NATIONAL TRANSPORTATION SAFETY BOARD
Office of Marine Safety
Washington, D.C., 20594

Operations Group Factual Report

Accident:	DCA-10-MM-017
Description:	Andrew J. Barberi allision with St. Georges Terminal Slip #5
Location:	Staten Island, New York
Date:	May 8, 2010
Time:	0918 Eastern Daylight Time
Location:	New York 40°-38.58' N, 074°-04.28'W
Owner/Operator:	New York City Department of Transportation
Complement:	18 crew, 2 concessionaires, 2 police officers, and 244 passengers

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Accident

Synopsis

At 0918[1] on Saturday May 8, 2010, the Staten Island Ferry *Andrew J. Barberi*, owned and operated by the New York City Department of Transportation (NYC DOT), was at the end of the third regularly scheduled trip from Manhattan to Staten Island when it allided with Slip #5 at the St. George, Staten Island Ferry terminal. The ferry was certified and inspected as a passenger vessel by the U.S. Coast Guard under Title 46 of the *Code of Federal Regulations* (CFR) (subchapter H). Eighteen crewmembers, two concessionaires, two New York City police officers, and 244 passengers were on board the ferry. Forty-eight passengers reported minor injuries.

The *Andrew J. Barberi* is a double-ended ferry whose symmetrical design allowed it to approach and leave its moorings without turning around. The end that docked in Manhattan is known as the New York end; similarly, the end that docked in Staten Island is called the Staten Island end. The sides of the ferry were referred to as the Brooklyn side and the New Jersey side.[2] The vessel is propelled by cycloidal propulsion units, one mounted at each end of the vessel (two diesel engines are coupled to each propulsion unit). The operator controls the vessel by manipulation of the three systems: athwartships pitch controls (New York and Staten Island ends) which is the equivalent of

[1] All times is eastern daylight time, based on the 24-hour clock.

[2] Thus, the starboard side on the trip to Manhattan was the Brooklyn side, while on the trip to Staten Island; the New Jersey side was starboard.

the ship's wheel, ahead/astern pitch controls (New York and Staten Island ends), engine speed in revolutions per minute (RPM) four engines.

Pre-Accident Events

The regularly scheduled work shift for the *Andrew J. Barberi* on Saturday May 8, 2010 was from 0630 to 1430. The crew conducted fire and man overboard drills from 0500 to 0600. The pilot house received control from the engine room at 0605 and the vessel got underway at 0630 for its first trip of the day.

At 0901, the *Andrew J. Barberi* departed Whitehall, at the south tip of Manhattan, on the third regularly scheduled, approximately 22-minute trip to St. George, Staten Island. The vessel was under the command of a Captain and staffed with an Assistant Captain, three mates, two engine officers, three oilers, seven deckhands, and a ladies' room attendant. Two concessionaires and two New York City Police Department (NYPD) officers were also on duty but were not part of the vessel crew.

The *Andrew J. Barberi* had identical pilothouses at either end. According to ferry officials, Captains typically operate the ferry on the trips from Staten Island to Manhattan, and the Assistant Captain, on the returns from Manhattan to Staten Island. The operator who had controlled vessel into the dock (the Captain or Assistant Captain) would maintain propulsion control in the pilothouse while passengers disembarked and embarked. Just before departure, that operator would transfer vessel propulsion to the operator in the departing pilothouse.[3] In Manhattan at 0901 the Captain transferred vessel control from the New York end to the Assistant Captain in the Staten Island end and the

[3] See "Vessel Information" section for more information on the transfer of vessel propulsion.

vessel got underway. At 0902 the Assistant Captain put the ahead/astern pitch controllers and the throttle (RPM) to full ahead. The pilot house team consisted of the Captain (in-command), Assistant Captain (operator), Mate and a deckhand serving as the lookout. AIS shows the vessel maintained its routine operating speed of 16-17 knots.[4]

AIS shows at 0916 the ferry pass abeam the buoy at the entrance to the Kill Van Kull waterway (the KV buoy), which is about 1,000 yards from the St. George terminal on Staten Island; and the Assistant Captain begins a series of engine speed and ahead/astern pitch reductions making the approach to Slip #5. The Mate turns off the AIS (transmit silent mode – on) at 0917 and the vessel's speed is 15 knots. At 0918, as the vessel is in open water within one boat length from entering the racks of the Slip #5, the Assistant Captain has both ahead/astern pitch control levers in the full astern position, where they remain until the impact 29 seconds later (the Assistant Captain pushed the levers downward in the full astern position several times before the allision). At the same time, the Captain is standing behind the Assistant Captain, his arms jerk upward and he steps forward to the control console. As the vessel enters the racks, the Captain advances the throttles, engine speed RPM, in the maximum position where they remain until the impact. The Captain stated he did this so the vessel could 'bite the water' or react faster to the astern pitch command.

Several crewmembers told the Safety Board that, as the vessel entered the racks, it was apparent that the vessel's speed was much faster than previously experienced. Some crewmembers on deck stated they could feel the vibrations and hear changes in engine noise audible throughout the vessel consistent with preparation for docking, a sound

[4] The vessel not required, and was not equipped with a vessel data recorder (VDR).

change that they had come to expect before arriving at Staten Island and Manhattan, but the vibrations and engine noise just did not 'feel normal.' Other crewmembers on deck did not feel or hear changes in the engine speed.

The Allision

The allision occurs twenty seconds after the vessel enters the slip. During this time, the Captain sounded the danger signal on the ship's whistle, the Mate made an announcement on the public address system: "brace, brace, brace", and the Assistant Captain continued to operate the vessel: steered the vessel's Staten Island/New Jersey end to make contact with the northern rack nine seconds before the allusion, in an intentional effort to slow the vessel. The ship allided with the transitional bridge ramp (bridge), the north concourse level upper passenger bridge (apron) and the concrete sides of the slip. The pilot house team braced for collision seconds prior to the allision. The Assistant Captain did not leave the operator's station with hands on the controls (left hand on the NY athwart ships control, and right hand on the ahead/astern pitch control and crouches down at his station a moment before impact. The transitional bridge ramp can be seen in the pier security video being pushed out of its cradle, as designed, and coming to rest after striking a security fence approximately 3 yards away. The northern apron can be seen as it is struck, thrown into the air and coming to rest on the Hurricane Deck, one level above its normal debarkation position.

The crewmembers who could see the impending collision estimated that they had several seconds to move the passengers away and to sit on the deck to brace themselves just before the impact.

A shipboard security camera video recording of the bridge team was recovered. The recording does not have any audio portion and was from a fixed vantage point on the Brooklyn side looking toward the conning station. It depicts the actions taken by the deck officers at the controls for the entire trip from Manhattan to Staten Island.

Post-Accident Events

After the allision, the Assistant Captain moves the ahead/astern pitch controls to a position at or just above neutral (dead slow ahead). Amber engine warning lights can be seen illuminating on the console and the Assistant Captain reduces the throttle settings. The Captain makes a cell phone call and the Assistant Captain responds to a sound-powered phone[5] call from the engine room.

Responders can be seen in the terminal within a minute after the allision, NYPD responders can be seen on the damaged Northern apron 6 minutes after the allision, and entering the pilot house 21 minutes after the allision.

From interviews with the crewmembers, the crew immediately began first aid on passengers and the shore side responders rigged a gangway to allow first responders access to the vessel and evacuate passengers.

Personnel Information

The *Andrew J. Barberi* had a crew of 18 (in the 2003 accident, the ferry had a crew of 15) consisting of a Captain, an Assistant Captain, three Mates, seven deckhands,

[5] 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.

one chief engineer, an assistant engineer, three oilers, and a female bathroom attendant;[6] two food concession attendants, not considered crewmembers, were employed on the vessel, as well as two NYPD officers assigned to the vessel for security purposes.

Captain

The Captain is a 27 year old male resident of Bolton Landing, New York. He graduated from the State University of New York Maritime College in 2005 and has been employed by the NYC DOT since August 2005. He started as a Mate, obtained his First Class Pilot license in October 2008 and was promoted to Assistant Captain in April 2009. He served as Assistant Captain on the Andrew J. Barberi for "hundreds" of trips. The Captain completed all qualification requirements and was issued his USCG Master's license on 30 December 2009. He completed the NYCDOT Ferry Division's six week master familiarization training prior to being assigned the Captain position onboard a ferry. The allusion occurred on the second day of his assignment as Captain.

At the time of the accident he held the new Coast Guard Merchant Mariner Credential issued on December 30, 2009 and valid until December 30, 2014. The terms of the applicable domestic section of the MMC were as follows:

> Master of any gross tons upon inland waters of any gross tons. Radar observer (unlimited).
>
> Third Mate of steam or motor vessels of any gross tons upon oceans. Radar observer (unlimited).
>
> First class pilot of vessels of any gross tons upon the New York Harbor, Upper Bay from the Narrows to the Battery. Radar observer (unlimited).[7]

[6] Position title.

The Captain also has STCW endorsements as master and as officer in charge of a navigational watch (Third Mate).

The Captain's annual merchant mariner physical examination report (required for First Class Pilot) was dated was dated October 12, 2009, and valid until October 12, 2010. The Captain's radar observed (unlimited) was dated October 23, 2009, and valid until October 23, 2014.

On Wednesday May 5, 2010 he worked the evening shift from 1330-2130 and conducted fire and boat drills; he went to sleep around mid-night. Thursday May 6, 2010 was a day off and he woke up at about 0800. He went rock climbing with his fiancé and went to sleep at 2100. On 07 May, his work hours were from 0430-1430. He was assigned onboard the Samuel Newhouse which operated from 0600-0915. He then reported to ECDIS training at the NYCDOT Ferry Division simulator room. The training ended at 1400 after which he clocked out at 1430. He went to sleep at 2000. On Saturday May 8, 2010, the day of the accident, he woke up at 0430, reported to work at 0500; he states that he conducted fire and man overboard boat drills. He indicated that he was taking no medications, prescription or over the counter. He exercises and competes in triathlons (run, bike, swim).

Assistant Captain

The Assistant Captain is a 47 year old male naturalized U.S. citizen originally from Karachi, Pakistan and now a resident of Flushing, New York. He graduated from

[7] 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."

the Pakistan Maritime College in 1982 followed by cadet sea service with the Pakistani National Shipping Company. He immigrated to the U.S. and after a series of odd jobs; he was employed by Miller Towing: three years as a deck hand, obtaining his U.S. Coast Guard 100 ton master's license and worked as a Captain for two years. He has been employed by the NYC DOT since June 2004, starting as a deck hand and subsequently being promoted to Mate and then Assistant Captain.

At the time of the accident he held the new Coast Guard Merchant Mariner Credential issued on March 11, 2010 and valid until July 10, 2013. The terms of the applicable domestic section of the MMC were as follows:

> *Master of steam or motor vessels of not more than 100 gross registered tons (domestic tonnage) upon Inland Waters. Radar observer (unlimited).*
>
> *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 George Washington Bridge; East River, from The Battery to Execution Rocks (including Hempstead Harbor); Kill Van Kull, Robbins Reef to Elizabethport. Radar observer (unlimited).*

The Assistant Captain's annual merchant mariner physical examination report (required for First Class Pilot) was dated December 30, 2009 and valid until December 30, 2010. The Assistant Captain's radar observed (unlimited) certificate is dated November 10, 2006.

The Assistant Captain works a 4-day on/3-day off work schedule. 4-6 May 2010 (Tuesday through Thursday) were off days and 7-10 May 2010 (Friday through Monday) were work days. 72-hour profile: On Wednesday May 5, 2010 he woke up around 1100/1200, it was a day off and he relaxed around the house. He did not state what time he went to sleep but said he had a good night's sleep. Thursday May 6, 2010 was a day

off and he woke up around 1100/1200 and relaxed around the house. On Friday May 7, 2010 he woke up at 0330, has an hour commute and worked from 0600 to 1530. He conducted steering verification drills that morning, was at home by 1700 and went to bed around 1900/1930. On Saturday May 8, 2010, the day of the accident, he woke up at 0300/0315 and started work at 0500; he states that he conducted fire, boat and man overboard drills. He indicated that he was taking no medications, prescription or over the counter.

Mate #3

The three mates rotate positions throughout the day. The duties of the mate in the pilot house are to assist with pre-arrival preparations, communications and as an extra lookout. The Mate in the pilot house at the time of the accident is a 23 year old male resident of Westbury, New York. He graduated from the U.S. Merchant Marine Academy in 2008 and has been employed by the NYC DOT since January 2010. He started as a deck hand and subsequently was promoted to Mate.

At the time of the accident he held a U.S. Coast Guard license issued on June 16, 2008 and valid until June 16, 2013. The terms of the license were as follows:

> *Third Mate steam or motor vessels of any gross registered tons (domestic tonnage); gross tons (ITC) upon oceans. Radar observer (unlimited) expires: June 2013.*

The Mate also has a STCW endorsement as officer in charge of a navigational watch (Third Mate).

On Wednesday May 5, 2010 he worked from 0500 to 1300; he did not remember what time he went to sleep or woke up. Thursday May 6, 2010 was a day off and he relaxed. On Friday May 7, 2010 worked from 0630 to 1530. After work, he went to the

gym, then had supper and went to sleep around 2130/2200. On Saturday May 8, 2010, the day of the accident, he woke up at 0300; he was onboard the ferry and conducted start-up checks with Mate #2 from 0430-0500. He states the Captain and the Assistant Captain came aboard at 0500. He stated that he takes Claritin for allergies.

Deckhand #7

The deckhand serving as lookout in the pilot house at the time of the accident is a 47 year old male resident of Staten Island, New York. He was raised in Grenada, West Indies and served in the U.S. Navy as a Petty Officer Second Class Boatswain's Mate for three and a half years on the USS *Niagara Falls* and the USS *Wichita*. He has been employed by the NYC DOT as a deckhand for 19½ years. He is not required to and does not have a U.S. Coast Guard issued mariner credential.

He stated that he was on the main deck during the 2003 Andrew J. Barberi allision and has noted many changes in the NYC DOT such as Safety Management System and weekly/monthly training drills.

On Wednesday May 5, 2010 he doesn't remember what time he woke up, but it was a day off and he spent the day doing house work and yard work; and he went to sleep before mid-night. On Thursday May 6, 2010 with about 7 or 8 hours of sleep he woke up around 0700/0800. This was also a day off stayed at home that day relaxing; and went to bed around2200. On Friday May 7, 2010 after 7 hours and 30 minutes sleep he woke up at 0530 and worked that day from 0630 to 1530. After work, he visited his daughter and went to sleep at 2200. On Saturday May 8, 2010, the day of the accident, after 6 hours of sleep he woke up at 0400; his work schedule was from 0500 to 1500. He stated that the

vessel conducted fire and man overboard drills the morning of the accident. He denies taking any medications.

Vessel Information

Construction and Equipment

At the time of the accident, the NYC DOT operated eight vessels in four ferry classes, the *Molinari, Barberi, Austen, and Kennedy* classes, which differed in the year when they were designed and constructed as well as in their design, capacity, and other features.[8] The two largest ferries, the *Andrew J. Barberi* and its sister vessel, the *Samuel I. Newhouse*, both passenger-only vessels, composed the *Barberi* class. The *Andrew J. Barberi*, built by Equitable Shipyards of New Orleans, was certified in 1981 and entered service the same year. Its overall length was 310 feet, its beam was 70 feet, and it had a draft of 12 feet, 6 inches. It displaced 2,721 long tons[9] and could accommodate 6,000 passengers.

The *Andrew J. Barberi* was a double-ended ferry, whose symmetrical structure, both above and below the waterline, allowed it to perform equally well in both directions. That is, the ferry could approach and leave the dock without turning around. The vessel had four decks, from low to high referred to as the main, saloon, bridge, and hurricane decks. Passengers were not permitted on the hurricane deck, where the two pilothouses were located. Passengers embarked and disembarked on the main deck and on a platform midway between the main and saloon decks, referred to as the upper embarkation level.

[8] *Staten Island Ferry*, www.nyc.gov/html/dot/html/ferrybus/statfery.shtml#fleet New York City, Department of Transportation, accessed September 6, 2010.

[9] One long ton = 2,400 pounds.

The main deck accommodated 1,630 seated passengers, arranged on longitudinal seats on the centerline and outboard seats and on transverse seats in the remaining areas. The saloon deck accommodates 1,212 passengers. The bridge deck accommodated 784 seated passengers on longitudinal seats on the centerline and outboard sides of the interior longitudinal bulkheads and transverse seats in the remaining areas.

Four General Motors EMD 16-645E6 diesel engines, two at either end, powered the vessel. The engines were coupled to each end's 3,500-horsepower Voith-Schneider cycloidal, five-bladed propellers that provided both propulsion and steering. Both forward and aft propulsion systems could be controlled from either pilothouse or from the engineroom. Two individuals, one in the sending station and one in the receiving station, were needed to transfer control from one location to the other. The person in the sending station pressed a transfer button and notified the individual in the receiving station that this task had been accomplished, at which time the person receiving control pressed an "accept" button in his or her station to complete the transfer operation.

Data from sea trials posted on the maneuvering diagram in the pilot house showed that the vessel could come to a complete stop, crash-stop from half-ahead, in 35 seconds and a distance of 420 feet. The maneuvering information was collected in the following conditions: calm weather, no current, water depth twice the vessel draft, clean hull and normal draft/trim. Normal vessel speed at half-ahead was 8.7 knots and at full-ahead was 15.9 knots.

Navigation equipment in the pilothouse consisted of a global positioning system (GPS) unit, two short range (x-band) radars (equipped with an automatic radar plotting

aid [ARPA] that automatically provides course, speed, and closest-point-of-approach information for other vessels), an automatic identification system (AIS), a gyrocompass, and a magnetic compass. The equipment did not include a fathometer for determining the water's depth below the keel. Both master radars are located behind the operator's control station, out of his field of view. Radar repeaters are installed on the forward overhead on each side of the operator's control station.

Certification and Inspection

The *Andrew J. Barberi* was certified by the Coast Guard as a large passenger vessel under 46 CFR parts 70-80 (subchapter H). The Coast Guard issued a certificate of documentation on September 21, 2009, and a certification of inspection (COI) on July 23, 2009.[10] A satisfactory 3rd quarter inspection was conducted on April 15, 2010 and is transcribed on the COI. One CG835 was issued on the quarterly inspection for improperly labeled circuit panels; the nonconformity was cleared on April 29, 2010 and there were no outstanding nonconformities at the time of the accident. A classification document was issued to the vessel by the American Bureau of Shipping on October 15, 2007.

Waterway Information

[10] Large passenger vessels carrying more than 12 passengers for hire may not operate without a valid Coast Guard COI, which is issued by the Coast Guard Officer in Charge, Marine Inspection, for the zone in which the boat operates. The COI, among other conditions, stipulates minimum firefighting, lifesaving, and crew requirements. When determining the number and competencies of the crewmembers, the Officer in Charge, Marine Inspection, considers many factors, including the size of the vessel, its route, the type and horsepower of the vessel's propulsion machinery, the number of passengers, the type and location of lifesaving equipment, and the hazards peculiar to the route and service

The Port of New York and New Jersey is the 3rd largest U.S. port in total trade and the world's 28th busiest port by total cargo tonnage.[11] Its harbor is divided at the Narrows into the lower bay and the upper bay.

The 5.2 nautical mile route of the *Andrew J. Barberi* was between St. George, Staten Island and Whitehall Street, Manhattan, in the upper bay of the harbor. The Whitehall Street terminal was on the East River side of the Battery, located at the southern tip of Manhattan, at the junction of the East River and the Hudson River. Because of the terminal's location, ferry operators were required to execute a 90º turn to the left to enter the ferry slips, and conversely, a turn to the 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 Channel Junction Lighted Whistle Buoy KV[12] (KV buoy) a red and green banded buoy, composite group-flashing red light, RACON "K", which marked the north side of the entrance channel into the Kill van Kull.[13] 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 one-half nautical mile or 1,000 yards, and the distance from Whitehall to the KV buoy was about 4 miles. Lighted buoys marked the channel.

[11] Source: *U.S. Port Ranking by Cargo Tonnage (2008) and World Port Ranking (2008)*, American Association of Port Authorities, http://www.aapa-ports.org, accessed September 6, 2010.

[12] *U.S. Coast Guard Light List Volume II Atlantic Coast (2010)*, U.S. Department of Homeland Security, U.S. Coast Guard Navigation Center, www.navcen.uscg.gov, Alexandria, VA, accessed September 7, 2010.

[13] 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 used between the KV buoy and the St. George ferry slips.

Tides & Currents: On the day of the accident, high water at the Battery reference station was 4.1 feet at 0438, and low water was 0.8 feet at 1006. Slack water at the Narrows reference station was at 0648, and a maximum ebb current of 1.7 knots at 1016.

Vessel Traffic Service: The Coast Guard operated and maintained a Vessel Traffic Service (VTS) to facilitate the orderly flow of vessels on the waterways in the Port of New York and New Jersey. The vessel traffic center was located at Ft. Wadsworth on Staten Island and was staffed continuously by Coast Guard personnel. 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. In the NY VTS area, automated reporting is allowed, vessels equipped with an Automatic Identification System (AIS) are required to make continuous, all stations, AIS broadcasts, in lieu of voice Position Reports; and vessels on a published schedule and route are exempt from reporting.[14]

The watch supervisor stated that VTS monitors ferry traffic on VHF channel 14. He was first informed of the accident from members of the New York Fire Department investigating an unrelated accident, and from a U.S. Coast Guard reservist who works part-time at the VTS and was called to respond to the accident in her capacity as a full-time civilian EMT. The watch supervisor called the ferry office to inquire about the

[14] *U.S. Coast Guard Vessel Traffic Service New York User's Manual (May 2010),* U.S. Department of Homeland Security, http://homeport.uscg.mil, Port Directory, Waterways Management, 04, Vessel Traffic Service New York, accessed September 6, 2010.

accident. The NYC DOT Division Staff (Director of Ferry Operations) made contact with the USCG Command Center at 0933 and provided details of the event to the USCG Command Center Watch Officer.

Meteorological Information

Marine Forecast: According to National Weather Service marine forecast was issued for New York Harbor at 0352 EDT on the day of the accident: *a warm front associated with the low approaching from the west will lift through the waters this morning…gale warnings in effect through Sunday afternoon. Southerly winds 10 to 15 knots with gusts up to 20 knots early, becoming southwesterly 15 to 20 knots with gusts up to 30 knots late this morning...waves 1 to 2 feet…showers and thunderstorms likely this morning…visibility 1 to 3 nautical miles this morning.*

Surface Observations: At 0911 EDT Newark Liberty International Airport approximately 5 miles northwest-west of the accident site reported calm wind, visibility of 10 miles or greater, light rain, trace amount of hourly precipitation, scattered cloud bases at 2,000 feet, broken ceiling at 2,900 feet with cumulonimbus present moving northeast, overcast cloud base at 7,000 feet temperature of 17˚ C (62˚ F) with a dew point of 10˚ C (50˚ F), an altimeter setting of 29.53 inches (1000.00 mb) of Mercury. At the time of the accident, the National Ocean Service Water Level Observation Network buoy ROBN4 located at Robins Reef, NJ, approximately 0.84 miles north-northeast of the accident site reported air temperature 61˚ F, wind direction from 293˚, wind speed of 2 mph and gusting to 3 mph. The water temperature at Bergen Point West Reach, NJ, approximately 3.4 miles west of the accident site was 16.1˚ C (61˚ F).

Weather Radar: The closest weather radar to the accident location was at Upton, NY, located approximately 56 miles to the east-northeast of the accident site. The radar imagery from 0919 EDT indicated that light to moderated precipitation was within the immediate vicinity of the accident location, however only very light intensities were observed at the accident site near the accident time.

Astronomical Data: 0516 civil twilight, 0546 sunrise, 1253 local apparent noon, 2000 sunset, 2030 civil twilight.

Crew Toxicological Testing

Shortly after the accident, the *Andrew J. Barberi* crew, submitted saliva and urine specimens to the Coast Guard for toxicological testing. All results were negative for alcohol and the five drugs of abuse that the U.S. Department of Transportation (US DOT) screens in postaccident testing (marijuana, cocaine, opiates, amphetamines, and phencyclidine [PCP]). In particular the Captain's alcohol and drug samples were taken at 1022 and 1510; the Assistant Captain's alcohol and drug samples were taken at 1026 and 1200; Mate #3's alcohol and drug samples were taken at 1033 and 1215; deckhand #7's alcohol and drug samples were taken at 1028 and 1154; and the chief engineer's alcohol and drug samples were taken at 1124 and 1528.

Additional Information

Coast Guard Oversight of Staten Island Ferries

The *Andrew J. Barberi* was constructed and certificated as a passenger vessel, subject to 46 CFR subchapter H.[15] The Coast Guard was given the authorization to oversee U.S. flag vessels that charged passengers a fare to board, under 46 *United States Code* (U.S.C.) 3301.[16] On July 1, 1997, the NYC DOT eliminated the fares that it had been charging its passengers, to integrate the New York City mass transit system into the "One City, One Fare" program. As a result, according to Coast Guard regulations, the operation of the ferries was considered to be carried out for public purposes. Consequently, the ferries were not subject to Coast Guard oversight.[17]

On September 17, 1997, the mayor of New York formally requested the Coast Guard to continue ". . . periodic maintenance inspections of the Staten Island Ferry boats . . ." On October 8, 1997, the Commander of the First Coast Guard District responded to the request, and indicated that the Coast Guard would "consider whether a statutory amendment to existing federal regulations is advisable or necessary to defuse any debates over whether the ferries are 'free.'" The Coast Guard determined that a memorandum of understanding (MOU) with the City of New York was the best method with which it

[15] Subpart 70.05-1: "This subchapter is applicable to all U.S.-flag vessels indicated in Column 3 of table 70.05-1(a) that are 100 gross tons or more, except as follows: (1) Any vessel operating exclusively on inland waters which are not navigable waters of the United States; or (2) Any vessel while laid up and dismantled and out of commission; or (3) With the exception of vessels of the U.S. Maritime Administration, any vessel with title vested in the United States and which is used for public purposes."

[16] "The following categories of vessels are subject to inspection under this part: (1) freight vessels, (2) nautical school vessels, (3) offshore supply vessels, (4) passenger vessels, (5) sailing school vessels, (6) seagoing barges, (7) seagoing motor vessels, (8) small passenger vessels, (9) steam vessels, (10) tank vessels, (11) fish processing vessels, (12) fish tender vessels, (13) Great Lakes barges, (14) oil spill response vessels."

[17] As stipulated in 49 CFR 70.05-1 (see above).

could continue its inspection authority and allow it to exceed its regulatory authority limits in overseeing the ferries.

On May 19, 1998, representatives of the Coast Guard and the City of New York signed an MOU, in light of the "mutual interest and concern for the safe operation of the Staten Island Ferries." The MOU states, "The parties have entered into this MOU to formalize procedures for developing standard operating procedures and agreements" between the Office in Charge of Marine Inspections, New York, and the NYC DOT, to improve passenger safety, the quality of ferry maintenance and operations and to 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 according to the document and the MOU would be "thoroughly reviewed periodically by each party."

Coast Guard safety oversight includes: 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. The *Andrew J. Barberi* was due to be inspected again on July 23, 2010.

According to 46 CFR 71.25-10, the Coast Guard examined the following areas in its annual vessel inspections:

> *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.

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,[18] required numerous changes to Staten Island Ferry operations to increase the level of both vessel and port security. The director of 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.

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

The same vessel was the subject of a previous National Transportation Safety Board investigation. 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 at the end of a regularly scheduled trip from Manhattan to Staten Island when it allided at full speed with a maintenance pier at the St. George ferry terminal. Fifteen crewmembers

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

and an estimated 1,500 passengers were on board. The assistant captain was at the controls but, for reasons that could not be determined, was unresponsive to cues of the impending allusion. Except for one deckhand, the crewmembers also did not recognize that the ferry was in danger. 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. Damages totaled more than eight million dollars, including the repair costs of $6.9 million for the Andrew J. Barberi and $1.4 million for the pier.

The National Transportation Safety Board determined 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. (NTSB/MAR-05/01) In response, NTSB issued Safety Recommendation M-05-01 to the NYC DOT on March 18, 2005 to:

Require your licensed pilots to provide proof of compliance with the Coast Guard medical certification requirements.

This Recommendation was CLOSED—ACCEPTABLE ACTION on May 29, 2006 after the NYC DOT implemented a system to (1) advise the date of the most recent physical (2) confirming that the physical was carried out according to Coast Guard regulations and (3) certifying that the individual is in good health and has no physical impairment or medical conditions that would interfere with the individual performing his or her duties.

New York City hired an outside consultant, the Global Maritime and Transportation School, to perform an assessment of the entire operation. The Safety Board issued Safety Recommendations to the New York City Department of Transportation to "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.)" In addition, "As part of your response to the Global Maritime and Transportation School assessment, fully comply with the technology-related recommendations…, and establish a recurrent evaluation process to assess the use of the navigation technology. (M-05-03)." New York City implemented procedures and installed additional technologies. These recommendations were resolved as "Closed-Acceptable Action" by the Safety Board in 2006.

Safety Management Systems

Safety management systems were developed in response to serious marine casualties, or to situations in which ship operators and owners could not be easily identified, or when ships' crews were not trained or empowered to take action to make the workplace safe or pollution free. International standards were developed by the International Standards Organization (ISO). Using the ISO codes as a guide, in 1993 the International Maritime Organization (IMO) adopted the International Management Code for the Safe Operation of Ships and for Pollution Prevention, also known as the

International Safety Management Code (ISM). According to guidelines on applying the ISM code,[19]

> A structured safety management system enables a company to focus on the enhancement of safe practices in ship operations and in emergency preparedness. A company that succeeds in developing and implementing an appropriate SMS should therefore expect to experience a reduction in incidents which may cause harm to people, damage to the environment or damage to property (such as the ship, its equipment and cargo).

The guidelines state further that

> Experience from within the shipping industry and from other industries has shown that a company may benefit further in terms of:
>
> - An improvement in the safety consciousness and safety management skills of personnel;
> - The establishment of a safety culture that encourages continuous improvement in safety and environmental protection;
> - Greater confidence on the parts of the clients; and
> - Improved company morale.

The Coast Guard formally endorsed the guidelines in NVIC No. 1-90, "Recommendation Concerning Management Practices for Safe Ship Operation and Pollution Prevention" (August 17, 1990) and formally endorsed the ISM code in 1994. July 1, 1998, was the deadline for signatories to SOLAS to implement safety management systems in all passenger ships, including passenger high-speed craft on international routes, compliant with the ISM code in chapter 9 of the international

[19] *Guidelines on the Application of the IMO International Safety Management (ISM) Code*, 3rd ed. (London: International Chamber of Shipping and International Shipping Federation, 1996), page 6.

convention. The Staten Island ferries were not required to comply because they operate on a strictly domestic route.

The safety management system outlined in the ISM code is a 13-point plan that requires owners and operators to do the following:

1. Establish a system and objectives.
2. Develop policies to address safety and environmental protection.
3. Outline company responsibilities and authorities.
4. Appoint designated persons capable of making decisions.
5. Outline the master's (Captain) responsibility and authority.
6. Ensure proper resources and personnel are provided.
7. Develop plans for shipboard operations.
8. Identify hazards and require development of plans for emergency operations.
9. Create a system of reporting and analyzing nonconformities, accidents, and hazardous occurrences.
10. Maintain the ship and equipment.
11. Establish a documentation system for compliance.
12. Establish company verification or auditing program.
13. Establish a certification and external verification audit program.

Some of the important milestones[20] for the NYCDOT's implementation of their Safety Management System are[21]:

- February 2004: GMATS report released
- May 2004: The NYCDOT Ferry Division Chief Operations Officer and the NYCDOT Ferry Division Executive Director of Safety and Security are appointed. Additional Senior Management positions are identified and hiring process is initiated for: Director of Ferry Operations, Senior Port Captain, Senior Port Engineer, Director of Ferry Engineering, Director of Terminal Operations, Director of Administration and Safety Manager/Designated Person.
- July 2004: Safety Management Systems, LLC (SMS LLC) is contracted by New York City Department of Transportation (NYCDOT) to perform a gap analysis of Staten Island Ferry to include a International Safety Management (ISM) Code Needs analysis and Project Plan.
- September 2004: Development and review of numerous processes and policies in support of ferry operations is initiated and continues throughout the calendar year.
- November 2004: The NYCDOT Ferry Division Safety Manager is appointed.
- January 2005: Policies are approved and implemented for pilot house operations for all Staten Island Ferry vessels. Also, an event tracking system is implemented to track employee reports of accidents, incidents, non-conformities and opportunities for improvement.

[20] NYCDOT-Ferry Division, Safety Management System Implementation Timeline, 03 August 2011

[21] Vessel audits not included in this summary

- March 2005: NTSB Report of 2003 Allision is released including recommendation for NYCDOT to adhere to the October 2005 target for implementation of a comprehensive safety management system.
- June 2005: Final drafts of SMS documentation are reviewed and approved for implementation and distribution to controlled locations.
- July 2005: SMS training conducted for all NYCDOT Ferry employees to include familiarization of newly implemented procedures.
- August 2005: Preventative maintenance software program is selected.
- September 2005: SMS and NYCDOT Ferry Division conduct first internal audit of the system.
- October 2005: Auditors from the American Bureau of Shipping conduct an audit of NYCDOT Ferry Operations for ISM Code Document of Compliance and Safety Management Certificates for five vessels that are in service.
- February 2006: SMS and NYCDOT conduct internal audit of the SMS.
- July 2006: Preventative maintenance system went live with inventory module.
- October 2006: ABS conduct annual verification audit of NYCDOT Document of Compliance
- June 2007: Preventative maintenance system phase 2A commenced to include vessels.
- October 2007: ABS conduct annual verification audit of NYCDOT Document of Compliance
- February 2008: Preventative maintenance system now includes terminals and shore side facilities.

- April 2008: Auditors from SMS ad NYCDOT conduct an internal audit and phase 4 of the preventative maintenance system is completed.
- October 2008: ABS conduct annual verification audit of the NYCDOT Document of Compliance.
- November 2008: Internal audit by SMS and NYCDOT
- April 2009: Internal audit by SMS and NYCDOT
- December 2009: ABS conduct annual verification audit of the NYCDOT Document of Compliance
- June 2010: Internal Audit by SMS and NYCDOT
- October 2010: ABS conduct annual verification audit of the NYCDOT Document of Compliance
- January 2011: NYCDOT Ferry Division conducts a major overhaul of the document that make up their SMS. Improvements include: consolidating manuals and making standard operating procedures more user friendly.

Assignments for Crewmembers in the Pilothouse:

As part of their implementation of a Safety Management System, NYC DOT issued their Staten Island Ferry Operations Manual (6th revision of 30-Oct-2008)). The Pilothouse Team Assignments Table – Section 4.1.2 for the Barberi Class – lists the following routine assignments:

Captain:

- *Supervise personnel assigned to the ferry to ensure the safety and security of passengers, personnel and vessel;*
- *Coordinate emergency and rescue responses as necessary;*

- *Safely navigate and operate the ferry according to the schedule;*
- *Upon docking, ensure the aprons and bridge are in the correct position to receive the ferry;*
- *Upon undocking, receive the signal from the Assistant Captain that the ferry is let go.*

Assistant Captain:

- *Assist the Captain in the safe and secure operation of the ferry;*
- *Advise the Captain of any weather or tidal conditions that may affect navigation;*
- *When the ferry is tied up, secure both pilothouses;*
- *Observe the disembarking and boarding of passengers to ensure that these procedures are orderly;*
- *When the ferry is loaded, the aprons are up and the Mate has signaled that the ferry is let go, signal the Captain and transfer controls;*
- *After the ferry has cleared the slip; complete log entries.*

Mate #3:

- *Assist Captain with vessel navigation as directed;*
- *Assist with pre-departure preparations (activate electronic navigation equipment) in offshore pilothouse;*

Deckhand #7:

- *As ferry approaches the slip, report to the operating Pilothouse and make the arrival announcements;*
- *After the ferry has docked and after passenger disembarking begun, depart Pilothouse and follow passengers picking up large refuse.*

NYC DOT Staten Island Ferry, Ferry Operations Manual (1st revision of 31-Mar-2006) Pilothouse Team Assignments Table – Section 4.2.2 provides more specific guidance for the navigation team:

Underway clear visibility:

a) the Operating Officer (OO)[22] *conducts safe navigation, collision avoidance, communications and conning*

b) Licensed deck officer (alternate OO or Mate) assist with navigation, collision avoidance and communications as necessary.

c) Deckhand[23] *perform lookout duties and assist as directed.*

d) In restricted visibility, additional licensed navigational deck officer will be designated to assist with navigation, collision avoidance and communications.

Arrival:

a) OO completes pre-arrival preparations; maneuver into slip; coordinate docking with Mate.

b) Licensed deck officer (alternated OO or Mate) assist with pre-arrival preparations.

c) Deckhand provide arrival announcement and perform lookout duties.

NYC DOT Staten Island Ferry Emergency Procedures Manual (6th revision of 18-Dec-2009) Ferry Emergency Response Standard Operating Procedures Propulsion & Steering Loss Response Procedures – Section 3.4 for the Barberi Class – other than Propulsion / Steering Unit:

1) Ensure all Pilothouse pitch gauges are at Zero position. Signal the engine room with one ring of the cowbell and communicate by use of the sound powered phone. The Chief Marine Engineer will transfer propulsion control to the engine room control mode.

2) The Captain will communicate the engine order commands and emergency steering commands through use of the emergency telegraphs.

[22] NYC DOT SIF SMS: only the Captain or Assistant Captain shall qualify whenever "OO" or "Alternate OO" is specified.

[23] NYC DOT SIF SMS: Wherever "Deckhand is specified – a Mate or other licensed deck officer may be provided to perform duties.

NTSB Recommendations on Safety Management Systems

In addition to the recommendations addressed to the NYCDOT, the Safety Board made a recommendation to the United States Coast Guard (M-05-006)[24]:

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 NTSB also issued a recommendation to the States (M-05-007)

The National Transportation Safety Board makes the following safety recommendation to you as Governor: 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.

On May 18, 2005, the United States Coast Guard concurred with (M-05-006) stating:

Industry studies have shown that such systems already attain a higher level of compliance and lower level of casualties caused by human factors when a true safety culture is made part of the company's management processes for all personnel. We will propose a legislative change extending the applicability of 46 USC 3202(a) to include US-flag ferries operating on domestic voyages; this will require compliance with 33 CFR Part 96 to implement safety management systems.

[24] NTSB Safety Recommendation M-05-006 Status by addressee

In response, the Safety Board classified this recommendation as Open—Acceptable Response on August 24, 2005. In July 2007, the United States Coast Guard submitted a legislative change proposal to amend 46 USC$3202(a) to cover U.S. flag ferries carrying more than 399 passengers and operating on domestic voyages and thus, require such vessels to implement safety management systems. The Coast Guard Authorization Act of 2008 (HR2830) failed to pass before the 110th Congress completed its session.

In a response to this action, the NTSB responded to the Coast Guard on August 27, 2009:

The NTSB is aware that in July 2007, the Coast Guard submitted a legislative change proposal to amend 46 United States Code 3202(a) to cover U.S. flag ferries carrying more than 399 passengers and operating on domestic voyages and, thus, require such vessels to implement SMS pursuant to 33 Code of Federal Regulations Part 96 but that the proposed legislation failed to pass before the 110th Congress completed its session. While supporting SMS on passenger vessels, the NTSB questions the 399 passenger threshold…The NTSB has not been able to determine a reason for that threshold and suggests that a smaller number might be appropriate. Coast Guard regulations do not distinguish between vessels with fewer than 399 passengers and those carrying more.

The legislation apparently combined the requirement threshold for VDR carriage and passenger vessel SMS. The NTSB letter of August 27, 2009 continues:

The NTSB articulated in a section-by-section analysis of the 2008 draft authorization a particular concern with the following statement: 'Finally, regarding the threshold number carrying more than 399 passengers there is alignment with the requirement found in the Coast Guard and Maritime Transportation Act of 2006.' The NTSB believes that there is no reason for such an alignment. VDRs and SMS are completely different concepts with different purposes and should not be linked to each other. VDRs are most useful in analyzing accidents; SMSs are most useful in preventing them…Accordingly, because the Coast Guard appears to seek legislative authority requiring SMS only on vessels carrying more than 399 passengers, in lieu of all ferry vessels as recommended" Recommendation M-05-06 was reclassified as OPEN—UNACCEPTABLE RESPONSE. On February 18, 2010, the National Transportation Safety Board placed M-05-06 on the Agency's Most Wanted List.

In the accident report: *Collision between U.S. Passenger Ferry M/V Block Island and the U.S. Coast Guard Cutter Morro Bay in Block Island Sound, Rhode Island on July 2, 2008* (adopted 12/3/2010), the National Transportation Safety Board reiterated Recommendation M-05-06, in part because the Interstate Navigation Company had declined the State of Rhode Island's request based on Safety Recommendation M-05-07, that the company voluntarily develop a safety management system.

In October of 2010, the Coast Guard Authorization Act of 2010 was enacted. (P.L. 111-281) amending 46 U.S.C Section 3202 gave the United States Coast Guard the authority to require safety management systems for US-flag passenger vessels, including ferries. On May 27, 2011, the United States Coast Guard wrote to the NTSB:

We are in the process of determining the appropriate requirements and applicability for safety management systems for U.S. flag passenger and ferry vessels. We will keep the Board informed of our progress.

In response, the Safety Board classified Recommendation M-05-06 as OPEN—ACCEPTABLE RESPONSE on July 7, 2011. The Board wrote:

The NTSB is pleased that, in the Coast Guard Authorization Act of 2010 Congress authorized the Coast Guard to require the implementation of SMS on domestic passenger vessels, including domestic ferries…The NTSB is opposed to the 399 passenger threshold specified in the Coast Guard's 2007 proposal to amend 46 United States Code 3202(a) to cover U.S.-flag ferries on domestic voyages…We continue to believe that the specified threshold is arbitrary and consequently, we advocate the implementation of SMS on all U.S ferries, regardless of passenger capacity.

The NTSB sent a letter to the United States Coast Guard on November 16, 2011 to inquire about the status of 29 open recommendations from 1995 and 2010, including M-05-06.

Addition of Technology to the Staten Island Ferries

In 2003, NYCDOT could only estimate the number of passengers aboard their vessels. In the event of an emergency, NYCDOT could not provide an accurate estimate. The *CountWise*® automated passenger counting system was installed in May 2008. By contract, the system's required accuracy is 95%. NYC DOT estimates that the system is 98% accurate. 100% accuracy is achieved by counting the number of persons entering the passenger waiting room on the departure side, then subtracting the number of persons

departing passenger waiting room after the ferry doors are closed. If required, the security cameras in the ferry terminal and onboard the ferry can be use to verify the presence of individual passengers.

Electronic chart systems (ECS) with automatic identification system (AIS) capability have been installed aboard the NYCDOT vessels as well as gyrocompasses and security cameras on the bridge. At each terminal, NYC DOT has installed weather stations to measure the wind speed and direction. This information is transmitted to the vessels and displayed on their ECS system, providing real-time information to the Captains and Assistant Captains to aid in their safe maneuvering at the terminals. The system can later include tide and current information.

NYCDOT has also constructed a dedicated simulator training facility at the Manhattan terminal. The simulator facility trains the crew for maneuvering in inclement weather, adverse currents and high traffic situations, radar, ARPA and ECS. Management also uses the facility to evaluate their crews' performance.

Carriage of VDR and S-VDR

Unless otherwise specified, the terms "voyage data recorder(s)" and "VDR(s)" used in this section also include simplified voyage data recorders, or S-VDRs. [25]SOLAS regulations require VDRs to be installed on all passenger vessels and on cargo vessels greater than 3,000 gross tons[26] but existing domestic regulations do not require VDRs on U.S. vessels that are not engaged in international voyages. The Andrew J. Barberi was

[25] A simplified VDR, or S-VDR, is not required to capture all of the parameters of a standard VDR but is permissible under the July 2006 amendment to SOLAS.

[26] SOLAS regulations are applicable to vessels on international voyages. SOLAS 74, Chapter V, Regulation 20.

not equipped with a VDR, or an S-VDR. As a result NTSB investigators had only limited information to work with in investigating this accident to document the status of the engine controls and speed of the vessel in relation to the input commands. There was a bridge security video, which did not capture audio and did not specifically capture the status of the bridge controls and indicators.

The NTSB has advocated the carriage of VDRs on ships in U.S. waters since 1976 when it made its first recommendation on this subject. Following the June 2, 1973 collision between the SS Sea Witch and the SS Esso Brussels in New York Harbor,[27] the NTSB issued Safety Recommendation M-76-8 to the Coast Guard:

Require the installation of an automatic recording device to preserve vital navigational information aboard oceangoing tank ships and containerships.

The Coast Guard responded that the information provided by recording devices was not needed when accident survivors could provide the information needed in an investigation and that the cost of the proposed equipment was not justified. Safety Recommendation M-76-8 was classified "Closed—Unacceptable Action" in September 1982.

Following the February 24, 1977 allision of the U.S. tank ship SS Marine Floridian with the Benjamin Harrison Memorial Bridge near Hopewell, Virginia, the NTSB issued Safety Recommendation M-78-2 to the Coast Guard:

[27] SS.C.V. Sea Witch-SS Esso Brussels Collision and Fire, New York Harbor, June 2, 1973, Marine Accident Report NTSB/MAR-75/06 (Washington D.C.: National Transportation Safety Board, 1975).

Conduct a formal study in coordination with the Federal Maritime Administration and the shipping industry to determine a standard array of operational and audio data that should be recorded automatically with a view to establishing a requirement for the installation and operation of suitable equipment in U.S. vessels over 1,600 gross tons built after 1965, and to submitting an initiative to Inter-governmental Maritime Consultative Organization (IMCO)[28] for the adoption of a similar requirement.

As a result of the 1981 NTSB special study Major Marine Collisions and Effects of Preventive Recommendations and in the interest of improving maritime safety and reducing the number of collision accidents, the NTSB issued Safety Recommendation M-81-84 to the Coast Guard:

Expedite the study to require the installation of automatic recording devices to preserve vital navigational information aboard applicable ships.

In its response to both recommendations, the Coast Guard stated that, while it generally supported the concept of recorders, costs and funding limitations prevented the Coast Guard from pursuing a voyage recorder project at that time. As a result, the NTSB classified Safety Recommendation M-78-2 and M-81-84 "Closed—Unacceptable Action in September 1982.

[28] The IMCO changed its name to the International Maritime Organization in 1982.

Following the November 6, 1993, collision between the passenger ship Noordam and the bulk carrier Mount Ymitos near Southwest Pass, Louisiana[29], the NTSB issued Safety Recommendations M-95-5 and -6 to the Coast Guard:

Require all vessels over 1,600 gross tons operating in U.S. waters to be equipped with voyage event recorders (M-95-5)

Propose to the International Maritime Organization that it require all vessels over 500 gross tons to be equipped with voyage event recorders. (M-95-6)

The Coast Guard stated in its response that it concurred with the intent of both recommendations, and Safety Recommendation M-95-6 was classified "Closed—Acceptable Action in April 2005. However, the Coast Guard also stated that its efforts to support international requirements for VDRs at IMO would be detrimentally impacted should the Coast Guard unilaterally impose VDR requirements on foreign-registered vessels operating in U.S. waters. As a result, the Board classified Safety Recommendation M-95-5 "Closed—Unacceptable Action" in February 1996.

In 1997, the IMO adopted performance standards for VDRs, and in 2000, adopted carriage requirements. These regulations, which came into force in 2002, required certain ships (including all passenger vessels) subject to SOLAS regulations to carry VDRs.[30]

[29] Collision of Netherlands Antilles Passenger Ship Noordam and Maltese Bulk Carrier Mount Ymitos, Gulf of Mexico, November 6, 1993, Marine Accident Report NTSB/MAR-95/01 (Washington, DC: National Transportation Safety Board, 1995).

[30] In December 2000, the IMO adopted carriage requirements for VDRs, which took effect in July 2002. In May 2005, the IMO adopted performance standards for S-VDRs. In December 2004, the IMO (MSC 79) adopted carriage requirements for S-VDRS, which took effect in July 2006.

In the Coast Guard and Maritime Transportation Act of 2006, enacted in the wake of the Andrew J. Barberi accident, Congress directed the Coast Guard to study the use of VDRs on ferries. The Act specified that the study should include an appraisal of the current standards for VDRs, the methods of approving VDRs, and the procedures for annual VDR performance testing. In its investigation of the issues, the Coast Guard conferred with the representatives of ferry vessel operating companies, the passenger vessel industry trade association, and navigation and VDR equipment manufacturers, and invited public comment to its docket for the project. Of the 43 comments in the public docket, only six including the NTSB's submission were in favor of installing VDRs on ferries.[31]

Based on its findings in its VDR report, particularly the significant costs associated with the use of VDRs, the Coast Guard recommended against requiring the use of VDRs or S-VDRs on ferries. In its report to Congress, the Coast Guard made three recommendations:

- Require these ferries to capture the type of information recorded by a VDR.
- Review electronic chart systems and AIS equipment to determine how they can be used or modified to capture the relevant information.
- Develop a performance standard that provides vessel owners and operators the flexibility to determine the best equipment to meet that standard considering other regulatory requirements.

[31] Collision between U.S. Passenger Ferry M/V Block Island and U.S. Coast Guard Cutter Morro Bay, Block Island Sound, Rhode Island, 2006. Accident Report, NTSB/MAR-11/01 (Washington, D.C: National Transportation Safety Board, 2010.)

In January 2010, the NTSB inquired with the Coast Guard about the status of the three recommendations that the Coast Guard made in its VDR report to Congress. The Coast Guard responded, in part, that it believed that electronic charting (whether an electronic chart system or an electronic chart display and information system (ECDIS) integrated with AIS and other navigation equipment can capture most of the information recommended in the VDR report. To that end, the Coast Guard stated that it was drafting new regulations for U.S. vessels that carry 50 or more passengers to have AIS and electronic chart systems. In addition, the Coast Guard reported that it was working with the international standards community to develop a new international standard (IEC 62376) that could be used to determine which type of electronic chart system could capture most of the information recommend in the report. The Coast Guard anticipated that the standard would be finalized in 2011.

As noted in the Coast Guard's VDR report, some electronic chart systems are able to record navigational data, such as position, course and route planning data. For those electronic chart systems designed to meet recognized industry performance standards, certain navigational data must be recorded for a period of at least 12 hours. The two recognized performance standards for electronic chart systems specify the same recording requirements: that is, that the electronic chart system must keep a record of the ship's actual track at 1 minute intervals and that, at a minimum, the record shall include the ship's positions, corresponding times, courses and speeds. They do not record commands. The standards specify that the electronic chart system shall prevent the record from being manipulated or changed and preserve it from being over-written, but they do not require

it to be in a standard (nonproprietary) format, nor retrievable by a standard connection.[32] In addition, the electronic chart system standards do not require the recording of radar imagery, bridge audio, or other ship-specific data specified in VDR and SVDR standards.

International performance standards for VDRS are undergoing revision at IMO, and it is anticipated that the revised standards will significantly improve the capabilities of recording equipment installed on new vessels.

In 2007, Transport Canada commissioned a cost/benefit analysis[33] in support of its work on a new regulatory requirement for VDRs on Canadian non-SOLAS domestic vessels. The analysis noted, among other things, the likely financial burden on small vessel operators of installing VDRs and the added technical difficulty and expense of installing VDRs on existing vessels. The analysis estimated that the 10 year costs to implement S-VDRs on existing passenger and cargo vessels (243) would about (267,000 Canadian dollars) per vessel. The analysis estimated that the monetary benefits of about 1 million Canadian dollars per year would accrue to the government as a result of cost reductions in accident investigations. Non-monetary benefits were increased safety, improvements in vessel design and operation, fewer lives lost in marine accidents, fewer accidents causing environmental damage, reduced litigation, and benefits to ship owners and operators, and satisfaction of public expectations for transportation safety. The analysis concluded that "the potential for benefits to outweigh the costs is greatest for

[32] In contrast, IMO performance standards for VDRs and SVDRs as amended by Resolution MSC.214 (81) specify that VDRs should provide a standard interface for downloading stored data and that the data be in a standard format or have software available to investigators.

[33] Transportation Safety Board of Canada (TSB) recommendation to Transport Canada to "extend the requirement for the carriage of VDRs /SVDRs to large passenger vessels over 500 gross tonnage and all other commercial vessels on an equivalent basis to those trading internationally." This was issued as a result of the 2006 grounding and sinking of the passenger ferry vessel Queen of the North.

passenger vessels because of the number of passengers carried and the potential to save lives." New Canadian regulations requiring the installation of VDRs on certain domestic vessels are expected to be published in May of 2011.

Previous NTSB Investigation Aided by Voyage Data Recorders

Information extracted from onboard VDRs has been helpful in several previous NTSB investigations.

On November 3, 2007, the Bahamas-registered tank ship M/T Axel Spirit allided with Ambrose Light, an aid to navigation, at the entrance to New York Harbor, as the ship was inbound to New Jersey.[34] The Master and the bridge team did not mention the allusion to the pilot who boarded the ship shortly, thereafter, nor did they notify the Coast Guard or the shipping company until after the Axel Spirit was docked and the Master ascertained that the ship had visual damage. He told investigators that he did not realize that the ship had hit Ambrose Light. However, when investigators reviewed the bridge audio recording captured by the ship's VDR, it was clear that the allusion was audible, alarms began sounding, and the Master reacted verbally to the impact.

On January 24, 2008, the Liberia-registered fruit carrier M/V Orange Sun allided with a moored dredge as the juice carrier was outbound in Newark Bay, New Jersey.[35] Initial reports suggested that the Orange Sun had experienced rudder failure when it veered off course and struck the dredge. However, when investigators reviewed the

[34] Allision of Bahamas-Registered Tank ship M/T Axel Spirit with Ambrose Light, Entrance to New York Harbor, November 3, 2007. Marine Accident Report NTSB/MAR-09/02 (Washington, DC: National Transportation Safety Board, 2009)

[35] Allison of the Liberia-registered Fruit Juice Carrier MV Orange Sun with U.S. Registered Dredge New York, Newark Bay, New jersey, January 24, 2008. Marine Accident Report NTSB/MAR 09/03 (Washington, DC: National Transportation Safety Board, 2009)

extracted wheel input and rudder response information from the juice-carrier's VDR, it was clear that the helmsman and the master had made incorrect wheel inputs, which they did not recall making. The NTSB also used VDR information when investigating the MV Crown Princess to determine the actions of the bridge crew when it heeled over off of Florida in 2006.

In its report on the collision between U.S. Passenger Ferry M/V Block Island and US Coast Guard Cutter Morrow Bay, Block Island Sound, Rhode Island, July 2, 2008, the NTSB concluded that "electronic chart systems and automatic identification systems do not provide the data recording capability of voyage data recorders and do not capture the level of detail required to identify causes of accidents." The report also concluded that "Flexible application of the voyage data recorder to existing ferry vessels would alleviate the burden of compliance for those vessels where it can be shown that recording the full set is not feasible." The Safety Board recommended to the United States Coast Guard to:

- Require installation of voyage data recorders meet the international performance standard on new ferry vessels. (M-10-5) and;
- Require installation of voyage data recorders on ferry vessels built before the enactment of voyage data recorder carriage requirements that will record, at a minimum, the same video, audio, and parametric data specified in the International Maritime Organization's performance standard for simplified data recorders. (M-10-6).