of equipment casualties to specifically address the critical vessel systems that should be reported immediately.

Action: I concur with recommendations 15, 16, and 17. A copy of the report will be provided to Det Norske Veritas and the International Association of Classification Societies (IACS) for their information and action as deemed appropriate.

Recommendation 18: COSCO should publish a standard operating procedure for the use of the main engine automation system's override functions when responding to emergency situations such as loss of propulsion aboard the BRIGHT FIELD.

Action: I concur with this recommendation. A copy of the report will be provided to COSCO for their information and action as deemed appropriate.

Recommendation 19: The owners and operators of vessels equipped with automation equipment for periodically unattended machinery spaces should establish standard operating procedures for the operation of vital auxiliary machinery when navigating in restricted waters where an automatic slowdown or shutdown might have catastrophic consequences. Instead of operating vital auxiliary equipment such as lubricating oil, fuel oil and cooling water pumps with the primary system on line and the secondary system on standby, special consideration should be given to operating both systems simultaneously, if it does not create an unsafe condition.

Recommendation 20: The owners and operators of vessels equipped with automation equipment for periodically unattended machinery spaces and not already required by 33 Code of Federal Regulations 164.13(b) to have a manned engineroom should consider it good marine practice to adequately man the machinery spaces when navigating in restricted waters.

Recommendation 21: The owners and operators of all vessels should ensure that the Bridge crew has the ability to establish effective communications with the bow lookout and/or anchor detail during the sounding of whistle signals so that adequate instructions or advisories can be passed.

Recommendation 22: The owners and operators of all vessels should consider it good marine practice to maintain a bow lookout and/or anchor detail when navigating in restricted waters.

Action: I concur with the intent of recommendations 19 through 22. These recommendations all concern the establishment of standard operating procedures and the following of good marine practice. Standard operating procedures and the following of good marine practice are integral parts of safe vessel operations. The International Safety Management Code (ISM) requires companies to prepare plans and instructions for key shipboard operations concerning the safety of the ship and the prevention of pollution, including shipboard organization and management, cargo and fueling procedures, preparing the vessel for sea, and underway operations. These recommendations should be considered by vessel owners and operators in their efforts to ensure safe vessel operations and to establish an effective safety management system under the ISM Code. In addition, we will consider these recommendations in our review of the navigation safety regulations as indicated in the responses to recommendations 4, 6, and 7.

Recommendation 23: Each Captain of the Port should assess the risk posed by allisions to high capacity passenger vessels operating within their zone and, where appropriate, require an adequate Bridge watch whenever these vessels are moored to the dock with passengers aboard.

Action: I concur with the intent of this recommendation. Risk Based Decision Making Guidelines & G-M Business Plan Goals, a publication developed by Commandant (G-M), was sent to each COTP in January, 1997. Section 8 of these guidelines provides a methodology for conducting a port risk assessment. In addition, the Coast Guard is working in partnership with the Passenger Vessel Association to develop risk assessment guidelines for passenger vessel operators. These guidelines should identify and evaluate appropriate safety actions.

Recommendation 24: Marine Safety Office New Orleans should consider requiring all commercial vessels with personnel on board that moor within the Port of New Orleans to maintain a live Bridge watch actively listening to the local marine traffic channels, VHF-FM Channel 67, and monitor their radar for potential danger. Watch personnel should have the ability and authority to take any action necessary, such as ordering an immediate vessel evacuation.

Action: The authority to issue regulations for Regulated Navigation Areas has been delegated to the Coast Guard District Commanders. This recommendation has been referred to the Commander, Eighth Coast Guard District for action as appropriate. Commander, Eighth Coast Guard District issued interim final regulations for the Lower Mississippi River RNA on October 30, 1997.

Recommendation 25: Marine Safety Office New Orleans should conduct a study of their Regulated Navigation Area equipment and control systems and identify their interim needs to improve their ability to monitor traffic. These upgrades should be completed as soon as possible.

Action: I partially concur with this recommendation. District Commanders and Captains of the Port should regularly evaluate the material condition and effectiveness of their waterway management tools as a part of a coordinated risk assessment program. Any component found lacking in capability should be identified for repair or replacement. Installation of a Vessel Traffic Service in the New Orleans area will begin in 1998 as the first port installation of the Port and Waterways Safety System.

Recommendation 26: Marine Safety Office New Orleans should review the evacuation procedures of all commercial vessels with personnel on board that moor within the Port of New Orleans and establish evacuation standards for each class of vessel.

Action: The authority to issue regulations for Regulated Navigation Areas has been delegated to the Coast Guard District Commanders. This recommendation has been referred to the Commander, Eighth Coast Guard District for action as appropriate. Commander, Eighth Coast Guard District issued interim final regulations for the Lower Mississippi River RNA on October 30, 1997. In addition, the Coast Guard will respond nationally by continuing the voluntary exercise of emergency response plans already in place, and encouraging all high capacity passenger vessels to prepare and exercise emergency response plans. We will also request public comment on the efficacy and contents of emergency response plans through an Advance Notice of Proposed Rulemaking, develop additional guidance for Captains of the Port and Group Commanders to analyze passenger vessel risk, and continue our industry partnership efforts.

Recommendation 27: The American Pilots Association should be encouraged to develop a nationwide computer system to allow local access for retrieval and updating of information by their member pilots, based on the information card system used by members of the Crescent River Port Pilots Association.

Recommendation 28: The various Mississippi River Pilots Associations, in conjunction with the Coast Guard, should develop and publish an information card, preferably in many foreign languages, that pilots can provide to masters to facilitate an exchange of critical navigation information.

Action: I concur with the intent of recommendations 27 and 28. The Coast Guard encourages continual improvement in the master - pilot exchange of information. The American Pilots Association (APA) is currently working with their individual members to develop a standardized system of exchanging information between the master and the pilot. A copy of this report will be provided to the APA and the other pilot's associations for their information and use in that effort.

Recommendation 29: The Board of Commissioners of the Port of New Orleans, or the owners of the vessel, should consider relocating the QUEEN OF NEW ORLEANS to a location less vulnerable to allisions by deep draft vessels.

Recommendation 30: As an alternative to Recommendation 29, the Board of Commissioners of the Port of New Orleans and the Army Corps of Engineers should evaluate the effectiveness of decreasing the normal water depth beneath and adjacent to the moorings for the QUEEN OF NEW ORLEANS and CREOLE QUEEN to the minimum acceptable level as a means of providing a passive defense against allisions by deep draft vessels.

Action: A copy of the report will be provided to the Board of Commissioners of the Port of New Orleans and the Army Corps of Engineers for their information and action as deemed appropriate.

Recommendation 31: The Marine Industry, in cooperation with the Coast Guard, should consider conducting a comparative analysis/test of the effectiveness of tractor tugs as assist vessels for use in riverine operating environments such as the Mississippi River.

Action: I concur with this recommendation. The U. S. Coast Guard has participated in several disabled ship/escort tug studies that have been performed in the recent past, notably for Puget Sound, Prince William Sound, and San Francisco Bay. These studies were conducted under the auspices of local safety committees made up of state and port authorities, tanker and towing companies, environmental organizations, the Coast Guard, and other local interest groups. The Coast Guard is willing to continue this history of participation in a local safety study group for riverine ports such as New Orleans.

Recommendation 32: A copy of this report should be forwarded to the Liberian Government for their information and action as they deem appropriate.

Recommendation 33: A copy of this report should be provided to the International Maritime Organization and Det Norske Veritas for their information and action as they deem appropriate.

Recommendation 34: A copy of this report should be provided to Clearsky Shipping Co. Ltd. and COSCO Shipping Co., Ltd. for their information and action as they deem appropriate.

Recommendation 35: A copy of this report should be provided to Marine Safety Office New Orleans for their information and action as they deem appropriate.

Recommendation 36: A copy of this report should be provided to the American Pilots Association, the Pilots Board of Commissioners, the Crescent City Port Pilot Association, the New Orleans-Baton Rouge Steamship Pilots Association, the Associated Federal Pilots and Docking Masters of Louisiana, and the Associated Branch Pilots for their information and action as they deem appropriate.

Recommendation 37: A copy of this report should be provided to the International Association of Classification Societies for their information.

Recommendation 38: A copy of this report should be widely disseminated to the marine industry to remind them of the dangers of inadequately maintained engineering systems, to educate them on the lessons learned from this casualty and to encourage the incorporation of these lessons learned in their own safety programs and initiatives.

Action: I concur with recommendations 32 through 38. Copies of the report will be distributed as recommended.

Recommendation 39: It is recommended that this investigation be closed.

Action: I concur. This investigation is closed.

ROBERT E. KRAMEK
Admiral, U.S. Coast Guard

[redacted]

8 December 1997.

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M/V BRIGHT FIELD ALLISION, 14 DECEMBER 1996

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16732/MC97000078
31 October 1997

From: U. S. Coast Guard Marine Board of Investigation
To: Commandant (G-MOA)

Subj: M/V BRIGHT FIELD, LLOYD'S NO. L8715302; LOSS OF PROPULSION AND ALLISION WITH THE RIVERWALK SHOPPING COMPLEX, MISSISSIPPI RIVER MILE 95.2 ABOVE HEAD OF PASSES, NEW ORLEANS, LOUISIANA ON 14 DECEMBER 1996 WITH NO LOSS OF LIFE AND MULTIPLE INJURIES

FINDINGS OF FACT

I. SUMMARY

At about 1407 (local time) on 14 December 1996, while down-bound in the Mississippi River, the M/V BRIGHT FIELD experienced an automatic trip of the main engine due to loss of main engine lubricating oil pressure. The vessel's crew could not restore power and regain steerageway in time to prevent the vessel from alliding with the Poydras Street wharf near the Riverwalk shopping mall complex, located on the left descending bank at river mile 95.2 in the port of New Orleans, at about 1410.

The allision caused major damage to the vessel's port bow and number one cargo hold. The pier and its footing absorbed the energy of the impact, collapsing approximately 350 feet of the open pier and damaging part of the adjacent condominium and garage. Several riverside rooms in the Hilton Hotel, as well as several shops in the mall, were also damaged. Damage to the BRIGHT FIELD was calculated at $ 1,827,952. Structural damage to the pier, hotel, and condominium is estimated at $ 10 million while non-structural damage to shops in the mall is estimated at $ 5 million.

Four high-capacity passenger vessels were moored along the left descending bank at the time of the allision. Two sea-going cruise vessels, ENCHANTED ISLE and NIEUW AMSTERDAM, were moored below the Crescent City Connection Bridges but upriver of the allision site at the Erato and Julia Street wharves, respectively. There was no reported damage to ENCHANTED ISLE or NIEUW AMSTERDAM. The casino river boat QUEEN OF NEW ORLEANS and the paddlewheel river excursion boat CREOLE QUEEN were moored down-river of the allision site. The BRIGHT FIELD's impact with the pier created a surge wave which rippled down-river along the face of the pier, causing minor damage to the QUEEN OF NEW ORLEANS and the CREOLE QUEEN.

All four vessels had passengers aboard. No deaths occurred, but 66 persons were treated by Emergency Medical Services for injuries resulting from the allision. Although most of the injuries were relatively minor, three people were admitted to local hospitals. All of the injured were passengers or crew members of QUEEN OF NEW ORLEANS, CREOLE QUEEN or Riverwalk pedestrians; there were no injuries on the BRIGHT FIELD, ENCHANTED ISLE or NIEUW AMSTERDAM.

The QUEEN OF NEW ORLEANS crew attempted to evacuate passengers, but the limited reaction time did not permit all to leave. Of the 66 total persons injured, as described above, 35 were reported as occurring aboard the QUEEN OF NEW ORLEANS. These injuries involved 22 passengers and 13 crewmembers. Some passengers panicked; two were injured when they jumped from the vessel to the pier while others received injuries from the jostling and crush of the crowd. Three people on the CREOLE QUEEN were thrown into the water when a sudden vessel movement caused by the surge wave caused the gangway to become disconnected from the vessel and fall into the river.

VESSEL DATA

Name:	**BRIGHT FIELD**
Flag:	Liberia
Lloyd's Number:	L8715302
Call Sign:	ELIL5
Service:	Dry Bulk Freight (Grain)
Gross Tons:	36120
Net Tons:	23035
Dead Weight Tons (DWT):	68676
Length (overall):	735 feet (216.1 meters)
Home Port:	Monrovia, Liberia
Date Built:	September, 1988
Place Built:	Sasebo, Japan
Built by:	Sasebo Heavy Industries
Propulsion:	Direct Drive Diesel
Horsepower:	9,800
Master:	Deng Jing Kuan
Classification Society:	Det Norske Veritas
Owner:	Clearsky Shipping Co. Ltd. 24th-29th Floors 167 Connaught Road, West Hong Kong
Operator:	COSCO (H.K.) Shipping Co., Ltd. 24th-29th Floors 167 Connaught Road, West Hong Kong

Name:	**QUEEN OF NEW ORLEANS** (aka FLAMINGO CASINO)
O.N.:	D999868
Service:	Passenger
Gross Tons:	1470
Net Tons:	1361
US Length:	202.5
Propulsion:	Diesel Reduction
H.P.:	1600
Homeport:	New Orleans
Max Persons:	1800
Master:	[redacted]
License:	USCG license #[redacted]
Owner/Operator:	Hilton New Orleans Corp. 610 S. Peters St. New Orleans, LA 70130

Name:	**CREOLE QUEEN**
O.N.:	D661140
Service:	Passenger
Gross Tons:	397
Net Tons:	275
US Length:	162.7
Propulsion:	Diesel Electric
H.P.:	600
Homeport:	New Orleans
Max Persons:	1000
Master:	Albert J. Christian
License:	USCG license #796698
Owner/Operator:	New Orleans Paddlewheels, Inc. 690 Port of New Orleans New Orleans, LA 70130-1608

II. RECORD OF INJURED

According to local emergency medical response organizations, an unknown number of persons were treated at the scene but not transported and 66 people were transported and treated at five local hospitals. The majority were treated and released, but three required admission for treatment. These more serious injuries were as follows:

A [redacted] year-old male sustained a left hip fracture after falling off a gangway that collapsed on the CREOLE QUEEN at the Canal Street wharf.

A [redacted] year-old female sustained blunt abdominal trauma after being pushed into a railing, fell, and was trampled during evacuation from the Riverwalk Marketplace.

A [redacted] year-old female sustained three pelvic fractures, a sacral fracture, and compression fractures of one of the lumbar bones after jumping off the QUEEN OF NEW ORLEANS to the dock.

III. RECORD OF DAMAGES

a. Shoreside Damage.

The allision caused significant damage to the Riverwalk structure, collapsing about 350 feet (122 meters) of the open pier and damaging part of the adjacent condominium and garage. Several riverside rooms in the Hilton Hotel, as well as several of the shops in the mall, were damaged. Because of concern that additional sections of the damaged structures might collapse if the vessel was moved, tugs continued to assist in holding the BRIGHT FIELD in position for three weeks until emergency bracing and repairs were made to the damaged structures. Structural damage to the pier, hotel, and condominium is estimated at $ 10 million. Non-structural damage to shops in the mall is estimated at $ 5 million. See Figure 1 for the most inclusive view of the damage.

b. M/V QUEEN OF NEW ORLEANS.

Damage was limited to paint scrapes and parted mooring lines as the vessel surged along the pier.

c. M/V CREOLE QUEEN.

Damage was limited to paint scrapes in the area of the gangway. As the vessel surged along the pier, the gangway fell into the water but was subsequently recovered.

d. M/V BRIGHT FIELD.

Allision damage to the BRIGHT FIELD was confined to the hull, port and starboard bows and the bulbous bow. On the port side, the side shell adjacent to the Bos'un locker sustained a puncture measuring about two meters high by four meters long, just forward of the port hawsepipe. The forecastle deck bulwark was crushed in along the edge for a length of about nine meters with the hand rails and stanchions on the bow torn off. There was also a gash just above the waterline, one meter in height by 18 meters long, with internal frame and bracket damage that penetrated the No. 1 hold. Two side shell plates on the starboard bow were indented and the bulbous bow plating was corrugated over an area of about eight by nine meters with holes in three plates. On 6 January 1997, after emergency bracing repairs to the wharf were completed and the vessel could be safely moved, it was towed to a repair facility at about Mile 84.7 AHP on the left descending bank near Violet, Louisiana for repairs. In all, 180,000 pounds (82,000 kilograms) of steel were required to complete repairs, with the cost of repairs to the BRIGHT FIELD calculated at $1,827,952. Repairs were completed to the satisfaction of the Det Norske Veritas Surveyor and the Coast Guard.

BRIGHT FIELD AT REST AND PIER DAMAGE

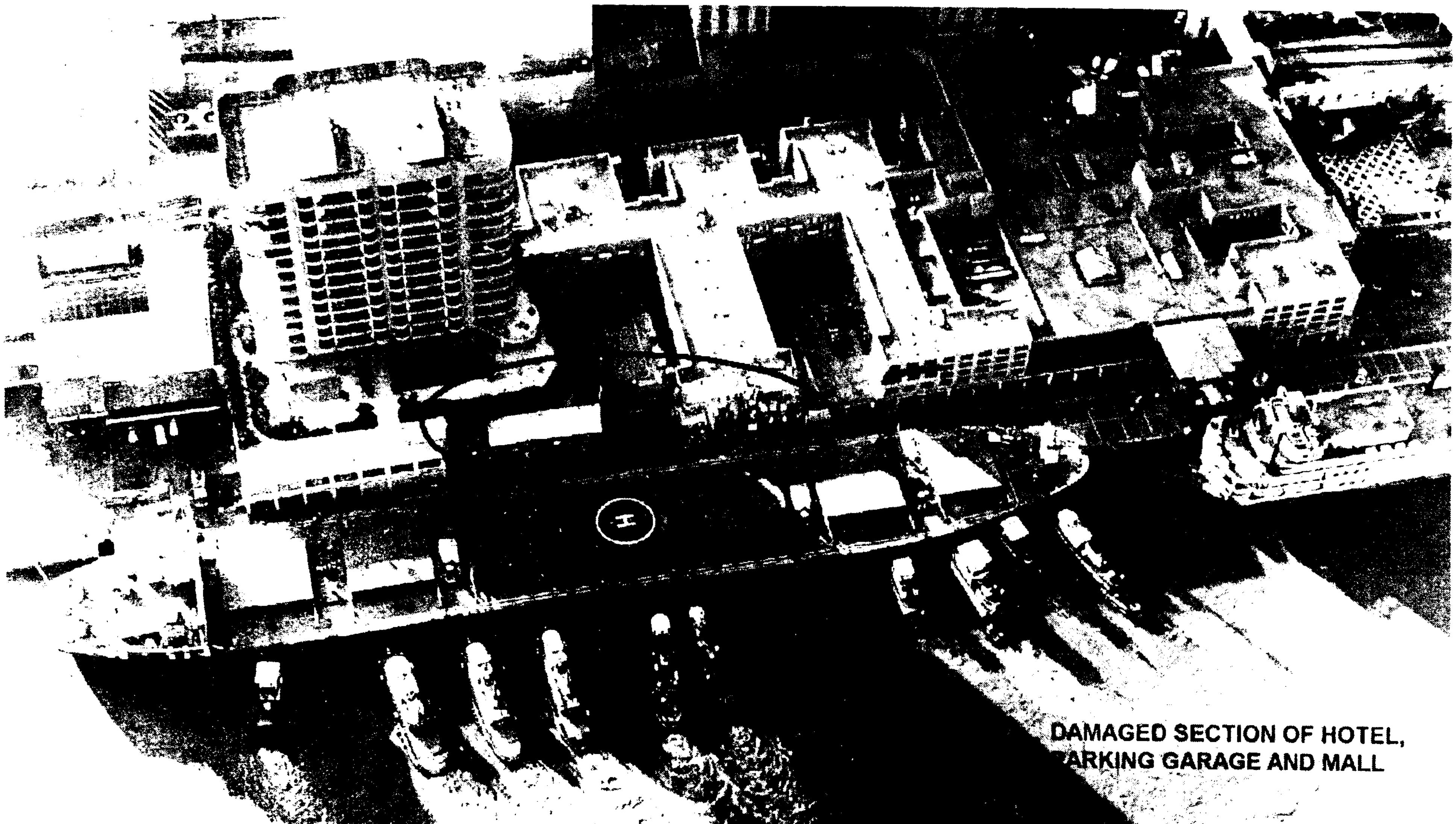

FIGURE 1
(Photograph courtesy of the Times-Picayune)

IV. NARRATIVE DESCRIPTIONS

a. Weather Conditions.

At the time of the allision, the weather according to the National Weather Service was as follows:

Cloud Cover	Clear
Visibility	20 miles (32 kilometers)
Precipitation	None
Wind	SW at 10 knots (16 kph)
Temperature	70 degrees F (21 degrees C)
River Stage	12.5 feet (Carrollton Gauge)
River Current	4.0 statute MPH (3.5 knots)

b. New Orleans Harbor and Vessels within the Port.

The Port of New Orleans straddles the section of the Mississippi River from about mile 88 to mile 120 Above Head-of-Passes (AHP). Approximately 70,000 vessel transits occur here in the course of a year, and an estimated 14,000 of those transits are deep draft vessels. In addition to traffic density, vessel operators must contend with three bridges and no fewer than 7 bends.

From the Crescent City Connection Bridges at mile 95.8 AHP, to the bend at Algiers Point or about mile 94.5 AHP, the left descending bank of the river is known as the Riverwalk and lined with structures including the Hilton Hotel, a parking garage, a condominium, a shopping mall, the New Orleans Aquarium and IMAX Theater. The Riverwalk shopping mall and river front complex is built on concrete pilings and extends out into the river. Because of an accumulation of silt under the pier structure, the water depth adjacent to the Riverwalk where the BRIGHT FIELD came to rest ranges from 6.7 to 11.2 meters (22 to 37 feet).

Along this area, cruise ships, several high-capacity passenger vessels, the Canal Street Ferry and the occasional visiting military ship moor. On the day of the allision, there were four major vessels moored along the Riverwalk complex. Directly downstream from the Crescent City Connection Bridges were the deep draft passenger vessels ENCHANTED ISLE and NIEUW AMSTERDAM, while slightly further down river were the casino vessel QUEEN OF NEW ORLEANS and the excursion vessel CREOLE QUEEN. At the time of the casualty, the CREOLE QUEEN was just getting underway from the dock for a river cruise, thus the vessel's pilothouse was manned by the vessel's master. The pilothouse of the QUEEN OF NEW ORLEANS was manned by a crewmember at the time of the incident.

c. Vessel Layout.

The BRIGHT FIELD is a conventional bulk carrier, built by the Sasebo Heavy Industries Co., Ltd. in Sasebo, Japan. Originally christened the OCEANUS, the keel was laid May 17, 1988 and the vessel was delivered on December 15, 1988. The engineering plant is located aft with the superstructure directly above. Forward of the superstructure are seven cargo holds with a total capacity of 81,337 m^3 (2, 872,395 ft^3). The BRIGHT FIELD's bridge, typical of large, sea-going merchant ships, is an enclosed rectangular workspace on the uppermost enclosed level of the aft superstructure. It provides an easy field of view from side-to-side and from forward to a limited view aft from inside the bridge. Under the forward bridge windows on the port and starboard side are a gyro repeater, a radar repeater, telephone handsets and manual control buttons for the two whistles (one atop the Bridge, another on the forward mast 17 meters above the forecastle). The helm control console is located centerline about 2.5 meters aft of the forward bulkhead; the magnetic compass periscope hangs from the overhead above it. To starboard of the helm console is the engine control console and the Engine Order Telegraph (EOT). Aft of the control consoles are the chart table and navigation equipment consoles. Forward of the control consoles, affixed to the overhead, are three-sided repeaters for the Rudder Angle Indicator and the Engine Order Indicator that may be read from virtually any position on the bridge. The Engine Speed Indicator is on the bulkhead above the windows and is best seen from centerline forward of the chart table. Rudder Angle Indicators are also located above the weather door on both bridge wings, visible from the bridge wing.

BRIDGE LAYOUT

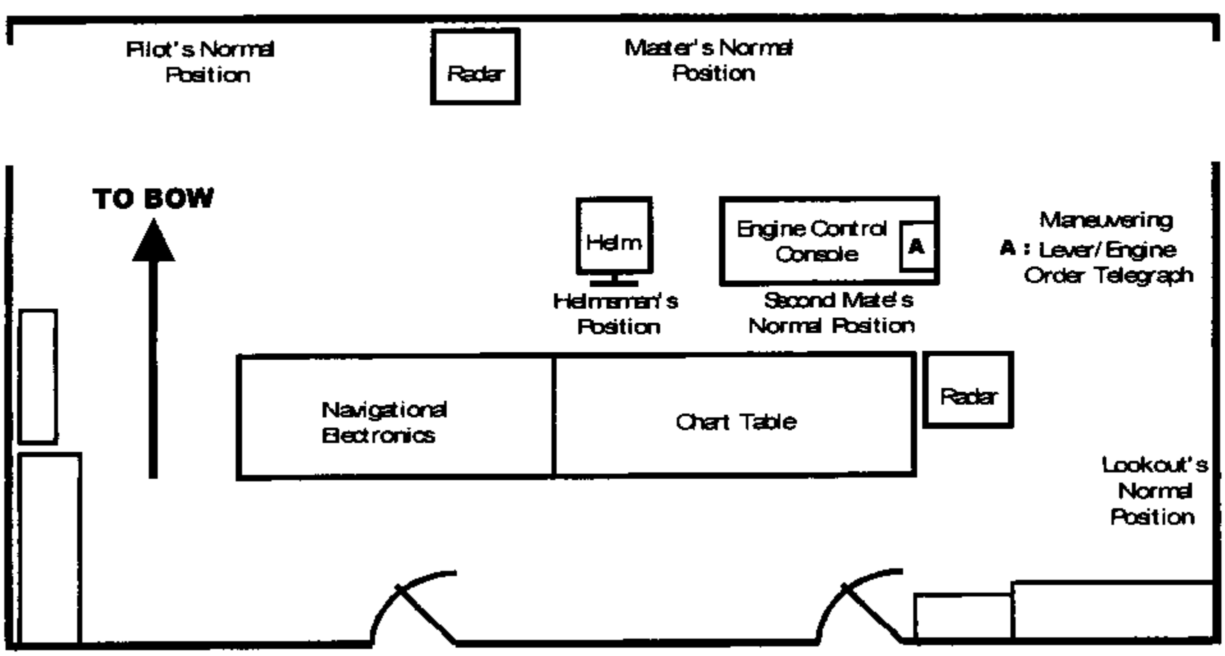

FIGURE 2

The main engine room of the BRIGHT FIELD consists of three major levels with the lower level being the tank top, an intermediate level, and the upper platform. The vessel has one main diesel engine, one auxiliary boiler, three main diesel generators and associated systems. Virtually all engine room operations are controlled or monitored from the Engine Control Room, an enclosed rectangular space located on the upper platform port side.

ENGINE CONTROL ROOM LAYOUT

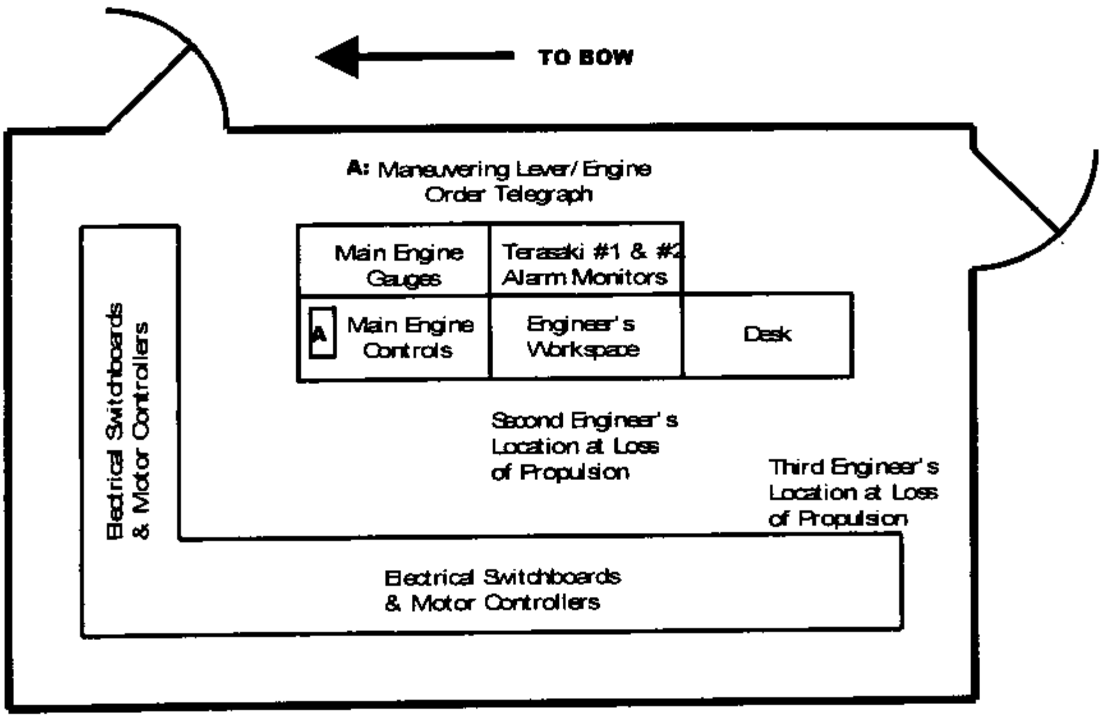

FIGURE 3

The BRIGHT FIELD'S main engine was originally designed to operate at a maximum continuous rating of 7,205 kW (9662 HP) at 81.0 RPM and a normal service rating of 6,485 kW (8696 HP) at 78.2 RPM. At the time of the incident, it had been de-rated to operate at a maximum of 72 RPM. See Appendix 1 for a detailed description of the main engine and its associated systems.

Control of the main engine is fully automated and the full range of control functions, i.e. start, stop, reverse, speed, etc., are provided such that the main engine can be directly controlled from the bridge. The vessel is equipped with redundant main engine vital auxiliary pumps, i.e. there are two lubricating oil pumps. These vital auxiliary pumps are equipped with a separate control system which provides for the automatic start of the standby pump in the event the system pressure drops below a set value. The vessel is equipped with a monitoring and alarm system which is integrated with the main engine control system as well as with the vital auxiliary control systems. Together, these control and monitoring systems provide a level of automation such that the vessel is certificated by Det Norske Veritas to operate with a periodically unattended engineroom. See Appendix 1 for a more detailed description of the automation and lubricating oil systems.

d. Completion of Voyage 46 and Beginning of Voyage 47; M/V BRIGHT FIELD.

On 21 November 1996, the BRIGHT FIELD transited the Mississippi River from sea and moored at the Electro-Coal facility (Mile 55 AHP) in Davant, Louisiana to discharge its cargo of coal. The BRIGHT FIELD'S last port of call prior to arriving in the United States was Singapore. On 25 November 1996, the discharge of cargo was completed and the vessel was moved to a nearby anchorage. At this point, Voyage 46 ended and Voyage 47 began. While at anchorage, the crew and shoreside personnel cleaned the holds for the next cargo of grain. Also at this time, the engineers and a representative from New Sulzer Diesel made some repairs to the main engine. On 6 December 1996, the BRIGHT FIELD moved to the Bonnet Carre Anchorage (Mile 127.3 to 128.8 AHP). It remained there until 9 December 1996, when it was moved to the Louis Dreyfus Grain Elevator at Reserve, Louisiana (Mile 139 AHP) to load grain. Loading was completed on 11 December 1996 and the BRIGHT FIELD moved to the LaPlace Anchorage until engine repairs were completed on 13 December 1996.

e. Events of 14 December 1996, Prior to the Loss of Propulsion.

On 14 December at 0730, Pilot Ted Davisson received notice for the BRIGHT FIELD's scheduled 1030 departure from the LaPlace Anchorage (Mile 135 AHP), and that the vessel was intending to go to sea.

At 0750, Master [redacted] notified Chief Engineer [redacted] that the pilot was scheduled to board about 1000. Shortly thereafter, the Chief Engineer, Second Engineer and Fourth Engineer began preparing the main engine for getting underway. They tested the main engine auxiliary pumps, the main and crosshead lubricating oil pumps, salt water cooling pumps and fresh water cooling pumps. The Chief Engineer testified before the Marine Board that he placed the #1 pumps of these systems on line and placed the #2 pumps in the stand-by mode. Further depositions taken in Hong Kong revealed that the #2 main engine lubricating oil pump was actually left in the manual mode, which would not allow the motor controller to automatically start the #2 pump in the event of a main engine low lubricating oil pressure condition. On this day, there were no repairs made or in progress in the engine room nor on any portion of the lubricating oil system.

Third Mate [redacted] was standing the 0800-1200 Bridge Watch. At about 0930, he began testing equipment and systems in preparation for getting underway. He advised the engine room to prepare the engine for departure and to synchronize the engine room clock with the bridge clock. He turned on all navigational equipment and, together with the Electrician, tested the steering gear. The Third Mate conducted a lamp test on the Bridge's engine control console, which consisted of a simple check for burned-out bulbs. He then, in concert with the engineers, tested the Engine Order

Telegraph in all positions from NAVIGATION FULL AHEAD to EMERGENCY FULL ASTERN. All pre-departure tests of the vessel's steering gear, navigation systems and emergency systems were logged as completed.

At about 0920, Electrician [redacted] began testing equipment in preparation for getting underway. At 0930, he tested the steering from the steering gear room while the Third Mate tested it from the bridge. He then conducted a lamp test of the lights on the engine room console; a simple test to check for burned out bulbs. He did not perform a lamp test on the bridge console because he had performed a similar test the day before. On both consoles, he found the lights in good working order. After the lamp test, he tested the vessel's internal communications and the main generator switchboard. He did not do any functional testing of the automation system. He did not conduct any tests of the main or crosshead lubricating oil pumps. The Electrician finished his tests at about 1000.

The Pilot arrived at the BRIGHT FIELD by launch at 1040. While en route, he took note of the vessel's stern draft marks, which were at 12.06 m (39.57 feet) and observed that the vessel had no severe list or trim. Upon boarding the vessel, he was escorted to the bridge and met the vessel's Master. As the Pilot was familiarizing himself with the bridge, he and the Master briefly discussed the vessel's equipment. The discussion did not include a review of methods or procedures for Pilot-crew communication or bridge management during an emergency, nor did it involve a review of the vessel particulars, draft, maneuvering characteristics, or vessel peculiarities as required by 33 Code of Federal Regulations 164.11. Moreover, the Pilot looked at the vessel particulars and maneuvering information posted on the bridge, but he testified that he did not thoroughly review the available information on the vessel's propulsion plant, nor the stated maneuvering or stopping performances, prior to getting underway.

At 1055, the Pilot and Master attempted to maneuver the BRIGHT FIELD to facilitate the raising of the port and starboard anchors. The engine was in Bridge control and set to run on marine diesel oil (MDO). When the maneuvering lever was moved from STOP to DEAD SLOW AHEAD to start the engine, the engine failed to start. There was no start failure alarm. Engine control was transferred to the engine room and the engineers on watch successfully started the main engine. At 1103, control was switched back to the bridge and the port anchor was raised. Shortly thereafter the engine was stopped. At 1110, the engine again failed a start attempt from the Bridge and again there was no start failure alarm. Engine control was switched back to the engine room and the engine was restarted. The Chief Engineer testified the apparent cause of the problem was that the fuel oil control valve was not opening properly. After the second failed start attempt, the engineroom maintained control of the main engine for the next 20 minutes.

As the BRIGHT FIELD got underway, the Chief Engineer, Fourth Engineer, Electrician and Oiler remained in the engine room in compliance with COSCO's policy of having engineers on watch whenever the vessel is in maneuvering or restricted waters (Note:

With the exception of 33 Code of Federal Regulations 164.13(b), which applies to tank vessels only, 33 Code of Federal Regulations Part 164 does not address engineroom manning requirements for vessels underway in restricted waters.). The Second Engineer, who was not on watch, also remained in the engine room. There were additional non-licensed personnel in the engine room, but they had no watchstanding responsibilities.

At 1113, the crew raised the starboard anchor. Shortly thereafter both anchors were staged clear of the hawsepipes and held only by the friction brake, ready for immediate release. The vessel got underway from LaPlace Anchorage at 1121 and proceeded down river at MANEUVERING FULL AHEAD. At this time, the Pilot was not made aware that engine control remained in the engine room.

There were five people on the bridge during the downbound transit from the LaPlace Anchorage. The Pilot, CAPT Ted Davisson, predominantly remained on the port side of the bridge while the Master, [redacted] tended to stay just to the right of the centerline and in front of the bridge console. The Helmsman remained at the wheel, located on the centerline, while the Mate on Watch was either standing by the Engine Order Telegraph (EOT), or moving to the chart table as needed to fulfill his navigational duties. There was also a relief Helmsman/Lookout stationed on the starboard side of the bridge.

As the BRIGHT FIELD proceeded down river, engine control was returned to the Bridge at about 1130 and the Pilot ordered NAVIGATION FULL AHEAD (72 RPM) at 1134. At 1140, the engineers switched the fuel system over and ran the main engine on heavy fuel oil (HFO).

Four times between 1114 and 1141, an alarm sounded in the engineroom indicating a high differential pressure across the second filter in the main engine lubricating oil system. The first time this occurred, the differential pressure remained above the alarm set point for 23 minutes. On the other three occasions, the differential pressure dropped and the alarms were cleared within two minutes. There is no evidence that the Master or Pilot were notified of these alarms.

Helmsman [redacted] relieved the watch at 1145 and was on the helm at the time of the casualty.

At 1158, the cylinder cooling water high temperature alarm for all five cylinders sounded noting the temperatures had reached the alarm set point of 90° C. The audible alarm for this condition, required by the classification society's rules, did not sound on the Bridge. There is no evidence that the Master or Pilot were notified of these alarms. At 1159, the Master ordered speed reduced to MANEUVERING FULL AHEAD. Also at 1159, the alarm condition cleared when the cooling water temperature dropped below the alarm point.

Second Mate [redacted] relieved the Third Mate at 1200 and was on watch at the time of the casualty.

Also at 1200, the Third Engineer relieved the Fourth Engineer in the Engine Control Room to stand his 1200-1600 watch. As was his custom, he looked around the control room and did not see anything abnormal. He testified that he saw the #1 main engine lubricating oil pump run indicator light lit and the #2 main engine lubricating oil pump on standby. As discussed before, the #2 main engine lubricating oil pump was actually not on standby.

The Pilot was dissatisfied with the vessel's response to helm commands at the reduced speed and at 1225, the Master increased the vessel's speed back to NAVIGATION FULL AHEAD. There were no other speed changes ordered by the Bridge until the attempt to avoid the allision with Riverwalk.

Between 1235 and 1237, the cooling fresh water temperature alarms for the main engine cylinders again sounded. These alarms were followed at 1239 by a scavenging air high temperature alarm. The Chief Engineer, Second Engineer and Third Engineer left the Engine Control Room to investigate the cause of these alarms. The Second Engineer discovered the main engine cooling sea water system overboard valve was stuck, restricting the flow of sea water. The Second Engineer and Third Engineer adjusted the valve handle and corrected the problem. The cooling fresh water temperature and scavenging air temperatures dropped and the alarm conditions cleared at 1249 and 1250, respectively. Three times between 1251 and 1306, an alarm sounded and then cleared, indicating low pressure in the main engine cooling sea water system. This alarm sounded again at 1307 and for the remainder of the voyage, the main engine cooling sea water system operated below the alarm set point of 1.30 kg/cm^2. There is no evidence the Master or Pilot were notified of these alarms.

At 1300, the Electrician began an inspection of the engine and steering gear rooms. During this round, he found all equipment to be operating normally. When he completed his round at about 1400, he returned to the engine room and stood in the vicinity of the generators.

At 1306 and 1307, alarms sounded noting an abnormal condition on the #1 lubricating oil purifier. In both cases, the purifier quickly returned to normal and the alarms cleared within a minute. The #1 purifier is used exclusively to clean the oil in the main engine lubricating oil sump.

At 1320, the Master dispatched Carpenter [redacted] to stand by the anchors. He arrived moments later and remained on the bow for the balance of the transit.

At 1326, just after the vessel passed under the Huey P. Long Bridge at Mile 106.1 AHP, the Pilot established a starboard-to-starboard meeting agreement with three upbound vessels, to take place in the vicinity of Nine Mile Point (about mile 104 AHP). First was a deep draft vessel and the meeting was completed without incident just above Nine

Mile Point. Second was a tug and tow that was supposed to remain near the right descending bank while in Carrollton Bend. The tug operator was unable to keep his tow in the agreed-upon position and it moved towards the middle of the navigable section of the river. The BRIGHT FIELD's intended path would have resulted in a collision, and the Pilot took evasive action by delaying the start of his turn. Following a close quarters starboard-to-starboard meeting with the tug in the bend, the Pilot ordered full starboard rudder and sounded the danger signal as the BRIGHT FIELD passed close to a barge fleet moored on the left descending bank in Carrollton Bend. The BRIGHT FIELD safely cleared the fleet and met the third vessel without incident.

At about 1352, the Pilot made contact with the Gretna Tower Light Operator, Mr. [redacted] to identify his vessel, relay the vessel particulars and discuss his intended transit through the Port. Follow-up contact was made at about 1357.

At 1400, the engineering alarm and monitoring system printed a Report Log that showed all systems relating to the main engine were within normal limits, except that the main engine sea water cooling system pressure was recorded as 1.25 kg/cm^2, slightly below the alarm set point. The main lubricating oil pressure was recorded as 2.64 kg/cm^2 and the temperature was 46°C, both within normal operating parameters. At about the same time, the Pilot established a starboard-to-starboard meeting with an upbound tug and tow, to take place below the Crescent City Connection Bridges. At this time, the Pilot had the BRIGHT FIELD in the center of the river and positioned to make the right hand bend at Algiers Point.

At 1406, as recorded on the alarm printout, an alarm sounded in the Engine Control Room indicating the main engine had automatically tripped due to low lubricating oil pressure. Seconds later, the main engine speed began to slow.

f. Bridge Activities, From Loss of Propulsion to the Allision.

As the BRIGHT FIELD was passing under the upriver span of the Crescent City Connection Bridges, the Second Mate glanced at the bridge clock, noting the time as 1407. At about this time, the Bridge crew felt a reduction of engine vibration in the deck and noted an accompanying decrease in engine speed from approximately 72 RPM to about 30 RPM on the various indicators on the bridge. The Master and Second Mate immediately examined the Bridge console's engineering alarm indicators and gauges to try and determine the nature of the problem. The Pilot immediately asked the Master "Do we have a problem?" The Master did not reply to the Pilot but instructed the Second Mate (in Chinese) to call the Engine Control Room, find out what happened, and demand they increase speed right away. The Second Mate's call was answered by the Chief Engineer, who stated he did not know what the reason was, but there was a sudden drop in the pressure of the lubricating oil pump. The Second Mate and Chief Engineer mutually agreed to transfer engine control from the Bridge to the Engine Control Room. The phone call ended without the Second Mate explaining the severity of the maneuvering situation to the Chief Engineer. The Second Mate then acknowledged the transfer of engine control to the engine room, with the entire procedure taking about 10 seconds. This information was not passed to the Pilot by any of the crew.

The Pilot broadcasted on Channel 67 on his VHF FM radio:

> "70 to Governor Nick: I just lost my engine. Alert everyone in the harbor to watch out!" (Note: "70" is the Pilot's identification number while "Governor Nick" is shorthand for the Governor Nicholls Light Operator)

As the BRIGHT FIELD passed under the bridges, the Pilot noticed the bow veer to port. The Pilot immediately ordered the rudder, which had been amidships, put hard starboard in an attempt to counteract the swing. The Helmsman immediately acknowledged the order, put the rudder to hard starboard and advised the Pilot when it reached hard starboard. This was the Pilot's final rudder command. The rudder stayed in the hard starboard position until the allision.

The Governor Nicholls Tower Light Operator responded, then began to broadcast warnings to the vessels in the harbor, requested tug assistance and contacted Marine Safety Office New Orleans. As the BRIGHT FIELD's bow cleared the down river span of the Crescent City Connection Bridges, the Pilot broadcast:

> "Governor Nick, I'm gonna hit that damn cruise ship. Call him or do something. Governor Nick, call him, or something, I'm a goin' right for him!"

By the time the vessel's stern was under the down river span of the Crescent City Connection Bridges, the Pilot had revised his prediction of where the vessel would land and broadcast:

> "Warn the gambling boat [QUEEN OF NEW ORLEANS] I'm going right for him!"

As the BRIGHT FIELD continued a slow swing to port, the Pilot ordered the Master to stand by to let go anchors. The Master testified that the order was "let go anchors" and he attempted to relay this order to the Carpenter on the bow by hand-held radio. Before the Master could pass the order, the Pilot began to manually sound the danger signal (five or more short and rapid blasts) on the ship's whistle. The button the Pilot was using operated the forward whistle and the noise from the almost continuous sounding of the whistle made effective communication from the bridge by hand-held radio impossible. The Master went out on the bridge wing in an attempt to attract the Carpenter's attention but was unable to do so. The Pilot continued to sound the danger signal until the allision.

When the Second Mate noted that the engine RPM had slowly increased to about 40 RPM, he informed the Master, who relayed this information to the Pilot. The BRIGHT

FIELD was now moving directly towards a clear section of the waterfront between the deep draft passenger vessels and the casino and excursion vessels. The Master and Pilot realized there was not enough time or distance to bring the vessel back under full control and the allision was now unavoidable. When the vessel was about 1.5 ship lengths from the pier, the Pilot broadcast:

> "Governor Nick, this looks bad. Tell those people to get away! Tell those people to get away! Tell those people to get away! There's people on the dock! Tell those people to get away! Tell those people to get away!"

The Pilot ordered the port anchor let go and the Master was finally able to relay that order to the Carpenter by hand-held radio. The Pilot ordered FULL ASTERN and the Second Mate repeated the command as he relayed the order FULL ASTERN to the Engine Control Room by the EOT. The Bridge Bell Log recorded this order at 1409.5. At the same time, the Master re-evaluated the situation and decided that letting go the port anchor might cause the vessel to again swing to port and strike the passenger vessels ENCHANTED ISLE and NIEUW AMSTERDAM. Speaking in Chinese, he countermanded his previous "let go port anchor" order to the Carpenter before it could be acted on. The Master did not advise the Pilot of this action.

The Second Mate testified that approximately 15 seconds after sending the EOT signal for FULL ASTERN, the bridge RPM indicators began to show ASTERN revolutions that increased to 35-55 RPM prior to the allision. The BRIGHT FIELD was noticeably vibrating, due to the propeller turning in reverse while the vessel was still moving forward. As the vessel continued to approach the Riverwalk, the Master ordered the Carpenter to let go the port anchor. The BRIGHT FIELD was about 30 meters from the Riverwalk when the Carpenter loosened the port windlass friction brake two turns and ran aft along the starboard side. The Carpenter testified that easing the brake two turns was normally enough to let the anchor fall by gravity yet still make the brake minimally effective. A videotape of the BRIGHT FIELD allision showed the port anchor was still hanging above the surface of the water when the vessel struck the pier.

The Second Mate testified that as the BRIGHT FIELD approached the pier, its bow turned slightly to starboard; he attributed this slight swing to the vessel grounding in the silt. Soundings taken after the allision indicate the water depth in the area of the allision point exceeded the vessel's draft.

At about 1410, the vessel struck the Riverwalk pier at an approximate 45-degree angle and slid along the face of the structure until the vessel was parallel to and alongside the face. When the vessel made contact with the pier, the port anchor and chain began to pay out. As the vessel scraped along the pier face, its bow entered an area of shallower water and came to rest with at least the first 70 feet of the vessel aground. Once the vessel stopped moving, the Pilot ordered the engine stopped. As recorded by the bridge bell logs, at 1411.5, the Bridge ordered ALL STOP. The Chief Engineer immediately responded and secured the main engine. The BRIGHT FIELD came to rest at mile 95.2 AHP on the left descending bank.

The Pilot and Master reported that they did not hear any engineering alarms on the Bridge from the loss of propulsion to the allision.

g. Engineering Activities, From Loss of Propulsion to the Allision.

The 1406 alarm indicating main engine trip due to low main engine lubricating oil pressure was heard by all in the Engine Control Room, as well as the Electrician who was in the engine room. The Second Engineer and Third Engineer, who were directly in front of the engine console, immediately looked at the alarm and monitoring system's #2 monitor to see which alarm was sounding. Within seconds the Chief Engineer, who had been in the engineroom, entered the Engine Control Room and silenced the audible alarm by pushing the red acknowledge button on the main engine console; the Second Engineer acknowledged the flashing display of the alarm on the monitor by pushing the black acknowledge button. The alarm display on the monitor changed from flashing to steady. All three engineers testified that the AUTO SLOW DOWN light on the main engine console lit up.

The print-out of the alarm log from the Terasaki alarm and monitoring system showed the main engine had experienced the following sequence of three alarms or abnormal conditions, all occurring at minute 1406 (Note: the alarm log print-out is used to maintain a historical record of alarms and is not normally used by the engineers to determine which alarms have sounded):

--M/E AUTO CONTROL FAIL. (The main engine control system was disabled due to an abnormal condition and the main engine would not respond to speed or direction commands from the bridge or engine room control consoles.)
--M/E MAIN LO PRESS TRIP. (The main engine had automatically shut down due to low lubricating oil pressure at the main bearings.)
--M/E LO IN PRESS A 2.49 KG/CM2. (The main engine lubricating oil pressure had dropped below the alarm pressure of 2.5 kg/cm^2.)

The engineers noticed the main engine was slowing down and heard the turbocharger surging. The Chief Engineer turned and walked toward the motor starters for the main lubricating oil pumps to see if there was a problem with the #1 main lubricating oil pump, the on-line pump. He noticed the motor controller for the #1 main lubricating oil pump indicated that the motor was running but the lubricating oil pressure reading on the console gauge was below the normal limit. He then turned toward the motor starter for the #2 main lubricating oil pump. He testified to the Marine Board that he saw it start automatically. As discussed before, the #2 main engine lubricating oil pump was in manual mode and therefore would not automatically start upon low lubricating oil pressure. It is not known who started the #2 main engine lubricating oil pump.

The Third Engineer noted the lubricating oil pressure reading below the normal range and the monitor showed a main lubricating oil pressure of "2.4 something" which was below the lower limit of 2.5 kg/cm^2. He testified that normally the main lubricating oil pressure read between 2.8 and 2.9 kg/cm^2. He also testified that he saw the run indicator light for #2 main lubricating oil pump come on. As he saw no one manually start the pump, he presumed it had started automatically.

The Second Engineer, who was watching the monitor, observed the low lubricating oil pressure alarm cancel, which meant the pressure had risen above the alarm set point. He also saw the green run indicating light for the #1 main lubricating oil pump was still lit which meant both lubricating oil pumps were running at the same time. The Chief Engineer then noted the oil pressure was reading about 3.0 kg/cm^2 and the engine speed had dropped to 30 - 35 RPM AHEAD. At minute 1407, the alarm and monitoring system printed the entries:

--M/E LO IN PRESS 2.60 KG/CM2. (The main engine lubricating oil pressure had been restored to a point above the alarm level.)
--M/E LO 2ND FILTER P H-PRESS. (The differential pressure across the second filter in the lubricating oil system was above the alarm set point.)

At about the same time, the Second Mate made the call to the engine room to ask about the problem. The Chief Engineer explained the engine slow down was due to the sudden loss of lubricating oil pressure, requested that engine control be transferred and started the control transfer process when the Second Mate agreed. Engine control was transferred to the engine room within one minute after the initial main engine lubricating oil low pressure alarm. At this time, the Second Engineer noted the engine speed at about 40 RPM AHEAD.

The Chief Engineer began to manipulate the reversing lever and speed-setting lever in order to restore control of the main engine. As described in Appendix 1, there are no provisions for overriding an automatic trip and the main engine could not be restarted until the initial trip condition (low lubricating oil pressure) had been corrected and the speed setting lever returned to the zero setting. At minute 1408, the alarm and monitoring system printed a recovery log with the entries:

-- M/E AUTO CONTROL NORMAL. (The main engine's auto control system returned to normal.)
-- M/E MAIN LO PRESS NORMAL. (The main engine lubricating oil pressure had returned to normal.)
-- M/E LO 2ND FILTER P NORMAL. (The differential pressure across the second filter was normal.)

At that time, the Second Engineer noted the engine speed had dropped to about 30 RPM AHEAD. The Chief Engineer, Second Engineer and Third Engineer testified they saw the AUTO SLOW DOWN light on the main engine console go off. The Chief Engineer moved the reversing lever to NAVIGATION FULL AHEAD and the speed setting lever to about 6 on the scale of 1 to 10. The engine speed rapidly accelerated to approximately 52 RPM.

The Chief Engineer pushed the speed setting lever further forward, to about position 7.5, to try to attain 72 RPM. The engine increased speed to about 57 to 60 RPM, but the rate of the main engine's acceleration was lower because it was automatically limited by the scavenging air pressure. None of the engineers bypassed this limit by pushing the CRASH MANEUVER button on the main engine console. At about this point, the Electrician entered the Engine Control Room and joined the other three engineers.

Approximately 30 seconds after the Chief Engineer regained control of the engine and increased the speed to over 50 RPM, the bridge ordered FULL ASTERN. The Bridge bell log recorded this order at 1409.5. The Chief Engineer saw the EOT move from NAVIGATION FULL AHEAD to FULL ASTERN but it was not one continuous movement; the EOT hesitated fractionally at HALF ASTERN. The Chief Engineer immediately responded to this speed and direction order by moving the reversing lever to FULL ASTERN and moving the speed setting lever to 0. The engine speed quickly dropped to 30 - 35 RPM AHEAD. The Chief Engineer stopped the engine by braking it with starting air.

Although the engineers, to this point, had not been informed of an emergency nor had the Chief Engineer told the Second or Third Engineer of an emergency, the Second and Third Engineers sensed the situation was urgent and noted the Chief Engineer working the controls to stop and reverse the main engine more quickly than normal. Once he had the engine stopped, which the Second Engineer testified took approximately four seconds, the Chief Engineer started the main engine in reverse and pushed the speed setting lever to somewhere between position 7.0 and 8.0. The main engine speed increased but fluctuated between 30 and 50 RPM ASTERN.

After receiving the FULL ASTERN order, it had taken approximately 30 seconds to stop and reverse the engine. The Chief Engineer pushed the speed setting lever further to try to obtain the full ASTERN speed of 56 RPM. Again, the Chief Engineer did not push the CRASH MANEUVER button to more quickly attain FULL ASTERN speed. The engineers reported that approximately one minute after receiving the order for FULL ASTERN, they felt a bump as the BRIGHT FIELD allided with the Riverwalk pier

At minute 1410, the alarm and monitoring system printed an alarm log with the entry:

-- MAIN LO SUMP TK L L-LEVEL. (Low lubricating oil level in main engine sump.)

Within the same minute, a recovery log printed with the entry

-- MAIN LO SUMP TK L NORMAL (The alarm condition was corrected.)

At 1411.5, according to the bridge bell log, the Bridge ordered ALL STOP and the Chief Engineer manually stopped the main engine.

The event from the sounding of the main engine trip alarm until the BRIGHT FIELD's main engine was stopped are summarized in Appendix 2.

h. Actions of Other Vessels.

1. Actions aboard the ENCHANTED ISLE.

The ENCHANTED ISLE was moored starboard side to the Erato Street Wharf and was the farthest upstream of the passenger vessels moored on the left descending bank. The vessel's Master and Third Officer were on the Bridge and heard the danger signals being sounded by the BRIGHT FIELD; the vessel was not monitoring VHF-FM channel 67. The Master recognized that the BRIGHT FIELD was in trouble but could tell from its position and relative motion that the ENCHANTED ISLE was not in danger.

There were approximately 200 passengers aboard at the time of the incident. There was no general passenger announcement, but the Master ordered the crew to mooring and gangway positions, secured the gangway and proceeded to the stern to monitor the situation. About one minute after the allision, the surge wave reached the ENCHANTED ISLE but caused no damage or injuries. Vessel personnel readjusted the mooring lines, reopened the gangway and resumed boardings.

2. Actions aboard the NIEUW AMSTERDAM.

The NIEUW AMSTERDAM was moored starboard side to the Julia Street Wharf just down stream from the ENCHANTED ISLE. An Officer on the Bridge heard the danger signals being sounded by the BRIGHT FIELD and called the Master to the Bridge; the vessel was not monitoring VHF-FM channel 67. The Master ordered the gangway secured, directed crewmembers to evacuate all persons from the vessel's stern and monitored the situation. The public address system was activated but no warnings to the passengers were broadcast. Watertight doors were readied for closing, but remained open.

The BRIGHT FIELD passed about 150 feet astern of the NIEUW AMSTERDAM. The surge wave caused no damage or injuries and once the situation appeared safe, normal operations and passenger embarkation resumed.

3. Evacuation of the QUEEN OF NEW ORLEANS.

At the time of the casualty, the four level casino vessel QUEEN OF NEW ORLEANS was moored starboard side to the pier with its bow pointed upstream. The vessel is so arranged that normal passenger entry and exit is funneled through a control point at a 12 foot wide fixed gangway installed on the pier, with a short ramp to bridge the distance between the gangway and the vessel. The ramp and control point are located at the forward end of the boiler or "02" deck. The vessel's Emergency Evacuation Procedure (Moored Condition), directs all passengers and crew to evacuate through that gangway. The QUEEN OF NEW ORLEANS is permitted to carry a maximum of 1800 persons and had 637 persons on board at the time the vessel's crew initiated the evacuation.

The Mate on watch on the Bridge heard the warning broadcast on VHF-FM channel 67 and immediately called the vessel's Master to the Bridge. The Master was on the main deck aft and while en route the Bridge saw the BRIGHT FIELD approaching. He realized the QUEEN OF NEW ORLEANS was in danger, called the Mate and ordered an immediate evacuation. The captain also ordered the engines started and preparations made to get the vessel underway. He testified that he had approximately 2.5 minutes in which to evacuate the persons on board and he estimated that 70% of that number (446 persons) managed to leave the vessel before the BRIGHT FIELD allided with the pier.

Using the Master's estimates, it would take approximately 10 minutes to disembark a full complement of 1800 persons from the moored vessel. As the BRIGHT FIELD slid along the pier towards their vessel, the crew stopped the evacuation and directed all remaining persons on board to move to the stern of the vessel, away from the anticipated point of impact, where they distributed lifejackets. While this action placed additional distance between the persons on board and the probable impact point, it also separated the persons on board from the only viable evacuation point. The BRIGHT FIELD's surge wave caused the QUEEN OF NEW ORLEANS to momentarily rise and fall several feet relative to its fixed shoreside gangway, rendering continued use of the gangway unsafe. Once the surge wave dissipated and the vessel stopped moving, the evacuation resumed.

In the evacuation, several people panicked. One patron jumped from the second level of the vessel breaking her pelvis and injuring her back, legs and hips. An employee also jumped from the boarding structure to the pier causing injuries to her back and neck. There were 35 reported injuries involving 22 passengers and 13 crewmembers, with almost all injuries caused by pushing and shoving as panicked passengers and crew attempted to get ashore.

4. Evacuation of the CREOLE QUEEN.

The excursion vessel CREOLE QUEEN is capable of carrying 1,000 passengers. At the time of the casualty, the crew had just gotten the vessel underway from its berth at the Poydras Street Wharf with 190 persons, including the crew, on board. Because of his vessel's position in the river behind the QUEEN OF NEW ORLEANS, he could not directly observe the BRIGHT FIELD approaching. When the Master heard the warnings broadcast on VHF-FM channel 67, he immediately brought the vessel back to the pier so that it was moored starboard side to the pier with its bow pointed upstream, sounded the general alarm system and ordered the passengers and crew to abandon ship. The crew managed to position the gangway and evacuate approximately 50% of the persons on board before a surge wave reached the vessel. Based upon a videotape of the allision, the surge wave reached the CREOLE QUEEN an estimated one minute and 10 seconds after the BRIGHT FIELD's initial contact with the Riverwalk pier.

The wave caused the vessel to surge away from the pier, tilting the gangway and causing three passengers to fall through the gap between the vessel and pier, into the water. The three passengers swam to a ledge under the pier. The crew suspended the evacuation and concentrated their efforts on rescuing the three persons in the water. Two of the three were able to climb a rescue ladder to the deck, but the third person had sustained injuries that required lifting him in a rescue litter. Once they were recovered, the evacuation resumed.

5. Assist Tugs

As the BRIGHT FIELD experienced the loss of propulsion, the tug MISSISSIPPI was also down bound close behind the BRIGHT FIELD. Responding to the calls for assistance, it made best speed to assist. There was little difference in speed between the vessels and the MISSISSIPPI did not reach the BRIGHT FIELD until after the allision. Together with as many as eight other tugs, the MISSISSIPPI helped hold the vessel in place until it could be securely moored to the remains of the pier structure.

i. Speed of Transit During Voyage 47.

The majority of the transit was made at NAVIGATION FULL AHEAD or 72 RPM on the main engine, which propelled the vessel at a speed the Pilot estimated at 16 MPH over the ground. At 1159, the vessel speed was reduced to MANEUVERING FULL AHEAD while the engineering staff investigated the cause of a main engine cooling water high temperature alarm. The Pilot testified the BRIGHT FIELD was not responding to helm commands as rapidly as he wanted at the reduced speed and at 1225, the crew increased the main engine speed to 72 RPM for the remainder of the transit. Even at a constant engine RPM, vessel speed was not constant due to the effect of the current and the drag created by hard rudder movements when steering through bends.

The BRIGHT FIELD's average speed can be calculated based on known times and locations. Since it departed the LaPlace Anchorage (mile 135 AHP) at 1121 and passed under the Huey P. Long Bridge (mile 106.1 AHP) at 1326, the vessel averaged 12.9 MPH (11.3 KTS) over the ground for that portion of the transit, which included the 26 minutes operated at FULL AHEAD. Maintaining NAVIGATION FULL AHEAD, the vessel passed under the Crescent City Connection Bridge (mile 95.7 AHP) at 1406, averaging 15.2 MPH (13.3 KTS) over ground for that portion of the voyage.

On the Mississippi's right descending bank, opposite the Riverwalk, is a barge fleeting area where the tug LOCKMASTER was moored. Through a fortunate coincidence, the LOCKMASTER was equipped with a video-recorder that captured a radar image of the BRIGHT FIELD as the incident developed, as well as the associated radio traffic on

Channel 67 VHF-FM. The LOCKMASTER's video tape provided a valuable real-time recording of the events.

Through timing the movement of the vessel on that recording, the bow of the BRIGHT FIELD passed under the upriver span of the Crescent City Connection Bridges three minutes and 25 seconds before the bow allided with the Riverwalk pier. After the BRIGHT FIELD came to rest, the Coast Guard established through radar ranging that the bridge of the vessel was approximately 840 yards from the nearest span of the Crescent City Connection Bridge and about 960 yards from the upriver span. Estimating the vessel passed under the Crescent City Connection Bridges 470 yards off the left descending bank, through triangulation the actual distance covered by the vessel during that three minutes and 25 seconds was 1069 yards. This translates to an average speed of 10.7 statute MPH (9.3 KTS or 17.2 kph).

j. Vessel Maneuverability.

The BRIGHT FIELD is a 224 meter (735 feet), 68676 dead weight ton freight vessel. Its hull design is consistent with large, modern ocean-going vessels and is optimized for the maximum cargo carrying capacity and fuel economy while still being able to fit within the Panama Canal locks. This design includes a hull with a very boxy shape. The main engine is placed as far aft as possible to increase the available space for the cargo section. The engine room's location causes the aft section of the hull to maintain its full width back to a sharp transition point where it abruptly narrows at the propeller and rudder.

According to Pilots [redacted] and [redacted] two senior pilots who testified at the Marine Board, a pilot might be forced to operate a vessel such as the BRIGHT FIELD at higher speeds when "high water" conditions exist. Normally a pilot would be maneuvering at the minimum speed necessary to maintain adequate response to helm commands. In high water conditions, the current runs faster and there are more problems with sets (lateral currents) than at lower river stages. This normally means a pilot must operate at greater speeds to keep water flowing across the rudder.

According to CAPT [redacted] this boxy hull form, when compared to vessels with more classic tapering stern lines, creates streamlines which do not naturally force full water flow over the rudder. The rotation of the propeller causes the streamlines to be drawn towards the rudder, enhancing water flow over the rudder. This, in concert with the outflow from the propeller, provides adequate steerage for a vessel of this type but is very much dependent on the propeller RPM. This is illustrated in the figure below.

WATER FLOW AROUND STERN OF VESSEL

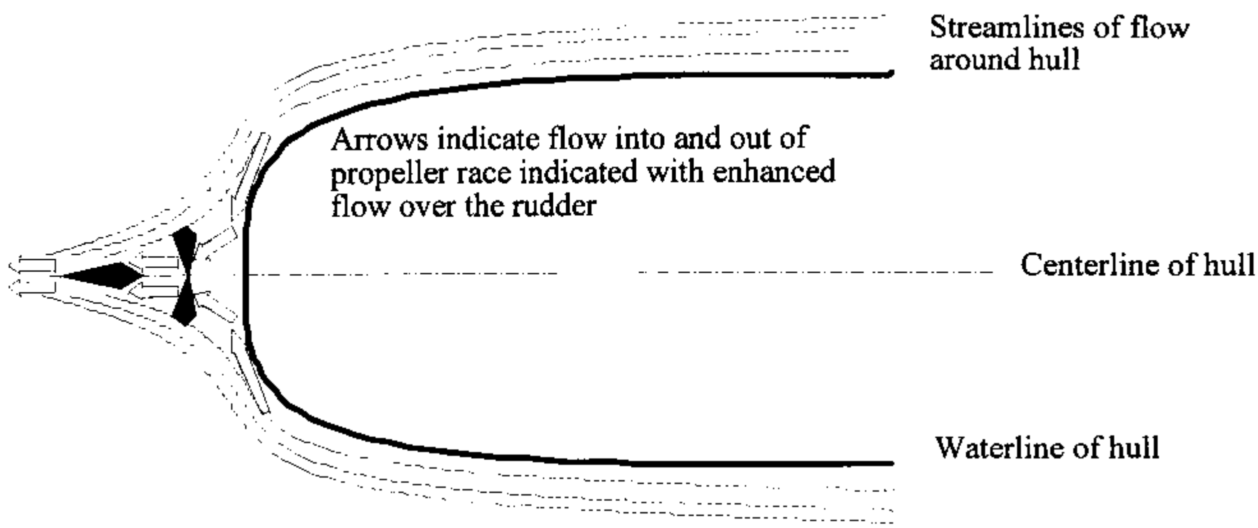

FIGURE 4

k. Rudder Stall.

Thomas C Gillmer, in his book, Modern Ship Design (Naval Institute Press, Annapolis, Maryland, 1986), defines stall as the sudden discontinuity of lift on the downstream surface of the rudder caused by an increasing angle of attack to the critical angle where separation occurs and when normal flow pressures can no longer exist. This happens in two ways, both of which occurred on the BRIGHT FIELD.

If propeller RPM rapidly decreases or the propeller is put in reverse, the volume of flow from astern of the propeller decreases, thereby decreasing the flow onto the rudder. Simultaneously, a temporary excess in volume on the forward side of the propeller pushes the streamlines out away from the rudder which increases the angle of attack. If the rudder is put over to the stops, it also pushes out the streamlines on that side, increasing the angle of attack, contributing to rudder stall and loss of steerageway.

l. Post-Casualty Testing.

1. Drug and Alcohol Testing.

Chemical tests were conducted on the Pilot, Master and all officers and crew who were on watch on the BRIGHT FIELD at the time of the incident. All results were [redacted] for drugs or alcohol. During testimony, the Pilot, Master and Chief Engineer all testified that the they were well rested, were not taking any medications and were not suffering from illness on 14 December 1996.

Chemical tests were also done on the Regulated Navigation Area Coast Guard Light Operators on watch at the time of the incident. All results were [redacted] or drugs or alcohol.

2. Testing of BRIGHT FIELD Equipment

CDR William Marhoffer, the Chief of the Inspection Department for Marine Safety Office New Orleans, supervised the Marine Board's post-casualty testing and verification of the BRIGHT FIELD's engineering and automation systems. All of the following tests and inspections were completed under his direction.

When conducting an examination of the main engine on 15 December 1996, a Coast Guard inspector saw both main lubricating oil pumps were running and on line. The vessel owner's representative verified this was the condition at the time of the allision. The #1 lubricating oil pump was noticeably vibrating and was very noisy. Both pumps were kept running and on 16 December 1996, when the Coast Guard inspector returned, he observed that #1 lubricating oil pump was still noisy and vibrating.

Coast Guard inspectors witnessed pressure tests conducted on both lubricating oil pumps on 16 December 1996. The testing was done by initially having both pumps running and then manually securing one of the pumps to test the ability of the remaining pump to sustain the necessary lubricating oil pressure. When #2 lubricating oil pump was secured, #1 lubricating oil pump was unable to provide sufficient pressure and the alarm sequence shown below was recorded by the alarm and monitoring system printer. This test was repeated. The pressures recorded with channel 0317 were 2.32 kg/cm^2 and 1.96 kg/cm^2, both of which were below the alarm set point of 2.5 kg/cm^2.

Channel	Title
0317	M/E LO In Pressure
0361	M/E Auto Control Fail
0102	M/E Main LO Pressure Trip

This sequence of alarms is different from that recorded on 14 December 1996.

When the #2 lubricating oil pump was tested for automatic start by securing the #1 lubricating oil pump, it provided sufficient pressure and there were no alarms recorded.

The inlet strainer for #1 lubricating oil pump was examined on 16 December 1996. The strainer was clean, there was no foreign material trapped in the strainer nor was there any damage to the basket.

On 19 December 1996, the #1 lubricating oil pump was removed from the vessel and transported to Boland Marine for disassembly and examination. The motor was removed and tested by Gulf Best Electric. These examinations and tests revealed no problems with either the pump or the motor. The pump and motor were reinstalled on 3 January 1997 and when the pump was started, discharge pressure was within normal limits. At that time, the relief valve for #1 lubricating oil pump was tested and it worked correctly, relieving at 5.1 kg/cm^2. By 4 January 1997, approximately 24 hours later, the pump was again making noise and vibrating but the discharge pressure remained the same. On 5 January 1997, it was louder and vibrating more, and on 6 January 1997, when the vessel moved to the Violet Anchorage it was again louder and vibrating more than before. After #1 lubricating pump began to make noise and vibrate, #2 lubricating pump was started. It too began to make noise and vibrate and in the end, both lubricating oil pumps were making noise and vibrating. The lubricating oil piping system was checked for leaks and none were found.

Coast Guard inspectors witnessed a test of the automatic start of the standby main lubricating oil pump due to a loss of lubricating oil pressure on 3 and 4 January 1997. The standby main lubricating oil pump did not start. Also on 4 January 1997, the audible and visual alarms on the Bridge console were satisfactorily tested.

It was during the testing on 4 January 1997 that the Coast Guard inspector observed the lubricating oil pressure reading for the Terasaki alarm and monitoring system was artificially high. It was approximately .4 kg/cm^2 higher than the actual pressure shown on the pressure gauges on the Engine Control Room console and on the engine side panel. During later testing on 21 and 28 January 1997, the lubricating oil pressure display on the Terasaki monitor was consistent with the gauges, which indicates someone, probably the vessel's engineering crew, had corrected this problem.

On 6 January 1997, the Coast Guard inspector witnessed a successful test of an automatic start of the standby main lubricating oil pump due to a loss of lubricating oil pressure, however it occurred at a pressure of 1.75 kg/cm^2, well below the set pressure for automatic start of 2.4 kg/cm^2. The ship's engineers had adjusted the Danfoss pressure switch, which initiates the auto start, since the tests of 4 January 1997. The auto start of the standby lubricating oil pump (channels 0901 and 0902 for #1 and #2 lubricating oil pumps, respectively) was recorded by the Terasaki printer. The pressure switch, which initiates auto start of the standby lubricating oil pump, was replaced with a spare sometime between 21 and 28 January 1997. The Danfoss pressure switch removed from the BRIGHT FIELD was subsequently tested on 12 February 1997 by Cali-Tech, Inc. The set point on the indicator scale was set at approximately 40 lbs/in^2 (about 2.5 Bar). It consistently actuated at 47.5 lbs/in^2 (about 3.0 Bar) and reset at 40 lbs/in^2. There was no apparent physical problem with the switch but the measured resistance of the contacts was reported as 2.32 ohms for the normally open set of contacts and 1.73 ohms for the normally closed set of contacts. The test facility characterized the contact resistance as abnormally high, stating that readings should be in the range of 50 milliohms (0.05 ohms) or less and that at low voltages, the switch could give "erroneous readings." A "new" switch of the same model was tested for comparison purposes and produced measured resistance of 2.8 milliohms for the normally open set of contacts and 3.2 milliohms for the normally closed set of contacts.

Additional testing on 21 January 1997 verified the correct operation of the auto start of the standby lubricating oil pump upon loss of lubricating oil pressure from the running pump and, in every case, the Terasaki system recorded the auto start on the printer. Also, in every case the pump that was originally running was automatically stopped after the automatic start of the standby pump. This test was repeated at least four times. The Coast Guard inspector also verified that the Terasaki printer does not record the manual starting or stopping of a lubricating oil pump.

During testing on 21 January 1997, the Terasaki system consistently printed the wrong status of the lubricating oil pumps that were automatically or manually stopped; they were shown as running. On 28 January 1997, the auto start of the standby lubricating oil pumps was again tested as well as manual starting and stopping. The testing verified that the auto start functioned correctly and the correct pump status was printed by the Terasaki printer. The erroneous status printouts from 21 January 1997 were not repeated and the investigators could not determine if correction of this condition was due to replacing the pressure switch, reprogramming of the system or some other reason.

The main engine lubricating oil sump was sounded on 3 January 1997 with both pumps off and it showed a level corresponding to a volume of 10.75 m^3 of oil. Both lubricating oil pumps were turned on and sufficient time allowed to fill the oil system piping and the main engine with oil. The sump was sounded again and showed a level corresponding to a volume of 8.1 m^3 of oil, at or just below the low oil level alarm set point corresponding to a volume of 8.16 m^3. The main engine lubricating oil sump alarm was tested; it activated at a set point corresponding to 7.25 m^3 on the float scale. Before transiting to the Violet Anchorage on 6 January 1997, lubricating oil was added to fill the sump and produce a sounding corresponding to a volume of 11.0 m^3 of oil with both lubricating oil pumps running. Refer to Appendix 1 for a description of the main engine lubricating oil sump.

The #1 lubricating oil purifier was put on line on 4 January 1997 and ran continuously until 10 January 1997. When the purifier was opened on 10 January 1997 to be cleaned, it was extremely dirty and packed with dense particulate.

An examination of the lubricating oil sump on 10 January 1997 showed there was emulsified oil/water mousse and considerable sediment on the bottom of the sump. The sediment was of an average depth of one-eighth to three-eighths of an inch. Later, the lubricating oil sump was mechanically cleaned, and the entire lubricating oil system, including the lubricating oil cooler, was drained and the lubricating oil was completely renewed with new, clean oil that met the engine manufacturer's specifications.

The second filter was examined by a Coast Guard marine inspector on 4 January 1997 and he noted the differential pressure, i.e. the pressure difference between the inlet and discharge of the filter, was reading approximately 1.3 kg/cm^2. This was well above the differential pressure alarm setting of 0.9 kg/cm^2. He also noted the alarm was not sounding. On 5 January 1997, the marine inspector again noted the second filter differential pressure was approximately 1.3 kg/cm^2 and again the alarm was not sounding. He also noted the filter was operating in automatic backwash mode, i.e. the automatic feature to flush the filter with lubricating oil to reduce the differential pressure, was activated and the local control panel for the filter was showing a high differential pressure condition.

On 10 January 1997, the marine inspector observed the vessel's engineering crew disassemble the second oil filter for examination and cleaning. The filter consisted of a housing for 16 separate cylindrical filter screens. The interior of the housing and discharge line were clear of any apparent blockage or cause for the high differential pressure. There was minor oil and water clingage in the housing. The second filter's sludge collector was also examined; no cause for high differential pressure was found.

The vessel's crew began the process of cleaning the 16 filter elements on 10 January 1997. The filter elements were first soaked with diesel fuel and then blown clean with compressed air. The cleaning was completed sometime after 15 January 1997 and the filter was reassembled.

On 21 January 1997, the lubricating oil system was tested with a Coast Guard marine inspector in attendance. The differential pressure was reading approximately 0.7 kg/cm^2. This differential pressure was also observed when the lubricating oil system was tested again on 28 January 1997 and a differential pressure of 0.6 kg/cm^2 was observed on 31 March 1997.

On 21 and 28 January 1997, the programming for the following channels was checked and verified that it complied with the documentation on the Terasaki system that pertained to the BRIGHT FIELD:

Channel	Title
0101	M/E Over Speed (Normal/Trip)
0102	M/E Main LO Pressure (Normal/Trip)
0201	M/E Auto Slow Down (Normal/Slow Down Function)
0202	M/E Cross LO Pressure Low (Normal/Slow Down)
0309	M/E Start In Pressure (Alarm)
0317	M/E LO In Pressure (Alarm)
0320	M/E Cross LO In Pressure (Alarm)
0331	Main LO Sump Tank Level (Normal/Low Level)
0361	M/E Auto Control (Normal/Fail)
0901	1 - Main LO Pump (Auto Start/Abnormal Stop)
0902	2 - Main LO Pump (Auto Start/Abnormal Stop)
1201	M/E LO 2nd Filter Pressure (Normal/High Pressure)

On 28 January 1997, testing was conducted to try to duplicate the alarm sequence of the allision on 14 December 1996. Initially, #1 lubricating oil pump was running, #2 lubricating oil pump was off and in manual mode. #1 lubricating oil pump was then manually stopped and the following alarms were recorded in the sequence shown. This test also verified that the time delays for channels 0361 and 0102 and for the IHI main engine trip were correct.

Channel	Title
0317	M/E LO In Pressure Alarm
0361	M/E Auto Control Fail
0102	M/E Main LO Pressure Trip (5 seconds later)
	M/E Trip light on C/R console (5 seconds later)

Mr. [redacted] of Advanced Marine Electronic Company, a contract service technician for the Terasaki line of automation systems, performed repairs, reprogramming and tests of the Terasaki system installed on the BRIGHT FIELD as part of the post-casualty preparations for the Det Norske Veritas survey. He provided expert testimony and interpretation concerning the BRIGHT FIELD's automation systems.

Mr. [redacted] testified that his review of the printed alarm log clearly shows the main engine tripped instead of going into the automatic slow down. All testing conducted after the casualty resulted in the main engine tripping as a result of the loss of lubricating oil pressure to the main bearings. His examination of the main engine control system and the monitoring system showed there was nothing wrong with its design or installation, however the correctness of the software programming at the time of the casualty could not be verified.

Mr [redacted] also testified that whenever a main lubricating oil pump starts automatically due to an abnormal condition, such as loss of lubricating oil pressure, it is recorded on the alarm log. His review of the alarm log for 14 December 1996 indicated to him that the #2 main engine lubricating oil pump did not start automatically because there was no alarm log entry 2 - MAIN LO PUMP printed. He testified that this log entry would appear if the #2 main engine lubricating oil pump had started automatically.

One possible explanation for the lack of the log entry for an automatic start of the #2 main engine lubricating oil pump is that the pump was started manually. The Marine Board has been advised by letter of a statement made by Mr. K. Y. Mo, COSCO's Technical Superintendent, during a deposition taken on September 18, 1997. In this statement, he testified that during a conversation with Chief Engineer Fang in late January 1997, Chief Engineer [redacted] admitted to him that at the time of the loss of propulsion the #2 main engine lubricating oil pump transfer switch had been in the manual rather than in the automatic position. This is a credible explanation for the absence of the alarm entry.

Mr. [redacted] also stated that, if the alarm set points and time delays are adjusted properly, the correct alarm sequence is channel 0361 (remote control system failure, no time delay), channel 0317 (main engine low lubricating oil pressure alarm, three second time delay) and channel 0102 (main engine low lubricating oil pressure trip, five second time delay). According to Mr. [redacted] the most likely cause for the differences in sequences is that time delay and/or pressure settings in the Terasaki system and various sensors were incorrect. He performed only limited testing of the system and did not conduct calibration tests of the various sensors, so he did not positively identify specific programming errors that might be the cause of the various alarm sequences.

Mr. [redacted] noted that the Terasaki system, one of the earlier models built by Terasaki, does not record changes to programming parameters, that it lacks a programming lock installed on newer versions of the system and that there were a number of programming problems with the system.

In conjunction with testing of the alarm and monitoring system, Mr. [redacted] repaired both Terasaki monitors. The #1 monitor was completely nonfunctional and #2 monitor had severe distortion on the bottom third of the screen. The #1 monitor was replaced and #2 was repaired. After replacing the #1 monitor, the vessel recalled Mr. [redacted] to correct some of the extension alarm programming for some channels.

As part of the investigation, records of the two most recent Coast Guard Port State Control boardings conducted on the BRIGHT FIELD prior to the allision were reviewed. The scope of Coast Guard port state control boardings does not normally include an examination of the automation system and related maintenance/inspection documentation; there is no evidence that either of these boardings included an examination of these systems. A detailed summary of the Coast Guard boardings can be found in Appendix 4.

3. Alarm Sequence Issues.

Based on the Terasaki system printing alarms in a "first in, first out" basis, the alarm printout from 14 December 1996 clearly showed the main engine tripped due to the loss of lubricating oil pressure before the low lubricating oil pressure alarm sounded. This is contrary to proper functioning of the automation system which was designed to sound the alarm before the main engine trip. The alarm is designed to sound when the pressure reaches a value of 2.5 kg/cm^2 and the trip occurs when the value drops to 2.3 kg/cm^2.

Post-casualty testing of the automation system verified that, in general, the automation system functioned as designed, i.e. the lubricating oil pressure and trip set points were correct for both the Terasaki system and the IHI main engine control system and the time delays were correct. However, Coast Guard inspectors conducting post-casualty testing on 4 January 1997 noted that the Terasaki alarm and monitoring system showed the lubricating oil pressure was approximately 0.4 kg/cm^2 above that shown on the IHI pressure gauges. This is possible since the Terasaki alarm and monitoring system is completely separate from the IHI main engine trip system. If the Terasaki alarm and monitoring system was reading a pressure sufficiently higher than the IHI system, it would explain the improper sequence of alarms and the failure of the automation system to forewarn the engineers.

The difference in pressure readings between the Terasaki system and the IHI system could not have been as high as 0.4 kg/cm^2 because that would have resulted in the main engine tripping earlier in the transit. The 1400 Report Log from 14 December 1996, only six minutes before the low oil pressure trip, showed the lubricating oil pressure at 2.64 kg/cm^2. If this reading was 0.4 kg/cm^2 high, this would have meant the true pressure in the IHI system was 2.24 kg/cm^2, which was below the trip pressure of 2.3 kg/cm^2. Therefore, the pressure difference could not have been any greater than 0.34 kg/cm^2. It was not until 21 January 1997 that Coast Guard inspectors noted the lubricating oil pressure reading on the Terasaki system had been corrected and was now reading the same as that on the IHI gauges.

Testing conducted on 16 December 1996, which resulted in the correct alarm sequence, appears contradictory with the improper alarm sequence from the casualty and the fact that the pressure differential between the Terasaki system and the IHI system had not been corrected. This is explained by the difference in the rate of drop of the lubricating oil pressure on the day of the casualty and when it was tested on 16 December 1996. This is documented by the pressure which was recorded on the alarm log, which is the pressure of the system after the three second time delay. On 14 December 1996, the pressure shown with the alarm is 2.49 kg/cm^2, which approximates a drop rate of 0.003 $kg/cm^2/sec$. On 16 December 1996, pressure dropped at a significantly higher rate due to the method of testing. The pressures recorded with the two tests were 2.32 and 1.96 kg/cm^2, resulting in drop rates of approximately 0.06 and 0.18 $kg/cm^2/sec$, respectively.

When this difference is considered, along with the different pressure settings and time delays for the alarm and trip (2.5 kg/cm^2 and three seconds for the alarm and 2.3 kg/cm^2 and five seconds for the trip), the alarm sequences from the day of the casualty and from the testing are entirely consistent provided the Terasaki system was reading a pressure that was approximately 0.34 kg/cm^2 greater than the IHI system. This is consistent with the observations of the Coast Guard Marine Inspectors.

On the day of the casualty, the improperly calibrated lubricating oil pressure sensor prevented the Terasaki monitoring and alarm system from alerting the engineers in the engine room that lubricating oil pressure was dropping and a main engine trip was imminent.

4. Testing of Main Engine Lubricating Oil Samples.

Eleven lubricating oil samples, two new oil and nine used oil, were taken on various dates at various locations in the main engine lubricating oil system and analyzed for compliance with the main engine manufacturer's specifications for lubricating oil. Analysis of the used lubricating oil indicated a failure of the engineers to monitor and maintain the main engine lubricating oil.

A total of four used lubricating oil samples were taken after the casualty but before the main engine sump was drained, cleaned and refilled on or about 10 January 1997. The viscosity of two of the four samples were outside the allowable +/-10% difference from new oil while all four samples exceeded the 0.2% maximum allowable water content, with one sample being 7.6% water.

A detailed summary of the main engine manufacturer's lubricating oil specifications and the test results can be found in Appendix 3.

5. Det Norske Veritas' Testing and Oversight.

Mr. [redacted] is the manager of the Det Norske Veritas located in New Orleans and was the Surveyor responsible for classification society oversight and approval of the BRIGHT FIELD's repairs. He also witnessed some verification tests and conducted a survey prior to the vessel's departure from New Orleans. For a detailed description of the DNV survey requirements, see Appendix 4.

DNV Rules, Section 1 of Part 6, Chapter 3, requires a test program for vessels certificated for unattended machinery operation, which includes test procedures, acceptance criteria and observations to be made during the testing. This test program must be submitted to DNV for approval. However, the rules do not specifically state that this test program must be maintained onboard the vessel. In addition, the rules require the vessel to have onboard instruction manuals that contain instructions for testing and for the systematic maintenance and function testing of the automation equipment.

These manuals must be submitted to DNV for information. The plan for the systematic maintenance and function testing must show how the automation system components and systems are to be tested and what is to be observed during the tests.

The testing of the automation system to maintain unattended machinery classification consists of maintenance and function testing conducted quarterly by the vessel's crew and the testing done with the DNV surveys. On the BRIGHT FIELD, it is the responsibility of the Electrician to conduct the function testing. He testified that when doing this testing, he did not follow a test procedure and did not know of a test procedure that was onboard the vessel. This was consistent with the testimony of the other engineers that they did not know of an automation test procedure. The Electrician followed a COSCO form entitled, "E.O. PLANT AND SAFTY (sic) DEVICES TEST RECORD" which listed the alarms and equipment that were to be tested. He used a list of alarm set points from an instruction manual onboard the vessel to determine if the test was satisfactory.

Following COSCO policy, the Electrician was required to complete this testing and submit the results to COSCO on a quarterly basis. The most recent form completed before the allision indicates the lubricating oil system low pressure alarm was tested on 1 October 1996 and found satisfactory. The Electrician testified that, when doing this testing while he was aboard the vessel, he never discovered an abnormality requiring him to make a repair.

As part of his oversight role, Mr. [redacted] reviewed the COSCO automation test record used by the BRIGHT FIELD's crew to conduct their periodic testing and maintenance on the automation system. The COSCO automation test record is a three page document that is a listing of many of the alarms and parameters monitored by the Terasaki alarm and monitoring system. The form shows the date the test was conducted and has a remark section which included either a notation or a value of the monitored parameter. However, there was no way of knowing if it was the value when the alarm sounded or if it was the alarm set point. This form did not include any information to indicate alarm programming, i.e. set points, time delays, etc., was verified as correct. It did not include testing the main engine automatic trip, automatic slowdown, automatic start of a standby lubricating oil pump or the low lubricating oil sump level alarm. Mr. [redacted] testified that the COSCO automation test procedure did not meet the requirements of automation system testing and calibration found in the Det Norske Veritas Rules. This form or something similar had been accepted by DNV Surveyors at the three most recent automation surveys before the allision. See Appendix 4 for additional information.

The classification rules do not give detailed requirements for testing the systems and equipment. They do not contain procedures for how the testing is to be conducted nor do they specify limits on the testing. This is generally left to the judgment of the surveyor at the time the surveys are conducted. However, the DNV Instructions to Surveyors No. I-C3.5, titled "Periodically Unattended Machinery Space -E0" contains guidance for surveyors to follow during the surveys. The guidance states that the systematic maintenance and function testing documentation must indicate which and when the equipment was subject to maintenance and testing.

6. Reporting of Maintenance and Repairs to DNV.

Mr. [redacted] also testified concerning whether the BRIGHT FIELD's engineering and automation problems should have been reported to DNV. According to DNV records, COSCO had not notified DNV of the failure of the alarm and monitoring system's #1 monitor or the main engine's extensive recent failure and repair history to correct cylinder liner and piston problems. Part 1, Chapter 1, Section 3, Paragraph B 300 of the DNV Rules for the Classification of Ships is titled "Survey of Damage." Subparagraph B 301 reads in part "If the hull, machinery installations or equipment covered by classification sustain damage of such extent that it may be presumed to lead to a Condition of Class (see 700), the Society is to be informed without delay."

A Condition of Class is a mandatory requirement that is imposed by DNV in order for the vessel to remain classed by DNV. Upon receiving this notification from the vessel, the rules stipulate that DNV will conduct a survey at the first port of call. DNV rules do not contain any specific requirements or guidelines concerning a threshold level of repairs and/or maintenance to a main diesel engine that would lead to a Condition of Class and subsequently would require DNV to be notified.

A review of DNV's computer data base for the BRIGHT FIELD showed there are 21 different items pertaining to the main diesel engine that were subject to survey every five years as part of the continuous survey program. Of these items, the BRIGHT FIELD experienced failures and/or damage and had to repair three of them during the period between 1 June 1996 and 14 December 1996. These three were: cylinder liners, air cooling and scavenging box. As noted above, DNV should have been notified of the failures and subsequent repairs. Mr. [redacted] stated that DNV would have imposed a Condition of Class and conducted additional surveys of the main engine if the owner had advised DNV of these engine problems or requested that DNV investigate the cause of the casualty.

7. Post-Casualty Survey by DNV.

Upon conclusion of repairs to the BRIGHT FIELD after the allision, Mr. [redacted] conducted a survey to verify the automation system complied with the DNV classification rules. He first met with the Chief Engineer and the vessel's Superintendent in mid February to discuss preparing the vessel and establishing a plan on how to carry out the survey. Very early in the investigation, the Chief Engineer and Superintendent had been asked by the Marine Board to produce the approved automation test program and none had been found. Lacking the approved automation test program and judging the COSCO survey form unacceptable, Mr. [redacted] designed a test procedure using the DNV rules as a guide and told the Chief Engineer and the Superintendent to follow it and conduct the tests.

He made a second visit approximately two days later to check on their progress and audit their work. At that time, the Chief Engineer and Superintendent produced for him a builder's automation checklist. He reviewed the checklist and even though it was not stamped by DNV, he was satisfied by its completeness and noted that it contained test procedures along with set points, time delays, etc. Mr. [redacted] wrote the date "97.02.17" on the cover of the test procedure, which also contained the label, "M. S. BRIGHT FIELD (Test Programme)." He couldn't recall if that was the date he received it from the Chief Engineer or if that was the date he completed his review of the document and satisfied himself it was acceptable for use. He then instructed the Chief Engineer and Superintendent to begin using this test program to test the vessel's automation system.

When Mr. [redacted] returned in early March to complete the survey, the first thing he did was verify that testing had been done in accordance with the test program and satisfied himself that the vessel had followed a systematic maintenance and testing program since 17 February 1997. He next checked to see if the vessel had the necessary test equipment, i.e. calibrated pressure and temperature sensors, required to complete the automation survey. He found the pressure gauge had not been verified as accurate, so he required the vessel to send the gauge ashore for verification. He discovered the vessel was missing one of the two required temperature sensors and required the vessel to obtain this equipment. He then conducted a survey, but in more depth than normally would be done. He testified that it was more comparable to a five year renewal survey.

In conducting the expanded survey, Mr. [redacted] paid particular attention to the lubricating oil pumps. He tested the auto start of the standby pump for both pumps, electrically and due to low lubricating oil pressure. Everything checked out satisfactorily. The alarm and monitoring system, including both monitors and printer functioned satisfactorily. He noted the lubricating oil pumps were a little noisy, but did not find anything unsatisfactory with their condition. Mr. [redacted] was satisfied with the results and signed off on the annual survey on 10 March 1997.

Except as indicated below, Mr. [redacted] did not conduct any special examinations on the main engine. He noted that a review of DNV's' computerized data base showed that all surveys of the main engine, as required under the continuous survey program, were up to date and the main engine was within class. Mr. [redacted] testified that under those circumstances DNV could not require the owner to open up the engine to conduct additional examinations.

Mr. [redacted] ordered the clearances checked for the main and crosshead bearings because he was sufficiently concerned from what he had heard about the main engine lubricating oil contamination. These readings showed bearing clearances were within normal tolerances. He conducted no other mechanical surveys of the main engine. At the time the BRIGHT FIELD departed New Orleans, there were no outstanding Conditions of Class indicating non-compliance with DNV Rules.

8. Automation Test Procedures.

Shortly after convening, the Marine Board asked for the automation test procedures, required to be approved by Det Norske Veritas, that were used by the BRIGHT FIELD's crew to test the vessel's automation systems. At the time, the crew was unable to locate a copy of the procedures aboard the vessel. Ultimately, four versions of automation test procedures were produced and entered into evidence but not until much later. There were minor variations between the four versions; see Appendix 5 for a detailed description of the similarities and differences. One version included notations showing it had been used as part of the automation testing program, but the most recent entry was made in 1989. Another version was approved by Mr. [redacted] for use by the BRIGHT FIELD's crew in testing required as part of the automation survey he conducted prior to the vessel's departure.

m. Main Engine Repair History.

According to the vessel's logs from 1 June 1996 until 14 December 1996, the BRIGHT FIELD was underway approximately 124 days with the main engine operating approximately 2806 hours. As part of the investigation, Coast Guard investigators reviewed the BRIGHT FIELD's maintenance and repair records for that period. Those records indicate that many main engine components were failing at a rate greater than expected for this model of engine. A detailed description of the vessel's maintenance and repair actions is included in Appendix 6.

During the time period specified above, the BRIGHT FIELD had problems with a clogged air scavenger cooler, improperly timed fuel pumps, high exhaust temperatures, cracked cylinder liners, improper fuel combustion, chronically damaged piston rings and burned piston crowns. In addition, the main engine suffered from combustion gas blow-by and high oil mist in the lubricating oil sump. The #1 lubricating oil purifier, which is dedicated to the main engine, was cleaned 18 times, the #1 and #2 main lubricating oil filters were cleaned a total of 16 times and the repairs listed below were made:

Main Engine Component (Number Installed)	Repair/Renewal Frequency Reported	Manufacturer's Service Interval Recommendation
Cylinder liners (5)	3 replaced	15,000 hours
Cylinder Heads (5)	1 repaired	15,000 hours
Fuel Injectors (10)	38 replaced	4,000-8,000 hours
Fuel Pumps (5)	2 replaced	20,000-40,000 hours
Piston Rings (5 sets)	7 sets replaced	15,000 hours
Piston Crowns (5)	3 replaced	15,000 hours
Exhaust Valves (5)	1 replaced	30,000 hours

n. Main Engine Lubricating Oil Sump Issues.

1. Inadequate Main Engine Lubricating Oil Sump Volumes

According to [redacted] General Manager of COSCO's Technical Division, the main engine sump was to have been drained for cleaning and renewal of oil on 5 November 1996 and then refilled to a volume of at least 9.6 m^3. The previous Chief Engineer did not clean the sump and added only about 8.4 m^3 of new lubricating oil, all that remained in the bulk new oil storage tank. The company was under the impression that the Chief Engineer was going to purify and return to the sump enough used oil to bring the volume up to at least 9.6 m^3, which he did not do. He continued to operate the BRIGHT FIELD's main engine with insufficient lubricating oil in the sump for the balance of the voyage to New Orleans.

The Chief Engineer's Log Book entries from 7 through 21 November 1996 showed the main engine lubricating oil sump sounding was at a level corresponding to a volume of between 7.0 and 7.5 m^3 with the main engine running, well below the level corresponding to the low oil level alarm set point of 8.1 m^3. The Log Book did not contain any sump soundings recorded after 21 November 1996. This low volume is further substantiated by COSCO's Technical Superintendent, Mr. [redacted] who testified at a deposition taken in Hong Kong that on 17 December 1996 he observed a sounding corresponding to a volume of 7.5 m^3 in the main engine lubricating oil sump.

2. Entrainment of Air in the Lubricating Oil.

As noted above, log entries indicate the volume of lubricating oil in the main engine sump was between 7.0 and 7.5 m^3 prior to the BRIGHT FIELD's arrival in New Orleans and there is no evidence that additional oil was added prior to the casualty. This low oil volume could contribute to two conditions increasing air entrainment in the lubricating oil.

The low oil level would increase the likelihood that the suction created by the lubricating oil pump would draw air into the supply piping to the oil pump.

Secondly, entrained air must be allowed time to escape from the lubricating oil. For the main lubricating oil pumps on the BRIGHT FIELD, the manufacturer's recommendation was that the minimum circulating volume in cubic meters should be between 10% and 15% of the pump's capacity in cubic meters per hour, which corresponds to a lubricating oil volume of 18 to 27 m^3. At this volume of oil, the system would be pumping the available amount of oil every six to nine minutes. With the actual volume of 7.0 to 7.5 m^3, the system was pumping the entire volume of oil available in less than three minutes and not allowing the entrained air to escape.

3. Main Engine Sump Low Level Alarm.

The BRIGHT FIELD operated for an extended period of time with the main engine sump oil volume below the low level alarm set point, yet the alarm was not sounding. As noted above, when the vessel struck the pier, the sump low level alarm sounded and then cleared, probably due to sloshing of the oil in the sump. It appears the main engine sump low level alarm was operable but had been recalibrated to operate at a volume of less than 7.5m^3.

o. Waterway and Navigation Issues.

1. Vessel Traffic Services.

Vessel Traffic Services (VTS) are authorized and implemented by 33 Code of Federal Regulations Part 161 in eight waterways at various locations around the United States. The Port of New Orleans is not one of those locations. At one time, the Port of New Orleans had a voluntary VTS system but it was de-activated in 1988 due to a lack of mariner participation.

2. Regulated Navigation Areas.

Regulated Navigation Areas (RNA) are authorized and implemented by 33 Code of Federal Regulations Part 165. The Port of New Orleans contains an RNA, described in 33 Code of Federal Regulations 165.810(c) that comes into effect during periods of high water. When the Mississippi River reaches 8 feet on the Carrollton Gauge on a rising stage, and until the Gauge reads 9 feet on a falling stage, all tugs and tows and all ships maneuvering in the vicinity of Algiers Point are governed by red and green one-way traffic lights. The lights are operated from two towers which are manned around the clock by Coast Guard Light Operators.

The Governor Nicholls Light Tower ("Governor Nick" to local mariners) is located on the left descending bank at approximately mile 94.3 AHP and commands a view of the river on both sides of Algiers Point. The Governor Nicholls tower shows lights which are visible to all vessels on either side of Algiers Point. The Gretna Light Tower is located on the right descending bank at approximately mile 96.6 AHP and shows lights which are visible to vessels which are upstream of Algiers Point only. All the lights flash once every second.

From downstream, the Gretna light shows always green. When a vessel approaches Algiers Point, a green light displayed ahead of a vessel (in the direction of travel) indicates that Algiers Point is clear and the vessel may proceed. A red light displayed ahead of a vessel (in the direction of travel) indicates that Algiers Point is not clear and the vessel must not proceed. Any absence of lights is to be treated as a danger signal and the vessel operator must not attempt to navigate through the area. During a red light situation, upbound vessels must hold position below Algiers Point (about mile 94 AHP); downbound vessels must hold position above Algiers Point (about mile 96 AHP). In all cases, vessels waiting for a change of signal must keep clear of vessels proceeding in the opposite direction.

The RNA applies to all tugs with tows and all ships, whether under their own power or in tow, but excludes tugs or towboats without tows or river craft of comparable size and maneuverability operating under their own power, in the vicinity of Algiers Point. Small towboats and other vessels which are not constrained by their draft are not required to obey the RNA if they can act as give-way vessels and comply with Inland Navigation Rule 16. During high water, the Light Operators carry COTP authority and vessel operators must comply with their direction. At other times, Light Operators act in an advisory capacity. As a condition of employment, Light Operators must hold Coast Guard licenses as pilots for these waters. It is customary for a vessel pilot to contact the Light Operators via radio prior to entering the Port of New Orleans area to identify his vessel, report his position and speed and discuss his intentions.

On the day of the allision, the river stage was 12.5 feet on the Carrollton gauge and had been above 8 feet since 19 November 1996. The RNA was in effect and the traffic control lights had just been switched to show green for down-bound vessels, in preparation for the BRIGHT FIELD's transit. There were no deep draft vessels or large tows underway within the harbor area that would hinder the BRIGHT FIELD's intended transit around Algiers Point. Mr. [redacted] was on watch in the Governor Nicholls Light Tower and Mr. [redacted] was on watch in the Gretna Tower.

Although there is nothing that the Coast Guard Light Operators could have done to prevent this accident, they nonetheless served a crucial function in protecting life and property during this incident. The Pilot was able to notify a single point-of-contact who was in turn able to send a warning to passenger vessels and property tenant security personnel in the path of the BRIGHT FIELD. Following the casualty, the Light Operators notified the Marine Safety Office and local emergency responders to expedite the response. They also helped stabilize the situation by coordinating the efforts of tugs arriving at the scene to hold the BRIGHT FIELD to the pier.

During the post-casualty interviews and testimony of the Gretna and Governor Nicholls Light Operators, they were questioned about their duties and the equipment available for their use. It appeared that the operators relied upon their personal experience and local knowledge to make the proper notifications. According to the Light Operators, some of the equipment at the lights needed to be updated, including new radars, the ability to record radar images and VHF-FM radio conversations, video cameras and environmental controls such as window tinting to improve operator visibility.

The regulations for that part of the Regulated Navigation Area in the vicinity of Algiers Point, found in 33 Code of Federal Regulations Part 165.810, do not specifically require vessels to contact the Governor Nicholls and Gretna Light Operators on VFH-FM channel 67 to discuss their intentions. Use of the VHF-FM radiotelephone is not discussed, although alternatives such as whistle signals and contact via telephone are mandated for certain circumstances.

3. Water Depth in the Area of the Allision.

Soundings and bottom profiles were done on 12 December 1996 and 3 February 1997. The soundings were taken at eight locations along the Upper and Lower Poydras Street Wharves in the area where the BRIGHT FIELD came to rest. The bottom profiles were done perpendicular to the pier front at several locations. All of the soundings and profiles were measured relative to the "0.0" elevation, a reference point independent of the actual water level that is used to measure vertical distances, including the water depth or gauge. All depth estimates given below are based on the reported river gauge of 12.5 feet on 14 December 1996 (Example: a sounding of 34.7 feet plus a river gauge of +12.5 feet equals a water depth of 47.2 feet).

Seven of the eight soundings along the pier front were done in an area subject to regular maintenance dredging and indicated the water depth adjacent to the pier ranged from 46.2 to 48.2 feet. The area examined included the original allision point.

The locations of the bottom profiles along the river bank were measured relative to geographic reference stations located 100 feet apart (Example: a point 48 feet north of reference station 423 is indicated as 423+48). The original allision point was at about 428+00; the BRIGHT FIELD's bow came to rest at about 432+70 while the stern was at about 425+35. One profile was done at 433+00, about midway between the bow of the BRIGHT FIELD and the bow of the QUEEN OF NEW ORLEANS, in an area not normally dredged. The water depth along side the pier front was 7.5 feet and slowly increased to about 13.5 feet at the approximate centerline of the BRIGHT FIELD (about

55 feet off the pier face) and continued to increase in depth to about 26.0 feet at an estimated 100 feet off the pier face. This is far shallower than the BRIGHT FIELD's original forward draft of 11.96 meters (39.24 feet).

A second profile was done 100 feet further upriver at 432+00, about 70 feet aft of the BRIGHT FIELD's bow and just down river from the area subject to maintenance dredging. The water depth slowly increased from 34.0 feet along the pier face to about 38.0 feet at a point about 35 feet off the pier face. From that location, the water depth rapidly increased to about 42.5 feet, in the area where the BRIGHT FIELD's hull came to rest, then decreased again to about 38.0 feet.

The other bottom profiles were done further upriver, between 423+00 and 432+00, in the area subject to maintenance dredging and including the rest of the distance along the pier face where the BRIGHT FIELD came to rest. The average water depth was about 37.5 feet at the pier face and rapidly increased until it leveled out at 45.5 feet.

CAPT [redacted] is a local senior pilot who has been active in local discussions concerning gaming vessel safety. On 12 November 1993, he appeared before the Congressional Coast Guard and Navigational Subcommittee at Baton Rouge regarding navigational safety concerns involving the introduction of gaming vessels on the Lower Mississippi River. He testified that allowing the bottom to shoal up under and near gaming vessels moored in the Mississippi River is one of the safety options that has been debated locally. He testified at the Marine Board that grounding in the relative shallow area near the QUEEN OF NEW ORLEANS' moorings helped to stop the BRIGHT FIELD.

4. Current Velocity and Flow Characteristics in the Area of the Allision.

On 17 December 1996, Coast Guard investigators conducted a study to measure the river's surface current between mile 96 AHP and mile 95 AHP. Using two drift buoys, a Coast Guard vessel made four deployments of each buoy for a total of eight. All deployments started at mile 96 AHP and were made at the center of the channel and at locations nearer the right and left descending banks. Two deployments were disregarded after the buoys were caught in an eddy shortly after their release. The average surface level current observed was 3.5 knots (4.0 statute miles/hour).

The results correlated closely with a current study conducted by the Army Corps of Engineers in January 1991 for river velocities at New Orleans relative to the Carrollton Gauge. Mean surface velocities observed were 3.9 statute miles/hour at a river level of 12 feet on the Carrollton Gauge and 4.2 statute miles/hour at 13 feet on the Gauge.

From approximately mile 94.3 AHP to about mile 96.5 AHP, there is a variable reverse current which flows typically along the left descending bank and can extend as much as 245 meters (800 feet) off the bank. The Marine Board interviewed three senior pilots concerning various facets of local knowledge and practices; see Appendix 7 for additional information on their experience and qualifications. The three pilots indicated that pilots are aware of this reverse current and try to avoid it during high water because of adverse steering effects. In the vicinity of the Crescent City Connection Bridges, there is also a "set" which may cause downbound vessels to veer to port. Pilots are aware of the tendency and may use it to their advantage while setting up for the right hand turn at Algiers Point.

5. Army Corps Of Engineers Computer Simulation.

The Marine Board requested the Army Corps Of Engineers (ACOE) attempt to duplicate the BRIGHT FIELD's movement using a computer simulation of the Mississippi River in the area of the Port of New Orleans. The purpose of the simulation was to attempt to determine the point at which the vessel could no longer recover steerageway and avoid an allision with the left descending bank.

The ACOE simulation was inconclusive in that the projected path of the vessel was not consistent with the actual path of the vessel. This variation is attributed to the accumulated effect of a number of differences between the model and the actual incident. As an example, the model does not include two actual conditions reported by CAPT [redacted] and the other pilots; the crosscurrent or "set" in the area of the Crescent City Connection Bridges or the reverse current along the left descending bank.

6. Use of Escort Tugs.

Carlyle J. Plummer, in his book, Ship Handling in Narrow Channels (Cornell Maritime Press, Cambridge, Maryland, 1978), explains the difficulty in having tug assistance in a bend. "... aside from being a very vulnerable position, the tug is where she can render practically no worthwhile assistance. If the ship has much headway, the tug is unable to work up to where she can shove in on the hip to a sufficient degree; but instead can only shove ahead -- an undesirable action. And if the ship's headway is only reduced sufficiently to enable a tug which has exceptionally good rudder power to work up to where she is nearly at right angles to the ship's heading, her pushing will be materially offset by the dragging effect caused by the tug being broadside to the direction in which the ship is making headway."

All three pilots agreed that, at the estimated speed of about 16 MPH over ground the BRIGHT FIELD was traveling prior to the loss of propulsion, conventional tugs could not have brought the vessel under control prior to the allision. They were asked to address four scenarios for the use of tugs to escort deep draft vessels through the Port of New Orleans.

Using Escort Tugs made up to Deep Draft Vessels.

According to the pilots, such a plan would not be practical because the tugs currently in use on the river are only adequate to assist deep draft ships when barely making way or maneuvering at slow speeds. They are limited by speed and power, more likely to be dragged by the deep draft vessel than merely tethered by the hawser, and thus at great risk to trip and sink.

Using Escort Tugs Accompanying Deep Draft Vessels.

The primary concern was the inability of most tugs on the Mississippi River to keep pace with a deep draft vessel operating at the speeds normally required for effective maneuvering. Also, assuming that a conventional tug were capable of maintaining an estimated 16 MPH over ground and escorting the BRIGHT FIELD, the brief period between the loss of propulsion and the allision was insufficient to close with the vessel, pass the towing hawser and begin exerting an effective hawser pull.

Staging a "Rescue Tug" at Algiers Point.

The pilots felt that staging a quick response tug it the vicinity of Algiers Point would not be a practical option because the tug would not be able to get underway and arrive in time to take action.

Use of Tractor Tugs.

None of the pilots had experience in working with tractor tugs and were not aware of any tractor tugs being tested or operating on the Mississippi River.

7. Marine Casualties on the Lower Mississippi River.

The Port of New Orleans straddles the section of the Mississippi River from approximately mile 85 to mile 108 Above Head-of-Passes (AHP). A port and waterways risk assessment study completed by Louisiana State University in 1995 reported that the Port's densest traffic time period is 1200-2000. Data gathered for 1994 showed that approximately 45,000 vessel pass through New Orleans Harbor yearly. This study predicted approximately 2.24 vessel incidents per month could be expected. The study showed that over a 10-year period, between miles 80 and 106, 15.6 collisions occurred per year. Moreover, the study also estimated 4.54 allisions per year in the section from mile 91 to mile 101 AHP.

A Coast Guard study of casualties in the Lower Mississippi River, covering the years 1993-1996 inclusive, revealed that one of the areas of concentration for vessel casualties is mile 85 to mile 110. Loss of vessel control is cited as the dominant casualty event for freight and tank vessels with a total of 205 incidents for the '93-'96 period (approximately 50 per year or 1 per week). The study further emphasized that freight ships have a high incidence of loss of vessel control, especially within the Port of New Orleans area.

A near-casualty almost identical to the BRIGHT FIELD allision occurred on 10 February 1997 and involved the Chinese flagged freight vessel GAO ZHOU HAI (L9055967). In size, tonnage and horsepower, this vessel is almost identical to the BRIGHT FIELD and as with that vessel, a radar image and radio communications of the GAO ZHOU HAI's transit was recorded by the tug LOCKMASTER. While down bound through the Port of New Orleans, the pilot became concerned because the main engine was not accelerating as rapidly as he needed and requested tug assistance. According to the pilot, the main engine was only producing about HALF AHEAD. The radar image clearly shows the effect of a "set" or lateral current in the vicinity of the Crescent City Connection Bridges. As the radar image of the GAO ZHOU HAI became visible below the down river span of the bridges, the bow of the vessel moved sharply to the left much as the BRIGHT FIELD's bow had done. In this instance, the master and pilot had enough power available to correct the vessel's course and continue down river. The apparent cause of the inadequate acceleration was the vessel's load control program.

All three of the pilots testifying as expert witnesses were federally licensed but only CAPT [redacted] served exclusively as a Federally licensed pilot. The other two pilots (CAPT [redacted] and CAPT [redacted] hold state issued commissions. CAPT [redacted] testified that while piloting an estimated 200 vessels each year he had never witnessed a propulsion failure aboard a vessel he was piloting in his 17 years as a pilot. The state-licensed pilots testified to having experienced numerous propulsion failures aboard vessels they were piloting. All three regularly pilot vessels with automated propulsion; the only difference being that the federally licensed pilot works aboard U. S. flag vessels subject to the automation inspection and testing requirements of 46 Code of Federal Regulations 61.40, while the state-licensed pilots work almost exclusively aboard foreign flag vessels subject to Chapter II-1, Part E of the SOLAS Convention, which does not provide specific guidance on automation inspection and testing.

CAPT [redacted] testified that the Crescent River Port Pilots Association uses a Vessel Deficiency Card system to document minor problems they encounter aboard vessels while serving as Pilots. Completed cards are forwarded to the Association's Board of Commissioners for incorporation into a database that can be used to determine, among other things, if a vessel is prone to certain problems. He felt a system such as this could be implemented on a national basis. He also stated the opinion that if he could access a vessel's casualty history on the Coast Guard's Marine Safety Information System, it would be used on a regular basis to evaluate the risks associated with piloting a specific vessel.

8. Anchors; Preparedness & Effectiveness in Loss of Power Casualties.

33 Code of Federal Regulations 164.11(o) requires that when underway on the navigable waters of the United States, a vessel's anchors must be ready for letting go. However, there is no specific requirement for an anchor watch. In the vicinity of the Port of New Orleans there is an ordinance adopted by the Board of Commissioners of the Port of New Orleans in 1969. It states in part "...making it unlawful for any master, or other person acting in said capacity, of an ocean or sea-going vessel underway and navigating within the harbor, rivers, canals and inland waters within the territorial limits of the Parishes of St. Bernard, Orleans and Jefferson, State of Louisiana, to so

navigate said vessel without at all times maintaining an anchor standby of at least one (1) competent seaman, stationed in the fore part of the vessel at the anchor windlass, and to provide penalties for the violation thereof." The Pilot testified that the BRIGHT FIELD was at about mile 110 when he told the Master to send someone forward to man the anchor windlass. By this point in the transit, the vessel was already well inside Jefferson Parish, and in apparent violation of the above ordinance. The Pilot's testimony would seem to indicate a local convention to man the standby anchor only in the vicinity of the Port of New Orleans.

As the BRIGHT FIELD's allision appeared inevitable, the Pilot began sounding the danger signal on the ship's whistle and ordered the port anchor let go. The Master concurred with this order and attempted to relay it to the Carpenter who was on the bow. The Master testified that he felt that dropping one or both anchors would merely have slowed the ship's momentum.

A discussion of the effectiveness of stopping a ship by dropping anchors is contained in Daniel H. MacElrevey's book Shiphandling For The Mariner, (Cornell Maritime Press, Centerville, Maryland, 1995). He states, "There is a common misconception, especially in an emergency, that a large amount of chain should run out so the anchor digs in and stops the ship. To stop a vessel in this manner would require the relatively small brake on the windlass to overcome the inertia of the entire moving mass of your ship. It will never happen! The brake will probably burn out and all the chain will run out while the ship continues moving ahead. If the brake does hold, the chain often parts as it comes tight. It is most unlikely that a chain would be able to withstand the shock load and almost instantaneously stop a moving ship as it would be required to do if the anchor is allowed to dig in hard."

Pilots [redacted] and [redacted] testified concerning the effectiveness of dropping anchors at the speed the BRIGHT FIELD was traveling at the time of the casualty. They stated that anchors are normally released when the vessel has little or no headway and the windlass friction brakes are designed to control the anchor's rate of fall, not to stop a 68676 dead-weight-ton vessel moving at any significant speed. Their primary concern is that if an anchor should foul on the bottom, the vessel's momentum will overpower the friction brake and pull the entire chain free of the vessel. There is also the potential for more serious damage from the hull striking the anchor or by ripping the windlass from its foundation.

9. Vessel Event Recorders.

At this time, Vessel Event Recorders (VERs) are not required by the International Maritime Organization (IMO) in SOLAS Chapter V (Safety of Navigation) or by the Coast Guard in 33 Code of Federal Regulations Part 164. In 1993, the IMO considered VERs but determined they were too complex to justify a requirement for their use. Since then, improved technology has expanded VER capability and more marine companies are installing these systems as means of monitoring bridge watchstanding performance and conducting accident reconstruction.

A number of recent marine casualties, particularly the grounding of the Liberian passenger vessel STAR PRINCESS on Poundstone Rock, Lynn Canal, Alaska on 23 June 1995, have demonstrated the value of VERs in marine casualty investigations. As an example of a modern VER system's capabilities, the STAR PRINCESS's system was capable of recording time, global positioning system (GPS) position (latitude and longitude), course, heading, speed made good over ground, RADAR data and audio data from several microphones located on the vessel's bridge.

The Marine Board was able to use the testimony of the BRIGHT FIELD's Pilot and Bridge crew, as well as the tug LOCKMASTER's videotape and videotapes made by persons ashore to reconstruct the vessel's path and the sequence of events, but with less precision than a VER record would have allowed.

p. Communications.

1. External Communications.

The Pilot used his personal hand-held VHF-FM radio to establish meeting agreements with a number of other vessels during the transit. He also used his radio to contact the Coast Guard Light Operators prior to entering the Port of New Orleans and to broadcast warnings after the loss of propulsion. Neither the Pilot or the Light Operators reported any difficulties making contact via radio.

2. Internal Communications on the Bridge.

The Pilot testified that he was able to establish adequate communications with the Bridge crew for the purposes of vessel navigation; the Master was able to speak and understand English, with a limited vocabulary, and the Helmsman and Mate-on-Watch did not misinterpret any helm or engine commands. According to the Pilot, he was aware of a potential for communications difficulties when the crew's primary language is not English and intentionally used a simplified vocabulary and spoke slowly and clearly.

Testimony of the Pilot and Bridge crew was that the Helmsman and Mate-on-Watch consistently followed good marine practice by repeating helm and engine commands twice; first to acknowledge the order and then to report achievement. Bridge crew communication was less effective in keeping the Pilot aware of other actions affecting the navigation of the vessel, such as transferring main engine control between the Bridge and the Engine Control Room and the Master's instructions (in Chinese) to the Chief Engineer following the loss of propulsion.

3. Communication Between the Bridge and Engine Control Room.

The vessel's internal telephone system was the normal mode for verbal communication between the Bridge and Engine Control Room. There was no testimony provided of difficulties encountered in using the telephone system.

4. Communication Between the Bridge and the Anchor Detail.

The normal mode of communication was through hand-held radios operating on frequencies that did not interfere with those in use by the Pilot.

q. Regulatory and Miscellaneous Issues.

As part of the investigation, the Marine Board examined a number of issues of interest that are not discussed elsewhere in the report. Those issues are discussed below.

1. Standard Operating Procedures for use of Automation Overrides.

During the attempts to restart the main engine and restore steerageway, neither the Bridge crew or the engineers activated the override functions for the BRIGHT FIELD's load control program, possibly limiting their ability to increase engine RPM rapidly. As part of the investigation, the Marine Board reviewed the Coast Guard and SOLAS Convention Regulations for manual overrides of automatic operational controls to determine what guidance, if any, is available on overriding of load control programs.

The SOLAS Convention Regulations do not discuss situations where use of overrides might be appropriate. There also is no mention of a requirement for preparing a standard operating procedure to guide a vessel's crew in use of the overrides. Neither 33 Code of Federal Regulations Part 164 or 46 Code of Federal Regulations Part 62 address a requirement for a standard operating procedure for the use of the override function of automation systems.

There is no evidence that COSCO has provided its vessel crews with a standard operating procedure on the use of automation overrides. Because of the potential for adverse impacts on the machinery when using an override function, there may be a reluctance on the part of a vessel's crew to do so. Such a standard operating procedure would be helpful in guiding a crew's decision to employ the automation override.

2. Tests Before Entering or Getting Underway.

The Third Mate testified that he did not conduct pre-departure tests of the Bridge engineering automation alarms prior to the BRIGHT FIELD getting underway on 14 December 1996. 33 Code of Federal Regulations 164.25(a)(2) requires testing of "All internal vessel control communications and vessel control alarms". There have been significant advances in engineering automation since 1984, when this section of the regulations was last revised. It is not clear on its face whether this requirement is intended to include engineering automation alarms.

3. Availability of Engineering Automation Test Procedures and Records.

The Marine Board also reviewed SOLAS Convention and Coast Guard Regulations, along with DNV Rules, concerning the availability of engineering automation test procedures and records. SOLAS Convention Regulations do not specifically require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board integrated automation test procedures approved by the vessel's flag administration or classification society; they are required for the initial trials only. Similarly, while DNV Rules require test procedures acceptable to DNV must be aboard, their Rules do not mandate that the test procedures bear a DNV approval stamp. With respect to U. S. flagged vessels, 46 Code of Federal Regulations 61.40 clearly requires Coast Guard-approved test procedures and test records be available on board. 33 Code of Federal Regulations 164.33, titled "Charts and Publications", does not discuss requirements for automation test procedures or any other engineering-related documents that could impact vessel navigation safety.

4. Live Bridge Watches within the Port of New Orleans.

An area of interest during the investigation was the presence of live Bridge watches aboard vessels moored within the Port of New Orleans. The Marine Board was unable to find any Federal, state or local regulations mandating a live Bridge watch aboard commercial vessels moored within the Port of New Orleans. Although there is no regulatory requirement to do so, Marine Safety Office New Orleans had already required a live Bridge watch on board the QUEEN OF NEW ORLEANS, among other vessels, whenever passengers were aboard. That requirement was vindicated by the role the Bridge watch played in expediting the evacuation actions aboard the QUEEN OF NEW ORLEANS.

5. Engineroom Manning Requirements aboard the BRIGHT FIELD.

SOLAS Convention Regulations dealing with automation systems do not discuss the issue of manning the engineroom while navigating in restricted waters. Coast Guard Regulations do not discuss the manning of enginerooms aboard bulk freight vessels such as the BRIGHT FIELD. The only Coast Guard Regulation on this issue is found in 33 Code of Federal Regulations 164.33(b), which requires tank vessels to have an engineering watch consisting of at least a licensed engineer physically present in the machinery spaces or in the main control space whenever navigating.

6. ISM and STCW Issues.

The International Safety Management (ISM) Code was adopted on 4 November 1993 and becomes mandatory for bulk cargo carriers not later than 1 July 1998. To be in compliance with the Code, both the company and the vessel are required to have a

Safety Management System (SMS), with the SMS audited by a third party and compliance shown through issuance of certificates by the third party. COSCO (H.K.) Shipping Co., Limited has implemented their SMS, which primarily covers their shore side safety management practices, and it has been audited by the China Classification Society and the American Bureau of Shipping, resulting in the issuance of an ABS Document of Compliance dated 19 September 1996.

Although COSCO has made significant progress in implementing their SMS for other vessels operated by them, they did not begin the certification process for the BRIGHT FIELD until 19 May 1997. American Bureau of Shipping will also be the issuing authority for the BRIGHT FIELD's Certificate of Compliance.

The BRIGHT FIELD was not subject to the requirements of the Seafarers' Training, Certification and Watchkeeping (STCW) Code at the time of the casualty. The 1995 amendments, and the STCW Code, were accepted on 1 August 1996 and entered into force on 1 February 1997.

During Coast Guard investigator's interviews with the Master, he stated that he felt the Pilot did not have adequate control of the vessel as it transited through the various points and bends on the Mississippi River. This opinion may have been expressed by the Master because he had limited experience in navigating rivers under these conditions (with currents of this magnitude and in an older river system with large bends). Also, the local custom of vessels establishing starboard to starboard meeting situations is probably foreign to most masters and probably causes some anxiety if not discussed beforehand with the local pilot. This situation (language difficulties, unique river system and starboard to starboard meetings) could work against the principles of a sound bridge management team if the team members are not knowledgeable in how the pilot will generally navigate this challenging river system.

7. DNV Verification of Critical System Sensors and Programming.

The Marine Board reviewed the Det Norske Veritas Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" concerning testing of vital automation systems by the Surveyor during annual and renewal surveys. The Rules do not specifically require the Surveyor to verify the calibration of sensors and the accuracy of system programming for those alarm conditions that result in an automatic trip or slowdown. On almost all survey items, the extent of the examination and testing is left to the discretion of the Surveyor.

8. Physical Security of the Investigation Site.

As soon as the Coast Guard's emergency response operations ended and the situation stabilized, Marine Safety Office New Orleans investigators took action to control the scene and preserve evidence. Security guards were posted at the gangway to control access to the vessel. Because of the loss of propulsion aspect there was significant interest in restricting access to the engine room, however, selected members of the crew had to retain access to ensure the safe operation of the ship's service generators and other critical systems. Based on evidence that portions of the automation system were repaired or re-calibrated without the knowledge or concurrence of the investigators, it appears that physical control over the engine room was not fully effective.

V. POST-CASUALTY IMPROVEMENT ACTIONS

a. Changes to Passenger Vessel Certificates of Inspection

On 23 December 1996, the Commander, Eighth Coast Guard District issued guidance to Captains of the Port (COTP) to assess the practices of passenger vessels in their zones. COTPs were directed to identify all passenger vessels situated in a waterway where they could be endangered by other ship or towing vessel traffic and to consider issuing COTP Orders to such vessels requiring them to maintain a constant Bridge watch whenever passengers were embarked and to maintain a constant monitoring watch on VHF-FM channel 16 and other bridge-to-bridge frequencies, as appropriate.

Additionally, this Bridge watch should be able to alert passengers and other crew and have the ability to direct initial action in the event of an emergency. In March 1997, COTPs were urged to make more permanent changes by modifying the Certificates of Inspection of the United States flagged passenger vessels to contain these requirements. This action has already been taken for certain passenger vessels in the COTP New Orleans zone.

While this guidance has established a Bridge watch standard for high capacity passenger vessel operations on the Western Rivers and the western Gulf Coast, there are a significant number of similar vessels operating on other waters that may face similar potential dangers yet are not required to maintain a live Bridge watch. There is a need for a national policy on protective measures that encompasses active measures such as live Bridge watches and other methods that will provide a level of passive protection to vessels at risk of allision in certain restricted waterways.

The Coast Guard has also published Notice of Proposed Rulemaking CCGD08-97-020 to revise the existing Regulated Navigation Area in the COTP New Orleans zone, described in 33 Code of Federal Regulations 165.810. This revision will include the requirement for live Bridge watches aboard passenger vessels with passengers embarked but does not specifically address the role and duties of the watchstander in initiating evacuation actions.

b. Coast Guard-Industry Quality Action Team.

In May 1997, the Commander of the Eighth Coast Guard District chartered a joint Coast Guard-Industry Quality Action Team to study the standard practices of ships' crews while transiting the Lower Mississippi River. The Team examined Prevention Through People issues. The Team's recommendations were completed in November 1997 and focused on improving general safety and reducing risk to the public and the environment from the large volume of ship traffic on the Lower Mississippi River.

The Team was formed to address problems involving the loss or reduction of control aboard deep draft vessels operating in the River. Numerous incidents of this type have occurred in recent years and there is sufficient data to examine the issue and develop cooperative or regulatory measures to prevent problems and reduce risk. Among the issues that the Team is considering are:

1. Engine Room Manning.

Many ships are equipped with various levels of engine room automation. The Team will examine the effects of increased automation on the safety of vessels during transits in the narrow confines of the Lower Mississippi River.

2. Fuel Selection.

The Team will examine whether the practice of shifting from light fuels to heavy fuels is contributing to the high number of power losses or power irregularities occurring during transits of the River.

3. Tug Assists.

The Team will examine the feasibility of using tug assists during deep draft vessel transits around Algiers Point in New Orleans, or any other historically high risk areas.

4. Port State Control Boarding Program.

The Team will examine whether the Coast Guard's local port state control examinations should be modified to place more emphasis on the factors contributing to problems on the Lower Mississippi River.

c. Development of Vessel Traffic Service Requirements.

In response to direction from Congress in the Fiscal Year 1997 Appropriation to "begin an analysis of future Vessel Traffic Service (VTS) system requirements," the Commandant of the Coast Guard directed the establishment of the local "Ports and Waterways Safety System" project for the New Orleans area. In August 1997, the Coast Guard released the draft statement of work for the Ports and Waterways Safety System (PAWSS), a new system designed to reduce the number of vessel accidents in ports and busy waterways by providing ships with up-to-the-minute data on traffic conditions on the water.

PAWSS would use off-the-shelf products that would automatically collect, process and disseminate information on the movement and locations of ships in ports and on busy waterways such as the Mississippi River. The system is based on Automated

Identification System (AIS) technology that depends on transponders on board ships to collect and transmit information on a ship's location, speed and direction.

While there is no existing requirement for vessels to purchase and install transponders, the Coast Guard intends to buy about 100 transponders to be installed on private ships under a separate contract to test AIS technology. A Vessel Traffic Service facility will use the transponder data, surveillance sensors and other sources to monitor traffic on the water. PAWSS is scheduled to operate in the Port of New Orleans in 1998. The Project Manager indicates that "New Orleans will get the system first because it is the busiest port, and we also [decided] it would get the greatest benefit from the system."

Working under the auspices of the Lower Mississippi River Waterways Safety Advisory Committee, an ad hoc committee of local government and marine industry experts was formed to develop baseline system requirements for a VTS for the Lower Mississippi River.

The ad hoc committee was chartered by the Commander of the Eighth Coast Guard District in his capacity as sponsor of the Advisory Committee. It was comprised of local representatives from the Federal Government, the State of Louisiana, marine industry associations, port authorities, and pilot associations. The committee was charged with evaluating existing VTS technology for the purpose of recommending to the District Commander user-based requirements for a baseline VTS system to enhance safety on the Lower Mississippi River. The committee considered the technical aspects of a VTS system, leaving the issues of funding, manning and acquisition for later development.

The ad hoc committee completed its mission in April 1997 and delivered to the District Commander a comprehensive report recommending user requirements for a baseline VTS system. The report recommended nineteen system capabilities, based on user information needs, that a VTS for the Lower Mississippi River should contain. In May 1997 the report was forwarded to the Commandant for use in developing the architectural requirements for the VTS system.

With the completion of the PAWSS project in April 1997, the District Commander disbanded the PAWSS Ad Hoc Committee and formed a VTS Task Force. The Task Force provides expertise in reviewing the technical design aspects of the VTS system being developed for the Lower Mississippi River. Task Force membership is from the Coast Guard and marine industry, and is being coordinated by the Eighth District's Marine Safety Division. The Task Force's first meeting was held in June 1997. The Task Force continues to provide valuable input into the design process through participation in periodic meetings in New Orleans. A test of the transponder-based VTS system will be conducted on the Lower Mississippi River during the Summer of 1998.

d. Guidance on Vessel Anchoring Capabilities.

In February 1997, the USCG Captain of the Port New Orleans issued a notice reminding mariners of federal safety requirements in 33 Code of Federal Regulations

Part 164 regarding vessel anchoring capabilities. The notice issued the following guidelines to mariners that must be followed to meet this requirement:

1. Man the vessel's foredeck with sufficient, qualified personnel to quickly release and control both anchors.

2. Provide an effective means of communication between bridge and foredeck.

3. Maintain anchors, and anchor equipment such that both anchors are ready for quick release.

4. If anchors will not free-fall from the hawespipe, they must be walked out and maintained in a position ready for quick release.

5. Schedule appropriate personnel relief during long transits.

e. Establishing of Temporary Regulated Navigation Area.

On 18 March 1997, the Coast Guard established a temporary Regulated Navigation Area affecting down-bound tows on the Lower Mississippi River from mile 88 to mile 437 AHP. These regulations were later amended to include operating requirements for vessels of 1600 gross tons or greater and incorporated in the proposed Notice of Proposed Rulemaking CCGD08-97-020. The order requires:

1. The engine room shall be manned at all times while underway in the Regulated Navigation Area.

2. Prior to embarking a pilot when entering or getting underway in the Regulated Navigation Area, the master of each vessel shall ensure that the vessel is in compliance with 33 Code of Federal Regulations 164.

3. The master shall ensure that the chief engineer has certified that the following additional operating conditions: the main propulsion plant is in all respects ready for operations including the main propulsion air start systems, fuels systems, lubricating systems, cooling systems and automation systems; cooling, lubricating and fuel oil systems are at the proper operating temperatures; automatic or load limiting main propulsion plant systems are operating in manual mode with engines available to immediately answer maneuvering commands; and main propulsion standby systems are ready to be immediately placed in service.

f. Riverfront Alert Network.

In March of 1997, the Captain of the Port of New Orleans and the Board of Commissioners of the Port of New Orleans signed an agreement which put into effect the Riverfront Alert Network. The Network is an 800 MHz emergency radio alerting and communications system installed at the Governor Nicholls Vessel Traffic Light control tower, the Port of New Orleans Harbor Police Third Street Station and at key property locations in the port. The network provides the capability to alert the Harbor Police and property tenants during a vessel abnormality or irregularity that may arise in the Algiers Point Regulated Navigation Area.

To activate the system, the Governor Nicholls Light Operator presses a button on his radio transceiver to transmit an 800 MHz warning tone. Following the tone, the Light Operator can then transmit a short verbal warning announcement to the Port of New Orleans Harbor Police and other system participants detailing the nature of the emergency. The Riverfront Alert Network is also designed to provide two-way radio communications between the Light Operator and system participants.

The Riverfront Alert Network is not intended to include direct notifications to vessels moored or operating within the Port of New Orleans. 33 Code of Federal Regulations Part 26.03(e) includes requirements for vessels that must be equipped with a radiotelephone that are operating on the Lower Mississippi River and adjacent waters. These waters include the Port of New Orleans and the regulations require these vessels to have on board a radiotelephone capable of transmitting and receiving on VHF-FM channel 67 when operating within the Port. 33 Code of Federal Regulations Part 26.04(d) mandates that if a listening watch is required to be kept, VHF-FM channel 67 is the designated frequency for these waters. Notice to vessels will be made through informational broadcasts on VHF-FM channel 67 by the Governor Nicholls or Gretna Light Operator, leaving the Riverfront Alert Network free to make timely notifications to shoreside personnel.

The Standard Operating Procedures for Algiers Point Light Operations, which establishes the Captain of the Port's policy for operation of the lights, have been revised to clearly indicate the Light Operators have been delegated COTP authority to direct vessel operations and activate the Riverfront Alert Network.

g. The Mississippi River Crisis Action Plan.

In November 1996, the Eighth Coast Guard District, the Army Corps of Engineers Lower Mississippi Valley Division, and the River Industry Executive Task Force signed an agreement issuing the Mississippi River Crisis Action Plan. This plan was developed to ensure government and industry coordination during crisis response on the inland rivers (Note: For the purposes of this plan, "inland rivers" refers to those navigable waterways tributary to the Mississippi River and that portion of the Mississippi River above the Baton Rouge area where deep draft vessels do not normally operate).

In light of the record high waters on the Lower Mississippi River during March and April of 1997, the Gulf Region Quality Steering Committee recommended that a similar document be developed for the Lower Mississippi River. The Commanding Officer of Marine Safety Office New Orleans has been tasked by the Commander of the Eighth Coast Guard District with leading a group of Coast Guard and industry representatives in developing this plan.

The plan is due to be completed by November 1997 and will be a comprehensive plan designed to coordinate government and industry action during high water on the Mississippi River. It will contain information on each agency's authorities and responsibilities, voluntary and regulatory safety measures to be implemented in a crisis, trigger points for enhanced safety measures, information regarding unique characteristics and hazards on the Lower Mississippi River, and a list of resources that can be utilized in a crisis. The River Crisis Action Plan developed for the inland rivers will be amended to include the portion being developed for the Lower Mississippi River, creating a single plan that will address crises along the entire length of the Mississippi River and on the western rivers.

h. Review of Vessel Evacuation Procedures.

Marine Safety Office New Orleans is conducting a comprehensive review of the Evacuation Procedures (Moored Condition) for the QUEEN OF NEW ORLEANS to determine what, if any changes should be made to facilitate passenger evacuation. Lessons learned from this review may be applied to other vessels moored within the Port of New Orleans, if appropriate.

VI. CONCLUSIONS

1. The proximate cause of this casualty was the loss of main engine lubricating oil pressure to the main bearings which resulted in a main engine trip, causing the loss of propulsion and steerageway. The sequence of RPM loss, hard right rudder and full astern propeller all reduced water flow over the rudder, induced a hydrodynamic stall and prevented the Pilot and Master from regaining positive control of the BRIGHT FIELD.

2. Due to the type of condition which caused the main engine to trip, i.e. loss of lubricating oil pressure to the main bearings, there was no action that could have been taken by the Master or Chief Engineer to by-pass the trip and maintain propulsion.

3. The loss of main engine lubricating oil pressure was caused by a combination of the high level of particulate in the lubricating oil which led to the clogging of the 2nd lubricating oil filter; and air entrainment in the lubricating oil which resulted in the lubricating oil pump being unable to maintain pressure.

4. The testimony of the engineers that the main engine experienced an automatic slowdown instead of a main engine trip just prior to the allision is not supported by the evidence.

5. A contributing cause was that the #2 main engine lubricating oil pump had not been placed in standby mode. This prevented the pump from automatically starting and maintaining lubricating oil pressure above the automatic trip set point. The #2 main engine lubricating oil pump was manually started by one of the engineers. However, even if the #2 main engine lubricating oil pump had been placed in standby, it may have failed to automatically start, based on the testing of the pressure switch after the casualty.

6. A contributing cause was that an improperly calibrated lubricating oil pressure sensor prevented the Terasaki monitoring and alarm system from alerting the engineers in the engine room that lubricating oil pressure was dropping and a main engine trip was imminent.

7. A contributing cause was the failure of COSCO and the vessel's crew to properly address long standing problems (at least six months duration) with the main engine which led to the high level of particulate in the lubricating oil.

8. Continued operation of the main engine using lubricating oil which did not meet the engine manufacturer's specifications for viscosity and water content, and containing excessive particulate contamination is an indication of improper engineering plant operation and inadequate maintenance.

9. A contributing cause was the low volume of lubricating oil in the main engine sump at the time of the casualty. The main engine sump low level alarm was operable but had been adjusted to allow operation below the normal alarm set point without sounding an alarm.

10. A contributing cause was the failure of COSCO and DNV to ensure the vessel's automation system functioned properly. COSCO abdicated its responsibility, as the vessel operator, to maintain and test the automation system and instead relied on the DNV, through their surveys, to verify the automation system was working properly. DNV in turn allowed COSCO to dispense with the requirement for an active maintenance and testing program.

11. A contributing cause was the improper operation of the second lubricating oil filter differential oil pressure alarm, i.e. at the time of the allision it did not sound until the differential pressure was at least 1.3 kg/cm^2, well above the correct setting of 0.9 kg/cm^2 and consequently, the vessel's engineers were not alerted to this dangerous condition.

12. Letting go the anchors would have had minimal impact on the vessel's speed and the decision to not let go the anchor played no significant role in the allision.

13. The programming in the Terasaki WE3 monitoring system for the alarm channels examined, primarily the alarm set points and time delays, were for the most part consistent with the manufacturer's design and specifications. There is no evidence that improper programming of alarm channels contributed to the casualty, but the system's inability to record programming changes and the lack of sensor calibration records makes it impossible to eliminate improper programming as a contributing cause.

14. The Pilot and the vessel's crew were able to communicate successfully and the fact that English was not the crew's primary language did not contribute to this casualty.

15. Prior to the loss of propulsion, the Pilot and Master used the proper and necessary vessel speed to maintain vessel control under prevailing conditions.

16. The Master and Pilot took reasonable actions under the circumstances. It was fortuitous that the BRIGHT FIELD allided with the pier and not with the passenger vessels moored in the area.

17. International Convention for Safety of Life at Sea (SOLAS Convention) Regulations do not specifically require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board integrated automation test procedures which are approved by the vessel's flag administration or classification society.

18. SOLAS Convention Regulations do not specifically require vessels equipped with automation equipment for periodically unattended machinery spaces to have a standard operating procedure addressing the use of override arrangements for automatic slowdown or shutdown functions of the automation system and the need for periodic training and drills on the use of the override functions.

19. SOLAS Convention Regulations do not require vessels to have a Vessel Event Recorder (VER) installed. Had a VER been installed aboard the BRIGHT FIELD, it might have significantly enhanced the Marine Board's understanding of the sequence of events and the role that Bridge Resource Management may have played in this casualty.

20. COSCO policy requiring the engineroom to be manned resulted in quick and effective action to restore propulsion after the main engine tripped.

21. 33 Code of Federal Regulations Part 164 does not require manning of the engineroom on a vessel, other than a tankship, when the vessel is in restricted or maneuvering waters.

22. 33 Code of Federal Regulations 164.11(k) does not contain any requirements for informing the pilot of the availability of and procedures for use of engineering automation override functions.

23. 33 Code of Federal Regulations 164.11(o) is not clear as to whether or not an anchor detail is required when a vessel is underway on the navigable waters of the United States. There is no other published national policy on requirements for anchor details.

24. No alarms, indicating a problem with the main engine, sounded on the Bridge on 14 December 1996.

25. 33 Code of Federal Regulations 164.25(a)(2) is not clear as to whether the extension alarms required by Chapter II-1, Part E of the SOLAS Convention for vessels equipped with automation equipment for periodically unattended machinery spaces are included in the alarms to be tested prior to getting underway.

26. Coast Guard Port State Control Boardings do not normally include an examination of a vessel's engineering automation system or vessel records of drills and maintenance involving these systems.

27. 33 Code of Federal Regulations 164.33 does not contain any requirements for vessels to have on board test procedures, manuals or other documentation involving a vessel's engineering systems.

28. 33 Code of Federal Regulations 165.810 does not specifically require vessels operating within the Regulated Navigation Area to use VHF-FM channel 67 to contact the Governor Nicholls or Gretna Light Operators.

29. The presence of a sophisticated VTS system would not have prevented the allision. However, the rapid and effective actions taken by the Coast Guard Light Operators demonstrates the role that a VTS system can play in mitigating the impact of an incident such as this.

30. There is currently no mechanism available to pilots allowing easy access to vessel casualty records contained in the Coast Guard's Marine Safety Information System.

31. Repairs were made to the Bridge alarm panel sometime between the casualty and when it was subsequently tested by Coast Guard and NTSB personnel. These repairs were probably made by the vessel's crew.

32. The Coast Guard did not take sufficient action to preserve the evidence crucial to investigating this casualty, especially that related to the automation system. There was circumstantial evidence that certain pieces of equipment were tampered with, repaired or adjusted before testing of the automation system by Coast Guard and NTSB investigators was complete.

33. There is evidence that the Chief Engineer was negligent in that he failed to maintain an adequate volume of lubricating oil in the main engine sump and that he failed to align the #2 main engine lubricating oil pump so that it would start automatically in the event of low main engine lubricating oil pressure.

34. There is evidence that the Chief Engineer and possibly some of the other engineers made false statements under oath, specifically that the #2 main engine lubricating oil pump was in standby mode when it was actually in manual mode and that the automatic slowdown indicator light had lit at the time of the loss of propulsion.

35. There is evidence that the previous Chief Engineer [redacted] may have lacked the training and experience to properly maintain the BRIGHT FIELD's main engine in satisfactory condition and failed to maintain an adequate volume of lubricating oil in the main engine sump.

36. The Det Norske Veritas Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" do not specifically require verification of the proper calibration of all temperature and pressure sensors providing inputs to the automatic shutdown and slowdown functions of the automation system in conjunction with annual and renewal automation surveys.

37. Any of the four automation test procedures entered into evidence would have been acceptable for use as part of the Det Norske Veritas automation survey program.

38. The Det Norske Veritas Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" do not require the vessel to maintain the DNV-approved test program aboard the vessel and use it as the plan for systematic maintenance and function testing of the automation system.

39. At the time of the allision, COSCO had not fulfilled Det Norske Veritas requirements to remain in class. COSCO should have notified Det Norske Veritas of the continuing breakdowns and repairs to the main engine and the inoperative #1 monitor for the Terasaki WE3 alarm and monitoring system.

40. The Det Norske Veritas rules requiring vessel owners and operators to notify them of equipment casualties are vague and do not specifically address the critical vessel systems that should be reported immediately.

41. There was nothing inherently wrong with the design and construction of the main engine, main engine control system, engineering alarm and monitoring system, lubricating oil pumps and lubricating oil pump control system.

42. The Master did not inform the Chief Engineer of the emergency facing the vessel. Consequently, the Chief Engineer did not use the CRASH MANEUVER button to by-pass the scavenging air limit to increase the rate of main engine acceleration. It cannot be determined if the use of the CRASH MANEUVER button would have averted the allision.

43. COSCO did not provide the BRIGHT FIELD's crew with a policy on the use of the main engine automation system's override functions when responding to emergency situations such as loss of propulsion.

44. Had the BRIGHT FIELD been navigating with both main engine lubricating oil pumps operating simultaneously, it is highly unlikely that the main engine automatic trip would have occurred.

45. The BRIGHT FIELD's Master was unable to establish effective communications with the Carpenter, standing by the anchors, because the high decibel sounds generated by the sounding of whistle signals prevented the use of the only available means of communication, a hand held radio.

46. While the use of the anchors would not have been effective in this casualty, there are many scenarios where the use of the anchors would be effective if they are deployed rapidly.

47. Marine Safety Office New Orleans has conducted risk assessments of passenger vessels that operate within their zone and taken action, where appropriate, to require a live Bridge watch monitoring VHF-FM channel 67 when passengers are on board.

48. There are no Federal, state or local requirements that all commercial vessels moored within the Port of New Orleans with personnel living on board must maintain a live Bridge watch monitoring VHF-FM Channel 67.

49. There are a number of areas where the equipment and control systems for the Regulated Navigation Area's traffic control system could be improved to enhance the Light Operator's ability to monitor and control vessel traffic.

50. Marine Safety Office New Orleans has initiated a review of the QUEEN OF NEW ORLEANS manual for Emergency Evacuation Procedures (Moored Condition) to establish evacuation standards for the vessel.

51. Other than the Coast Guard's Marine Safety Information System, there is no national database listing vessel casualties and deficiencies that can be used by pilots in evaluating the risks associated with piloting specific vessels.

52. A standardized information card that briefly explains the unique problems involved in navigating the Lower Mississippi River, the techniques used, and the pilot's expectations would be a valuable tool that pilots could provide to the foreign crews to help develop a Bridge Management Team.

53. As noted in the Port of New Orleans' Risk Analysis study, mooring any vessel in the area of the Riverwalk pier presents a known risk of allision from vessels transiting through the area.

54. The passenger evacuation procedures (moored condition) for the QUEEN OF NEW ORLEANS requires all passengers to climb stairs to the boiler or "02" deck in order to reach the only gangway normally rigged for passenger debarkation.

55. The Coast Guard has not established a national policy on protective measures (Bridge watches and/or passive safeguards such as breakwaters) for high capacity passenger vessels that operate while moored with passengers on board. Where the Coast Guard has mandated a live Bridge watch, it is not always clear if the watch personnel must have the ability and authority to take any response action necessary, such as ordering an immediate vessel evacuation.

56. The statement made by the Second Mate that the vessel appeared to ground in the silt prior to the allision appears incorrect. The vessel did subsequently ground after the allision with the pier as the bow entered an area not subject to maintenance dredging. Friction with the silt may have contributed to stopping the vessel's movement down the pier face. Whether that friction prevented the BRIGHT FIELD from continuing down the pier face and striking the QUEEN OF NEW ORLEANS cannot be determined.

57. A greater accumulation of silt beneath and adjacent to the moorings for the QUEEN OF NEW ORLEANS and CREOLE QUEEN would reduce the water depth to minimally acceptable levels and provide a significant level of passive protection to these vessels from allisions by deep draft vessels such as the BRIGHT FIELD.

58. The use of a conventional tug as an escort would have been ineffective in preventing or mitigating the damage from this casualty.

59. As part of its investigation, the Marine Board searched for information on the effectiveness of tractor tugs in a riverine operating environment. The Marine Board was unable to produce any evidence that tractor tugs have ever been used as escorts on the Mississippi River or any information on their effectiveness on swift flowing rivers.

60. The rapid movement of the BRIGHT FIELD into the shallower water adjacent to the Riverwalk created a surge wave ahead of it, which caused the minor damage and the injuries reported aboard the QUEEN OF NEW ORLEANS and the CREOLE QUEEN.

61. The actions of the Masters of the CREOLE QUEEN and QUEEN OF NEW ORLEANS were prudent and their decision to evacuate their passengers and crews to the dock minimized the potential loss of life and injury.

62. There is evidence of a violation of 33 Code of Federal Regulations 164.11(k) in that the Master did not fulfill his responsibility to inform the Pilot of the draft, maneuvering characteristics and any abnormal circumstances, i.e. the recent failure history and the extensive repairs of the main engine. The Pilot took no special action to obtain this information from the Master.

63. There is no evidence that fatigue, illness, medication or illegal drug use by the Pilot or the crew of the BRIGHT FIELD played a part in this casualty.

64. Except as noted above, there is no evidence of actionable misconduct, inattention to duty, negligence or willful violation of law or regulation on the part of licensed or documented persons. There is no evidence that the failure of inspected material or equipment, nor evidence that personnel of the Coast Guard, or any other government agency or any other person, contributed to the casualty.

VII. RECOMMENDATIONS

1. The International Maritime Organization should amend Chapter II-1, Part E of the International Convention for Safety of Life at Sea (SOLAS Convention) to require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board integrated automation test procedures which are approved by the vessel's flag administration or classification society.

2. The International Maritime Organization should amend Chapter II-1, Part E, Regulation 52 of the SOLAS Convention to require a standard operating procedure addressing the use of override arrangements and automatic slowdown and shutdown functions of the automation system. This standard operating procedure should address conducting periodic drills and training in use of the override arrangements and maintaining appropriate records of drills and training aboard the vessel. These records should be examined during port state control boardings and, if not available, the vessel should be detained until drills and training are conducted to the satisfaction of the flag administration or classification society.

3. The International Maritime Organization should revisit Chapter V, Regulation 12 of the SOLAS Convention to evaluate the cost/benefit of requiring vessels navigating in restricted waters to be equipped with a Vessel Event Recorder.

4. The Coast Guard should modify 33 Code of Federal Regulations 164.11 to require that the owner, master, or person in charge of each vessel navigating in restricted waters shall ensure that the engineroom is adequately manned by crewmembers competent to respond to alarms and emergencies.

5. The Coast Guard should modify 33 Code of Federal Regulations 164.11(k) so that a pilot is made aware of the status of and method of activation for any override arrangement for the automatic slowdown and shutdown functions of the automation system.

6. The Coast Guard should modify 33 Code of Federal Regulations 164.11(o) to require vessel owners and operators to maintain a bow lookout and/or anchor detail while navigating in restricted waters. Prior to enactment of this regulatory change, each Captain of the Port should assess the risk posed by loss of propulsion and/or steering casualties to the port and the appropriateness of requiring an anchor detail when vessels are underway on the navigable waters of the United States.

7. The Coast Guard should modify 33 Code of Federal Regulations 164.25(a)(2) to clarify the requirement for testing of the audible and visual extension alarms for the automation system.

8. The Coast Guard should modify 33 Code of Federal Regulations 164.33 to require vessels equipped with automation equipment for periodically unattended machinery spaces to have on board automation test procedures similar to those required in Coast Guard regulations (46 Code of Federal Regulations 61.40 and 62.20) which are approved by the vessel's flag administration or classification society. Documentation showing these procedures have been followed must be available on board the vessel and should be examined during port state control boardings.

9. The Coast Guard should modify 33 Code of Federal Regulations 165.810 to require vessels operating within the Regulated Navigation Area to identify the VHF-FM radiotelephone as the preferred method of contacting the Governor Nicholls or Gretna Light Operators, with whistle signals and telephone as secondary methods.

10. The Coast Guard should consider installing a Vessel Traffic Services at the Port of New Orleans as soon as possible due to the high volume of vessel traffic and the potential for marine casualties within the Port of New Orleans.

11. The Coast Guard should ensure that the development of the Marine Safety Network, the follow-on system to the Coast Guard's Marine Safety Information System, allows access to certain portions so that waterways users can determine current vessel safety histories and apply this knowledge to their involvement with the vessels.

12. The Coast Guard should revise Sections 1.G and 3.A of Volume V of the Marine Safety Manual to emphasize the importance of taking prompt and effective action to secure the casualty scene and preserve evidence crucial to the investigation.

13. The Republic of Liberia should conduct a suspension and revocation investigation of the BRIGHT FIELD's licensed engineers for negligence and misconduct while under the authority of their licenses and documents in that they apparently: failed to maintain an appropriate level of lubricating oil in the main engine sump, failed to properly set the #2 main engine lubricating oil pump for automatic operation and provided false sworn testimony to the Marine Board.

14. The Republic of Liberia should conduct a suspension and revocation investigation of the BRIGHT FIELD's prior Chief Engineer, Liu Qing Zhu, for negligence and/or incompetence for his failure in maintaining the vessel's main engine in a satisfactory condition and failure to maintain an appropriate volume of lubricating oil in the main engine sump.

15. Det Norske Veritas should amend the Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" to require, in conjunction with all automation surveys, verification of the proper calibration of all temperature and pressure sensors providing inputs to the automatic slowdown and shutdown functions of the automation system. Other classification societies should take action to amend their rules to the same end.

16. Det Norske Veritas should amend the Rules for "Periodically Unattended Machinery Space (E0) and Machinery Centralized Control (EC0)" to require the vessel to maintain the DNV-approved test program aboard the vessel and use it as the plan for systematic maintenance and function testing of the automation system. Other classification societies should take action to amend their rules to the same end.

17. Det Norske Veritas should amend their rules requiring vessel owners and operators to notify them of equipment casualties to specifically address the critical vessel systems that should be reported immediately.

18. COSCO should publish a standard operating procedure for the use of the main engine automation system's override functions when responding to emergency situations such as loss of propulsion aboard the BRIGHT FIELD.

19. The owners and operators of vessels equipped with automation equipment for periodically unattended machinery spaces should establish standard operating procedures for the operation of vital auxiliary machinery when navigating in restricted waters where an automatic slowdown or shutdown might have catastrophic consequences. Instead of operating vital auxiliary equipment such as lubricating oil, fuel oil and cooling water pumps with the primary system on line and the secondary system on standby, special consideration should be given to operating both systems simultaneously, if it does not create an unsafe condition.

20. The owners and operators of vessels equipped with automation equipment for periodically unattended machinery spaces and not already required by 33 Code of Federal Regulations 164.13(b) to have a manned engineroom should consider it good marine practice to adequately man the machinery spaces when navigating in restricted waters.

21. The owners and operators of all vessels should ensure that the Bridge crew has the ability to establish effective communications with the bow lookout and/or anchor detail during the sounding of whistle signals so that adequate instructions or advisories can be passed.

22. The owners and operators of all vessels should consider it good marine practice to maintain a bow lookout and/or anchor detail when navigating in restricted waters.

23. Each Captain of the Port should assess the risk posed by allisions to high capacity passenger vessels operating within their zone and, where appropriate, require an adequate Bridge watch whenever these vessels are moored to the dock with passengers aboard.

24. Marine Safety Office New Orleans should consider requiring all commercial vessels with personnel on board that moor within the Port of New Orleans to maintain a live Bridge watch actively listening to the local marine traffic channels, VHF-FM Channel 67, and monitor their radar for potential danger. Watch personnel should have the ability and authority to take any action necessary, such as ordering an immediate vessel evacuation.

25. Marine Safety Office New Orleans should conduct a study of their Regulated Navigation Area equipment and control systems and identify their interim needs to improve their ability to monitor traffic. These upgrades should be completed as soon as possible.

26. Marine Safety Office New Orleans should review the evacuation procedures of all commercial vessels with personnel on board that moor within the Port of New Orleans and establish evacuation standards for each class of vessel.

27. The American Pilots Association should be encouraged to develop a nationwide computer system to allow local access for retrieval and updating of information by their member pilots, based on the information card system used by members of the Crescent River Port Pilots Association.

28. The various Mississippi River Pilots Associations, in conjunction with the Coast Guard, should develop and publish an information card, preferably in many foreign languages, that pilots can provide to masters to facilitate an exchange of critical navigation information.

29. The Board of Commissioners of the Port of New Orleans, or the owners of the vessel, should consider relocating the QUEEN OF NEW ORLEANS to a location less vulnerable to allisions by deep draft vessels.

30. As an alternative to Recommendation 29, the Board of Commissioners of the Port of New Orleans and the Army Corps of Engineers should evaluate the effectiveness of decreasing the normal water depth beneath and adjacent to the moorings for the QUEEN OF NEW ORLEANS and CREOLE QUEEN to the minimum acceptable level as a means of providing a passive defense against allisions by deep draft vessels.

31. The Marine Industry, in cooperation with the Coast Guard, should consider conducting a comparative analysis/test of the effectiveness of tractor tugs as assist vessels for use in riverine operating environments such as the Mississippi River.

32. A copy of this report should be forwarded to the Liberian Government for their information and action as they deem appropriate.

33. A copy of this report should be provided to the International Maritime Organization and Det Norske Veritas for their information and action as they deem appropriate

34. A copy of this report should be provided to Clearsky Shipping Co. Ltd. And COSCO Shipping Co., Ltd. for their information and action as they deem appropriate.

35. A copy of this report should be provided to Marine Safety Office New Orleans for their information and action as they deem appropriate.

36. A copy of this report should be provided to the American Pilots Association, the Pilots Board of Commissioners, the Crescent City Port Pilot Association, the New Orleans-Baton Rouge Steamship Pilots Association, the Associated Federal Pilots and Docking Masters of Louisiana, and the Associated Branch Pilots for their information and action as they deem appropriate.

37. A copy of this report should be provided to the International Association of Classification Societies for their information.

38. A copy of this report should be widely disseminated to the marine industry to remind them of the dangers of inadequately maintained engineering systems, to educate them on the lessons learned from this casualty and to encourage the incorporation of these lessons learned in their own safety programs and initiatives.

39. It is recommended that this investigation be closed.

[redacted]	[redacted]	[redacted]
A. REGALBUTO	**J. G. LANTZ**	[redacted]
Captain, U. S. Coast Guard	**Captain, U. S. Coast Guard**	[redacted] **U. S. Coast Guard**
Chairman	**Member**	**Member and Recorder**

The members of the Marine Board thank the Eighth Coast Guard District and Marine Safety Office New Orleans for the outstanding logistical, administrative and technical support they provided to the Marine Board during the investigation of the BRIGHT FIELD. Deserving of special recognition is CDR William Marhoffer, Chief of the Inspections Department at Marine Safety Office New Orleans, whose technical expertise and coordination of on site investigation activities was critical to the success of this Marine Board. Another noteworthy contributor was LCDR Robert Garrott of the Atlantic Area Marine Safety Division, who provided crucial administrative and editorial assistance to the Marine Board.

APPENDIX 1

MAIN ENGINE AND ASSOCIATED SYSTEM DESCRIPTIONS

MAIN ENGINE DESCRIPTION

The main engine on the BRIGHT FIELD is a Model 5RTA-62, New Sulzer Diesel slow speed diesel engine manufactured under license by Ishikawajima-Harima Heavy Industries Co., Ltd. (IHI) of Japan. It is a five-cylinder, single-acting two-stroke, reversible engine of crosshead design with exhaust gas turbo-charging and uniflow scavenging. The exhaust gasses flow from the cylinders through hydraulically operated exhaust valves, then into an exhaust gas manifold and turbocharger. The scavenging air delivered by the turbochargers flows through air coolers and water separators into the scavenging air box, then enters the cylinders by non-return valves through the scavenging ports in the cylinders when the pistons are nearly at bottom dead center. At low loads, independently driven auxiliary blowers supply additional air to the scavenging air box. The engine can burn either marine diesel oil (MDO) or heavy fuel oil (HFO). Cylinders and cylinder heads are fresh water cooled while scavenging air is sea water cooled. The lubricating oil and cooling water pumps are electrically driven and are separate from the main engine.

MAIN ENGINE LUBRICATING OIL SYSTEM

The main engine lubricating oil system serves both the main bearings and crosshead bearings. It is a closed system where the main lubricating oil pumps take suction from the lubricating oil sump to provide lubricating oil under pressure to the main and crosshead bearings, after which the lubricating oil drains to the sump.

The main lubricating oil pumps are positive displacement screw type, built by Tiako Kikai Industries, Co., Ltd. and rated at 180 m^3/hr at 4 kg/cm^2. The normal operating range for the main bearing lubricating oil system is 2.5 - 3.0 kg/cm^2 and, according to manufacturer's recommendation, an alarm should sound if the pressure drops below 2.5 kg/cm^2.

The crosshead lubricating oil pumps, sometimes referred to as the lubricating oil booster pumps because they increase or boost the lubricating oil pressure, take suction from the discharge of the main lubricating oil pumps to supply lubricating oil to the crosshead bearings. The crosshead pumps are also positive displacement pumps, rated at 25 m^3/hr at 12 kg/cm^2. The normal operating pressure of the crosshead lubricating oil system is 10 - 12 kg/cm^2 and, according to the manufacturer's recommendation, an alarm should sound if the pressure drops below 10 kg/cm^2. Both the main and crosshead lubricating oil pumps are controlled by a MAC-2S motor automatic control system manufactured by Terasaki, which is located in the Engine Control Room. The lubricating oil system is designed such that only one each of the two main and two crosshead lubricating oil pumps needs to be running at any one time. The other pump provides a redundant backup should the running pump experience a casualty. The MAC-2S motor starter allows the pump motors to be operated in either manual or standby mode. The logic of the MAC-2S motor starter is such that a manual start and manual stop of a lubricating oil pump is not considered an alarm condition and therefore an alarm signal is not sent to the Terasaki WE3 system.

In the manual mode, the pumps must be manually started and stopped. In the standby mode, the pump automatically starts if the lubricating oil pressure drops below a preset level or if the running pump stops for any reason other than being stopped manually. After the standby pump starts and the lubricating oil pressure is raised to within normal limits, the pump that was initially running is automatically stopped. A pump in standby can also be started and stopped manually.

According to manufacturer's recommendations, the standby main bearing lubricating oil pump automatically starts when the pressure drops below 2.4 kg/cm^2; the standby crosshead lubricating oil pump automatically starts when the pressure drops below 8.0 kg/cm^2. The main and crosshead lubricating oil pumps are also electrically interlocked such that one of the main pumps must be running in order to run one of the crosshead pumps. The lubricating oil system is fitted with instrumentation providing input for the following reasons:

Instrument	Purpose
Pressure switch	Auto start of standby main lubricating oil pump
Pressure switch	Auto start of standby crosshead lubricating oil pump
Pressure switch	M/E automatic trip due to low main bearing lubricating oil pressure
Pressure transducer	M/E automatic slow down due to low crosshead lubricating oil pressure
Pressure transducer	Monitor and alarm for main lubricating oil pressure
Pressure transducer	Monitor and alarm for crosshead lubricating oil pressure
Temperature probe	Monitor and alarm for main lubricating oil system

MAIN ENGINE LUBRICATING OIL SUMP

The lubricating oil sump on the BRIGHT FIELD is located below the main engine between frames 21 (aft) and 29 (forward). It is 6.40 meters (m) long, 3.34m wide, slightly "V" shaped on the bottom and has an average height of 1.175m. The normal fill volume for the lubricating oil sump is 14.0 m^3, however after deducting 3.7 m^3 of lubricating oil for the piping (1.17 m^3), cooler and pump (1.03 m^3) and main engine (1.5 m^3), the normal running volume is 10.3 m^3, corresponding to a sounding of 0.65 m at a condition of even trim and list.

The sump contains a number of intervening bulkheads with lightening holes that result in a purposely designed labyrinth to provide a circuitous lubricating oil path from the lubricating oil returns to the main pump suction. There is a transverse bulkhead at each frame (seven total) evenly spaced the length of the sump, with two circular lightening holes, approximately 0.4m in diameter. A centerline bulkhead runs the length of the sump with three elliptical lightening holes, about 0.4 m by 0.8 m. The forward lightening hole is located between the forward bulkhead (frame 29) and the first transverse bulkhead (frame 28), the aft lightening hole is located between the aft most transverse bulkhead (frame 22) and the aft bulkhead of the sump (frame 21). The middle lightening hole is located between the third and fourth transverse bulkheads (between frames 25 and 26).

There are two lubricating oil returns (fore and aft) from the main engine, both located just to the port side of the longitudinal bulkhead. The forward return is located between frames 27 and 28 and the aft one is located between frames 23 and 24. The suction line for the main lubricating oil pumps is on the starboard side of the centerline longitudinal bulkhead between frames 24 and 25. There is a low level alarm provided that sounds when the oil level drops below a level corresponding to a sump volume of 8.16 m^3. There is no high level alarm. The sounding tube and float gauge with the low level switch are physically located next to each other aft of the sump on the port side.

The interior structure of the lubricating oil sump and the circuitous lubricating oil path is designed to delay the lubricating oil's return to the circulation line to allow entrained air to dissipate from the lubricating oil. If there is not ample time for the entrained air to escape, the lubricating oil pump will be noisy and vibrate. For the main lubricating oil pumps on the BRIGHT FIELD, the manufacturer's recommendation is that the minimum circulating volume in cubic meters should be between 10% and 15% of the pump's capacity in cubic meters per hour. For the BRIGHT FIELD, this meant the sump operating volume should have been in the range of 18 to 27 m^3, instead of the actual volume of less than 14 m^3.

The volume of the lubricating oil in the sump is also critical to giving the entrained air time to escape. The quantity of lubricating oil in the main engine on the day of the casualty was below the volume corresponding to the low level alarm set point of 8.1 m^3. This contributed to the short time period for entrained air to escape. In addition, this low quantity coupled with the oil path in the sump may have led to the pump partially losing suction, i.e. air was being introduced through the suction line.

MAIN ENGINE LUBRICATING OIL FILTERS AND PURIFIERS

There are two stages of filters provided in the lubricating oil system. The first filter, referred to as the main filter, is an 80 mesh strainer provided on the suction side of each main lubricating oil pump. Since there is a separate filter for each pump, it is a simple matter of switching to the other pump in order to clean the main filter. As a matter of practice, the pumps were switched by the ship's engineers and the filters cleaned every five days of operation.

The second filter is a 180 m^3/hr, 250 mesh strainer on the discharge side of the main lubricating oil pumps and on the suction side of the crosshead lubricating oil pumps. All of the main lubricating oil pump discharge passes through this filter and there is no redundancy, i.e., if there is a problem with the second filter, the engine must be secured until the problem is corrected. As such, there are two safety features provided for the second filter. First is an automatic backwash feature which uses lubricating oil to remove sludge from the 16 separate filter elements. The oil used to wash the elements then drains through a sludge collector and returns to the main engine lubricating oil sump. This backwash feature is operated by a pressure switch when the differential pressure across the second filter reaches 0.7 kg/cm^2. The other safety feature is an alarm that sounds when differential pressure across the second filter becomes unacceptably high. According to the manufacturer's recommendation, the alarm should sound when the differential pressure reaches 0.9 kg/cm^2.

The BRIGHT FIELD has two lubricating oil purifiers, with the No. 1 purifier dedicated to the main engine. The purifier system is separate from the main engine lubricating oil piping system. The purifier takes suction from the main engine sump, processes the lubricating oil and returns it to the sump. There are two alarms provided to indicate there is a problem with the purifier, a high temperature alarm and a summary normal/abnormal alarm. When the summary alarm sounds, the engineer must go to the purifier control panel, located at the purifier, to determine the specific problem.

MAIN ENGINE CONTROL SYSTEM

The main engine control system is an electro-pneumatic system, model TCM-24DF, manufactured by IHI to New Sulzer Diesel specifications. The control system provides the necessary controls to start, stop, reverse, and set the speed for the main engine. It includes safety features such as a main engine emergency trip, an automatic slowdown and an acceleration limiting program to protect the engine from damage. In some cases, these safety features can be used to save the ship while sacrificing the engine. There are three main engine control stations: the Bridge, the Engine Control Room and the Engine Side station.

Control is easily transferred from one control station to another and safety interlocks are provided to prevent inadvertent or unwanted transfer from one station to the other. For example, control cannot be transferred from Engine Side to Engine Control Room without acknowledgment by an engineer at the Engine Control Room station. Likewise, control cannot be transferred from the Engine Control Room to the Bridge without acknowledgment at the Bridge control station. In an emergency, control of the engine can always be seized by an engineer at the Engine Side station.

The Bridge control station is fitted with a single maneuvering lever that provides the necessary control for starting, stopping, reversing, and setting the speed of the main engine. The Bridge operator merely moves the maneuvering lever to the desired engine condition, which is then achieved through a preprogrammed sequence within the control system. A predetermined governor setting controls engine speed for each position of the maneuvering lever, as shown below. When the Bridge does not have main engine control, the maneuvering lever acts as the Engine Order Telegraph (EOT), transmitting engine orders to the Engine Control Room or Engine Side control stations.

			Design Speed (kts)	
Direction	Engine Order	RPM	Loaded	Ballast
Ahead	Navigation Full	72	14.7	15.2
Ahead	Full	56	10.3	11.0
Ahead	Half	48	8.9	9.6
Ahead	Slow	40	7.4	8.0
Ahead	Dead Slow	30	5.5	6.0
Stop				
Astern	Dead Slow	30		
Astern	Slow	40		
Astern	Half	48		
Astern	Full	56		
Astern	Emergency Full	60		

The Engine Control Room and Engine Side control stations are configured differently. Each has a reversing lever, speed setting lever and START push-button instead of the single maneuvering lever installed on the Bridge. Unlike the Bridge control station, a predetermined control sequence is not used for starting, stopping, reversing and speed setting. The ship engineer in the Engine Control Room or the Engine Side station must select AHEAD or ASTERN using the reversing lever and select the desired speed using the speed setting lever. The engineer then must manually apply air using the START push-button to brake and start the engine. When in Engine Control Room or Engine Side control, the reversing lever both selects the direction of engine operation and serves as the EOT, allowing the engineer to respond to engine orders from the Bridge control station. When in Bridge control, the reversing and speed setting levers are disabled and their position is immaterial.

When the engine is in Bridge control, an automatic acceleration program, sometimes referred to as a load control program, keeps the rate of acceleration within safe limits to prevent damage to the engine. A selector switch in the remote control cabinet, located in the Engine Control Room, is used to set the rate of acceleration to require between 0.5 and 9.9 hours for the engine to reach full navigation speed. If more rapid acceleration is required, the load control program can be bypassed by pushing a BY-PASS button on the Bridge control station console. The rate of acceleration set at the time of the loss of propulsion is not known. When the engine is in Engine Control Room Control, the rate of acceleration is automatically limited by the scavenging air pressure. This limitation can be bypassed by pushing the CRASH MANEUVER button on the Engine Room Control console.

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MAIN ENGINE ALARM AND MONITORING SYSTEM

The main engine control system is equipped with an alarm and monitoring system which is independent of the other alarm and monitoring systems within the engineroom. This alarm and monitoring system pertains only to the control system and the alarms are provided to alert engineers when something has gone wrong with the control system. The alarm indicator lights for this system are on the main engine console in the Engine Control Room as follows:

- Over Speed Trip
- Main Bearing Lubricating Oil Low Pressure Trip
- Cooling Fresh Water Low Pressure Trip
- Exhaust Valve Air Low Pressure Trip
- Manual Trip
- Automatic Slow Down
- Passive Fail
- Wrong Way
- Main Engine Start Fail

MAIN ENGINE EMERGENCY TRIP SYSTEM

The BRIGHT FIELD is equipped with a main engine emergency trip system. The emergency trip system is independent of the main engine control system and operates regardless of the control position and alarm condition. Three separate main engine trips make up the emergency trip system:

Manual Trip. A manual trip is provided in the event the main engine can not normally be stopped, i.e., the engine does not stop when the maneuvering lever is moved to STOP. The operator manually stops the engine by pressing the EMERGENCY STOP button at the Bridge or Engine Control Room control stations, electrically stopping the engine by closing solenoid valves that cut off the fuel supply to the main engine.

Overspeed Trip. The overspeed trip is an automatic shutdown of the main engine once the engine RPM exceeds a pre-set limit which, if exceeded, would result in damage to the engine. For the BRIGHT FIELD, the overspeed trip activates at 89 RPM and electrically closes solenoid valves that stop the supply of fuel to the main engine.

Automatic Trip. The main engine is automatically stopped whenever the pressure in any of the following systems drops below a preset level. For the BRIGHT FIELD, the lower limits are shown below.

System	Trip Pressure
Lubricating oil to the main bearing	2.3 kg/cm^2
Spring air for the exhaust valves	4.0 kg/cm^2
Cooling fresh water to cylinder liner	2.5 kg/cm^2

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A main engine trip due to loss of spring air pressure and cooling fresh water pressure electrically closes solenoid valves in the fuel supply line. A trip due to loss of lubricating oil pressure at the main bearings trips the engine by two means; it electrically closes solenoid valves in the fuel supply line and pneumatically shuts off the fuel by closing the fuel rack. The pneumatic trip has a time delay of 12 seconds and the electric trip has a time delay of 10 seconds. The time delays prevent spurious trips due to a momentary drop in the lubricating oil pressure.

A main engine automatic trip caused by a loss of pressure for the cylinder liner cooling fresh water can be overridden, however, this is the only automatic trip that can be overridden. This is accomplished by pushing the button labeled M/E TRIP OVERRIDE at either the Bridge or Engine Control Room control station (whichever one is currently controlling the main engine) and this allows the main engine to be restarted without correcting the pressure of the cylinder liner cooling fresh water. For all other main engine trips the condition that caused the trip must be corrected prior to restarting the main engine. In addition, the maneuvering lever (Bridge control) or the speed setting lever (Engine Control Room control) must be returned to STOP or zero, respectively, in order to restore the fuel supply to the main engine and thus be able to restart it. An automatic slow down feature is provided in the event any of the conditions shown below. When this occurs, the engine speed automatically drops to DEAD SLOW or 30 RPM. The manufacturer's recommended settings are as follows:

System	Condition	Setting
Crosshead lubricating oil pressure	Low	9.0 kg/cm^2
Jacket water cooling water pressure	Low	2.7 kg/cm^2
Exhaust valve spring air pressure	Low	4.0 kg/cm^2
Exhaust temperature	High	530 °C
Piston oil outlet temperature	High	80 °C
Thrust bearing temperature	High	65 °C
Scavenging space temperature	High	200 °C
Crankcase oil mist	High	
Non-flow of cylinder oil	N/A	

An automatic slow down can be overridden at either the Bridge or Engine Control Room control position by pressing the AUTOMATIC SLOW DOWN OVERRIDE button at the station controlling the main engine. However, the main engine cannot be operated throughout the full range of speed without correcting the condition that caused the automatic slow down.

In Bridge control, after an automatic slow down, the engine may be operated in the speed range from FULL AHEAD to EMERGENCY FULL ASTERN without correcting the condition that caused the slow down provided the maneuvering lever is moved once to the DEAD SLOW position. To operate at NAVIGATION FULL AHEAD, the condition that caused the automatic slow down must be corrected and the maneuvering lever must be moved to the DEAD SLOW position. If the maneuvering lever is moved to

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NAVIGATION FULL AHEAD without correcting the condition that caused the automatic slow down, the speed will again automatically drop to DEAD SLOW.

In Engine Control Room control, the cause of the automatic slowdown must be corrected and the speed lever must be set to a the position corresponding to DEAD SLOW before the engine can be operated at any speed other than DEAD SLOW.

TERASAKI WE3 WATCH-FREE SYSTEM

The BRIGHT FIELD is equipped with a monitoring and alarm system manufactured by Terasaki. It is a model WE3 Watch-Free System with color monitor and printer and is installed in the Engine Control Room. It is designed to provide a high degree of communication between people and machine for the modern automated ship. It is a microcomputer-based system that monitors the conditions of the main engine, generators, boilers, and other auxiliaries of a ship's machinery. It is not a control system. It is used only to monitor various machinery parameters, sound an alarm if a parameter goes outside set limits and display the parameters and alarm condition. It is completely independent (electrically and pneumatically) from all control systems, including the IHI main engine control system and MAC-2S controllers for the main and crosshead lubricating oil pumps. It is a redundant system, i.e., there are two microcomputers, each with its own separate monitor, to ensure the vessel always has the capability to monitor the engineering systems.

The system is capable of receiving and processing a maximum of 455 separate inputs or channels which can be divided into a maximum of 16 groups. There are two types of channels. The first is an analog channel, used to send information for a parameter that has a range, e.g. lubricating oil pressure or cooling water temperature. The second is a digital or on/off channel, used to transmit information relating to the state of a parameter, e.g. lubricating oil pump running/stopped or lubricating oil level low/normal. The BRIGHT FIELD used 262 channels which were divided into 15 groups. The groups and the number of channels within each group are shown below:

The WE3 system displays alarms in three different locations, the Engine Control Room, the Bridge console and in the crew's quarters.

In the engine control room, when an alarm condition exists in any of the 262 channels, a buzzer sounds and a light on the monitor flashes to show which alarm group contains the channel. A buzzer stop button may be pushed to silence the buzzer. A button adjacent to the alarm group on the monitor must be pushed to display the channels in the alarm group. The channel in an alarm condition will be shown in flashing red. After these steps are taken, an alarm acknowledgment button may be pushed, which changes the display from flashing red to steady state red. After the alarm condition is corrected and the channel condition has returned to normal, the color displayed on the monitor will change back to green. The alarm groups are:

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Group	Title	Channels
01	M/E (Main Engine) Trip	5
02	M/E Slow Down	21
03	M/E Other	61
04	No. 1 Generator	14
05	No. 2 Generator	14
06	No. 3 Generator	14
07	Emergency Generator & Electric Plant	15
08	Boiler	6
09	Pump	33
10	Tank	22
11	Purifier	10
12	Miscellaneous	15
13	Steering Gear & Auxiliary Unit	9
14	Electrical System	16
15	Bilge & Fire System	7

Extension alarms sound outside of the engineroom and are used to alert the Bridge and/or engineers of a problem when the vessel is operating with the engineroom unmanned. On the BRIGHT FIELD, the extension alarms sound on the Bridge, the engineers' (Chief, Second, Third and Fourth) staterooms, the electrician's stateroom, crew's recreation room, officers' smoking room, dining rooms, and engineering office. The extension alarm panels do not have the capability of displaying the specific channel with the alarm condition. Instead the WE3 system groups the channels into extension groups. If any channel in the extension group goes into an alarm condition, the indicator light next to the extension group lights and a buzzer sounds. In the WE3 system, the maximum number of extension groups is 20. The seven extension alarm groups on the BRIGHT FIELD are:

Extension Group No.	Title
1	M/E (Main Engine) Trip
2	M/E Automatic Slow Down
3	M/E Abnormal
4	Generator Plant Abnormal
5	Other Abnormal
6	Bilge Abnormal
7	Fire

The Bridge console has indicators for 13 extension alarms. Besides the seven listed above, it has indicator lights for six additional alarms, including main engine alarms for:

Control air pressure low
Starting air pressure low
Starting failure
Auto control failure

APPENDIX 1

PROGRAMMABLE INFORMATION; TERASAKI MODEL WE3 WATCH-FREE SYSTEM

The WE3 system has two independent microcomputers and the programmable information listed below must be keyed into each microcomputer for each channel. While this information can be modified by the vessel's engineers, a key is required to gain access to the key pad used to modify the channel information. On the BRIGHT FIELD there were two keys, one held by the Chief Engineer, the other by the Electrician. The microcomputers do not keep a log of changes made to the channels.

Information	Analog Channel	On/off Channel
Alarm high limit	Yes	N/A
Alarm low limit	Yes	N/A
Scan	Yes	N/A
Time	Yes	Yes
Repose group	Yes	Yes
Extension group	Yes	Yes
Print	Yes	Yes
Monitor	Yes	Yes

Alarm high limit and Alarm low limit. The alarm high limit will cause an alarm to sound when the parameter being monitored on the channel exceeds that value. The alarm low limit will cause an alarm to sound when the parameter falls below that value.

Scan. Controls the microcomputer scanning channels and updating the information. This can be turned on or off. If off, the information on that channel will not be updated.

Time. The delay in seconds between the WE3 system detecting an alarm condition and when it is displays on the monitor, the alarm sounds and the output is sent to the printer. It can be set between 1 and 30 seconds to prevent nuisance alarms from transient conditions. An example is the lubricating oil sump low level alarm with a 10 second delay. The 10 second delay prevents nuisance alarms due to sloshing of the lubricating oil when the vessel rolls in a seaway.

Repose group. The system allows the grouping of alarms into repose groups, which may be manually or automatically turned on or off, depending on the operating condition of the vessel. For example, the alarms enabled when the vessel is moored are vastly different from those enabled when its underway on the open ocean. There are up to 31 repose groups and if a channel is assigned to a repose group, the group number is entered. There were 15 repose groups on the BRIGHT FIELD.

Extension group. The extension group number is entered for each channel.

Print and monitor. These are on/off parameters which provide the option on whether or not a channel will appear on the monitor or will be printed on the printer.

APPENDIX 1

TERASAKI WE3 WATCH-FREE SYSTEM PRINTOUTS

The WE3 system's dot matrix printer provides printouts of the alarms and conditions for the various channels. There are four types of printouts provided with this system:

Report Log. The report log gives a printout of information of the pre-selected analog channels at the end of every 1, 2, 4 or 8 hour period. The interval was set for 4 hours on the BRIGHT FIELD. Besides the date and time, the information printed is the channel number, condition mark (A = abnormal, F = sensor fail, R = repose, # = scan off), measured value and units of measure. Conditions that are normal are printed in black, those that are abnormal are printed in red.

Demand Log. This is the same as the report log, except it can be done at any time by pushing the "DEMAND" button on the control panel.

Alarm Log. When the monitored parameter of any analog channel becomes abnormal an alarm log for that channel will be printed in red. The information printed is the channel number, date, time, name, alarm mark (A), measured value and units of measurement. An on/off channel may also be selected for the alarm log, in which case the information printed in red is the channel number, date, time, name and alarm message. In both cases, the alarm time shown is only the nearest minute. Alarms are printed on a "first in, first out" basis, which means alarms are printed in the order received during that one minute interval. Aside from knowing the order received, it is not possible to determine to the precise second when that alarm condition occurred. For example, an alarm reported at minute 11 may have occurred as early as minute 11 and 0 seconds or as late as minute 11 and 59 seconds.

Recovery Log. A recovery log is printed in black when the parameter of a channel in an alarm condition is restored to normal. The same information as the alarm log is printed, but a recovery mark (R) is printed in place of the alarm mark for analog channels and a condition message instead of an alarm message is printed for on/off channels.

ALARM SET POINTS, TIME DELAYS AND PRINTING LOGS

The following is a brief description with specific information concerning alarm set points, time delays and printing for alarms generated by the Terasaki WE3 system that are germane to this casualty. The specific information comes from the List of Automation Equipment, Drawing M 30-705, which was approved by Det Norske Veritas on 24 May 1988 and from OCEANUS Finished Drawing, S NO 368, Engine Control Console.

0102, M/E Main LO Pressure. An on/off channel that alarms when the main engine trips due to loss of lubricating oil pressure from the main lubricating oil pumps. The same pressure switch initiates the main engine trip through the IHI main engine control system. There is a 5 second time delay for this alarm. This channel is only printed in the alarm and recovery logs. It is not printed as part of the report log.

APPENDIX 1

0201, M/E Auto Slow Down. An on/off channel that alarms when the main engine goes into an automatic slow down condition. This alarm is initiated from the temperature and pressure switches and transducers listed on page 7 of this appendix. There is no time delay for this channel. It prints only in the alarm and recovery logs.

0202, M/E Cross LO Pressure Low. An on/off channel that alarms when the main engine has gone into automatic slow down due to low cross head lubricating oil pressure. The pressure switch is shared with the IHI control system. There is a 10 second time delay for this alarm. It prints only in the alarm and recovery log.

0309, M/E Start In Pressure. An analog channel that displays the starting air pressure and alarms if the starting air pressure drops below the alarm point of 12.0 kg/cm^2. There is a 3 second time delay for this alarm. This channel is printed in the alarm, recovery and report logs.

0317, M/E LO In Pressure. An analog channel that displays the main bearing lubricating oil pressure and alarms if the lubricating oil pressure to the main bearings drops below the alarm set point of 2.5 kg/cm^2. There is a 3 second time delay for this alarm. This channel is printed in the alarm, recovery and report logs.

0320, M/E Cross LO In Pressure. An analog channel that displays the crosshead bearing lubricating oil pressure and alarms if the pressure drops below the alarm set point of 10.0 kg/cm^2. There is a 10 second time delay for this alarm. This channel is printed in the alarm, recovery and report logs.

0331, Main LO Sump Tank Level. An on/off channel that alarms when the lubricating oil level in the main engine sump is low. It is activated by a float switch on the aft port side of the sump. There is a 10 second time delay for this alarm. This channel prints only in the alarm and recovery logs.

0361, M/E Auto Control. An on/off channel that alarms if the remote control system has failed. Inputs are from a number of sources that disable the control system, such as loss of power or loss of control air. A main engine automatic trip or automatic slow down will cause this alarm. There is no override or time delay for this alarm. It prints only in the alarm and recovery logs.

0901, 1 - Main LO Pump. An on/off channel that alarms if the #1 lubricating oil pump either stops for an abnormal reason or auto-starts for any reason. There is no time delay for this alarm. It prints only in the alarm log.

0902, 2 - Main LO Pump. The same as Channel 0901,1, for #2 lubricating oil pump.

1201, M/E LO Second Filter Pressure. An on/off channel that alarms if the second lubricating oil filter differential pressure exceeds the set point of 0.9 kg/cm^2. This alarm has a 3 second time delay. It prints only in the alarm and recovery logs.

APPENDIX 2

TIMELINE AND SEQUENCE, LOSS OF PROPULSION TO ALLISION

The Bridge and Engine Control Room personnel did not maintain accurate records of events during the loss of propulsion and allision by taking notes at times referenced to a ship's chronometer or other time piece. The Second Mate's rough log entry that the BRIGHT FIELD passed beneath the Crescent City Connector Bridges at 1407 was not made until after the allision and is based on his estimate of the time.

Two mechanical event recorders, the Maneuvering Bell Log and the Terasaki WE3 alarm and monitoring system printer tape, contain some information about the sequence of events but there was no calibration of the two recorders against each other or a time standard and neither of the recorders indicate the time of an event to the second. The Maneuvering Bell Log records Maneuvering Lever/Engine Order Telegraph commands in half minute increments while the Terasaki WE3 printer records alarms in one minute increments.

The following sequence of events was developed using the testimony and exhibits obtained by the Marine Board. As in any effort to reconcile the statements of multiple observers to an event, not all are consistent and some events have been interpolated at the most probable time.

EVENTS FROM LOSS OF PROPULSION TO ALLISION

Note: Channel 0361 is auto control failure, channel 0102 is low lubricating oil pressure trip, channel 0317 is low lubricating oil pressure, channel 1201 is second lubricating oil filter high differential pressure and channel 0331 is lubricating oil sump low level alarm.

TIME	EVENT
1406	Terasaki printer records alarms for channels 0361, 0102 and 0317. The Chief Engineer silences the audible alarm and the Second Engineer acknowledges the alarm on the WE3 monitor.
	Engineering and Bridge crews note a reduction in main engine noise and vibration; main engine speed drops from 72 RPM to just over 20 RPM on Bridge RPM Indicators.
	Third Engineer notes main engine lubricating oil pressure below normal range. A member of Engineering crew manually starts the #2 main engine lubricating oil pump.
	Main engine lubricating oil pressure increases above alarm set point.
1407	Terasaki printer records channel 0317 alarm recovery, alarm for channel 1201
	Pilot asks Master "Do we have a problem?"
	Master orders Second Mate to call Engine Control Room, inquire about what happened and demand they increase the speed right away.
	Chief Engineer answers telephone, requests transfer of main engine control to Engine Control Room.

APPENDIX 2

	Pilot's first warning broadcast "70 to Governor Nick, I just lost my engine. Alert everyone in the harbor to watch out!" The Gretna Light operator responds and rebroadcasts warnings.
	Pilot notices bow veering to port, orders hard right rudder. Helmsman acknowledges, puts rudder to right full and confirms to Pilot.
	Transfer of main engine control to Engine Control Room completed.
	Chief Engineer begins manipulating the reversing lever and speed setting lever to restore control of main engine.
1408	Terasaki WE3 printer records channels 0361, 0102 and 1201 alarm recovery.
	Chief Engineer restores main engine control and begins increasing main engine RPM.
	Pilot broadcasts "Governor Nick, I'm gonna hit that damn cruise ship. Call him or do something. Governor Nick, call him or something, I'm going right for him!"
	Pilot broadcasts "Warn the gambling boat I'm going right for him!"
	Pilot orders Master to stand by anchors and begins sounding the danger signal on the ship's whistle. Second Mate notices main engine speed has increased to 40 RPM ahead.
	Master begins unsuccessful attempts to contact Carpenter by radio and hand signals from the Bridge wing.
	BRIGHT FIELD 1.5 ship lengths from pier. Pilot broadcasts "Governor Nick, this looks bad. Tell those people to get away. Tell those people to get away. Tell those people to get away. There's people on the dock. Tell those people to get away. Tell those people to get away!"
	Pilot orders port anchor let go.
	Master orders Carpenter by radio to let go port anchor.
	Second Mate notes main engine RPM has increased to 50 RPM ahead. Pilot orders FULL ASTERN; Second Mate acknowledges and orders FULL ASTERN on EOT.
1409-30	Maneuvering Bell Log records order for FULL ASTERN. Chief Engineer stops main engine, reverses direction and restarts main engine.
	Master orders Carpenter to not let go port anchor.
	Second Mate notices RPM indicator shows astern revolutions; increasing to 35-55 RPM astern prior to allision. BRIGHT FIELD vibrates noticeably.
	MASTER orders Carpenter to let go port anchor.
	Carpenter loosens port windlass brake and runs towards stern; bow of BRIGHT FIELD is about thirty meters from pier.
	BRIGHT FIELD's bow strikes the pier and slides along the pier face.
1410	Terasaki WE3 printer records alarm and recovery for channel 0331.
	BRIGHT FIELD comes to a stop parallel to pier face. Pilot orders ALL STOP.
1411-30	Maneuvering Bell Log records order for ALL STOP. The Chief Engineer manually stops the main engine.

APPENDIX 3

PHYSICAL AND QUALITATIVE LUBRICATING OIL ANALYSIS

a. Main Engine Manufacturer's Specifications

IHI, who built the main engine under license from New Sulzer Diesel [redacted] published operating and maintenance instructions for the main engine. Two of the manuals aboard the BRIGHT FIELD were titled "Description and Operating Instructions for IHI-Sulzer Diesel Engines" and "Engine Manual for RTA 52/62/84M Type Diesel Engine". Both manuals include guidance on the acceptability and maintenance of lubricating oil for the main engine.

The operating instructions found in Chapter 7 of the "Engine Manual for RTA 52/62/84M Type Diesel Engine" addresses the prevention of water mixture into system oil, stating "When water enters the system oil, the system oil is emulsified, and removal of water with a purifier becomes hard, insolubles content in the system oil increases and as a result, deterioration of system oil occurs. Therefore, it is very important to be careful to prevent this mixture of water into system oil."

Group 075 of the "Description and Operating Instructions for IHI-Sulzer Diesel Engines" discusses oil specifications. The engine type RTA 62 installed on the BRIGHT FIELD has oil cooled pistons that require a slightly alkaline oil with detergent characteristics (HD type). Of particular concern are solid dirt particles and water, which must be removed as completely as possible. Water content of the lubricating oil may not exceed 0.2 % over an extended period. Periodic oil analysis is required and the analysis values of the lubricating oil should remain within the following limits which should be taken as guidance values:

Flashpoint	over 180^0 C
Change in Viscosity	below +/- 10% of new oil values
Pentane Insolubles	below 0.5%
Benzene insolubles	below 0.3%
Water content	below 0.2% by volume (values above this are tolerable for a short period)
Total Acid Number (TAN)	below 1 mgKOH/g
Strong Acid Number (SAN)	none

b. Lubricating Oil Specifications.

The main engine lubricating oil is identified as the multi-purpose diesel engine lubricant ENERGOL DL-MP30, manufactured by BP Marine International. According to the specification sheet, ENERGOL DL-MP30 is a detergent-type oil with an SAE number of 30 and kinematic viscosity at 100^0C of 11.5 centiStokes (cSt).

APPENDIX 3

c. Samples Collected and Analyzed.

A total of 11 lubricating oil samples were collected for chemical analysis. Saybolt, Inc. analyzed two samples, one used oil and one new oil. BP Oil International analyzed three used oil samples. Spectro Oil Analysis Company analyzed five used oil and one new oil samples.

In evaluating the three reports of lubricating oil analysis discussed below, two assumptions were made. First, that the new oil met the main engine manufacturer's specifications. The BP Marine International's specifications for the oil do not indicate an acceptable range for the viscosity. The viscosity of the new oil sample taken on 18 December 1996 from the BRIGHT FIELD's new oil storage tank was 11.7 cSt as opposed to the manufacturer's specification of 11.5 cSt, a deviation of less than 2%. In determining whether the viscosity was acceptable, the sample's viscosity of 11.7 cSt was used as the basis for setting the +/- 10% range (10.53 to 12.87 cSt). Second, the viscosity of the new oil sample taken 8 April 1997 was improperly measured and should be disregarded. The oil in the storage tank had been replenished on or about 10 January 1997 when the main engine lubricating oil was replaced and the viscosity of the other samples taken that date were within the acceptable range.

1. Evaluation of Samples Analyzed by BP Oil International.

Three oil samples had been taken in November 1996, prior to the incident. Analysis of the settling tank sample taken 20 November 1996 indicated the viscosity at 100°C was 18.67 cSt and the water content was 0.2%. Analysis of the sample taken 25 November 1996 from the lubricating oil sump, before the purifier, indicated the viscosity at 100°C was 12.86 cSt and the water content was 0.3%. Analysis of the sample, also taken 25 November 1996, from the lubricating oil sump, after the purifier, indicated the viscosity at 100°C was 12.79 cSt and the water content was 0.4%. The viscosity of the settling tank sample was outside the acceptable parameters, while the water content was at or exceeded the maximum allowable value per these guidelines for all three samples.

2. Evaluation of Samples Analyzed by Saybolt, Inc.

Analysis of the used oil sample taken 18 December 1996 from the #1 main engine lubricating oil pump filter housing indicated the viscosity at 100°C was 13.8 cSt and the water content was 0.50%; both values were outside the acceptable parameters per Figure 19. Analysis of the new oil sample taken 10 January 1997 from the lubricating oil storage tank indicated the viscosity at 100°C was 11.7 cSt and water content less than 0.05%.

3. Evaluation of Samples Analyzed by Spectro Oil Analysis Company.

A sample taken from the main engine on 5 January 1997 indicated the viscosity at 100°C was 13.32 cSt and the water content was 2.9%. A sample taken from the main engine sump on 10 January 1997 indicated the viscosity at 100^{0}C was 10.16 cSt and the water content was 7.6%. A sample taken from the 2nd filter sludge collector on 10 January 1997 indicated the viscosity at 100^{0}C was 12.23 cSt and the water content was 2.9%. The samples of 10 January 1997 were taken after the main engine sump was topped off on 6 January 1997. Except for the final sample, the viscosity exceeded the guidelines while the water content of the three samples greatly exceeded the guidelines.

A sample taken from the main lubricating oil pump discharge on 8 April 1997 indicated the viscosity at 100^{0}C was 11.61 cSt and the water content was 0%. A sample taken from the 2nd filter casing on 8 April 1997 indicated the viscosity at 100^{0}C was 11.57 cSt and the water content was 0%. The sample of new oil taken from the storage tank on 8 April 1997 indicated the viscosity at 100^{0}C was 18.97 cSt and the water content was 0%. The samples of 8 April 1997 were taken after the main engine sump was drained, cleaned and the lubricating oil renewed on or about 10 January 1997.

APPENDIX 4

MACHINERY AND AUTOMATION SYSTEM SURVEYS AND TESTING

a. Det Norske Veritas Surveys and Certificates.

At the time of the BRIGHT FIELD's allision with the Riverwalk, the Norwegian classification society Det Norske Veritas (DNV) was the classification society retained by the vessel's owners to certificate the vessel and attest to its seaworthiness and materiel condition. As a classification society, DNV conducts surveys of the vessels under its class. If they are found to comply with DNV classification rules, the vessel is issued a DNV Classification Certificate valid for a period of five years. The vessel is subject to annual surveys, done within three months of either side of the anniversary date of the original survey, during this five year period to verify that it remains in class, i.e. it continues to meet DNV's classification rules.

At the end of each five year period, the vessel is subject to a renewal survey that is more thorough and in-depth than the intermediate annual surveys. If found in compliance with the classification rules, a new Classification Certificate is issued. DNV has classed the BRIGHT FIELD since it was constructed, and DNV also reviewed the design drawings to ensure the vessel was designed in accordance with its rules. This included review and approval of the machinery automation system described above.

DNV maintains a computer data base for all the vessels it classes which is used by class surveyors in preparing to conduct a vessel survey. This data base shows if there is any outstanding conditions of class. A "condition of class" is a requirement, which may be operational or material, that a vessel must comply with in order to maintain being classed by DNV. The computer data base also shows the status of all surveys on the vessel's equipment and it includes a history file. The history file shows any recurring problems a vessel has experienced over the years and it may include past conditions of class. The computer data base is maintained by DNV headquarters in Oslo, Norway using the input from surveyors throughout the world.

In addition, as with approximately 60 other countries, DNV is authorized by Liberia, the flag state for the BRIGHT FIELD, to issue statutory and safety certificates on its behalf. This includes all safety certificates required by the SOLAS (Safety of Life At Sea) Convention, to which Liberia is a party. At the time of the allision, the BRIGHT FIELD held the following international safety certificates, issued by DNV on behalf of Liberia:

Certificate	Issued	Expiration
Safety Construction Certificate	26 Jan 1994	30 Nov 1998
Safety Equipment Certificate	11 Mar 1996	1 Apr 1998
Cargo Ship Safety Radio Certificate	5 Jan 1996	4 Jan 1997

The DNV Classification Certificate valid at the time of the allision was issued on 26 January 1996. This certificate was issued based on a five year renewal survey conducted on 16 December 1993 and expires on 30 November 1998. The certificate onboard the BRIGHT FIELD, which was issued during the five year period between classification renewal surveys, was reissued due to an assignment of a new class when the BRIGHT FIELD entered into the Enhanced Survey Programme (Note: IMO Resolution A.744(18), adopted on 4 November 1993, established guidelines on inspections of aging bulk carriers and oil tankers. Under this Resolution, bulk carriers of 30,000 tons deadweight and above become subject to closer scrutiny for structural failure in cargo holds. The International Association of Classification Societies (IACS) initiated the Enhanced Survey Programme to implement these guidelines.). In addition to the classification certificate, an Appendix to the Classification Certificate was issued. This appendix gives the operating conditions that must be followed in order for the BRIGHT FIELD to remain in class. The BRIGHT FIELD is classed as **✠ 1A1 Bulk Carrier ESP HC/E E0** with register notations **ib(+), holds 2, 4, 6 empty**. The classification codes mean the following:

✠	Vessel built under the supervision of Det Norske Veritas.
1A1	Vessel for which periodical surveys are stipulated in relation to special (main) periodical survey intervals of five years.
Bulk Carrier ESP	Bulk carrier with Enhanced Survey Programme.
HC/E	Implies that heavy dry bulk cargoes may be unevenly distributed among the holds. One or more holds may be empty when the vessel is fully loaded.
E0	Vessel with machinery spaces for unattended operation during normal service at sea as well as alongside quay.
ib(+)	Inner bottom strengthened for grab loading and discharge.
holds 2, 4, 6 empty	Holds 2, 4 and 6 of the 7 cargo holds may be empty when the vessel is fully loaded.

b. Det Norske Veritas Machinery Survey Requirements

The machinery for the BRIGHT FIELD is subject to five year renewal and annual surveys, as is the rest of the vessel. However, on the BRIGHT FIELD, the machinery was being surveyed under a continuous survey program. Under a continuous survey program, each year twenty percent of the machinery is given the detailed in-depth survey required for the renewal survey, so that at the end of the five year validity period for the Classification Certificate all the machinery has been surveyed as required to reissue the Classification Certificate.

DNV uses a computer data base to track the status of the continuous survey program. The data base printout shows when different components, such as the lubricating oil pumps, are due for their five year renewal survey. The #1 lubricating oil pump was last surveyed in December 1993 and the #2 lubricating oil pump was surveyed in September 1995. Further review of this data base for the BRIGHT FIELD showed that, at the time of the allision, there were no outstanding requirements or outstanding conditions of class applicable to the machinery and that all machinery component surveys were up to date.

c. Det Norske Veritas Main Engine Survey Requirements

For vessels in which the machinery is not under a continuous survey program, the DNV rules require the following to be conducted on the main diesel engine at the five year renewal survey: A visual inspection by opening up fully or partly, as deemed necessary by the surveyor and pressure testing as determined by the surveyor, or an external survey and performance test which may include, at the discretion of the surveyor, testing of the safety devices, opening up, and pressure testing.

d. Det Norske Veritas Automation Survey Requirements

As noted in Appendix 1, the automation system, comprised of the control systems for the main engine and its vital auxiliaries and the machinery monitoring and alarm system, was designed and built for periodically unmanned engineroom operation and as such the vessel is classed E0. The automation system is subject to classification surveys like the rest of the vessel, e.g. five year renewal surveys with intervening annual surveys. DNV records the results of these surveys on two different forms, the E0A Survey Check List for the annual survey and the E0C Survey Check List for the five year renewal survey. These forms are internal to DNV and are not made available to vessel owners.

The DNV classification rules give the requirements for the items that are checked during the E0A and E0C surveys. The classification rules are nonspecific in that they only specify that the surveyor is to verify the correct functioning of systems and equipment. The rules do not specify how or give detailed testing requirements for the systems or equipment. These rules are amplified by the E0A and E0C Survey Check Lists, which give additional instructions for the surveyor to follow when verifying the automation system meets classification requirements.

APPENDIX 4

The items that are checked in the E0A survey are:

Telephone communications system
Engine order telegraph
Propulsion remote control system
Transfer of main engine control between control stations
Automatic control systems
Automatic start of standby generator upon loss of power
Automatic trip on nonessential electrical loads
Emergency lighting in the engineroom
Alarm system performance
Engineers' alarm
Safety system performance
Fire detection and alarm system

The E0A Survey Check list also includes an item for the surveyor to verify the vessel has been adhering to a systematic maintenance program and function testing of the automation instrumentation and the results of this program have been documented. The E0A survey also requires the surveyor to verify the vessel has onboard the necessary equipment to test the automation system.

An E0C (RENEWAL) Survey Check list includes all E0A items plus the following:

Propulsion control manual switch over, local control of the main engine
Emergency run and override of automatic safety action
Propulsion remote control system tested:
    From stop to ahead,
    From ahead to astern,
    Stop
From stop to astern
Alarm for bridge remote control failure
Transfer of alarm monitoring responsibility
Group alarms and extension alarms
Alarm functions
Redundant power supply
Repose alarms
Safety functions

The DNV Instructions to Surveyors No. I-C3.5, titled "Periodically Unattended Machinery Space -E0" contains guidance for surveyors to follow during the E0A and E0C surveys. The guidance states that the systematic maintenance and function testing documentation must indicate which and when the equipment was subject to maintenance and testing.

APPENDIX 4

The DNV Instruction also provides guidance should the surveyor discover a vessel has not completed the maintenance and function testing. If discovered during an E0A survey, the surveyor is to issue a recommendation to complete the testing by the vessel's crew and complete a new annual survey. If discovered when conducting an E0C survey, the surveyor must check each instrument and issue a recommendation for the vessel to carry out the testing and that it is due within one year of discovery. This instruction contains specific guidance for Form No. E0 86.8, which has been replaced by the E0A and E0C Survey Check Lists. This guidance expands and amplifies the items the surveyor needs to check or verify during the surveys.

For vessels classed E0, DNV class rules require the preparation of two test programs. As specified in Section 7 of Part 6, Chapter 3 of the DNV Rules for Classification of Steel Ships, titled "Periodically Unattended Machinery Space (E0) and Machinery Centralized Operated (ECO)", the shipbuilder is required to prepare a detailed test program for testing the machinery installation during initial sea trials after construction. This test program is to cover the alarm and monitoring system, main engine remote control system, generator blackout test and the control system for automatic boilers. This test program is to be filled in, signed by the surveyor and kept onboard the vessels. The results of the sea trials testing were onboard the BRIGHT FIELD but were not found until February 1997.

The second test program required by DNV class rules concerns the periodic testing requirements for the automation system. Section 1 of Part 6, Chapter 3 of the DNV Rules requires a test program for vessels certificated for unattended machinery operation, which includes test procedures, acceptance criteria and observations to be made during the testing. This test program must be submitted to DNV for approval. However, the rules do not specifically state that this test program must be maintained onboard the vessel. In addition, the rules require the vessel to have onboard instruction manuals that contain instructions for testing and for the systematic maintenance and function testing of the automation equipment.

e. Det Norske Veritas E0 Survey History

The most recent E0C (renewal) survey was completed on 16 December 1993 in Qinhuangdao, China. There were no outstanding requirements or conditions of class relating to the automation system resulting from this survey. In a statement provided by the surveyor, Mr. [redacted] he stated he did not recall anything noteworthy from the examination. He was confident the survey was done in accordance with the E0C checklist. After being shown the current version of the COSCO E0 survey form, he recalled viewing a similar document when he conducted the survey.

The first E0A (annual) survey was completed by Mr. [redacted]n Hong Kong on 25 November 1994. There were no conditions of class for the automation system as a result of this survey. In his statement he could not recall any specifics about the exam but was sure he sighted satisfactory evidence of a systematic maintenance and testing program. Notes from the survey showed that initially the overspeed trips for the Number 1 and 2 generators had to be repaired. The survey was completed on 17 November 1994.

The second E0A survey was conducted on 5 January 1996 in Kaohsiung, Taiwan by Mr. [redacted] In his statement he indicated that it was completed satisfactorily and without noteworthy incident. He did point out that when he first boarded the vessel on 30 December 1995, the three page COSCO E0 survey form had not been completed. He required the vessel to complete the testing before he would conduct the E0A survey. This was done and he completed the survey on 5 January 1996. During this survey there were two automation system items that were not satisfactory, "Propulsion remote control system performance verified" and "Transfer of control responsibility from engine room to the bridge and vice-versa tested." The deficiency noted in the results of this survey read, "Remote control system for engine control are not changeable now."

Mr. [redacted] confirmed that this deficiency was given because, at the time of the E0A survey, the transfer of main engine control from the engineroom to the bridge did not work. Consequently, the vessel was given a condition of class that read, "Remote control system to be dealt with and tested at the presence of DNV surveyor. In the meantime, engine room to be manned." This condition of class was removed during a survey in Newcastle, Australia on 19 February 1996. The surveyor who cleared this condition of class, Mr. [redacted], noted that he did this upon testing the remote control system from the bridge and engineroom and finding it satisfactory. At the time of the allision, there were no requirements or outstanding conditions of class applicable to the automation system on the BRIGHT FIELD.

f. Coast Guard Port Safety Boardings.

In the three years prior to the accident, the BRIGHT FIELD was boarded three times by the U. S. Coast Guard under port state control authority, twice undergoing required annual examinations. The most recent annual examination prior to the allision was conducted on 10 June 1996 at Davant Anchorage, Davant, Louisiana by Marine Safety Office New Orleans. The boarding team examined the vessel's classification certificates, documents, officer competency certificates, logs, record books, manuals, charts, nautical publications, posted graphs and instructions, as well as the proper operation of navigational equipment. The team also examined the lifesaving, firefighting, electrical cargo and mooring systems, the operation of the steering system from all stations in all modes, the fire pump, emergency fire pump and the firemain. There were no deficiencies noted and all outstanding deficiencies were cleared. The scope of this boarding and examination is normal for an annual examination of a freight vessel under the port state control program.

The previous annual examination, the first under the Coast Guard's port state control initiative, was conducted on 9 August 1995 at the Alcoa facility in Port Lavaca, Texas by Marine Safety Office Corpus Christi. The scope of the boarding was comparable to that of the 10 June 1996 boarding and resulted in seven discrepancies noted: the fire plan was missing on the port side, the fireman's lifeline was not fireproof, weak links were not installed on port side liferafts, the hospital space lacked some supplies, pressure testing of bunker piping system was not current, the oil transfer procedures did not comply with Coast Guard regulations and the speed log was found inoperative. With the exception of the inoperative speed log, all discrepancies were corrected prior to departure; a letter of deviation was issued for the outbound transit.

APPENDIX 5

COMPARISON OF AUTOMATION TEST PROCEDURES

A total of four automation test procedures were provided to the Marine Board and entered into evidence. In appearance, there are only minor differences between the four versions. The text of the instructions for each operation, and the expected results, were all drawn from the same document.

a. The "Main Engine Control & Instrument On-Board Test Procedurs (sic)".

This document was provided to the Marine Board by DNV and is the only version that bears a DNV approval stamp (dated 24 May 1988). It contains three sections missing from the other versions: a matrix indicating the frequency of test and which tests should be attended by a DNV Surveyor, a schematic of the pneumatic control system and a section 10 (main engine starting test). The right side of each page in each section has two columns titled "Observations" and "Remarks", for recording test results.

b. The "M.S. BRIGHT FIELD (Test Programme)".

This document was produced by the Chief Engineer and COSCO's Technical Superintendent and was given to the Marine Board in mid-February 1997; it is the version sighted by Mr. [redacted] as he prepared to conduct the automation survey and bears his notation of the date "97.02.17". This version had been modified to replace the DNV-approved document's two columns titled "Observations" and "Remarks" with five columns, the first of which is titled "Interval", while the remaining four are under the heading "Date of Test". In the "Intervals column, recommended intervals of one, two or three months are indicated. Aside from a few hand-written notations, there is no evidence it has been used to record any test results.

This version includes a section 6A-1 (wrong way test), a two page procedure for the actual testing of the various sensors installed in the automation system and a more extensive list of the channels and programming parameters than was included in the DNV-approved document.

c. The "Systematic Maintenance and Function Testing".

This document is stamped "M.V. BRIGHT FIELD" and was provided to the Marine Board by COSCO on 19 March 1997. It has a cover sheet indicating that it was drawn by Sasebo Heavy Industries (SHI), Ltd. Shipyard. This version had been modified to replace the DNV-approved document's two columns titled "Observations" and "Remarks" with five columns, the first of which is titled "Interval", while the remaining four are under the heading "Date of Test" with the handwritten marks "J", "F", "M" and "A" above the columns. In the "Intervals column, recommended intervals of one, two or three months are indicated.

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There is a hand written note on the index that "X" meant tested and found in order while "X circled" meant repairs or adjustments had been made. In some of the four columns under "Date of Test", there was an "X" to show which of these months each of the tests were completed. The year was not shown. Many, but not all, of the tests are logged as being completed according to the recommended frequency but did not indicate what values or responses were observed.

This version includes a section 6A-1 (wrong way test), a two page procedure for the actual testing of the various sensors installed in the automation system and a more extensive list of the channels and programming parameters than was included in the DNV-approved document.

d. The "Systematic Maintenance and Function Test".

This document was discovered in the BRIGHT FIELD's technical library by Mr. [redacted], the technician for the Terasaki alarm and monitoring system, in mid-February 1997. At the time, he was searching for documentation in conjunction with servicing of the system. This version had been modified to replace the DNV-approved document's two columns titled "Observations" and "Remarks" with five columns, the first of which is titled "Interval", while the remaining four are under the heading "Date of Test". Depending on the test procedure, intervals of one, two or three months are indicated.

It contains a significant number of hand-written notes on channel programming values and the four columns under "Date of Test" were not labeled. However, there were log entries for when the various tests were conducted. The log entries showed the tests were completed at different times, but were all in 1989. Not all tests contained a log entry showing it had been completed; in general, this document showed the tests were not being conducted according to the recommended frequency and did not indicate what values or responses were observed.

This version also includes a section 6A-1 (wrong way test), a two page procedure for the actual testing of the various sensors installed in the automation system and a more extensive list of the channels and programming parameters than was included in the DNV-approved document.

APPENDIX 6

RECENT MAIN ENGINE REPAIR HISTORY

The review of the vessel logs and records showed that they did not always indicate the reason for automatic slowdowns or temporary stops for repairs. Where this information is known, it is indicated.

On 1 June 1996, the BRIGHT FIELD was anchored in the Panama Canal Atlantic Anchorage. From 1 through 4 June 1996, the vessel's engineers opened and examined the #2 and #3 cylinders; the liner for #2 cylinder was lifted out for closer inspection and replaced with a previously used cylinder liner while the cracked cylinder head for #3 cylinder was repaired by welding. In addition, during this period, the engineers removed, cleaned and inspected all ten fuel injectors for the five cylinders, with five of the ten needing to be replaced. They also replaced the fuel pumps for #4 and #5 cylinders. Upon completing these repairs, the engineers found the main engine operating satisfactorily. The crew and vessel proceeded to New Orleans, arriving on 9 June 1996.

On 11 June 1996, while in New Orleans, the engineers opened, cleaned and inspected the #1 cylinder: the piston was pulled and the piston rings were renewed. After leaving New Orleans en route the Panama Canal, the main engine experienced an automatic slowdown at 0836 on 20 June 1996. The crew stopped the vessel a short period of time but were underway again at 0900. On 24 June 1996, while anchored in the Panama Canal Atlantic Anchorage, the crew replaced the #1 cylinder exhaust valve.

After passing through the Panama Canal, the BRIGHT FIELD proceeded to Kashima, Japan via Long Beach, where it stopped to bunker. The vessel departed Long Beach on 5 July 1996. During the crossing of the Pacific there were a number of occasions when the crew had to slow down or stop the vessel. On 10 July 1996, over the course of a two hour period, the vessel's speed was reduced from NAVIGATION FULL AHEAD to FULL AHEAD and reduced again to SLOW AHEAD before the crew brought it back to NAVIGATION FULL AHEAD. Again, on 14 July 1996, the vessel dropped below NAVIGATION FULL AHEAD. During the period from 0655 to 0850, the vessel operated at SLOW AHEAD, HALF AHEAD and FULL AHEAD. At 1408 on 14 July 1996, the vessel experienced another automatic slowdown. On 18 July 1996, the crew stopped the vessel twice, once for 15 minutes and the other for 1 hour and 14 minutes, to complete engine repairs.

While conducting cargo operations in Kashima, Japan from 23 July to 6 August 1996, the engineers removed and tested all ten fuel injectors; four had to be replaced. They also removed, disassembled and cleaned Valve 14B in the pneumatic logic box for the main engine remote control system because the acceleration of the engine was too slow. The engineers opened up and examined the pistons in the #4 and #5 cylinders; all piston rings on both pistons were replaced. The rings installed on the #4 piston had previously been used. The engineers tested the main engine and found it to be operating normally.

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While conducting cargo operations in Pulau Laut in the Caroline Islands on 16 and 17 August 1996, the engineers replaced the fuel injectors on the #4 cylinder and opened the #5 cylinder to correct a water leak. On 20 August 1996, while underway en route to Hong Kong, the crew checked the cylinder combustion pressures and made adjustments to the fuel injection quantity.

During cargo operations while in Banjarmasin, Jakarta, Indonesia from 2 to 13 September 1996, the engineers' examination of the #1 cylinder revealed the piston was severely burned and the liner was cracked near the top in the combustion chamber. An unsuccessful attempt was made to repair the liner by welding. The piston and liner were replaced from spares on board the vessel. In addition, all fuel injectors were replaced and the air starting valves for cylinders #1, #3, #4 and #5 were overhauled.

After departing Banjarmasin on 13 September 1996 and while underway en route to Singapore, the crew stopped the vessel to replace the fuel injectors on #3 and #5 cylinders. On 17 September, the vessel again stopped so that the engineers could investigate a knocking sound from the main engine. Examination showed that the rings for #4 piston were seized and the rings on #5 piston had lost their elasticity. The BRIGHT FIELD resumed its voyage at the reduced main engine speed of 65 RPM.

On 18 September 1996, the crew again stopped the vessel and it remained dead in the water for the next four days so the engineers could complete engine repairs. The engineers found the pistons damaged and the liners cracked in the #4 and #5 cylinders. Over 20 cracks were found in the #4 cylinder liner. There were insufficient spares on board the vessel to replace the liners and pistons for these two cylinders. The vessel's engineers attempted to weld the #4 cylinder liner but the results were unsatisfactory. They had to resort to installing the liner from the #1cylinder that had just been removed during the stay in Banjarmasin and replacing the piston crown. After reassembling #4 cylinder, the engineers found it was still leaking water through cracks that could not be repaired. The cracking in #5 cylinder liner was not that serious, and the cylinder was re-assembled. The voyage to Singapore resumed at the reduced speed of 56 RPM.

A telex, sent by the crew to COSCO, reported that due to residue in the lubricating oil, the oil strainer seemed to be continually blocked even though the lubricating oil purifier was working normally. A later telex to COSCO requested arrangements for the following repairs while in Singapore: renew the #4 cylinder liner, renew the #4 piston crown, renew the rings for the #5 piston, dismantle and clean the main engine air cooler, repair the #2 main engine fuel oil injection pump, and adjust the timing of all fuel injection pumps.

While conducting cargo operations in Singapore from 30 September to 3 October 1996, shipyard workers repaired the #4 cylinder liner and piston crown and the air cooler. The rings for #1 piston were replaced and the scavenging box was cleaned.

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After leaving Singapore en route to the Suez Canal, the crew reported to COSCO that the BRIGHT FIELD's speed had to be reduced to 63 RPM due to high exhaust temperatures. On 10 October 1996, the crew stopped the vessel while the engineers replaced the fuel oil injectors for #1 and #3 cylinders. In addition, they dismantled and cleaned pneumatic valves 14A and 14B, which control engine speed as part of the engine control system. After the repairs, the vessel was able to resume a speed of 72 RPM. The crew reported to COSCO by telex that problems were being experienced with fuel injector valves.

Upon arrival at the south Suez Canal anchorage on 21 October 1996, the engineers opened the main engine scavenging box and examined the piston rings for all five cylinders, finding damage to the rings for #2 and #3 pistons. The crew reported to COSCO that repairs would be made after passing through the Suez Canal. While anchored in Port Said on 23 and 24 October 1996, the engineers overhauled the #2 and #3 cylinders; pistons were pulled and cleaned, liners were cleaned and piston rings renewed. The piston crown for #2 cylinder was found to be dented. On 25 October 1996, the crew reported to COSCO the reason for having to repeatedly replace piston rings was the poor quality of rings on board the vessel.

On 5 November 1996, while en route to New Orleans, the crew had to reduce main engine speed to 61 RPM because of high exhaust temperature in the turbocharger. Later that day the engine began emitting large amounts of smoke and the alarm noting high oil mist in the main engine crankcase sounded. The engineers immediately stopped the engine. Suspecting the lubricating oil had been diluted by fuel oil, they drained the main engine sump to the lubricating oil settling tank. The engineers visually inspected the sump but it was not entered and cleaned. They refilled the sump with 8400 liters (8.4 m^3) of new lubricating oil, all the new oil remaining in the bulk new oil storage tank. The crew requested COSCO arrange at the next port of call for the repair of the main engine fuel oil timing and a new monitor to replace the inoperative #1 monitor for the Terasaki WE3 Watch Free alarm and monitoring system.

On 6 November 1996, the engineers tested the main engine and found it had an exhaust leak. They removed the #2 cylinder cover, which revealed the #2 piston crown was cracked and burned through. The engineers repaired the cylinder and piston and the vessel got underway again on 7 November 1996. Since it was still experiencing high exhaust temperatures, it proceeded at the reduced speed of 61 RPM. The crew requested COSCO arrange for the immediate supply of main engine lubricating oil and two main engine piston crowns. By this time, all reserves of lubricating oil and spare piston crowns had been consumed. The crew also requested new piston rings and specifically cited manufacturer and part numbers to avoid receiving the same as those that were presently on board, allegedly of poor quality.

On 9 November 1996, the crew once again had to stop while underway. Both fuel injectors for the #3 cylinder were replaced. The crew again stopped on 11 November 1996 and the engineers adjusted the fuel injection timing. The crew reported to

COSCO the details of repairs made to the fuel timing on all cylinders and that the main engine speed still remained at 61 RPM. In a telex sent to COSCO on 14 November 1996, the crew reported that due to the present condition of the main engine an expert would be needed in New Orleans. Every time they increased engine speed to 63 RPM, the exhaust temperature climbed and exceeded normal limits. Further, the crew reported that if repairs were not made in New Orleans, the vessel would not be able to carry out its next voyage.

On 21 November 1996, the BRIGHT FIELD arrived in New Orleans and a new Chief Engineer reported aboard. According to COSCO's port engineer, the previous Chief Engineer was fired since he did not properly maintain the engine as evidenced by the previous mentioned repairs. As cargo operations permitted, a number of repairs to the main engine were completed. A New Sulzer Diesel engineer came on board on 22 November 1996 and opened and inspected the main engine. He found heavy carbon deposits in all of the cylinder scavenging ports and that the piston rings had sharpened edges and had lost their elasticity. The scavenging box was very dirty with heavy carbon deposits and the vessel's engineers began cleaning it. A spare cylinder liner and piston crown were received. Cleaning the scavenging box was completed on 23 November 1996.

On 24 November 1996, the engineers replaced the fuel injectors for the #4 and #5 cylinders. The next day, they opened the #2 cylinder, pulled the piston and renewed the piston crown. On 26 and 27 November 1996, the engineers removed, disassembled, cleaned, re-assembled and re-installed the high pressure fuel pumps for all five cylinders. The New Sulzer Diesel representative checked and adjusted the fuel timing.

On 29 November 1996, the BRIGHT FIELD took delivery of 7983 liters (8.0 m^3) of new lubricating oil, which was placed in the bulk oil storage tank. Engineering logs do not indicate any of this oil was transferred to the main engine lubricating oil sump prior to the vessel's down river transit on 14 December 1996.

The engineers overhauled the #5 cylinder on 28 and 29 November 1996. The liner had three cracks near the top in the combustion chamber. The piston rings were worn and had lost elasticity and were replaced. In addition, they replaced the fuel injectors on #1, #2 and #3 cylinders.

On 30 November 1996, the crew dismantled the main engine emergency stop valve; three air diaphragms were renewed and the valve re-installed. Test results showed it was working normally. On 5 and 6 December 1996, they dismantled and repaired the pressure reducing valves for the main engine control air system.

On 7 December 1996, the crew reported to COSCO that the trouble with the main engine was due to a defective or fouled turbocharger and/or air cooler and requested arrangements be made to repair both items.

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The Master sent an undated facsimile to COSCO on 8 or 9 December 1996 (based upon the Master's recollection). The English translation of the Chinese original reads "Because the main engine of the Bright Field still has problem(s), and the process of washing holds did not go smoothly, while COSCO Hong Kong has explicitly expressed that the crew will not have any bonuses, the crew members are joining together to ask for leave. The leadership of the vessel and each department, under the circumstances, cannot do anything but their best to maintain order, and to make sure that everybody finishes his own work. We can only expect the Company to handle this accordingly." Accompanying this message was a list of 23 of the 28 crewmembers signed aboard, applying for leave.

On 9 December 1996, the Chief Engineer reported to COSCO that the main engine lubricating oil pumps were noisy and that he would investigate the cause at a later date.

Over the period from 10 - 13 December 1996, dockside workers came on board and repaired the turbocharger and air cooler.

APPENDIX 7

PERSONNEL ISSUES

a. BRIGHT FIELD Personnel; Professional Qualifications and Experience

1. Captain [redacted] Pilot, M/V BRIGHT FIELD.

Captain [redacted] holds a U. S. Coast Guard Merchant Mariner's License as Master Rivers Steam or Motor Vessels of any gross tons; also, radar observer-inland; also, First Class Pilot Steam or Motor Vessels of any gross tons on the Lower Mississippi River (Mile 0.0 AHP to Mile 946.4 AHP); the Ohio Rivers (Mile 469.4 AHP to Mile 877.0 AHP); the Vicksburg, Mississippi Harbor; also, Operator of Uninspected Towing Vessels upon Great Lakes and Inland Waters. The license was issued 18 May 1995 and was valid on 14 December 1996.

Captain [redacted] also holds a commission issued by the State of Louisiana as Pilot, New Orleans and Baton Rouge Pilots Association. There is no state license as such and the validity of the commission is dependent on the holder possessing a Federally issued license for Louisiana state waters. The commission was originally issued on 7 January 1980 and was valid on 14 December 1996.

Captain [redacted] began working on the river while working his way through college. He received formal training as a pilot from the National River Academy in Helena, Arkansas, graduating in 1975. Among other positions, he worked on the DELTA QUEEN and MISSISSIPPI QUEEN for five years and has served as a pilot of deep draft vessels on the Lower Mississippi River for the last 17 years, averaging 200 trips annually. He has not attended a ship simulator school and has no formal training in Bridge Resource Management.

Captain [redacted] testified that he had 8.5 hours of sleep between 2300 on 13 December 1996 and 0730 on 14 December 1996. He described himself as being in good health and not taking any medications on 14 December 1996.

2. Captain [redacted], Master, M/V BRIGHT FIELD.

Captain [redacted] holds a Republic of Liberia license as Master; also Radar Observer, on oceangoing vessels of any gross tonnage; the license was issued on 3 October 1996 and was valid on 14 December 1996. He also holds a People's Republic of China Marine Officer's Certificate of Competency as Master of ships of 1600 gross tons or more, except for oil tankers, chemical tankers and liquefied gas tankers. This license was issued 20 April 1995 and was valid on 14 December 1996.

Captain [redacted] has spent fourteen years at sea, advancing through the ranks. He also attended Talien Maritime College in Talien, China for four years. He had attended three ship simulator courses, beginning while a cadet and most recently when he passed his Master's examination. He has not received any formal training in the principles of Bridge Resource Management. He has served as the Master of three vessels and this was his first term as Master of the BRIGHT FIELD; he had been aboard for about four months.

Captain [redacted] testified that he had seven hours sleep between 0000 and 0700 on 14 December 1996. He described himself as being in good health and not taking any medications on 14 December 1996.

3. [redacted], Chief Engineer, M/V BRIGHT FIELD.

Mr. [redacted] holds a Republic of Liberia license as Chief Engineer on motor vessels of any kilowatt propulsion power; the license was issued on 23 May 1995 and was valid on 14 December 1996. He also holds a People's Republic of China Marine Officer's Certificate of Competency as Chief Engineer of ships of 3000 kilowatts propulsion power or more, except for oil tankers, chemical tankers and liquefied gas tankers. This license was issued 27 October 1993 and was valid on 14 December 1996.

Mr. [redacted] pursued a marine engineering specialization while attending the Jing Mae Navigational College from 1979 to 1982. Since 1982, he has been employed as an engineer aboard vessels with lesser and greater levels of automation than the BRIGHT FIELD. He received additional training in automation systems at the Talien Maritime Academy in 1993. This was his first employment aboard the BRIGHT FIELD.

Mr. [redacted] testified he had seven hours sleep between 2300 on 13 December 1996 and 0600 on 14 December 1996. He described himself as being in good health and not taking any medications on 14 December 1996.

b. Crew Experience aboard the BRIGHT FIELD.

All of the deck officers has been aboard the BRIGHT FIELD for several months. Except for the Chief Engineer, the engineers aboard the BRIGHT FIELD at the time of the allision had reported aboard the vessel in August 1996. The Chief Engineer had joined the ship on 21 November 1996 after the vessel's arrival in New Orleans; this was his first extended down-river transit on this vessel. During his time on board, the ship had moved 4 times within the Lower Mississippi River for a total of only 11 hours of maneuvering time.

c. Pilots Testifying as Expert Witnesses.

There were a number of waterways issues raised during this investigation to determine what, if any, impact they had on the events of 14 December 1996. Three experienced river pilots testified as expert witnesses and provided testimony concerning these issues. The pilots were CAPT [redacted] CAPT [redacted] and CAPT [redacted]

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1. CAPT [redacted] retired in September 1996 from the Crescent River Port Pilot Association, with 25 of his 40 years experience as a ship pilot on the Mississippi River. He has served as a member of the Board of Pilot Commissioners for six years.

2. CAPT [redacted] has been a ship pilot on the Mississippi River for 32 years and an official in the Crescent River Port Pilot Association for 27 years; he is currently President of the Association, Chairman of the National Pilot Safety Committee of the American Pilot's Association as well as a past Vice-President of the American Pilot's Association.

3. CAPT [redacted] has been a member of the Associated Federal Pilots and Docking Masters of Louisiana, LLC since 1980 and is presently completing his fifth term as Chief Executive Officer of that organization.