Collision Between U.S. Passenger Ferry M/V *Block Island* and U.S. Coast Guard Cutter *Morro Bay*
Block Island Sound, Rhode Island
July 2, 2008

Accident Report

NTSB/MAR-11/01
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National Transportation Safety Board

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Notation 8053A
Adopted December 3, 2010

Marine Accident Report

Collision Between U.S. Passenger Ferry M/V *Block Island* and U.S. Coast Guard Cutter *Morro Bay* Block Island Sound, Rhode Island July 2, 2008

National Transportation Safety Board

490 L'Enfant Plaza, SW
Washington, DC 20594

National Transportation Safety Board. 2011. ***Collision Between U.S. Passenger Ferry M/V*** **Block Island** ***and U.S. Coast Guard Cutter*** **Morro Bay,** ***Block Island Sound, Rhode Island, July 2, 2008*****. Marine Accident Report NTSB/MAR-11/01. Washington, DC.**

Abstract: This report discusses the July 2, 2008, collision between the Coast Guard cutter *Morro Bay* and the passenger ferry M/V *Block Island* on Block Island Sound. The ferry was carrying a total of 305 people and the cutter had 21 crewmembers on board. As a result of the collision, two passengers on the *Block Island* sustained minor injuries and were treated and released that same afternoon. The *Block Island* sustained about $45,000 in damage and the *Morro Bay* about $15,000.

Safety issues identified in this accident include failure to follow “rules of the road” in reduced visibility, ineffective use of the radars on board both vessels, and lack of safety management systems and voyage data recorders on U.S. passenger ferries.

As a result of its investigation, the National Transportation Safety Board makes new recommendations to the Coast Guard and the *Block Island*’s operating company, and reiterates an existing recommendation to the Coast Guard.

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Acronyms and Abbreviations

AIS	automatic identification system
CFR	*Code of Federal Regulations*
DGPS	differential global positioning system
ECDIS	electronic chart display and information system
ECPINS	electronic chart precise integrated navigation system
GPS	global positioning system
IEC	International Electrotechnical Committee
IMO	International Maritime Organization
ISM	International Safety Management
NOAA	National Oceanic and Atmospheric Administration
NVIC	Navigation and Vessel Inspection Circular
PA	public address system
RTCM	Radio Technical Commission for Maritime Services
SEOPS	special emergency operations and procedures
SINS	scalable integrated navigation system
SOLAS	International Convention for the Safety of Life at Sea, 1974
S-VDR	simplified voyage data recorder
TSB	Transportation Safety Board of Canada
U.S.C.	*United States Code*
VDR	voyage data recorder
VHF	very high frequency
VTS	vessel traffic service

Executive Summary

On Wednesday, July 2, 2008, about 1215 eastern daylight time, the 187-foot-long passenger and car ferry M/V *Block Island* collided with the 140-foot-long U.S. Coast Guard cutter *Morro Bay* in reduced visibility on Block Island Sound, about 4 nautical miles south of Point Judith, Rhode Island. The ferry, carrying 294 passengers, eight crewmembers, two concession stand employees, and one off-duty employee, had departed Point Judith about 25 minutes earlier and was traveling south, headed for Old Harbor on the eastern side of Block Island, Rhode Island. The cutter, carrying 21 personnel, had departed Naval Station Newport, Rhode Island, about 1015 and was traveling west, headed for Coast Guard Station New London, Connecticut. As the vessels approached the accident site, the visibility decreased due to fog. At the time of the collision, the crew on the *Morro Bay* estimated the visibility at about 500 yards.

As a result of the accident, the *Block Island* ferry sustained about $45,000 in damage and the *Morro Bay* about $15,000. Two ferry passengers were treated for minor injuries and released that same day.

Safety issues identified in this investigation include failure to follow “rules of the road” in reduced visibility, ineffective use of the radars on board both vessels, and lack of safety management systems and voyage data recorders on U.S. passenger ferries.

The National Transportation Safety Board (NTSB) determines that the probable cause of the collision between the ferry *Block Island* and the Coast Guard cutter *Morro Bay* was the failure of the bridge watch officers on both vessels to monitor their radars, sufficiently assess traffic, and compensate for limited visibility. Contributing to the accident was the failure of the bridge watch officers on both vessels to maintain a proper lookout and to sound appropriate fog signals.

As a result of its investigation, the NTSB makes new recommendations to the Coast Guard and to Interstate Navigation Co., and reiterates an existing recommendation to the Coast Guard.

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Factual Information

Accident No.:	DCA08FM023
Vessel No. 1:	M/V *Block Island*, U.S.-registered passenger and car ferry, official no. 1055424, 187.3 feet long, 98 gross registered tons, steel construction, built in 1997
Vessel No. 2:	USCGC *Morro Bay* (WTGB 106), "Bay" class tug/tender, official no. 1077537, 140 feet long, 1,485 gross tons, steel construction, built in 1981
Accident Type:	Collision
Location:	Block Island Sound, latitude 41° 17.535' N, longitude 71° 31.682' W
Date:	July 2, 2008
Time:	1215[1]
Owner No. 1:	Interstate Navigation Company
Owner No. 2:	U.S. Government, U.S. Coast Guard
Property Damage:	M/V *Block Island*: $45,000
	Morro Bay: $15,000
Injuries:	Two minor
Complement:	M/V *Block Island*: 294 passengers, 10 on-duty crewmembers and employees, and one off-duty employee
	Morro Bay: 21 crewmembers

Accident Narrative

On Wednesday, July 2, 2008, about 1015, the 140-foot-long Coast Guard cutter *Morro Bay* (figure 1) departed Naval Station Newport, Rhode Island, for a 5-hour transit to Coast Guard Station New London, Connecticut (figure 2). The *Morro Bay* was returning to its home port after completing a scheduled maintenance period for routine inspection and repair at Naval Station Newport during the month of June. The July 2 transit was the cutter's first voyage following the maintenance work.

[1] All times in this report are eastern daylight time based on the 24-hour clock.

Figure 1. Coast Guard cutter *Morro Bay*.

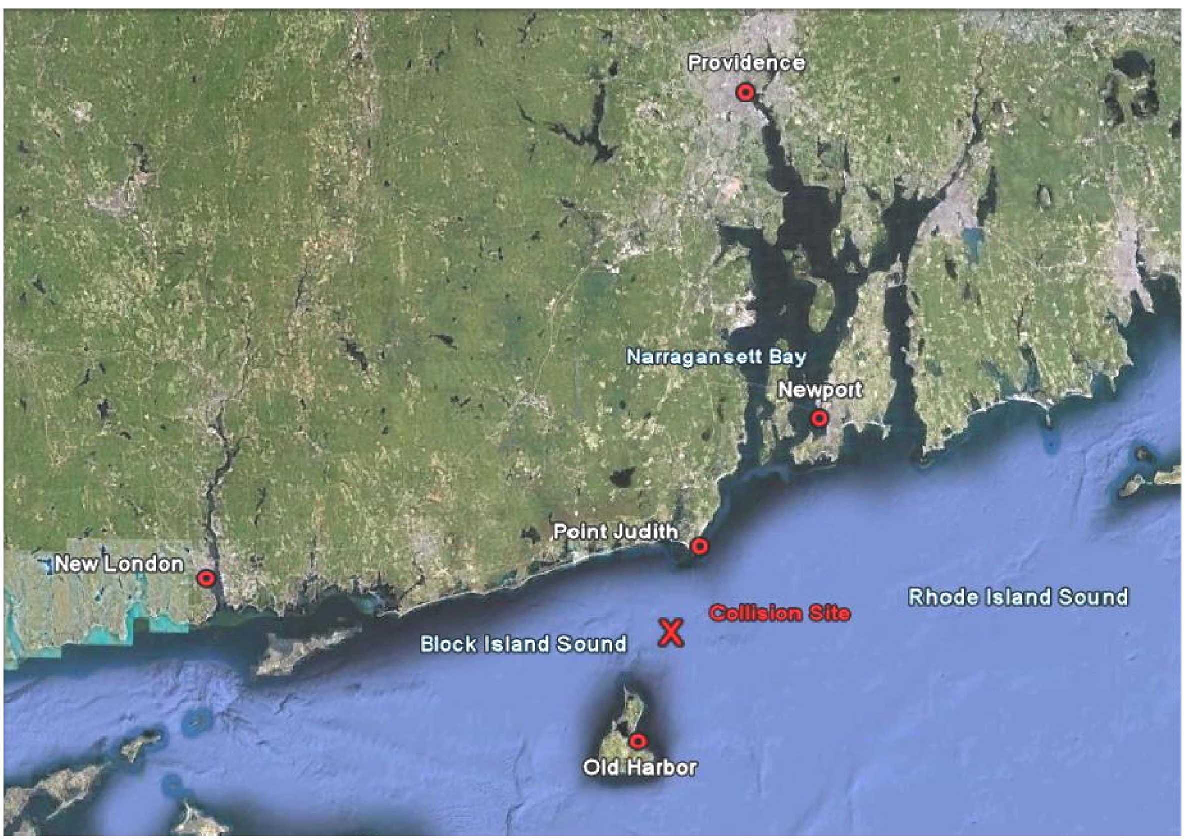

Figure 2. Aerial map of the location where the *Block Island* and the *Morro Bay* transited. The *Morro Bay* was traveling west from Newport to New London; the *Block Island* was traveling south from Point Judith to Old Harbor. Background by Google Earth.

On July 1, after the maintenance period was complete, a change of command ceremony had taken place. A new commanding officer[2] was assigned, and the July 2 transit was his first as commanding officer of the *Morro Bay*. About 0730 on the morning of the accident, he, along with the executive officer,[3] the chief boatswain's mate (chief),[4] and the cutter crew, boarded the *Morro Bay* at Naval Station Newport and began preparing to get under way at the scheduled departure time of 1000.

Neither the *Morro Bay* nor the *Block Island* ferry had voyage data recorders (VDR)[5] on board, nor were they required to. The chain of events and onboard activities described in this report are therefore based on crew and passenger interviews, electronic chart information, security camera video on the *Block Island*, and automatic identification system (AIS)[6] information, where available.

A pre-departure navigation briefing was held on the *Morro Bay* navigation bridge, which covered crewmember duties, engineroom and bridge equipment, and the plan for unberthing and transiting out of Newport Harbor and Narragansett Bay. According to the commanding and the executive officers, they reminded the crew that, because this was the vessel's first run since the maintenance period, great vigilance and attention needed to be paid to all operations. The crewmembers were instructed to speak up promptly should they notice anything wrong. Weather information from various sources had been received, and the commanding officer told investigators that he did not remember any mention of thick fog in the area, only radio conversations about "patchy" fog. No discussion took place regarding underway challenges beyond Narragansett Bay, such as crossing ferry routes.

On departing Newport, the navigational team consisted of the commanding officer, the executive officer, the chief, a quartermaster of the watch,[7] and a helmsman. The chief operated the throttle and gave helm orders to maneuver the cutter out of the harbor. The executive officer supervised the overall undocking operation. The quartermaster of the watch began plotting position fixes every few minutes. The commanding officer remained on the bridge and in overall command of the vessel.

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[2] On Coast Guard and Navy vessels, the commanding officer is in charge overall.

[3] The executive officer is the officer second in command.

[4] Boatswain's mates are skilled in all aspects of seamanship and are frequently in charge of patrol boats, tugs, and small shore units. Boatswain's mates may perform a significant number of tasks associated with the operation of small boats, including navigation, cargo storage, and handling of ropes, cables, and lines.

[5] A VDR maintains continuous, sequential records of data relating to a ship's equipment and its command and control, and captures audio from certain areas on the bridge and the bridge wings. For more information, see section "Voyage Data Recorders."

[6] AIS is a maritime communications system that automatically transmits vessel information. For more detail, see section "Automatic Identification Systems."

[7] Coast Guard quartermasters are assigned to all types of ships and serve on the bridge or in the chartroom (located adjacent to the bridge). Quartermasters know whistle, bell, and light signals, navigation rules, and visual communication, including blinker signaling and signal flags. Quartermasters can take bearings and soundings, plot courses, and alternate as helmsman. The quartermaster of the watch assists the officer on duty; supervises the performance of the helmsman; monitors changes in weather, temperature, and barometer readings; and makes appropriate entries in the ship's log.

As the *Morro Bay* was leaving the berth at Newport, the crew discovered that the cutter's rudder angle indicator[8] was off by about 5 degrees. The problem was resolved after a few minutes of adjustment, and the cutter got under way. While still in Newport Harbor, the crew experienced difficulty attaining the desired engine rpm, using the throttle. Again, the crew attended to and resolved the problem, and the *Morro Bay* resumed the transit. Thereafter, the passage out of Narragansett Bay was uneventful, with only some passing traffic and lobster pot buoys to clear. As the cutter entered Rhode Island Sound, the visibility, which had been good in Narragansett Bay, decreased to about 3 miles. As a result, at 1055, the bridge team turned on the cutter's navigation lights and, at 1059, activated an automatic fog signal setting on an onboard loudhailer to sound one prolonged blast every 2 minutes.[9] The chief told investigators that two of the bridge windows were open so that fog signals from other vessels also could be heard. According to the chief, the helmsman was serving as both helmsman and lookout. The chief also told investigators that "everybody [on the bridge] is a lookout."

The *Morro Bay* proceeded at about 12 knots on a southwest course. At 1115, the executive officer departed the bridge to tend to other duties, and the commanding officer and the chief remained on the bridge with the helmsman and the quartermaster. About 1120, the commanding officer and the chief noticed that the cutter's radar overlay and the electronic chart were out of alignment with each other and that the gyrocompass[10] was giving erratic readings. They ordered the helmsman to steer by magnetic compass[11] headings. The chief switched the radar to a "heads up" display.[12] The radar had been set to a "north up" display, but, because the gyrocompass was malfunctioning, the switch to "heads up" display was necessary. The chief called up two electrician's mates to troubleshoot the gyro problem. He told investigators that the radar range scale was set to 1.5 miles.

About 1130, the midday meal was announced throughout the vessel. On the bridge, numerous personnel changes began taking place. About 1145, the executive officer, who had left the bridge about 1115, returned to relieve the chief so that the chief could go below for lunch. The commanding officer remained on the bridge with the executive officer until about 1155, when the commanding officer went below for lunch. About noon, the chief returned to the bridge and took the watch from the executive officer. Before the commanding officer returned, the executive officer went below for lunch. Also about noon, the helmsman who had been steering the cutter since the departure from Newport was relieved for lunch, and another helmsman took his place. The quartermaster of the watch was also relieved for lunch by another crewmember. Also on the bridge at this time were the two electrician's mates who were assessing the problem with the gyrocompass, and a boatswain's mate first class who was there to observe and learn the

[8] Rudder angle indicators denote the actual position of the rudder.

[9] For more information on the loudhailer, which is a multipurpose device for audio amplification, see section "Vessel Information; *Morro Bay*."

[10] A gyrocompass has one or more gyroscopes as the directive element, which is north-seeking. Its operation depends on the earth's rotation, gravity, gyroscopic inertia, and gyroscopic precession.

[11] A magnetic compass uses the attraction of the horizontal component of the earth's magnetic field for a magnetized needle or sensing element free to turn in a horizontal direction.

[12] When a radar is set to "heads up" (or unstabilized) display, radar targets are displayed in their direction relative to the ship's own heading, not relative to "north." The vessel's heading, regardless of the ship's current course, is always pointed at the top (000°) of the radar screen.

chief’s duties. During the personnel transition, between five and seven persons were on the bridge at the same time (figure 3).

Figure 3. Bridge on the *Morro Bay*.

At 1150, the 187-foot-long passenger and car ferry *Block Island* (figure 4) departed its berth at Point Judith, Rhode Island. The ferry, operated by Rhode Island-based Interstate Navigation Co., was on its third trip of the day, a 55-minute transit to Old Harbor on the east side of Block Island, with 294 passengers, eight crewmembers, two concession stand employees, and a full load of vehicles on board. An off-duty employee of Interstate Navigation Co. was riding along as a passenger in the pilothouse.

Routine departure information and a safety announcement were given over the ferry’s public address (PA) system. After making a safety and security sweep through the car and passenger areas, the mate reported to the pilothouse to assist the master and to perform the duties of lookout. The master was at the helm and piloted the ferry out of the harbor. When the *Block Island* cleared the Point Judith breakwater, the ferry was about 4 miles to the north-northwest of the westbound *Morro Bay*. The master said that he did not have open any windows or doors in the pilothouse for hearing fog signals from other vessels.

Figure 4. Ferry *Block Island*.

The master of the *Block Island* told investigators that when the ferry departed Point Judith, visibility was about 1 mile, and that he therefore placed a security call[13] on very high frequency (VHF) channels 13 and 16. According to Interstate Navigation Co., doing so was company policy whenever the prevailing visibility was less than about 2 miles. Later, as the ferry traveled south onto the open waters of Block Island Sound, the visibility decreased. The master told investigators that he then began sounding the ferry's fog signal. He did not activate the automatic setting, which would have sounded the signal every 2 minutes as required by the "rules of the road,"[14] but instead manually sounded the fog signal, because he did not want the automatic fog signal to interrupt radio and other communication. The master told investigators that he understood that the rules of the road called for a prolonged blast every 2 minutes, but stated that, because he manually sounded the horn, he may have waited up to 5 minutes between blasts. The *Block Island* was traveling at near full-ahead speed, about 15 knots, on a south course.

[13] A security call is an informational message of a safety nature issued to all area vessels. The chief on board the *Morro Bay* told investigators that he did not recall hearing any of the three security calls from the *Block Island* leading up to the accident. However, the commanding officer stated that he heard a *Block Island* security call shortly before the collision.

[14] Navigation Rules and Regulations: International Navigational Rules Act of 1977 (Public Law [P.L.] 95-75, 91 Stat. 308, or 33 *United States Code* [U.S.C.] 1601-1608), and the Inland Navigation Rules Act of 1980 (P.L. 96-591, 94 Stat. 3415, 33 U.S.C. 2001-2038). The accident site was under the authority of the International Navigational Rules Act of 1977. Rule 35 addresses "Sound Signals in Restricted Visibility."

About 1208, the *Block Island* and the *Morro Bay* were about 1.6 miles from each other; the *Block Island* approaching from the north on the cutter's starboard side, and the *Morro Bay* approaching from the east on the ferry's port side (figure 5). Neither vessel's crew was aware of the other vessel.

Figure 5. The two vessels' tracklines in the minutes leading up to the collision. The *Block Island*'s path is shown on the left in green, running south; the *Morro Bay*'s path is shown on the right in red, running west-southwest. Point Judith is shown in the upper left corner. The tracklines were plotted using available global positioning system (GPS) data. Background by Google Earth.

The ferry had two 10-centimeter radars. One of the radars was set on a 6-mile range scale, and the other radar was set on a 0.75-mile range scale. The radar display set on the shorter range scale was "offset" on the screen, which allowed targets ahead to display at a distance of about 1 mile. As a result of the radar offset ahead of the vessel, targets behind and to the sides of the ferry would be detected at about 0.75-mile distance or less. The master of the *Block Island* told investigators that he observed a large ship on the radar set on the 6-mile range scale. He said that the ship was arriving from sea and proceeding toward a nearby pilot boarding area at slow speed and safe distance. The master then contacted a northbound ferry—the *Athena*, another Interstate Navigation Co. ferry that was returning from Old Harbor—and the two masters determined that their ferries would pass each other portside to portside. The *Block Island* master monitored the approaching *Athena* on the 0.75-mile range scale radar. He also detected on that radar four or five small boats in the vicinity, which he told investigators concerned him because they were not visible from the pilothouse windows in the thickening fog. The master told investigators that, after the *Athena* passed, he placed another security call on VHF channels 13 and 16. Shortly thereafter, another group of three or four small targets appeared on the radar and held the master's attention until they cleared the area. No traffic other than the *Athena* had yet appeared visually during this period because of the fog.

At 1210, the chief on board the *Morro Bay* suddenly spotted a powerboat, about 30 feet in length and about 500 yards off the *Morro Bay*'s port side, pass in front of the cutter from port to starboard. He told investigators that he had been monitoring the radar and thought that the 1.5-mile range scale would have detected the powerboat, but the radar had not. The chief ordered the wheel to port and reduced the speed from 11 knots to about 9 knots in an effort to increase the passing distance between the two vessels. When he attempted to judge the distance to the powerboat, he realized that the visibility had deteriorated further.

The chief told investigators that just minutes earlier, about noon, he had discussed the reduced visibility with the executive officer before the officer went to lunch, and the two men had then estimated the visibility as 1.5–2 miles. Now, on sighting the 30-foot-long powerboat so close by, the chief estimated the visibility to be about 500 yards. He reduced the engine's rpm, instructed the helmsman to steady back on course once the cutter had passed the powerboat, and monitored the helmsman for about a minute to ensure that the order was correctly followed.[15] He then called down to the mess hall to inform the commanding officer of the reduced visibility and speed. The commanding officer was not in the mess hall and the chief asked the crewmember who had answered the phone to check the nearby wardroom to see if the commanding officer was there. As the phone call was taking place, the commanding officer returned to the bridge, and the chief began briefing him about the situation. While the chief was informing the commanding officer about the steps he had taken after observing the powerboat, the two men heard a prolonged whistle blast off the starboard side. According to the chief, it was the first whistle anyone on the bridge of the *Morro Bay* had heard during the transit and it came about 10–20 seconds after the commanding officer returned to the bridge. The two men made their way to the starboard side and saw the *Block Island* emerging from the fog, about 50–100 yards away. The chief pulled back on the throttles and ordered the helmsman to put the wheel to full port rudder. The commanding officer ordered all back full and ordered three short blasts of the

[15] The relief helmsman had not steered since before the cutter's maintenance period, and, according to the chief, needed a bit more supervision as he tried to maintain the course.

cutter's whistle to notify the ferry that the cutter's engines were going astern. He also ordered the collision alarm to be sounded. Shortly thereafter, the executive officer arrived on the bridge. He saw the ferry off the cutter's starboard side and realized that impact was imminent.

The master of the *Block Island* told investigators that he had just placed another security call on the VHF radio when he detected the *Morro Bay* on the left side of the 0.75-mile radarscope. He said that the cutter's emergence startled him because he had been monitoring both the 0.75- and the 6-mile radars. He immediately reduced speed, stopped the engines, and sounded the fog signal. He then reversed his engines.

At this point, both vessels were reversing their engines and managed to reduce their forward speeds to about 1–2 knots. Nevertheless, the bow of the *Block Island* struck the starboard side of the *Morro Bay* just aft of the cutter's midship. In the commanding officer's estimation, the collision took place about 60–90 seconds after he returned to the bridge. The chief told investigators that he considered the impact to be "a little shudder" and not bad. He also concluded that the ferry's engines must have been reversed because of the black smoke that he saw pouring out of the ferry's stack.

When the vessels collided, the commanding officer on the *Morro Bay* activated the "man overboard" feature on the cutter's navigation system. Doing so registered the latitude and longitude of the accident location. The commanding officer also put the cutter's general emergency and damage control procedures into effect and contacted the *Block Island* on VHF radio channel 16 to ask about its status. No injuries were reported at that time, nor did the ferry appear to be taking on water or in danger of sinking. The commanding officer on the *Morro Bay* began notifying his chain of command of the collision and the status of both vessels. About the same time, Coast Guard Sector Southeastern New England, the local authority that responded to the accident, instructed the *Block Island* to hold near the collision site pending arrival of a backup Coast Guard vessel that would conduct external damage assessment of the ferry's bow (because it was difficult for the ferry crew to do so while on board). The five deckhands on the *Block Island* reported to the pilothouse and then went below to check for flooding and damage. The engineer, who had gone to the forward end of the ferry from the engineroom following the collision, was also assessing the integrity of the vessel. After he determined that no flooding forward was taking place, he went to the bridge and reported this to the master. Shortly thereafter, two responding Coast Guard vessels arrived on scene. One of them maneuvered around the bow of the *Block Island,* and its crew determined that the ferry was seaworthy to proceed to Old Harbor.

According to several passengers on the ferry, no warning announcement was made before the collision. These passengers also told investigators that several minutes passed after the accident without any crew announcement as to what was going on and what the passengers should do. Some of the passengers reported feeling concerned that the ferry's seaworthiness might be compromised, and they therefore located and donned lifejackets on their own accord. A few passengers were reportedly crying. Other passengers reported that they did not feel concerned and that the postaccident crew response was satisfactory. After the engineer made a PA announcement that the ferry was not taking on water and that the Coast Guard would provide escort to Old Harbor, the group of passengers who had initially felt concerned were reportedly no longer worried.

On-scene personnel with Coast Guard Sector Southeastern New England requested that the *Block Island* crew have all passengers provide their personal contact information, and the crew did so. About 1345, the two Coast Guard vessels began escorting the ferry at slow speed toward Block Island. The *Morro Bay* was released to proceed under its own power to New London, where the cutter arrived about 1700. All bridge equipment, with the exception of the gyrocompass, worked satisfactorily during the transit.

Injuries

The *Block Island* crew also checked whether any passengers were hurt in the collision and found that two passengers had sustained minor injuries that did not require medical intervention. Nevertheless, the two passengers elected to seek treatment at the Block Island Medical Center. Both were released the same day. No one on board the *Morro Bay* was injured.

Weather

Satellite images taken at the time of the accident depict low clouds and fog in the area. Air temperature recorded at the airport on Block Island (about 7 miles south of the accident site) was 81° F. Winds were from the south-southwest at 4 mph. According to the *United States Coast Pilot* No. 2, Cape Cod to Sandy Hook, 32nd edition, because the waters of Block Island Sound and Rhode Island Sound stay relatively cold even in summer, fog occurs two to three times more often in these waters than in Narragansett Bay. The *Coast Pilot* also reports that during early summer, visibility in the area drops below half a mile about 9 percent of the time.

Damage

Block Island

The ferry sustained a fracture and deformation to its bow hull plate. Internal frames and stiffeners were buckled at the vessel's stem above the waterline (figure 6). The final cost for temporary and permanent repairs was about $45,000. Repairs were completed and the Coast Guard cleared the ferry to return to service in September 2008.

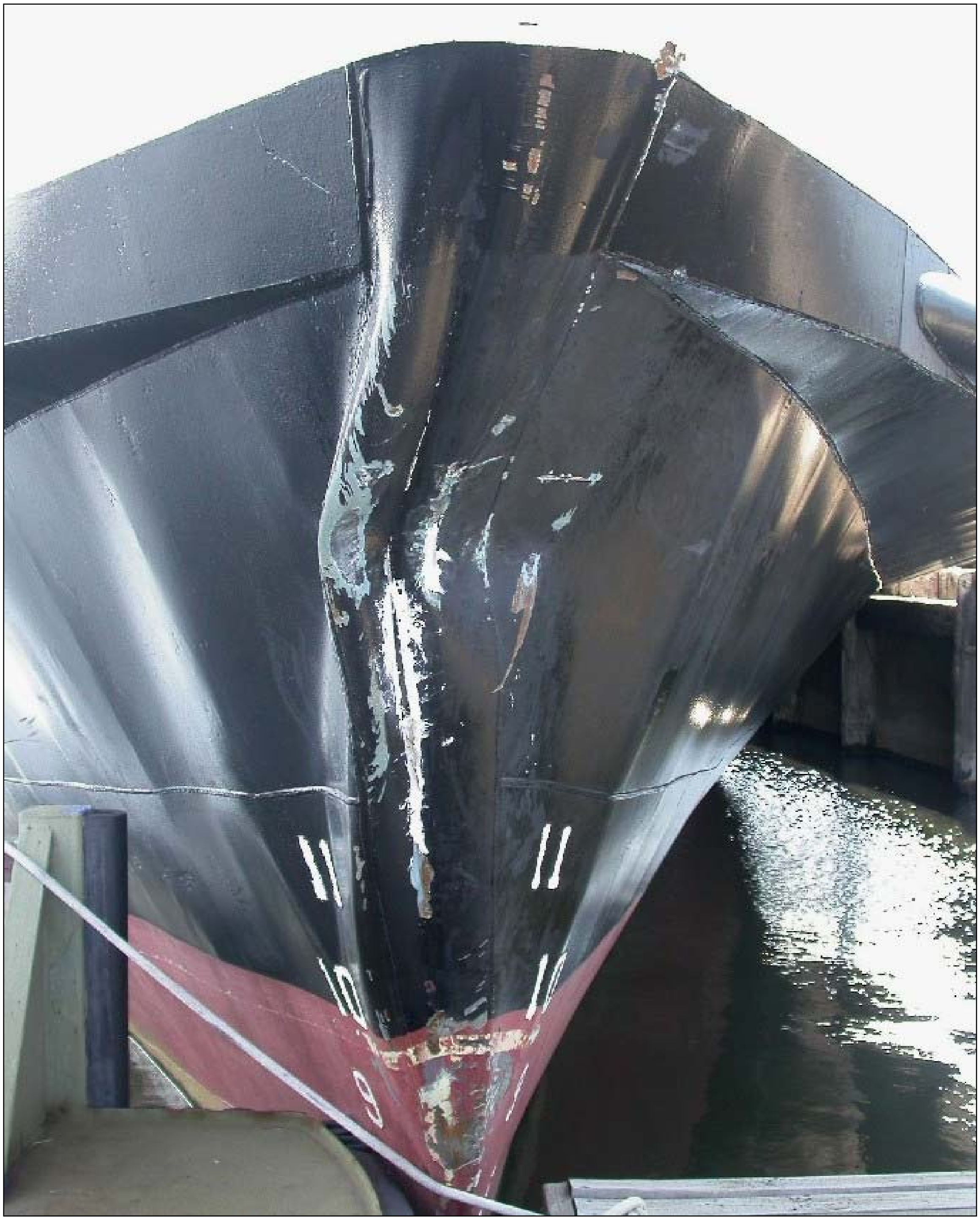

Figure 6. Scraped and inset bow on the *Block Island*.

Morro Bay

The cutter sustained minor impact damage to its starboard-side deck edge about midship (figure 7). The damage repair was estimated at $15,000.

Figure 7. Scraped and inset deck edge on the *Morro Bay*'s starboard side (looking down). Photo by the Coast Guard.

Toxicological Testing

Because the collision between the *Morro Bay* and the *Block Island* was not considered a "serious marine incident,"[16] toxicological testing under the regulations at 46 *Code of Federal Regulations* (CFR) 4.06 was not required.[17] However, some toxicological testing took place, as described below.

[16] According to 46 CFR 4.03-2, a serious marine accident results in any of the following: one or more deaths; injury to a crewmember, passenger, or other person that requires professional medical treatment beyond first aid, and, in the case of a person employed on board a vessel in commercial service, an injury that renders the individual unfit to perform routine vessel duties; damage to property in excess of $100,000; total loss of any vessel subject to inspection under 46 U.S.C. 3301, or total loss of any self-propelled vessel of 100 gross tons or more not subject to said inspection; discharge of 10,000 gallons of oil or more into U.S. navigable waters, or discharge of a reportable quantity of a hazardous substance into U.S. navigable waters or into the environment of the United States.

[17] According to 46 CFR 4.06-3, alcohol testing following a serious marine accident must be conducted within 2 hours of the accident, unless precluded by safety concerns directly related to the accident. If more than 8 hours have passed following the accident, alcohol testing is not required. Drug-test specimens must be collected within 32 hours, unless precluded by safety concerns directly related to the accident.

Morro Bay Crew

When the cutter returned to Coast Guard Station New London about 7 hours after the accident, the station's officer of the deck performed alcohol testing on all 21 crewmembers, using an alcohol breathalyzer (a sensor device). The test was not performed until the return to port because the *Morro Bay* did not have any alcohol testing supplies, such as saliva strips or a breathalyzer, on board. A New London police officer observed the testing, which took about half an hour starting at 1920. All results were negative. Medical personnel from Coast Guard Sector Long Island Sound collected urine samples from the crew for drug testing. The urine samples were sent to Tripler Army Medical Center in Honolulu, Hawaii, for analysis. All results were negative.

Block Island Crew

After the ferry arrived at Block Island about 1445, a representative of Interstate Navigation Co. escorted the master and the mate to the Block Island Medical Center for toxicological testing. Interstate Navigation Co. had an established arrangement with a third-party administrator—Newport Alliance, certified by the U.S. Department of Transportation for toxicological testing—to have both drug and alcohol-testing capabilities at the Block Island Medical Center. This arrangement would ensure that Interstate Navigation Co. could comply with Federal regulations on postaccident toxicological testing.

Alcohol Testing. Neither Interstate Navigation Co. nor Newport Alliance was aware that the Block Island Medical Center had lost the capability to test for alcohol. Consequently, the center did not test the master and the mate for alcohol. By the time the Coast Guard learned of this omission, it was no longer possible to test the master and the mate at an alternate facility within the 8-hour time limit. Interstate Navigation Co. was not required to have alcohol test kits at its terminal office on Block Island because of the presumed ability of the Block Island Medical Center to test for alcohol, and because approved alcohol test kits were available at the company's office at Point Judith, a 55-minute ferry ride away. As a result, the master and the mate were never tested for alcohol following the accident.[18]

Drug Testing. The Block Island Medical Center collected urine samples from the master and the mate for drug testing at 1530 and 1545, about 3.5 hours after the accident, which was well within the required 32-hour postaccident test window. The samples were to be analyzed for drugs at an approved laboratory located on the mainland. Staff from the Block Island Medical Center transported the urine samples, in DHL packaging, to Interstate Navigation Co.'s terminal office on Block Island on July 3, 2008. Chain-of-custody records show that the samples were delivered to the office and subsequently to an Interstate Navigation Co. ferry for transport to the mainland. However, in mid-July, following NTSB requests for the test results, the Coast Guard contacted the laboratory and learned that the samples had never arrived. Further investigation revealed that the samples were never delivered to the DHL office on the mainland.

[18] According to 49 CFR 40.277, the U.S. Department of Transportation does not authorize blood or urine to be used for alcohol testing under this subpart. Only saliva or breath for screening tests and breath for confirmation tests are permitted, using approved devices.

The samples were reported missing to the Coast Guard, which in turn conducted an investigation but could not determine how the samples were lost.[19]

As a result of the missing specimens, Interstate Navigation Co. announced in a memo dated July 22, 2008, that the company was changing its drug and alcohol testing procedures. According to the new policy, Interstate Navigation Co. no longer uses the Block Island Medical Center as a sample collecting facility. All Interstate Navigation Co. vessels now carry saliva strips for alcohol testing on board. Drug testing is conducted on the mainland, and the samples are shipped directly to the laboratory for analysis.

Postaccident Assessment of Navigational Equipment

The day after the accident, July 3, NTSB investigators observed the *Block Island*'s radars in use during a transit and concluded that the radars performed satisfactorily, which the master had attested to. On July 4, two technicians from Coast Guard Station New Haven, Connecticut, boarded the *Morro Bay* to assess the functionality of the cutter's radar. The radar tested satisfactorily.

Waterway and Navigational Charts

The collision took place about midway between Point Judith and Old Harbor, in a location identified as a pilot boarding area and a recommended vessel route. The accident area is near the boundary between Block Island Sound and Rhode Island Sound, which runs south from Point Judith. About 7 miles of open water separate the southern tip of Point Judith and the northern point of Block Island, and two buoys mark the shoaling water in the vicinity of these points. Buoy R (red) "2" is located about 3 miles south of Point Judith, and buoy G (green) "1BI" is located about 1 mile north of Block Island. The navigable waterway distance between the two buoys is about 3 miles. The east-west traffic scheme, marked by the horizontal green band in figure 8, crosses the path of the Block Island ferry route. The pilot boarding area is also located in this immediate vicinity and adds to the occasional traffic congestion. The area in which the collision occurred is governed by international rules of the road.

Interstate Navigation Co. is the only company with ferries crossing the east-west traffic scheme between Block Island and the mainland. The general ferry traffic runs between Point Judith and Old Harbor, and between Newport and Old Harbor. Both of these routes cross the east-west traffic scheme near the accident area.

The *Morro Bay* bridge team used National Oceanic and Atmospheric Administration (NOAA) chart 13218, "Martha's Vineyard to Block Island," for the start of the transit from Newport to New London, and the *Block Island* crew used NOAA chart 13215, "Block Island Sound Point Judith to Montauk Point," on board the ferry. At the time of the accident, the Block Island ferry route was not marked on any charts of the area. As a result of the accident, NOAA updated the charts to depict the ferry route (figure 8).

[19] Follow up correspondence from the Coast Guard, July 2010; available in the NTSB public docket.

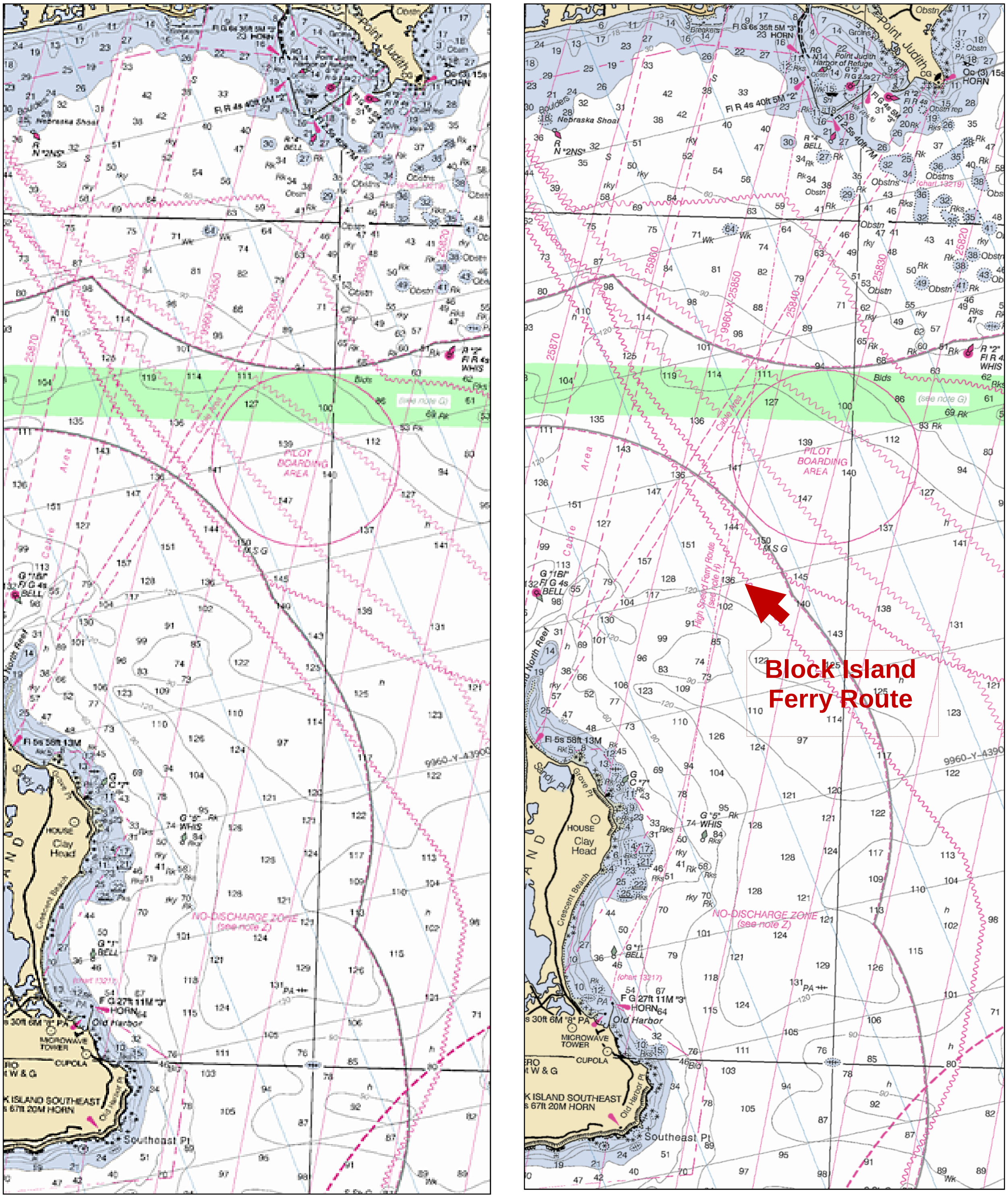

Figure 8. Preaccident and postaccident sections of NOAA Chart 13218 (the chart used by the *Morro Bay* bridge team), showing Point Judith in the upper right corner and Block Island in the bottom left corner. The horizontal green band denotes the east-west traffic scheme between Block Island and the mainland. At the time of the accident, charts of the area did not show the ferry route between Point Judith and Old Harbor (left image). NOAA has since revised the charts, and the ferry route is now marked (center of right image).

Vessel Information

Morro Bay

The *Morro Bay*, a 140-foot-long “Bay” class icebreaking tug, was built by the Tacoma Boat Building Company in Tacoma, Washington, and was launched in July 1980. The Coast Guard commissioned the *Morro Bay* in January 1981. The cutter’s primary mission was icebreaking, but the cutter had also been used in a variety of missions for the Coast Guard, including law enforcement, drug interdiction, search and rescue operations, homeland security, public affairs, environmental protection, and as a training ship for Coast Guard personnel.

The *Morro Bay* had three navigation systems on the bridge: a military-unique electronic chart precise integrated navigation system (ECPINS); a scalable integrated navigation system (SINS); and a captain’s “Voyager” unit, which is an electronic chart plotting device. In addition, the cutter had a radar (AN/SPS-73),[20] an L3 communications AIS, a gyrocompass by Sperry Marine, two VHF radios, a Raytheon Ray 430 multifunction loudhailer, a Simrad MX420 differential global positioning system (DGPS), a Furuno GPS navigation unit, and a Ritchie B 463 magnetic compass. The cutter also had a backup radar.

In a June 2010 letter of proposed findings to the NTSB, the Coast Guard stated that the *Morro Bay* bridge team should not have used the Ray 430 loudhailer to sound the fog signals because the loudhailer did not produce a minimum of 130 decibels required by navigation rules and therefore was not an authorized sound signaling device. Instead, the cutter’s whistle—which investigators tested following the accident and found to be in working order—should have been used. Investigators followed up with the Coast Guard and learned that the previous commanding officer on the *Morro Bay* had authorized the loudhailer’s installation a couple of years before the accident, in part for sounding the bell signal when anchored in fog. Over time, a habit developed of exclusively using the loudhailer to sound fog signals; in fact, the Coast Guard stated that no one in the current *Morro Bay* crew recalled using the whistle for sound signaling purposes. The current *Morro Bay* commanding officer has since prohibited the use of the loudhailer as the cutter’s sound signaling device.

Block Island

The *Block Island*’s navigation equipment consisted of two Furuno 10-centimeter radars, model 1510 MK2; a magnetic compass; two Standard Communications VHF marine radio telephones, model GX2330S Nova; a North Star depth sounder, model NS 3100; and a Garmin color chart plotter GPS, model 3010C. The ferry had seven surveillance and security cameras on board to monitor the passenger and vehicle decks.

[20] The radar set AN/SPS-73 is a short-range, two-dimensional, surface-search/navigation radar system that provides contact range and bearing information. The AN/SPS-73’s surface-search function provides short-range detection and surveillance of surface craft and low-flying aircraft, while the AN/SPS-73’s navigation function enables quick and accurate determination of position relative to nearby vessels and navigational hazards. Information obtained from Federation of American Scientists <http://www.fas.org/man/dod-101/sys/ship/weaps/an-sps-73.htm> (accessed March 11, 2010).

The *Block Island* was certificated to carry a total of 975 persons, including 13 crewmembers. Whenever the ferry operated between July 1 and September 30, and if the vessel operated only within 1 mile of shore, the onboard headcount could be increased to a total of 1,013 persons. The ferry had three inflatable liferafts for a total of 300 persons, 24 lifefloats for a total of 528 persons, and three ring buoys on board. Thus, primary lifesaving equipment (liferafts and lifefloats) was available for about 82 percent of the ferry's total passenger carrying capacity, and out-of-water flotation (liferafts) was available for about 30 percent of the total passenger carrying capacity. These percentages of primary lifesaving equipment and out-of-water flotation were permissible by Coast Guard regulations. Lifejackets for all people on board, including child sizes, were available.

Personnel Information

Morro Bay Crew

Commanding Officer. The commanding officer of the *Morro Bay*, age 48, had served in the Coast Guard for 30 years and became a lieutenant in 2004. He had experience on board several Coast Guard vessels and had been a qualified deck watch officer for more than 12 years. He had recently finished a 2-year assignment as operations officer and qualified deck watch officer on board the 210-foot-long Coast Guard cutter *Confidence*. In May 2008, 2 months before being assigned as commanding officer of the *Morro Bay* and just before the vessel started the shipyard period, he had been on board the cutter for 2 days to become familiar with the vessel and prepare for his upcoming July assignment. He had sailed on the waters in the accident area before and told investigators that he knew about the ferry vessels operating in the area.

Executive Officer. The executive officer, age 26, graduated from the Coast Guard Academy in May 2004. His first assignment on commissioning from the Academy was as deck watch officer on the Coast Guard cutter *Cypress* in Mobile, Alabama. In July 2006, after 2 years on the *Cypress*, he was assigned as executive officer of the *Morro Bay*. His duties included oversight of administrative, staff, and medical matters.

The executive officer was aware of the ferries between Block Island and Point Judith but told investigators that the ferry information would not normally come up during initial navigation briefings.

Chief Boatswain's Mate. The chief, age 31, joined the Coast Guard in 1995. After completing 4 months of basic training, he reported to the 180-foot-long buoy tender *Acacia* in Charlevoix, Michigan. In a little over 2 years there, he advanced in rank from seaman apprentice, to seaman, and finally to boatswain mate 3rd class. Over the next 5 years, while stationed at St. Inigoes, Maryland, he received training and manned various small boats from 21–41 feet in length. He advanced to first class petty officer and was made the executive petty officer for the station. He continued his training and advancement at the Coast Guard Coxswain "C" School in Yorktown, Virginia, where he gained experience in towing, boat handling, navigation principles, and search patterns. The chief reported to the *Morro Bay* in July 2007 and made chief petty officer in October the same year. He served for about a year as the "breaking in under way officer on duty" on the *Morro Bay*, where he was in charge of the bridge and all associated duties with a qualified officer supervising him to ensure that he carried out his duties correctly. In mid-May 2008, he became fully qualified as watch officer on duty and had stood about three watches before the collision with the *Block Island*. The chief estimated that, at the time of the accident, he had about 10.5 hours of qualified time as officer on duty under way on the bridge of the *Morro Bay*.

Quartermaster of the Watch. The quartermaster of the watch, age 25, had served on the *Morro Bay* for 14 months at the time of the accident and was a boatswain's mate 3rd class. He joined the Coast Guard in October 2006 and attended basic training in Cape May, New Jersey. He qualified as quartermaster of the watch in August 2007. On the day of the accident, he was scheduled to stand the 1600–2000 watch but arrived on the bridge about noon to relieve the 1200–1600 quartermaster of the watch for lunch.

Helmsman. The helmsman, age 19, had served on the *Morro Bay* for about 9 months, the last 6 of which he was a qualified helmsman. The *Morro Bay* was his first unit after 2 months of basic training at the Coast Guard training center in Cape May, New Jersey. During his time on board, he had served as helmsman numerous times. He told investigators that most of the steering was done to gyrocompass courses, but he had also steered magnetic courses during drills. On the day of the accident, the helmsman reported for duty about 1200.

In the days leading up to the accident, the *Morro Bay* was dockside and the bridge crew was working only daytime hours. The crewmembers told investigators that they therefore felt well-rested and alert on the day of the accident.

Block Island Crew

Master. The master, age 49, held a master's license of steam or motor vessels of not more than 100 gross tons upon near-coastal waters. The license was most recently renewed in January 2005. The Coast Guard does not require radar training for the type of master's license that he held; however, Interstate Navigation Co. required it. The master had most recently completed radar observer training in February 2008. He also held a merchant marine document endorsement as able seaman, any waters unlimited.

The master stated that his career at sea began as an unlicensed deckhand in 1976. He worked on board various ferry boats operated by Interstate Navigation Co. on near-coastal waters of Rhode Island and Connecticut. Between 1976 and 1983, he worked as deckhand on various offshore service/supply boats tending to oil rigs in the Gulf of Mexico and in northeast U.S. offshore locations, which increased his experience and sea time and enabled him to obtain a Coast Guard-issued able seaman document. In March 1983, he returned to Interstate Navigation Co.'s Block Island ferry operation and was employed there from then on. In February 1985, he qualified for and was issued a Coast Guard license as master of steam and motor vessels of not more than 100 gross tons upon near-coastal waters. He was promoted to "seasonal" master that summer. The following winter season, 1995–1996, he returned to a mate position. In the summer of 1996, he returned to the position of master, and from that point forward maintained the position full-time. In 1997, he was assigned to take delivery of the *Block Island* when it was first delivered from the builder's yard in Panama City, Florida, and he became its master from that point on. At the time of the accident, the master was Interstate Navigation Co.'s senior captain.

The master had been off from work the Sunday and Monday before the accident. On Tuesday, July 1, he worked 12 hours, 0730–1930, and then had a full night's rest (he was in bed at 2200 and rose about 0600 on the day of the accident). The master reported for work at 0715, which was his usual start time.

The master had no previous accident history and, as of the date of this report, was still employed by Interstate Navigation Co. as master of the *Block Island*.

Mate. The ferry mate, age 22, had worked for Interstate Navigation Co. since July 2004, when he joined the company as a seasonal deck hand. He worked the ferry service during breaks from college, and the company eventually designated him senior deck hand. He gradually accrued enough sea time to apply for a Coast Guard-issued marine license. He enrolled at and attended Northeast Maritime Institute in New Bedford, Massachusetts, for his formal preparation and training, and in April 2008, obtained a Coast Guard-issued license as master of steam or motor vessels of not more than 100 gross tons on inland waters. No radar endorsement or formal radar training was required by the Coast Guard or Interstate Navigation Co. for this license. The mate usually served as the ferry's lookout and had not taken any radar observer training. About a month before the accident, he had begun training as a mate. Responsibilities included pre-underway checks, crew assignments, passenger boarding, required drills and training, and underway security. Communication with other crew was conducted via handheld radio.

The mate also worked 12-hour days. He had been off from work the Sunday before the accident, and had worked Monday and Tuesday. He stated that he was well-rested on the day of the accident and had arrived for work about 0650.

The mate is no longer employed by Interstate Navigation Co.

Engineer. The ferry's licensed engineer had worked for Interstate Navigation Co. since May 1989 and had served on all of the company's boats. After June 2006, he was primarily assigned to the *Block Island*. He held a valid Coast Guard license as designated duty engineer for vessels of not more than 4,000 horsepower and a merchant mariner's document endorsed for any unlicensed rating in the engine department. His engineering duties included day-to-day operation, preventive maintenance, and troubleshooting and repairing mechanical, electrical, sanitary, and environmental systems, such as the main engines, propulsion, navigation equipment (including steering gear), and radars and external communications.

The *Block Island*'s Coast Guard-issued certificate of inspection did not require a licensed engineer to be on board. However, Interstate Navigation Co.'s policy required it. Per company policy, the purpose of having an engineer was to provide general maintenance and to assist in the event of an emergency.

Interstate Navigation Co.

Background

Interstate Navigation Co., a family-owned corporation, was founded in 1933. As of the date of this report, the company operates six ferries. During the summer season, the company employs about 150 people and during the off season fewer than 50. The Coast Guard certificates all Interstate Navigation Co.'s ferries under 46 CFR Subchapter K (small passenger vessels carrying more than 150 passengers).

Interstate Navigation Co. provides year-round freight, auto, and passenger ferry service to Block Island. During the off season, the company operates one ferry, the *Block Island*, from Point Judith to Block Island. During the peak season, the company operates three ferries from Point Judith, one high-speed ferry from Galilee, Rhode Island (about 1 mile west of Point Judith), and one passengers-only vessel from Newport. All ferries arrive in Old Harbor, Block Island. During the winter, the high-speed ferry is kept in service in New York Harbor, New York.

The vessel operations manager for Interstate Navigation Co. told investigators that its masters and mates commonly worked their way up through the ranks by gaining on-the-job experience on company vessels. Both he and the vice president of Interstate Navigation Co. had previously sailed on company vessels and had advanced from deck hand to mate to master.

Crew Training

Interstate Navigation Co. had an 18-page vessel-specific manual, dated February 2005, titled "Motor Vessel Block Island Training Manual for Fire and Shipboard Emergencies," on board the *Block Island*. Some of the topics covered in the manual included watch standing, rough weather/sea conditions/restricted visibility, fire education and firefighting methods/scenarios, man overboard scenarios, evacuating the ferry, and loading the ferry. Interstate Navigation Co. did not mandate training or professional development for permanent employees, nor did it maintain any formal records of employee training. On a monthly basis, the ferry crew was required to conduct and log firedrills, practice man-overboard response, operate the rescue boat, and conduct drills in abandoning ship. Investigators examined the onboard "drills and training" logbook for 2008, and, according to it, new crewmembers had received orientation, and monthly fire and man-overboard drills had been conducted most recently on June 8, 2008. Man-overboard and sprinkler drills were reportedly conducted for Coast Guard inspectors on May 21, 2008. The ferry also had a 2008 maintenance and inspection log, showing inspections of "rafts and lights" logged and initialed at weekly intervals.

At the time of the accident, Interstate Navigation Co. had no formal training for crisis management and crowd control. However, in a July 23, 2009, phone interview with the company operations manager, investigators learned that Interstate Navigation Co. had revised its safety program based on lessons learned from the collision. Revised sections included those pertaining to fire and shipboard emergencies. The drill log had also been revised to include an updated drill record sheet for each crewmember. Crowd management training was now also mandatory.

Company Management

At the time of the accident, Interstate Navigation Co. comprised five divisions: operations, freight, vessels, ticket sales, and security. Each division reported to the vice president and the general manager. In interviews with investigators, management indicated that it was a “hands on” company, but that much of the day-to-day operation of its vessels, such as decisions about speeds and posting of lookouts in restricted visibility, was left to the discretion of its masters. Interstate Navigation Co. was not required by regulations to have a safety management system, nor did the company have one; however, the vessel-specific manuals contained some information that would be included in a safety management system.

Safety Management Systems

Definition and Background

A safety management system is a documented system developed to enhance safe operations of vessels, prevent injury or loss of life, and avoid environmental pollution. Safety managements systems should result in ship owners and operators resolving safety-related issues before incidents happen. The International Maritime Organization (IMO) developed international safety management standards for safe ship management in the 1980s, following a number of serious marine casualties caused by human error or management failure. This led to the development of the International Safety Management (ISM) code, whose purpose is “to provide an international standard for the safe management and operation of ships and for pollution prevention.” The IMO made the ISM code mandatory in 1993. In 1994, IMO members, including the United States, adopted the ISM code as Chapter 9 of the International Convention for the Safety of Life at Sea (SOLAS).[21] Chapter 9 of SOLAS took effect in July 1998, and the ISM code became required for vessels on international voyages, such as passenger ships, high-speed craft, tankships, and cargo carriers. For other cargo ships on international voyage, the ISM code took effect in July 2002. Vessels in U.S. domestic service are not required to have safety management systems.

Federal Rules for Safe Operation of Vessels

The Coast Guard publishes U.S. maritime rules for safe ship operation at 33 CFR Part 96, which also addresses safety management systems. According to 33 CFR 96.230, the objectives of safety management systems are to:

- Provide for safe practices in vessel operation and a safe working environment onboard the type of vessel the system is developed for;
- Establish and implement safeguards against all identified risks;

[21] SOLAS is a major international treaty addressing the safety of merchant ships. The first version of the treaty was adopted in 1914 in response to the sinking of RMS *Titanic*; there have been a number of amendments since.

- 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;

- Ensure compliance with mandatory rules and regulations.

Under 33 CFR 96.210(c), vessel operators such as Interstate Navigation Co., which are not required to comply with the ISM code, can voluntarily meet the standards and have their safety management systems certified. The Coast Guard has established an equivalent to ISM code compliance for vessels not engaged in foreign voyage and provided guidance for voluntary compliance in Navigation and Vessel Inspection Circular (NVIC) 5-99. As of December 2009, 364 U.S. vessels are registered in the voluntary program.

In its guidance to vessel operators who wish to voluntarily comply, the Coast Guard states that the following "functional requirements," among others, should be documented and detailed when a company develops a safety management system:

- Instructions and procedures to ensure safe operation of ships and protection of the environment in compliance with relevant international and flag state legislation;
- Defined levels of authority and lines of communication between and amongst shore and shipboard personnel;
- Procedures for reporting accidents and nonconformities within the provisions of the ISM code;
- Procedures to prepare for and respond to emergency situations; and
- Procedures for internal audits and management reviews.

Previous Board Action on Safety Management Systems

As a result of its investigation of the October 15, 2003, allision of the Staten Island ferry *Andrew J. Barberi* with a maintenance pier at the Staten Island ferry terminal, New York,[22] the NTSB issued Safety Recommendation M-05-7 to all states that operate ferries:

> Encourage your public ferry operators to voluntarily request application of the Federal requirement at 33 CFR [Part] 96 for implementing a safety management system, if they have not already done so.

Following the *Morro Bay*/*Block Island* collision, NTSB investigators contacted the state of Rhode Island and learned that the state had complied with Safety Recommendation M-05-7 by contacting and encouraging commercial ferry operators, including Interstate Navigation Co., to voluntarily implement a safety management system. Interstate Navigation Co. responded to the

[22] *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: National Transportation Safety Board, 2005).

state of Rhode Island in February 2008, about 5 months before the accident, stating that it was in compliance with all current requirements for intrastate ferry operations and declined to voluntarily implement a safety management system. Safety Recommendation M-05-7 was classified "Closed—Acceptable Action" in April 2009. As mentioned earlier in this report, Interstate Navigation Co. did have some documented safety procedures in place, and, following the accident, revised and expanded some of its policies. However, the company did not develop a safety management system in accordance with 33 CFR Part 96 or NVIC 5-99. In an August 2009 follow up letter to the state of Rhode Island, the NTSB expressed disappointment over Interstate Navigation Co.'s decision not to take the recommended action.

Also as a result of the *Andrew J. Barberi* allision, the NTSB issued Safety Recommendation M-05-6 to the Coast Guard:

> 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.

In May 2005, the Coast Guard indicated initial concurrence with the recommendation. In July 2007, the Coast Guard submitted a legislative change proposal to amend 46 U.S.C. 3202(a) to cover U.S. flag ferries carrying 399 or more passengers and operating on domestic voyages and, thus, require such vessels to implement safety management systems pursuant to 33 CFR Part 96. The Coast Guard's section-by-section analysis stated that 399 passengers "is the universe of ferry vessels where the NTSB and the Coast Guard believe safety management systems will be most effective." In an August 2009 response, the NTSB clarified to the Coast Guard that the NTSB advocates safety management systems on all U.S. ferries, not just those carrying more than 399 passengers. Because the Coast Guard had only sought legislative authority to require safety management systems on ferries with 399 or more passengers—as opposed to all ferries, as recommended—Safety Recommendation M-05-6 was classified "Open—Unacceptable Response" in August 2009. The Coast Guard's proposed legislation failed to pass before the end of the 110th congressional session.

In October 2009, the House passed H.R. 3619 (the Coast Guard Authorization Act of 2010), which in part sought to amend 46 U.S.C. Section 3202 to require safety management systems for passenger vessels, including ferry vessels. The applicability of the safety management system regulation would be determined by the Coast Guard, based on vessel characteristics, methods of operation, nature of service, and, for ferries, the size of the ferry system. In October 2010, H.R. 3619 was enacted into law (P.L. 111-281) (appendix B).

The NTSB held a public meeting in February 2010 to review its Most Wanted List of Transportation Safety Improvements directed at Federal agencies. Based in part on Safety Recommendation M-05-6, the NTSB added "Require Safety Management Systems for Domestic Vessels" to the Most Wanted List and advocated that domestic vessel operators develop, implement, and maintain a systematic and documented safety management system to improve their safety practices and minimize risk.

Coast Guard Crew Oversight and Training

Selection and Assignment of Coast Guard Navigation Personnel

Commanding officers of vessels such as the *Morro Bay* are selected by a screening panel, comprising five Coast Guard officers. The selection process entails a review of the applicant officer's records and documentation, and also takes into account the applicant officer's performance reports and competitiveness for the assignment. The applicant's most recent assignment is also considered in the evaluation. The panel needs to rank the officer as fit for follow-on command or for command at sea at soonest opportunity. The Coast Guard, through its evaluation process, had determined that the accident commanding officer was qualified for command at sea.[23]

Once an officer is selected for command, he or she is given an onboard orientation, either on the actual vessel he/she is going to command, or on a similar vessel. A check ride is also conducted so that the officer can become familiar with the vessel before taking command. Regarding changes of command, such as the one that took place on board the *Morro Bay* the day before the accident, Coast Guard personnel told NTSB investigators that it was up to the two commanding officers (the outgoing and the incoming officers) to schedule and be satisfied with the interchange throughout the transition process.

Supervision and Assessment of Coast Guard Navigation Personnel

A few months after the accident, the NTSB conducted follow up interviews with the sector response department head of Coast Guard Sector Long Island Sound and a representative of the Coast Guard's 1st District in Boston regarding oversight and supervision of vessels such as the *Morro Bay*. The sector response department head told investigators that, about 6 times per year, the sector command cadre (sector commander, department head, and division chief) would try to visit the cutter dockside or go on an observation ride on board the vessel, usually a day trip.[24] During the vessel observation rides, the command cadre would observe the commanding officer's ability to manage the vessel, perform risk assessment, and conduct high-quality operational briefings. The command cadre would also assess the communication between crewmembers and the crew's overall performance, and review all formal officer evaluation and operational reports issued by the vessel's commanding officer. In addition, the sector's "Ready for Operations" team would conduct formal readiness inspections each year, which evaluated the vessel's operational and training administration, including training and qualification records, and rescue and survival equipment logs. The Ready for Operations team would then evaluate the vessel's drills for navigation, seamanship, firefighting, and damage control. The command cadre would use all the collected information to gain an overall sense of the crew's readiness and proficiency.

[23] According to Coast Guard interview regarding oversight, October 2008, available in NTSB's public docket.

[24] The sector response department head also oversaw two or three other cutters and several smaller boats and small boat stations. Because of the *Morro Bay*'s assignment out of the sector area, the command cadre had only taken about six observation rides on the cutter in the previous 2 years, and only with the previous commanding officer.

The Coast Guard's Atlantic Area Training Team would also conduct special emergency operations and procedures (SEOPS) training visits every 18–24 months. The visits would include classroom and hands-on training, watchstander testing, and shipboard training exercises. At the completion of these exercises and inspections, the vessel would either be deemed ready or not ready for operations, and receive either a satisfactory or unsatisfactory rating. The last SEOPS for the *Morro Bay* before the accident was conducted in April 2007, and the Coast Guard had determined that the *Morro Bay* was ready for operations.

The sector response department head also told investigators that the Coast Guard strives to "stagger" crew turnover, so that new crewmembers in key positions do not all report for duty at the same time. The commanding officer, the executive officer, and the chief were all due to change assignments around the same timeframe. However, the command decision was to keep the executive officer for a month into the new commanding officer's 2-year tenure on board the *Morro Bay*. The new boatswain's mate first class was also to "shadow" the chief to learn his duties and become familiar with the cutter before the chief departed. The sector response department head and the 1st District representative also stated that they relied mainly on the onboard commanding officers to ensure that not too many personnel changes would take place at the same time. Most of the *Morro Bay* crewmembers were either on a 2- or 3-year rotation for their assignments.

Automatic Identification Systems

AIS is a maritime navigation safety communications system. At 2- to 12-second intervals on a moving vessel, the AIS automatically transmits vessel information, including the vessel's name, type, position, course, speed, navigational status, and other safety-related information, to appropriately equipped shore stations, other vessels, and aircraft. The AIS also automatically receives such information from similarly fitted vessels.

In response to the terror attacks of September 11, 2001, Congress passed the Maritime Transportation Security Act of 2002.[25] In the Act, Congress mandated that AIS be installed and operated on board most commercial vessels in U.S. waters. Two years later, in 2004, Congress mandated that electronic charts also be installed and used on board the same types of vessels.[26] Under current domestic regulations at 33 CFR Part 164, AIS is required to be fitted on commercial vessels, including passenger vessels carrying more than 150 passengers, in areas covered by Coast Guard vessel traffic service (VTS).[27] Two of Interstate Navigation Co.'s ferries, including the *Athena*, which operates in New York Harbor during the winter months, had been fitted with AIS, because this system was required to operate in New York Harbor, an area covered by VTS. As of the date of this report, the Block Island ferry route is not covered by VTS, and the *Block Island* is not required to have, nor does it have, AIS.

[25] Maritime Transportation Security Act of 2002, P.L. 107-295, Section 102, 116 §2064, U.S. Government Printing Office, 2002.

[26] Coast Guard and Maritime Transportation Act of 2004, P.L. 108-293, U.S. Government Printing Office, 2004.

[27] VTS monitors and provides navigation advice for vessels in confined or busy waterways.

On December 16, 2008, the Coast Guard published a notice of proposed rulemaking, seeking to expand AIS requirements beyond VTS areas to all U.S. navigable waters, and to require AIS on self-propelled vessels that carry more than 50 passengers (such as the *Block Island*).[28] The rule would require the *Block Island* to have, at a minimum, a nonintegrated AIS installed within 7 months after the final rule takes effect. A nonintegrated AIS is a more basic version of AIS that lists only the name, range, and bearing of all AIS-carrying targets in order of proximity. It does not graph and display the information as an integrated AIS would. However, many small passenger vessels today have some form of electronic chart navigation aid that can receive, graph, and display the information that the nonintegrated AIS receives.

The Coast Guard's rulemaking on AIS is expected to be finalized and published in 2011.

Voyage Data Recorders

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.[29]

Background

SOLAS regulations require VDRs to be installed on all passenger vessels and on cargo vessels greater than 3,000 gross tons,[30] but existing domestic regulations do not require VDRs on U.S. vessels that are not engaged in international voyages. As mentioned in the accident narrative, neither the *Morro Bay* nor the *Block Island* had VDRs. As a result, NTSB investigators had only limited information to work with in investigating this accident, mainly position history data recorded by the vessels' GPS units and crew and passenger interviews.

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 C.V. *Sea Witch* and the SS *Esso Brussels* in New York Harbor,[31] 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 tankships 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.

[28] "Vessel Requirements for Notices of Arrival and Departure, and Automatic Identification System," U.S. Coast Guard, notice of proposed rulemaking, *Federal Register*, vol. 73, no. 242 (December 16, 2008), pp. 76295–76318.

[29] 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.

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

[31] *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, DC: National Transportation Safety Board, 1975).

The NTSB issued additional safety recommendations to the Coast Guard regarding VDRs following several other marine accidents. Following the February 24, 1977, allision of the U.S. tankship SS *Marine Floridian* with the Benjamin Harrison Memorial Bridge near Hopewell, Virginia,[32] the NTSB issued Safety Recommendation M-78-2 to the Coast Guard:

> 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)[33] for the adoption of a similar international requirement.

As a result of the 1981 NTSB special study *Major Marine Collisions and Effects of Preventive Recommendations*[34] 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 Recommendations M-78-2 and M-81-84 “Closed—Unacceptable Action” in September 1982.

Following the November 6, 1993, collision between the passengership *Noordam* and the bulk carrier *Mount Ymitos* near Southwest Pass, Louisiana,[35] 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

[32] *U.S. Tankship SS* Marine Floridian *Collision with Benjamin Harrison Memorial Bridge, Hopewell, Virginia, February 24, 1977,* Marine Accident Report NTSB/MAR-78/01 (Washington, DC: National Transportation Safety Board, 1978).

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

[34] *Major Marine Collisions and Effects of Preventive Recommendations,* Marine Special Study NTSB/MSS-81/1 (Washington, DC: National Transportation Safety Board, 1981).

[35] *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).

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.

Also in 1996, following proposals by the United States and the United Kingdom, the international maritime community began work on developing international performance standards for VDRs. 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.[36]

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 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.

The Coast Guard's report[37] on the study noted the following:

- Seventy-five vessels met the study's specified criteria,[38] and in 40 (6%) of the 691 incidents that these 75 vessels had experienced over a recent 6-year period, a VDR would have provided relevant information to the accident investigation.

- Mandating the use of VDRs on these ferries would have significant upward pressure on fares charged for some ferry operators and a negligible effect on other operators with higher profit margins, with a resultant reduction in ridership in markets where passengers are not dependent on ferries for transportation.

- Of the 43 comments in its public docket (including 37 comments from ferry vessel operators), only six (including the NTSB's submission) were in favor of installing VDRs on ferries. Most of the comments stated that a VDR requirement would overburden the industry, and many stated that VDRs provided no safety benefit.

[36] The IMO adopted the performance standards for VDRs in November 1997 by resolution A.861(20), and detailed performance and test standards established by the International Electrotechnical Committee (IEC) took effect in July 2000 (IEC 61996). In December 2000, the IMO adopted carriage requirements for VDRs, which took effect in July 2002. In May 2004, 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.

[37] *Report to Congress on Use of Voyage Data Recorders on Ferries* (Washington, DC: U.S. Department of Homeland Security, U.S. Coast Guard, March 26, 2008).

[38] In Section 420 of the Coast Guard and Maritime Transportation Act of 2006 (P.L. 109-241), Congress directed the Coast Guard to conduct the study and to submit a report within 1 year. Congress specified the criteria as ferries over 100 gross tons carrying more than 399 passengers between two points not more than 300 miles apart.

- Three items currently on the Coast Guard's regulatory agenda may be considered as alternatives to VDRs, and each of these regulatory requirements will apply to the vessels targeted in the report: carriage of AIS, requirements for carriage of and standards for electronic chart systems, and updating domestic regulations by incorporating the navigation equipment requirements in SOLAS Chapter V. The electronic chart systems can receive and store navigation data from the required equipment, and these data "can readily be stored and retained on board for months."

- Bridge audio is an essential aspect of VDRs and is not featured in electronic chart systems. Manufacturers of electronic chart systems recognize this and are developing audio recording channels in the electronic chart system that will record bridge audio and primary VHF. Although not specified in the IEC committee draft 62376,[39] an electronic chart system can be developed to integrate and store all of the information that a VDR captures, such as rudder position, engine controls, etc.[40]

- The combination of AIS and the navigational data captured by the electronic chart system could provide the same information as a VDR. Another benefit of the electronic chart system is that recording of other crucial navigational data is possible—for instance, tides, currents, automatic radar plotting aid, AIS, past tracks, and maneuvering data.

- The Coast Guard estimated that the 10-year discounted cost of retrofitting affected vessels[41] with VDRs would be $13.4 million ($210,000 per ferry) for a full VDR and $3.1 million ($48,000 per ferry) for an S-VDR. The Coast Guard's estimates did not take into account the costs associated with installing VDRs on newly constructed vessels subject to the requirement because the Coast Guard was confident that the costs of the requirement would be adequately captured by looking at its effect on existing vessels alone. The Coast Guard noted that the principal benefit of VDRs would be improved effectiveness of postaccident investigations and possibly increased safety in ferry transportation through the introduction of safety recommendations and regulations. The Coast Guard did not attempt to quantify the value of the benefits, but noted that only one of the 691 accidents reviewed as part of the study resulted in fatalities, injuries, or property damage in excess of $200,000.

[39] The IEC standard 62376 is in committee draft form and is discussed later in this section.

[40] It was not specified to which performance and test standards such a new class of electronic chart systems would be held or if such standards are under development. Existing and in-development standards for electronic chart systems do not require recording of such additional data.

[41] As noted previously, 75 vessels met the study criteria, but because 11 vessels operated internationally and were already required to carry a VDR, the economic analysis considered the 64 vessels not currently required to be fitted with a VDR.

Based on the 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.

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 would capture most of the information recommended 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[42] 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.[43] 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 standard interface connections.[44]

[42] The requirement for recording of certain navigational data by electronic chart systems is specified in performance standards promulgated by two standards agencies, the Radio Technical Commission for Maritime Services (RTCM) and the IEC. The performance standards are the "RTCM Standard 1090014 for Electronic Chart Systems," published in 2008, and IEC Standard 62376 "Electronic chart systems, operational and performance requirements, methods of testing and required test results" (draft version, final version anticipated in 2011).

[43] In addition, the performance standards specify that electronic chart systems shall keep a separate voyage record of the ship's actual track at intervals not exceeding 4 hours, with a minimum record duration of 3 months.

[44] In contrast, IMO performance standards for VDRs and S-VDRs, as amended by Resolution MSC.214(81), specify that VDRs should provide a standard interface (e.g. USB, Ethernet, FireWire) for downloading stored data and that the data either be in standard (nonproprietary) format or have software available to investigators for converting the data into open industry standard formats.

In addition, in contrast to the performance standards for VDRs and S-VDRs, the electronic chart system standards do not require the recording of radar imagery, bridge audio, or certain other ship-specific data specified in the VDR/S-VDR performance standards. The VDR/S-VDR performance standards specify the recording of parametric data, such as own ship's position, course and speed at 1-second intervals, radar images at 15-second intervals, and bridge audio continuously. International performance standards for VDRs are currently undergoing revision at IMO, and it is anticipated that the revised standards will significantly improve the capabilities of recording equipment installed on new vessels. Among the improvements being considered are longer recording time, recording of additional data, such as both radars images and electronic chart system/ECDIS data, and improved audio quality.[45]

In 2007, Transport Canada commissioned a cost/benefit analysis[46] 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 vessels) would be 65 million Canadian dollars (about 267,000 Canadian dollars per vessel).[47] The analysis estimated that monetary benefits of about 1 million Canadian dollars per year would accrue to the government as a result of cost reductions in accident investigations. Nonmonetary benefits were increased safety, improvements in vessel design and operation, fewer lives lost in marine accidents, fewer accidents causing environmental damage, reduced litigation, benefits to ship owners and operators, and satisfaction of public expectations for transportation safety. The analysis also noted that the cost and difficulty of installing VDRs on new vessels were insignificant. The analysis concluded that "the potential for benefits to outweigh the costs is greatest for 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 2011, as part of the "Canada Shipping Act 2001."

In addition to Canada, several other countries have implemented or are considering implementing regulations for their non-SOLAS domestic vessels. In a 2009 NTSB-sponsored study on the feasibility of application of VDRs and safety management systems to U.S. domestic vessels,[48] it was found that of the nine countries surveyed (including Canada), three have

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[45] Work on revisions to VDR performance standards began in 2009 and is being undertaken by the IMO Safety of Navigation Sub-Committee under a 3-year work item.

[46] The Canadian regulatory project was undertaken in response to the Transportation Safety Board of Canada (TSB) recommendation to Transport Canada to "extend the requirement for the carriage of VDRs/S-VDRs to large passenger vessels over 500 gross tonnage and all other commercial vessels on an equivalent basis to those trading internationally." The recommendation resulted from TSB's investigation of the 2006 grounding and sinking of the passenger ferry vessel *Queen of the North*. Transport Canada has indicated its agreement with the general intent of the recommendation and commissioned a study to conduct a cost-benefit analysis of potential regulatory requirements for VDRs and S-VDRs for Canadian non-SOLAS vessels. Information obtained from TSB's website <http://wwwapps2.tc.gc.ca/saf-sec-sur/4/rqs_query/ed_md.aspx?lang=en&N=2000000005> (accessed March 19, 2010).

[47] The study considered both private and government costs and benefits.

[48] "Feasibility Study on the Potential Application of VDRs and [safety management systems] to U.S. Domestic Commercial Vessels," Alexander A. J. van der Zee, 2009. The study is available at NTSB's public docket. The countries surveyed were Australia, Canada, China, Finland, Germany, Mexico, New Zealand, South Africa, and the United Kingdom.

adopted VDR carriage requirements for certain domestic vessels, and several other countries are considering VDR regulations.

Previous NTSB Investigations Aided by Voyage Data Recorders

Information extracted from onboard VDRs has been helpful in several previous NTSB investigations. In certain cases, the VDR information was crucial in revealing the actual course of events, which differed from crewmember or witness accounts.

About 0143 on November 3, 2007, the Bahamas-registered tankship 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 Perth Amboy, New Jersey.[49] The impact caused $10 million in damage to Ambrose Light and $1.5 million in damage to the ship. The master and the bridge team did not mention the allision to the pilot who boarded the ship shortly thereafter, nor did they notify the Coast Guard or the shipping company about the accident until after the *Axel Spirit* was docked in Perth Amboy and the master had 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 allision was audible, alarms began sounding, and the master reacted verbally to the impact.

On January 24, 2008, the Liberia-registered fruit juice carrier M/V *Orange Sun* allided with a moored dredge as the juice carrier was outbound in Newark Bay, New Jersey.[50] 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 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.

[49] *Allision of Bahamas-Registered Tankship 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).

[50] *Allision of Liberia-Registered Fruit Juice Carrier M/V* 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).

Analysis

Exclusions. Following the accident, investigators tested the radar, steering, and propulsion equipment on both vessels and found it to be in proper working order. The NTSB therefore concludes that performance of radars and steering and propulsion systems was not a factor on either vessel, and was neither causal nor contributory in this accident.

Investigators interviewed the personnel on both vessels about their work and sleep schedules leading up to the accident. No one reported being tired or having reason to be fatigued on the day of the accident. However, the sleep/rest information collected was limited, and crew fatigue or wakefulness could not be verified. The NTSB therefore concludes that, because of insufficient sleep/rest information, it could not be determined whether fatigue was a factor in the accident.

Navigating in Restricted Visibility

As the *Morro Bay* entered Rhode Island Sound, the visibility decreased to about 2 miles. The bridge team then turned on its navigation lights and activated an automatic fog signal setting on the cutter's onboard loudhailer, which continued to sound every 2 minutes for over an hour leading up to the collision. However, as the Coast Guard stated in its June 2010 letter to the NTSB, the loudhailer was not an authorized sound signaling device because it did not produce the 130-decibel minimum required by navigation rules. This circumstance—along with the fact that the *Block Island*'s doors and windows were closed—may explain why the *Block Island* master and the mate never heard the cutter's fog signals leading up to the collision. Instead of the loudhailer, the *Morro Bay* bridge team should have used the cutter's whistle to sound the fog signals. The NTSB therefore concludes that the *Morro Bay* sounded fog signals on a device that did not meet auditory standards of international navigation rules, and consequently, the signals sounded by the *Morro Bay* leading up to the collision were not technically appropriate or sufficient. The commanding officer of the *Morro Bay* has since prohibited the use of the loudhailer as a sound signaling device. The prohibition should apply to all Coast Guard vessels. The NTSB therefore recommends that the Coast Guard determine whether its vessels are inappropriately using loudhailers for sound signaling, and ensure that all Coast Guard vessels use only sound signaling devices that meet auditory standards of international navigation rules.

The master of the *Block Island* told investigators that he did not activate the ferry's automatic fog signal, which would have sounded every 2 minutes, and instead sounded the signal manually, because he did not want automatic signals to interrupt radio communications. The master told investigators that he consequently sounded the fog signal less frequently than every 2 minutes, and that as many as 5 minutes or more may have passed between the signals. The NTSB therefore concludes that, up to the time of the collision, the *Block Island* did not sound fog signals at the 2-minute interval mandated by the rules of the road.

Despite the restricted visibility, both the *Morro Bay* and the *Block Island* were proceeding at fairly high rates of speed. The ferry was near full speed, about 15 knots, and maintained this speed until just before the collision. The cutter was proceeding at about 11 knots at a time when the visibility was, at best, 1.5–2 miles. Only after the *Morro Bay* crew unexpectedly spotted a 30-foot-long powerboat cross about 500 yards in front of the cutter did the bridge team reduce speed. And, despite the increasing fog during the transit, both bridge teams chose to station their lookouts within the confines of the bridge. The NTSB therefore concludes that, given both vessels' speeds in decreasing visibility, the *Morro Bay* and the *Block Island* bridge teams should have used greater precaution by stationing lookouts in locations where they could better see and hear other vessels.

The master of the *Block Island* told investigators that he was monitoring a deep draft vessel on the ferry's 6-mile radar and nearby small boat traffic on the 0.75-mile radar. In addition, the master was manually sounding the ferry's fog signal and making security calls on the VHF radio. All of this activity created enough distraction that the master missed spotting the approaching *Morro Bay* on the 6-mile radar and only became aware of its presence once the cutter appeared on the 0.75-mile radar.

Because the *Morro Bay*'s radar range scale was set to 1.5 miles, it is understandable that the *Block Island* did not appear on the cutter's radar until probably about 1208 or 1209, some 11–12 minutes after the ferry had already entered the open waters of Block Island Sound. It was only then that the outer limits of the cutter's 1.5-mile radar range scale would have picked up the ferry. Nevertheless, even after the *Block Island* would have appeared on the cutter's 1.5-mile radarscope about 1208 or 1209, no one on the *Morro Bay* noticed the ferry on the radar screen, and a close quarters situation was allowed to develop in spite of properly functioning radar equipment. About this time, numerous personnel changes had taken place on the cutter's bridge with people coming and going, which could have been distracting. Shortly before the accident, between five and seven persons were on the bridge, which was not an expansive space. The crossing of the 30-foot-long powerboat about 500 yards in front of the *Morro Bay* at 1210, 5 minutes before the collision, could also explain why the ferry continued to go unnoticed for the next few minutes. The chief took steps to ensure that the distance between the vessels opened, which was appropriate. However, while the chief watched the powerboat clear the *Morro Bay*'s path ahead, valuable time was lost in detecting the *Block Island* on the radar. Additional detection time (1–3 minutes, possibly) was also lost while the chief monitored the helmsman to ensure that he followed the order to return to original course after yielding to the powerboat. The chief also tried to reach the commanding officer by telephone to inform him of the decreasing visibility. The phone call took some time because the commanding officer was not immediately located (he was returning to the bridge). It cannot be determined who among the many persons on the bridge was monitoring the radar, or whether the radar was being monitored at all, during this phone call. The NTSB therefore concludes that the bridge watch personnel on both vessels failed to use their radars effectively in the minutes leading up to the collision.

Toxicological Testing

Morro Bay Crew

The crew of the *Morro Bay* was drug and alcohol tested about 7 hours after the accident at the Coast Guard station in New London, with a local police officer overseeing the testing. The alcohol test involved a sensor device and was completed on site. All results were negative. The drug testing samples were sent to an Army medical center in Hawaii for analysis. All results came back negative. The NTSB therefore concludes that neither illegal drug nor alcohol use by the *Morro Bay* crew was a factor in the accident.

Block Island Crew

The Block Island Medical Center collected urine samples from the master and the mate for drug testing but did not test the men for alcohol. The urine samples were to be shipped from Block Island to a laboratory on the mainland for analysis, but were lost after Interstate Navigation Co.'s terminal office took custody of the samples and delivered them to a company ferry at Block Island. Because of these lapses, Interstate Navigation Co. revised its drug and alcohol testing policy. However, the NTSB concludes that because no alcohol testing was done following the collision and because Interstate Navigation Co. personnel lost the drug testing samples before they were analyzed, Interstate Navigation Co.'s postaccident toxicological testing program in effect at the time of the accident was ineffective and prevented a determination whether illegal drug or alcohol use by the *Block Island* master or the mate played a role in the accident.

Safety Management Systems

Interstate Navigation Co.'s Block Island ferries travel across a major east-west traffic route for large vessels transiting between New York Harbor and the Atlantic Ocean, often in limited visibility conditions. Had the July 2, 2008, collision been more serious, the consequences of this accident could have been far greater.

During postaccident communication with several *Block Island* passengers, NTSB investigators found that a majority of the passengers thought that the accident response of the *Block Island* crew could have been better. In particular, passengers generally thought that a collision warning should have been announced over the PA system and that a more prompt advisory announcement should have been made following the collision so that passengers could have had a better sense of what was happening. Only after being prompted did the master ensure that an announcement to the passengers was made following the collision.

As previously mentioned, Interstate Navigation Co. declined the state of Rhode Island's request, based on Safety Recommendation M-05-7, that the company voluntarily develop a safety management system. Interstate Navigation Co. did have documentation that outlined shipboard positions and duties and what was required (qualifications, experience, and education) to perform those. The company also had a training manual, which provided expectations for handling fire and emergencies and for general watchstanding. Nevertheless, in reviewing Interstate Navigation Co.'s policies and procedures, investigators found that the company's safety philosophy was informal and incorporated into on-the-job training. It was not evident whether Interstate Navigation Co. had conducted any internal or management audits. As a result, the company may not have conveyed a consistent safety culture to its crewmembers. Better management oversight of crew operations could have prevented deficiencies such as the master's inadequate sounding of the *Block Island*'s fog signal, the ineffective posting of a lookout, and the crew's postaccident response to passengers. The NTSB therefore concludes that a safety management system at Interstate Navigation Co. could have contributed to more thorough operational procedures on the *Block Island* and greater oversight by management.

Interstate Navigation Co. was responsive in correcting some of the problems that investigators identified during the accident investigation; however, the company still falls short of meeting the functional requirements prescribed for a safety management system. The NTSB therefore recommends that Interstate Navigation Co. comply with the provisions of 33 CFR Part 96 for implementation of a safety management system for its fleet to improve safety practices and minimize risk.

In operations such as passenger ferry services, where accidents can lead to catastrophic loss of life, a proactive safety management system can be a chief countermeasure to safety risks. Such a system entails risk assessment appropriate to the vessel and its operation, development of safety-centered practices and procedures for which documents and training are provided, and internal and external audits to ensure consistent performance.

A safety management system identifies safety-related procedures for crewmembers during both routine and emergency operations. Duties and responsibilities are specified and supervisory and subordinate chains of command delineated. Each crewmember, as a result, better understands what is expected of him or her in critical phases of operations. In addition, safety management systems call for the creation of plans, with crewmember duties and responsibilities specified, to respond to the range of potential emergency situations the ferry could encounter.

Despite the large carrying capacity of individual ferry vessels, such as the *Block Island* with potentially over 1,000 persons on board, only organizations that operate internationally or that have voluntarily adopted the approach operate under safety management systems in the United States. Given the thousands of passengers who ride ferries on U.S. waterways, the NTSB continues to be concerned that the absence of a requirement to implement safety management systems could result in the type of safety-deficient operations found both on the *Block Island* and in the 2003 accident involving the *Andrew J. Barberi* ferry. Although some U.S. domestic ferry systems have voluntarily adopted a safety management system, the NTSB concludes that safety management systems on all passenger ferries would enhance the likelihood that operators will maintain the high standards of safety that the Coast Guard requires of U.S. oceangoing vessels operating from the United States. Therefore, the NTSB reiterates Safety Recommendation M-05-6 and recommends that the Coast Guard 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.

Automatic Identification Systems

One of the benefits of AIS is that the system provides a secondary electronic method of detecting AIS-equipped vessels in the area. AIS is independent of radar, which can have limitations, such as when a target might be obscured by rain and sea clutter on the radar image. Both the fully integrated and the more basic, nonintegrated AIS versions can help enhance vessel operators' situational awareness. Because of that, the NTSB supports the Coast Guard's rulemaking initiative to expand AIS requirements, which could provide significant improvement to passenger vessel safety. The NTSB concludes that, if AIS had been installed on the *Block*

Island, both the *Block Island* and the *Morro Bay* would have had navigational information about each other, independent of radar, that could have facilitated a safe passing arrangement.

Voyage Data Recorders[51]

The safety value of recorded electronic data has been definitively demonstrated in all modes of transportation. Witness statements are important in understanding the circumstances of an accident, but they are sometimes contradictory and less conclusive than electronic data, especially high-quality audio recordings of events before an accident. Contrary to the comments made by some operators of small passenger vessels in response to the Coast Guard's 2008 VDR report, analysis of recorded electronic data can result in the identification and correction of safety deficiencies in vessel operations, which can help prevent accidents. A number of countries around the world have recognized the potentially severe consequences of accidents on passenger vessels and have taken action to mandate the carriage of VDRs on their domestic vessels.

In its 2008 VDR report, the Coast Guard acknowledged the value of recorder information and made a recommendation that certain ferry vessels be required to "capture the types of information recorded by a VDR." However, the Coast Guard's expectation that the current rulemaking for AIS and electronic chart system carriage requirements will encompass the recording of an adequate level of data is unrealistic. To be most useful to accident investigators, the recorded electronic data should be in a standard, nonproprietary format and contain specific information recorded with adequate quality. In these respects, the performance standards for electronic chart systems are inadequate. For example, the standards allow for parametric data (own ship's positions, and corresponding times, courses, and speeds) to be recorded at 1-minute intervals, which is far less than the VDR standard's data rate of 1-second intervals. In addition, the electronic chart system performance standards do not require the recording of bridge audio or radar images, a serious limitation to accident investigation. As noted in the Coast Guard's VDR report, some makers of electronic chart systems are developing the capability to record bridge audio, but, because of the additional cost involved, it will likely be an optional feature that few vessel operators will incorporate in their electronic chart system equipment unless required by the Coast Guard. In addition, the quality of the audio recording will be unpredictable because it would not be designed to meet a recognized performance standard, such as the existing VDR performance standard for audio recordings. Finally, the format of the data in electronic chart system recordings, unlike those of VDR recordings, is not required to be in a standard, nonproprietary format, and it is likely that manufacturer-specific software and hardware will be needed to analyze them, greatly complicating the work of accident investigators. The NTSB therefore concludes that electronic chart systems and AIS do not provide the data recording capability of VDRs and do not capture the level of detail required to identify causes of accidents. As noted in the Canadian cost/benefit analysis, installing VDRs on vessels at the initial design stage poses little technical difficulty and moderate additional cost. The NTSB therefore concludes that installing VDRs would enhance safety on new ferry vessels. The NTSB recommends that the Coast Guard require installation of VDRs that meet the international performance standard on new ferry vessels.

[51] Unless otherwise specified, the terms "voyage data recorder(s)" and "VDR(s)" used in this section include simplified voyage data recorders, or S-VDRs.

Installing VDRs or S-VDRs on existing ferry vessels will likely be technically challenging on older vessels because it may not reasonably be possible to capture the designated data on these vessels. The IMO anticipated this technical difficulty and developed an alternative standard for older vessels. This standard allows for exemptions from the requirement to record certain data if it can be shown that it would be infeasible to do so. The NTSB concludes that flexible application of the VDR standard to existing ferry vessels would alleviate the burden of compliance for those vessels where it can be shown that recording the full data set is not feasible. The NTSB recommends that the Coast Guard require installation of VDRs on ferry vessels built before the enactment of VDR carriage requirements that will record, at a minimum, the same video, audio, and parametric data specified in the IMO's performance standard for S-VDRs.

Conclusions

Findings

1. Performance of radars and steering and propulsion systems was not a factor on either vessel, and was neither causal nor contributory in this accident.

2. Because of insufficient sleep/rest information, it could not be determined whether fatigue was a factor in the accident.

3. The *Morro Bay* sounded fog signals on a device that did not meet auditory standards of international navigation rules, and consequently, the signals sounded by the *Morro Bay* leading up to the collision were not technically appropriate or sufficient.

4. Up to the time of the collision, the *Block Island* did not sound fog signals at the 2-minute interval mandated by the rules of the road.

5. Given both vessels' speeds in decreasing visibility, the *Morro Bay* and the *Block Island* bridge teams should have used greater precaution by stationing lookouts in locations where they could better see and hear other vessels.

6. The bridge watch personnel on both vessels failed to use their radars effectively in the minutes leading up to the collision.

7. Neither illegal drug nor alcohol use by the *Morro Bay* crew was a factor in the accident.

8. Because no alcohol testing was done following the collision and because Interstate Navigation Co. personnel lost the drug testing samples before they were analyzed, Interstate Navigation Co.'s postaccident toxicological testing program in effect at the time of the accident was ineffective and prevented a determination whether illegal drug or alcohol use by the *Block Island* master or the mate played a role in the accident.

9. A safety management system at Interstate Navigation Co. could have contributed to more thorough operational procedures on the *Block Island* and greater oversight by management.

10. Safety management systems on all passenger ferries would enhance the likelihood that operators will maintain the high standards of safety that the Coast Guard requires of U.S. oceangoing vessels operating from the United States.

11. If an automatic identification system had been installed on the *Block Island*, both the *Block Island* and the *Morro Bay* would have had navigational information about each other, independent of radar, that could have facilitated a safe passing arrangement.

12. 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.

13. Installing voyage data recorders would enhance safety on new ferry vessels.

14. Flexible application of the voyage data recorder standard to existing ferry vessels would alleviate the burden of compliance for those vessels where it can be shown that recording the full data set is not feasible.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the collision between the ferry *Block Island* and the Coast Guard cutter *Morro Bay* was the failure of the bridge watch officers on both vessels to monitor their radars, sufficiently assess traffic, and compensate for limited visibility. Contributing to the accident was the failure of the bridge watch officers on both vessels to maintain a proper lookout and to sound appropriate fog signals.

Recommendations

New Recommendations

As a result of its investigation, the National Transportation Safety Board makes the following safety recommendations:

To the U.S. Coast Guard:

Determine whether your vessels are inappropriately using loudhailers for sound signaling, and ensure that all Coast Guard vessels use only sound signaling devices that meet auditory standards of international navigation rules. (M-10-4)

Require installation of voyage data recorders that meet the international performance standard on new ferry vessels. (M-10-5)

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 voyage data recorders. (M-10-6)

To Interstate Navigation Co.:

Comply with the provisions of 33 *Code of Federal Regulations* Part 96 for implementation of a safety management system for your fleet to improve safety practices and minimize risk. (M-10-7)

Previously Issued Recommendation Reiterated in This Report

As a result of its investigation, the National Transportation Safety Board reiterates the following safety recommendation:

To the U.S. Coast Guard:

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-05-6)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

DEBORAH A.P. HERSMAN
Chairman

ROBERT L. SUMWALT
Member

CHRISTOPHER A. HART
Vice Chairman

MARK R. ROSEKIND
Member

EARL F. WEENER
Member

Adopted: December 3, 2010

Member Rosekind filed the following concurring statement on November 24, 2010.

Notation 8053B

Member Rosekind, Concurring:

The available out-of-water survival craft on board the *Block Island* vessel would not have accommodated all of the ferry's total passenger carrying capacity. Given this circumstance, it is important to note that in 2009 the Board recommended that the U.S. Coast Guard require all small passenger vessels to have out-of-water survival craft available for each passenger on all routes. (M-09-17)

Appendixes

Appendix A

The NTSB's Office of Marine Safety team of investigators arrived in Providence, Rhode Island, on the evening of July 2, 2008. At 0800 the next day, the team met Coast Guard investigators and proceeded to the *Block Island*, which was moored at the ProMet Marine Services shipyard in Providence. The team was joined there by Interstate Navigation Co. operations management and by Coast Guard inspectors assigned to oversee repairs to the ferry. The team documented the damage to the vessel and also assessed the pilothouse equipment, official logs, and files, and began interviewing crewmembers. On the afternoon of Friday, July 4, 2008, the NTSB team accompanied Coast Guard investigators to New London to assess the *Morro Bay* and to interview its crew. The team reviewed and downloaded playback of the vessel's electronic chart display system, and a video was made for distribution to parties.

On Saturday, July 5, 2008, NTSB investigators boarded the *Block Island* for her scheduled 0800 transit from Point Judith to Block Island. Investigators observed operations, conducted further interviews, and verified whistle signals and PA system announcements. On arrival at Block Island, investigators met with the company's security officer and collected documents and information about the accident. Investigators also had the opportunity to observe the ferry's operation in restricted visibility, because fog during the return transit decreased the visibility to less than 0.10 mile. Whistle signals were assessed from the passenger deck, with the doors to the bow open.

Appendix B

House bill H.R. 3619 (the Coast Guard Authorization Act of 2010) was enacted into law on October 15, 2010 (P.L. 111-281). Section 810 of that bill, which pertains to safety management systems on passenger vessels, states the following:

SEC. 610. SAFETY MANAGEMENT.

(a) Vessels to Which Requirements Apply- Section 3202 of title 46, United States Code, is amended--

(1) in subsection (a) by striking the heading and inserting ‘Foreign Voyages and Foreign Vessels- ’;

(2) by redesignating subsections (b) and (c) as subsections (c) and (d), respectively;

(3) by inserting after subsection (a) the following:

‘(b) Other Passenger Vessels- This chapter applies to a vessel that is--

‘(1) a passenger vessel or small passenger vessel; and

‘(2) is transporting more passengers than a number prescribed by the Secretary based on the number of individuals on the vessel that could be killed or injured in a marine casualty.’;

(4) in subsection (d), as so redesignated, by striking ‘subsection (b)’ and inserting ‘subsection (c)’; and

(5) in subsection (d)(4), as so redesignated, by inserting ‘that is not described in subsection (b) of this section’ after ‘waters’.

(b) Safety Management System- Section 3203 of title 46, United States Code, is amended by adding at the end the following new subsection:

‘(c) In prescribing regulations for passenger vessels and small passenger vessels, the Secretary shall consider--

‘(1) the characteristics, methods of operation, and nature of the service of these vessels; and

‘(2) with respect to vessels that are ferries, the sizes of the ferry systems within which the vessels operate.’.