Allision of Staten Island Ferry *Andrew J. Barberi*
St. George, Staten Island, New York
October 15, 2003

Marine Accident Report
NTSB/MAR-05/01

PB2005-916401
Notation 7628A

National Transportation Safety Board
Washington, D.C.

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Adopted March 8, 2005

National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594

National Transportation Safety Board. 2005. *Allision of Staten Island Ferry* Andrew J. Barberi, *St. George, Staten Island, New York, October 15, 2003.* Marine Accident Report NTSB/MAR-05/01. Washington, DC.

Abstract: This report discusses the allision of the passenger ferry *Andrew J. Barberi* with maintenance pier B-1 at the Staten Island ferry terminal on October 15, 2003. The ferry carried an estimated 1,500 passengers and 15 crewmembers. Ten passengers died in the accident and 70 were injured. An eleventh seriously injured passenger died 2 months later. Damages totaled more than $8 million, with repair costs of $6.9 million for the *Andrew J. Barberi* and $1.4 million for the pier.

From its investigation of the accident, the Safety Board identified the following safety issues: actions of the assistant captain and captain, oversight of ferry operations by the New York City Department of Transportation, medical oversight of mariners, safety management systems, and the potential contribution of navigation technology to the safety of ferry operations.

On the basis of its findings, the Safety Board made recommendations to the New York City Department of Transportation, the U.S. Coast Guard, the States that operate public ferries, and the Passenger Vessel Association.

Contents

Acronyms and Abbreviations

AIS	automatic identification system
APTA	American Public Transportation Association
ARPA	automatic radar plotting aid
CFR	*Code of Federal Regulations*
COI	certificate of inspection
CPR	cardiopulmonary resuscitation
EMS	emergency medical services
EMT	emergency medical technician
FDNY	New York City Fire Department
GMATS	Global Maritime and Transportation School
GPS	global positioning system
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
ISM	International Safety Management [code]
MOU	memorandum of understanding
NVIC	Navigation and Vessel Inspection Circular
NYC DOT	New York City Department of Transportation
NYPD	New York City Police Department
OCMI	Officer in Charge, Marine Inspection
PCP	phencyclidine
PDR	*Physicians' Desk Reference*
PVA	Passenger Vessel Association
REC	regional examination center
SOLAS	International Convention for Safety of Life at Sea
STCW	International Convention on Standards of Training, Certification and Watchkeeping
TIA	transient ischemic attack
U.S.C.	United States Code
VTS	Vessel Traffic Service

Executive Summary

About 1520 on October 15, 2003, the Staten Island Ferry *Andrew J. Barberi,* owned and operated by the New York City Department of Transportation, was near the end of a regularly scheduled trip from Manhattan to Staten Island when it allided with a maintenance pier at the Staten Island Ferry terminal. Fifteen crewmembers and an estimated 1,500 passengers were on board. Ten passengers died in the accident and 70 were injured. An eleventh passenger died 2 months later as a result of injuries sustained in the accident.

Hundreds of emergency personnel and dozens of emergency vehicles, including several vessels, responded to the accident, dispatched by the New York City Police Department, the New York City Fire Department (including emergency medical services), the U.S. Coast Guard, and the U.S. Army Corps of Engineers. Damages totaled more than $8 million, with repair costs of $6.9 million for the *Andrew J. Barberi* and $1.4 million for the pier.

The National Transportation Safety Board determines that the probable cause of this accident was the assistant captain's unexplained incapacitation and the failure of the New York City Department of Transportation to implement and oversee safe, effective operating procedures for its ferries. Contributing to the cause of the accident was the failure of the captain to exercise his command responsibility over the vessel by ensuring the safety of its operations.

The Safety Board's investigation of this accident identified safety issues in the following areas:

- Actions of assistant captain and captain.
- New York City Department of Transportation oversight of ferry operations.
- Medical oversight of mariners.
- Safety management systems.
- Potential contribution of navigation technology to the safety of ferry operations.

As a result of its investigation, the Safety Board makes recommendations to the New York City Department of Transportation, the U.S. Coast Guard, the States that operate public ferries, and the Passenger Vessel Association.

Factual Information

Accident Narrative

About 1500 on October 15, 2003, the Staten Island Ferry *Andrew J. Barberi* (figure 1) departed Whitehall, at the south tip of Manhattan, on a regularly scheduled, approximately 22-minute trip to St. George, Staten Island (figure 2). The *Andrew J. Barberi* was a large passenger vessel owned and operated by the New York City Department of Transportation (NYC DOT) and certificated by the U.S. Coast Guard. The ferry had a maximum capacity of 6,000 passengers but carried a smaller load, estimated at 1,500 people, on the accident trip.[1] The vessel was under the command of a captain and was staffed with an assistant captain, two mates, a chief engineer, an assistant engineer, two oilers, and seven deckhands. A ladies' room attendant and two New York City Police Department (NYPD) uniformed officers were also on duty but were not part of the crew.

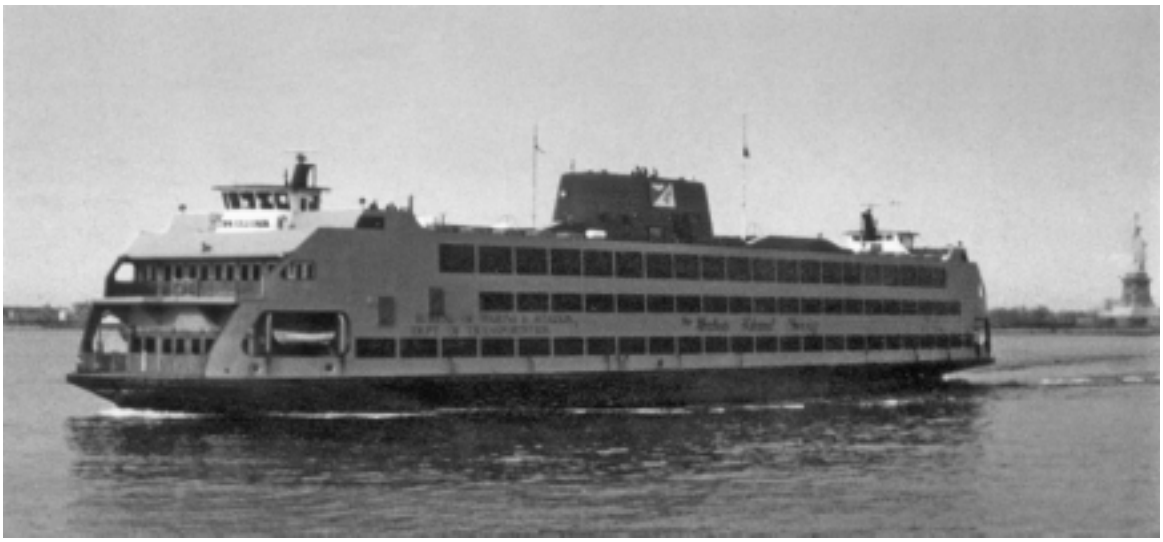

Figure 1. *Andrew J. Barberi* in New York Harbor after passing Statue of Liberty en route to St. George terminal. The ferry's symmetrical design allows it to approach and leave its berth without turning around. The end that docks in Manhattan is known as the New York end, and the end that docks in Staten Island is called the Staten Island end. The sides of the ferry are referred to as the Brooklyn side and the New Jersey side. The starboard side on the trip to Manhattan is the Brooklyn side, while on the trip to Staten Island, the New Jersey side is starboard.

[1] After the Staten Island Ferry stopped charging passengers in 1997 (see "Additional Information" section), the number of people riding the ferry was determined by rough estimation. The method, according to a police officer assigned to the ferry, was to watch the passengers boarding the vessel and observe the extent to which they filled the accommodation areas. The officer told investigators that ferries later in the afternoon (4 o'clock and after) might reach the maximum load.

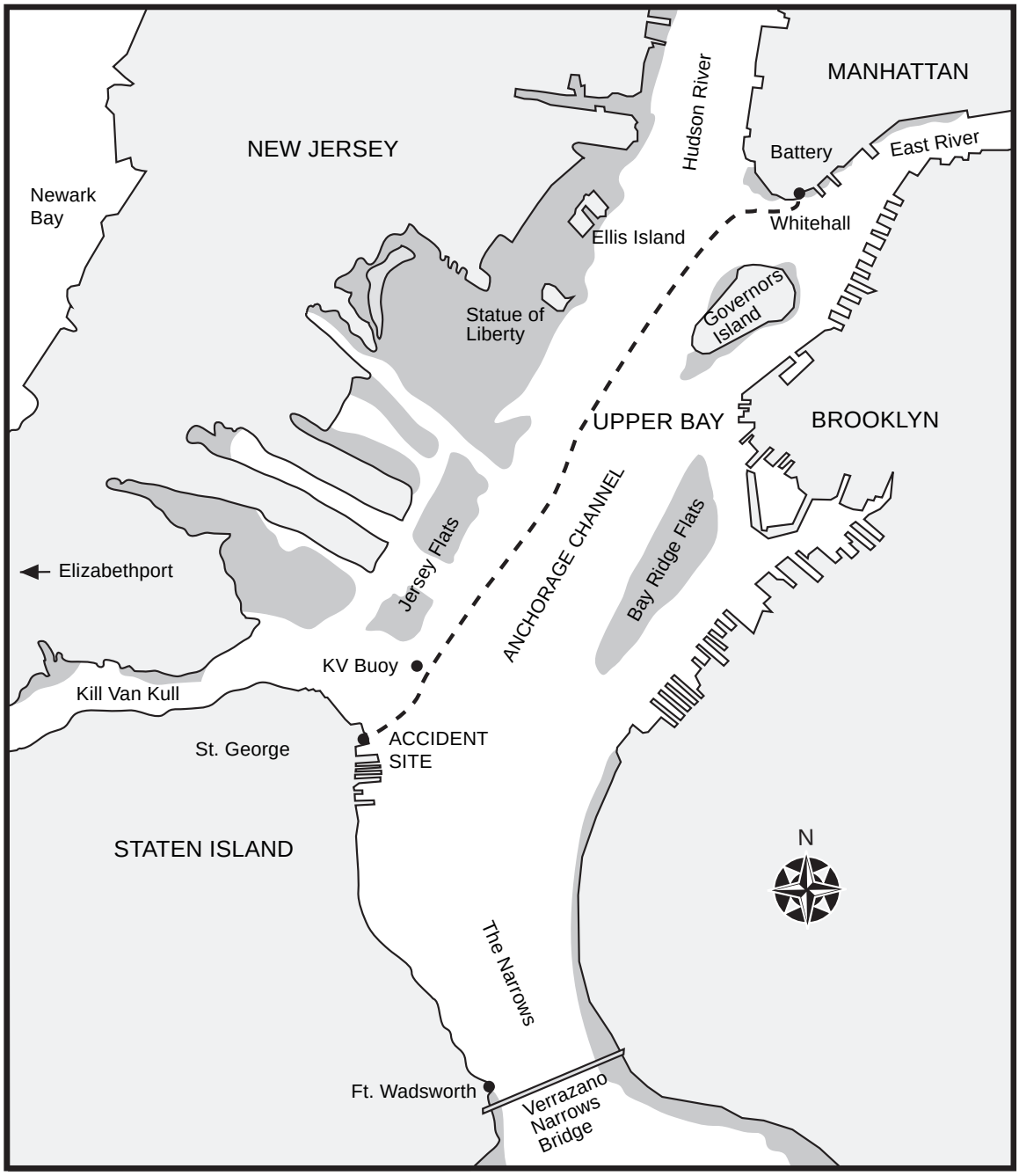

Figure 2. Route of *Andrew J. Barberi* in New York Harbor from Manhattan to accident site at Staten Island.

En route to St. George, the assistant captain was operating the controls in the pilothouse on the Staten Island end of the ferry. The navigation watch also included a deckhand who served as lookout. The lookout told Safety Board investigators that he sat on a stool next to the assistant captain and that they engaged in casual conversation. "He told me some tugboat stories," said the lookout. "We were just having a regular

conversation." Crewmembers estimated that the assistant captain was operating the vessel at the routine speed of 14 to 16 knots.[2]

About halfway into the trip, the senior mate entered the pilothouse. His station while passengers disembarked and embarked was on the main deck at the docking end. His other responsibilities included monitoring the deckhands on the main deck and on one side of the saloon deck and securing the New York end when the ferry docked in Manhattan.[3] The senior mate first told Safety Board investigators that he went into the pilothouse to complete work orders for repairing broken doors on the saloon deck. In a later interview, the senior mate said that he was reading a newspaper while he was in the pilothouse. He said that he sat on a settee (padded bench) behind the controls, aft of both the assistant captain and the lookout. The senior mate further stated that he could not see out the pilothouse window, meaning that he could not observe the course of the vessel and its approach toward the Staten Island piers.[4]

According to witnesses, the trip was uneventful until the vessel passed the buoy at the entrance to the Kill van Kull waterway (the KV buoy), about 1,000 yards from the St. George terminal (and about 2 minutes away at a speed of 15 knots). The lookout told investigators that "somebody" had entered the pilothouse and was reading a newspaper on the bench behind the control platform. He said that when the ferry passed the KV buoy, he asked permission of the assistant captain to leave the pilothouse. He told investigators that his intent was to go down to the saloon deck and untie the handles of the broken exit doors[5] in preparation for docking. He said that the assistant captain replied, "Okay, see you later." The senior mate told investigators that he heard the lookout ask permission to go below and that he also heard the assistant captain agree to the lookout's request.

According to crewmembers, shortly after the ferry passed the KV buoy, the standard procedure was for the bridge deckhand on duty to go to the pilothouse on the docking end of the ferry and make an arrival announcement. Those interviewed stated that some lookouts always waited to leave the pilothouse until the bridge deckhand arrived; however, practices varied.[6] On the day of the accident, the lookout left the Staten Island-

[2] The ferry's navigation equipment did not include any means to measure its speed through the water. See "Vessel Information" section for details.

[3] Duty stations and responsibilities of the ferry's crewmembers are detailed in the "Survival Factors" section.

[4] The settee was lower than the navigation area, which was on a raised platform 4 inches above the pilothouse floor.

[5] The senior mate told investigators that on the day of the accident, the doors on the second, or saloon, deck on the Staten Island end, New Jersey side, were broken and could not be latched. The senior mate told investigators that a deckhand had reported the broken doors the day before. Because the wind gusts exceeded 30 knots, the doors swung freely. The senior mate said that he gave a piece of line to the second lookout on that shift and instructed him to lash the door handles together to prevent inadvertent passenger injury from a swinging door. The doors were to be untied before arrival in Staten Island to allow passengers to disembark and embark.

[6] For example, one deckhand told investigators that he made his arrival announcement from the nonoperating pilothouse.

end pilothouse before the bridge deckhand arrived. The lookout told investigators that when he left, the assistant captain, who had been sitting at the controls, stood up.

Crewmembers indicated that the KV buoy was also the point where the ferry operators typically began slowing the vessels and applying small course corrections in preparation for docking. Deckhands and passengers told investigators that normally, though not on the accident voyage, they could hear when the engines "backed down" (slowed) and that the sound change would inform them that they were ready to dock. Another Staten Island Ferry captain said that the sound change ordinarily triggered a "chain reaction that people start walking forward . . . . They could be half asleep, as soon as they hear the throttle [slowing], they get up and get moving forward."

The senior mate told investigators that after the lookout left the pilothouse, he did not hear the assistant captain say anything. He recalled that the assistant captain was standing at the controls: "He basically never sat down. He would always gear the boat standing up." The senior mate told investigators that it "did not surprise" him that the captain was not present in the pilothouse and did not come to supervise the docking. The senior mate said that he was still sitting on the settee when he heard a sound and felt a "heavy vibration" as if the vessel had struck an object in the water: "Nothing seemed out of the ordinary and bang." He said that he looked up, heard the assistant captain exclaim, "Jesus," looked out the window, and saw the ferry alliding with the concrete maintenance pier (pier B-1) south of the intended docking point.

The chief engineer, who was in the engineroom, said that he saw from the console speed and pitch indicators that both the main engine speeds and the pitch of the propulsion drives were still at full ahead at the time of the allision.[7] In the pilothouse immediately after the allision, the senior mate saw the assistant captain pull the throttle back to full pitch astern with his right hand and use his left hand to steer the ferry away from another vessel moored nearby. The mate said that the ferry stopped at a 45° angle between the moored vessel and two piers about 600 yards southeast of the intended docking point, slip 5.

The director of ferry operations told investigators that he was in the St. George port captain's office when a ferry employee alerted them that the *Andrew J. Barberi* was not turning toward slip 5. He said that the port captain ran to the radio and tried to contact the vessel.[8] He himself ran toward the pier but arrived after the allision. Emergency call records indicate that the allision occurred about 1520.

A crewmember of the tugboat *Dorothy J*, which was docked at the maintenance pier, told investigators that immediately after the allision, he saw "a person in an officer's uniform" walk across the top deck and enter the pilothouse on the Staten Island end. According to the senior mate of the *Andrew J. Barberi*, the captain entered the pilothouse "very shortly after impact," immediately moved the assistant captain away from the controls, and took control of the vessel. The captain maneuvered the vessel away from the

[7] See "Vessel Information" section for a description of the ferry's propulsion system.

[8] The ferry was equipped with two ship-to-ship and ship-to-shore VHF radios (see "Vessel Information" section).

pier and sent the mate below to assess the damage and the extent of injuries. The assistant captain then left the pilothouse.

As shown on a videotape from a Coast Guard Vessel Traffic Service (VTS)[9] camera on Governors Island (3 miles from the accident site), the ferry drifted several hundred yards into the harbor southeast of the terminal. The director of ferry operations said that he instructed the port captain to have the ferry "get back to St. George [and] turn around." The video recording (which started about 10 minutes after the accident) shows the ferry drifting a few minutes, then moving back toward the terminal and turning around (so it could dock by the undamaged New York end).

While the ferry was drifting, the chief engineer told investigators that he tried to call both pilothouses from the engineroom's sound-powered phone to discover what had happened, but no one answered.[10] After he sent the assistant engineer and the oilers to survey the damage, he heard the sound-powered phone ring and determined by its distinctive sound that it came from one of the pilothouses. No one answered when he picked up the receiver. Leaving the assistant engineer to monitor the propulsion plant, the chief engineer went to the pilothouse to find the captain.

The chief engineer said that when he entered the pilothouse, the captain immediately asked him to help transfer propulsion control to the New York-end pilothouse because the captain "couldn't land the boat [at the] Staten Island end, it was destroyed" and two people were needed to transfer control.[11] The chief engineer recalled the captain saying, "[The assistant captain] has lost it, he couldn't focus—he was pacing in a daze." The captain then left the pilothouse and entered the New York-end pilothouse to accept the transfer of propulsion control from the chief engineer at the other end. After the transfer was complete, the chief engineer saw the assistant captain outside the Staten Island-end pilothouse and asked him what happened. According to the chief engineer, the assistant captain said, "I passed out."

None of the crewmembers or passengers recalled hearing any warning announcements, alarms, or other alerts before the accident. Passengers who could see the impending allision estimated that they had seconds to move away or brace themselves for the allision. Other passengers took no action to lessen the effects of the accident, such as those who had no view of the pier or who were facing the opposite direction. Some passengers with cell phones called 911 to report the accident.

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[9] For further information on the VTS, see "Waterway Information" section.

[10] A sound-powered phone has no external power supply. To make a call, the user selects the number of the destination station (each has its own line) and cranks a handle to ring a bell at that station.

[11] According to ferry officials, captains typically controlled the ferry on the trips from Staten Island to Manhattan, and the assistant captains were at the controls on the returns to Staten Island. The operator who had controlled the vessel into the dock (the captain or assistant captain) would maintain propulsion control in the arriving pilothouse while passengers disembarked and embarked. Just before departure, that operator would transfer vessel propulsion to the operator in the departing pilothouse. For additional information on the ferry's propulsion system, see "Vessel Information" section.

A Coast Guard enlisted man, who was a regular ferry passenger, used his cell phone to contact the Coast Guard's New York command center at Ft. Wadsworth, Staten Island. Coast Guard records indicate that the command center logged the call at 1525. He reported that many passengers had been injured and would need medical help. An off-duty lieutenant with the New York City Fire Department (FDNY) called his dispatcher in Staten Island, described the accident, and advised sending multiple units and perhaps a boat in response. He described the scene after the allision as chaos, with people "screaming and yelling." Passengers reported hearing no emergency instructions from ferry crewmembers after the allision. Crewmembers told investigators that they helped the wounded as much as they could, moved debris, and tried to keep uninjured passengers away from the vessel's damaged areas. (For details of the crew's actions in the emergency, see the "Survival Factors" section.)

Emergency response records indicate that the ferry reached slip 5 at St. George at 1543, about 20 minutes after the allision. When the ferry docked, personnel from the FDNY, the NYPD, emergency medical services (EMS), and the Coast Guard immediately entered the vessel to help the injured. The director of ferry operations, who entered with the first responders, told investigators that he met the assistant captain on the saloon deck and that the assistant captain told him, "I'm sorry. I blacked out. It's all my fault. I killed these people." The assistant captain then pulled away and ran to the dock. After sending two NYC DOT employees after the assistant captain, the director of ferry operations entered the pilothouse. There, the captain told him that the assistant captain had slumped over the controls and that he had grabbed the assistant captain off and taken control of the vessel. However, by that time the allision had occurred.

Injuries

Ten passengers were killed and 70 passengers were injured as a result of the accident (table 1). One of the injured passengers died 2 months after the accident as a result of injuries received in the allision. (According to the provisions of Title 49 *Code of Federal Regulations* [CFR] part 830, section 2, that passenger was considered seriously injured.[12]) Injuries are categorized according to the criteria of the International Civil Aviation Organization (ICAO). For uniformity, the Safety Board uses the ICAO injury criteria in all its accident reports, regardless of transportation mode.

[12] Title 49 CFR 830.2 defines a fatal injury as any injury that results in death within 30 days of the accident. It defines serious injury as that which requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; results in a fracture of any bone (except simple fractures of fingers, toes, or nose); causes severe hemorrhages, nerve, muscle, or tendon damage; involves any internal organ; or involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.

Table 1. Injuries sustained in *Andrew J. Barberi* accident.

Injuries	Crew	Passengers	Other	Total
Fatal	0	10	0	10
Serious	0	19[a]	0	19
Minor	0	57	0	57
None	16	1,414	4[b]	1,434
Total	16[c]	1,500[d]	4	1,520

[a] One seriously injured passenger died on December 16, 2003.
[b] Includes 2 NYPD officers assigned to the ferry and 2 people working at the concession stand on the bridge deck.
[c] Includes 15 crewmembers and 1 restroom attendant.
[d] Passenger total estimated by the NYC DOT and NYPD.

Damages

The *Andrew J. Barberi* struck the concrete maintenance pier at an oblique angle and continued to move forward, allowing the concrete to tear a 210-foot-long gash into the main deck on the vessel's New Jersey side (figure 3). The vessel was repaired by a Staten Island company at the Brooklyn Navy Yard at a cost of $6.9 million. The ferry returned to service in July 2004.

Figure 3. Postaccident view of *Andrew J. Barberi*.

Approximately 1,500 square feet of the surface of pier B-1 collapsed into the harbor after the *Andrew J. Barberi* struck its southeast corner (figure 4). The pier was repaired at a cost of $1.4 million.

Figure 4. View of damage to maintenance pier caused by *Andrew J. Barberi*.

Personnel Information

Regulatory Requirements

Under 46 CFR parts 70-80, large passenger vessels (those measuring 100 gross tons or more[13]) that carry more than 12 passengers for hire[14] may not be operated without a valid Coast Guard certificate of inspection (COI), which is issued by the Coast Guard Officer in Charge, Marine Inspection (OCMI), for the zone (in this case, New York). The COI stipulates a number of operating requirements, including minimum staffing needs. When determining the number and competencies of the crewmembers, the OCMI considers, among other things, the size of the vessel, its route, the type and horsepower of

[13] Gross tonnage is a measure of vessel volume, or overall size.

[14] As defined in Title 46 *United States Code* (U.S.C.) section 2101(21)(21a), *passenger for hire* means "a passenger for whom consideration is contributed as a condition of carriage on the vessel, whether directly or indirectly flowing to the owner, charterer, operator, agent, or any other person having an interest in the vessel." After the Staten Island Ferry stopped charging passenger fares in 1997, questions arose about the applicability of Federal regulations regarding required Coast Guard inspections. See "Additional Information" section for further discussion.

the vessel's propulsion machinery, the number of passengers the vessel will carry, the type and location of lifesaving equipment installed on the vessel, and the hazards peculiar to the route and service.

According to its COI, the *Andrew J. Barberi* was required to carry the following crew complement:

1 master with first-class pilot endorsement
1 first-class pilot
2 licensed mates
7 deckhands
1 chief engineer
1 licensed assistant engineer
2 oilers

The COI states that "the required mate positions may be filled by holders of valid licenses endorsed for 'non-navigating duties onboard the Staten Island ferries.'"

Both the captain and the assistant captain were licensed as masters and first-class pilots (the COI required only one licensed master). The senior mate was licensed as a chief mate on oceans, which meant that he had passed more Coast Guard examinations than required for mates on inland waters such as New York Harbor. The junior mate held a first-class pilot's license for Lake Erie (but not for New York Harbor).

Captain

Background. The captain, age 38, was born in Staten Island, New York, and graduated from high school in Staten Island in 1984. After graduating, he joined the Navy and was assigned to the submarine fleet. He was honorably discharged in 1988 at the rank of quartermaster second class, or E5. He received several decorations and commendations for performance, including a Meritorious Unit Commendation and letter of commendation from the Commander in Chief, Atlantic Fleet.

In October 1990, he became a deckhand with the Staten Island Ferry, a position he held until January 1996, when he was promoted to mate. In February 1996, he was promoted to the provisional position of assistant captain.[15] He was promoted to the permanent position of assistant captain in February 2002.

At the time of the accident, the captain held an inland Coast Guard license issued on December 31, 2001, and valid until December 31, 2006. The terms of the license were as follows:

[15] New York City personnel rules allowed employees to serve on the ferry in a position for which they were qualified and to earn the pay of someone in that position, but they could not be permanently assigned to those positions until a vacancy was posted, until they met the pertinent NYC civil service requirements for those positions, and until they then had been selected to fill those vacancies in accordance with NYC civil service requirements. Thus, employees often served for years in positions that were at higher levels than those to which they had been "permanently" assigned.

> Master of steam or motor vessels upon inland waters of any gross tons. First class pilot of vessels of any gross tons upon NY Harbor the Upper Bay, from the Narrows to the Battery; the East River, from the Battery to the Execution Rocks; the Kill van Kull, from Robbins Reef to Elizabethport; the Hudson River from the Battery to the George Washington Bridge. Radar observer.

Coast Guard regulations require a captain to hold a valid endorsement as a radar observer.[16] The captain's radar endorsement expired in March 2002, but the Coast Guard, under 46 CFR 10.480(k), allowed mariners' radar endorsements to extend for up to 2 years beyond their expiration dates so that the renewal dates for licenses and endorsements could be synchronized.[17]

NYC DOT personnel records of the captain contained a total of nine performance appraisals between 1991 and 1998, the most recent appraisal form found in the records. The captain's performance in the 1991 appraisal was rated as "very good," which was second to the highest on a 5-point scale that ranged from "unsatisfactory" to "outstanding." His performance in all subsequent appraisals was uniformly rated as "outstanding."

No letters of reprimand were found in the captain's personnel records. On August 2, 1991, he received a letter of commendations for the "prompt action and professional manner" in which he helped rescue a passenger who had jumped overboard in New York's Upper Bay.

The Safety Board repeatedly attempted to interview the captain after the accident. The Board issued a subpoena to compel him to appear before its investigators, and Federal judicial authorities enforced the subpoena. He appeared before investigators on November 6, 2003, but he invoked his Fifth Amendment rights against self-incrimination and did not respond to questions except to give his name and date of birth.

Schedule. In the month before the accident, the captain worked on a shift that typically began at 1330 and ended at 2130, although the actual start and stop times were an hour earlier on several days. In keeping with NYC DOT practice, the captain and assistant captain both worked 4 days and then had 3 days off. The captain was off work on October 11, 12, and 13. He reported for duty on the *Andrew J. Barberi* on October 14 at 1307 and worked until 2300, earning an hour and a half of overtime for working past 2130, the end of the scheduled shift. He reported for work on the day of the accident at 1245, although the shift did not begin until 1330. The Safety Board was unable to learn more from the captain about his activities in the days before the accident because of his unwillingness to cooperate with the investigation.

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[16] Title 46 CFR 15.815(b): "Each person who is employed or serves as pilot in accordance with Federal law on board vessels of 300 gross tons or over which are radar equipped, shall hold a valid endorsement as radar observer."

[17] Title 46 CFR 10.480(k): "The renewal date of a Radar-Observer endorsement may be extended beyond the normal 5-year duration to coincide with the renewal date of the license to which it pertains. This extension may not exceed 2 years and will be necessary only once, to synchronize the two renewal dates."

Assistant Captain

Background. The assistant captain, age 55, was born in Brooklyn, New York. From 1968 until 1970, he was on active duty in the Army, with a specialty in radar operations. In 1976, he briefly worked for Murphy Pacific Marine Salvage Company as a deckhand. From 1976 until late 1985, he worked as a deckhand and tankerman for Poling Transportation Corporation of Staten Island, New York, a tugboat and barge operator. There he received training in vessel navigation in New York Harbor. According to the assistant captain's résumé, on file with the NYC DOT, he operated "on the waters of the Atlantic Ocean from Maine to Virginia up to 200 miles offshore, including the entrance to New York Harbor" while employed at Poling.

He began his employment with the Staten Island Ferry on September 16, 1985, as a deckhand. He was promoted to assistant captain on May 11, 1987. NYC DOT personnel records indicate that on March 24, 1986, he completed instruction in radar use and interpretation at Marine Simulation, Inc. On February 9, 1996, he completed "Radar Observer Recertification-Any Waters" at the Center for Maritime Education, Seamen's Church Institute of New York and New Jersey.

The assistant captain was promoted to the provisional position of assistant captain on May 11, 1987, to the provisional position of captain on July 21, 1996, and to the permanent position of assistant captain on February 2, 2002, the position he held at the time of the accident. According to the director of administration for the Staten Island Ferry, the assistant captain acted to gain a higher seniority, which would protect him against the layoffs the NYC DOT was planning in spring 2003 because of anticipated budgetary shortfalls.

The assistant captain held an inland Coast Guard license issued on September 14, 2000, which was valid until September 14, 2005. The terms of the license were as follows:

> Master of steam or motor vessels of any registered tons (domestic) upon inland waters. First class pilot of vessels of any gross tons upon: New York Harbor Upper Bay, from the Narrows to the Battery; Hudson River from the Battery to the George Washington Bridge; the East River from the Battery to Hart Island; Kill van Kull from Robbins Reef to Elizabeth Port.

The assistant captain's radar endorsement expired in February 2001.[18]

NYC DOT personnel records for the assistant captain contained 13 performance appraisals between 1987 and 2001. His performance in the first two appraisals (1987 and 1988) was rated as "superior" (second to highest) on the NYC DOT's 5-point performance scale. His performance was uniformly rated in all subsequent appraisals as "outstanding."

The assistant captain's personnel records contained no letters of reprimand or other negative assessments. The records contained two letters of commendation, dated March 9, 1990, and April 28, 1995. The first concerned his performance as the assistant captain on

[18] See previous note.

the *Andrew J. Barberi* when it experienced a propulsion control failure while docking in Manhattan, when his actions helped minimize potential injury to passengers and crew and damage to the vessel. The second letter noted his "outstanding leadership and dedication to duty" as the captain of the *Andrew J. Barberi* when it experienced a mechanical failure while docking in Staten Island.

Schedule. The assistant captain could not be interviewed in the immediate weeks after the accident because he had been hospitalized after a suicide attempt (see below). Nonetheless, his wife and daughter cooperated with Safety Board investigators and provided information about his activities in the days preceding the accident.[19] After the assistant captain had recuperated, Safety Board investigators tried repeatedly to interview him. His attorney informed the Board, however, that the assistant captain would invoke his Fifth Amendment rights against self-incrimination and would not respond to questions from the Board.

According to his personnel records, the assistant captain worked the same shift continuously for at least 2 months before the accident, a 1330 to 2130 shift that began on a Tuesday and ended on a Friday. However, he almost always worked an additional 30 minutes to 2 hours, beyond 2130, in overtime during that period. On October 7 and 8 he worked until 2230. On October 9 he worked until 2330, and on October 10 he worked until 2200. He was off work on October 11, 12, and 13. On October 14, he worked on the *Andrew J. Barberi* until 2300. He reported for work on the day of the accident at 1315.

According to his wife, 2 days before the accident, on October 13, the assistant captain awoke at 0730. On the day before the accident, October 14, he was asleep when his wife left the house at 0815. The night before the accident, October 14, he went to sleep between 0115 and 0130. On the day of the accident, he was asleep when his wife left the house about 0815 and arose sometime thereafter. She returned home for lunch about 1220 and found him working around the house. She told investigators that he seemed fine when she left the house before 1300.

Actions After Accident. After the allision, the assistant captain telephoned his wife at her workplace to inform her of the accident. According to other witnesses, the assistant captain drove home, saw his daughter and grandson, went into a bathroom on the second level of his house, and refused to leave despite his daughter's entreaties. Shortly after 1600, the assistant captain's wife arrived home. She also could not persuade him to unlock the door. The two NYC DOT employees who had been sent by the director of ferry operations arrived about 1630, forced open the locked door, and found the assistant captain bleeding from lacerations to his wrist and from a gunshot wound to his chest. They saw a pellet gun nearby.

The NYC DOT employees immediately called 911 and requested medical assistance. An ambulance arrived about 1640 and the assistant captain was transported to a nearby hospital, where he was admitted at 1703. His injuries were considered life

[19] On advice from her legal representative, the assistant captain's wife did not provide Safety Board investigators with information about statements that her husband made to her.

threatening and he was sent to the operating room, where he underwent emergency surgery to repair the effects of the gunshot wound and wrist lacerations. On November 13, 2003, following recuperation from the surgery and after psychiatric treatment in response to his suicide attempt, the assistant captain was discharged from the hospital.

Medical Status. To determine the assistant captain's medical status at the time of the accident, the Safety Board obtained records of his medical care before the accident, as well as dental, employer, and pharmacy records. The Safety Board also obtained records from the hospital that treated the assistant captain after his suicide attempt.

The Safety Board obtained a record of prescriptions for the assistant captain at a Staten Island branch of a national chain of pharmacies.[20] According to the pharmacy records, the assistant captain's primary physician prescribed most of the medications. Many of the prescriptions, however, were not listed in the primary physician's medical records that corresponded to the prescription dates. Further, except for the assistant captain's dental treatment and a few instances when he got a "disability certificate" for work, the medical records contain no references to limitations on his work because of medical conditions or treatment. The records of his primary physician included information on the assistant captain's occupation. No evidence of the assistant captain's use of prescribed medications was found in the records of either the NYC DOT or the Coast Guard, nor was documentation of the use of medications required by either agency.

According to medical and pharmacy records, at the time of the accident the assistant captain had been diagnosed with and continuously prescribed medications for multiple medical conditions, including high blood pressure, high cholesterol, insomnia, and chronic back pain. In particular, his physician had prescribed 10 milligrams of zolpidem (a prescription sedative marketed under the trade name Ambien®), to be taken at bedtime for insomnia,[21] and 50 milligrams of tramadol (a prescription narcotic-like analgesic marketed under the trade name Ultram®), to be taken every 4 to 6 hours for back pain. According to the *Physicians' Desk Reference* (*PDR*),[22] the drug manufacturers specify that the total daily dose of zolpidem should not exceed 10 milligrams and that the total daily dose of tramadol should not exceed 400 milligrams. Common side effects of

[20] The Safety Board is confident that it has a complete record of the assistant captain's prescriptions, because prescriptions at all the chain's branches were examined, the chain had numerous branches in Staten Island, and few pharmacies not associated with the chain were in the area. All the medical and dental practitioners were located on Staten Island. Although it is possible that the assistant captain had been treated by physicians outside Staten Island, several factors suggest that this was unlikely: the comprehensiveness of the records, both in the diagnoses and treatments described; the length of time he had been treated; the interrelationships between the physicians noted in the records; and the statements of his spouse.

[21] The assistant captain's wife indicated that he would often take half a tablet, or 5 milligrams, at bedtime.

[22] A reference manual for physicians published yearly by Medical Economics Company, Atlanta, Georgia. The drug manufacturers whose products are listed in the reference prepare the information.

tramadol include dizziness and sleepiness,[23] and seizures have been reported in patients both after receiving their first tramadol prescription and after using the drug over time.[24]

The assistant captain had been taking both zolpidem and tramadol regularly since 2000. He had been prescribed medication for high blood pressure since at least 1989. Since at least 1998, he also had multiple prescriptions filled for different psychoactive medications (medications that can alter mood, anxiety, behavior, and cognitive processes) for dental work. NYC DOT attendance records indicate that the assistant captain was on sick leave on the days he received dental treatment that involved psychoactive medication and was off work afterward on regularly scheduled days.

The assistant captain underwent cardiovascular surgery and cardiological, neurological, and psychiatric examination and treatment while hospitalized after the accident. Among the tests administered to him were the following: carotid color duplex Doppler examination, which can detect abnormalities in the carotid arteries in the neck; echocardiography, which can detect abnormalities in the walls and valves of the heart; 24-hour Holter monitoring, which can detect abnormal heart rhythms; computerized tomography of the head, which can detect abnormalities in the brain; and cardiac catherization, which can detect abnormalities in the coronary arteries (whose function is to supply blood to the heart). The assistant captain was found to have significant narrowing of his coronary arteries (for which he underwent stent placement to open the arteries), but he had no significant abnormal heart rhythms on 24-hour monitoring. Echocardiography noted an interatrial septal aneurysm (a bulging of the wall between the two upper chambers of the heart) and patent foramen ovale (a persistence after birth of an opening in the wall between the two upper chambers of the fetal heart).

According to a note in the medical records, a week after the accident the assistant captain told a cardiologist that "he was exhausted at the time [of the accident, but] no more exhausted than usual." The cardiologist's note states that "when the boat hit the pier [the assistant captain] was sitting in a chair." The records of a neurology consultation state that the assistant captain had "no recollection of what happened on the boat . . . he suddenly passed out, [and] when he regained consciousness there was chaos." Further, he denied "any prior history of loss of consciousness." The assistant captain was discharged from the hospital with a diagnosis of and treatment for depression.

Coast Guard medical records of the assistant captain include the results of four required medical evaluations. The partner of the assistant captain's primary physician in a two-physician medical practice performed the evaluations on March 31, 1986, October 4, 1989, September 14, 1995, and August 14, 2000; the partner had occasionally treated the assistant captain. The results, as noted on the completed examination forms (after the first examination, this was the 1995 version of Coast Guard form 719K), included notations

[23] T. Hummel and others, "Assessment of Analgesia in Man: Tramadol Controlled Release Formula vs. Tramadol Standard Formulation," *European Journal of Clinical Pharmacology*, vol. 51 (1996), pp. 31-38.

[24] J. S. Gardner and others, "Tramadol and Seizures: A Surveillance Study in a Managed Care Population," *Pharmacotherapy*, vol. 20, no. 12 (2000), pp. 1423-1431. Seizures were noted in 0.9 percent of patients after they received their first tramadol prescription.

corroborated by the examining physician and (as required for the last two examinations) by the assistant captain with their signatures, that the assistant captain had not been taking prescribed medications. For each examination, the physician noted that he considered the assistant captain "competent" to perform the duties of a merchant mariner.

For example, on Coast Guard form 719K, dated August 14, 2000, under the question, "Does the applicant have or has he/she ever suffered from any of the following?" "no" was written next to "high blood pressure," "impaired range of motion," and "other illness or disability." Under "medications taken," the word "none" was written, and the box next to the indication "no prescription medications" was checked. Under "comments on findings," the box next to "no significant medical history" was checked. In response to the item, "Considering the findings in this examination, and noting the duties to be performed by the applicant aboard a merchant vessel of the United States of America," the physician noted that he considered the applicant "competent." The applicant's signature appears below the statement: "I certify that all information provided by me is complete and true to the best of my knowledge." Making false or fraudulent statements to a Federal agency such as the Coast Guard is a crime.[25]

In August 2004, the assistant captain pleaded guilty in U.S. District Court in Brooklyn, New York, to Federal charges that he knowingly made a false report to the Coast Guard on his medical evaluation form that he did not suffer from any illnesses and had not taken any medications.[26] He told the court that he "just didn't want the Coast Guard to know" because he was afraid that reporting his medications would jeopardize his job.

Vessel Information

Construction and Equipment

The *Andrew J. Barberi* was built by Equitable Shipyards of New Orleans and delivered in 1981. Its overall length was 310 feet, its beam was 70 feet, it had a draft of 12 feet, 6 inches, and it displaced 2,721 long tons.[27] Data from sea trials conducted by George G. Sharp, Inc., of New York in 1981 showed that the vessel could come to a complete stop, from full ahead, in about 420 feet and within about 43 seconds.[28] Normal vessel speed at

[25] The Coast Guard website <http://www.uscg.mil/STCW> states: "Title 18 U.S. Code (U.S.C.), Section 1001 states that intentionally making false or fraudulent statements or representations in any matter within the jurisdiction of any department or agency of the United States is a Federal crime punishable by not more than five years in jail and/or a fine of up to $250,000 for individuals or $500,000 for organizations. When signing the application and forms to apply for an MMD [merchant mariner's document], License, Certificate of Registry, or STCW [International Convention on Standards of Training, Certification and Watchkeeping] you acknowledge awareness of the meaning of the statute in 18 U.S.C. 1001. If there is evidence that an application was submitted fraudulently, the application may be denied and the case will be forwarded to the local U.S. Attorney for appropriate action."

[26] The physician who performed the assistant captain's medical evaluations was indicted in the same jurisdiction on similar charges.

[27] One long ton = 2,240 pounds.

[28] George G. Sharp, Inc., "Trial Report—Staten Island Ferry-Andrew J. Barberi," New York (1981), p. 94.

full ahead was 16 knots. Postaccident testing indicated that the *Andrew J. Barberi* required about 5 seconds, from either pilothouse, to generate 100 percent thrust from zero thrust (see "Tests and Research" section for further information).

The *Andrew J. Barberi*'s symmetrical structure, both above and below the waterline, allowed it to perform equally well in both directions. Thus, the ferry could approach and leave the dock without turning around. The vessel had four decks, from high to low called the hurricane, bridge, saloon, and main decks (figure 5). Passengers were not permitted on the hurricane deck, which held the two pilothouses. A concession stand was situated on the bridge deck. Passengers embarked and disembarked on the main deck and on a platform midway between the main and the saloon decks, referred to as the upper embarkation level. Enclosed stairs led from the saloon deck to the upper embarkation levels, and ramps led from the upper embarkation levels to the bridge deck. The ferry had seating for 3,672 passengers;[29] passengers in excess of that number had to stand.

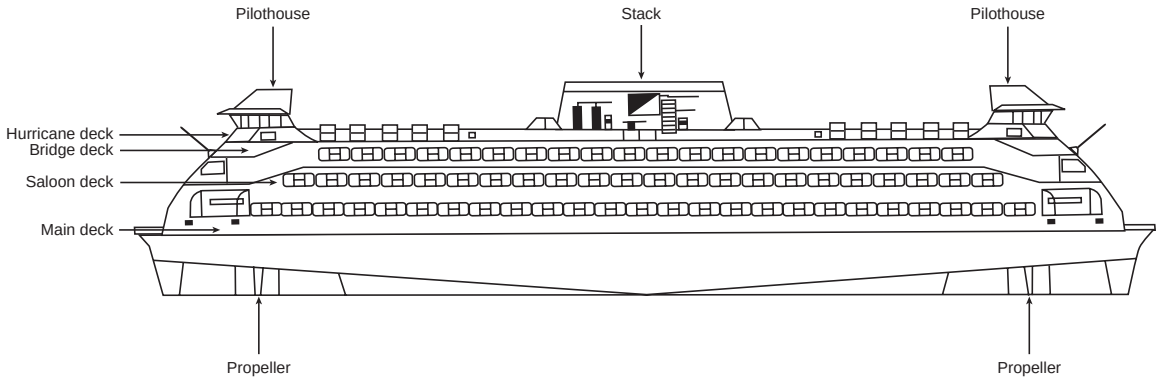

Figure 5. Profile of *Andrew J. Barberi*.

The hull was of steel, all-welded construction, transversely framed on 30-inch centers and subdivided by watertight bulkheads. The hull was symmetrical about the midships transverse section. Frame numbers ran in either direction from frame 0, located midships, to frame 56 at either end of the vessel. Watertight bulkheads were located on both ends at frames 12, 39/40, and 52. Partial watertight bulkheads, interrupted by the shaft tunnels, were located at frames 20 and 31. The hull was generally single-bottomed, with a 4-foot-high inner bottom at the shaft tunnels.

[29] The main deck could seat 1,630 passengers, the saloon deck, 1,258, and the bridge deck, 784.

Navigation equipment in the pilothouse consisted of short-range (3 centimeter) and long-range (10 centimeter) radar[30] (equipped with an automatic radar plotting aid [ARPA] that automatically provided information on other vessels' course, speed, and closest-point-of-approach), a gyrocompass, and a magnetic compass. The equipment did not include any means of determining the ferry's speed (speed had to be estimated on the basis of elapsed time over the 5.2-mile run) or projected path, water depth, or wind speed. Two radar screens were located behind the operator's chair, out of his or her field of view. A repeater screen for the 3-centimeter radar was mounted above the navigation controls, in full view of the operator (see below).

Each pilothouse was also equipped with devices for communicating with both the engineroom and the passengers. The devices included an engine-order telegraph for quickly communicating commands to the engineers; a sound-powered telephone; and a lever that rang a cowbell in the engineroom, to signal an emergency in which the engineers should take over propulsion control. A microphone was on the console behind the operator for making announcements over the public address system. Other communication equipment included a general alarm that rang bells throughout the ship in case of emergency, two VHF radios for ship-to-ship or ship-to-shore transmissions, and a UHF radio for the crew's walkie-talkies.

Both mates had walkie-talkies, and according to the director of ferry operations, each of the three passenger decks was supposed to have one. One of the deckhands told investigators that he had a walkie-talkie and heard it "crackling" after the accident but ignored it. Another deckhand said that he had a working walkie-talkie but that it would not function in the engineroom.

Propulsion System

Characteristics. Four General Motors 1,700-horsepower EMD 16-645E6 diesel engines powered the vessel. The engines were coupled to a Voith-Schneider cycloidal propeller at either end of the vessel that provided both propulsion and steering. The Voith-Schneider cycloidal propeller had five titanium blades, each mounted on a vertical shaft and attached to the outside of a large circular plate (figure 6). As the blades rotated, they applied force to the water and pushed the ferry in the desired direction. An automatic control system maintained the speed of the main engines at about 750 rpm while the vessel was under way.

The vessel operator was positioned in the center of the pilothouse, with two steering directional handwheels on the left and two forward/aft thrust levers (one for each end's propulsion drive) on the right (figure 7). By using a combination of the levers for ahead/astern thrust and the handwheels for port and starboard motion, the operator could quickly and precisely maneuver the vessel in any direction. The operator controlled the engine speed using levers farther to the left, at the forward end of the console.

[30] The designation in centimeters refers to the wavelength of the transmission signal the radar emits. The signal reflects off a target and thereby detects it. In general, the shorter-wavelength radar is more suitable for close-in navigation, while the longer-wavelength radar is used for distant targets.

Figure 6. One of *Andrew J. Barberi*'s two Voith-Schneider cycloidal propellers.

Both forward and aft propulsion systems could be controlled from either pilothouse or from the engineroom. Two operators were needed to transfer control from one pilothouse to the other. The operator in the controlling pilothouse activated a "send" button on the console. The operator in the other pilothouse then pushed an "accept" button to receive and take control. The engineer could single-handedly take control over either propulsion system from the engineroom.

Operating Condition At Time of Accident. During the week before the allision, the *Andrew J. Barberi*'s crew tested the vessel's engines and propulsion units. All were found to be satisfactory, with no faults in either the machinery or the alarm circuits. The engineering logbook contained no entries that suggested engineroom problems either before or during the accident. The ferry's chief engineer told investigators that the propulsion plant and associated machinery were in satisfactory operating condition the day of the accident, and that the chief engineer on the previous watch told him that he had experienced no problems in the engineering spaces. The assistant engineer on watch during the accident stated that the vessel's two propulsion systems and engineroom machinery performed as expected and that he had a "very normal watch" before the accident. After the accident, an NYC DOT port engineer boarded the vessel and observed that the propulsion units were operating normally and that they held the ferry against the

dock for an hour or more. (The ferries were not tied to the docks during loading and unloading, but rather were hooked into recessed cleats[31] on the dock and held in position by the propulsion units.)

Figure 7. Pilothouse controls on ferry's Staten Island end. Thrust levers are on right of operator's chair, handwheels on left. Behind operator's chair (outside his field of view) is monitor for 10-centimeter radar display with automatic plotting aid showing other vessels' course, speed, and closest-point-of-approach. Data (blips) on 3-centimeter radar display (smaller screen behind operator) are repeated on monitor hanging above controls.

Certification and Inspection

The *Andrew J. Barberi* was certificated as a large passenger vessel by the U.S. Coast Guard and was inspected by the Coast Guard under a memorandum of understanding (MOU) with the NYC DOT (see "Additional Information" section for details). The American Bureau of Shipping issued classification documents to the vessel on November 29, 1996, and May 14, 2002. The Coast Guard issued a certificate of documentation on September 11, 2003.

The Coast Guard conducted its last annual inspection of the *Andrew J. Barberi* before the accident on January 15, 2003, and issued a COI. The Coast Guard also

[31] Fasteners, usually with two projecting horns, around which a line (rope) can be secured.

conducted quarterly inspections on April 17 and July 25 during the year before the accident. The Safety Board noted only minor deficiencies in the inspection records, such as missing locks, loose wires, or cracked casings. The ferry was due for another quarterly inspection on October 16, 2003—the day after the accident.

Wreckage

After the accident, the ferry's propulsion system was found undamaged. The vessel's main deck sustained the bulk of the damage, with some tearing of the deck into various voids, machinery, and ballast tank spaces below (figure 8). The leading edge of the starboard passenger cabin on the main deck (Staten Island end), at frame 54, appeared to have taken the brunt of the allision. The bulkhead at frame 54 was fully torn from the deck, from the starboard deck edge inboard through to a point about 12 feet to the left of the centerline.

All bulkheads and associated frames, structural support columns, and saloon deck support frames between frames 54 and 44 on the starboard side were missing. The stairs between the main deck and the saloon deck were fully collapsed (figure 9). The centerline support column at frame 36, the forwardmost support column (that is, closest to the Staten Island end) for the pilothouse remained intact and appeared to have provided the main support for the forward pilothouse after the starboard support columns were destroyed.

The deck around the cleat on the starboard side (forward of the cabin) was found largely intact but with a 15-inch longitudinal and 8- to 10-inch transverse tear that created an opening to the ballast tank space below. Four tears that exposed the propulsion room below the main deck were also found. The first, of approximately the same dimensions as the forward tear, was found aft of the cleat. The second, about 4 feet aft of the cleat in the area of the bunker (fuel) station, was associated with numerous flattened and bent pipes leading to the propulsion room (lubrication oil fill connections, fire main connections, fuel oil fill pipes, water tank fill pipes, and tank vents). The third tear was 12 feet inboard of the bulkhead, where a ventilator trunk had been ripped out. The fourth tear was aft of the vent trunk, where a pipe duct had been torn off.

Vertical steel support columns for the frame member that supported the forward superstructure were sheared off on the Staten Island end aft of frame 54 to frame 4. The outboard attachment point of the column at frame 20 was sheared off, but the inboard attachment point was intact. The saloon deck sagged 2 to 3 inches near the forward starboard corner of the pilothouse because of the damage to the supports. The side shell was peeled back from frame 54 at the Staten Island end to frame 25 at the New York end. Bulkheads, seating areas, bulkhead trim, ceiling panels, lighting cables, fixtures, and plumbing systems were destroyed from the bow to about frame 20, inboard of a point about 12 feet left of the centerline.

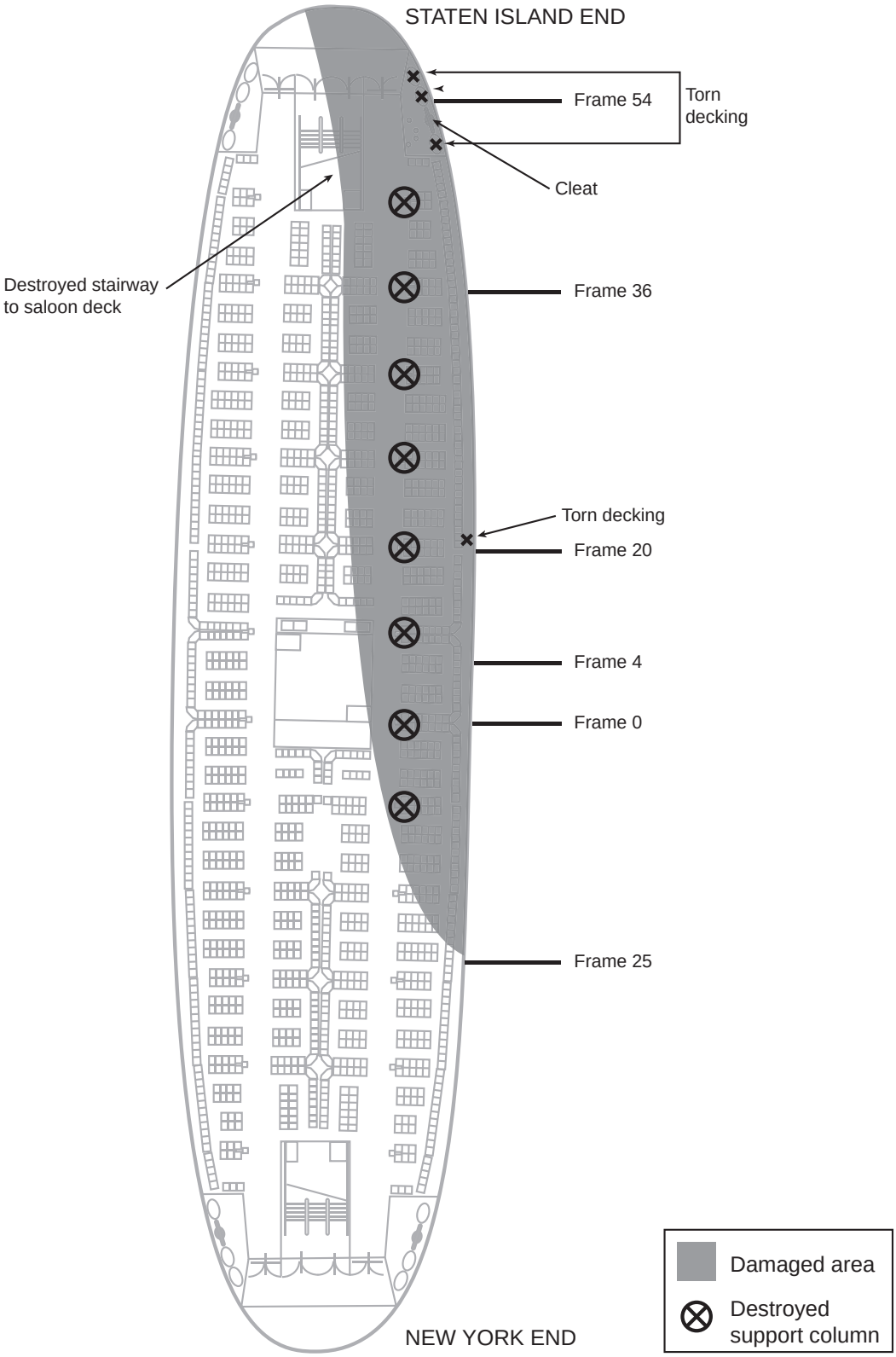

Figure 8. Plan view of ferry's main deck highlighting damaged areas.

Figure 9. View of damage to New Jersey side of main deck showing collapsed stairway to saloon deck, destroyed columns, crushed seats, ruined ceiling panels, dislodged cables and fixtures, debris, and other destruction.

Waterway Information

The Port of New York and New Jersey is the largest port complex on the East Coast of North America[32] and was the world's eighteenth busiest port in 2002.[33] Its harbor is divided at the Narrows into the Lower Bay and the Upper Bay (figure 2). The Verrazano Narrows Bridge crosses the Narrows to link Staten Island with Brooklyn. The anchorage channel, the main passage through the center of the bay, runs west of Governors Island at the Upper Bay entrance to the East River. A shallow area with depths of 8 to 20 feet lies east of the anchorage channel, and a shallower area lies to the west, off the New Jersey shore.[34] Lighted buoys mark the anchorage channel.

[32] Source: <http://www.panynj.gov/commerce/marmain.htm> (accessed April 26, 2004).

[33] In tonnage of annual cargo passing through it (*Information Please Almanac* <http://www.infoplease.com/ipa/A0104779.html> [accessed March 22, 2005]).

[34] National Oceanic and Atmospheric Administration, National Ocean Service, *United States Coastal Pilot*, vol. 2 (Atlantic Coast: Cape Cod to Sandy Hook), 2003, p. 372.

The route of the *Andrew J. Barberi* was between St. George, Staten Island, and Whitehall Street, Manhattan, in the Upper Bay of the harbor (figure 2). The Whitehall Street terminal was on the East River side of the Battery, located at the southern tip of Manhattan, where the East River and the Hudson River meet. Because of the terminal's location, ferry operators were required to execute a 90º left turn to enter the ferry slips, and conversely, a turn right on the return to Staten Island. Beyond the Battery, the route to Staten Island continued past the west side of Governors Island on a south-southwesterly course in the anchorage channel.

The route continued past Ellis and Liberty islands toward the KV buoy, which marked the north side of the entrance channel into the Kill van Kull.[35] After passing the KV buoy on the vessel's starboard side, the route continued past the Kill van Kull and turned toward the designated ferry slip. The distance from the KV buoy to the ferry slips was about 1,000 yards, and the distance from Whitehall to the KV buoy was about 4 miles.

The Coast Guard operated and maintained a VTS to facilitate the orderly flow of vessels on the waterways in the Port of New York and New Jersey.[36] The vessel traffic center was located at Ft. Wadsworth on Staten Island and was staffed continuously. The center used a VHF-FM radiotelephone network to obtain and disseminate vessel traffic information to vessel operators, as well as radar and low-light closed-circuit television to confirm and supplement this information. Low-power, remote VHF-FM sites were located throughout the New York/New Jersey waterway environment. Staten Island Ferry operators routinely called the VTS center when they left the dock but did not call when they arrived at their assigned slip, according to the VTS operator.

The VTS system had limited video and radar recording capability. The operator at Ft. Wadsworth told investigators that, after being notified of the accident, he focused the VTS camera on Governors Island toward the *Andrew J. Barberi*. The camera recorded approximately 11 minutes of the ferry's postaccident actions while it maneuvered in the harbor before it docked.

As of December 31, 2004, certain domestic vessels that use the New York VTS, including passenger vessels of 100 gross tons or more, were required by the Maritime Transportation Security Act of 2002 to have an installed, operational automatic identification system (AIS).[37] AIS is a shipboard broadcast system, operating in the VHF maritime band, that can send and receive ship information such as identity, position, course, and speed.

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[35] Kill van Kull is a 4-mile channel that connects the Upper Bay of New York Harbor to Newark Bay and the channels on the west side of Staten Island. Vessels entering or departing the waterway pass through the same area the ferries use between the KV buoy and the St. George ferry slips.

[36] *Vessel Traffic Service New York User's Manual* <http://www.navcen.uscg.gov/mwv/mwv_files/VTS_NY_UM.pdf> (accessed April 28, 2004).

[37] The AIS carriage requirements were established by the Maritime Transportation Security Act of 2002 (Public Law 107-295, November 25, 2002). The Coast Guard published the final rule for implementing the act on October 22, 2003 (*Federal Register*, vol. 68, no. 204, pp. 60559-60570). The final rule became effective on November 21, 2003.

Operations of New York City Department of Transportation

According to information published on its website,[38] the NYC DOT manages

> much of the city's transportation infrastructure, including city streets, highways, sidewalks, and bridges. DOT is responsible for installing and maintaining street signs, traffic signals, and street lights, resurfacing streets, repairing potholes and other street defects, installing and maintaining parking meters, managing municipal parking facilities, and operating the Staten Island Ferry.
>
> DOT supervises the city's franchise agreements with seven private bus companies, oversees private ferry operations on city-owned piers, manages the city's contracts with companies that provide transportation to pre-kindergarten special education children, issues parking permits to people with disabilities, not-for-profit agencies and governmental entities, and commercial vehicle permits for trucks, issues construction permits for work in city streets, and manages the city's Adopt-a-Highway program. DOT also promotes safe travel by bicyclists and pedestrians, and offers programs to foster traffic safety education.

The Staten Island Ferry, a division of the NYC DOT, had been a municipal service since 1905, and at the time of the accident carried over 19 million passengers a year. The ferry division operated seven vessels in three ferry classes of different design and capacity (*Kennedy*, *Barberi*, and *Austen*), as well as two passenger terminals, a maintenance facility, and a fuel storage and transfer facility. As many as five ferries operated at any one time, depending on time and day. The division had an annual budget of $452 million and 430 to 450 employees. Of those, 19 were captains and 16 were assistant captains.

The NYC DOT had no established minimum requirements for its personnel to qualify as ferry assistant captain or captain. Ferry operating personnel began as deckhands and then qualified as either mates (nonnavigating officers) or assistant captains, who could then be promoted to captains. The NYC DOT required both assistant captains and captains to have masters' and first-class pilots' licenses, with extensions to the Upper Bay of New York Harbor, the East River from the Battery to Execution Rock, the west river (Hudson River) from the Battery to the George Washington Bridge, and Fresh Kills from the KV buoy to Elizabethport, New Jersey.

No Coast Guard documentation was required of deckhands on the Staten Island ferries. The deckhands reported to the mates, who reported to the captain during vessel operations. The assistant captain and the captain both reported to two port captains. The port captains were the immediate supervisors of the ferry officers who oversaw day-to-day ferry operations and who wrote the officers' performance appraisals. The port captains reported to the director of ferry operations, who oversaw ferry operations and maintenance.

[38] "DOT: Who We Are & What We Do" <http://www.nyc.gov/html/dot/html/about/dotdoes.html> (accessed March 8, 2004).

The director of ferry operations, along with the director of terminal operations and the director of administration, reported to the assistant commissioner, who oversaw all aspects of ferry operations (operations, maintenance, terminals, ferry personnel, budgeting). The assistant commissioner reported to the NYC DOT deputy commissioner, who reported to the NYC DOT first deputy commissioner, who then reported to the NYC DOT commissioner.

In September 2000, construction began on a new Whitehall ferry terminal, with the NYC DOT as one of the project overseers; renovation of the St. George terminal had gotten under way the year before.[39] In April 2003, the mayor of New York announced his fiscal year 2004 budget. Among other cuts the mayor proposed in the face of the city's $3.8 billion budget deficit were reductions in rush-hour services on the Staten Island Ferry and the elimination of over 200 NYC DOT jobs.[40]

Meteorological Information

According to National Weather Service data, on the day of the accident, a low-pressure system, with a central pressure of 976 millibars, was located just north of New York State. Data from the immediate vicinity of the accident site indicate winds from the west at 25 to 30 knots, with scattered to broken sky conditions and a temperature of 64º F (18º C). Observations at the three weather stations closest to the accident site (Newark Liberty International Airport, 6 nautical miles away; New York Central Park, 11 nautical miles away; and John F. Kennedy International Airport, 14 nautical miles away) were similar, although they indicated stronger peak winds and stronger wind gusts.[41] Visibility was 10 miles in the area.

National Ocean Service data for the New York and New Jersey harbor, recorded at Battery Park, New York, and Sandy Hook, New Jersey, indicate that at 1530, winds were from the west at 35 to 40 knots, atmospheric pressure was approximately 998 millibars, and the air temperature was about 60º F (15.5º C). The water level was approximately 2 feet above the mean, with an outgoing tide, and the water temperature was 62º F (16.6º C).

[39] Archives of the Mayor's Press Office, New York City, June 9, 1999, and September 25, 2000 <http://www.ci.nyc.ny.us> (accessed January 24, 2005).

[40] "Leaving No City Service Intact: The Mayor's Executive Budget(s) for Fiscal Year 2004" (New York: City Project, May 8, 2003), p. 10.

[41] Kennedy Airport recorded the highest wind speeds, with peak winds of 47 knots and gusts of 41 knots at 1451. Newark Airport recorded peak winds of 40 knots at the same time.

Medical and Pathological Information

Passenger Injuries

Most furnishings and seating areas and most supporting structures of the vessel about the midships sections on the main deck New Jersey side were severely damaged or destroyed by the allision and by the vessel's continued momentum against the pier as the concrete decking passed through the passenger cabin. The resulting debris entangled many passengers who were gathering in the primary impact area to disembark.

Ten passengers were found dead by emergency response personnel who met the vessel after it docked.[42] Emergency personnel identified the locations of the fatally injured passengers several days after the accident. All the fatally injured passengers were found on the New Jersey side of the vessel's main deck (figure 10). The cause of death of the fatally injured was blunt force trauma and its consequences, with numerous severe injuries to head, torso, and extremities.

About 70 passengers were injured in the accident. The injuries of those admitted to area hospitals ranged from minor ones requiring observation to more serious ones such as bone fractures, internal organ damage, limb amputations, and other injuries requiring major surgery. Thirty-five passengers were taken to Staten Island University Hospital; 10 were admitted and 25 were treated for minor injuries and released. Between October 16, the day after the accident, and October 31, an additional 13 passengers were treated at Staten Island University Hospital for injuries they received in the accident. None was admitted overnight.

Three passengers were taken from the accident site to Staten Island University Hospital South. One was admitted and two were treated and released. On October 16, an additional passenger went to that hospital for the treatment of injuries sustained in the accident. He was treated and released.

Thirty passengers, and later the assistant captain, were taken to St. Vincent's Hospital on Staten Island. Eight passengers were admitted and 22 were treated and released. The assistant captain was admitted, underwent emergency surgery, and remained in postsurgical and, later, psychiatric care through mid-November 2003.

Six passengers were taken to hospitals in Brooklyn. Three were transported to Kings County Hospital, where they were treated and released. Three were taken to Lutheran Medical Center, where they too were treated and released.

Toxicological Testing

Shortly after the accident, the *Andrew J. Barberi* crew, except for the assistant captain, submitted blood and urine specimens to the Coast Guard and to the NYPD for toxicological testing in response to a combined NYPD/Coast Guard request. For all crewmembers, the results were negative for alcohol and the five drugs of abuse that the

[42] An eleventh passenger died in December 2003 from injuries she received in the accident.

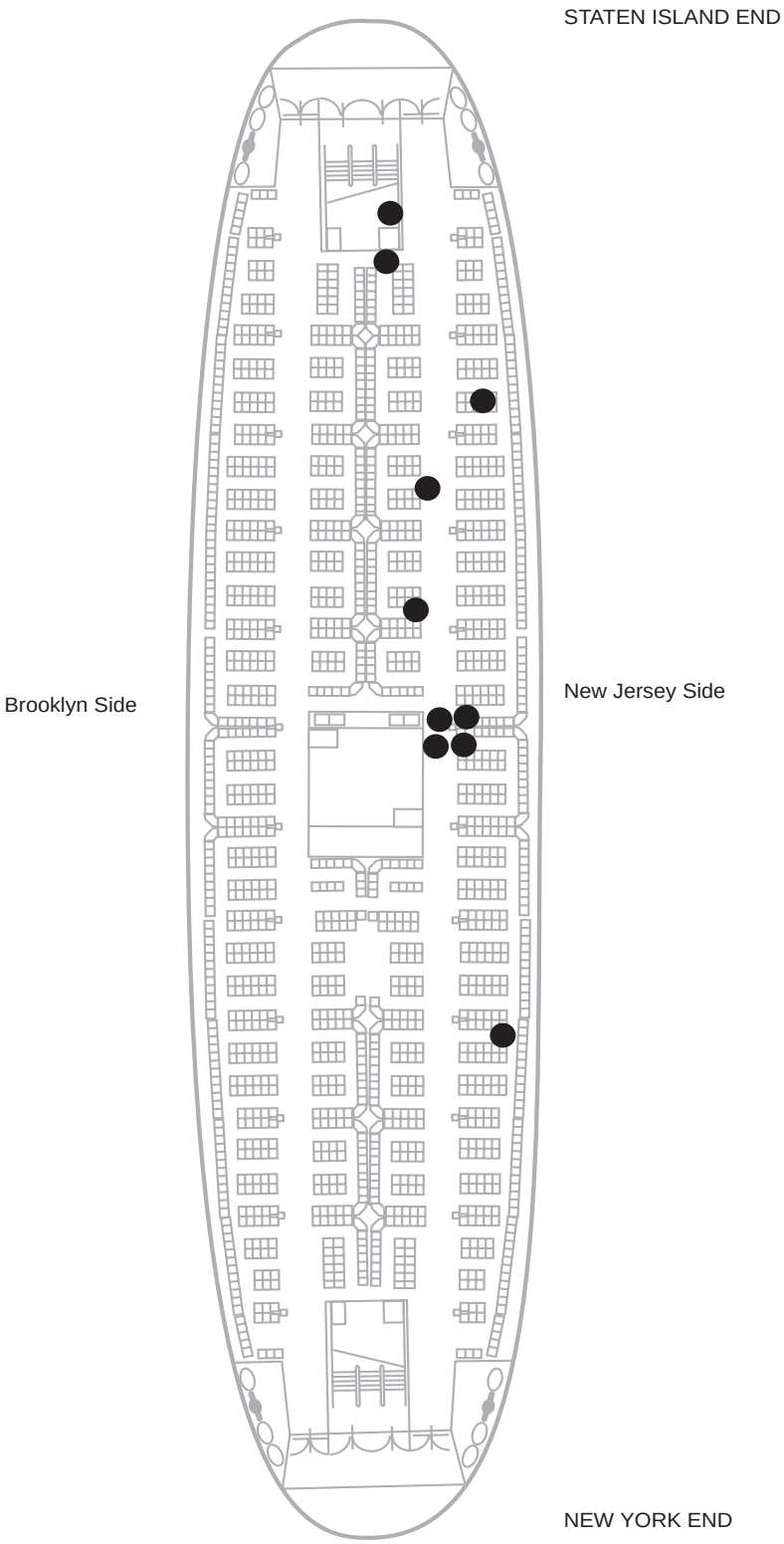

Figure 10. Locations on main deck where emergency personnel recovered bodies of fatally injured passengers. When emergency personnel arrived on board, some bodies had been moved from where fatal injuries occurred.

U.S. Department of Transportation screens for in postaccident testing (marijuana, cocaine, opiates, amphetamines, and phencyclidine [PCP]).

The Safety Board requested and obtained blood and urine samples of the assistant captain that St. Vincent's Hospital had obtained on his admission. The Board sent the samples to the Federal Aviation Administration's Civil Aerospace Medical Institute for toxicological analysis. The results were negative for alcohol and illegal drugs. The analysis found 0.76 micrograms/milliliter of tramadol in the blood and diphenhydramine (a sedating antihistamine[43]) in the urine.

Survival Factors

Crew's Emergency Actions

Safety Board investigators interviewed the *Andrew J. Barberi*'s senior and junior mates, the seven deckhands, and the four crewmembers in the engineroom (chief engineer, assistant engineer, and two oilers). The investigators also interviewed two crewmembers of the *Dorothy J*, the tugboat that assisted after the accident.

The senior mate (mate No. 1) was sitting on the settee in the Staten Island-end pilothouse when the ferry struck the pier. According to the standard operating procedure, his station during docking was on the main deck at the ferry's inshore end. His duties were to secure the New York end and supervise deckhands on the main deck and the New Jersey side of the saloon deck. After the accident, the senior mate, as instructed by the captain, went below to assess the situation. The mate told investigators that when he walked out of the pilothouse, he confronted panicky passengers and tried to assure them that everything was all right. He made his way to the New York end and down the stairs. On the main deck, he witnessed two deckhands assisting the injured and applied what he could remember of his emergency medical technician (EMT) training from 20 years before to help injured passengers. He told investigators that he attempted triage and used his belt and the straps from a lifejacket as tourniquets. He "instructed crew members as they came by," sending one for a defibrillator and telling others to move everyone to the saloon deck who was not involved in helping or was not critically injured. He directed EMS personnel to the most seriously injured passengers when they came on board.

The standard operating procedure called for the junior mate (mate No. 2) to be on the upper embarkation deck at the inshore end of the ferry during docking. His duties were to secure the Staten Island end and to supervise deckhands on the bridge deck and on the Brooklyn side of the saloon deck. The junior mate told investigators that he was making his way toward the Staten Island end of the ferry's main deck, Brooklyn side, and was about 15 feet from the doors when the ferry struck the pier. He thought they had hit another vessel and had no idea that the ferry was close to the dock. After they hit the pier, he ran to the New Jersey side, where all the damage was, and helped injured passengers.

[43] Found in such over-the-counter medications as Nytol®, Benadryl®, and Tylenol PM®.

Because the damaged area looked unsafe to him, he had deckhands direct passengers who could walk to the saloon deck or toward the New York end. He directed other deckhands and an off-duty Staten Island Ferry mate to assist the approaching tug he could see "through the hole in the hull." Next, he went down to the engineroom to see why the vessel was not moving. The chief engineer told him that he had no communication with the pilothouse, so the junior mate gave the chief engineer his radio, then ran up to the pilothouse to inform the captain. The assistant captain asked for his cell phone and the junior mate gave it to him. Then he went back to the main deck, where he witnessed the senior mate and a nurse applying a tourniquet to an injured passenger. When the rescue workers came on board, the junior mate said that he showed a fireman where the deck needed to be shored up and took detectives to the pilothouse to see the captain.

Deckhand No. 1 was on the main deck at the time of the accident, on his way to the restroom near the engineroom. His duty station was the bridge deck, New Jersey side. He was also responsible for making departure and prearrival announcements from the pilothouse. He told investigators that after the accident, he rushed up to the bridge deck, telling passengers to don lifejackets on his way. He said, "People were going . . . crazy. There was chaos going on." Then, he said, he realized that the saloon deck might fall on the main deck, so he ran down to the saloon deck and told passengers to move to the Brooklyn side. After a passenger told him there were many wounded on the main deck, he ran to the pilothouse to inform the captain. Then he went back to the main deck to help with the injured, but he told investigators that after he saw body parts and corpses, he was "no good." He said the crewmembers were "running all over the place." He said he heard no emergency announcements.

Deckhand No. 2 was at his duty station on the saloon deck, Brooklyn side, at the time of the accident; his assignment was to attach and release the safety chain at the gates, look after passengers, and clean. He told investigators that after the allision he made sure that passengers who could walk stayed away from the damaged end and helped the junior mate attend to the injured.

Deckhand No. 3 was the lookout assigned to the accident trip. The standard operating procedure listed no specific duties for the lookout, stating only that deckhands were to "act as a lookout as assigned." The lookout left the pilothouse shortly after the ferry passed the KV buoy. His duty station was the New Jersey side of the saloon deck, where he had the same responsibilities as deckhand No. 2. The lookout told investigators that he had just untied the saloon-deck doors and was at the top of the staircase between the saloon and main decks at the time of the accident. He said that when he realized that the ferry had not slowed down, he chased passengers to the other end of the boat, then grabbed a man and held onto the stair rail when the ferry hit the pier. After that, he kept people away from the collapsed stairway. He said he saw the assistant captain descend what was left of the stairs, climb over the wreckage, and "go around the side." He said, "People were panicking, putting on lifejackets and everything." He said he heard no alarms or other danger signals before the accident.

Deckhand No. 4 was sweeping the men's rooms on the saloon deck at the time of the accident. His duty station was all the men's rooms and the crew's locker room. The

impact knocked him down. He went outside, helped a fallen passenger, then ran to the bow, which he could not see because of the debris. He saw dead and injured passengers and yelled to the bridge for a police officer. Then he ran to the pilothouse to tell the captain not to move the ferry because the bow was not intact. He went down again and heard the captain yell to get a line to the tugboat. He said he tried to move passengers to the stern and assured them that the ferry was not sinking. He then went back to the pilothouse, where the captain was trying to contact the engineroom. The deckhand said he grabbed a radio and ran down to the engineroom, where he determined that the crew was uninjured but that the radios and phones were not working. He said that he tried to make an announcement on the public address system but that it also was not working. He told investigators that he did not try to call either of the mates on his radio and that he could not think of where his emergency station was.[44]

Deckhand No. 5 was walking toward the Staten Island end of the main deck at the time of the accident. His duty station was the New York half of the main deck. He told investigators that he ran to the New York end, making his way among passengers who were grabbing and putting on lifejackets. Then he went to the bridge to find out what the captain wanted the crew to do. The captain told him to find the chief engineer. On his way to the engineroom, he said he saw other deckhands controlling the crowd and helping passengers. He told investigators that he heard no alarms and no announcements to put on lifejackets.

Deckhand No. 6 was sitting on the main deck, amidships on the Brooklyn side, at the time of the accident. His duty station was the Staten Island half of the main deck. He told investigators that he had been trying to keep the doors closed, which the wind kept blowing open. After the ferry hit the pier, he said he ran to the bow, than ran back, encountering dead and injured passengers. The senior mate asked him to find the defibrillator, which he did. He said, "I did the best as I could to help people." When the ferry docked at slip 5, he helped fasten the hooks.

Deckhand No. 7, the utility bridge deckhand, was cleaning out a lifejacket locker at the time of the accident. His duty station was the Brooklyn side of the bridge deck, the ramps to the upper embarkation area, the New York-end pilothouse, and the officer's locker room. He told investigators that he had his back to the windows when the ferry hit the dock and was not paying attention to the vessel's location but was waiting for the engines "to back down." He heard no alarms before the accident and thought the ferry had run aground. He ran toward the bow, went to the saloon deck, and saw the lookout moving people back. He said the captain yelled at him from the pilothouse to go get the engineer, but he saw that the engineer was already on his way up. He continued to move people on the saloon deck to the New York end, then went to the main deck to help shift debris out of the way and to move people to the New York end.

The engineering staff were all in the engine control room at the time of the accident. The chief engineer told investigators that he was sitting in front of the control board when the ferry started shaking as if it had gone aground. He looked at the engine speed indicators and said, "How come he is not slowing down?" Then he heard crunching

[44] See "Emergency Plans," below.

"like something going under the hull and being caught in the wheel." He told investigators that he tried to call both pilothouses but got no response, so he sent the assistant engineer and the two oilers to the deck to find out what had happened. As the assistant engineer and oilers were leaving, debris fell into the engineroom. The phone was ringing from the bridge, but when the chief engineer picked it up, he got no answer. Meanwhile, the engines had slowed and the pitch had been taken off.

The assistant engineer and the oilers came back and the chief engineer said he put the assistant engineer in front of the controls and went on deck himself. He said it looked like a bomb had gone off. He went to the Staten Island pilothouse, where the captain told him that the assistant captain "had lost it." The captain then went to the New York end and the engineer transferred power to him there. The chief engineer told investigators that the ferry did not lose power when it hit the pier, that no alarms went off, and that "nothing blinked." The Staten Island propeller was still turning but the engineers shut it down because the FDNY needed to enter the shaft housing.

The assistant engineer told investigators that he was looking at the electrical panel in the engineroom when he heard "a violent crash." He told investigators that he heard no ship's whistles or alarms beforehand: "It was a very normal watch preceding the accident." He said that after the crash the chief engineer sent him with the oilers to check for damage at the ends of the ferry. At the top of the stairs they saw what had happened and as a former advanced EMT, he tried to help one person but had to leave the accident area because he felt so disturbed. He went back to the engineroom to inform the chief about the situation on deck. After the chief engineer left the engineroom, the assistant engineer closed the water lines because water was coming in and also closed a surface air line and double-checked the boiler because he thought the steam lines might be broken. He told investigators that the generator lights flickered but the vessel's lights never went out. He said he stayed in the engineroom the rest of the time.

Both oilers were in the engine control room at the time of the accident. One was sitting across from the assistant engineer and the other was standing. One of the oilers said that he thought the ferry had hit something in the middle of the harbor. He told investigators that he heard no alarms or bells or changes in the engine sounds before the accident. Both oilers went on deck, as instructed by the chief engineer, to check for damage to the propulsion system. One oiler told investigators that he helped pull debris off an injured passenger.

The engineer of the *Dorothy J* told investigators that no deckhands were available to help with the lines, and that as a result, he jumped back and forth from the tugboat to the ferry three times to tie and untie lines. He said that one of the ferry's passengers helped him with the lines. The tugboat's mate said that the deckhands stopped passengers from getting on the tugboat while it was attaching lines to the ferry.

Shoreside Emergency Response

New York City's 911 emergency notification system was first notified of the accident at 1522 by a caller who informed the operator that the *Andrew J. Barberi* had

struck a dock. In response, the FDNY dispatched three engine companies, two hook-and-ladder companies, and a battalion chief to the St. George terminal. Subsequent callers to 911 provided information about the scope of the accident and the consequent injuries. One caller reported a passenger in the water. In response to that information, the FDNY dispatched a fireboat to the scene. Early callers also gave inaccurate information about the accident, such as a report that an explosion had occurred on the vessel. At 1526, the first of two EMS life support ambulances was dispatched.[45]

At 1527, the first FDNY personnel arrived on scene. Under existing agreements between New York City first responders, the FDNY was responsible for overseeing the response to multiple casualty incidents and accidents. FDNY personnel established an incident command system to oversee rescue efforts. Also at 1527, the FDNY received reports of numerous injured on board and a minute later, it learned of at least one fatality on board. At 1529, the first EMS unit arrived on scene. The ferry had not yet arrived at the terminal.

At 1530, a second life support ambulance and an EMS supervisor were dispatched to the scene. Two minutes later, scuba-trained and tactical support personnel were dispatched. At that time, the incident commander also transmitted a notification signal alerting all personnel dispatched to the scene that they would be needed to participate in the response and automatically dispatching another engine company, another ladder company, and two more battalion chiefs. As described in a memo to the Safety Board after the accident, FDNY on-scene operations were organized as follows:

> Operations were conducted under the incident command system, utilizing chief officers as sector or function commanders, each being assigned the number of units required to accomplish the task assigned. Operating units were rotated to avoid fatigue. [As a result] . . . additional units were called to the scene either individually or by transmitting multiple alarms.

At 1536, the FDNY was informed that more than one person was in the water near the accident scene. In response, a second fireboat, a water rescue unit from another ladder company, and additional support and supervisory personnel were dispatched. Three minutes later, the off-duty FDNY lieutenant who was on board the ferry as a passenger called dispatchers with information about conditions on board, including information about multiple casualties. The FDNY then dispatched an additional rescue company, a squad company, a special operations chief, and a safety chief. FDNY records indicate that the *Andrew J. Barberi* arrived at the terminal at 1543.

When the ferry docked, emergency personnel entered the vessel from two levels simultaneously, searching for victims and providing them with initial medical care. Those in need were stabilized and transported to area hospitals. Other emergency personnel located and extricated trapped victims and helped brace the upper decks of the vessel on the New Jersey side. As the severity of the accident became clear, information was relayed to the incident commander, who transmitted a major emergency signal that automatically brought more FDNY and EMS assets to the scene.

[45] Life support ambulances carry many of the materials found in a hospital emergency room.

All told, the FDNY dispatched 213 personnel to the accident, including 2 staff chiefs, 3 deputy chiefs, 16 battalion chiefs, 16 engine companies, 10 ladder companies, 3 rescue companies, 2 fireboats, a squad company, a tactical support unit, a hose wagon, a fireground rehabilitation unit, a field communications unit, a technical response unit, and a collapse rescue unit. In addition, 59 EMS personnel, 24 ambulances, 15 advanced life support and 9 basic life support units, and 2 logistical support units participated in the response.

After responding to the first 911 call, units from the NYPD continued to arrive. Over 311 NYPD personnel assisted during the afternoon and evening of October 15—helping the injured and taking witness statements, interviewing crewmembers and passengers, organizing crowd control and traffic control, and forming a protective area around the ferry terminal.

The local Coast Guard operational field command facility, Coast Guard Activities New York, was notified of the accident at 1525, as noted previously, by a Coast Guard enlisted person who was a passenger on the *Andrew J. Barberi.* At 1533, Coast Guard Station New York, the local Coast Guard search-and-rescue facility collocated with Coast Guard Activities New York, launched a 25-foot small response boat and a 27-foot utility boat to the St. George terminal, located 3 miles from the Coast Guard facilities at Ft. Wadsworth. At 1535, Coast Guard Station New York launched a 41-foot utility boat to the ferry. At 1537, personnel from the Coast Guard's 27-foot boat reported that the *Andrew J. Barberi* had sustained major damage to its New Jersey side above the waterline. At 1545, Coast Guard Activities New York dispatched a safety officer and an investigating officer to begin the Coast Guard's investigation of the accident.

At 1553, Coast Guard on-scene personnel established a 250-yard security zone around the ferry and broadcast to vessels in the waterway that an approximately 400-yard debris field was moving through the waterway, as a result of the ebb tide and westerly winds. At 1559, Coast Guard Activities New York halted all Staten Island Ferry operations. A ferry under way from Manhattan was ordered to return. During this period, three organizations involved in the waterborne response—the Coast Guard, the NYPD, and the U.S. Army Corps of Engineers—sent additional rescue and response vessels to the scene. By 1700, 15 vessels in addition to the FDNY boats were participating in the waterborne response—6 from the Coast Guard, 5 from the NYPD, and 4 from the Army Corps of Engineers. Coast Guard vessels searched for people in the water between St. George and the Verrazano Bridge until 2040. Because no accurate count was made of the number of passengers, rescue personnel had no indication of how many people might be missing and in the water. Only one person, it turned out, had to be rescued from the water.

Coast Guard personnel remained on scene throughout the evening to assist with the investigation, search the areas next to the ferry terminal, keep water traffic not involved with the accident away from the terminal, and monitor possible hazards in the water. Their numbers increased the next morning before ferry operations resumed at 0500. Altogether, 15 Coast Guard officers, 6 enlisted personnel, and 4 Coast Guard Investigative Service agents responded to the emergency.

Emergency Plans

The ferry's station bill (list of crewmembers' duties in emergencies such as fire or abandon ship) stated that during an emergency, the crew was to be notified in the following manner: The ship's whistle and general alarm would be continuously sounded for at least 10 seconds. Additional signals on the whistle and general alarm (one to five blasts and rings) would designate the location of the emergency. According to the station bill, general alarm controls were in the pilothouse and control room, and the ship's whistle controls were in the pilothouse, along with controls for the public address system.

When they heard the emergency alarm, crewmembers were to report to their assigned stations. Each crewmember (captain, assistant captain, senior mate, deckhand No. 1, and so forth) had designated duties or assignments. In case of fire in the engineroom, for example, the deck crew was directed to arrive on scene with emergency equipment such as fire hoses, axes, and fire extinguishers and wait for instructions from the chief engineer. Mates were instructed to act under the direction of the master, deckhands under the direction of the mate. The captain or assistant captain was expected to make announcements over the public address system. Crewmembers were instructed to "stay calm, listen for instructions and signals . . . and remember that instruction(s) to the passengers will minimize panic and confusion." The station bill was posted outside the pilothouse and at other locations on the ferry.

The station bill required crews to participate in weekly fire and rescue drills. According to ferry crewmembers, the same drills were conducted every week: fire and emergency, abandon ship, and emergency anchoring. The drills were conducted after hours without passengers, with crewmembers working an hour or two extra before or after a shift to participate. The drills began with the ferry captain or assistant captain sounding the ship's whistle to initiate the general alarm bell. The crew would then gather to simulate actions taken during an emergency, according to the type of drill signaled. New deckhands were given verbal training, informally conducted on the job. No training was given for a mass casualty event, such as the type that the *Andrew J. Barberi* experienced.

The station bill contained general instructions for crewmembers on (1) recognizing and responding to emergency events, (2) required emergency announcements, (3) duties during emergencies, and (4) station locations during emergencies. Crewmembers did not receive, nor were they required to receive, training or procedures in such areas as crowd control or bridge resource management.

The six officers of the *Andrew J. Barberi* (captain, assistant captain, two mates, chief engineer, assistant engineer) received training in first aid and cardiopulmonary resuscitation (CPR) as a condition of being licensed by the Coast Guard. Crewmembers received no training in first aid or basic lifesaving techniques. At the time of the accident, automated external defibrillators were present on the ferry and the crew was being trained in their use (they were not used in the accident). The defibrillator training included CPR instruction.

Emergency Equipment

Lifesaving. According to the vessel's COI, the *Andrew J. Barberi* was required to have the following lifesaving equipment:

Rescue boats/platforms	4
Inflatable rafts	4 (32 people)
Life floats/buoyant apparatus	20 (400 people)
Adult life preservers	6,022
Child life preservers	603
Ring buoys with lights	8
Ring buoys with lines	4

Notices were stenciled on the lifejacket lockers (located along the bulkheads and under seats), indicating whether they contained children's or adults' lifejackets. Other notices directed passengers to the locations of lifejacket lockers. According to the COI, the ferry was not required to be equipped with lifeboats, immersion suits, portable lifeboat radios, or an emergency position indicating beacon.

Firefighting. The COI lists the following firefighting equipment on the ferry:

- Two fire pumps.
- Four fire hoses, each 50 feet long.
- Two fixed carbon dioxide fire-extinguishing systems: a 3,100-pound-capacity system in the engineroom, and a 200-pound-capacity system in the emergency generator room.
- Thirty-seven portable or semiportable fire extinguishers: 17 class A-II, 9 class B-II, 3 class B-V, and 8 class C-II.[46]

Tests and Research

Two days after the accident, the Safety Board participated in tests of the *Andrew J. Barberi*'s communication and propulsion systems.

[46] Class A extinguishers are for fires involving ordinary combustibles, such as wood, cloth, and paper. Class B extinguishers are for fires involving flammable liquid, grease, or gas. Class C extinguishers are for fires involving energized electrical equipment, such as appliances, switches, panel boxes, and power tools (these extinguishers are also rated for class A and class B fires). According to the Coast Guard classification system, type A-II portable extinguishers hold 5 pounds of dry chemical; class B-II, 10 pounds; class B-V, 50 pounds; and class C-II, 10 pounds.

Communication System Tests

New York–End Pilothouse. The engine-order telegraphs, both thrust and steering, were tested in the New York-end pilothouse. An individual in the pilothouse sent orders to another in the engine control room via the telegraph system. A VHF radio was used to communicate between stations for verification that the orders were being received at both stations properly. Both engine-order telegraphs were found to work satisfactorily.

The sound-powered phone systems were tested by phoning from the pilothouse to an individual in the engineroom. Calls made to the engineroom were completed satisfactorily, while calls made to the other pilothouse would ring in the pilothouse but the audio circuit was not completed.

The public address system was tested and found to perform satisfactorily. It was heard clearly throughout the vessel.

The pilothouse ship's whistle was tested using two methods. One involved depressing a console pushbutton, which in turn opened a solenoid admitting air to sound the whistle. The other involved manually pulling an overhead pull cable in the pilothouse, which was mechanically linked to the valve at the whistle itself, thereby sounding it. The whistle performed satisfactorily irrespective of the method used.

The "cowbell system," essentially a pull lever in both pilothouses that connected directly to a cable that was attached to two cowbells in the engine control room, was tested in the pilothouse. The system performed satisfactorily.

Staten Island–End Pilothouse. Tests found that the public address system, the cowbell signaling system, and the whistle from the pilothouse worked satisfactorily, similarly to the systems in the New York end. Several deficiencies, however, were found in the sound-powered phone system. All calls initiated from the pilothouse, regardless of the location being called, had no audio circuit. The ringer would ring at the selected call destination, but no audio connection was made. Calls from the engineroom or the New York-end pilothouse met with the same results—the phones would ring but the people could not talk to each other.

Tests of the engine-order telegraph also found deficiencies. When a command was ordered from the pilothouse, the engine-order telegraph rang in the engineroom but the telegraph needle did not move to indicate the speed change being ordered. Engine-order telegraph commands from the engineroom showed the same results in the pilothouse—a ring indicating an incoming engine-order telegraph command was heard but no corresponding needle movement was observed. This test was performed in both directions, for each speed from stop to full astern, and from stop to full ahead, with the same results.

Propulsion System Tests

The propulsion system was tested without applying rotational drive from the main engine to the unit's gearboxes. That was because of concern about the effect of vibrations from the main engine and propulsion system on the structural integrity of the upper deck,

which had been weakened by the accident. The tests were intended to demonstrate the operation and response of the propulsion units themselves, not of the driving medium.

The hydraulic drive pumps were started and the system was brought to operating pressure. Investigators were positioned at the pilothouse controls and at the propulsion system's actual location. Control was transferred from the engine control room to each of the two pilothouses, and the investigators in the pilothouses varied both the thrust and the steering from zero to 100 percent in both directions. The results showed that the propulsion system performed satisfactorily in both end units, through all phases of thrust and steering testing. Units in both ends were found to have a response time from zero to 100 percent thrust of approximately 5 seconds in any direction, and a response time from full ahead to full astern of between 7 and 8 seconds.

The investigative team tested the transfer of propulsion control from the engineroom to the pilothouse stations, as well as between pilothouses. All propulsion transfers from operating station to operating station in each pilothouse, and from each operating station to the engineroom, were completed satisfactorily.

Additional Information

Staten Island Ferry Rules and Policies

The NYC DOT required deckhands (the starting ferry operations position) to have 2 years of sea time or related experience before being hired. After personnel were hired as deckhands, the NYC DOT had no minimum or maximum time intervals in which they were to serve at each step before they could be promoted. According to the director of operations, deckhands could serve as little as 6 months before being promoted to assistant captain, provided they met the Coast Guard licensure requirements. The NYC DOT required assistant captains and captains to demonstrate knowledge of ferry procedures and ferry routes, including markers, buoys, and other navigational features. Applicants for the assistant captain or captain position submitted their résumés and were subsequently interviewed by the port captains and the director of operations, who then made the final selections.

The NYC DOT had no formal curriculum for training deckhands or mates for assistant captain positions. When new deckhands reported for duty, they were given verbal instructions and trained on the job. Those selected for the assistant captain position would begin training by steering the vessel under the supervision of the captain, before taking the civil service examination for the position.

At the time of the accident, no formal safety management system was in place, nor was one required to be, and management directives were communicated verbally to crewmembers. Emergency information listed in the vessel's station bill covered alarm signals and announcements for fire, man overboard, and abandon ship emergencies, and listed fire stations and boat stations for crewmembers.

According to the director of ferry operations, "directives [and] memos" delineated standard operating procedures that were made available to ferry personnel. No system was in place to document crewmembers' receipt of the directives and memos. Safety Board investigators, as a routine part of their investigation, asked the NYC DOT for a copy of the operating procedures. The NYC DOT provided the Board with an 8-page, undated document, "Standard Operating Procedures for Captains, Assistant Captains, Mates, Deckhands, and Female Attendants While the Boats Are Loading, Off Loading and Underway" (appendix B). According to that document, the captain was required to be in the operational pilothouse "upon docking" and to be in the "off shore" pilothouse "upon undocking to receive the signal from the assistant captain that the boat is let go." According to the procedure, the captain was responsible for operating the boat safely and for emergency and rescue operations. The assistant captain, in addition to assisting the captain in the operation of the ferry, was responsible for advising the captain of any dangers to navigation. This officer also observed passenger embarkation and disembarkation and when the boat had cleared the dock, was directed to go to the operating pilothouse.

According to the director of operations, no single procedure explicitly directed the captain or assistant captain to remain at certain locations during the voyages. Rather, he said, "You have to kind of put them [the procedures] together." By doing so, the director said, "You see that they're to be together [captain and assistant captain]. In weather, absolutely, positively together all the time." He told investigators that he would talk to operators who were discovered not to follow this procedure. If they refused to follow the procedure, he would discipline them according to the NYC DOT's disciplinary procedures (which he did not specify).

The two port captains disagreed on the existence of an NYC DOT requirement for both the captain and assistant captain to be present in the pilothouse after propulsion control had been transferred from one end of the ferry to the other. One said that such a procedure was in place and that captains and assistant captains were expected to follow it. The other said that the decision was up to the captain of the vessel: "If he doesn't want to be in the pilothouse, if he has to go do something, he can do it, as long as he knows a qualified person is in the pilothouse." In addition, Safety Board investigators could find no evidence that the NYC DOT had a procedure that required crewmembers to signal or otherwise sound an alert to indicate that docking preparations were to be made.

According to the director of ferry operations, the two port captains would regularly ride in the ferry pilothouses during their duty hours and observe the performance of crewmembers, although there was no standard inspection procedure mandating this practice or describing how the observation was to be carried out. The observations enabled the port captains to determine the extent to which the crewmembers followed the required procedures. According to the director, he or the port captains would document unusual situations or instances in which crewmembers did not follow procedures.

Coast Guard Oversight of Staten Island Ferries

Under 46 U.S.C. 3301, the Coast Guard has inspection authority over U.S.-flag vessels that charge passengers a fare to board. Coast Guard Activities New York was the

local Coast Guard office in charge of vessel oversight. The OCMI of Activities New York had final authority for vessel inspection, licensing, and investigation of marine casualties and accidents, among other responsibilities (33 CFR 1.01-20).

The Coast Guard's inspection authority was defined in terms of passengers paying for their passage. On July 1, 1997, the NYC DOT eliminated the fares that it had been charging its passengers, to integrate the Staten Island Ferry into the New York City mass transit system's "One City, One Fare" program. As a result, a question arose whether the ferries would continue to be inspected by the Coast Guard. On May 19, 1998, the Coast Guard and the NYC DOT signed an MOU to maintain the Coast Guard's inspection of the ferries, in light of their "mutual interest and concern for the safe operation of the Staten Island Ferries."[47]

The document stated, "The parties have entered into this MOU to formalize procedures for developing standard operating procedures and agreements between OCMI NY and the NY City DOT to achieve the following goals: (1) improve passenger safety, (2) improve the quality of Ferry maintenance and operations, and (3) expedite the Coast Guard inspection process." The MOU called for quarterly meetings "to exchange information and discuss issues of mutual concern." Further, any agreements specifying procedures or operations would be "formalized in writing" and the MOU would be "thoroughly reviewed periodically by each party." At the time of the accident, no agreements amending the MOU had been reached and no other written agreements had been added to it. The Coast Guard continued to examine the Staten Island ferries and issue COIs.

Safety Assessment. In November 1998, new Coast Guard rules went into effect under 46 CFR 199 (subchapter W) that required vessel operators to install additional survival equipment, including lifeboats, liferafts, rescue boats, and associated appliances, which had been originally intended for oceangoing passenger vessels. Subchapter W consolidates the lifesaving regulations for U.S. inspected vessels and implements chapter 3 of the International Convention for Safety of Life at Sea (SOLAS), 1974, as amended.[48]

The new regulations gave operators until October 1, 2003, to install the lifesaving equipment. Under the provisions of 46 CFR 199.630(f), however, operators were allowed to obtain an approved safety assessment as an alternative to equipping their vessels with the additional survival craft. The regulations required the alternative safety assessment to address (1) the navigation and vessel safety conditions in the vessel's planned operating area, and (2) a comprehensive shipboard safety management and contingency plan that was "tailored to the particular vessel," "easy to use," "understood by vessel management personnel both on board and ashore," and "updated regularly." In February 2003, the Coast Guard issued a Navigation and Vessel Inspection Circular (NVIC 01-03) describing the alternative safety assessment and giving guidance for having it approved.[49] A previous

[47] See appendix C.

[48] SOLAS is an international treaty concerning the safety of merchant ships. The first version of SOLAS was adopted in 1914 after the *Titanic* sinking. A new Convention was adopted in 1974 and is sometimes referred to as SOLAS, 1974, as amended, because of its numerous updates and amendments.

[49] U.S. Coast Guard, "Guide to the Subchapter W Safety Assessments Under 46 CFR 199.630(f)," NVIC 01-03 (Washington, DC: U.S. Department of Transportation, 2003).

Coast Guard circular described shipboard management and contingency plans, focusing on emergency procedures.[50]

In June 2000, George G. Sharp, Inc., in accordance with 46 CFR 199.630(f) and at the request of the NYC DOT, completed a safety assessment of the Staten Island ferries.[51] The results of the Sharp assessment were submitted to the Coast Guard. The assessment included a description of the ferry fleet's safety equipment and scope of operation. It described vessels, routes, crew requirements, schedules, vessel traffic characteristics, and environmental factors, and outlined basic emergency procedures and drills. The report noted that "the navigating risk is highest near the two terminals," where "the ferry crosses perpendicular to the prevailing vessel traffic flow." Appendix A to the report ("Contingency Planning") detailed procedures to be followed in case of collision, flooding, grounding, abandon ship, loss of power or steering, fire and explosion, bomb threat, and oil spill. According to section A.1.1, "only collision carries a significant potential of passenger injury." Section A.1.2.1 identified the bridge team as the most important element in preventing collisions and assuring safe vessel operation, with the Coast Guard's VTS as the next most important element.

On August 7, 2000, the Commanding Officer of Coast Guard Activities New York informed George G. Sharp by letter that its safety assessment provided the ferries "a satisfactory alternative to the installation of primary lifesaving gear" that was required under the new regulations. The letter added, however, that final approval of the substitution of "risk-reducing features" for lifesaving gear would "be determined after reviewing crew training and witnessing safety drills."

An amended version of the Sharp safety assessment received final approval on March 30, 2004. It was much longer than the original version (250 pages, largely unnumbered, versus the original's 38 pages) and contained a shipboard safety management and contingency plan for each of the three vessel classes (not, however, as stand-alone documents). A crew safety training manual had been added, including information about emergency signals, basic firefighting, lifesaving equipment, and basic first aid. Training materials for supervisors dealing with drug and alcohol testing had also been added. The risk assessment section had been augmented with a risk matrix that considered the following accident scenarios: fire, collision/allision, grounding, security threat, and loss of power or propulsion. All scenarios were rated as having a low risk of requiring vessel evacuation.

Inspections. Coast Guard safety oversight was limited to inspections of the ferries' hulls, establishing and overseeing crew medical standards and licensing of ferry operating personnel, and enforcing rules of the road and environmental regulations. The Coast Guard inspected each vessel quarterly and conducted more in-depth inspections of the vessels annually.

[50] U.S. Coast Guard, "Shipboard Management and Contingency Plans for Passenger Vessels," NVIC 1-97 (Washington, DC: U.S. Department of Transportation, 1997).

[51] George G. Sharp, Inc., "New York City Ferry Safety Assessment," prepared for NYC DOT, June 2000.

As stated at 46 CFR 71.25-10, annual Coast Guard vessel inspections entail the following:

> The annual inspection shall include an inspection of the structure, boilers, and other pressure vessels, machinery and equipment. The inspection shall be such as to insure that the vessel, as regards the structure, boilers and other pressure vessels, and their appurtenances, piping, main and auxiliary machinery, electrical installations, life-saving appliances, fire-detecting and extinguishing equipment, pilot boarding equipment, and other equipment is in satisfactory condition and fit for the service for which it is intended, and that it complies with the applicable regulations for such vessels, and determine that the vessel is in possession of a valid certificate issued by the Federal Communications Commission, if required. The lights, means of making sound signals, and distress signals carried by the vessel shall also be subject to the above-mentioned inspection for the purpose of ensuring that they comply with the requirements of the applicable statutes and regulations.

Coast Guard rules that apply to international passenger vessels call for a comprehensive safety management system under SOLAS. (For details, see "Safety Management Systems," below.) Because the Staten Island Ferry operated in domestic service, it was exempt from the SOLAS requirement. As a result, the Coast Guard did not refer to or assess the quality of the NYC DOT's operating procedures.

After the September 11, 2001, attacks on the United States, the Coast Guard, in its capacity as the Federal agency overseeing the security of U.S. waterways,[52] required numerous changes to Staten Island Ferry operations to increase the level of both vessel and port security. The director or ferry operations worked closely with the Coast Guard to upgrade security on the ferries. Among the changes, car ferries were not allowed to carry vehicles and police officers were posted to each ferry while under way.

Medical Oversight of Mariners

The NYC DOT had no independent medical standards for ferry operators. Coast Guard standards governing medical evaluations and Coast Guard–maintained medical records were the only medical standards and medical record-keeping system that applied to ferry operators. The NYC DOT did, however, track the number of absences of individual employees to ensure that the absences were within the number permitted by established NYC DOT policy. When employees exceeded the limits, they were required to present physicians' notes explaining the reason for their absence.

Mariners holding Coast Guard licenses are required to undergo a physical examination once every 5 years, or when their licenses are upgraded, to determine that they are in sound health and have no physical limitations that would hinder or prevent performance of duties. A licensed physician, physician assistant, or nurse practitioner can perform the Coast Guard-required examination for license holders, as indicated on form

[52] The Coast Guard retained this responsibility after its transfer to the Department of Homeland Security, although some aspects of its security oversight were assigned to the Transportation Security Administration.

719K. Mariners then submit proof of their fitness to the Coast Guard, according to regulations at 46 CFR 10.209(d) or (e). Form 719K provides information to the examining health practitioner on the medical evaluation and on general duties required of licensed mariners.

The Coast Guard requires mariners with pilot endorsements, which includes captains and assistant captains on the Staten Island Ferry, to be examined annually (46 CFR 10.709). Form 719K does not apply to the annual pilot medical evaluation, and the regulations and other published material do not provide additional information on the medical evaluation or the documentation necessary after the evaluation is completed. Mariners with pilot endorsements do not have to submit proof of their medical examinations outside the 5-year or license-upgrade interval. The regulations require pilots to possess such proof, however, and make it available to Coast Guard personnel on demand (46 CFR 10.709[e]).[53]

Neither Coast Guard Activities New York nor representatives of the Coast Guard's New York regional examination center (REC), the office responsible for overseeing and approving mariner licensing in the New York area, requested proof of compliance with the annual medical evaluation requirement from either the captain or the assistant captain of the *Andrew J. Barberi*. Coast Guard personnel also did not ask any Staten Island Ferry captain or assistant captain for such proof in the 12 months before the accident. The Safety Board was unable to establish that the Coast Guard enforced compliance by ferry operating personnel with the annual examination requirement in that interval or at any other time.

Medical standards differ according to the general assignment of applicants (deck or engineering). For example, deck officers are required to have vision correctable to 20/40 in each eye, engineering officers to 20/50 in each eye. After completing the examination, the health practitioner signs Coast Guard form 719K and indicates whether the applicant is considered medically qualified. (The Coast Guard makes the final determination of a mariner's qualifications.) Other forms may be used, provided that the examination is carried out in accordance with the standards listed in form 719K. At the end of the examination, the examiner provides the applicant with form 719K or, if warranted, with a certificate that the applicant is in good health and otherwise meets the physical requirements at 46 CFR 10.209(d) or 12.02-27(d). Applicants can choose whether to submit the evaluation results to the Coast Guard.

[53] "Upon request, a first class pilot shall provide the Coast Guard with a copy of his or her most recent physical examination."

In January 2002, the Coast Guard revised form 719K. Four and a half years earlier, on June 26, 1997, as a result of its investigation of the grounding of the passenger vessel *Star Princess* north of Juneau, Alaska,[54] the Safety Board had issued the following Safety Recommendation to the Coast Guard:

> M-97-42
>
> Review, in consultation with experts in occupational health, your medical standards, guidelines, and examination forms to ensure that they require the disclosure and appropriate evaluation of the history or presence of any medical conditions, symptoms, or medication use that would affect an individual's fitness to pilot a vessel.

According to the commander of the Coast Guard's National Maritime Center, physicians experienced in the physical evaluation of mariners provided guidance for the revisions published in 2002. The revised form explains a mariner's duties and contains a section where applicants and physicians are to list all medications being taken, dosages, possible side effects, and relevant medical conditions. The form includes a medical history section and requires a signed statement by the physician as to whether the applicant is competent, not competent, or in need of further review. The applicant certifies that the information is complete and true. In light of these revisions, on February 3, 2003, the Safety Board classified Safety Recommendation M-97-42 as "Closed—Acceptable Action."

Before it revised the evaluation form, the Coast Guard published NVIC No. 2-98,[55] "Physical Evaluation Guidelines for Merchant Mariner's Documents and Licenses," which is available from any Coast Guard REC, the Coast Guard's Washington, D.C., headquarters, or from the Coast Guard website. The 10-page document describes general physical demands that mariners may be expected to meet, and provides guidance to physicians and applicants on mariner medical qualifications. The NVIC's list of "Potentially Disqualifying Conditions" includes impaired vision (uncorrected vision worse than 20/800), impaired color vision, or impaired hearing; poorly controlled diabetes; lung disease such as chronic or active asthma or tuberculosis; chronic/recurrent pancreatitis; chronic renal failure; multiple or recent myocardial infarctions; psychiatric disorders such as psychosis, suicidal behavior, drug or alcohol addiction; convulsive disorders; conditions that seriously limit balance such as Parkinson's disease; narcolepsy; somnambulism; infectious diseases; and medications such as anticoagulants or psychotropics; or "any other disease, constitutional defect, medication (side effects), sleep disorders or therapy which would result in gradual deterioration of performance of duties, sudden incapacitation or otherwise compromise shipboard safety, including required response in an emergency situation." In short, any condition that poses a risk of incapacitation or debilitating complication, and any condition requiring medication that

[54] *Grounding of the Liberian Passenger Ship* Star Princess *on Poundstone Rock, Lynn Canal, Alaska, June 23, 1995*, Marine Accident Report NTSB/MAR-97/02 (Washington, DC: National Transportation Safety Board, 1997).

[55] Also listed in Coast Guard references as COMDTPUB.P16700.4.

impairs judgment or reaction time, is potentially disqualifying and requires a detailed evaluation before the mariner will be considered fit to qualify for a license.

Mariners who develop disqualifying physical conditions before their next scheduled physical examinations are not required to inform the Coast Guard. However, if the Coast Guard becomes aware that a licensed mariner has developed a disqualifying physical condition, it would investigate the situation and possibly begin suspension and revocation proceedings. The Coast Guard has no formal mechanism that allows physicians or other interested persons to notify them of a mariner who has a disqualifying physical condition.

Because of the manner in which data from medical evaluations are maintained, the Coast Guard cannot examine trends in form 719K results. Limitations in the data storage system prevent the Coast Guard from categorizing the results to determine trends in the findings of examining physicians, the number of applications completed by a single health practitioner, or the percentage of applicants found physically qualified by individual health practitioners. In addition, the Coast Guard does not compare the results of reviews by its own RECs to determine the extent of commonalities or differences in the review process. Coast Guard personnel engaged in the review of mariner medical evaluations indicated to Safety Board investigators that the RECs may not be consistent in their approval or denial decisions for identical medication use.

Applicants who choose to provide the results of the examinations to the Coast Guard send them to the nearest REC. There, evaluators review the results of the completed evaluations according to policy, regulations, and guidance published in the Coast Guard's *Marine Safety Manual* and in NVIC No. 2-98. According to personnel at the National Maritime Center, after receiving the results of the medical evaluations, REC evaluators place the results into one of three categories, in which applicants are found to be (1) physically qualified—a medical approval would thus be granted, (2) not qualified—approval would thus be denied, or (3) not qualified but by a "very minor" disqualifying factor. Applicants with "very minor" disqualifying conditions may be granted waivers after demonstrating that they can perform the job safely. Personnel at the National Maritime Center said that REC examiners would forward applications from mariners with "very minor" disqualifying conditions to the National Maritime Center, with the recommendation that a waiver be granted. Examiners at the National Maritime Center would then further review the application and, if still uncertain, would forward the application to one of two medical officers, who would make the final determinations.

Of the 50,000 to 60,000 applications that the Coast Guard is estimated to receive annually, National Maritime Center personnel estimated that 1,200 to 1,400 are sent to the center for further review. The Coast Guard keeps no central record of the number of applications that are denied. National Maritime Center personnel informed the Safety Board that the Coast Guard plans to centralize the medical evaluation process, with a hoped-for date of 2007 to implement the change.

The Coast Guard retained two physicians, both permanently employed by the Public Health Service but assigned to the Coast Guard's National Maritime Center, to

make the final determination regarding the approval of a mariner's physical condition. The physician in charge of these determinations was the Coast Guard personnel command senior medical officer. The senior medical officer told Safety Board investigators that he had no formal training in occupational medicine.[56] He stated that if he had questions regarding whether to grant a waiver for a mariner, he relied on the mariner's health care provider for guidance. If the health care provider considered the condition not debilitating and one with which the mariner was able to perform his or her job, he would grant the waiver. The senior medical officer said that he would almost always follow the guidance of the examining or treating physician.

The Coast Guard does not maintain a list of prohibited medications. REC examiners referred to the *PDR* for guidance when considering medication use. In general, however, as long as the treating physician believed that the medication was controlling the condition without side effects, the senior medical officer indicated that the Coast Guard would grant a waiver. The senior medical officer considered the use of certain medications to be disqualifying. For example, medications for sleep such as Ambien® or Sonata® were disqualifying because a mariner taking these pharmaceuticals might not be able to function if performing nighttime duty. Similarly, use of any kind of narcotic would disqualify a mariner because of the likelihood of drowsiness.

The senior medical officer said that he would send the request of an applicant who had been using the pain reliever tramadol back to the treating physician to determine whether the applicant was drowsy as a result of the medication. Unless such information was provided, or unless he had information from his employer or others that they observed the person in a drowsy state, he told Safety Board investigators that he would grant the waiver because, in his opinion, it would be very difficult to assess a potential risk of sudden incapacitation due to medication such as tramadol.

Two weeks after Safety Board investigators met with the personnel command senior medical officer and others at the National Maritime Center, its commanding officer wrote to inform the Safety Board that the senior medical officer "misspoke at the meeting and asked to clarify his statement." The commanding officer stated that the physician said:

> When I was asked at the NTSB Inquiry about a waiver possibility for Tramadol, I was under the mistaken opinion that Tramadol was not a narcotic. Since the meeting, I have checked the *PDR* . . . and realized that it is a narcotic. If possible, you may want to inform the board attendees that I was mistaken and had responded too quickly to their question. You might also add that I do refer to the *PDR* when a mariner is on a medication with which I am unfamiliar.

Coast Guard personnel informed the Safety Board that the Coast Guard was planning, in the near future, to revise the medical standards that mariners would be required to meet. As of the date of this report, the Coast Guard had not yet issued proposed revisions to its medical standards for licensing mariners.

[56] Training in occupational medicine can range from a multiweek course to residency and board certification.

Safety Management Systems

A safety management system is a structured, documented system developed to enhance the safe operation of vessels, prevent human injury or loss of life, and avoid damage to the environment. With a safety management system, ship owners and operators are encouraged to resolve safety problems before casualties or incidents occur ("self-regulate"), rather than simply comply with regulations imposed from outside, which usually means waiting for notification of defects before taking corrective action.

Background. International safety management standards were developed in the early 1990s in response to a number of serious marine casualties whose cause was identified as human error or management failure and that occurred despite improvements in engineering and technology designed to prevent them. One of the most serious was the March 1987 capsizing of the passenger/car ferry *Herald of Free Enterprise* off the Belgian coast, which killed 193 people. The investigating British justice described the ferry management's failures as "the disease of sloppiness."[57]

In the aftermath of that disaster, the International Maritime Organization (IMO), a specialized agency of the United Nations, began developing guidelines for safe ship management, focusing at first on roll-on, roll-off ferries such as the *Herald of Free Enterprise*. In May 1991, work began on what became the International Safety Management (ISM) code,[58] whose stated purpose is "to provide an international standard for the safe management and operation of ships and for pollution prevention." In 1993, the IMO decided to make the ISM code mandatory, and in May 1994, IMO members, including the United States, adopted the ISM code as chapter 9 of SOLAS. Chapter 9 of SOLAS went into force on July 1, 1998. On that date, the ISM code became mandatory for the following vessels on international voyages: passenger ships, high-speed craft (passenger and cargo) of 500 gross tons or more, tankers, and cargo carriers. For other cargo ships, the code came into force on July 1, 2002.

U.S. Regulations. The ISM code has the force of law in countries that are signatories to SOLAS. In October 1996, Congress revised 46 U.S.C. chapter 32 ("Management of Vessels") to incorporate the ISM code into the laws of the United States. In May 1997, the Coast Guard published a Notice of Proposed Rulemaking setting out Federal regulations for safety management systems for U.S. vessels "engaged on a foreign voyage."[59] The proposed regulations included standards that would allow companies to satisfy international certification requirements for safety management systems and also to seek voluntary certification of safety management systems for U.S. domestic vessels. On December 24, 1997, the Coast Guard issued final regulations for implementing the ISM code (33 CFR 96, "Rules for the Safe Operation of Vessels and Safety Management Systems"); the final rule became effective on January 23, 1998.

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[57] Department of Transport (United Kingdom), *MV Herald of Free Enterprise*, Report of Court No. 8074—Formal Investigation, Hon. Mr. Justice Sheen, Wreck Commissioner (London: Her Majesty's Stationery Office, 1987).

[58] The full name of the code is International Management Code for the Safe Operation of Ships and for Pollution Prevention.

[59] *Federal Register*, vol. 62, no. 84 (May 1, 1997), p. 23705.

Objectives. The objectives of a safety management system, as given in 33 CFR 96.230, are as follows:

(a) Provide for safe practices in vessel operation and a safe working environment onboard the type of vessel the system is developed for.

(b) Establish and implement safeguards against all identified risks.

(c) Establish and implement actions to continuously improve safety management skills of personnel ashore and aboard vessels, including preparation for emergencies related to both safety and environmental protection.

(d) Ensure compliance with mandatory rules and regulations.

Main Elements. A safety management system aims to create a "culture of safety" throughout an organization by documenting a vessel owner's operational policy, chain of authority, and operational and emergency procedures; specifying the responsibilities of the owner or operator, managers, and masters; and outlining procedures for management review, internal audits, and correction of nonconformities (failure to adhere to procedures or regulations). Procedures are compiled in a safety management manual and a copy is kept on board the vessel. A person or persons are designated in writing to monitor the safety management system, and managers conduct regular audits to ensure that employees follow the procedures. Checklists are supplied for critical areas. When deficiencies are noted or an accident or a nonconformity occurs, corrective action is taken until the problem is resolved, and the problem is documented from start to finish.

Application. The Federal regulations for safety management systems apply to U.S. vessels "engaged on a foreign voyage" that carry more than 12 passengers or that are tankers, bulk freight vessels, or mobile offshore drilling units of 500 gross tons or more (33 CFR 96.210). The regulations do not apply to barges, recreational vessels not engaged in commercial service, fishing vessels, vessels operating only on the Great Lakes or its tributary and connecting waters, or public vessels. The Staten Island Ferry was not required to comply with the regulations because it operates on a strictly domestic route.

Requirements. Operators whose vessels fall under the Federal regulations must prepare internal audit reports that demonstrate compliance with the ISM code (33 CFR 96 subpart B). They must also hold a valid Document of Compliance certificate and a Safety Management Certificate as evidence of compliance with the ISM code (33 CFR 96 subpart C). Organizations can be authorized by the Coast Guard to act on behalf of the United States to perform safety management audits and certification (33 CFR 96 subpart D).

A complete list of documents required for a safety management system under the Federal regulations is found at 33 CFR 96.250. Briefly, they include the following:

(a) Safety and environmental impact statements, which are to be carried out and kept current at all levels.

(b) Statements of responsibilities and authority.

(c) Designation in writing of a person or persons to monitor the safety management system.

(d) Written statements defining the master's responsibilities and authorities.

(e) Written statements that the master has overriding responsibility and authority to make vessel decisions.

(f) Personnel procedures and resources available on shore and on board ship.

(g) Vessel safety and pollution prevention operation plans and instructions for key shipboard operations.

(h) Emergency preparedness procedures.

(i) Reporting procedures on required actions.

(j) Vessel maintenance procedures.

(k) Safety management system document and data maintenance.

(l) Safety management system internal audits that verify the vessel's safety and pollution prevention activities.

Audit Procedures. The ISM code requires companies to demonstrate how safety is managed on shore and on its vessels, through both internal and external audits. Internal audits allow companies to measure the effectiveness of their own systems. Companies prepare their own internal procedures for auditing their safety management systems, setting out the objectives, scope, and responsibilities involved. They develop an audit schedule that specifies which ships and office locations to audit and target dates for carrying out and completing the audits. Reporting lines are clearly defined and reports are distributed to all relevant personnel.[60]

External audits are performed at the request of the operating organization by an approved outside organization, usually a marine classification society, for a fee paid to the auditor by the requestor organization. The external auditor reviews the results of the operating organization's internal audits and all elements of its management system. The auditor questions management and vessel crews about their knowledge of the system, examines safety records, and verifies that procedures are followed. It may take an entire day to audit one vessel. If the audit is successful, a Safety Management Certificate is issued and the ship can continue operations. If critical areas have deficiencies, a vessel operator can lose its Document of Compliance.

Voluntary Compliance. Under 33 CFR 96.110(b), vessel operators that are not required to comply with the ISM code can voluntarily meet the standards and have their safety management systems certificated. Guidance for voluntary compliance is provided in Coast Guard NVIC 5-99.[61] As stated in the NVIC, "33 CFR 96 is the basis for the requirements of a voluntary safety management system." However, as outlined in the

[60] For further information, see *Guidelines on the Application of the IMO International Safety Management (ISM) Code*, 3rd ed. (London: International Chamber of Shipping and International Shipping Federation, 1996), pp. 34-51.

[61] U.S. Coast Guard, "Guidance Regarding Voluntary Compliance with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (International Safety Management [ISM] Code)," NVIC 5-99 (Washington, DC: U.S. Department of Transportation, 1999).

Coast Guard's *Marine Safety Manual*, an equivalent to ISM code compliance has been established for small passenger vessels, certificated under 46 CFR subchapter T, for which full accordance with 33 CFR 96 would be "too extensive."[62] The Coast Guard has prepared guidance documents (booklet and computer disc) for use in developing equivalent safety management systems. Vessel operators must apply in writing to participate in the equivalent safety management program.

Conclusion. The Coast Guard concluded from its casualty studies that "in excess of 80 percent of all high consequence marine casualties may be directly or indirectly attributable to the 'human element.'" The Coast Guard stated that "the use of safety management systems by all U.S. commercial vessels would result in significant benefits and we will support the development of such programs." However, it also noted that "46 U.S.C. 3202 . . . does not provide the Coast Guard with the authority to require such safety management systems on these U.S. domestic vessels."[63]

Other Ferry Systems

Nationwide. According to the National Ferry Database, ferry systems operate in 40 of the 50 States, plus Puerto Rico, the Virgin Islands, and the Northern Mariana Islands.[64] The American Public Transportation Association (APTA) counts about 30 metropolitan areas and small cities in the United States that offer transit ferry service across rivers or bays or to offshore islands, where bridges or other modes of transportation are nonexistent or impractical.[65] In Alaska, ferries operated as part of the Alaska Marine Highway System connect areas along 8,000 miles of coastline that are not linked by roads.

Some of the ferries are privately owned, some publicly owned, and some represent public/private partnerships—usually, a public transit authority contracting with a private company that owns and operates the vessels. The vessels include vehicle ferries, which carry both vehicles and passengers; passenger-only ferries, which may carry bicycles in addition to pedestrians; and water taxis, which are very small passenger-only ferries that operate on fixed routes or provide on-demand service.

APTA statistics show that ferries operated by 42 transportation agencies carried nearly 58 million passengers in 2002, with an average trip length of 5.8 miles and total passenger miles of 333 million. According to APTA, the largest number of ferry operators are found in New York/New Jersey, San Francisco Bay, and the Boston area. In the San Francisco area, voters have approved funding for a major ferry expansion that, it is hoped,

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[62] U.S. Coast Guard, *Marine Safety Manual*, vol. II, section E, chapter 3, "Safety Management Systems (SMS)" (revised May 2000), pp. E3-13–E3-15.

[63] The Coast Guard published these statements in its discussion of the final rule for 33 CFR 96 (*Federal Register*, vol. 62, no. 247 [December 24, 1997], pp. 67492 and 67503).

[64] National Ferry Database, U.S. Department of Transportation, Bureau of Transportation Statistics <http://www.transtats.bts.gov/Tables>. The database lists 224 ferry operators, including those that operate small ferries, many cable-operated, that carry 4 to 6 cars or farm equipment across rivers or canals on backroads not served by bridges.

[65] Information obtained from APTA website <http://www.apta.com/research/stats/ferry/fbagency/cfm> (accessed December 12, 2004).

will relieve traffic congestion on bridges and highways. By 2025, the San Francisco Bay Water Transit Authority plans to triple annual ferry ridership to 12 million, adding 31 new ferryboats and 7 new ferry routes.[66] As shown in table 2, annual ferry ridership exceeds 1 million in five urban areas of the country, with the largest ferry operation being the Washington State Ferries.

Table 2. Largest U.S. urban ferry operations (annual ridership over 1 million).

Transit Authority/Operator	Area Served		Annual Ridership (million)	Number Vessels	Maximum Vessel Capacity (passengers)
	Waterway	Primary City			
Washington State Ferries	Puget Sound	Seattle	26	29	2,500
Staten Island Ferry	New York Harbor	New York City	19	7	6,000
(a)	San Francisco Bay	San Francisco	4	14	788
Louisiana Department of Transportation, Crescent City Connection Division	Lower Mississippi River	New Orleans	3.1	5	1,000
Massachusetts Bay Transportation Authority (Harbor Express and Boston Harbor Cruises)	Boston Harbor	Boston	1.3	11	400

SOURCE: APTA website <http://www.apta.com/research/stats/ferry/fbridership>; also, for Seattle <http://www.wsdot.wa.gov/ferries>; San Francisco <http://www.watertransit.org, http://www.baycrossing.com>, personal communication, San Francisco Bay Area Water Authority; New Orleans <http://www.dotd.state.la.us>; Boston <http://www.bostonharborcruises.com>, <http://www.harborexpress.com>, personal communication, Massachusetts Bay Transportation Authority, Boston Harbor Cruises.

[a] San Francisco Bay Area Water Transit Authority, charged with expanding transportation service, has no authority over existing commuter ferry operations: city of Alameda/Port of Oakland, city of Vallejo Baylink Ferry, Blue and Gold Fleet, and Golden Gate Bridge, Highway and Transportation District.

Washington State Ferries. The largest ferry system in the United States, in terms both of ridership and vessel size, is the Washington State Ferries, owned and operated by the Washington State Department of Transportation. The ferries carry over 26 million passengers a year across Puget Sound and its inland waterways, serving eight counties in Washington State and in British Columbia, Canada. One of the largest vessels in the Washington fleet, the *Wenatchee* in the *Jumbo Mark II* class, is 450 feet long and carries 2,500 passengers on 35-minute commuter runs in the harbor between Seattle and Bainbridge Island, Washington. The ferry system has over 1,800 employees, 20 terminals, and 29 vessels of various sizes. All but one of the routes carries cars. The ferries charge fares for passengers and cars.

[66] <http://www.watertransit.org/about_us.shtml> (accessed December 30, 2004).

All mariners employed by the Washington State Ferries are documented by the Coast Guard. Deck officers all have pilotage endorsements for Puget Sound and crews receive basic safety training, including advanced firefighting. The ferry management uses a comprehensive computer system that tracks employee qualifications and ensures that certificates are up to date. Deck officers, for example, receive letters 90, 60, and 30 days in advance of the due date for their required annual physicals.

Washington State Ferries operate under a comprehensive safety management system that specifies procedures for the entire fleet, for each particular vessel, and for each route (appendix D reproduces the tables of contents for the various safety management system manuals). The procedures include bridge manning and approach speeds to the dock. For example, on the *Wenatchee* run, the ferry is required to slow 0.7 mile from the terminal and the quartermaster is required to steer until 0.3 mile from the dock, when either the captain or the chief mate takes manual control. At the terminal, the second mate, bosun, and able-bodied seaman attend to the discharge of vehicles and loading of vehicles and passengers. Time at the terminal is about 15 minutes, and after the gates close, a strict sequence of commands begins. Once under way, the second mate plays a recorded safety briefing for passengers.

New radar equipment is installed on the Washington State Ferries every 5 years. The newest radars have AIS technology integrated into the display. The ferries have a 24-hour communication system that is always manned. Ships are tracked by means of AIS every 3 minutes and monitor a single VHF frequency. Management is exploring a new vessel-tracking system that will capture AIS data from all nearby traffic, and is also investigating a wireless radio network and a computerized intranet that could be used in conjunction with the safety management system.

British Columbia Ferries. The British Columbia Ferries of Canada is one of the largest ferry services in the world, with 25 routes, 35 ships, 47 terminals, and 4,500 employees. All vessels in the fleet carry both passengers and cars, transporting 21 million passengers and 8 million vehicles a year. The ferries make over 500 runs a day. The two largest vessels, the *Spirit of Vancouver Island* and the *Spirit of British Columbia*, can carry 2,100 passengers and crew and 470 cars. The fleet includes eight other vessels with a capacity of between 1,000 and 1,700 passengers and crew. Most of the large vessels have runs that last nearly 2 hours. British Columbia Ferries have served British Columbia's coastal communities for 44 years. In 2003, the company converted from a Crown corporation (corporation owned by the government) to an independent, regulated company, which in 2004 announced a long-term plan to introduce 22 new vessels over the next 15 years.

British Columbia Ferries began implementing a safety management system in 1995 after an accident in Departure Bay that resulted in passenger fatalities. The safety management system, which is not mandatory because the ferries run inside Canadian waters, includes a bridge watch table that specifies the number of persons in the pilothouse for various vessels, routes, and conditions (see appendix E for a sample procedure). Specific procedures for arrival and departure are detailed, even stipulating the precise words to be used in radio transmissions.

Two of the largest British Columbia ferries are now equipped with electronic chart systems, and the ferries are considering a 24-hour communication center like that of the Washington State Ferries. For emergency medical care on board, the ships have a full emergency kit with a trauma kit, drugs, and defibrillator. On some longer runs in remote areas, a doctor or paramedic is carried on board.

Passenger Vessel Association

The Passenger Vessel Association (PVA) is an association of small passenger vessel owners and operators in the United States. The organization serves the interests of more than 350 vessel owners and operators in the domestic passenger vessel industry, which represents about 65 percent of the industry nationwide. Association members operate more than 1,100 passenger vessels in the United States carrying up to 200 million passengers annually. Members offer services including dinner cruises, tour and excursion services, car and passenger ferries, private charters, whale-watching trips, overnight cruises, and riverboat gaming. According to the National Ferry Database, about 45 ferry companies across the United States are PVA members.

The PVA has a committee responsible for reviewing, developing, and implementing programs to encourage enhanced training and safety among its members. The programs are designed to improve the loss record for the industry. The PVA publishes risk management and training manuals to help its member companies improve the safety of their passenger vessel operations.

Actions Since Accident

After the *Andrew J. Barberi* accident, the NYC DOT requested the Global Maritime and Transportation School (GMATS) at the U.S. Merchant Marine Academy to conduct an assessment of the Staten Island Ferry with respect to vessel operations, human factors, safety, and management. The GMATS assessment was completed in February 2004 (appendix F). Among its recommendations, the assessment called for the establishment of a safety management system; standard manning with three licensed deck officers, so as to provide certainty that two licensed deck officers would be in the pilothouse at all times; significant increases in personnel; greater emphasis on technical training and professional development; the creation of specific operating procedures; the use of technology to assist in navigation; and an immediate upgrade in the system's ability to respond to emergency conditions or mass casualty events.

Staten Island Ferry officials informed the Safety Board by letter on July 9, 2004, that they had changed or planned to change various aspects of the ferry operations. According to the letter, "most of [the planned improvements] revolve around the establishment of a Safety Management System." At the time, officials estimated that it might take 2 years to develop and implement such a system. The system would address "all aspects of vessel operations, safety and emergency response, and maintenance."

Improvements already implemented were listed as installation of global positioning system (GPS) units, ARPA collision avoidance equipment, and automated

passenger announcement systems. Training programs had been established for the new equipment, according to the letter. Further, new procedures designated specific stations and responsibilities for crewmembers, both while under way and while docked. Ferry management was reportedly reviewing scheduling and medical response capabilities. Rest periods had been established for deckhands and crewmembers had been issued walkie-talkies and uniforms.

In an update received on February 11, 2005, the NYC DOT informed the Safety Board that it intends to follow the GMATS recommendations.[67] According to its letter, the agency has embarked on "an aggressive hiring program," has installed safety equipment on ferries, and has retained a firm to develop its safety management system. The NYC DOT further stated that it has already revised manuals and that new policies and checklists have been drafted, with some already in place. Currently, October 1, 2005, is set as the date for completion of the safety management system, with a target of December 2005 for receiving a Document of Compliance from the American Bureau of Shipping. Bridge team procedures already stipulate the use of three licensed officers, with two in the pilothouse at all times. All ferries are now equipped with GPS, ARPA, and AIS capabilities.

[67] Discussions between the Safety Board and NYC DOT personnel indicate that certain of the automated equipment recommended by GMATS actually requires manual activation, including the prerecorded passenger announcements (already installed) and the "vessel speed indicators with alarm functions" (planned for installation).

Analysis

General

The analysis first identifies factors that can be readily eliminated as causal or contributory to the *Andrew J. Barberi* accident. It then discusses what the Safety Board's investigation revealed about the actions of the assistant captain and the captain, NYC DOT oversight of ferry operations, medical oversight of mariners, safety management systems, and the potential contribution of navigation technology to the safety of ferry operations.

Exclusions

The evidence indicates that the *Andrew J. Barberi*'s propulsion systems, propulsion system controls, and main engines functioned without defect before, during, and after the accident. The assistant engineer on watch during the accident stated that the vessel's two propulsion drives and related controls performed without fault and that he had a "very normal watch" before the accident. No plant alarms sounded to indicate a propulsion problem before the allision. After the accident, the captain had complete control of the propulsion system in maneuvering the vessel to slip 5, and the propulsion system effectively held the vessel tight against the dock there for an hour or more. Further, the transfer of control from pilothouse to pilothouse was carried out without incident, and the Safety Board's postaccident testing found that the ferry's propulsion systems responded correctly to commands from both pilothouses.

National Ocean Service data for the New York/New Jersey harbor indicate that the tide was ebbing, and according to the National Weather Service, visibility was at least 10 miles in the area. The wind was strong—nearby winds were from the west, measured at 20 knots with gusts of up to 35 knots. Nonetheless, the wind velocity had no adverse effect on the ship's handling ability or on the ability of the ship's operators, both the captain and assistant captain, to control it. According to the senior mate in the pilothouse, he heard "no complaints" from either operator about the wind affecting control of the ferry.

Except for the assistant captain, the ferry's crew submitted blood and urine specimens to the Coast Guard and to the NYPD for toxicological testing shortly after the accident. The Safety Board obtained a blood and a urine sample taken from the assistant captain when he was admitted to the hospital about an hour and a half after the accident. Results for all *Andrew J. Barberi* crewmembers were negative for both alcohol and the five illicit drugs that U.S. Department of Transportation regulations require screening for. Therefore, the Safety Board concludes that none of the following were factors in the accident: the vessel's propulsion systems, environmental conditions, alcohol, or illicit drugs.

Accident

The vessel departed Manhattan at 1500 and struck the pier about 1520. According to both crewmembers and passengers, the ferry was operating at full speed when it allided with the maintenance pier. Witnesses stated that the vessel never slowed down or altered direction, and that the engine sound changes that crewmen and regular passengers routinely heard when the engines slowed down before docking were not heard. The chief engineer stated that the pitch was at 100 percent at both ends of the vessel and never changed before the ferry hit the pier. The Safety Board, therefore, concludes that the *Andrew J. Barberi* was operating at full speed when it struck the maintenance pier.

According to the lookout and the senior mate, the lookout and the assistant captain were in the Staten Island–end pilothouse when the senior mate joined them halfway through the transit. Both the lookout and the senior mate reported that the assistant captain had been conversing with the lookout during the transit until just before the ferry reached the KV buoy, when the lookout left the pilothouse and while the mate was reading a newspaper. The mate told investigators that the captain entered the pilothouse after the accident. Neither the lookout nor the senior mate recalled seeing the captain in the pilothouse before that, from the time the ferry left Manhattan until after the accident. From the circumstances of the accident and the statements of the crew and other witnesses, the evidence indicates that the captain was not in the pilothouse until after the allision. Therefore, the Safety Board concludes that at the time of the accident, the assistant captain was at the controls, the senior mate was seated in the aftmost section of the pilothouse reading a newspaper, and no one else was in the pilothouse at the ferry's Staten Island end.

The evidence is clear that the assistant captain made no changes before the impact to slow or change the ferry's course for the approach to the terminal, as he should have done near the KV buoy. Immediately after the accident, he told the chief engineer that he had "blacked out" and then told the ferry director that he had "passed out." His postaccident medical records noted that he told hospital physicians that he "suddenly passed out," although the records also indicated that he had no recollection of the events surrounding the allision. In addition, he told physicians that he was "exhausted," though "no more exhausted than usual" at the time of the accident.

According to the senior mate, immediately after the impact he observed the assistant captain standing, making an exclamation, and actively manipulating the controls to maneuver the vessel away from the dock. In the estimated 1- to 2-minute period after the ferry passed the KV buoy, when speed and course should have been changed, visual cues to the impending allision would have been unmistakable. The assistant captain would have needed no information other than the increasing proximity of the maintenance pier to tell him what he needed to do to avoid the accident. The mate's description of the assistant captain as standing and alert immediately after the impact indicates that the assistant captain was conscious at that time. Had he lost consciousness, he most likely would have fallen. Even though he was aft in the pilothouse reading, the senior mate would most likely have noticed such a fall because people perceive a change, such as someone falling, more readily than they do the absence of change. Therefore, the Safety Board concludes

that the assistant captain was apparently upright but unresponsive to his surroundings and the visual cues of the impending allision for an estimated 1 to 2 minutes before the accident.

The distance between Manhattan and the Staten Island pier is 5.2 miles (9,152 yards). At the vessel's normal crossing speed of between 14 and 16 knots, the ship would travel roughly a quarter of a mile (440 yards) in 1 minute. The normal length of a transit is about 21 minutes and the accident voyage lasted approximately 20 minutes, an elapsed time that was within the routine range for the transit.

According to what they told investigators, mates and deckhands typically prepared for docking at Staten Island on hearing the sounds associated with the engines slowing down, which generally occurred near the KV buoy, about 1,000 yards from the dock. Although one of the deckhands would ordinarily have made an arrival announcement, on the accident voyage no crew announcement was made. Passengers and crew typically recognized the impending docking by the changes in the sounds associated with the engines. In the absence of the engine sound changes and a prearrival announcement, only one crewmember recognized the projected path of the vessel. Thus, only one deckhand warned passengers of the impending allision. The other crewmembers were unaware of the impending allision and took no action to warn either passengers or other crew or to prepare them for the accident. Therefore, the Safety Board concludes that the crew did not recognize that the ferry was in danger because of the absence of changes in sounds that they typically used as cues for arrival, because they were not attending to visual cues outside the vessel, and because of the absence of any crew announcement or alert.

Assistant Captain

The Safety Board examined the nature of the assistant captain's unresponsiveness to clear visual cues that the vessel was about to crash in an attempt to determine why he failed to prevent the allision, given his consistent, superior employment history with the NYC DOT. Although he did not agree to cooperate with the Safety Board, the Board obtained considerable information about his work history because his wife agreed to be interviewed, his daughter provided the Board with information, and coworkers and supervisors gave information about his work habits and history. In addition, the Board examined pertinent NYC DOT personnel records and medical, dental, and pharmaceutical records.

The Safety Board sought to determine whether a medical or behavioral explanation could account for the assistant captain's episode of unresponsiveness on the day of the accident, in light of the absence of any similar documented episode in his years with the NYC DOT. The senior mate, the only person present during the period of the assistant captain's unresponsiveness, told the Safety Board that when he looked up immediately after the allision, the assistant captain was standing at the controls. The lookout who had left the pilothouse near the KV buoy described the assistant captain as fully responsive and effectively performing the duties of vessel operator while he was in

the pilothouse. The senior mate and the lookout were the only two crewmembers to have seen the assistant captain just before the accident. None of the other crewmembers who saw him on the day of the accident remarked to Safety Board investigators on anything unusual about the assistant captain's behavior. His wife, who saw the assistant captain about 3 hours before the accident, said that his behavior was normal and unremarkable at that time.

The Safety Board studied the assistant captain's sleep, work, and medical history to determine whether fatigue contributed to his actions. Several factors, such as his medication use, history of insomnia, and chronic back pain may have been associated with fatigue. On the other hand, the assistant captain's work and sleep schedule were not consistent with someone who was fatigued, making it difficult to determine whether his actions were affected by fatigue.

The assistant captain had been diagnosed with chronic back pain and had been taking a prescribed pain reliever, tramadol, for several years. A side effect of this medication, as documented by the manufacturer, is an increased risk of seizures. The episode that the assistant captain experienced was potentially consistent with a brief, nongeneralized seizure, with symptoms such as the temporary inability to maintain normal awareness of and contact with the environment. Episodes such as these are usually followed by a full recovery of alertness after a transition that can last anywhere from seconds up to an hour. However, other factors, such as the lack of information regarding when the assistant captain had last taken tramadol, the lack of a previous reported seizure, and the absence of supporting evidence from extensive neurological and cardiovascular tests, do not support such a determination.

A postoperative cardiac examination after the assistant captain's suicide attempt found a congenital heart abnormality (patent foramen ovale). The defect, which would not have been detected in routine cardiac examinations and would not have affected his day-to-day activities or his job performance, increased the likelihood of a transient ischemic attack (TIA) or "mini-stroke," a condition that might have matched the symptoms that the assistant captain manifested at the time of the accident. TIAs by definition do not result in lasting changes to the brain. Both seizures and TIAs cause similar effects—a temporary loss of responsiveness, with or without concurrent physical manifestations—and both leave no evidence of their presence afterward. Given the absence of evidence from the extensive cardiological and neurological examinations that the assistant captain underwent following his suicide attempt, as well as the absence of evidence to allow a determination of fatigue or other physiological or behavioral condition, the Safety Board is unable to determine what, if any, medical or behavioral factor, alone or in combination, led to the assistant captain's failure to respond to the cues of the impending allision. Although these medical events are somewhat consistent with the assistant captain's actions in the minutes preceding the accident, none is especially compelling, and there are insufficient data to determine which, if any, might have occurred. Therefore, the Safety Board concludes that the cause of the assistant captain's unresponsiveness to cues clearly indicating an impending allision could not be determined.

Yet, several of the assistant captain's known medical conditions and medications should have called into question his ability to pilot a vessel safely. In particular, the assistant captain had chronic back pain, continuously treated with tramadol, a potentially impairing medication that had the additional risk of increasing the likelihood of seizures. In addition, he was being treated for a variety of other ailments (high blood pressure, high cholesterol, insomnia) by several physicians and dentists and had regularly taken medications prescribed by those health practitioners. Although the assistant captain performed effectively before the accident and consistently received good evaluations of his performance as a ferry captain and assistant captain, some of his medical conditions and medication use increased the likelihood of incapacitation or impaired performance. In a safety-critical system such as the Staten Island Ferry, operator performance without medical oversight is unacceptable; the associated risk of a potentially catastrophic accident is too high. At the time of the accident, the NYC DOT took no role to ensure the continued medical fitness of its ferry captains and assistant captains, but instead, relied entirely on the Coast Guard regulations covering licensed mariners and Coast Guard enforcement of those regulations.

Nonetheless, the assistant captain and his physician omitted critical information regarding details of the assistant captain's medical conditions and treatment on form 719K used for Coast Guard medical evaluations. Consequently, the Coast Guard was effectively prevented from performing the requisite evaluation of the assistant captain's medical fitness to serve as ferry operator. In each of the evaluations submitted to the Coast Guard, the assistant captain and the examining physician indicated that the assistant captain was not taking medication and had no medical condition that required the use of medication. As a result of their false information, the Coast Guard was never afforded the opportunity under its current medical oversight system to evaluate the compatibility of the assistant captain's medical conditions and medication use with his duties. In his appearance before a Federal judge over a year after the accident, the assistant captain pleaded guilty to knowingly submitting false medical information to the Coast Guard.[68] Therefore, the Safety Board concludes that because accurate medical information about the assistant captain was not provided to the Coast Guard by the assistant captain and his physician, the Coast Guard had no opportunity to evaluate his fitness to maintain his mariner's license.

Medical Oversight

The Coast Guard has the responsibility to oversee compliance with regulations governing the medical qualifications of licensed mariners. Licensed deck and engineering officers are required to undergo medical evaluations every 5 years. Able-bodied seamen, ordinary seaman, food handlers, and those without critical responsibility for vessel operation need only meet a partial list of medical requirements. For pilots of vessels over 1,600 gross tons, Coast Guard regulations at 46 CFR 10.709 require "thorough physical

[68] The false information was that the assistant captain did not suffer from any illnesses and was not taking any medication. As noted earlier, the examining physician was indicted for his role in providing false information about the assistant captain on the Coast Guard form.

examinations each year while holding the license or endorsement." The regulation applies to all NYC DOT ferry captains and assistant captains because they are required to hold pilot endorsements to their Coast Guard licenses, but there is no requirement for pilots subject to the regulation to report the results of their annual medical appraisal, either to the Coast Guard or to their current employer. The Coast Guard regulation merely calls for mariners to provide the Coast Guard with a copy of their most recent physical examination on request.

In the absence of any interval reporting requirements, a mariner's medical status is reviewed only every 5 years, during which time he or she could experience new medical symptoms, see a health care provider, take new medications, or be hospitalized. The Coast Guard maintained no record of annual medical evaluations of mariners in its New York jurisdiction, and the NYC DOT did not maintain records of its employees' compliance with this requirement.

In addition to the absence of any review of the annual physical examination required of licensed pilots, the Coast Guard does not provide guidance on acceptable methods of meeting its requirements for the annual review. The Coast Guard does not provide information on the thoroughness of the examination, nor does it give guidance to examiners performing the annual evaluation. The Safety Board is concerned that the lack of specificity in fulfilling the annual evaluation requirements, compared with the thorough requirements delineated in form 719K for the 5-year evaluation, may inhibit effective compliance. Therefore, the Safety Board believes that the Coast Guard should revise regulation 46 CFR 10.709 to require that the results of all physical examinations be reported to the Coast Guard, and provide guidance to mariners, employers, and mariner medical examiners on the specific actions required to comply with these regulations. The Safety Board further believes that the NYC DOT should require its licensed pilots to provide proof of compliance with the Coast Guard medical certification requirements.

In attempting to determine the medical status of the assistant captain, the Safety Board found additional shortcomings in the Coast Guard's system of medical oversight of mariners. For example, headquarters Coast Guard personnel overseeing the medical evaluation process knew little about the quality of regional reviews of medical evaluations—the initial, and for most mariners, the final evaluator of the results of medical examinations. Consequently, differences between regions in their reviews and determination of fitness may be present and undetected, potentially having an adverse effect on the reliability of the medical oversight system.

The Safety Board also noted potential difficulties with the Coast Guard's storage of medical data. The data maintained in the medical data storage system could provide the Coast Guard with valuable information about changes in mariners' medical fitness over time, across regions of the country, between different health care providers, or in any number of other critical areas. However, deficiencies in the data storage system make it impossible for the Coast Guard to discern even these most basic measures of medical oversight or mariner medical status. Coast Guard representatives informed the Safety Board that they hoped to modernize and centralize the data storage system within 4 years

of this accident. The Board hopes that the Coast Guard meets this objective at the earliest opportunity.

Finally, the Coast Guard's senior medical officer, the final authority in the Coast Guard's mariner medical oversight process, told Safety Board investigators that he had no formal training in occupational medicine. Given the importance of his responsibility as the final determiner of a mariner's medical qualification to obtain a license, this lack of formal training is discouraging.

Despite the number of shortcomings in the Coast Guard system of medical oversight identified during the investigation, the Safety Board determined that none of the problems played a role in the *Andrew J. Barberi* accident. The Safety Board, therefore, concludes that while the Coast Guard's system of medical oversight has deficiencies, they were unrelated to the accident. Nevertheless, the Safety Board found the elements necessary for an effective system of medical oversight within the Coast Guard medical oversight system:

- Evaluation form with specific guidance for examiners.
- Actual authority over certification of medical fitness, rather than delegation of such authority to examiners.
- Retention of the data from the exams that mariners submit.

Form 719K provides considerable information to examiners and, if read thoroughly before an examination, should facilitate the examiner's task. The Coast Guard also makes the determination regarding the medical fitness of mariners, rather than delegating this decision to the examining health care practitioner. In addition, it retains the data from the evaluations. Thus, the Coast Guard has the foundation on which to build an effective medical oversight system. Therefore, the Safety Board recommends that the Coast Guard, in formal consultation with experts in the field of occupational medicine, review its medical oversight process and take actions to address, at a minimum, the lack of tracking of performed examinations; the potential for inconsistent interpretations and evaluations between medical practitioners; deficiencies in the system of storing medical data; the absence of requirements for mariners or others to report changes in medical condition between examinations; and the limited ability of the Coast Guard to review medical evaluations made by personal health care providers.

New York City Department of Transportation

The Safety Board sought to determine whether this accident reflected a set of operating deficiencies unique to this trip, or whether the accident resulted from a systemic weakness in NYC DOT ferry operations. The evidence indicates that numerous deficiencies were present in the Staten Island Ferry in the form of ferry operating procedures that were poorly understood, ineffectively disseminated, inconsistently applied, and inadequately overseen. These deficiencies adversely affected the safety of the

ferry system. Largely because of them, the assistant captain permitted the lookout, the only other crewmember who would have been in a position to be aware of the impending allision, to leave the pilothouse shortly before docking. Further, because the captain failed to inform other crewmembers of his location on the ferry, did not establish communications with other crewmembers, was absent from the pilothouse until after the accident, failed to specify a watch in his absence, and did not exercise the oversight responsibilities of the captain of the vessel, neither he nor any other crewmember was in a position to prevent the accident.

Throughout the accident voyage, two qualified operators—the captain and the assistant captain—were on duty. Yet, the evidence indicates that the captain was not in the operating pilothouse until after the accident. Further, for a substantial part of the accident trip, three NYC DOT employees—the assistant captain, the lookout, and the senior mate—were in the pilothouse, but none of them remarked on the captain's absence. Given the circumstances, it is probable that (1) the captain considered it acceptable, both operationally and in terms of the evaluation of his performance, to be absent from the pilothouse for almost an entire voyage without informing any other crewmember of his location, and (2) his absence was sufficiently commonplace to have been accepted by those individuals without comment.

As master of the vessel, the captain had a duty to oversee its safety. This responsibility required him to properly oversee its crew and ensure that they performed in a safe manner. Although he could not have realistically anticipated the assistant captain's episode of unresponsiveness, he should have been prepared for the possibility, no matter how unlikely. Had he properly exercised his command responsibilities, he either would have been present in the pilothouse, informed other crewmembers of his location, established communications with other crewmembers to enable him to exercise his command responsibilities immediately if needed, briefed the crew on actions to take during his absence, or taken any number of other actions that would have enhanced the safety of the vessel. Because he did not do so, he was absent from the pilothouse and unavailable during the assistant captain's unresponsiveness and therefore, was not in a position to prevent the allision or to mitigate its severity. Therefore, the Safety Board concludes that the captain failed to exercise his command responsibilities over the *Andrew J. Barberi*.

NYC DOT operating procedures for the ferries in its fleet, to the extent that they were in effect, were contained in an 8-page handout. The procedures called for the captain "upon docking . . . to be [present] in the inshore pilothouse." The Safety Board found that, in addition to the lack of specificity regarding the captain's actions and the precise time or point in the voyage at which he or she was to be present in the pilothouse, this requirement was poorly understood by ferry crewmembers and ineffectively enforced by its managers. The two supervisors responsible for the enforcement of the procedures offered conflicting interpretations of the policy itself. One said that the captain was required to be present in the pilothouse, the other said that the captain could determine where he or she should be located. By contrast, the Safety Board's examination found that procedures employed by

another large-scale ferry operator, British Columbia Ferries, unambiguously describe tasks and statements that crewmembers critical to vessel operations are to use.

The Safety Board sought to determine why the captain was not present in the pilothouse until after the accident, and why none of the other three NYC DOT employees remarked about his absence. The captain refused to cooperate with Safety Board investigators in the investigation of this accident. The Board asked numerous ferry personnel about their understanding of NYC DOT procedures, interviewed NYC DOT managerial personnel, and examined NYC DOT procedural documentation. Safety Board investigators received conflicting interpretations of the existence of a requirement for the vessel master to be present in the pilothouse after propulsion control had been transferred. The conflicting viewpoints extended to the highest levels of ferry management. These conflicting views were consistent with, and enabled by, the sparse documentation and dissemination of organizational procedures.

NYC DOT operational procedures were not specific to particular phases of operations. They were not housed in a single manual or in a readily accessible reference location at headquarters. There was no systematic method to disseminate procedures to operating personnel and no mechanism to record who received the procedures and when. Further, the NYC DOT had no effective method to determine the extent to which operators understood the procedures and implemented them during vessel operations. NYC DOT oversight of ferry operations consisted primarily of the two port captains riding in the pilothouses during daylight voyages, without a formal method of assessing individual crew performance.

The NYC DOT ferry operating procedures that were provided to the Safety Board, which purported to cover the entire conduct of a ferry voyage, were in the form of eight sheets of paper with no dissemination date. Although some procedures were written, they were general and did not assign locations and specific duties to key personnel (captains, assistant captains, and mates) for critical phases of ferry operations. To illustrate, no procedure:

- Prohibited lookouts from leaving the pilothouse just before docking.
- Required the captain to enter and remain in the pilothouse for the duration of the voyage once the transfer of propulsion control was complete.
- Specified duties that the senior mate was to accomplish as the vessel approached the dock.

By contrast, procedures of other passenger-carrying ferry organizations[69] contain explicit instructions regarding actions that crewmembers are to take through all phases of ferry operations and specific words crewmembers are to say in response to precise commands during selected operating phases. In the Safety Board's opinion, unambiguous, detailed operating procedures are a prerequisite to managing a safe transportation system. Explicit procedures provide the guidance operators need to operate the systems as

[69] See appendixes D and E.

intended and ensure that regardless of the individual, the system will be controlled as appropriate for each phase of operation. In any ferry system, each crewmember should have duties delineated in the procedures for all operational phases, for both routine and emergency conditions. Because people vary in their experience, training, and perceptions, explicit operating procedures reduce the likelihood of variation in operator control of the system. Without specific, formal procedures, effective dissemination, and operational validation through systematic oversight, the NYC DOT could not be certain that the ferries would be operated as intended throughout all phases of the voyages, and that crewmembers would respond appropriately to emergency situations.

Transportation systems such as the Staten Island Ferry, in which the consequences of operator error or equipment failure can be catastrophic, must develop and implement "system defenses"[70] to (1) minimize the opportunity for operators to commit errors, and (2) mitigate, to the extent possible, the consequences of those errors that are committed. Redundancy is the hallmark of all safe system operation, because it can help prevent a single-point failure, such as the error of a lone operator, from easy translation into system failure. The stationing of two qualified operators in the pilothouse is just such a system redundancy. Although the NYC DOT appears to have recognized its value by mentioning in its standard operating procedures that the captain was to be present in the inshore pilothouse "while docking," this was not pursued with the systematic rigor that is required in repeated operations where, over time and with deceptive monotony, the need for redundancy may not appear necessary.

Because a redundancy requirement had not been implemented or enforced, the captain was absent from the pilothouse and unavailable to all crewmembers until after the allision, and the assistant captain permitted the lookout to leave the pilothouse without clearing his absence with the captain and without securing effective backup in the lookout's place. As a result, no one was in the pilothouse attending to vessel operations when the assistant captain became unresponsive and the allision occurred. Therefore, the Safety Board concludes that the NYC DOT failed to implement and oversee safe and effective operating procedures for its ferries.

Safety Management Systems

In organizations that lack proactive risk reduction measures, deterioration in safety margins in operations may go unnoticed. Organizational complacency, attention to the economic necessities of operation rather than to the safety aspects, and the absence of external audit and accountability can lead organizations, from the operators themselves to the very highest organizational levels, to fail to recognize and act on risks to safe operations until an accident occurs. In operations such as the Staten Island Ferry, where risks can lead to catastrophic loss of life, there is little room for such complacency. Chief among the countermeasures against organizational complacency, or system defenses as described previously, measures that are recommended by maritime authorities (and

[70] J. T. Reason, *Human Error* (New York: Cambridge University Press, 1990).

required of oceangoing vessels), is an aggressive safety management system. Such a system entails a top-to-bottom risk assessment, the development of safety-centered practices and procedures for which documents and training are provided, and internal and external audits to ensure consistent performance.

The NYC DOT had performed a safety assessment before the accident, commissioning George G. Sharp to conduct an assessment in lieu of a Coast Guard requirement for additional lifesaving equipment on its new vessels and eventually, on all existing vessels. That report was never intended, nor did it provide, the type of systematic, thorough examination of operational risks necessary to lay the foundation for effective safeguards against safety-related risks.

A safety management system necessitates a cultural change in an organization, where the safety of operations is the objective behind every action and decision by both those who oversee procedures and those who carry them out. The system leads to standardized and unambiguous procedures for each crewmember, during both routine and emergency operations. Duties and responsibilities are specified and supervisory and subordinate chains of command delineated, again for standard and emergency operations. Each crewmember, as a result, understands precisely what he or she is to do, and say, in critical phases of operations. In addition, safety management systems call for the creation of plans for responding to a range of possible emergency situations, with crewmember duties and responsibilities specified.

As discussed previously, despite a Coast Guard requirement that vessels engaged in oceangoing service implement safety management systems, inland ferry operators are not required, but are encouraged, to do so. Ferries operated by the State of Washington and the Province of British Columbia, two of the largest ferry operators in North America, have implemented safety management systems to enhance the safety of their operations. Comparing the documented procedures of such systems with the broad generalities and vague responsibilities included in the NYC DOT procedures before the accident is instructive. As illustrated in appendix E, the operating practices under such a system include exact location of crew, specific crewmember duties and responsibilities, and even precise language to use during critical phases of operation. By contrast, the NYC DOT procedures were so ambiguous as to be of little use in addressing potential risks to safety.

After the accident, the NYC DOT commissioned GMATS to assess its ferry operations. Among other recommendations, GMATS recommended that the NYC DOT adopt a safety management system for its continued operations, and, in a July 9, 2004, letter to the Safety Board, the NYC DOT indicated that it agreed with this recommendation and planned to implement such a system. The NYC DOT updated the Safety Board on its progress in a February 11, 2005, letter. It indicated that it had retained an organization to develop its safety management system, and that it expected to have its system completed by October 2005, with the receipt of a Document of Compliance in December 2005. The Safety Board supports the decision and subsequent actions of the NYC DOT to implement a safety management system and believes that they are in the best interests of the safety of its operations. Therefore, the Safety Board believes that the NYC DOT should adhere to its October 2005 target for implementation of a

comprehensive safety management system, incorporating all matters recommended by the GMATS assessment, and ensuring medical fitness oversight (requiring, minimally, assurance of compliance with Coast Guard requirements).

Within the United States, recent data indicate that 42 ferry organizations transported 58 million passengers annually. Despite the total size of this industry and the very large carrying capacity of individual vessels, only organizations that operate internationally or that have voluntarily adopted the approach operate under safety management systems. Given the thousands of passengers who daily ride ferries on U.S. waterways, both those that are subject to Coast Guard oversight and those that are not, the Safety Board is concerned that the absence of a requirement to implement safety management systems could result in the type of safety-deficient operations found in the Staten Island ferries. With the proper legislative authority, the Coast Guard could mandate that all ferries that carry members of the public implement a safety management system, thereby ensuring that they maintain the high standards of safety that the Coast Guard requires of U.S. oceangoing vessels. Therefore, the Safety Board believes that the Coast Guard should seek legislative authority to require all U.S.-flag ferry operators to implement safety management systems, and once obtained, require all U.S.-flag ferry operators to do so.

The Safety Board believes that the Passenger Vessel Association should encourage its member ferry operators to voluntarily request application of the Federal requirements at 33 CFR 96 for implementing a safety management system, if they have not already done so. The Safety Board also believes that the States operating public ferries should encourage their public ferry operators to voluntarily request application of the Federal requirements at 33 CFR 96 for implementing a safety management system, if they have not already done so.

Response to Emergency

On Board Andrew J. Barberi

After the vessel struck the maintenance pier, an undetermined interval passed before the captain entered the pilothouse and assumed control of the vessel. With the chief engineer's assistance, the captain shifted propulsion control from the Staten Island to the New York pilothouse, maneuvered the vessel to the dock, and docked it with the ferry's undamaged New York end heading into its intended slip. He also directed the senior mate to assess the damage and report back to him. The mate, however, failed to return until after the vessel docked, and the captain did not follow up on his direction to the mate. The Safety Board evaluated the appropriateness of the captain's actions in moving the ferry to its intended berth after the accident rather than using the maintenance pier as the docking pier, and the effectiveness of the crew's response to the aftermath of the accident.

The maintenance pier is long and narrow, with dimensions that would have interfered with the ability of numerous responding vehicles to approach the vessel and

quickly exit. In contrast, the vehicle ramp at the ferry terminal is horseshoe-shaped, designed to allow traffic to flow smoothly and with ample space for the vehicles of the emergency responders. Further, the ferry had no gangways other than the open-ended ramps, so passengers would have had no means of egress to the maintenance pier and would have had to remain on board the ferry until an alternate means of disembarking could be found. Maneuvering the vessel to its intended dock thus allowed responders safer and quicker access to the victims than if the vessel had docked at the maintenance pier, and also allowed safer and quicker disembarkation of the passengers. Finally, the maintenance pier itself was damaged, with no quickly accessible locations where the vessel could be moored. Given the many advantages to docking at the regular slip, even at the expense of the additional time it took, the Safety Board concludes that the captain's maneuvering the ferry back to its intended berth was appropriate.

The Safety Board also examined the effectiveness of the crewmembers' response to the accident. Passengers and crewmembers told Board investigators that before and immediately after the accident, they heard no warning sounds or public address announcements offering information about the accident or actions to take in its aftermath, or other information potentially useful to both passengers and crew.

The ferry's station bill states that, in the event of an emergency, crewmembers are to be alerted by the sounding, for at least 10 seconds, of the ship's whistle and general alarm, with additional signals and alarms designating the location of the emergency. However, the captain did not sound the requisite 10-second alarm, made no emergency announcements over the public address system, gave no commands or directions to crewmembers over the walkie-talkies or the public address system, and did not inform passengers of the vessel's situation.

The evidence indicates that crewmembers reacted individually to what each immediately saw, rather than performing a coordinated response to the emergency. However, had crewmembers attempted to coordinate a response, they would have been hampered by the lack of communication devices. Some crewmembers had walkie-talkies, but others did not. Without access to immediate information, even the best command and control system would not have been maximally effective. Since the accident, NYC DOT has issued walkie-talkies to all ferry crewmembers.

Without hearing the 10-second alarm or comparable spoken alert from the captain, the crew did not have the signal they had been repeatedly trained to rely on to initiate a response to an emergency. Because of the lack of an alarm or alert, some crewmembers were unaware of the accident and did not respond until they either directly saw the need for a response or heard from passengers or crew of the accident and the location of the injured. The Safety Board, therefore, concludes that the failure of the captain to sound an alarm or provide a spoken alert calling for the initiation of crew actions in response to the emergency adversely affected the quality of the crew's response.

During the approximately 20-minute period between the allision and the docking, rather than awaiting instructions, three different crewmembers independently went to the pilothouse to obtain information about the accident or the response. The captain sent two

to the engineroom because he was unable to contact the chief engineer by phone and needed to coordinate the shift in propulsion control with the engineer.

At the time of the accident, the engineers and oilers remained in the machinery spaces while the remainder of the crew was dispersed throughout the vessel. According to both passengers and crewmembers, deckhands reacted to the accident according to what they could see and immediately assess. Some directed passengers back to the New York end on the saloon deck of the vessel. Others tended to the injured they encountered as best they could, then moved on to other injured passengers. Crewmembers who were located away from the damage were unable to assess its severity unless they walked to the affected area and saw the damage for themselves. Some had no immediate knowledge of the allision with the pier and therefore did not immediately respond. Only one crewmember foresaw the impending allision and warned passengers of the accident just seconds before it occurred.

The Safety Board recognizes that the crew faced an emergency that was considerably beyond anything they had been prepared or trained for, and one for which no guidance was available. Many of the individual responses were ineffective, albeit well intentioned. For example, two crewmembers ran to retrieve defibrillators, despite the fact that they were of little use in response to the traumatic injuries the victims sustained. The nature of many of the injuries was also beyond anything for which the crew had been prepared, either in training or with equipment. Several injured passengers required tourniquets to stanch severe bleeding; one deck officer applied a tourniquet to an injured passenger using a belt and a lifejacket strap. In addition, while attempting to attend to the injured, crewmembers also had to manage the vessel's operation, thus limiting their ability to perform either activity effectively.

Crewmembers had minimal, if any, emergency medical training. Officers were required to take a CPR and an advanced first aid course to be licensed. One of the mates had received advanced emergency medical training 20 years earlier. However, because of the extensive severe injuries the fatally injured passengers received, even the timeliest medical treatment would not have substantially improved the likelihood of survival. As a result, given the severe nature of several of the injuries, any shortcomings of the crew response had little effect on the overall survivability of those most severely injured. Although the shortcomings did not adversely affect the survivability of the injured in this accident, had the accident occurred during rush hour, considerably more passengers would have been on board and many more injured passengers may have needed prompt emergency response services. The Safety Board is concerned that without improvement, crew response to potential future accidents could compromise passenger survivability.

Moreover, no single command and control source guided crewmembers in responding to the emergency. Crewmembers responded as best as they could, but no single individual directed the crew response to the accident, unlike the system that managed the response of the shoreside emergency personnel. Consequently, crewmember response was uncoordinated, made up of individual crewmember actions to individual passengers who were within view. Other than the single 10-second alarm, the NYC DOT had no procedures calling for a single source to guide the crew in assessing the emergency, and then using that information to respond in a coordinated and effective manner.

Further, the training that the crew received was inadequate to provide for a coordinated response to a mass casualty event. Ferry crews held weekly drills to practice responding to an onboard fire or emergency. The drills were invariant and, over time, elicited rote responses to predictable scenarios. Given the sameness in the scenarios they repeatedly encountered, the crew's preparedness to respond to a scenario that was outside the inflexible parameters used in the practice drills, let alone one of the magnitude of this accident, was limited at best.

The Safety Board found that individual crewmembers responded appropriately to the emergency, given limitations in resources, inadequate training, and poorly delineated procedures, which limited the quality of their response. However, the evidence indicates that overall, the crew's response to the accident was uncoordinated. Therefore, the Safety Board concludes that although a superior crew response would most likely have made no difference in the survivability of the injured, deficiencies in the NYC DOT procedures, training, and equipment could compromise the survivability of passengers and crew in other potential accident scenarios.

Shoreside

Many passengers used cell phones to notify emergency personnel of the allision. The first 911 call was recorded at 1522. Dispatchers notified the FDNY within 2 or 3 minutes of that, and within 5 minutes of the accident the first FDNY personnel arrived at the terminal. Two minutes after that, the first EMS unit arrived. Even before the ferry docked, requests for additional FDNY and EMS personnel and equipment were made as the magnitude of the accident became apparent to some on the ferry, including an off-duty FDNY officer. The FDNY dispatched over 200 personnel to the accident, plus nearly 60 EMS personnel, 24 ambulances, and 26 fire engine or ladder companies, plus rescue companies and support units. Contributing to the timeliness and effectiveness of the response was the presence of the off-duty FDNY officer who repeatedly contacted FDNY dispatchers with updates on the nature of the emergency, and with requests for specific types of assistance.

A Coast Guard enlisted person on board the vessel notified the Coast Guard incident command center of the accident at 1525, and Coast Guard personnel arrived on scene before the ferry arrived at the dock. The Coast Guard response included six vessels of various sizes that were used to search for people in the water, patrol the harbor, and monitor the debris field created by the allision. In addition, over 300 NYPD personnel responded, including a dive team. A total of 17 vessels from a variety of agencies, including the NYPD, the FDNY, the Coast Guard, and the Army Corps of Engineers, participated in the waterborne response.

By 1543, the time the *Andrew J. Barberi* docked at the pier, numerous emergency response vehicles and vessels and trained paramedics were in place to deal with the emergency. Injured passengers and crew were promptly attended to, and those in need were quickly transported to nearby hospitals. Given the scope of the emergency and the timeliness and effectiveness of the response, the Safety Board concludes that shoreside emergency response was effective.

Navigation Technology

The Safety Board noted that, at the time of the accident, the pilothouses of the Staten Island ferries lacked many of the common technological innovations that can assist operators during restricted visibility conditions in determining vessel location, heading, speed, approaching vessels, and other key navigational parameters. Modern equipment is also available to monitor vessel condition and alert operators to recognize out-of-profile or unsafe conditions. Vessels lacked even such basic instrumentation as speed indicators.

Further, bridge layout was found to be suboptimal in presenting critical information to operators. For example, radar target information was presented behind the operator, requiring him or her to leave the controls, turn around, and lose external visual references to see the information. These potential deficiencies, which can lead to deficient operator performance, were noted by the GMATS assessment that was performed after the accident at the request of the NYC DOT. The assessment suggested that the NYC DOT acquire equipment such as ARPA, AIS, and electronic chart display and information systems, as well as digital, multidirectional vessel speed indicators with alarm functions that provide vessel speed information to vessel operators, including approach speed to berths. The GMATS assessment concluded that the installation of integrated navigation bridge systems "will be crucial to provide enhanced safe navigation of the vessels."[71] GMATS also recommended the accelerated installation of prerecorded, automated safety and emergency announcements, to be delivered over the public address system before the ferries depart and when they approach the pier.

As noted earlier, on February 11, 2005, the NYC DOT informed the Safety Board that it agreed to follow the GMATS recommendations, and that it already had installed GPS receivers, ARPA, and AIS units on its vessels. The Safety Board is encouraged by the NYC DOT's acceptance of the GMATS recommendations with regard to navigation technology. However, the full integration of the advantages of technology into navigation practices and system monitoring requires careful evaluation and thorough review. The GMATS assessment indicated that navigation technology should be fully operable at all times and that navigation personnel should receive initial and then periodic training in the effective use of navigation technology. The Safety Board agrees with these judgments. However, Board discussions with NYC DOT personnel indicate that the prerecorded announcements that have already been installed are not automatic but require manual activation, and that the alarm functions related to speed indicators that are planned for installation will also require manual activation. In the Safety Board's opinion, manual activation is not consistent with the GMATS recommendations.

The GMATS assessment did not call for the type of systematic evaluation that regularly assesses the effectiveness of existing bridge navigation technology in light of new technologies that become available. Such a system of regular technological assessment would help ensure that NYC DOT vessels take maximum advantage of available technology to enhance the safety of ferry operations. Therefore, the Safety

[71] See appendix F.

Board recommends that, as part of its response to the GMATS assessment, the NYC DOT should fully comply with the technology-related recommendations of GMATS, and establish a recurrent evaluation process to assess the use of navigation technology.

Conclusions

Findings

1. None of the following were factors in the accident: the vessel's propulsion systems, environmental conditions, alcohol, or illicit drugs.

2. The *Andrew J. Barberi* was operating at full speed when it struck the maintenance pier.

3. At the time of the accident, the assistant captain was at the controls, the senior mate was seated in the aftmost section of the pilothouse reading a newspaper, and no one else was in the pilothouse at the ferry's Staten Island end.

4. The assistant captain was apparently upright but unresponsive to his surroundings and the visual cues of the impending allision for an estimated 1 to 2 minutes before the accident.

5. The crew did not recognize that the ferry was in danger because of the absence of changes in sounds that they typically used as cues for arrival, because they were not attending to visual cues outside the vessel, and because of the absence of any crew announcement or alert.

6. The cause of the assistant captain's unresponsiveness to cues clearly indicating an impending allision could not be determined.

7. Because accurate medical information about the assistant captain was not provided to the Coast Guard by the assistant captain and his physician, the Coast Guard had no opportunity to evaluate his fitness to maintain his mariner's license.

8. While the Coast Guard's system of medical oversight has deficiencies, they were unrelated to the accident.

9. The captain failed to exercise his command responsibilities over the *Andrew J. Barberi*.

10. The New York City Department of Transportation failed to implement and oversee safe and effective operating procedures for its ferries.

11. The captain's maneuvering the ferry back to its intended berth was appropriate.

12. The failure of the captain to sound an alarm or provide a spoken alert calling for the initiation of crew actions in response to the emergency adversely affected the quality of the crew's response.

13. Although a superior crew response would most likely have made no difference in the survivability of the injured, deficiencies in the New York City Department of Transportation procedures, training, and equipment could compromise the survivability of passengers and crew in other potential accident scenarios.

14. Shoreside emergency response was effective.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the assistant captain's unexplained incapacitation and the failure of the New York City Department of Transportation to implement and oversee safe, effective operating procedures for its ferries. Contributing to the cause of the accident was the failure of the captain to exercise his command responsibility over the vessel by ensuring the safety of its operations.

Recommendations

As a result of its investigation of the *Andrew J. Barberi* allision, the National Transportation Safety Board makes the following safety recommendations.

To the New York City Department of Transportation:

Require your licensed pilots to provide proof of compliance with the Coast Guard medical certification requirements. (M-05-01)

Adhere to your October 2005 target for implementation of a comprehensive safety management system, incorporating all matters recommended by the Global Maritime and Transportation School assessment, and ensuring medical fitness oversight (requiring, minimally, assurance of compliance with Coast Guard requirements). (M-05-02)

As part of your response to the Global Maritime and Transportation School assessment, fully comply with the technology-related recommendations of the Global Maritime and Transportation School, and establish a recurrent evaluation process to assess the use of navigation technology. (M-05-03)

To the U.S. Coast Guard:

Revise regulation 46 CFR 10.709 to require that the results of all physical examinations be reported to the Coast Guard, and provide guidance to mariners, employers, and mariner medical examiners on the specific actions required to comply with these regulations. (M-05-04)

In formal consultation with experts in the field of occupational medicine, review your medical oversight process and take actions to address, at a minimum, the lack of tracking of performed examinations; the potential for inconsistent interpretations and evaluations between medical practitioners; deficiencies in the system of storing medical data; the absence of requirements for mariners or others to report changes in medical condition between examinations; and the limited ability of the Coast Guard to review medical evaluations made by personal health care providers. (M-05-05)

Seek legislative authority to require all U.S.-flag ferry operators to implement safety management systems, and once obtained, require all U.S.-flag ferry operators to do so. (M-05-06)

To the States Operating Public Ferries:

Encourage your public ferry operators to voluntarily request application of the Federal requirements at 33 CFR 96 for implementing a safety management system, if they have not already done so. (M-05-07)

To the Passenger Vessel Association:

Encourage your member ferry operators to voluntarily request application of the Federal requirements at 33 CFR 96 for implementing a safety management system, if they have not already done so. (M-05-08)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: March 8, 2005

Appendix A

Investigation

The Safety Board was notified of this accident by its communication center about 1600 on October 15, 2003. The Board immediately notified the Coast Guard of its selection to lead the investigation under the Safety Board–Coast Guard memorandum of understanding. The Board then dispatched a team of investigators from Washington, D.C., to the accident site, and an investigator from its Parsippany, New Jersey, Aviation Regional Office to control the scene until the team arrived. The team, consisting of an investigator-in-charge and specialists in deck operations, marine engineering, human factors, survival factors, and vehicle recorders, arrived at the Staten Island ferry terminal about 2300 on October 15. The Chairman of the Safety Board joined the team at the accident site, as well as representatives from the Safety Board's Office of Transportation Disaster Assistance. The on-scene investigation concluded on October 25, 2003.

The Safety Board investigated the accident under the authority of the Independent Safety Board Act of 1974, according to Safety Board rules. The designated parties to the investigation were the U.S. Coast Guard, the New York City Department of Transportation, and the New York City Fire Department.

Appendix B

Standard Operating Procedures, Staten Island Ferry

STANDARD OPERATING PROCEDURES FOR CAPTAINS, ASSISTANT CAPTAINS, MATES, DECKHANDS AND FEMALE ATTENDANTS WHILE THE BOATS ARE LOADING, OFF LOADING AND UNDERWAY

CAPTAIN:
Immediate Supervisor – Port Captain

The Captains responsibilities are to familiarize themselves with the station bill and muster list of any boat they are assigned, insure the boat is in a safe and clean condition for our customers while safely navigating and operating the boat maintaining the advertised schedule. The Captain is responsible for all emergency and rescue operations

Upon docking the Captain will be in the inshore pilothouse insuring the aprons and bridge are in the correct position to receive the boat and the slip is in otherwise safe condition to dock.

Upon undocking the Captain will be in the off shore pilothouse to receive the signal from the Assistant Captain that the boat is let go. As soon as Vessel Traffic Service is contacted and it is safe to depart get the boat underway.

The Captain (taking full responsibility) may allow the Assistant Captain to make landings at Whitehall, maneuver in and out of tie up and fueling slips or get the boat underway.

ASSISTANT CAPTAIN:
Immediate Supervisor – Captain

The Assistant Captains responsibilities are to familiarize themselves with the station bill and muster list of any vessel they are assigned, assists the Captain in the safe and clean transport of our customers.

As the First Class Pilot the Assistant Captain must advise the Captain of any dangers, tide, current, aid to navigation changes or discrepancies occurring over the route. Assists the Captain in the operation and navigation of the ferry.

After the boat is secured to the dock take a position in the inshore pilothouse to observe the off loading and loading of the vessel in order to react to any problems that may arise during this time.

As soon as the boat is loaded, the aprons are up and the Mate has signaled the boat is let go and safe to depart the Assistant Captain will signal the Captain and transfer the controls.

After the boat clears the slip proceed to the operating Pilothouse. Makes log entries. (1)

When the boat is tied up the Assistant Captain is responsible for securing both Pilothouses.

MATE KENNEDY CLASS:
Immediate Supervisor – Captain

The Mates responsibilities are to familiarize themselves with the station bill and muster list of any vessel they are assigned, supervise the Deckhands and Female attendant as well as assisting the customers whenever possible. Insuring the deck areas are in a safe and clean condition. Make appropriate notations on check lists located in the male rest rooms. The Mate, under the direction of the Captain, will supervise the Deckhands during emergency and rescue operations.

The Mate is to insure that the Deckhands and the female attendant are in uniform, patrolling and maintaining their stations in a safe and clean condition.

As the boat is approaching the slip the Mate will be at the inshore end of the vehicle deck observing the slip, aprons and bridge ready to wave the Captain off if any dangerous or unsafe conditions exists.

After the boat is safely in the slip drop the tie back lines and safety cables, hook up and open the gates.

Direct the off loading and loading of vehicles in a timely manner in order to maintain the schedule.

Upon completion of loading close the gates, unhook, insure the rudder pin is up and it is otherwise safe to get underway before signaling the Assistant Captain to transfer power and get underway.

While underway patrols all decks constantly on the lookout for any situation requiring attention. Insure that the Deckhands and female attendant are performing their assigned duties.

Report any situation that requires additional assistance to the pilothouse.

When the boat is tied up the Mate is responsible to secure all deck areas excluding the pilothouses.

MATE AUSTEN CLASS:
The Mate onboard the Austen class follows the same operating procedures as the Mate onboard the Kennedy class with the exception of off and on loading vehicles and the rudder pin operation.

MATE BARBERI CLASS:
While docking and undocking the two Mates onboard the Barberi Class will be stationed at the inshore end of the boat. The Number 1 Mate will be on the main deck and the number 2 Mate will be at the upper embarkation deck.

Like the Austen Class there is no vehicle off loading and loading as well as no rudder pin operation. Each of the two mates will have the following areas of responsibility following the same operating procedures as the Mate onboard the Kennedy class.

Number 1 Mate will be responsible for the main deck and the New Jersey side of the saloon deck including the stairs and ramps.

The number 2 mate will be responsible for the bridge deck and the Brooklyn side of the saloon deck including the stairs and ramps.

DECKHAND:
Immediate Supervisor – Mate

The Deckhands responsibilities are to familiarize themselves with the station bill and muster list of whatever boat they are assigned, be in uniform, patrol their assigned station to insure it is in a safe, clean condition and to assist the customers whenever possible. Participate in all drills and actual emergency situation and act as a lookout as assigned.

FEMALE ATTENDANT, ALL BOATS
Immediate Supervisor – Mate

The Female Attendants responsibilities are to be on station in the female restroom and in uniform. Insure the rest room has adequate supplies and is in a safe, clean condition for the customers, immediately report any emergency situations, supply or operating deficiencies to the Mate for appropriate action.

KENNEDY CLASS:
DECKHAND NUMBER 1 – BRIDGE DECK
This station is the bridge deck, inside and outside, the officers locker room, both stair ways to the saloon deck and both pilothouses.

As the boat is approaching the slip report to the operating pilothouse and make proper announcements.

After the boat is made fast to the dock depart the pilothouse and go through the station following behind the customers picking up the large refuse.

As the boat is departing the slip report to the operating pilothouse and make the proper announcements. After making the announcements go back through the station to pick up any remaining refuse with the scoop and broom. Spot mop and wipe any spills on the decks, stairs, sills and seats.

Constantly Patrol the station being on the lookout for any situations requiring attention. Report any situations that require additional assistance to the Mate or the pilothouse.

DECKHAND NUMBER 2 AND 3 - SALOON DECK
Number 2 station is the Brooklyn side including the horseshoe areas.
Number 3 station is the New Jersey side including the horseshoe areas.

As the boat is approaching the slip be at the inshore end of the saloon deck. When the boat is safely in the slip drop the tie back lines and safety chains.

After the aprons are resting on the deck of the boat open the gates, attach the safety chain between the apron and the gates. As the customers leave the boat be on the lookout for anyone in need of assistance.

After the main body of the crowd is off the boat go to the off shoe end and follow behind the customers picking up the large refuse.

As the boat is loading be at the inshore end of the boat to be on the look out for anyone in need of assistance. As soon as the boat is loaded and the apron operator is ready release the safety chains and close the gates and chains.

As the boat is departing the slip go back through the station and pick up the remaining refuse with the scoop and broom. Spot mop and wipe any spills on the decks, seats and sills.

Constantly patrol the station being on the lookout for any situation requiring attention. Report any situation requiring additional assistance to the Mate or pilothouse.

DECKHAND NUMBER 4 – MEN'S ROOM CABIN
This station is the main deck passenger cabin and outside area on the New Jersey side, the men's room and both sets of stairs from the main deck to the saloon deck and the crew's locker room.

As the boat is approaching the slip be on station by the men's room to deter undesirables from hanging around.

After the main body of the crowd is off the boat go back through the station and follow behind the customers picking up the large refuse.

While the boat is loading recheck the men's room.

As the boat is departing go back through the station and pick up the remaining refuse with a scoop and broom. Spot mop and wipe any spills on the deck, seats, sills and stairs. Constantly patrol the station being on the lookout for any situation requiring attention. Report any situation requiring additional assistance to the mate or pilothouse.

DECKHAND NUMBER 5 AND 6 – MAIN DECK
Number 5 station is the New York end of the Brooklyn side passenger cabin, outside area, the New York end stairs to the saloon deck and vehicle deck. Number 6 station is the Staten Island end of the Brooklyn side passenger cabin, outside area, the Staten Island end stairs to the saloon deck and vehicle deck.

As the boat is approaching the slip the inshore end deckhand will be at the inshore end of the vehicle deck . When the boat is safely in the slip drop the safety cable then the tie back lines. As soon as the boat is settled in the throat of the bridge attach the hooks to the boat, open the gates and let the customers off.

Go back to the cars and remove the wheel chocks. (The mate will direct the unloading and loading of the vehicles).

As soon as the crowd thins go back through the station and follow behind the customers picking up the large refuge.

As the boat is loading be at the inshore end on the lookout for anyone in need of assistance. As soon as the boat is loaded and the boat is ready to be let go close the gates, raise the rudder pin, secure the safety cable and chock the wheels of the last row of vehicles.

As the boat is departing the slip go back through the station and pick up the remaining refuse with the scoop and broom. Spot mop and wipe any spills on the decks, seats, sills and stairs.

Constantly patrol the station being on the lookout for any situations requiring attention. Report any situation requiring additional assistance to the Mate or the pilothouse.

The offshore end deckhand will on station at the offshore end of the boat as the boat is approaching the slip.

As soon as the boat is made fast to the dock and the customers begin to depart follow behind picking up the large refuse.
As the boat is loading be on station by the rudder pin. Chock the wheels of the front row of vehicles. Drop the rudder pin when signaled by the pilothouse.

As the boat is departing the slip go back through the station and pick up the remaining refuse with the scoop and broom. Spot mop and wipe any spills on the

deck, seats, sills and stairs.
Constantly patrol the station being on the lookout for situations requiring attention. Report any situations requiring addition assistance to the Mate or the pilot house.

BARBERI CLASS:
DECKHAND NUMBER 1
This station is the bridge deck inside cabin, New Jersey side weather deck, the Staten Island end pilothouse and the ramps to the upper embarkation area on the New Jersey side.

The duties and responsibilities are the same as the bridge deck person assigned to the Kennedy class, including making the announcements in both directions.

DECKHANDS NUMBER 2 AND 3 – SALOON DECK
Number 2 station is the Brooklyn side of the saloon deck including the horseshoe area and the Brooklyn side stairs connecting the saloon deck to the upper embarkation area.

Number 3 station is the New Jersey side of the saloon deck including the horseshoe area and the New Jersey side stairs connecting the saloon deck to the upper embarkation area.

The duties and responsibilities are the same as the people assigned to the saloon deck aboard the Kennedy class.

DECKHAND NUMBER 4 – MEN'S ROOM
This station is all the men's rooms and the crew's locker rooms.

The duties and responsibilities are the same as the person assigned to the men's room aboard the Kennedy class.

DECKHAND NUMBER 5 AND 6 – MAIN DECK
Number 5 station is the New York half of the main deck, including the stairs between the main and saloon decks as well as the outside area of the main deck, New York end.

Number 6 station is the Staten Island half of the main deck, including the stairs between the main and saloon decks as well as the outside area of the Staten Island end.

With the exception of the rudder pin operation and vehicle loading and unloading the duties and responsibilities are the same as the people assigned to the main deck aboard the Kennedy class.

DECKHAND NUMBER 7 – BRIDGE UTILITY
This station is the Brooklyn side weather deck and the ramps leading to the upper embarkation area, the New York pilothouse and the officer's locker room on the bridge deck.

With the exception of making announcements the duties and responsibilities are the same as the person assigned to the bridge deck aboard the Kennedy class.

AUSTEN CLASS
DECKHANDS NUMBER 1 AND 2 - BRIDGE DECK
Station number 1 is the Brooklyn side of the bridge deck, the ramps leading to the upper embarkation areas, the upper embarkation area of the Brooklyn side and the Staten Island pilothouse.

Station number 2 is the New Jersey side of the bridge deck, the ramps leading to the upper embarkation areas, the upper embarkation area of the New Jersey side and the New York pilothouse. Deckhand number 2 is responsible for the announcements.

The duties and responsibilities are the same as the people assigned to the saloon deck aboard the Kennedy class. (with the exception of the number 2 deckhand making the announcements aboard the Austen class).

DECKHANDS NUMBER 3 AND 4 – MAIN DECK
Station number 3 is the New York End including the stairs on the New York end and the crew's locker room.

Station number 4 is the Staten Island end including the stairs and the Men's room

The duties and responsibilities of the number 3 and 4 deckhands are the same as the people assigned to the main deck of the Barberi class. The number 4 deckhand (Men's room) is responsible to maintain the Men's room as onboard the Kennedy class.

ALL BOATS:

DURING HOT RELIEF TIMES CREW MEMBERS WILL NOT LEAVE THEIR STATIONS UNTIL THEY ARE PROPERLY RELIEVED.

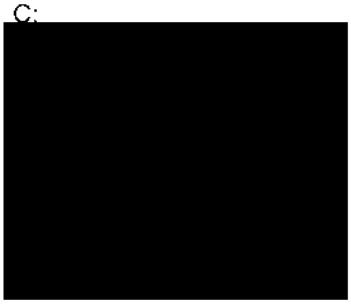
The doors on the inshore end of both the upper and lower embarkation areas will be secured open while the boat is loading and unloading customers.

ON THE AUSTEN CLASS THE UPPER LEVEL DOORS WILL NOT BE OPENED UNTIL IT IS DETERMINED THAT THE APRONS WILL CLEAR THE DOORS.

The boarding gates will not be opened until the aprons are properly positioned on the deck.

ANY "ALL HANDS" SITUATION ORDERED BY THE CAPTAIN OR THE MATE WILL TAKE PRIORITY. THE CAPTAIN, MAY AT ANY TIME, UTILIZE THE CREW AS SEEN FIT TAKING FULL RESPONSIBILITY FOR SUCH ACTIONS.

C:



Appendix C

Memorandum of Understanding Between New York City Department of Transportation and U.S. Coast Guard

MEMORANDUM OF UNDERSTANDING

Between the U.S. Coast Guard and the City of New York

The New York City Department of Transportation (DOT) and the U.S. Coast Guard Officer in Charge, Marine Inspection, New York (OCMI) hereby agree to the following Memorandum of Understanding (MOU):

A. PURPOSE: The U.S. Coast Guard and the City of New York have mutual interest and concern for the safe operation of the Staten Island Ferries. Over 60,000 passengers ride the ferries daily and these ferries transit waters through which a significant portion of the marine commerce of the Port of New York navigates.

The parties have entered into this MOU to formalize procedures for developing standard operating procedures and agreements between OCMI NY and the NY City DOT to achieve following goals:

1. Improve passenger safety
2. Improve the quality of Ferry maintenance and operations
3. Expedite the Coast Guard inspection process

B. METHODS:

1. The USCG and the Staten Island Borough Commissioner will hold regular meetings, at least quarterly, to exchange information and discuss issues of mutual concern.

2. Agreements specifying procedures and/or operations will be formalized in writing using the format in enclosure (1). These agreements will be signed by OCMI New York and the Staten Island Borough Commissioner. Agreements may be amended by mutual consent, and may be terminated by either party upon delivery of thirty days written notification.

3. This Memorandum of Understanding and all addenda will be thoroughly reviewed periodically by each party.

4. Nothing in this Memorandum of Understanding and its addenda is intended to, nor shall operate to preempt federal law or regulations. This Memorandum of Understanding and its addenda do not supplant duly established U.S. Coast Guard policy. Any terms in conflict with established U.S. Coast Guard policy shall be void.

[redacted]

Richard C. Vlaun
Captain, U.S. Coast Guard
Officer in Charge, Marine Inspection, New York

MAY 19 1998
Date

[redacted]

Richard A. Malchow
Acting Commissioner
New York City Department of Transportation

MAY 19 1998
Date

FORMAT FOR OPERATIONAL AGREEMENT

This agreement is entered into under the auspices of the MOU between the U.S. Coast Guard Officer in Charge, Marine Inspection, New York (OCMI) and the New York City Department of Transportation (DOT). It details mutually acceptable procedures or policies. This agreement may be terminated at any time by either party upon thirty days written notification to the other party.

SUBJECT:

REFERENCES

PURPOSE:

DISCUSSION:

AGREEMENT:

Officer in Charge, Marine Inspection New York	Ferry Operations Division Staten Island Borough Commissioner
Date	Date

Appendix D

Contents Pages from Safety Management System Manuals, Washington State Ferries

Washington State Ferries

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PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
ADMN 0010	Document Control System	2	03/18/03
ADMN 0020	SMS Vocabulary	2	03/18/03
ADMN 0030	SMS Documentation	2	03/18/03
ADMN 0040	How to Write/Revise a Procedure	0	1/7/01
ADMN 0060	Document Distribution	1	10/25/02
REVU 0010	SMS Report Program: Nonconformity/Corrective Action	1	5/20/01
REVU 0020	SMS Report Review and Appeal	3	03/18/03
REVU 0030	How to Complete an SMS Report	0	1/7/01
REVU 0040	Internal Auditing	0	1/7/01
REVU 0050	External Auditing	0	1/7/01
REVU 0060	Management Review	0	1/7/01

Approved:

[redacted]

Gary Baldwin
Director, Organizational
Strategy and Human Resources
Washington State Ferries

[redacted]

Mark Nitchman
Director of Maintenance
Washington State Ferries

[redacted]

Joe Nortz
Director of Marine Operations
Washington State Ferries

03/11/2003
Date of Approval

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Uncontrolled - For Reference Only

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Approved: [redacted]

Director, Department of Corporate Services & Strategy — Date of Approval: 02/11/2004

Uncontrolled - For Reference Only

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Approved:

[redacted] 12/04/03

Director of Marine Operations Date of Approval

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Washington State Ferries

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Gary Baldwin
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[redacted]

Mark Nitchman
Director of Maintenance

[redacted]

W. Michael Anderson
Director of Marine Operations

9/8/2003

Date of Approval

Uncontrolled - For Reference Only

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PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
SAFE 0105	Scaffolding and Staging	0	9-27-02
SAFE 0110	Confined or Enclosed Space Entry	0	1-7-01
SAFE 0120	Safe Use of Power Tools	0	1-7-01
SAFE 0130	Lockout-Tagout	1	03-18-03
SAFE 0140	Welding and Hot Work	0	1-7-01
SAFE 0150	Storm-Inclement Weather Precautions	0	1-18-02
SAFE 0160	Respiratory Protection Program	0	01-05-04

Approved: [redacted]

Director of Maintenance

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Director of Marine Operations

12/04/03

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Uncontrolled - For Reference Only

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Director of Maintenance

12/17/03

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PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
OPER 0200	Annual Inspections	0	1/7/01
OPER 0210	Galley Inspections and Drills	1	5/20/01
OPER 0220	Cold Weather Measures	0	1/7/01
OPER 0230	Vessel Shipyard Breakout	0	12/21/01
OPER 0240	Freight Shipments	0	7/19/02
SAFE 0010	General Safety	5	12/19/03
SAFE 0020	Safety Meetings – Shipboard	1	12/21/01
SAFE 0030	Minor Incident & Safety Hazard Reports	0	1/7/01
SAFE 0040	Bloodborne Pathogens/Biohazardous Waste Disposal	1	6/15/01
SAFE 0050	Housekeeping/Janitorial Supplies	1	11/16/01
SAFE 0060	Lighting	1	7/20/01
SAFE 0070	Intrinsically Safe Radios During Oil Transfers	0	1/7/01
SAFE 0080	Lockout/Tagout	1	5/20/01
SAFE 0090	Working Aloft or Over the Side	0	1/7/01
SAFE 0100	Customer Gas Cans	2	12/19/03
SAFE 0110	Vehicle Fuel Leaks	1	8/17/01
SAFE 0120	Tractor/Trailer Operations	0	1/7/01
SAFE 0130	Power Outages, Terminal	0	1/7/01
SAFE 0140	Respiratory Protection Program	0	01/05/04

Approved:

[redacted]

Director of Operations

02/11/2004

Date of Approval

Uncontrolled - For Reference Only

Washington State Ferries

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PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
ROUT 0001	Table of Contents	16	02/27/04
ROUT 0002	Record of Revisions	16	02/27/04
ROUT 0010	Route Manual Contents	0	1/7/01
ANAC 0010	Navigation – General	0	1/7/01
ANAC 0020	Loading/Unloading	4	10/25/02
ANAC 0030	Charts	0	1/7/01
ANAC 0040	Wake Concerns	0	1/7/01
ANAC 0050	Routing – Heavy Weather	0	1/7/01
ANAC 0060	Routing – Primary and Secondary Routes	0	1/7/01
ANAC 0080	Turn Point Special Operating Area	0	3/18/02
ANAC 0100	Route/Vessel Description	0	8/1/02
ANAC 0110	Emergency Resources	0	8/1/02
BAIN 0010	Navigation – General	1	5/20/01
BAIN 0020	Loading/Unloading	1	3/18/02
BAIN 0030	Charts	0	1/7/01
BAIN 0040	Wake Concerns	1	5/20/01
BAIN 0100	Route/Vessel Description	0	8/1/02
BAIN 0110	Emergency Resources	0	8/1/02
BREM 0010	Navigation – General	6	05/15/03
BREM 0020	Loading/Unloading	2	7/20/01
BREM 0030	Charts	0	1/7/01
BREM 0040	Wake Concerns	5	8/30/02
BREM 0100	Route/Vessel Description	0	8/1/02
BREM 0110	Emergency Resources	0	8/1/02

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PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
TAHQ 0010	Navigation – General	0	1-7-01
TAHQ 0020	Loading/Unloading	2	2-15-02
TAHQ 0030	Charts	0	1-7-01
TAHQ 0040	Transport of Liquid Oxygen	0	1-7-01
TAHQ 0100	Route/Vessel Description	0	8-1-02
TAHQ 0110	Emergency Resources	0	8-1-02
VASH 0010	Navigation – General	0	1-7-01
VASH 0020	Loading/Unloading	1	5-20-01
VASH 0030	Charts	0	1-7-01
VASH 0100	Route/Vessel Description	0	8-1-02
VASH 0110	Emergency Resources	0	8-1-02

Approved:

[redacted]

Director of Operations

02-11-2004

Date of Approval

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Washington State Ferries

Table of Contents – Deck

PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
ELWH 0000	Introduction	0	1-7-01
DECK 0001	Table of Contents - Deck	9	12/19/03
DECK 0002	Record of Revisions – Deck	9	12/19/03
DECK 0010	Deck Section Contents	0	1-7-01
DECK 0020	Loading Unloading	0	1-7-01
DECK 0030	Propulsion Control System	2	7-19-02
DECK 0040	Steering System	2	06/06/03
DECK 0050	Watertight Doors	2	12-19-03
DECK 0060	Manning	0	1-7-01
DECK 0070	Vessel Squat	0	06-06-03
DECK 0075	Fire Detection & Alarm System	0	1-7-01
DECK 0085	Launching IBA's	0	1-7-01
DECK 0100	Public Address General Alarm Systems	0	10-1-01

Approved:

[redacted]

Director of Marine Operations

12/04/03

Date of Approval

Washington State Ferries

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Table of Contents – Engineering and Maintenance

PROCEDURE NUMBER	PROCEDURE TITLE	REVISION NUMBER	ISSUE DATE
ENGR 0001	Table of Contents - Engineering and Maintenance	2	2/15/02
ENGR 0002	Record of Revisions - Engineering and Maintenance	2	2/15/02
ENGR 0010	Engineering and Maintenance Section Contents	0	1/7/01
ENGR 0020	Start-Up & Control Transfer	0	1/7/01
ENGR 0030	Control Shutdown	0	1/7/01
ENGR 0040	Connecting and Disconnecting Vessel to Shore Power	0	1/7/01
ENGR 0050	Cold Weather Precautions for the Fire Main	0	1/7/01
ENGR 0060	List of Critical Equipment	1	12/21/01
ENGR 0070	Sewage Pumping	0	1/7/01
ENGR 0080	Bilge Pumping	0	1/7/01
ENGR 0085	Oily Bilge Holding Tank Pumping	0	1/7/01
ENGR 0090	Used Oil Discharge	0	1/7/01
ENGR 0100	Engine Room CO_2 Flooding	1	2/15/02
ENGR 0110	Elevator Emergency Operation	0	1/7/01

Approved: [redacted]

Director of Maintenance

2/01/2002

Date of Approval

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** Only designated accounts receive OPCT forms.

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Check Lists – The following laminated check lists have been assigned to the following accounts: pilothouses, engine rooms, terminals, and some shoreside accounts.

Appendix E

Example Procedures from Safety Management System, British Columbia Ferries

BC FERRIES		Fleet Regulations
7.1	Shipboard Operations	Page 1 of 7
7.1.25	Ship Arrival Procedures	FRM-PP-7.1.25-R03

POLICY

Vessel arrivals shall comply with standardized procedures.

OBJECTIVE

To achieve the highest degree of safety for passengers, crew and vessel.

PROCEDURES

Bridge team

Masters shall ensure that the minimum bridge team is in place prior to all arrivals as follows:

All Large Vessels:

Master, Watchkeeping officer and Quartermaster.

Minor/Intermediate Vessels:

Master and Quartermaster/additional crewmember.

Vessels with Right Angle Drive (RAD) Units:

On vessels with Right Angle Drive (RAD) units, an appropriate method should be employed to confirm correct rotation of the RADs.

RAD ships, at the discretion of the Senior Master, may also put a plaque on the consuls stating "visual and verbal confirmation of the leg rotation is required by the bridge team before docking" if this is considered of value.

General docking

All vessel crews must wear PFDs when outboard of the gates, safety lines or restraint netting until the vessel is fully docked.

NOTE: There should be no personnel on the ramp other than the ramp operator. Embarking personnel or passengers must be kept on the shore side of the traffic barrier.

LARGE VESSELS

Safely docked

After a vessel has docked, no shore ramp apron shall be lowered onto the vessel deck and no transfer of traffic, passengers or employees shall begin until the following has taken place in this sequence:

the Master is satisfied that:

- the vessel is safely and properly secured in the dock;
- controls at all other stations are either synchronized with the inshore wheelhouse controls or placed in the neutral position; and
- in vessels equipped with multi-station bridge controls, controls at all other stations including the engine room are either synchronized with the wheelhouse controls or placed in the neutral position.

Docking buzzer

The Main Deck Loading Officer may, at the Master's discretion, sound one long and three short on the docking buzzer to indicate that the vessel is in the dock.

When the Master is satisfied that the vessel is safe and properly positioned in the dock and control is on the bridge the Master shall signal by sounding one long and three short on the docking buzzer to indicate that "the bridge is now in the in dock mode".

Clear to discharge

Upon hearing the one long and three short from the docking buzzer, the Main Deck Loading Officer will confirm visually that the ship is properly in the berth before giving the Ramp Equipment Operator the signal to lower the main vehicle ramp apron onto the vessel. When the apron is on the deck he/she will make fast the shore connections.

The Main Vehicle Deck Loading Officer will then call the Master with the following request:

"This is the Main Vehicle Deck Loading Officer. The Main Vehicle Deck Apron is down, the lines are on. Are we clear to discharge?"

The Master responds with the direction:

"All clear to discharge."

The Main Deck Loading Officer repeats the verbal clearance:

"Main vehicle deck roger, All clear to discharge."

The Master or his designate will then call the foot passenger ramp position and issues the verbal instruction:

"All clear to discharge."

Foot passenger ramp position acknowledges:

"Foot passenger ramp roger, all clear to discharge."

Main ramp barriers

The Main Deck Loading Officer after receiving clearance to discharge from the Master, will instruct the Ramp Equipment Operator to lift the Main Ramp Barriers.

Upper vehicle deck

As the Upper Vehicle Deck Loading Officer is released from the bridge, he/she shall request from the Master:

"Permission to discharge the upper vehicle deck."

The Master shall confirm either visually or by the CCTV that the Main Vehicle Deck Loading Officer is discharging prior to responding with:

"All clear to discharge."

The upper vehicle deck loading officer when arriving at the upper vehicle deck shall confirm ***visually*** that the main vehicle deck is still discharging prior to authorizing the lowering of the vehicle ramp apron for discharge of the upper vehicle deck. If he/she cannot confirm that discharge is still taking place on the main car deck, he/she shall then call the Main Deck Loading Officer for clearance to discharge the upper vehicle deck.

On double deck vessels, the discharge of vehicular and passenger traffic from the upper vehicle deck shall await the arrival of the upper deck loading officer.

On single deck vessels, the loading officer must be present for the discharge of traffic unless the Master can see the vessel deck and shore apron.

SPIRIT CLASS

On vessels with a Third Officer who is positioned at the upper vehicle deck when the ship arrives, the Third Officer or the upper deck officer shall wait to receive a call from the Main Deck Loading Officer with the following instructions:

"All clear to discharge."

The Upper Vehicle Deck Loading Officer shall respond:

"Upper vehicle deck roger. All clear to discharge."

The Upper Deck Loading Officer may then authorize the vehicle ramp apron to be lowered and commence discharge.

VESSELS WITH OPEN VEHICLE DECKS

Safely docked

After a vessel has docked, no shore ramp apron shall be lowered onto the vessel deck and no transfer of traffic, passengers or employees shall begin until the following has taken place in this sequence:

The Master is satisfied that:

- the vessel is safely and properly secured or pushing into the dock; and
- controls at all other stations are either synchronized with the inshore wheelhouse controls or placed in the neutral position.

Docking buzzer

The Deck Officer shall sound one long and three short on the docking buzzer, if fitted, to indicate that the vessel is in the dock.

The Master shall sound one long and three short on the docking buzzer to indicate to the Main Deck Loading Officer that it is clear to lower the main deck loading ramp and attach shore lines and connections and commence discharge passengers and vehicles.

On open deck vessels the loading officer must be present for the discharge of traffic unless the Master can see the vessel deck and shore apron.

Clear to discharge

Where fitted, the Master shall issue the verbal command **"all clear to discharge"** by hard wire phone or talk back system.

MINOR VESSELS - ALL REGIONS

On the minor vessels, it is permissible for the mate to designate an experienced seaman to act as loading officer while the mate is not present on the vehicle deck. These duties must be formally handed over and both people must have a clear understanding of who is in charge of the vehicle deck. Other crewmembers must also be informed.

GENERAL

Main ramp apron first on

The main ramp apron shall always be the first apron to be placed on the vessel deck, and no upper ramp or passenger ramp apron shall be placed aboard before the main ramp apron.

Upper ramp and passenger ramp aprons

Upper vehicle ramp aprons and foot passenger ramp aprons shall not be placed on the vessel deck until after the main ramp apron has been placed aboard.

Main ramp apron not to be raised

Subject to the exception noted below, while a vessel is in the dock the main ramp apron is never to be raised from the deck of the vessel if any other ramp apron is aboard the vessel.

Exception

During routine adjustments of main ramps and upper ramps for tidal conditions and freeboard, the passenger ramp apron may remain aboard the vessel.

Emergency lift-off

In the event of an **EMERGENCY** all ramp aprons must be locked immediately. All movement of traffic and passengers between ship and shore must cease immediately and aprons vacated. All vehicle ramp aprons and foot passenger ramp aprons must be raised clear of the vessel without delay (see Article 8.01 of this manual).

Main ramp apron last off

The main ramp apron shall not be removed from the deck of the vessel at departure time until after all other aprons and shore encumbrances have been removed.

Ramp status lights

Ramp status lights must be switched on at each ramp station when the apron has been lowered onto the vessel.

Ramp safety

The vessel shall not permit the transfer of traffic or passengers until the ramp operator has indicated to the vessel, by word or by appropriate hand signal, that the ramp and apron are safe and secure for each transfer.

Restraint netting

Restraint netting is to be properly secured top and bottom athwartships, at each end of the vehicle decks. The lower attach points should be as low as possible to ensure that the netting is as taut as it can be made. This is a safety measure to prevent passengers from accidentally falling overboard.

The restraint netting may be removed at the shoreward end only when the vessel is secured in the berth, the ramp is in position, and clearance has been received from the Master to discharge traffic. Ropes can be used in addition to, but not in lieu of, the netting.

M.V. Spirit of Vancouver Island
Article 7.1.14
Appendix A (Page 1 of 1)
1012-SS-7.1.14A-R01

PRE-ARRIVAL CHECKLIST - BRIDGE

1.	Full Bridge crew - Master, Mate and Quartermaster.	☐
2.	Master briefed by OOW on traffic, tide, wind conditions and assigned berth.	☐
3.	Ring Standby to Engine Room.	☐
4.	Quartermaster on the helm.	☐
5.	4 steering pumps "on line".	☐
6.	Bow thrusters started and tested - **ONE AT A TIME** - before reaching Terminal Limit of approach to avoid possibility of blackout.	☐
7.	Both anchors ready for letting go.	☐
8.	Limit of Approach call on BCFC FM frequency - confirm berth Tsawwassen - 1 mile out Swartz Bay - Imrie Island/Shute Reef	☐
9.	Passing arrangements with BCFC or other vessels.	☐
10.	Whistle sounded - Swartz Bay approaches, Fir Cone Point.	☐
11.	Pitch reduction, confirm speed dropping.	☐
12.	Confirm astern pitch is available.	☐
13.	Permission to open bow/stern doors - 1 long buzz on docking buzzer or by telephone.	☐

Once the vessel is in the dock a separate Pre-Discharge check list is to be followed.

M.V. Spirit of Vancouver Island
Article 7.1.9
Appendix A (Page 1 of 1)
1012-SS-7.1.9A-R02

Supersedes: 1012-SS-7.1.9A-R01
& 1012-SS-7.1.9B-R01

Pre-Departure Checks – Swartz Bay and Tsawwassen

1.	Breast line let go (Swartz Bay)	
2.	Watertight doors closed.	
3.	Draughts under five (5) metres.	
4.	Clearance procedure with Main Deck Loading Officer.	
5.	Passenger count.	
6.	Ring standby to MCR.	
7.	Four steering pumps on line.	
8.	Bow thrusters on and tested.	
9.	CCTV monitor check.	
10.	Strobe lights activated.	
11.	Ramp status light off.	
12.	Bow/stern/stores/visors closed. All lights green.	
13.	Sound whistle	
14.	Lockout's traffic report	
15.	Strobes lights completed.	
16.	Clear to sail.	
17.	BCFS FM radio departure call.	
18.	Vancouver Traffic radio call (advise Mater of traffic).	

Appendix F

Assessment of Staten Island Ferries by Global Maritime and Transportation School, U.S. Merchant Marine Academy

Global Maritime and Transportation School
At the United States Merchant Marine Academy

Assessment of Staten Island Ferry Operations

Prepared for: New York City
Department of Transportation

Prepared by: Global Maritime and Transportation School
At the United States Merchant Marine Academy
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Date: February 12, 2004

Note that comments and remarks provided in this report are based on observations made during on-site assessments and reflect conditions as they existed at that time. Specific conditions discussed in this report may not exist in a similar condition today.

This report is a review and assessment of Staten Island Ferry operations only as they existed at the time of observation. It is not a comprehensive safety inspection or accident investigation. This report shall not imply any form of certification or approval of any operation or indicate compliance with any applicable international, federal, state, or local laws or regulations.

It is also critical to understand that the comments and remarks provided herein may be subject to modification and/or change based on further and more thorough examination of ferry operations as this assessment continues to evolve and proceed.

Executive Summary

Following the tragic Staten Island Ferry accident on October 15, 2003, the New York City Department of Transportation (NYC DOT) requested the Global Maritime and Transportation School (GMATS) at the United States Merchant Marine Academy (USMMA) develop a proposal to conduct an assessment of Staten Island Ferry Operations. By the end of October 2003, the GMATS and the NYC DOT had agreed in principal for the GMATS to conduct the assessment in four main topical areas: vessel operations, human factors, safety, and management.

On November 3, 2003, the NYC DOT signed a Letter of Intent/Notice to Proceed for assessment of the Staten Island Ferry Operations. GMATS began work on the project immediately and commissioned two assessment teams to conduct an initial review of operations, management, policies, procedures, manuals, and other documents related to the operation of the Staten Island Ferry. Both assessment teams performed on-site surveys (including discussions with ferry crews and shore-based management as well as observations aboard underway ferries) during November 2003 through mid-January 2004. The first team focused on overall operations and management; engineering; safety; and conformity with regulatory schemes and maritime industry best practices and standards. The second assessment team focused primarily on human factors and bridge team management.

Based on these assessments, the goal of this report is to provide a framework and suggested guidance for operation and management of a world-class Staten Island Ferry system that is safe, secure, fiscally sound, and environmentally sensible.

To its credit, the Staten Island Ferry system appears to be a good operation overall considering 1) the limited levels of funding and human resources the organization has at its disposal and 2) the existence of a corporate culture within the ferry organization which may not be conducive to operating a first-rate marine transportation system.

GMATS feels the NYC DOT is committed to operating a ferry service that inspires public confidence in that system and is dedicated to making improvements and changes in the following areas:

- **Safety Management System (SMS)** - The foundation of the revitalization of the Staten Island Ferry system will be the establishment of a Safety Management System (SMS) – in accordance with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (more widely known as the International Safety Management (ISM) Code). Implementation of a SMS has become a maritime industry standard around the world and critical in making the Staten Island Ferry system mainstream with its best passenger-carrying contemporaries in the global arena. SMS application within the Staten Island Ferry system will forge a new era of safety and environmental protection benefiting

passengers, crew, and the City of New York. The functional requirements of a SMS (as outlined in the ISM Code) for the Staten Island Ferry system will incorporate:

a) a safety and environmental protection policy;
b) instructions and procedures to ensure safe operation of ferries and protection of the environment in compliance with relevant international, national, and local laws and regulations;
c) defined levels of authority and lines of communication between, and amongst, shore-based and ferry personnel;
d) procedures for reporting accidents and non-conformities with the provisions of the SMS;
e) procedures to prepare for and respond to emergency situations; and
f) procedures for internal audits and management reviews.

The goal of a Staten Island Ferry SMS is to assure that ferry system best practices are clearly defined, that documented practices conform to regulatory requirements, and the opportunity for continuous improvement is available to all who are covered by the Staten Island Ferry SMS. Refer to Long-term Areas of Focus section (pages 6-7) for further information.

- **Bridge Team Management** – GMATS recommends establishment of a new 3-member bridge team comprised of licensed deck officers to 1) provide enhanced safe navigation of Staten Island Ferry vessels, suitable rest breaks, and support for more comprehensive watch relief procedures; 2) meet new vessel security officer and other maritime security statutory requirements to be implemented by July 1, 2004; and 3) incorporate additional tasks and responsibilities mandated under the SMS (all while maintaining a minimum of 2 licensed deck officers in the pilothouse at all times when underway). Additional personnel (from the existing on-watch crew) may be required to support the 3-member bridge team during operations in foul weather and adverse environmental conditions.

  As part of this bridge team program, all personnel required to be present on the navigation bridge while underway will be assigned specific duties and responsibilities so that all human resource capacity is effectively engaged in a coordinated, managed, and more efficient manner. Each bridge team member will also be adequately trained and qualified in the operation and capabilities of all navigation, communication, and other pilothouse equipment and technologies.

  Further assessment and development of the bridge team management structure specific to the Staten Island Ferry system will be required in order to formulate the best practices in this area. The first step in this process will be to conduct an inventory of all bridge team tasks required for operation of the ferries in various conditions and situations. The second step will be to develop a formal, bridge team

operations manual which will be part of the SMS. The final phase in this process will be to develop and deliver a bridge resource management course. This curriculum will be customized to meet the unique operational characteristics of the Staten Island Ferry system. Refer to Specific Comments and Observations for Immediate Consideration Section (page 15) for further information.

- **Organizational Structure and Human Resources** – GMATS feels the immediate hiring of a Chief Operations Officer (COO) to provide leadership and direction for the operation of the Staten Island Ferry system is absolutely critical in guiding the organization through this period of renewal, transition, and implementation of a Safety Management System. GMATS recognizes a person of this caliber (refer to Appendix A for a detailed job description) serving as COO in a comparable maritime organization would typically be compensated with an annual salary of $160,000 to $180,000 per annum. In order to attract the best person for this position, NYCDOT may have to authorize relocation benefits as well. Further, GMATS feels a long-term commitment (e.g. 5 years) for the COO position would serve the NYCDOT well.

  Further, it is clearly evident, based on this initial review of documents and observations, the operations function of the ferry system is 95 persons short of staffing levels required to implement a safety management system and to provide for other enhancements. These staffing shortfalls result in large overtime expenditures as well as a potential for increase in fatigue, reduction in safety, decline in service, or any combination of all four of these issues. This recommendation for additional staffing was based on three central issues: 1) the ferry system is currently not staffed to support a safety management system, 2) more senior personnel need to be on board the vessels in command positions, and 3) as people are sent for training and compliance issues there will be a need for additional personnel in the system to offset any fatigue, hours of labor issues, etc. that will come up during the training process. Refer to Long-term Areas of Focus section (pages 7-10) for further information.

- **Technical Training and Professional Development** – The need for a comprehensive technical training and professional development program for vessel crews and shore-based personnel will be an integral component of the SMS. The Staten Island Ferry should establish and maintain procedures for identifying training which may be required in support of the SMS and ensure that such training is provided for all personnel concerned. Professionally trained personnel are an asset to the SMS and the Staten Island Ferry system. Maintaining one of the Kennedy-class vessels (in a fully-operational status) after delivery of the new ferries will be crucial in meeting the needs of this comprehensive training program. Refer to Long-term Areas of Focus section (page 10) and Specific Comments and Observations for Immediate Consideration Section (page 16) for further information.

- **Operations Procedures –**

  - Staten Island Ferry needs to conduct a full review of at-sea casualty and emergency response plan (including search and rescue operations) and plan coordinated, table-top and other exercise scenarios with external response assets (NYPD Harbor Units, FDNY Marine Units, U.S. Coast Guard, NJ State Marine Police, private harbor tugs, etc.).
  - Develop operational checklists (vessel departures, arrivals, foul weather, emergencies, etc.) required to be used by afloat personnel.
  - Establish formal, internal policies and procedures for and publicize an alternate ferry service operational schedule for foul weather and adverse environmental conditions (i.e. reduced visibility, high winds, excessive wave and/or current action, etc.).

  Refer to Specific Comments and Observations for Immediate Consideration Section (pages 16-17) for further information.

- **Security -** Begin planning for implementation of Vessel and Facility Security Plans as soon as practicable and provide related training to appropriate vessel crew and shore-based staff. Vessel and Facility Security Plans have been submitted to the Coast Guard for approval. Changes and/or modifications may have to be made to the plans based on feedback from the Coast Guard. *** Implementation and subsequent changes/modifications (post U.S. Coast Guard approval) may result in a requirement for hiring of additional crew and shoreside personnel to put the facility and the vessel security plans in effect by July 1, 2004 as required. ***

- **Utilization of Advanced Marine Technologies** – Equipment to be updated or newly installed aboard Staten Island Ferries include RADAR, Automated RADAR Plotting Aids (ARPA), Electronic Chart Display and Information System (ECDIS), Automatic Identification System (AIS), and digital, multi-directional vessel speed indicators with alarm functions (which allows vessel personnel to monitor vessel speed fore/aft and athwartships including approach speeds to berths). Installation of integrated navigation bridge systems aboard all ferries will be crucial to provide enhanced safe navigation of the vessels.

Long-term Areas of Focus (12 –36 months)

GMATS recommends the following organizational strategies receive the highest priority in way of design, development, formalization, and implementation.

- **Safety Management System (SMS)**

  The foundation of the revitalization of the Staten Island Ferry system will be the establishment of a Safety Management System (SMS) – in accordance with the International Management Code for the Safe Operation of Ships and for Pollution Prevention (more widely known as the International Safety Management (ISM) Code). The main objectives of a SMS (as outlined in the ISM Code) for the Staten Island Ferry system are to:

  a) provide for safe practices in ferry operations and a safe working environment;
  b) establish safeguards against all identified risks; and
  c) continuously improve safety management skills of personnel ashore and aboard ferries, including preparing for emergencies related both to safety and environmental protection.

  Implementation of a SMS has become a maritime industry standard around the world and critical in making the Staten Island Ferry system mainstream with its best passenger-carrying contemporaries in the global arena. SMS application within the Staten Island Ferry system will forge a new era of safety and environmental protection benefiting passengers, crew, and the City of New York. The functional requirements of a SMS (as outlined in the ISM Code) for the Staten Island Ferry system will incorporate:

  a) a safety and environmental protection policy;
  b) instructions and procedures to ensure safe operation of ferries and protection of the environment in compliance with relevant international, national, and local laws and regulations;
  c) defined levels of authority and lines of communication between, and amongst, shore-based and ferry personnel;
  d) procedures for reporting accidents and non-conformities with the provisions of the SMS;
  e) procedures to prepare for and respond to emergency situations; and
  f) procedures for internal audits and management reviews.

  On November 4, 1993, The International Maritime Organization adopted Resolution A.741(18), the International Safety Management (ISM) Code for the Safe Operation of Ships and for Pollution Prevention. An integral part of the Code is the requirement that vessel operators establish a Safety Management System (SMS). The goal of a SMS is to assure the best practices are clearly defined, that documented practices conform to regulatory requirements, and the opportunity for continuous improvement is available to all who are covered by the Safety Management System. The SMS is to provide “best practice”

guidelines for all members of the Staten Island Ferry system (employees) in a standardized approach to routine, critical and emergent activities. SMS policies and procedures provide a structure within which managers and employees are expected to use sound judgment in the performance of their duties. An effective SMS will ensure safety, prevention of human injury or loss of life and avoidance of damage to the environment, in particular to the marine environment and to property. The SMS will incorporate crisis management, incident response, training and standard operating procedures covering every aspect of operation and maintenance of the vessels and terminals. The Staten Island Ferry system and the traveling public will both benefit from its creation by:

a) ensuring that all industry standards and best practices are complied with;
b) helping to prevent accidents from occurring;
c) ensuring procedures are in place for dealing with any emergency situation aboard the ferries;
d) ensuring there are adequate communications between ferry and shore-based personnel;
e) ensuring that all individuals know their role and responsibility and are adequately trained and have the appropriate resources to do their job; and
f) ensuring that all activities and operations are planned, controlled, and verified.

- **Organizational Structure**

GMATS feels the immediate hiring of a Chief Operations Officer (COO) to provide leadership and direction for the operation of the Staten Island Ferry system is absolutely critical in guiding the organization through this period of renewal, transition, and implementation of a Safety Management System. The COO candidate (refer to Appendix A for a detailed job description) needs to be the strongest advocate of a SMS.

The Safety Management System will establish a corporate culture that is committed enthusiastically to the policy's success from the highest level of Staten Island Ferry management. The management should define and document the responsibility, authority and interrelation of all personnel who manage, perform and verify work relating to and affecting safety and pollution prevention. Management will be responsible to ensure that adequate resources and shore-based support are provided to enable all levels of the organization to carry out their functions under the SMS. A short-term management organization matrix conducive to this goal might look like the chart in Appendix B. A long-term organizational matrix might look like the chart in Appendix C.

Prior to implementation of the short-term management organization matrix, several key shore-based management personnel need to be hired or realigned in order to introduce a new SMS. These position descriptions are outlined in Appendices D-F.

∉ **Human Resources**

In broad terms, ferry personnel who were interviewed by the assessment teams put their best foot forward and had the desire to do well in the workplace. However, without the proper funding, staffing, and professional training programs, these inherent individual aspirations will not be sufficient and little will change to improve safety.

A similar situation exists for shore-based management staff. During on-site interviews and observations, it was a rare moment when a manager being interviewed was not being paged or responding to telephone calls. The pace is such that decisions are being made reactively instead of proactively; long term planning appears to be a luxury, not a staple. Again, the prevalence of inadequate staffing and funding levels seems to have contributed to the apparent erosion of the overall ferry system organization.

Originally GMATS was tasked with observing and making recommendations. We made our recommendations based on the existing labor contracts (which incorporate a 30-hour work week). A change of work hours, from 30 to 40, should make an impact on these recommendations. However, the impact may be smaller than expected. The first category of new hires (24 of the recommended 95 new personnel additions) will enable the Staten Island Ferry system to run all vessels under the current operating schedule without requiring crew members to work inordinate amounts of overtime in order to meet minimum vessel manning requirements. The remaining 71 new personnel are needed to create a labor pool to provide critical support to:

- ∉ the design, development, and implementation of the SMS (this may take as long as 24 months utilizing existing vessel personnel);
- ∉ surge training and professional development requirements as a result of the implementation of the SMS (this may take as long as 36 months and require vessel crew members to be withdrawn from their regular watchstanding duties to attend training sessions – on-call crew personnel will be required to fill-in these positions);
- ∉ a new 3-member bridge team structure incorporating enhanced bridge team management functions;
- ∉ increased crew responsibilities to meet maritime security regulations;
- ∉ work/rest break rotations and watch reliefs; and
- ∉ increased interaction between vessel crew members and ferry passengers (i.e. customers).

GMATS feels that following implementation of the new safety management system and after surge training requirements are fulfilled, there may or may not be a need for maintaining the recommended overall crew staffing levels discussed above (i.e. 71 of the 95 new positions). There most likely will be a gradual "weaning" process take place within the ranks of the afloat personnel over the next several years. In GMATS' estimation, 1) some current employees will not feel comfortable with the new system and will retire or move on, 2) some current employees will find that in the new way of doing things they will want to become

part of the management structure instead of the crew, and 3) normal attrition. In the same vein, some of the "new hires" will not work out and will not be retained. A thorough analysis of afloat personnel staffing needs should be conducted following SMS implementation and completion of surge training requirements (in 24-36 months) to determine appropriate crewing requirements at that point.

Additional Personnel Requirements (as soon as practicable)

First Category (24 of 95 total personnel) - to enable the Staten Island Ferry system to operate all vessels under the current operating schedule without requiring crew members to work inordinate amounts of overtime in order to meet minimum vessel manning requirements.

1 x Captain
1 x Assistant Captain
1 x Mate
1 x Ferry Terminal Supervisor
15 x Deckhands
1 x Chief Marine Engineer
4 x Marine Oilers

Second Category (71 of 95 personnel) – develop labor pool vital to accomplishing SMS, training, and other areas of critical support noted previously.

8 x Assistant Captains
10 x Mates
13 x Deckhands
1 x Marine Engineer
1 x Senior Port Captain (shore-based, non-union)
1 x Senior Port Engineer (shore-based, non-union)
4 x Relief Captains
4 x Relief Assistant Captains
4 x Relief Mates
9 x Relief Deckhands
4 x Relief Chief Marine Engineers
4 x Relief Marine Engineers
8 x Relief Marine Oilers

The Senior Port Engineer and Senior Port Captain are to be utilized for day-to-day management of the ferries. This will allow for long-term planning and proactive decision-making by upper management staff.

GMATS feels that appropriate opportunities be given to well-qualified personnel from within the Staten Island Ferry system to fill these positions. The Deckhands will be brought in from outside the Staten Island Ferry system as this is an entry-level position.

Specifically, the Relief positions will be utilized to allow the permanent crew to be focused on their 1) training while maintaining a level of safety on the boats, and 2) to allow regular personnel to be utilized for any "Special Projects" where their expertise may be better utilized for the benefit of the Staten Island Ferry system.

Whatever decision is made concerning the employment of these additional personnel, GMATS strongly believes that due consideration be given to upgrading licensed employees from within the fleet. This may mean the waiver of existing civil service testing and hiring procedures for current employees. New hires filling upgrades could be tested as per usual. The reason for this is to improve morale within the fleet. The cooperation and enthusiastic acceptance by Staten Island Ferry employees of a new SMS system is key in the success of that system.

*****Note, additional staffing beyond what is noted above may be required to implement facility and vessel security plans as required by the International Ship and Port Facility Code (ISPS Code), the Maritime Transportation Security Act of 2002 (MTSA), and United States Coast Guard's maritime security regulations by July 1, 2004.*****

∉ **Technical Training and Professional Education**

The need for a comprehensive technical training and professional development program for vessel crews and shore-based personnel is obvious. The desire among ferry system personnel to participate in educational programs is apparent. Additionally, the need for an infusion and acceptance of "new blood" is equally evident as it appears the corporate culture has prevented professional growth in the ferry system's workforce.

The Staten Island Ferry system needs to ensure that each vessel is manned with qualified, certificated, and medically fit personnel with the implementation of the Safety Management System. The SMS will establish procedures so that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties. The Staten Island Ferry system should establish and maintain procedures for identifying any training which may be required in support of the SMS and ensure that such training is provided for all personnel concerned. Professionally trained personnel are an asset to the SMS and the Staten Island Ferry system. As such, all costs pertaining to the professional education of its workforce should be the burden of the Staten Island Ferry System. Ferry personnel should not be required to use vacation time to attend needed training.

- **Work Schedules and Employee Compensation**

  During negotiations with labor unions, every effort should be made to eliminate built-in overtime. It is imperative to move to a standard forty (40) hour week for employees to reduce labor costs. Failing a compromise, vessel schedules can be arranged to accomplish this goal. In hiring new employees, NYC DOT needs to provide professionally documented, certified, medically fit, and qualified personnel to the Staten Island Ferry system.

  A marine industry salary survey should also be undertaken to ensure the Staten Island Ferry system compensation structure is closely aligned with similar domestic ferry operations (e.g. Washington State Ferries). This will help to positively impact recruiting, retention, and morale.

- **Budget and Finance**

  New revenue sources need to be found to carry out the mission of Staten Island Ferry system. This could include new vessel and terminal concession contracts or other alternative revenue sources. Long-term recommendations in this report are going to require long term funding sources dedicated to Staten Island Ferry operations and maintenance. Capital programs need to be clearly defined for both the short- and long-term and managed directly by the Staten Island Ferry system.

  Software systems need to be acquired that link management to the budget and provides for real-time reporting on expenditures of labor and materials. Each division head within the Staten Island Ferry system should formulate a fiscal year budget he or she is directly accountable for managing.

Specific Comments and Observations for Immediate Consideration

Safety

- Strengthen relations with United States Coast Guard (USCG) Sector New York (previously known as Activities New York) wherein USCG marine inspection elements recognize Staten Island Ferry vessels as 46 CFR Subchapter H – Passenger Vessels.

- Conduct a full review of at-sea casualty and emergency response plan (including search and rescue operations) and plan coordinated, table-top and other exercise scenarios with external response assets (NYPD Harbor Units, FDNY Marine Units, U.S. Coast Guard, NJ State Marine Police, private harbor tugs, etc.).

  Current emergency contingency plans rely too heavily on external resources, the ability to conduct a vessel-to-vessel transfer at-sea, and the capacity to bring a ferry in the harbor back to one of the ferry landing piers. While the existence and close proximity of extensive and very capable external response resources are critical and should remain an integral component of any ferry contingency plan, it is prudent to have the internal capacity to deal with all possible emergency scenarios as a "first responder." Circumstances may dictate that a ferry-to-ferry transfer of passengers, moving a vessel to a pier, or use of external response resources does not provide for a practical, safe, or timely response scenario.

- Increase lifesaving resources (lifeboats, liferafts, rescue craft, and inherently buoyant apparatus) on all vessels sufficient for 80% of passenger carrying capacity (this amount would be above and beyond what is required for similar types of passenger vessels subject to Coast Guard inspection).

  These resources are currently not required for the Staten Island ferries by the U.S. Code of Federal Regulations, but may be critical to prevent loss of life and/or serious injury to passengers and crew in certain emergency contingencies. Also, consider replacing existing davit-launched, antiquated, low-freeboard, manually-powered rowboat with a quick–launching, Zodiac-type rigid hull inflatable with a 50-horsepower outboard propulsion motor.

- Install marine evacuation slides on all vessels.

  In conjunction with the increase of lifesaving resources listed above, installation of marine evacuation slides may greatly decrease the risk of loss of life and/or serious injury to passengers and crew in certain crisis scenarios by keeping people out of the water during these events.

- Install additional Personal Flotation Device (PFD) storage compartments on car deck tunnels of Kennedy class vessels.

  During some emergency scenarios, passengers and crew may need to assemble on the car deck and PFDs should be accessible in that location as well -- provided a comprehensive risk assessment is completed considering safety versus security issues in allowing passengers easy, open access to the car decks – see related comment below regarding removal of metal gates/fencing/screen on car decks.

- Confirm each vessel has enough PFDs to meet or exceed 100% passenger and crew carrying capacity.

  During testing for alternate compliance (wherein a simulated transfer of passengers between ferries took place), GMATS observed PFDs from different vessels on the crew members. It is possible that PFDs assigned to a particular vessel may be utilized aboard other vessels in the fleet.

- Replace scissor-type gates currently used for crowd control aboard the vessels with rolling, expanded metal gates to afford additional protection for children.

  These gates currently are approximately 14" above the deck. This gap opens the possibility for a child to "scoot" out over the side without any protective barrier.

- Move passengers away from the bow "picklefork" areas while vessel is docking.

  This has already been partially implemented. A small rope has been installed. Passengers outside are exposed to risk of injury should a collision or hard landing occur. Passengers should be prohibited from "picklefork" area while vessel is landing to prevent injury or loss of life.

- Remove expanded metal gates/fencing/screen on car decks of Kennedy class ferries.

  This allows for assembly of passengers prior to evacuation. *** A comprehensive risk assessment must be conducted to consider an appropriate balance between safety and security in allowing passengers easy, open access to the car decks in the event of an emergency situation. Removal of these security measures may not be viable.***

- Provide complete set of blueprints, vessel plans, and engineering equipment manuals for each engine room.

  Currently there are no plans in the engine room. In case of an emergency, the engineers would not have the availability to utilize prints for damage control or manuals to conduct underway diagnosis, maintenance, and repairs.

- Post fire and emergency control plan/schematic in the engine room and on the navigation bridge of each vessel.

  Regulations require and accepted industry practice dictates a Fire and Emergency Plan be posted in these areas.

- Confirm fire main shore connections on all vessels are appropriately marked and easily accessed and identifiable by New York City Fire Department (FDNY) as well as other regional fire emergency response personnel that may respond to an emergency situation aboard the ferries.

  Currently, markings for the FDNY shore connection are located on a large, bolted panel well above the actual shore connection device. This could lead to confusion or delay in an emergency situation. Also, both shore connections aboard the Kennedy-class vessels are located behind the locked gates referred to previously. Further, it appears that the shore connection is co-located with an individual fire station and may not directly tie into the central fire main piping as required.

- Provide Self-Contained Breathing Apparatus (SCBA) aboard each vessel enough for each crew member below the rank of Captain.

  Accepted industry practice dictates proper firefighting resources be provided to crew members to include SCBAs.

- Accelerate installation of pre-recorded, automated safety and emergency announcements for delivery over public address systems prior to departure and while approaching pier landing area before docking.

  These formalized safety announcements may be critical in saving lives prior to an emergency.

- Improve medical response and first aid capabilities aboard ferries.

  Increase crew medical knowledge and training and supply sufficient equipment to provide adequate first response to a wide-range of possible medical-related emergencies and non-emergency situations.

- The NYC DOT and the US Coast Guard should work together to examine all the safety recommendations listed above to determine appropriateness for each particular ferry. The table top exercises described on page 12 may be helpful in this activity.

Bridge Team Management

- Create multiple, standardized watchstanding conditions requiring extra manning during adverse environmental and weather situations.

- Require and enforce that all navigation bridge electronics and communications gear be energized and fully operational at all times while underway regardless of weather conditions and sea state unless special circumstances exist.

- Update navigation bridge equipment and improve layout.

  Existing layout of navigation bridge equipment does not provide for the most efficient monitoring of critical sensor, communications, and navigation gear by persons responsible for the safe navigation and piloting of the ferries. Equipment to be updated or newly installed include RADAR, Automated RADAR Plotting Aids (ARPA), Electronic Chart Display and Information System (ECDIS), Automatic Identification System (AIS), and digital, multi-directional vessel speed indicators with alarm functions (which allows vessel personnel to monitor vessel speed fore/aft and athwartships including approach speeds to berths). Consider installation of integrated navigation bridge systems aboard all ferries.

- Develop operational checklists (vessel departures, arrivals, foul weather, emergencies, etc.) required to be used by afloat personnel.

  Use of formal operations checklists will be part of the safety management system and reduces potential for complacency, tedium, and creates error traps.

- Provide specific navigation bridge equipment operations training.

  All vessel personnel with responsibility for the safe navigation and piloting of the ferries should have initial as well as periodic refresher training in the capabilities, limitations, and operation of all navigation bridge equipment.

Training

- Establish a formal process and methodology for documenting mariner and shoreside personnel training and qualifications.

  This is to promote qualified training and to eliminate the possibility of nepotism and discrimination.

- Provide formal Situational Awareness and Human Factors training to all personnel responsible for ferry operations including shoreside personnel.

  These programs will be part of a comprehensive, long-term training and education plan which will be an integral component of the safety management system.

- Provide crisis management training (including crowd management and control training) to all vessel personnel including galley employees in accordance with U.S. and international regulatory requirements and accepted industry practices.

  Currently, vessel personnel have no formal training in crowd control procedures and techniques. This training may be critical to saving lives in an emergency.

Operations

- Establish formal, internal policies and procedures for and publicize an alternate ferry service operational schedule for foul weather and adverse environmental conditions (i.e. reduced visibility, high winds, excessive wave and/or current action, etc.)

  U.S. navigation law requires that foul weather and other adverse environmental operating conditions be considered when determining a safe vessel speed. Normal ferry service speed while operating in these conditions is not appropriate. Making sure the riding public is made aware of the impacts of these factors on ferry operations including necessitated changes to the schedule is crucial in order for customers to make the most informed decisions about their travel.

- Institute constant and continuous safety and security rounds by the deckhands while ferries are underway.

  GMATS observations indicate that deck crews do not make routine rounds for safety, security, and to enforce posted policies (e.g. smoking and alcohol consumption).

- Expand the content and delivery method of the existing passenger survey program.

- Accelerate schedule to uniform deckhands and all engine room employees; make distinction between oilers and CME/ME with traditional maritime uniforms.

  At present time, crew members are difficult to distinguish from passengers. In a crisis, the passengers will look for clear direction from uniformed crew members.

- Modify existing work schedules and crew exchanges for afloat personnel to provide for proper amounts of rest and to reduce fatigue.

  Current watch rotations and work schedules may be negatively impacting ability for crew to gain appropriate rest time to maintain the highest levels of alertness.

- Establish formal procedures and standing orders and develop methods for monitoring to ensure compliance with these procedures and orders.

  This will be part of the safety management system and subject to change based on a more thorough assessment and implementation of a bridge team organization. However, development of standing orders and procedures and a system to monitor compliance can be done now.

- Limit radio communications aboard the ferries (especially during approach, docking, and undocking evolutions) to operational necessities.

  GMATS observed communication exchanges between shoreside staff and afloat crew during critical operational periods described above. The substance of these conversations related to overtime and other administrative topical matters.

Other Areas

- Provide public safety and security resources for all vessels and terminals in the Staten Island Ferry system through formal arrangements with agencies to facilitate utilization of federal, state, and local law enforcement elements.

Management Position Description

Title: Chief Operations Officer – Staten Island Ferries

The Chief Operations Officer (COO) – Staten Island Ferry reports directly to the Deputy Commissioner, Passenger Transport Division, New York City Department of Transportation (NYCDOT). The COO provides the leadership and direction for the operation of Staten Island Ferry vessels and terminals. A key role of the COO is to ensure the Staten Island Ferry operates as a first-class marine transportation system that is safe, secure, fiscally sound, and environmentally sensible while providing superb customer service for the citizens of the City of New York and others who utilize the Staten Island Ferry marine transportation system.

Principal Duties and Responsibilities

1) Overall management and control of Staten Island Ferry system and NYCDOT terminal operations.
2) Direct activities of and provide policy direction and guidance to senior Staten Island Ferry management personnel, specifically, subordinate Directors of Finance, Human Resources, Maintenance, Marine Operations, and Terminal Engineering.
3) Manage appropriated funding to successfully accomplish Staten Island Ferry mission statement.
   a) Ensure adequate resources are made available to provide for an effective safety management system (SMS) and proper maintenance of vessel fleet and shore-side facilities, infrastructure, and equipment, and other NYCDOT-controlled assets.
   b) Protect existing funding sources and recommend alternative sources to ensure proper funds required to maintain and upgrade the Staten Island Ferry system.
   c) Identify areas of operational cost reductions, when feasible.
4) Provide overall direction for and ensure compliance with established safety management system (SMS).
5) Ensure safety, security, health, and environmental standards are met throughout the operation.
6) Promote and maintain a workforce culture of good order, discipline, high morale, and ethical soundness within the Staten Island Ferry system.
   a) Ensure NYCDOT policies and procedures are applied consistently and fairly within the Staten Island Ferry organization.
   b) Ensure all Staten Island Ferry system employees have working knowledge and understanding of all applicable NYCDOT policies and procedures.
   c) Meet with employees as necessary to clarify and discuss policy, procedures, and rules issues.

7) Facilitate continuous professional growth of Staten Island Ferry system employees through professional education, technical training, and mentorship programs.
8) Manage the Staten Island Ferry system in accordance with all applicable laws, regulations, and industry best practices.
   a) Maintain close liaison with the NYCDOT legal staff and obtain legal opinions on decisions as necessary.
9) Translate broad goals articulated by the NYCDOT Commissioner into Staten Island Ferry action plans.
10) Provide customer service levels commensurate with demand and goals.
11) Act as senior advisor on maritime matters to the NYCDOT Commissioner and/or Deputy Commissioner as well as other individuals or organizations as directed by the Commissioner.
12) Apprise the Commissioner of significant events and potential problem areas within the Staten Island Ferry system in a timely manner. Coordinate Staten Island Ferry system activities with key NYCDOT staff.
13) Promote and maintain close working relationships with federal, state, and local government agencies, including the U.S. Coast Guard and the Metropolitan Transportation Authority (MTA) – Staten Island Ferry system's intermodal connections.
14) Prepare and deliver testimony and reports as directed by the Commissioner.
15) In close coordination with the NYCDOT Offices of the Commissioner and Public Information, serve as primary representative of the Staten Island Ferry system to the public.
   a) Provide fast, factual, and frank information for response to media inquires.
   b) Speak at public functions representing the Staten Island Ferry system.
   c) Maintain liaison and facilitate positive working relations with key citizen and other stakeholder groups.

Knowledge, Skills, and Abilities

Education: Requires a college degree in operations management, business management, marine transportation, nautical science, marine engineering, or related discipline. Industry relevant work experience may be substituted for college degree.

License: United States Coast Guard license as Master or Chief Engineer.

Experience: Requires at least seven to ten years experience with a large passenger ferry system in a management capacity with significant experience in labor relations and contract negotiations. Requires at least five to ten years experience serving as either Captain and/or Chief Engineer aboard large passenger ferries.

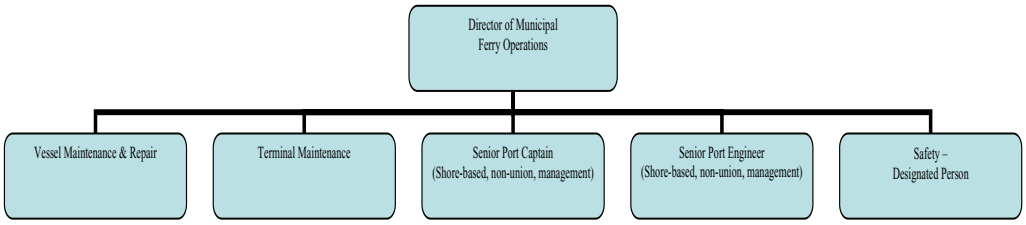
Specialized Knowledge:

1. Must have extensive knowledge of ferry terminal and ferry operations. This includes marine engineering and vessel maintenance and repair.
2. Must have a working knowledge of proven managerial and leadership principles, with the ability to influence other management team members and lead a department of technically proficient individuals.
3. Must have extensive knowledge of safety, health, and environmental issues as they affect the workplace, including all applicable regulatory schemes. Must be familiar with maritime and admiralty law.
4. Must have knowledge of safety management system principles, policies, and procedures and the ability to effectively implement them.
5. Must have working knowledge of budget preparation, financial management, and their applications. This includes an understanding of basic accounting, statistics, problem solving, goal setting, and business applications.

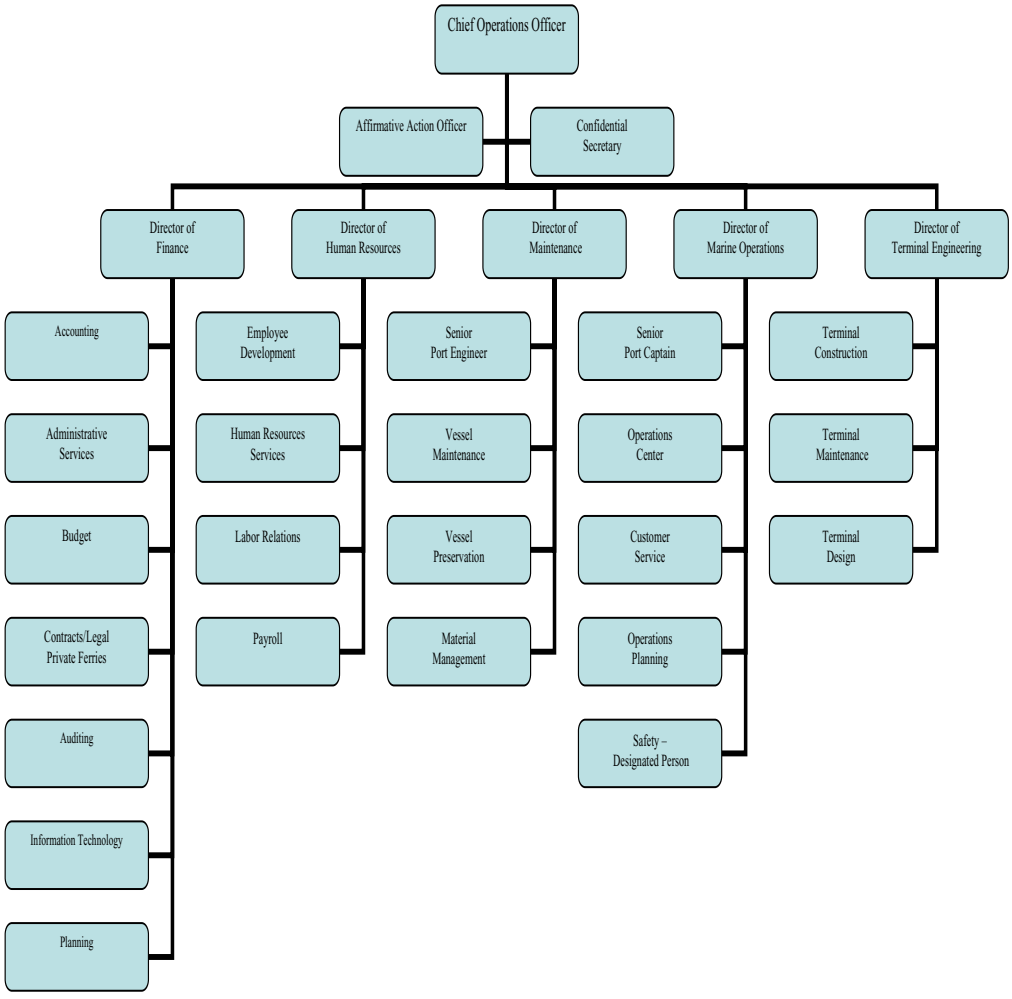
Skills:

1. Must be able to demonstrate strong leadership, influencing, and motivation skills.
2. Must have demonstrated negotiation skills.
3. Must be able to exercise sound business judgment in order to set direction and establish priorities.
4. Requires excellent managerial skills, including planning, organizing, and directing work.
5. Requires advanced level verbal and written communications skills in English, in addition to effective interpersonal skills.
6. Requires excellent analytical skills, including the ability to extract and analyze data.
7. Requires exceptional time management, due to fast-moving, demanding work environment.
8. Must be able to create and deliver effective presentations.
9. Must be able to exercise discretion and good judgment, with an ability to understand the effect of decisions in the overall organization.
10. Must be able to use a desktop and laptop computer and standard business software applications with ease.
11. Requires the ability to successfully represent the Staten Island Ferry system to the public, the City of New York, government agencies, and other stakeholders.
12. Requires the ability to positively interface with customers and employees with tact and courtesy.
13. Must be adept in corporate communications and public relations.

Sample Short-term Management Organization Matrix



Sample Long-term Management Organization Matrix



Management Position Description

Title: Senior Port Captain

Position Objective

Manage day to day marine operations including vessel traffic, licensed and unlicensed deck personnel, and facilities, to assure ferry system reliability and efficiency. Set standards for safety of crew and passengers in accordance with all applicable safety rules, regulations, industry standards, and best practices. Directly supervise and provide leadership to all deck department ferry personnel. Coordinate regulatory interaction with ferry system. Develop budget for input to Director of Municipal Ferry Operations.

This position reports to the Director of Municipal Ferry Operations

Qualifications

The Senior Port Captain must possess a wide range of operating knowledge of all the ferry systems. The position calls for inspired leadership to motivate shipboard and shore side personnel with an emphasis on regulatory agency compliance. Possess a strong background in a Safety Management System environment. Experienced in labor relations, negotiations and grievance resolution. Must be able to work within the community to develop good community relations.

Must possess a United States Coast Guard License as Master.

Nature and Scope

This is a mission critical position responsible for the day to day management of the Staten Island Ferry deck departments and deck personnel. This position supervises all phases of deck operations and personnel. As Senior Port Captain, responsible to coordinate all activities of vessels and operating personnel from an operational perspective. Candidate will interact with regulatory agencies and civil authorities to keep vessels and personnel in compliance with all known regulations. Will be the lead technical advisor to Director of Municipal Ferry Operations for labor negotiations. Will prepare budgets and supervise expenditures related to the deck department. Will directly oversee all operational functions including, but not limited to, certification of personnel. Is the first point of contact for issues relating to the deck department.

Principal Responsibilities

Manage day to day ferry system deck operations.

Maintain deck department crewing schedules within the framework of a Safety Management System.

Supervise deck department personnel and staffing on a 24 hour a day basis.

Approve labor, materials, supplies, equipment and parts within vessel deck department operating budgets.

Evaluate routine deck department work orders, stores requests and labor expenditures to assure they comply with budgetary constraints.

Manage vessel regulatory compliance for nautical and radio areas.

Be the technical advisor to the CEO for corporate communications involving the deck department.

Management Position Description

Title: Senior Port Engineer

Position Objective

Manage day to day engine department operations and maintenance, including facilities and personnel, to assure vessel propulsion system reliability and efficiency. Maintain vessels for safety of crew and passengers in accordance with all applicable safety rules, regulations, industry standards, and best practices. Directly supervise and provide leadership to licensed and unlicensed engine department professional marine engineers and oilers. Schedule vessel maintenance with Staten Island Ferry repair yard or commercial yards and direct routine vessel maintenance programs. Coordinate regulatory interaction with vessel engine departments.

This position reports to the Director of Municipal Ferry Operations

Qualifications

The Senior Port Engineer must possess a wide range of operating knowledge of engine room operation and maintenance practices of a large marine passenger ferry operation. The position calls for shipyard contract management experience with an emphasis on regulatory agency compliance. Possess a strong background in a Safety Management System environment. Experienced in labor relations, negotiations and grievance resolution.

Must possess a United States Coast Guard License as Chief Engineer.

Nature and Scope

This is a mission critical position responsible for the day to day management of the Staten Island Ferry engine rooms and personnel. This position supervises all licensed and unlicensed engine room personnel. As Senior Port Engineer, responsible to coordinate all maintenance items related to the vessels, to include commercial yard and repair facilities. First point of contact in dealing with regulatory agencies to keep vessels and personnel in compliance with all known regulations. Ensure vessels are crewed, stored and maintained to meet and complete Staten Island Ferries scheduled runs.

Principal Responsibilities

Manage day to day engine operations and maintenance.

Maintain vessels within the framework of a Safety Management System.

Supervise engine room personnel and staffing on a 24 hour a day basis.

Approve labor, materials, supplies, equipment and parts within vessel engine department operating budgets.

Evaluate routine work orders, stores requests and labor expenditures to assure they comply with budgetary constraints.

Manage vessel regulatory compliance.

Management Position Description

Title: Safety Manager/Designated Person

Position Objective

Directs the Safety Management System (SMS) for Staten Island Ferries and oversees the Corrective Action Reporting (CAR) Program and the SMS internal audit system. Manage the day to day coordination of the Safety Management System to ensure the Staten Island Ferries are in full compliance with the International Safety Management (ISM) Code for the Safe Operation of Ships and for Pollution Prevention. Supervise compliance with 46 CFR Subchapter W, Part 199.630, Alternatives for Passenger Vessels. Develops and supervises formal training of vessel personnel to comply with alternative provisions of the ISM Code.

This position reports to the Director of Municipal Ferry Operations and to the Deputy Commissioner as required by the ISM Code.

Qualifications

Thorough knowledge of all international and domestic regulatory requirements, application of marine safety management system programs and must possess a Master's or Chief Engineer's license. Knowledge of policies and procedures in the operation and maintenance of a large marine passenger ferry organization. Ability to plan strategic and effective positions for a successful and safe operating program.

Nature and Scope

This mission critical position is responsible for identifying and recommending solutions for SMS policy issues across the organization and has access to the CEO for SMS policy issues that demand the highest level of organizational action.

Principal Responsibilities

Functions as the Designated Person for Staten Island Ferries and directs the Safety Management System.

Is the key link between vessel and shore in Staten Island Ferries SMS program, holding authority to inspect all SMS records and work sites, hold drills and bring SMS problems to the attention of appropriate personnel.

Directs labor and non-labor budget planning and management for the Safety Office.

Participates in vessel casualty investigations.

Participates in investigations involving injury to passengers or crew.

Participates in investigations involving pollution of the environment.

Supervises the content of SMS documentation and advises the CEO of SMS matters that require the highest level of attention.

Oversees the Corrective Action Reporting System and conducts timely audits of vessels and terminals.

Keep current all formal training of Staten Island Ferry personnel to comply with SMS requirements.

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