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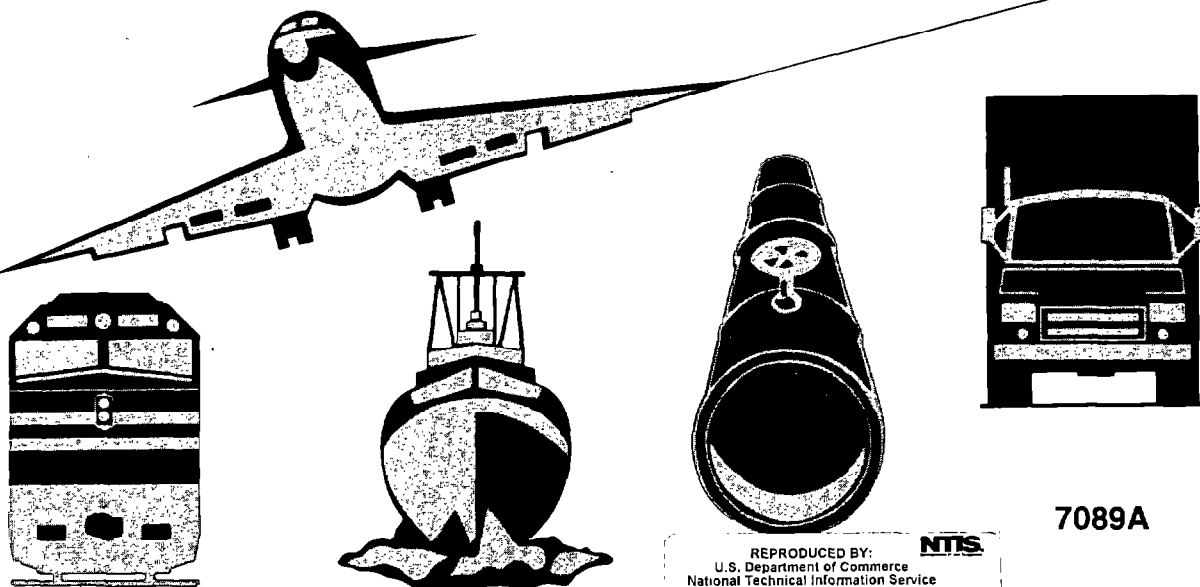
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MARINE ACCIDENT REPORT

SINKING OF THE RECREATIONAL SAILING VESSEL
MORNING DEW AT THE ENTRANCE TO THE HARBOR
OF CHARLESTON, SOUTH CAROLINA
DECEMBER 29, 1997



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National Transportation Safety Board. 1999. *Sinking of the Recreational Sailing Vessel Morning Dew at the Entrance to the Harbor of Charleston, South Carolina, December 29, 1997.* Marine Accident Report NTSB/MAR-99/01. Washington, DC.

Abstract: During the early morning hours of December 29, 1997, the 34-foot recreational sailing vessel *Morning Dew* struck the rock jetty on the north side of the shipping channel into the harbor of Charleston, South Carolina. The owner/operator of the vessel and his three passengers, all members of the same family, died as a result of the accident.

The major safety issues identified in this investigation are the adequacy of the reasoning and decision-making of the operator; the fatigue and hypothermia suffered by the operator; the adequacy of the reasoning and decision-making of U.S. Coast Guard Group Charleston's watchstanders; the adequacy of Coast Guard Group Charleston's personnel, equipment, and procedures for responding to an emergency; and the role of the Coast Guard in providing factual information for safety investigations.

As a result of its investigation, the Safety Board makes safety recommendations to the U.S. Coast Guard, the Governors of the 50 States and the U.S. Territories, the National Association of State Boating Law Administrators, the U.S. Coast Guard Auxiliary, the U.S. Power Squadrons, the National Safe Boating Council, and the Boat Owners Association of the United States.

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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Marine Accident Report

Sinking of the Recreational Sailing Vessel *Morning Dew* at the Entrance to the Harbor of Charleston, South Carolina December 29, 1997

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Notation 7089A
Adopted: October 5, 1999



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

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Executive Summary

During the early morning hours of December 29, 1997, the 34-foot recreational sailing vessel *Morning Dew* struck the rock jetty on the north side of the shipping channel into the harbor of Charleston, South Carolina. The boat was later found about 15 yards south of the jetty, submerged in about 12 feet of water. The owner/operator of the vessel and his three passengers, all members of the same family, died as a result of the accident.

The National Transportation Safety Board determines that the probable cause of the sinking of the recreational sailing vessel *Morning Dew* was the operator's failure to adequately assess, prepare for, and respond to the known risks of the journey into the open ocean that culminated in the vessel's allision with the jetty at the entrance to Charleston Harbor. Contributing to the loss of life in this accident was the substandard performance of U.S. Coast Guard Group Charleston in initiating a search and rescue response to the accident.

The major safety issues identified in this investigation are the adequacy of the reasoning and decision-making of the operator; the fatigue and hypothermia suffered by the operator; the adequacy of the reasoning and decision-making of Coast Guard Group Charleston's watchstanders; the adequacy of Coast Guard Group Charleston's personnel, equipment, and procedures for responding to an emergency; and the role of the Coast Guard in providing factual information for safety investigations.

As a result of its investigation, the Safety Board makes safety recommendations to the U.S. Coast Guard, the Governors of the 50 States and the U.S. Territories, the National Association of State Boating Law Administrators, the U.S. Coast Guard Auxiliary, the U.S. Power Squadrons, the National Safe Boating Council, and the Boat Owners Association of the United States.

Background of Investigation

The Safety Board undertook its investigation of the *Morning Dew* accident at the specific request of several Members of Congress who wanted an independent investigation of the accident, with particular attention given to the U.S. Coast Guard's response.

The congressional requests came in April 1998, more than 3 months after the accident. By this time, the *Morning Dew* had been scrapped and its hull buried in a landfill. The vessel was thus not available for Safety Board examination. Nor were certain recordings of radio transmissions and telephone conversations available for transcribing or review, because the tapes had been reused.

On February 3 and 4, 1999, the Safety Board held a public hearing in Charleston, South Carolina, to examine the issues raised by the Safety Board's investigation and to provide an opportunity for public comment by interested parties. At the hearing, the Board heard testimony from the Group Charleston watchstander and operations duty officer who were involved in the accident response; higher level Coast Guard officials, including the commander of the Seventh Coast Guard District, the commander of Group Charleston, and the chief of the Coast Guard Office of Search and Rescue; the operator of the pilot boat that conducted a search after cries were reported being heard from the water; personnel from the South Carolina Department of Natural Resources and the coroner's officer who were involved in the response to the accident and the subsequent investigation; officials from the U.S. Naval Surface Warfare Center; an official from the Canadian Coast Guard; and the widow of the deceased operator of the *Morning Dew*.

One issue the Safety Board addressed in particular involved the Coast Guard's sharing of search and rescue information with State and local agencies and with the families of the accident victims. Coincident with the public hearing, the Coast Guard published ALDIST 041/99, which provides interim guidance for sharing search and rescue information with State and local agencies and for interacting with families of victims of boating accidents.

Early in its investigation of the *Morning Dew* accident, the Safety Board recognized that, as in several other accidents known to the Board, the major safety issue involved the communications that preceded the initiation of a search and rescue effort. Therefore, the Board made the decision to concentrate primarily on Coast Guard search and rescue communications personnel, equipment, and procedures. Adequacy of Coast Guard stations, vessels, aircraft, and personnel to perform search and rescue missions was not addressed.

After the Safety Board began its investigation of the *Morning Dew* accident, two other accidents, a 1998 accident involving the recreational fishing vessel *Florida Air Specialist* and a 1999 accident involving the commercial fishing vessel *Adriatic*, occurred

and brought to light similar issues relating to the Coast Guard's response to distress calls. The facts of those accidents were also considered in the Safety Board's evaluation of the Coast Guard's search and rescue communications effort, as were findings from two other accidents previously investigated by the Board.

Factual Information

Events Preceding the Accident

In December 1997, a 49-year-old recreational boater planned to sail his newly purchased 34-foot sailboat, *Morning Dew* (figure 1), from its berth in a marina at Little River (near North Myrtle Beach, South Carolina) to Jacksonville, Florida. (See figure 2.) According to family members, he was to be accompanied on the trip by his brother, his two sons, ages 16 and 13, and his 14-year-old nephew. Although the boat was equipped with sails, the owner (hereinafter referred to as the “operator”) planned to make the trip under power using the vessel’s auxiliary diesel engine.



Figure 1. Sailing vessel *Morning Dew* before it was acquired by the accident owner

According to the operator’s brother, the two men and the three teenagers arrived at Lightkeepers Marina, where the *Morning Dew* was berthed, about 1730 on December 26, 1997. After moving personal equipment, including life preservers (hereinafter referred to as “personal flotation devices,” or PFDs) onto the boat, they had dinner and then spent the night on the vessel, going to sleep about 2200.

The brother said that he and the operator got up about 0600 the next day. He said the entire party had breakfast at a nearby restaurant and then went to a marina where they bought some signal flares and a series of nautical charts covering the Intracoastal

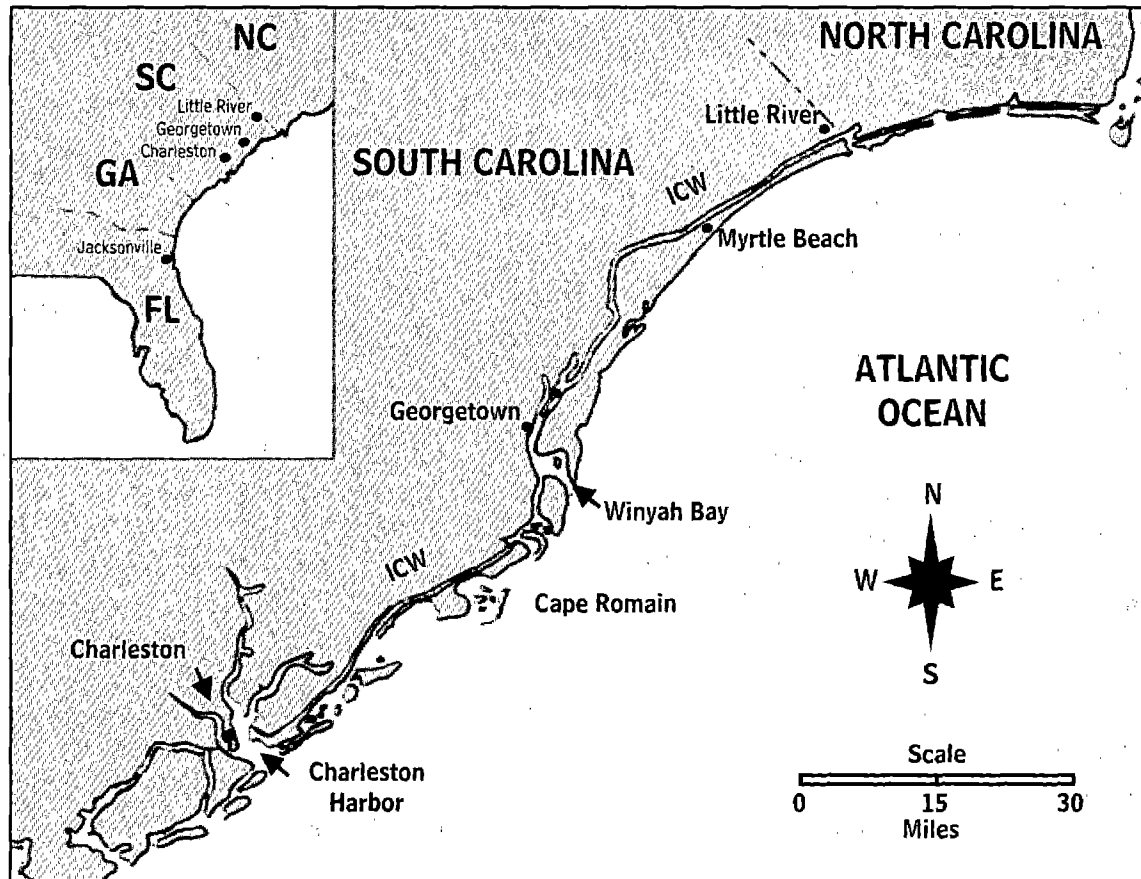


Figure 2. Intended Route of *Morning Dew*

Waterway (ICW)¹ between Little River and Jacksonville. The brother stated that the operator pencilled in the intended route to Jacksonville and that the entire route followed the ICW. He said the operator said nothing that would indicate that he planned at any point along the route to leave the waterway and take the vessel to sea.

The brother said that when they returned onboard, they attempted to start the diesel engine, but the starting battery was dead. He said that they bought and installed a new battery, after which the diesel engine was started and the battery charging system was checked. He said the alternator was working and the batteries were being charged. The brother said the operator conducted a radio check of the onboard VHF-FM radio and that the radio was working. He stated that he and the operator verified that all the navigation lights were operating satisfactorily. He also recalled that the operator had obtained a weather report.

The operator's brother stated that because their father was hospitalized at the time the trip was set to begin, he decided to stay behind. He said he left his PFD on board. He said the boys had brought sleeping bags and were planning to sleep in the vessel's V-berth in the forward part of the boat. Metal hooks in the cabin were to be used to hang the PFDs.

¹ For more information about the ICW, see the "Waterway Information" section of this report.

According to the brother, the operator and the three boys got underway about 1230 on December 27, then stopped for fuel at a nearby marina. Records from the Myrtle Beach Yacht Club indicate that the operator bought 39.5 gallons of diesel fuel.²

The bridge tender's log at Little River swing bridge, ICW mile 347.2, indicated that the bridge draw span was opened for the southbound *Morning Dew* between 1300 and 1310. The next exit from the ICW was Georgetown, South Carolina, where Winyah Bay provides a route to the Atlantic Ocean. To reach Georgetown, the vessel had to pass through the Soccastee draw bridge at ICW mile 371.0; however, the bridge tender there did not log the passage of the *Morning Dew*; thus, the time of the vessel's arrival at that location could not be determined.

The operator telephoned his sister-in-law in Jacksonville about 2030 on December 27. Telephone records indicate that the call was made from a motel on the ICW about 10 miles north of Georgetown. According to the sister-in-law, the operator reported that the vessel had made only about 20 miles up to that point because of its late start, but that he intended to stay in the ICW all the way to Jacksonville. The investigation revealed no other information regarding the *Morning Dew*'s voyage on the evening of December 27.

A Georgetown salvage master stated that he saw the *Morning Dew* moored at the Boat Shed Marina in Georgetown (figure 3) about noon on December 28. Marina employees stated that the marina was closed for the holidays on December 28 and that they had no knowledge of the *Morning Dew*'s having been moored there.

The salvage master said that later in the day on December 28, about 1430, he was proceeding inbound in the main shipping channel of Winyah Bay when he met and passed the *Morning Dew* near buoy 26. (See figure 4.) He said the sailing vessel was under power and was proceeding southeasterly in the main shipping channel, heading toward the ocean. The salvage master stated that he saw three boys in windbreakers on the bow of the boat and an adult dressed in rain gear at the wheel.

The salvage master stated that boaters proceeding south in the ICW occasionally fail to follow the ICW across Winyah Bay and erroneously follow the main shipping channel toward the ocean. Believing that the operator of the *Morning Dew* may have made this mistake, he said he noted the name of the *Morning Dew* and made four or five unsuccessful attempts to reach the vessel using VHF channel 16.³ He said that a sport fishing vessel in the vicinity also attempted to call the *Morning Dew* but received no answer.

To exit Winyah Bay and reach the open ocean, it was necessary for the *Morning Dew* to continue in or near the shipping channel for about another 7 miles, during which time the vessel would pass some 12 or more channel markers before reaching the mouth of

² The vessel's fuel tank held 35 gallons; a 5-gallon container of diesel fuel believed to have come from the *Morning Dew* was found on the beach after the accident.

³ Coast Guard officials stated that under Coast Guard policy, tape recordings of radio transmissions are retained for only 30 days, after which they are reused. By the time the Safety Board began its investigation, recordings of radio transmissions received on December 28 were thus no longer available for transcribing or review.

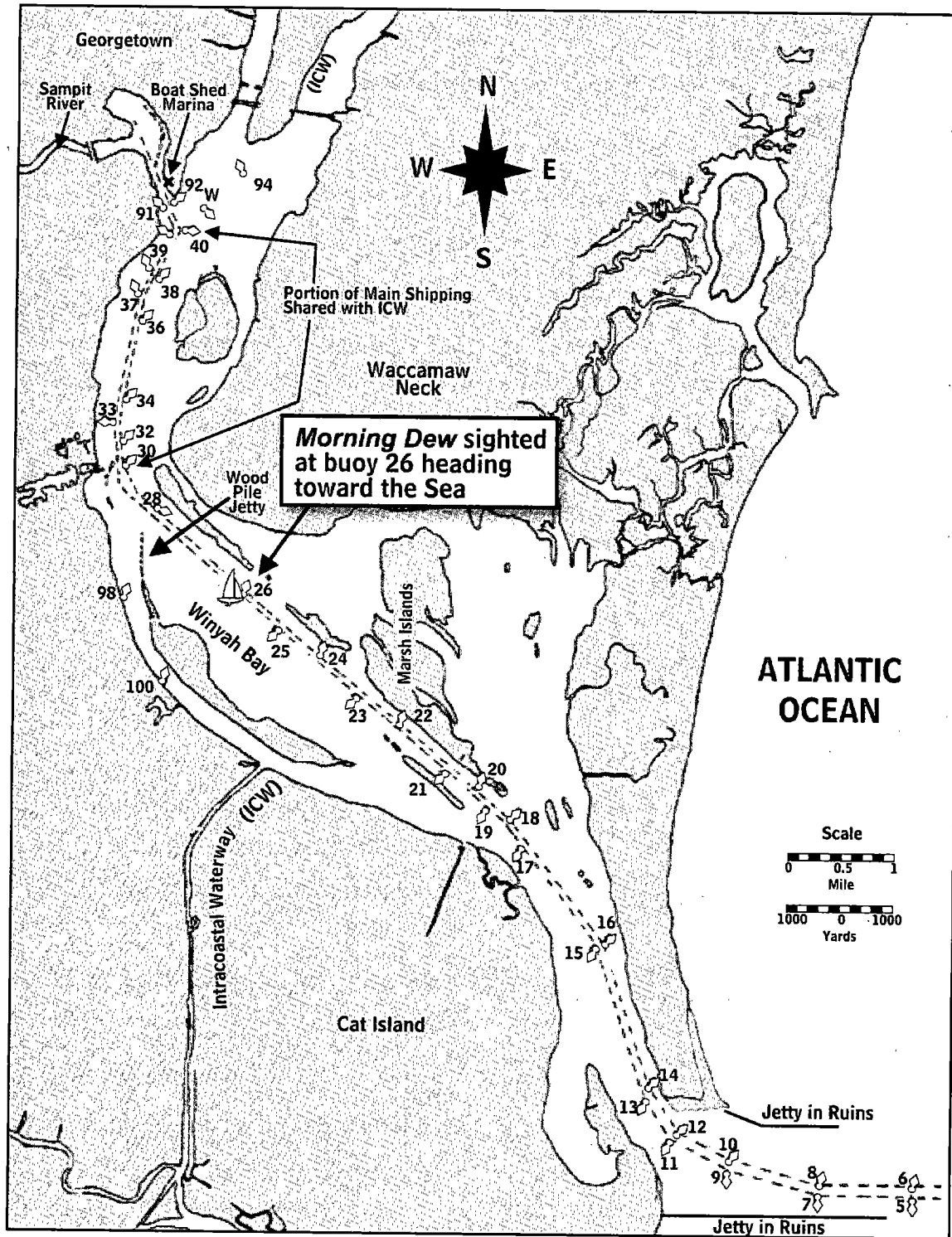


Figure 3. Winyah Bay

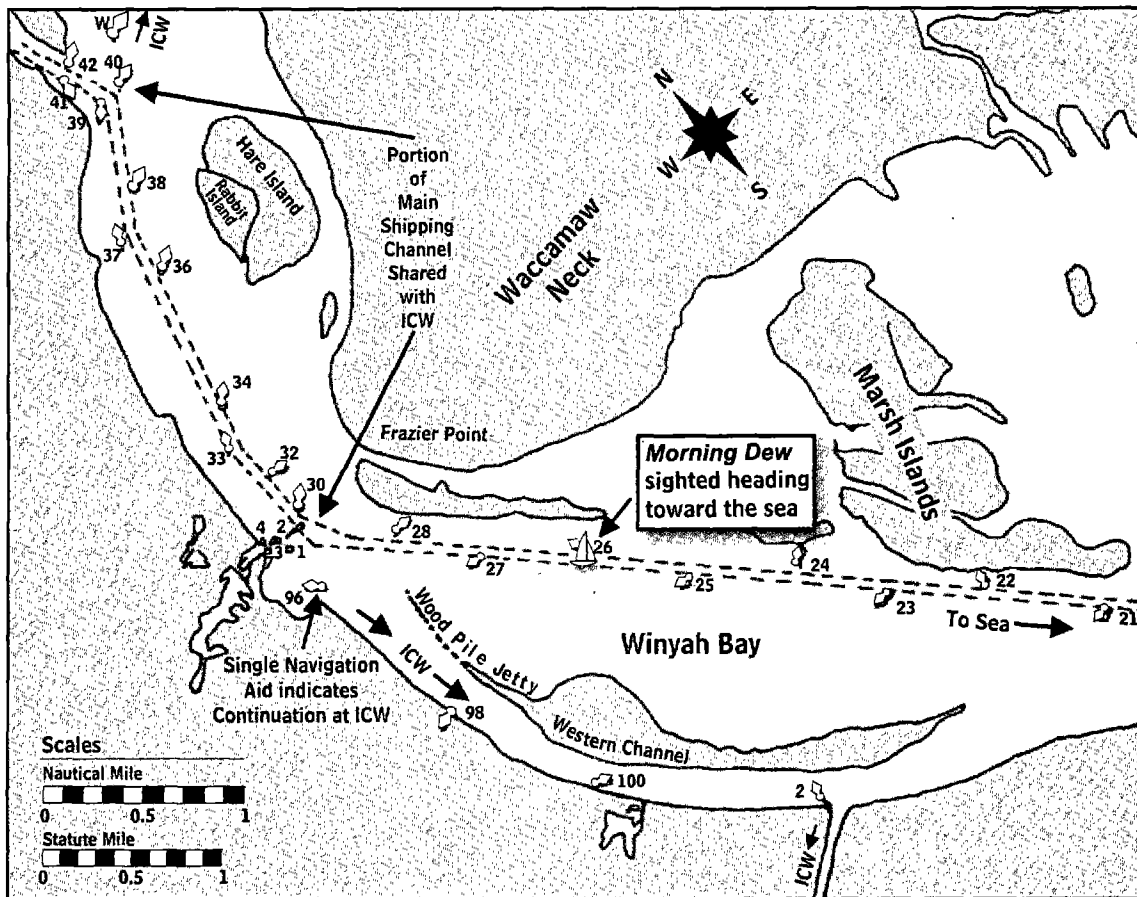


Figure 4. Winyah Bay detail view

the bay. Once at the mouth of the bay, the vessel had to navigate past the 2.2-mile-long south jetty before turning right to follow a southwesterly course, along the coast, toward Charleston, South Carolina, about 43 miles away. (See figure 5.)

Events During the Early Hours of December 29

At 0217 on December 29, 1997, the communications watchstander at U.S. Coast Guard Group Charleston received a radio call on VHF Channel 16. The watchstander said he was standing at the coffee pot just outside the door of the communications center (see figure 6) when the call was received and that he heard only the portion of the message consisting of "U.S. Coast Guard...," which he said he thought he heard twice. He said he noted that the transmission had been received by the high-site antenna at Mount Pleasant, near the entrance to Charleston Harbor.

The watchstander stated that the call was weak and affected by static. According to recordings of the radio transmissions, about 14 seconds later, the watchstander used the Mount Pleasant antenna to broadcast, "Vessel calling Coast Guard, this is Coast Guard Group Charleston, over." He then repeated the transmission using all six high-site antennas and invited the caller to respond on channel 16. He did not receive a reply. About

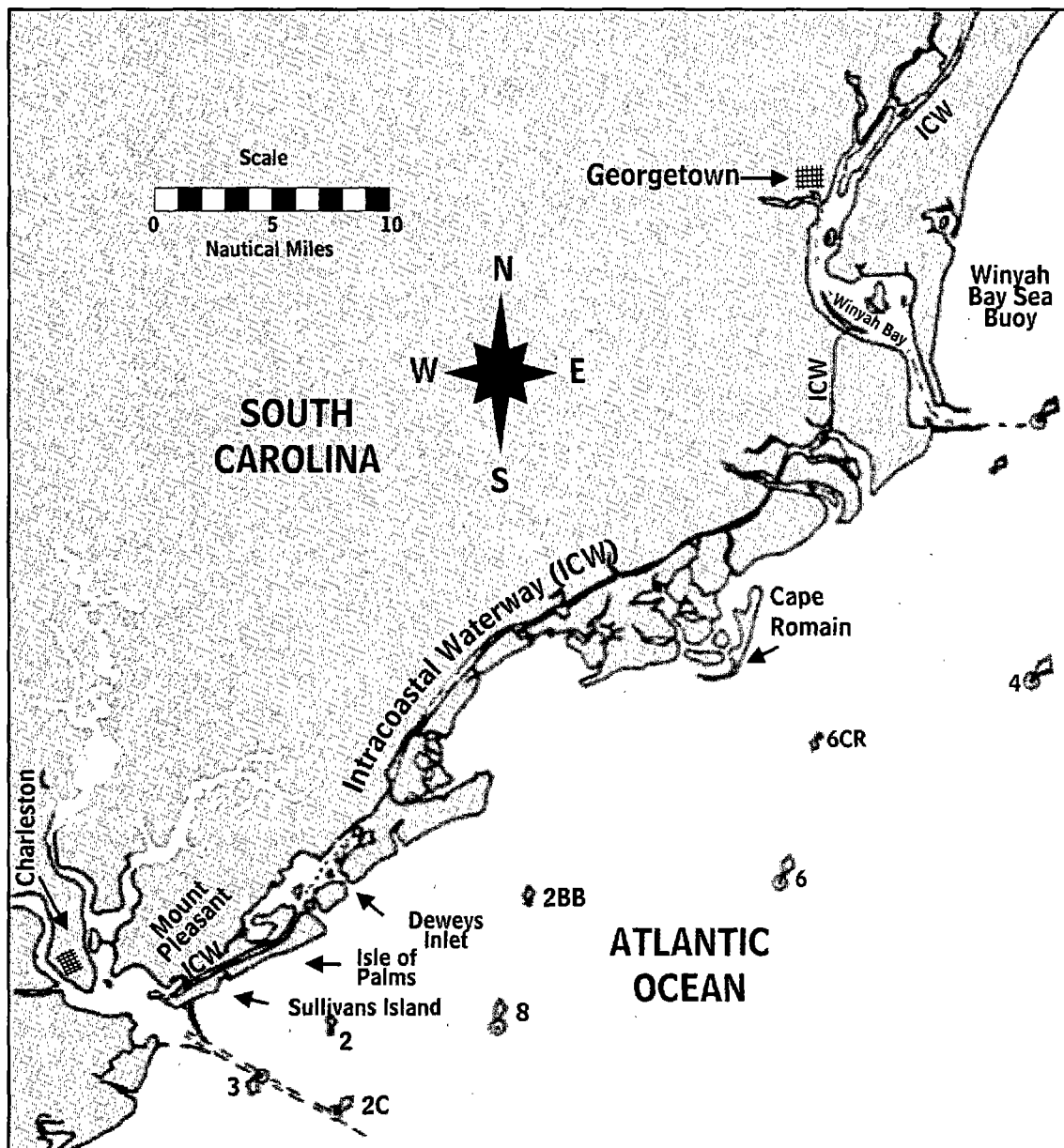


Figure 5. Coast route from Winyah Bay to Charleston Harbor

4 minutes later, another radio transmission, which sounded like a brief burst of static, was received. Later replaying of the recording revealed that although the words of the second call were unintelligible, the call seemed to have been transmitted by the same person as the first, in the same urgent, shouting fashion. About 14 seconds after the second call, the watchstander responded with two call outs,⁴ using all six high sites, but he again did not receive an answer.

⁴ In Coast Guard terminology, a *call out* consists of a watchstander's attempting to reach the initiator of a call by transmitting "Vessel calling Coast Guard, this is Coast Guard [group/station], channel one six, over."

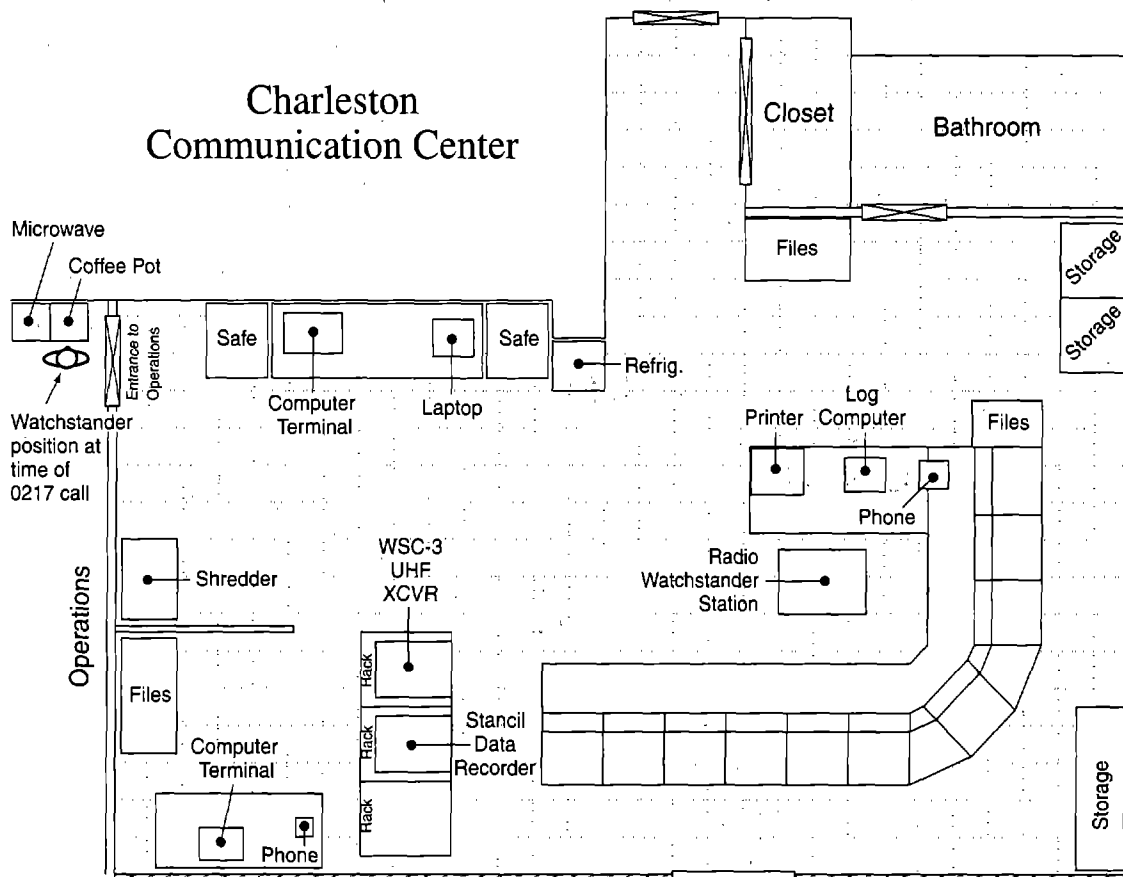


Figure 6. Layout of Group Charleston communications center

The watchstander later stated he considered the first call to be a routine call, either for information or as a radio check, possibly from a distant vessel. He did not log the call, nor did he consider it necessary to replay the recording of the call or to inform the operations duty officer, who was sleeping in a nearby room.⁵

In response to the question: "When you did not receive a response, did you try to evaluate what was going on?" the watchstander testified:

Not a whole lot. I...just felt there was somebody calling...the Coast Guard. I didn't get a response, so I thought, well it might have been they didn't need me anymore, or...they were out of my range or something because it was a bad transmission.

⁵ Because of personnel shortages, Coast Guard Group Charleston had adopted 24-hour shifts for operations duty officers. When no search and rescue or other activities were ongoing, the duty officers were permitted to sleep from 2200 to 0600 in a bunk room near the communications center. See the "Other Information" section of this report for more information.

Asked why he did not replay the recording of the 0217 call, he said:

I thought it wasn't...[an] important enough call to go back to and listen to it.... I didn't hear any distress words. All I heard was U.S. Coast Guard. We get lots of calls for U.S. Coast Guard, constantly, that are...nothing. They're just wanting to ask a question or something. I thought it was something like that. I thought it was just a question.

Later replaying of the tape recording of the 0217 call revealed what sounded like the voice of an excited adolescent male. The transmission, which lasted about 3 seconds, consisted of "May...mayday, U.S. Coast Guard come in."⁶ When the watchstander was asked whether he considered the excitement in the voice, or the time of night, or the weather forecast when he was evaluating the call, he replied that seemingly excited young people talking loudly on the radio is not unusual. He stated that people calling the Coast Guard are frequently in a noisy environment and feel they must yell to be understood. Further, he stated that he had received, at all hours, routine calls for information, such as status of the tide, time, and radio checks.

The watchstander stated that the second call, received about 4 minutes after the first, sounded like a burst of static and that he did not hear any indication of a voice. He stated that a similar burst of static could be caused by a lightning strike.

About 0620 on the morning of December 29, 1997, the automobile carrier *Pearl Ace* was proceeding into Charleston Harbor. The vessel's boatswain was on deck on the starboard side, securing a pilot ladder. The boatswain said that about this time, he heard cries for help that seemed to come from the water on the starboard side of the vessel. He immediately called the bridge and reported the cry or cries for help.

The vessel's master informed the pilot, who was in charge of navigating the vessel into port. The master, the chief officer, and the pilot went outside to the wing of the bridge, but, they said, they neither saw nor heard anything. The chief officer used an aldis lamp, a small handheld signal search light, to illuminate the water, but they could see nothing. The pilot determined that the *Pearl Ace* was passing buoy 22 about the time of the boatswain's call to the bridge. (See figure 7.)

The pilot called the pilot boat *Palmetto State*, which was proceeding into port ahead of the *Pearl Ace*, informed the operator about the boatswain's report, and asked the operator to return and search the area. He also asked the pilot dispatcher to call the Coast Guard and inform them of the report and of the actions of the pilot boat. The operator of the *Palmetto State* stated that it was about 0625 when he received the call from the pilot and that he immediately turned around and proceeded to the area.

At 0628, the pilot dispatcher called the Coast Guard. The night watchstander (the same watchstander who had received the earlier radio calls) answered the phone. He was

⁶ The first mayday was incomplete, as though the radio had cut out briefly. The word sounded like "may" or "mayd." For consistency, "may..." is used in this report for the first mayday.

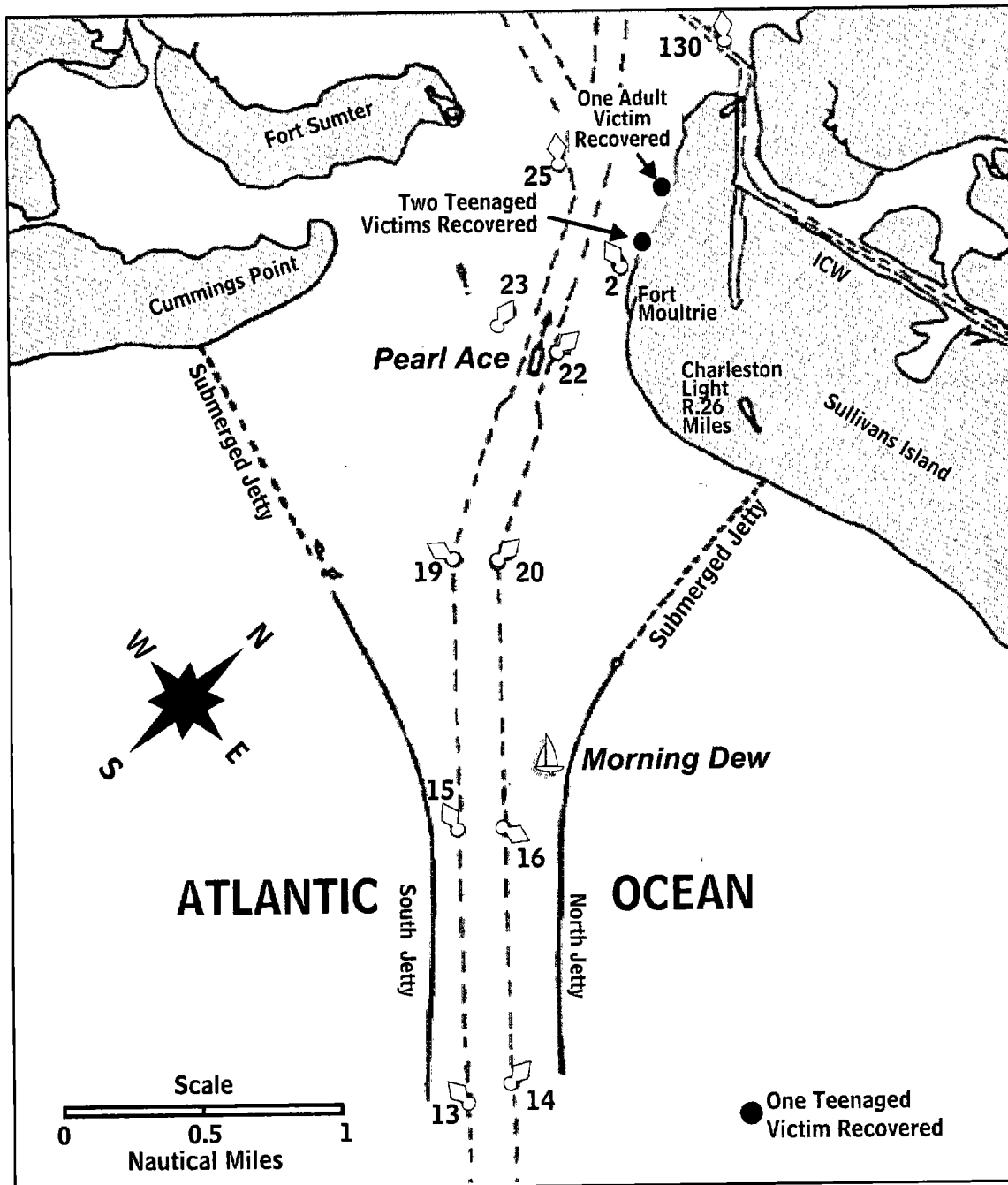


Figure 7. Charleston Harbor

off duty, having been relieved by the day telecommunications watchstander, but he was still in the communications center when the call came in. According to telephone transcripts, he was told,

We got a pilot inbound...he just passed 22 buoy, you know, right inside the harbor. The boatswain on the ship radioed to the bridge that he heard somebody yelling for help...somebody in the water. The pilot boat...just turned around and went back out to 22 to look around.... Once they get back to 22, I can call you back and let you know what they see or hear.

The watchstander replied, "OK, OK. I'll alert the station, and they'll determine if they want to get underway also." The watchstander reported the contents of the phone call to the operations duty officer who had come on duty at 0600⁷ and to the day watchstander.

Although the duty officer had a Coast Guard boat available that he could have launched on his own authority, he took no action in regard to the call. He later said, "At the time, since they were going to have a boat right there and get back to us, I didn't personally feel a need to take it any further." When asked if this was common practice, he said,

Well, it was to me.... I figured...if they took the time to call the pilot boat and the pilot boat called the pilot office and the pilot office called us, I was figuring, well, they couldn't be...too sure of the situation....

The operator of the *Palmetto State*, who stated that he had no search and rescue training or experience, stated that it took about 10 minutes to reach the area and that he went first to buoy 22 to see whether anyone might be clinging to it. He understood that he was to search from buoy 22 to buoy 2, which was near the shore of Sullivans Island near Fort Moultrie. He said that it was dark at the time, that the wind was from the northeast at about 25 knots, and that it was raining.

He stated that he would move his boat about 50 feet, then stop and go outside to look and listen. He stated that throughout his search, he had the boat's floodlights on. According to the operator, the floodlights were designed to illuminate the deck as an aid in embarking and disembarking pilots, but that the lights illuminated water about 10 feet out from the boat. The operator stated that he could see beyond the lighted area and believed that using the vessel's handheld spotlight would not have assisted him in searching.

After reaching buoy 2, the pilot boat operator reported to the pilot of the *Pearl Ace* that he had not seen or heard anything. The pilot requested that he remain in the area until morning twilight. The operator said he resumed searching from buoy 22 to buoy 2 and thence to buoy 130, near the entrance to the ICW. The operator said he was in the search area for about 30 minutes.

⁷ The operations duty officer who had been sleeping when the 0217 radio call was received went off duty when his relief reported at 0600. From this point forward in the report, all references to *duty officer* or *operations duty officer* refer to the operations duty officer who came on duty at 0600.

At 0648, the pilot dispatcher called the Coast Guard again to say, "Well, the pilot boat's out there, and they don't see anything and they haven't heard anything, so they're going to come on back." The watchstander reported this information to the duty officer, who took no further action.

Discovery of the Accident

Later that morning, shortly before 1100, a couple walking along the beach a short distance northwest of Fort Moultrie on Sullivans Island (figure 7) saw someone floating in the water. They described the water as rough and the winds as extremely strong. Another couple helped the first couple pull the body of a teenage boy out of the water and to summon help. The boy reportedly had no pulse, and those who found him performed CPR until an officer from the nearby National Park Service office arrived. The officer found no pulse and called 911.

At 1055, two police officers from the Sullivans Island police department were dispatched to the Sullivans Island beach for a possible drowning victim. They arrived at 1100. At 1103, the Sullivans Island fire and rescue squad was dispatched to the scene. The fire chief arrived on scene first. One of the police officers and fire department personnel began performing CPR. Emergency medical services (EMS) personnel arrived shortly thereafter and started assisting with the CPR.

About 1110, another person was sighted floating in about 4 1/2 feet of water about 100 yards west of where the first boy was found. EMS personnel pulled the boy from the water and immediately started CPR. The fire chief requested that the police obtain a Coast Guard boat and helicopter to conduct a search for a boat. Meanwhile, the National Park Service used one of its boats to assist in the search in addition to other volunteers. The boys were brought to the East Cooper Regional Medical Center's emergency room at about 1146 by the EMS. Rewarming techniques were performed and CPR continued by emergency room personnel.

About 1145, the Charleston coroner heard over a scanner that the two boys were being taken to the East Cooper Regional Medical Center and that they showed no signs of life. The coroner met the EMS personnel at the medical center. The coroner, who was a registered nurse, stated that she helped emergency room personnel as they aggressively tried to resuscitate the boys. While in the emergency room, the coroner received a call from the Sullivans Island fire chief who reported that the body of another boy was recovered. (The body of the third boy, the 16-year-old, was found about 1300 by a Coast Guard helicopter.)

Search and Rescue Efforts

At 1115, the Coast Guard operations duty officer received a call from an Isle of Palms, South Carolina, police officer. The officer was calling on behalf of the Sullivans Island police department to report the discovery of the two bodies in the surf and to request a Coast Guard boat to search the area. At 1122, the duty officer briefed the group

operations officer about the call. They agreed to initiate a search and rescue response, and the group commander was notified.

The duty officer then told the group operations officer about the 0628 call from the harbor pilot dispatcher because, he said, he was concerned that the 0628 call and the 1115 call might be connected. The operations officer told him that they would discuss it later but in the meantime to concentrate on planning a search of the area. The operations officer told the duty officer to request a helicopter from the nearby Coast Guard air facility on Johns Island.

Coast Guard helicopters and a utility boat were prepared to launch within 30 minutes of being notified. At 1128, the duty officer requested the services of a helicopter from the Seventh District Operations Center. The district approved the request at 1137. At 1144, the duty officer received a call from the operator of the pilot boat *Sis*, which was accompanying the *Pearl Ace* out of the harbor, stating that the pilot boat's crew had sighted a sailboat mast extending above the water near the south side of the north jetty between buoys 16 and 20. The operator of the pilot boat stated that he had seen the mast protruding from the water about 1130.

At 1146, a Coast Guard helicopter was airborne from the air facility at Johns Island, and at 1151, the helicopter pilot reported a sailboat mast sticking out of the water near the north jetty. About the same time, emergency responders discovered a horseshoe-shaped buoy and a life preserver on the shore near where the two young boys had been found. The life preserver was unmarked, but "*Morning Dew*" was stenciled on the buoy. Also, a blue 5-gallon plastic container marked "kerosene" but filled with diesel fuel was found a short time later in the same area.

A 41-foot Coast Guard utility boat was underway from Coast Guard Station Charleston at 1159. The duty officer stated that he had not called the boat crew sooner because he was absorbed in requesting and planning for the helicopter operation. At 1217, the Coast Guard utility boat coxswain reported that the boat was about 100 yards from the sailboat mast and that the mast was about 15 yards off the rocks of the jetty. The boat then proceeded toward the entrance channel to start a search along the jetties. No victims or debris was found. At 1256, the Coast Guard helicopter discovered a person in the water about 1 mile northeast of the north jetty. The Coast Guard utility boat recovered and transported the victim, a teenager who was showing no signs of life, to the shore.

Two helicopters and the utility boat completed five parallel searches that included the area where the sailboat mast was located, along the shoreline, the harbor entrance, and the jetties. Coast Guard helicopters continued to search the harbor and shoreline area until 1755 on December 29. The search was suspended for the day about 1800. The next day, a Coast Guard helicopter continued to search, but found nothing. The families of the boys were informed about the intent to suspend the search, and the search operation was terminated at 1134 on December 31, 1997. The body of the operator washed ashore and was found by a passerby on January 23, 1997, northwest of Charleston Lighthouse on Sullivans Island.

Emergency Response and Accident Investigation

After the discovery of the bodies, a command post was set up in a trailer at the beach. An incident command system (ICS)⁸ was implemented by the Sullivan's Island fire chief, who served as the incident commander during the medical response after the bodies were recovered. The South Carolina Department of Natural Resources (SCDNR), the local coroner's office, local police departments, and EMS personnel all participated in the ICS. Although the Coast Guard adopted the ICS in 1996 for oil spills and other pollution-related incidents, Coast Guard Group Charleston personnel were untrained and unaware of the ICS and did not participate in it during the response to this accident. (In August 1998, all Coast Guard emergency response personnel began receiving training in the ICS.)

The SCDNR is responsible for enforcing fish, game, and boating laws and for investigating recreational boating accidents in South Carolina.⁹ According to the SCDNR major in the law enforcement division, the SCDNR begins its investigations of boating accidents as criminal cases in order to preserve evidence.

The SCDNR received a report of the accident at 1138 on December 29. An SCDNR sergeant went to Sullivan's Island, where he boarded a Sullivan's Island police department patrol boat and went to the site of the sunken vessel. The sergeant stated that when the patrol boat arrived on scene, he found a single sailboat mast, without sails up, extending above the surface of the water about 1/2 mile from the entrance to Charleston Harbor. A Coast Guard 41-foot boat was already on the scene.

The SCDNR investigator who would head the accident investigation learned of the accident about noon on December 29. He said he received a telephone call from his supervisor and, about the same time, received a page from the SCDNR communications center dispatcher. On the way to Sullivan's Island, the investigator spoke by radio to the SCDNR sergeant who was already at the scene. The sergeant told the investigator that the Coast Guard had arranged for commercial divers to dive on the vessel. The investigator gave permission for the divers to search for the vessel name, hull number, or other form of identification, but he issued instructions that nothing on the boat was to be disturbed. The divers were unable to identify the vessel because of currents and poor visibility. The SCDNR dive team was dispatched to the vessel.

At 1240, the SCDNR investigator arrived at Sullivan's Island and met with another officer from the SCDNR, who briefed him about the discovery and disposition of the two bodies that were found near the beach. While the investigator was being briefed, he was notified that the Coast Guard helicopter had located another body in the water. A Coast Guard boat recovered the body and brought it to the fire station boat ramp, where it was turned over to the deputy coroner.

⁸ For more information on the ICS, see the "Other Information" section of this report.

⁹ Responsibility for investigating recreational vessel accidents was delegated from the Coast Guard to the States in the early 1980s by a memorandum of understanding (MOU) with each State. In the case of South Carolina, the MOU was signed in 1984.

The command post was transferred from the trailer on the beach to the town hall on Sullivan's Island, and the SCDNR investigator assumed the role of incident commander. According to telephone transcripts, at 1401 on December 29, 1997, a Coast Guard representative spoke with someone from SCDNR and asked who was in charge of the overall response "or are we all doing our own thing." The SCDNR officer told the Coast Guard representative that the overall incident commander was from SCDNR, since that agency was conducting a boating accident investigation.

At 1500, the SCDNR investigator joined the Charleston County rescue divers who were attempting to dive to the vessel to identify it. They were unable to do so because of rough seas. SCDNR divers arrived at 1600, but after discussing sea conditions with the rescue divers, they decided not to dive until the next day.

At 1620 on December 29, 1997, the Coast Guard duty officer called the night watchstander at home to ask him about the details of the telephone conversation the watchstander had had with the pilot dispatcher regarding the *Pearl Ace* and the report of cries for help from the water. The watchstander recounted the conversation and was told by the duty officer of the discovery of the three bodies.

About 10 minutes after this call ended, at 1630, the watchstander called the duty officer back and told him:

I remember that last night—I guess it was a couple of hours before that happened—I remember hearing a call, I think, calling Coast Guard, and I called out and called out and called out and never got another answer. I think it was on Mount Pleasant high site. It just said 'Coast Guard.' I think it was about an hour and a half or about 2 hours before that pilot office called—but it should be on the recordings. [You] guys want to check it out or not?

When the tape was later replayed for the group commander, he immediately suspended the night watchstander's qualifications and contacted the Seventh Coast Guard District to initiate an administrative investigation into the matter.¹⁰

At 1800 on December 29, emergency responders met at the command post to discuss how to proceed. After contacting several salvage companies, the SCDNR arranged with one of them to attempt to raise the still-unidentified vessel. At this time, the SCDNR did not know how many people had been aboard.

Although responders still had no positive identification of the boat, they had the horseshoe buoy with the name *Morning Dew*, and the coroner's office was working with the Coast Guard to find the owner of a boat by that name. The coroner stated that she had learned that Coast Guard officials planned to call potential owners to identify the sailboat

¹⁰ An *administrative investigation* is a fact-finding process, the purpose of which is to "search out, develop, assemble, analyze and record available information" for use in later administrative or legal proceedings. On December 31, 1997, a commander from the Clearwater Air Station was assigned to conduct an administrative (internal) investigation. The commander conducted interviews and collected evidence, and submitted his report to the Seventh Coast Guard District for review on January 13, 1998.

and the occupants. The Coast Guard had planned to start contacting possible owners at 1500, but the coroner said she asked the Coast Guard not to call the families until she gathered more information to help identify the boys. The Coast Guard agreed to wait until 1600, and officials told her they would ask only general questions about the boat to reduce the possibility of alarming those called.

Using Coast Guard vessel documentation records, the investigation eventually identified the owner of a recently purchased sailboat named *Morning Dew*. The coroner was notified at 1813 on December 29. Officials were not certain that it was the same *Morning Dew* or that the sunken vessel was, in fact, a vessel by that name.

The coroner said that in order to gather more information and help determine whether the accident vessel was the one indicated by the records, she contacted law enforcement officials in the area where the owner of the *Morning Dew* lived. The local sheriff went to the owner's home but found no one there. Through neighbors, officials obtained telephone numbers that were used to locate members of the operator's family. Later that night, the wife of the operator, who was the mother of two of the boys, contacted the coroner and investigator and provided information to help identify the boys.

About 0730 on December 30, 1997, the SCDNR investigator returned to the site of the sunken boat to observe salvors as they tried to raise the vessel. The first attempt failed due to the poor weather, and they returned at 1000 to try again.

On December 31, the investigator returned to the sunken vessel to observe operations by the salvage company to secure the boat with anchors to keep it from drifting in the current. Divers attempted to search for any other bodies inside the boat, but they had to curtail the search because of rough water and debris in the vessel.

The investigator continued to investigate other aspects of the accident. On January 1, 1998, about 0800, the investigator accompanied a Charleston County sheriff's deputy to the *Morning Dew* to meet with the salvors. A commercial diver successfully searched the cabin of the *Morning Dew* and found no one inside the vessel. At 1400, the investigator and others noticed scrape marks on the rocks of the jetty. The investigator went onto the jetty where he found debris, paint scrapings, and disrupted barnacle patterns on some of the rocks. He stated that he was able to determine that the *Morning Dew* had crossed the rocks before it sank. He said the path of the vessel could be documented by the debris, which included the vessel's bell, stove, and rubber carpeting, and a number of small items such as fragments of the hull.

On January 3, 1998, the investigator returned with divers to the *Morning Dew* to get a sample of the wreckage to compare with the paint scrapings obtained from the rocks on the north side of the jetty. At 1100, the SCDNR investigator read in a local newspaper about the salvage boat captain in Georgetown who saw the *Morning Dew* with three boys on the bow leaving Winyah Bay. At 1650, the investigator briefed a minister for the family about the investigation. The investigator's captain maintained contact with the family during the investigation.

On January 6, 1998, about 1430, the investigator learned that the *Morning Dew* had been moved without authorization from its original location by a second local salvage operator. According to the investigator, this salvage operator said he was trying to be a good Samaritan by relocating the boat in bad weather after he read about the accident in the newspaper. During the attempted salvage operation, the *Morning Dew* broke loose from its lines and the salvor could not reattach the lines before the boat sank in 20 feet of water not far from the southwest shore of Sullivans Island. The SCDNR's contracted salvor later secured the *Morning Dew*. On January 8, 1998, the contracted salvor raised the *Morning Dew*, and the SCDNR searched the vessel. The SCDNR completed its investigation on February 4, 1998.

Medical and Pathological Information

Injuries

Autopsies were performed on the three boys at the Medical University of South Carolina Department of Pathology in Charleston, South Carolina, on December 29 and 30, 1997, and on the operator on January 23, 1998. Findings were that all four of the victims died as a result of asphyxia due to drowning, with a contributing cause of hypothermia.

Injury Table

Type of Injury ^a	Operator	Passengers	Total
Fatal	1	3	4
Serious	0	0	0
Minor	0	0	0
None	0	0	0
Total	1	3	4

^a 49 Code of Federal Regulations 830.2 defines fatal injury as "any injury which results in death within 30 days of the accident" and serious injury as "an injury which: (1) requires hospitalization for more than 48 hours, commencing within 7 days from the date the injury was received; (2) results in a fracture of any bone (except simple fractures of fingers, toes, or nose); (3) causes severe hemorrhages, nerve, or tendon damage; (4) involves any internal organ; or (5) involves second or third-degree burns, or any burn affecting more than 5 percent of the body surface."

Of the two boys found floating in the surf near the Sullivans Beach, one was wearing boxer shorts, the other was wearing denim jeans. The boy found on the north side of the jetty was dressed in a pullover shirt and boxer shorts. He was also wearing a PFD. The operator was wearing a nylon jacket, a windbreaker, two T-shirts, a sport shirt, a pair of nylon foul-weather pants, a pair of blue jeans, jockey shorts, dress socks, and boat shoes.

Each of the victims was tested for alcohol and other drugs. The tests for the three boys were negative. Drug tests were negative for the vessel operator. Ethanol at a level of 0.05 percent was detected in the liver tissue of the operator. The autopsy report characterized this finding as "likely a postmortem artifact." No vitreous specimens were tested.

Toxicological Testing

The Coast Guard personnel directly involved in the misidentification of the 0217 radio call from the *Morning Dew* and the 0628 message from the pilot dispatcher were not tested for alcohol or drugs. The Coast Guard normally is responsible for toxicological testing of its own personnel when their actions or inaction are factors in the outcome of an accident. Coast Guard regulations (COMDTINST M1000.6 [series]) state that “a commanding officer should order a urinalysis test of a specific member when the member has been involved in a mishap.”¹¹

“Mishap” is defined in COMDTINST M5100.47 (series), *Safety and Environmental Health Manual*, as “any unplanned, unexpected, or undesirable event causing injury, occupational illness, death, material loss, or damage.” Under this guidance, it is left up to the commanding officer to determine whether a mishap has occurred. The manual contains instructions concerning the investigation of injuries, illness, deaths, material loss, or damage to Coast Guard assets only.

In the case of the *Morning Dew* incident, the Coast Guard never started a mishap investigation. Instead, it ordered a single-officer, informal administrative investigation, limited to a fact-finding process for later use in administrative or legal proceedings. Under these rules, only informal testimony was taken from the principal personnel involved. The rules do not specify alcohol or drug testing.

Personnel Information

Morning Dew Operator and Passengers

The operator of the *Morning Dew* was a 49-year-old married man. From interviews with family members, it was determined that he was a mechanical engineer who had worked for some years in the nuclear power industry in various locations. He had also been in the construction business and had been a partner in several construction companies. He was interested in sailing and had owned several boats.

According to family members, the operator, together with his wife, had sailed extensively in Florida and around the Bahamas in the 1970s. For a time, they owned and lived aboard a 33-foot sailing vessel. They both had taken a Coast Guard-sponsored boating course in about 1974 and had bought and studied nautical reference books. In 1981, the couple sold their sailing vessel and moved to Anderson, South Carolina, where they kept a small (12- or 14-foot) sailboat and a canoe. In 1991, they moved to Mountain City, Tennessee, where they acquired another sailing vessel, a 21-foot racer. They acquired the *Morning Dew* in November 1997 and intended to move it from South Carolina to Florida.

According to the mother of two of the boys on the *Morning Dew*, all three boys were good swimmers, and her two sons knew how to operate the radio and how to send a distress call.

¹¹ A *mishap* investigation serves to establish the cause of an accident for preventive purposes rather than for assessing liability (COMDTINST M5100.47).

Coast Guard Personnel

Communications Watchstander. The communications watchstander, a telecommunications specialist third class, was a 23-year-old single male. He had enlisted in the Coast Guard in April 1996 and, after basic training, was sent to Hawaii as a seaman on a patrol boat. In April 1997, he was assigned to the Coast Guard's telecommunication specialist school in Petaluma, California. (See the "Other Information" section of this report for more information on watchstander training.) After completing the "class A" school, a 10-week telecommunications specialist course, he became a watchstander trainee at Group Charleston, reporting there in early July 1997.

After arriving in Charleston, the watchstander, while standing watches with a qualified watchstander, received additional qualification training based mainly on COMDTINST [Commandant Instruction] M16120.7, *Group and Stations Communications Specialist Qualification Guide*. The watchstander stated that he was not assigned a principal instructor during his training period; rather, he stood watch with any of the scheduled watchstanders and operations duty officers. The watchstander testified, and records indicate, that he completed the study guide in 3 to 4 weeks. He stated that after completing the guide, he went before a qualifications review board and responded orally to questions related to the duties of a watchstander. Records indicate that he passed the group's qualification review board on August 27, 1997, after which he was allowed to stand watch independently. He said that the review by the qualifications board lasted 20 to 30 minutes.

The watchstander stated that his habit while on a day schedule (0600 to 1800) was to go to bed about 2200 and awaken about 0500 to arrive at work by 0600. When on a night schedule (1800 to 0600), his habit was to go home after handing over the watch and go to sleep right away, awakening about 1200 or 1300. He said he sometimes took a nap before going to work. He stated that his watchstanding rotation usually consisted of 2 12-hour days on and 2 full days off and that the schedule changed about mid-month from a day watch to a night watch. He also stated that the schedule sometimes varied to accommodate people on leave or training assignments and for other reasons. He shared the watch rotation schedule with four other telecommunications specialists.

The watchstander had been on leave from December 20 to 25, 1997. He had been on duty during the day on December 26 and 27 and had gone on the night shift on December 28. He said he was well rested when he reported for duty on December 28, and he said he did not have any adverse health conditions, nor had he used any drugs before going on duty. He stated that December 28 was a quiet night, with very little radio or message traffic (computer messages from Seventh District and other Coast Guard units). His last medical examination was on January 12, 1996. The results were unremarkable.

The commander of Group Charleston, after learning about the 0217 mayday call, suspended the qualifications of the watchstander and required him to requalify for the position under the same standards as his initial qualification. The watchstander stated that he completed the requalification and went back on duty as a watchstander in "about 2 weeks." The watchstander also received a notation in his personnel file regarding his

failure to notify the operations duty officer of the 0217 call when the nature of the call could not be confirmed.

Operations Duty Officer. The operations duty officer was a boatswain's mate first class with 17 years' service. He was 37 years old and married. He had been assigned to Group Charleston for about 3 years. He was previously stationed at Coast Guard stations at Manasquan Inlet in New Jersey and Swansboro, North Carolina. He had completed training and was qualified to stand watch as operations duty officer at Group Charleston on June 20, 1995. He stated that he was well rested when he came on duty at 0600 on December 29. He said he did not have any health problems and was not taking any medications. His last medical examination had been on April 1, 1992. The results were unremarkable.

The duty officer said he usually went to bed about 2100 or 2130 and awoke at 0430 to arrive at work by 0600. He said he usually stayed home during his off-duty hours. He had been on duty on December 23 and 26. He was off duty on December 24 and 25 and again on December 27 and 28.

In March 1998, a notation was placed in the duty officer's personnel file regarding his failure to respond with Coast Guard resources to the report from the pilot dispatcher about cries for help being heard from the water and his failure to notify higher level Coast Guard authorities in a timely fashion about the report. According to GRUCHASNINST [Group Charleston Instruction] 16100.1B, higher levels of authority (command duty officer, at a minimum) are to be notified:

2(i) For all cases suspected to be a hoax or false alarm, (Group Commander notification for hoaxes/false alarms where no CG response is recommended).

Vessel Information

Vessel Description

The *Morning Dew* was a Cal 34 class sailboat built in 1978 by the Cal Boats Division of Bangor Punta Marine at Costa Mesa, California. The sloop-rigged¹² Cal 34 class sailboats were built between 1966 and 1979. The Cal 34 was designed and marketed as a racer-cruiser suitable for coastal operation. (See figure 8.)

The hull was constructed of one-piece reinforced fiberglass laminate of the woven roving type. The vessel had a fin keel, a counter-balanced spade rudder, and a deck-stepped mast. The cabin could accommodate a total of six people using a V-berth in the forward area, a settee berth, a dinette that converted into a double berth in the mid-cabin area, and a single quarter berth in the starboard after area of the cabin. The cabin had a head with a shower and a galley with stove and refrigerator. Windows and hatchways included four large windows on the sides of the cabin, four small windows, a large sail hatch forward of the mast, a mid-cabin hatch, and a companionway hatch. A small chart table was installed at the after starboard side of the cabin.

¹² A sloop is a fore-and-aft rigged boat with one mast and a single jib.

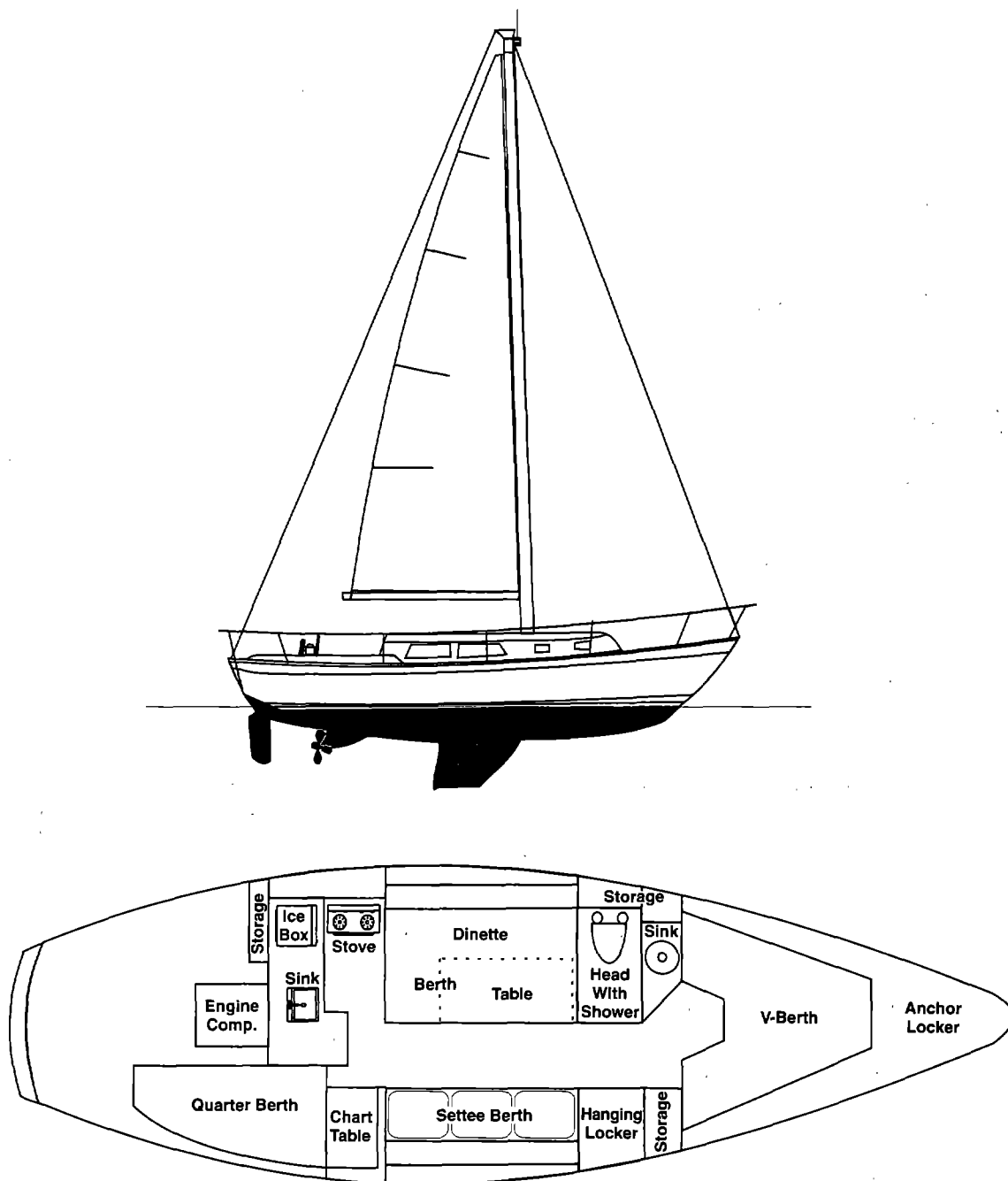


Figure 8. Profile and plan views of typical Cal 34 sailboat

The deck was constructed of hand-laid fiberglass over a plywood core. The self-bailing cockpit in the after end of the boat was fitted with a pedestal-type steering stand. Molded into the cockpit were seats for the helmsman and several passengers. The cockpit steering position was the only location from which the boat could be steered. The cockpit area had one under-seat storage hatch with a hinged cover.

Principal dimensions and specifications:

Length overall	33 ft. 6 in.
Length on waterline	25 ft. 4 in.
Beam	10 ft
Draft	5 ft.
Displacement (lbs.)	10,200 lbs.
Ballast (lbs.)	3,750 lbs.
Sail area	479 sq. ft.
Height of mast above water	45 ft.
Height of eye, sitting at steering station	4-5 ft. (est.)

Mechanical and Electrical Systems

The *Morning Dew* had a Westerbeke 30 (25 horsepower) auxiliary propulsion diesel engine. Fuel capacity was 35 gallons. The estimated endurance (hours) for the boat, based on rated fuel consumption at 2,500 rpm and a usable fuel capacity of 34 gallons, was 28.3 hours. Full-power cruising speed under normal conditions was estimated to be between 5 and 6 knots. The estimated cruising range for the boat at 5 knots was 141.7 nautical miles.

The electrical system consisted of two 12-volt lead acid batteries supplying a negative ground electrical system. A 40-amp engine-driven alternator supplied d.c. voltage for recharging the batteries when the engine was running. A selector switch allowed current to be drawn from either or both batteries. Electrical power distribution to the various attached loads was through a circuit-breaker-type accessory panel adjacent to the chart table. Electrical power was provided for lighting in the forward compartment, head, galley, and dinette. Power was also provided to the running lights, as well as to the spreader lights and anchor light. The system also had a shore power connection that allowed 110-volt a.c. power to be taken from the pier while the boat was docked.

Water that may accumulate in the lower part of hull (the bilge) was removed through the use of a pump. The *Morning Dew* was originally fitted with an electric bilge pump, but one of the previous owners reported that he had replaced the electric pump with a hand-operated one.

Navigation and Safety Equipment

The navigation and safety equipment aboard the *Morning Dew* at the time of the accident included a VHF-FM marine radio, a depth sounder, a knot meter, and a magnetic compass. In addition, the boat was fitted with a model Autohelm 3000 autopilot, but the previous owner reported that it was not working properly when he sold the boat. As is typical with sailboats, the antenna for the VHF-FM marine radio was mounted on the top of the mast.

The VHF-FM radio was reportedly tested before the start of the voyage and was believed to be operating properly. In addition, the mechanic who performed maintenance work on the boat before it was sold reported that he had used the radio and that it was

functioning properly. The previous owner reported that the volume had to be turned up high if the radio was to be heard from the cockpit when the boat was under way on auxiliary power.

The *Morning Dew* had three hatches. One was forward of the mast, directly above the V-berth. This hatch was opened by a diver while searching the vessel. Another hatch at mid-cabin was found secured closed when the boat was raised. A companionway hatch was the primary access between the cockpit and cabin.

Lifesaving Equipment

The operator's brother stated that he had checked the flotation devices on the boat and had found four PFDs, a horseshoe-shaped buoy, and a white seat cushion that could be used as a flotation device. He said he had left his PFD on board because a couple of those that were already there were in poor condition. Also on board, according to the brother, were six new flares and two air horns. The owner's wife recalled that three PFDs were on the boat originally and that she had packed two additional ones. The previous owner said that he had left two old PFDs onboard.

The lifesaving equipment recovered from the *Morning Dew* after the accident included the following: one strobe light; one older, torn orange PFD with no identification or other markings; one yellow horseshoe-shaped lifesaving buoy with *Morning Dew* stenciled on it; and one white buoyant cushion approved as a throwable flotation device. An unauthorized and unsuccessful salvage operation after the accident resulted in debris from the *Morning Dew* being strewn over a wide area in the harbor. Additional lifesaving equipment from the boat may have been lost during that operation.

History of the Morning Dew

The *Morning Dew* was first purchased in 1978 at Hampton, Virginia. The boat had several owners before it was acquired by the operator in this accident. According to the previous owner, during the 5 years preceding the accident, the boat received little use and maintenance. The moderately temperate climate in which the boat was stored obviated the need for the annual winterizing commonly done by boat owners living in freezing climates. According to the previous owner, very little routine maintenance was carried out on the boat's mechanical systems or hull exterior. The exterior appearance of the boat was poor according to a witness familiar with the boat.

The previous owner said that the fuel system filters had not been inspected or cleaned in several years and that the fuel tank had been maintained in a partially full condition. According to authorities on marine engines, lack of maintenance on the fuel system of an internal combustion engine may result in the well-known phenomenon of microbiological fouling. Such fouling is the result of microorganisms, primarily fungi, bacteria, and yeast, that live in water and feed on the organic molecules (carbon and nitrogen compounds) in the fuel. As the microbes grow and spread, they create a biomass, or sludge. When the engine is operated after a long period of idleness (such as a winter lay-up period), it will often initially operate satisfactorily; however, when the boat is subjected to sea conditions that agitate the fuel-water interface, the sludge may be pumped

into the fuel delivery system, fouling strainers, filters, and injectors, and ultimately resulting in the stopping of the engine for lack of fuel.

Vessel Damage

The *Morning Dew* had been scrapped when the Safety Board initiated its investigation, hence the vessel was not available for examination by Safety Board investigators. According to an SCDNR diver's report, damage to the boat consisted of a large hole several feet long on the starboard side of the hull, aft of amidships. When divers inspected the sunken vessel, they reported that it was lying on the bottom, listing to the starboard side. Since the boat was listing to starboard and the damage to the hull was on the starboard side, divers could not fully assess the extent of the damage.

According to a mechanic who inspected the boat after the accident, the damage to the propeller was consistent with what would have resulted if the boat had grounded while the propeller was rotating. Damage to the propeller blades was reported to be such that the blades were bent in both the fore and aft directions. The propeller was not available for Safety Board inspection.

The first, unauthorized attempt to raise the vessel failed, and further damage is believed to have been inflicted on the boat during the unsuccessful operation. After the boat was successfully raised, a surveyor working on behalf of the insurer made the following brief report:

A joint inspection of the subject watercraft was conducted at Sullivans Island municipal boat ramp by the SCDNR upon the wreck removal and its placement on land. There is an approximate twelve-foot hole in the starboard side of the vessel from the aft berth to the fwd bulkhead. The missing section of hull side extends from the below the boot stripe to deck level. All of the interior furnishings and woodwork, for the most part, [are] destroyed.

When the boat was raised, its engine was apparently in good condition, according to the mechanic who inspected it. The engine was not disassembled for the inspection, and the engine was not operated after it was recovered. The boat was later sold for scrap. Before disposing of the hull, the new owners stripped it of any items of value. The condition of the various mechanical systems was not noted at the time of the salvage and cannot now be determined. In addition, a survey of the boat's condition had not been made before its last sale before the accident, even though such surveys are commonly made before a boat is accepted for coverage by the insurer. A professional opinion of the boat's general condition either immediately before or immediately after the accident is therefore not available.

Waterway Information

The ICW

The Atlantic Coast ICW extends from Norfolk, Virginia, (mile 0) to Key West, Florida (mile 1,243.8). It consists of canals, rivers, and bays. From the basin at mile 346, where the Lightkeepers Marina is located, leading south to mile 347.3, the ICW is essentially a canal created by improving an existing estuary of the Little River. From mile 347.3 southward to mile 375.3, the ICW is a man-made canal. At mile 375.3 the ICW merges with the Waccamaw River and continues as a part of the river to mile 402.7, where the Waccamaw enters the northern part of Winyah Bay. The ICW continues across Winyah Bay in a southerly direction and makes use of approximately 3 statute miles of the main shipping channel.

Green, odd-numbered square markers mark the east side of the waterway. Red, even-numbered triangles mark the west side. The numbers on the navigation markers, like the waterway mile numbers, increase in a southward direction. Most of the ICW navigation markers are daymarks, mounted on pilings or dolphins, although a few buoys are used. When the route of the ICW coincides with another channel, such as a shipping channel, that has a different navigation marking system, the buoys or other navigation aids of the other channel will be marked by yellow squares to denote the east side of the ICW channel and yellow triangles to denote the west side.

For nighttime navigation of the ICW, some lighted navigation aids are available. They are located primarily at junctions and bends. A spotlight is needed at night to locate unlighted navigation aids, to keep track of the bank, and to avoid flotsam. For that reason, one navigation guide for the ICW recommends that boaters avoid navigating the ICW at night.¹³

Winyah Bay

Winyah Bay affords a main shipping channel between the Atlantic Ocean and the Port of Georgetown. The main shipping channel, like all main shipping channels, is marked predominantly by red and green buoys, with red buoys to be left on the starboard side of vessels entering from the sea. The buoys are numbered from the sea and increase as the vessel draws closer to port. As with the ICW, the red buoys and lights are marked by even numbers and green buoys are marked by odd numbers. The buoys marking the portion of the main shipping channel that is shared with the ICW are marked with yellow triangles on the western side and yellow squares on the eastern side.

At the end of the common north-south portion of the main shipping channel, the continuation of the ICW is marked with a red triangle numbered 96 that is mounted on pilings about 600 yards south of the main shipping channel. Marker No. 96 is near the shore and is not in line with the main shipping channel buoys along the west side of the main shipping channel. At this location, the main shipping channel changes course about

¹³ Moeller, Jan and Bill, *The Intracoastal Waterway: Norfolk to Miami*, fourth edition, page 9.

40° to 135° and the use of yellow ICW markings on the buoys is discontinued. Vessels following the ICW continue in a southerly direction past marker No. 96.

Vessels entering and departing Winyah Bay must navigate past a jetty located along the south side of the channel that extends approximately 2.2 miles from land in an easterly direction. A shorter jetty extends easterly about 1 mile from shore along the northern side of the channel. The distance from the Winyah Bay entrance to the north jetty at Charleston is approximately 43 miles. (See figures 2 and 4.) A series of three buoys approximately 10 miles from shore can be used to reach the vicinity of the sea buoy at the entrance of the channel to Charleston Harbor, and three other buoys about 5 miles off shore can be used to reach a point near the end of the Charleston jetties. When approaching Charleston from the northeast, the first prominent navigation aids are the Charleston sea buoy and Charleston lighthouse.

Entrance to Charleston Harbor

The Charleston sea buoy, buoy C, is about 10 miles from shore. A series of channel buoys spaced 1 to 2 miles apart marks the main shipping channel to the entrance of the two stone jetties protecting the entrance to the harbor. The two stone jetties extend about 3 miles from shore. Except for a submerged section of the north jetty extending approximately 0.8 mile from the shore of Sullivans Island, the north jetty is awash at high tide, and at low tide, the higher portions of the jetty extend above the surface approximately 5 to 7 feet.¹⁴ The average range of the tide is 5.2 feet. Extra high tides can be 7 feet. Two buoys, numbered 13 and 14, are at the entrance to the jetties, and two other sets of buoys, 15 and 16 and 19 and 20, are spaced 1 mile apart and mark the channel through the jetties. Buoy 22, located about 1 mile beyond buoys 19 and 20, is almost even with the shoreline of Sullivans Island. The channel buoys are lighted to provide a nominal visibility of 4 miles. The height of the lights on the buoys is about 10 feet.

Meteorological Information

A weather radar tape from Charleston doppler weather radar was obtained from the National Climatic Data Center in Asheville, North Carolina. The radar data showed that at the approximate time of the accident, an area of rain was located about 13.3 nautical miles to the south of the accident location. The rain was moving toward the north and reached the accident site around 0240.

The weather forecasts for coastal waters out 20 miles are summarized as follows:

1030 Sunday, December 28, 1997 [In effect before the *Morning Dew* left Georgetown]

Little River Inlet to Cape Romain (about one-third the distance from Winyah Bay to Charleston Harbor):

¹⁴ The National Oceanic and Atmospheric Administration, at the request of the Safety Board, conducted a depth survey of the approaches to the north jetty that would have been transited by the *Morning Dew*. The soundings confirmed that the vessel would not have run aground before reaching the jetty.

Small craft advisory conditions expected Monday.

This Afternoon: North wind 15 to 20 knots, becoming northeast 15 knots or less. Seas 4 feet.

Tonight: Northeast wind 10 knots, becoming east 15 knots. Seas 3 feet building to 4 feet. Isolated showers late.

Monday: East wind 20 knots, becoming south 25 knots. Seas 4 feet building to 6 feet. Areas of rain with embedded thunderstorms reducing visibility below 1 nautical mile.

Cape Romain to Savannah:

Small craft advisory conditions expected Monday.

This Afternoon: North wind 15 knots or less, shifting to northeast. Seas 3 feet.

Tonight: Northeast wind less than 15 knots. Seas 3 feet. A chance of showers late.

Monday: Southeast wind 15 knots, increasing to 25 knots. Seas 4 feet building to 6 feet. Areas of rain with embedded thunderstorms reducing visibility below 1 nautical mile.

1530 Sunday, December 28, 1997:

Little River Inlet to Cape Romain: Small craft advisory conditions expected Monday.

Tonight -- Variable wind 10 knots becoming east 20 knots. Seas 3 feet building to 4 feet. Scattered showers late.

Monday: Southeast wind 20 knots, becoming southwest 25 knots. Seas 5 feet building to 7 feet. Areas of rain with embedded thunderstorms reducing visibility below 1 nautical mile.

Cape Romain to Savannah: Shallow coastal flooding possible at high tide Monday morning. Small craft advisory conditions expected Monday.

Tonight: Variable wind 10 knots, becoming southeast 15 knots. Seas 3 feet. A chance of rain late.

Monday: Southeast wind 15 knots, shifting to west and increasing to 25 knots. Seas 4 feet building to 6 feet. Areas of rain with embedded thunderstorms reducing visibility below 1 nautical mile.

The weather during the voyage of the *Morning Dew*, based on actual weather observations, is summarized as follows: Winds were generally from an easterly direction at 10 to 15 knots. Seas ranged from 3 to 4 feet. Air temperatures were near 50° F. Visibility at the time of the accident is unknown, but it was a dark night with no moon and an overcast sky. At the time of the accident, the wind had increased to about 25 knots from the northeast, and rain began near the time of the accident or soon thereafter.

On the evening of December 28, 1997, sunset was at 1722 and evening twilight ended at 1749. On the morning of December 29, 1997, morning twilight began at 0654, and sunrise was at 0722. At the time of the accident, it was low tide, and the rock jetty, in calm seas, would have been projecting about 7 feet above the water.

Tests and Research

Coast Guard Group Charleston Communication System Survey

The communications center at Group Charleston is able to monitor channel 16, (the maritime distress, safety, and hailing channel), as well as six other preset VHF channels. The transceivers and antennas for the communications system are located at six remote sites along the coastline of South Carolina, to the north and south of Charleston and extending to the northern coast of Georgia.¹⁵ Also located within the communications center are several telephones over which the watchstander may receive inquiries or reports of maritime distress situations.

As a part of its investigations of the *Morning Dew* accident and a June 1998 accident in Florida involving the recreational fishing vessel *Florida Air Specialist*, the Safety Board contracted with the U.S. Navy's Naval Surface Warfare Center, Carderock Division (NSWC-CD), to document and assess the communications infrastructure at Group Charleston and at Group Mobile, Alabama.¹⁶ (See the "Other Information" section in this report for a more detailed discussion of that survey.) The Group Charleston evaluation also addressed the Coast Guard stations at Georgetown, South Carolina, and Tybee Island, Georgia.

In a report of its findings, the NSWC-CD found the communications systems to be in generally good condition and able to carry out the assigned mission in search and rescue operations. In particular, Group Charleston's Mount Pleasant antenna high site, which was located nearest to the accident site, was thoroughly tested and was found to provide excellent coverage for the Charleston coastal area. Electronic testing of the antenna high-site equipment revealed that all measurements were within design specifications. In addition, the system maintenance records reviewed by the NSWC-CD indicated no significant changes in the condition of the system between the time of the *Morning Dew* accident and the time of the survey.

At the time of the *Morning Dew* accident, the Group Charleston communications center had a Stancil model DBR-32 audio recorder that enabled it to continuously record radio and telephone communications directed to or emanating from the communications center or the operations center. The recording equipment was of the analog type and used standard magnetic VHS tape. The recorder was able to simultaneously record 24 channels of analog audio data and was able to replay the time-stamped recorded data on demand.

¹⁵ The remote antennas are located on towers at Myrtle Beach, South Island, Mount Pleasant, Parris Island, Tybee Island, and Kellar.

¹⁶ The accident involving the *Florida Air Specialist* occurred within Group Mobile's area of responsibility.

The date and time information, or time stamp, was digitally recorded on its own channel of the tape and served as the time reference for the recorded audio information. The telephone lines used by Group Charleston were located both in the communications center and the operations center. Of the phone lines that were continuously recorded by the recording equipment, one was in the communications center near the watchstander's station, and the others were in the operations center.

The NSWC-CD found the recording equipment at Group Charleston to be fully functional, with the exception of an intermittent problem with the date/time display. However, the evaluation found that the Stancil DBR-32 is difficult to operate when searching for specific communications on a tape and for playback of recorded communications. Further, surveyors found that the analog multi-head recording device allowed "a lot of bleed over between channels" and that the machine required a "strict head cleaning and maintenance policy...to ensure that the recorder is maintaining proper channel isolation."¹⁷

As part of the NSWC-CD assessment of the communications infrastructure at Group Charleston and Group Mobile, the Safety Board requested an assessment of the direction finding (DF) capabilities at these communications centers. DF technology can be used to determine the direction from which a radio transmission is originating (a line of bearing), and if two or more separated antennas are used to detect the radio signal, the location of the transmitting vessel or station (a "fix") can be determined through triangulation.

The survey determined that DF equipment was not installed at Group Mobile. Operational testing of the DF equipment at Group Charleston revealed significant problems with its suitability for locating distressed mariners. In its assessment, the NSWC-CD said that the DF systems in use by the Coast Guard in its centers had limited range and that they were inaccurate, unreliable, and obsolete. Actual tests of the equipment by NSWC-CD personnel on behalf of the Safety Board established bearing errors of as much as 101°. NSWC-CD personnel noted that because the equipment had no recording/archiving or playback capability, the Coast Guard watchstander, in order to obtain a bearing, must be looking at the DF at the exact time that the transmission is made.

Furthermore, the NSWC-CD observed that, at Charleston, the DF unit was mounted such that it would be behind the watchstander when the watchstander is seated at the normal watchstanding station. Communications center watch personnel were aware of the limitations of the DF equipment and stated that the DF equipment installed at Charleston was not regularly used and, in fact, was not routinely turned on.

The NSWC-CD assessment included an evaluation of the ergonomics, equipment layout, and ambient noise levels of the communications centers. The NSWC-CD evaluations of both the Charleston and Mobile communications centers found that the

¹⁷ "United States Coast Guard Charleston, South Carolina Group: Documentation of Communications Infrastructure and Assessment of Current and Future Capabilities," by Department of Navy, Naval Surface Warfare Center, Carderock Division, Philadelphia, PA, December 16, 1998.

Stancil recording and playback device was not located conveniently to the watchstander. At both centers, watchstanders had to leave their normal work station and walk to the playback device to replay recorded transmissions. Since the accident, the Coast Guard has replaced the Stancil recorder at Charleston and 31 other group communications centers with a digital voice logger (recorder), or DVL. At Group Charleston, the DVL has been placed within reach of the communications watchstanders' station.

The 0217 Mayday Call

The Safety Board analyzed the 0217 call to the Coast Guard by reviewing the taped transmission, by having the NWSC and the Safety Board's Office of Research and Engineering conduct a technical analysis, and by having both novice and experienced people (including the parties to the investigation) listen to a recording of the transmission. The recording was not enhanced in any way.

The technical analysis demonstrated that the loudness of the call was not consistent and that the initial part of the transmission was masked by static. The tape also contained noise from the tape machine itself, which would not have been present during the original transmission.

The transmission was made in a shouting, urgent fashion. Those without training or experience in listening for such calls did not immediately hear the words "may...mayday..." the first time the tape was played. They stated that they clearly heard "mayday" when they listened to the recording subsequent times.

Review of Radio Transmission and Telephone Call Transcripts

Investigators reviewed 92 pages of transcripts of radio transmissions and 165 pages of telephone conversations placed to and from the Group Charleston communications center and recorded on December 28 and 29, 1997. According to the transcripts, the watchstander received no radio calls directed to Group Charleston from midnight until the receipt of the unidentified mayday call, nor did he make any broadcasts. During this time, fewer than 50 radio transmissions from other stations and ships were recorded. The watchstander received no telephone calls after 2100 on the evening of December 28.

No telephone calls took place between 2300 on December 28 and 0500 on December 29. More than 2 1/2 hours of telephone conversations took place between 0500 and the call from the police at 1115. A review of the transcripts showed that a substantial number of these calls were personal calls made by either a communications watchstander or an operations duty officer. In many of the conversations involving the watchstander, the transcript identifies a background radio call or radio communications, but the transcript does not indicate that the watchstander is pausing to listen.

Coast Guard Communications Procedures

At the time of the accident, a national telecommunications manual, COMDTINST M2000.3B, dated April 23, 1991, established policy and procedures for the administration

and operation of the Coast Guard telecommunications system. Procedures for responding to a call when “mayday” may not be received states, in part:

Most small vessels will not follow prescribed procedures during a distress. They may call MAYDAY or they may call an individual Coast Guard unit. In any event, it may become necessary for a Coast Guard unit to assume control of the distress.

During the Safety Board investigation, Group Charleston provided its local “Radio Watch Procedures” and “Radio Log Procedures,” for the telecommunications watchstander and operations duty officer.

The following sections were extracted from the procedures provided by Group Charleston:

Section 4.C. stated:

The duty officer shall normally maintain a presence within the operations center until 2200 hours. The ODO [operations duty officer] shall also be present during any significant evolution or event which involves or has the potential of involving Coast Guard resources under the Group’s operational control. An experienced watchstander may be able to prosecute certain evolutions as directed by the ODO on his or her own without the presence of the ODO. However, as a minimum, the ODO shall be notified of all situations which deviate from an anticipated or desired outcome within the Group’s AOR [area of responsibility]. The ODO maintains complete responsibility of the management and control of the Operations Center while on watch, regardless of his or her physical presence. The watchstander shall never feel pressured to handle matters on his or her own to provide the ODO uninterrupted sleep.

Section 4.D. stated:

If a transmission is received and the watchstander is not completely certain of its contents, he or she shall immediately replay the recording device as many times as necessary to determine the contents of the transmission. If unable to review the tape due to other responsibilities, the watchstander shall contact the TC [telecommunications] day worker, ODO or CDO [command duty officer] or any other operations personnel to assist.

Radio log procedures indicated that watchstanders should log in:

e. All unusual happenings on the watch. This includes anytime a vessel calls the Coast Guard and does not respond to our reply. (i.e., calls to Coast Guard when no further information is gathered, unusual broadcasts--when in doubt--log it.)

The procedures were not dated and had "Reviewed 1-4-98" at the bottom of the pages. When Safety Board investigators asked Coast Guard officials which procedures were in effect on the date of the accident and which were added later, a Coast Guard official stated that, based on statements and public hearing testimony, "it appears" that section 4D of the radio watch procedures and paragraph e of the radio log procedures were added after the incident.

The radio watchstander on duty at the time of the accident testified that he normally logged in "distress calls, any calls dealing with our own Coast Guard boats, personnel. Anything out of the ordinary." He did not believe it was necessary to log the 0217 call or the call received 4 minutes later, or to replay the tape. The group commander stated that it was not unusual for the staff to replay a call that was unclear.

The operations duty officer stated that he filled out a checklist to record information concerning calls that were evaluated as distress calls.

Safety Board investigators also reviewed the *National SAR* [search and rescue] *Manual* with the Coast Guard *Addendum*, the Group Charleston SOP: *Distress Traffic*, *USCG Telecommunications Manual M2000.3B*, and *GRUCHASNINST 16100.1B*. Although each addressed notification and other procedures for various types of calls, none of them addressed the handling of an uncertain call that could, in fact, be a distress call.

Other Information

Coast Guard Release of Information

On December 30, 1997, while efforts were underway to raise the *Morning Dew*, the Sullivan's Island fire chief showed the SCDNR investigator an article in the newspaper stating that someone on a ship entering the harbor on December 29 had reported hearing a cry for help coming from the water. Until this time, the investigator had been unaware of the report.

At 1903 on December 30, the investigator called the Coast Guard and spoke with the group operations officer and asked him about the *Pearl Ace* and about any other distress call that may have been received from the *Morning Dew*. The operations officer confirmed the report from the boatswain of the *Pearl Ace*, but he told the SCDNR investigator that no distress calls from the *Morning Dew* had been "perceived" during the early morning hours of December 29. The SCDNR investigator said he believed he was being informed that no distress call had been received, and he thus made no further inquiries of the Coast Guard.

The commander of Group Charleston stated that Coast Guard standard procedures for conducting an administrative investigation were followed in the case of the *Morning Dew*, and his understanding was that information concerning the investigation—including the discovery of the 0217 call—was not releasable until after the Coast Guard's investigation had been completed. He also stated that the administrative investigation had not confirmed that the 0217 mayday call came from the *Morning Dew*, even though he

personally believed the call was from the *Morning Dew* because no other accidents were reported and because the Coast Guard had carefully searched the area.

On February 7, 1998, a monthly boating periodical submitted a Freedom of Information Act (FOIA) request for tapes of radio transmissions received by Group Charleston on December 29, 1997. The group commander stated that the FOIA request would cover the recording of the 0217 call, and he became concerned that information about the call might appear in the press before the families had been notified. He said he prepared and submitted a plan to the Seventh Coast Guard District staff for informing the families and the SCDNR about the 0217 mayday call.

According to the group commander, the district approved a plan to inform the victims' families, and he made an appointment to meet with them on March 17, 1998, at the home of the parents of the deceased nephew. He stated that he told the wife of the operator and mother of the two boys that he had evidence that may be related to the accident and that he would like the family to review it with him. He said that he told her that reviewing the evidence may be painful and if they would rather that he not come, he would honor that request.

The wife told the commander to come and bring the evidence, but she later said he did not tell her he was bringing a tape recording. The group commander said he took the tape to play for the families so they could determine whether the call was connected to the *Morning Dew* and so they could become aware of the call before it was discussed by the news media. When the tape was played, the families immediately recognized the voice of the younger son, and according to the operator's wife, family members were shocked to learn of the previously unknown call. The wife said that when she asked questions about the call, the group commander did not elaborate on the call or provide any additional information.

The next day, March 18, 1998, the SCDNR investigator returned a telephone call from the operator's wife. He said she sounded quite upset. She told him of the Coast Guard group commander's visit and of the recording of the mayday call, and when the investigator told her he was not aware that such a recording existed, she asked why he had not been informed. The investigator said he told her he would brief his supervisors and keep her informed of any developments.

On March 19, the investigator returned the call of the Group Charleston group operations officer. The operations officer told the investigator that when the investigator had asked whether the Group had received any distress calls on the morning of December 29, the operations officer was able to release only the information that his supervisors allowed and that he would like to talk to the SCDNR investigator about the situation. On March 20, the investigator received a copy of the Coast Guard's report of its administrative investigation and heard the tape recording of the 0217 mayday call.

On April 3, the operations officer met with the investigator and his captain to further discuss their working relationship. The operations officer explained the reason behind his apparent negative response when he was asked by the SCDNR investigator

whether any distress call had been received on the morning of December 29. The operations officer explained that the Coast Guard was conducting an internal investigation and that he understood that no information under investigation could be released. The SCDNR captain asked whether Coast Guard policy prohibited the release of information pertinent to an investigation during an administrative review; the operations officer stated that he was not sure if it was a written policy, but it was an "understanding." The Safety Board's investigation revealed that no written policy existed that addressed the release of information under administrative review.

Regarding the group commander's visit to the victims' families, the group commander stated that he did not inform the SCDNR of the existence of the recording at that time because the group did not routinely work with the SCDNR during investigations and the plan approved by the district did not include that agency. He also stated that because this was the first investigation he had been involved in with the SCDNR during his 2 years at Group Charleston, the two entities "may not have understood each other's investigative process very well." The group commander stated that he was not aware until April 1998 that the SCDNR investigation was conducted as a criminal investigation. He said that if he had known, the group may have shared information about the tape recording sooner.

The Seventh Coast Guard District chief of staff stated in an August 1998 interview that the district did not intend to withhold any information collected during its investigation and that when an investigation is completed, the tapes and other documents are a matter of public record. He also stated that the review of the investigation took much longer than expected. The chief of staff stated that Coast Guard officials had planned to work with the SCDNR and the families in an organized and professional manner after the investigation had been completed and approved by the Commandant. He stated that the district believed that SCDNR boating accident investigations were routine; the staff was unaware that they were criminal investigations. He stated that this lack of awareness contributed to the Coast Guard's focus on its own internal investigation rather than on the SCDNR investigation. He said the district was also concerned about the rights of individuals who were involved in the administrative investigation.

The chief of staff stated that during the administrative investigation, he asked the commander of Group Charleston, through other staff members, whether the SCDNR had inquired about the matter and was told no. He said he was not aware of the SCDNR's concern about the release of the information until April 1998. He said he was aware of the need to inform the families before releasing the information to the press pursuant to the then-pending FOIA request and of the need to confirm the identity of the caller. He stated that the district had agreed that the group commander should visit the family and play the tape recording before releasing the information to anyone else.

The chief of staff acknowledged that the group operation officer's answer to the SCDNR investigator's query about whether the Coast Guard had received any distress calls was "improper" and the cause for a loss of trust between the Coast Guard and the SCDNR. He said that in April 1998, the commander of the Seventh District met with the major in charge of SCDNR law enforcement to apologize for the misunderstanding and to assure the major that such a misunderstanding would not happen again.

The commander of the Seventh Coast Guard District testified at the Safety Board's public hearing on February 4, 1999, that during the administrative investigation of Group Charleston, it was the district's prerogative to act on the release of information about the accident. The district commander stated that the district staff decided that it would be prudent to "find the facts" before making a disclosure about the 0217 radio call, but that the administrative investigation took much longer than expected. He stated that in his experience, information under investigation was not disclosed until the investigation was completed.

The district commander stated that the staff was concerned about the fact that the caller in the 0217 mayday call had not been positively identified and that a FOIA request was pending. He stated that the effect of the FOIA request was that it alerted the staff that the review of the administrative investigation report had become bogged down within the staff and that it was necessary to speed up the process. He stressed that review procedures had been improved for expediting future reviews. He stated that Coast Guard headquarters approved the release of part one of the unfinished administrative investigation, which included information on the 0217 radio call, probably in February 1998. Approving the release made it possible to offer information about the recording of the 0217 radio call to the families.

The district commander stated that the families were offered the opportunity, if they chose, not to publish information about the tape if publication would be too painful to them. The commander stated that the district staff was not aware that the SCDNR was conducting a casualty investigation into the loss of the *Morning Dew* and that it was criminal investigation. He stated that the Coast Guard would not have been harmed by early release of information about the 0217 radio call and that the Coast Guard would have been better served to have released the information early.

The chief of the Office of Search and Rescue at Coast Guard headquarters discussed new guidance about releasing search and rescue information that was published in ALDIST¹⁸ 041/99 and disseminated on February 3, 1999. According to the ALDIST:

Any Coast Guard unit receiving a request for search and rescue information from a federal, state, or local agency within their area of responsibility will comply with that request unless there is a compelling reason to withhold it. Before the request is denied concurrence will be obtained from the cognizant District Commander.

The ALDIST also instructed Coast Guard commands at all levels to establish sound working relationships with counterpart agencies within their area of responsibility.

¹⁸ An *ALDIST* (short for "all districts") is a message to all Coast Guard activities and personnel that transmits information and/or guidance. A *COMDTNOTE* (short for Commandant Notice) provides information and/or guidance to Coast Guard activities and personnel. A *COMDTNOTE* is normally effective for a specified time and may be disseminated as an *ALDIST* when rapid transmission is warranted.

Regarding family interaction, the ALDIST states:

District Commanders will ensure the greatest possible sensitivity in the prosecution of all search and rescue cases. Search and rescue controllers are faced with the challenge of using all sources of information including interaction with next of kin to prosecute search and rescue cases. Those interactions shall be in the most humanitarian yet expeditious manner possible.

The chief of search and rescue testified that information on search and rescue would be disseminated as stipulated in the ALDIST even if an administrative investigation was in progress.

Watchstander Scheduling

The Coast Guard operates 49 Group offices nationwide. These groups prosecute search and rescue cases through operations and communications centers. The operations centers exercise command and control and search and rescue mission coordination. They are staffed by continuous shift watches typically stood by a senior petty officer who has completed training at the Coast Guard national search and rescue school. The communications centers provide 24-hour coverage to monitor the national distress frequencies and Coast Guard working frequencies. Group communications centers are staffed by telecommunications specialists. (The training of communications center watchstanders is discussed elsewhere in this report.)

The person in charge of the operations center is the operations duty officer. Some operations centers provide 24-hour coverage by placing operations duty officers on rotating 12-hour watches, while others place one operations duty officer on a continuous 24-hour watch. The watchstanding system at Group Charleston consisted of five telecommunications specialists who stood 12-hour watches on a 2- or 3-days on, 2-days off rotation and three petty officers who stood 24-hour watches as operations duty officers on a 1-day on, 2-days off rotation (changed in November 1997 from a 12-hour, 1-day on, 3-days off rotation because of personnel shortages at the group). The duty officer duty was also performed on occasion by a junior commissioned officer.

Because the duty officers had 24-hour duty schedules, they were allowed to go to bed on the premises after 2200 hours but were subject to being called by the watchstander. The Safety Board was unable to find any evidence that the Coast Guard has undertaken any systematic study of communication watchstanders' work hours or conducted a scientific study to assess the optimum work schedule for communications watchstanders.

The Coast Guard's ALDIST 209/99 established interim policy on staffing levels and watch duty length at group/activity command and communications centers. Staffing for a 12-hour watch was established at one supervisor and five watchstanders per watch position, and duty length was established at a maximum of 12 hours. This interim policy was established pending the results of an analysis of workload and staffing of all group/activity functions by the Center for Naval Analysis (CNA).

Watchstander Training

Regular Coast Guard communications watchstanders attend the 10-week telecommunications "A" school, during which they learn the operation of various communications equipment, radiotelephone protocols, and procedures for handling different types of communications, including distress messages. Safety Board review of the telecommunications school curriculum revealed that the school did not include a course designed specifically to enhance a watchstander's analytical and decision-making skills.

After completing the formal classroom training provided at the school, telecommunications specialists must complete the *Group and Stations Communications Watchstander Qualification Guide* and on-the-job training at their assigned communications center. Review of the guide revealed that it does not set a minimum or maximum time for completion of the study material. The guide sets performance criteria (procedural steps best followed for performing each task) and suggests the manner in which the student should be guided through the learning process.

The guide contains five divisions of qualification tasks comprising reading assignments and a number of tasks in each division (22 in all) to be completed and practiced in sequence by the student, with the help of the instructor. Once candidate watchstanders complete the local on-the-job training, they are required to pass an oral examination by a qualifications review board at their local command before they are considered "qualified" to stand watch unsupervised.

NSWC-CD Survey

The NSWC-CD found a number of significant deficiencies with the communication systems at the Charleston and Mobile group offices and developed recommendations for improving the antenna systems in both areas. The NSWC-CD found the following problems and made the indicated recommendations to the Coast Guard:

- Some antennas and towers were found to be in need of maintenance, and there was no program to specifically inspect antenna towers. Recommendation: To improve antenna reliability by early detection of deficiencies, perform an antenna tower inspection once each year (by professional antenna tower company).
- A continuous frequency swept VSWR (voltage standing wave ratio) measurement, which can be used to document antenna bandwidth and identify nulls, had not been performed on the antennas. Recommendation: To ensure Group Mobile is getting full coverage of its area of responsibility, measure the swept VSWR of each antenna array with a network analyzer.
- The antenna at Mount Pleasant was found to be located on a tower along with several other commercial antennas, and tests indicated the presence of some interference from these other antennas at certain frequencies. Also, no attention was being given to the potential interference effects from these nearby antennas. Recommendation: To improve system performance, ensure proper channel

spacing, and eliminate potential interfering frequencies, perform a frequency management study and test on each antenna tower.

- The noise levels on the telephone lines connecting the Charleston group communications center to the antenna high sites were not being routinely monitored. Recommendation: To improve system performance, identify phone line quality degradation by conducting monthly tests to determine the phone line service health.
- The quality of the telephone lines being used to connect the group communications centers to the antenna high sites were less than optimum. Recommendation: To improve telephone line performance, wherever possible, replace service type 3002 telephone lines with service B telephone lines.
- Potentially noisy and outdated carbon-technology surge suppressors were being used at the Mount Pleasant antenna high site. Recommendation: In order to minimize telephone line noise, remove all carbon-technology surge suppressors from the telephone lines and have the telephone company upgrade them to state-of-the-art surge suppressors.
- Continuous remote monitoring of the electrical power, telephone lines, and space temperatures of the antenna high sites was not being done. Degradation in any of these elements remains undetected until the system fails or when discovered during biannual site inspections. Recommendation: To improve system reliability, consider installing a condition-based monitoring system on all antenna high sites.

The National Distress System

According to the Coast Guard *Addendum* to the *National SAR Manual*:¹⁹

The Coast Guard is required by federal law (14 U.S.C. 2) to develop, operate and maintain ‘... rescue facilities for the promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States....’ This authorizes the Coast Guard to provide distress and safety communications for the boating public, both commercial and recreational. The system established and maintained by the Coast Guard to provide this service is the VHF-FM National Distress System (NDS). The objective of the NDS is to provide distress, safety, and command and control VHF-FM communications coverage in all areas of boating activity (including inland waters) in which the Coast Guard has SAR responsibilities.

The Coast Guard-operated NDS consists of about 300 VHF-FM transceivers and antenna high sites that are remotely controlled by 49 regional communications centers. The communications centers are usually paired with operations centers, and together they support the operational command known as a “group.”

¹⁹ COMDTINST M16130.2B, Chapter 1, Section 1.E.

The mission of a group, in addition to search and rescue, may include law enforcement, drug interdiction, and maintenance of aids to navigation. The groups are located near U.S. waterways and provide two-way voice communication coverage along U.S. navigable waters to a range of about 20 nautical miles from shore. The NDS is the primary means for mariners in distress to contact the Coast Guard by VHF-FM radiotelephone. Other functions of the short-range NDS are to provide command, control, and communications for Coast Guard search and rescue, law enforcement, maritime safety, and marine environmental protection activities.²⁰ The electronic equipment that makes up the system, when it was developed in the early 1970s, had an expected service life of 15 years.

Hardware Description. The hardware and equipment that make up the physical communications system consist of radio transmitters and receivers, telephones, radio antennas, recording devices, radio direction finders, and various connectivity devices that link the individual pieces.

Antennas. The Coast Guard's short-range VHF radio communication system is a "line-of-sight" system that is dependent upon strategically located antennas known as "high sites" because they are mounted on tall towers located near the coastline. The high sites are remotely controlled by regional communications centers and selected stations. Typically, the antenna sites are connected to communications centers via conventional telephone lines.

Radios. The NDS comprises about 300 VHF-FM analog base radio stations, most with a transceiver with six predesignated maritime channels. All have one guard receiver, normally set on VHF-FM channel 16 (156.8 MHz). Most communication sites (approximately 265) use the Motorola MICOR base station, dating from 1979-1984 and modified for Coast Guard use. Although still supported by the manufacturer, it is no longer manufactured. Since the MICOR line was cancelled (1985-1990), the Coast Guard has purchased approximately 35 modified Motorola MSR 2000 base stations.²¹ According to the Coast Guard, maintenance and spare parts have become difficult and expensive to obtain, and when equipment failures necessitate replacement of equipment, such replacement must be with nonstandard units.

Recording/Playback Capability. All radio traffic over monitored frequencies and all telephonic communications at Coast Guard group communications centers are recorded. The Stancil DBR-32 recorders that are now being replaced by DVLs record information on a 32-track magnetic tape in real time, meaning that a 10-minute period of silence over the radio will result in a 10-minute period of silence on the recorded tape. The tape is changed each day, and each day's tape is typically saved for 30 days, after which the tape is reused.

²⁰ The National Distress and Response System Modernization Project Operational Requirements (ORD) <<http://ndsmrp.spawar.navy.mil/site/ndshome.nsf>>.

²¹ Mission Analysis Report—"Justifying the Need for a Short Range Communication System," U.S. Coast Guard Telecommunication & Information Systems Command <<http://ndsmrp.spawar.navy.mil/site/ndshome.nsf>>.

As of August 26, 1999, the Coast Guard had purchased 47 DVL units (ADS RD-624 DVL) for installation at shoreside communications centers and on board selected Coast Guard cutters. The DVL uses magneto-optic disks. The recording function is voice activated. Long periods of silence are not recorded, and specific communications can be located by selecting discrete digital files from a time-indexed menu listing of recorded messages. Safety Board investigators had an opportunity to operate a DVL. The recorder was found to be user-friendly and precise, but it was judged to be slow to retrieve a previously recorded transmission. The units lack the ability to rapidly replay the last recorded transmissions.

As of August 1999, 32 of these units had been installed in Group communications centers around the country, and five had been installed at Coast Guard district communications centers. Although the budget allocation has not yet been approved, the Coast Guard has said it expects that the remainder of the group and district communications centers will be provided with units in FY 2000.

The U.S. Navy's Naval Air Systems Command, through a commercial contract, is the supplier of DVLs to the Coast Guard and has recently issued a "request for proposal" for a new generation of DVLs that will include the capability to instantly play back recently recorded transmissions, to filter/enhance audio signals, and to digitally transmit discrete voice transmissions to a PC or onto the Internet to avoid having to copy transmissions onto a cassette tape.

Direction-Finding Systems. The typical Coast Guard communications center does not currently rely upon DF capability in prosecuting search and rescue missions or in evaluating received radio messages. Many of the group communications centers have DF equipment installed, but because of known limitations in functionality, the equipment is usually not used. The DF equipment installed at the group communication centers consists of antennas mounted on local low-level towers and receivers that do not have the ability to archive or record data that has been received. Also, the existing DF systems have only a single antenna, which limits the system to indicating a line of bearing to a transmitting radio without providing a position fix through triangulation of signals.

The Safety Board has learned that the Coast Guard intends to install new DF equipment at selected communications centers in areas having significant search and rescue activity. The Coast Guard has allocated approximately \$2 million in FY 2000 for the procurement and installation of this new equipment, which is intended to provide a limited interim DF capability ahead of the high-performance DF system sought in the NDS modernization project (see next section). According to the chief of the Coast Guard Office of Search and Rescue, the new DF equipment will be similar to equipment previously installed at many communications centers, including Group Charleston, in that the antennas will determine a line of bearing (rather than a position fix) to the transmitting radio. The equipment may not provide the capability to store DF data. The new DF equipment will be selected and purchased at the local level. Coast Guard headquarters does not intend to give the local commanders specific guidance on performance specifications for the equipment that they are to install.

Coast Guard National Distress and Response System Modernization Project

In order to upgrade the system to meet current and future needs, the Coast Guard has instituted a national distress and response system modernization project (NDRSMP). The basic objective of the project is to allow the Coast Guard to receive maritime distress and emergency response alerts and to permit command and control of responding facilities for all operational missions that occur in coastal areas. The Coast Guard plans call for the system to, as much as possible, use existing, proven, off-the-shelf equipment (referred to as commercial/government-off-the-shelf [COTS/GOTS] acquisitions.).

The NDRSMP mission analysis report and mission need statement state that the new NDRS must:

- Provide distress alerting, coordination, and command and control in coastal areas and navigable waterways where commercial or recreational traffic exists.
- Provide reliable two-way voice and data communications between shore units, vessels, aircraft, and vehicles in the maritime environment—including a continuous and uninterrupted guard on channel 16 VHF-FM at communications centers and operation centers of Coast Guard groups/activities and mobile assets.
- Be compatible, interoperable, and interfaceable between Coast Guard units, other government agencies, and the maritime public.
- Allow simultaneous multi-functional operations in the same or separate geographic location.
- Allow for protection of sensitive information.
- Survive during and after adverse conditions such as war or natural disaster.
- Allow for the dissemination of marine safety information to all boaters in a specified region.
- Provide a means for determining the location of an originating signal whether by a vessel in distress or a hoax caller.
- Automatically record and time stamp all voice and data transmissions, and provide instant playback and archiving capability for incoming voice communications.
- Send and receive digital selective calling (DSC) signals in order to communicate with SOLAS convention vessels as well as provide a continuous guard on channel 70 VHF-FM (DSC).

The modernization project has been in various stages of development for 20 years. According to the Coast Guard's Office of Search and Rescue, the modernized system is scheduled to have initial operational capability in mid-2002 and full operational capability during the 2004-2005 time frame. The cost of the system has been estimated at \$200 to \$250 million.

Canadian Coast Guard Search and Rescue Communications

The Safety Board contacted a representative of the Canadian Coast Guard, the officer in charge of the Marine Communications and Traffic Services (MCTS) station at Prince Rupert, British Columbia, for information about Canadian Coast Guard search and rescue communications. Station Prince Rupert is one of three MCTSs located on the Canadian West Coast and is responsible for search and rescue operations over an area of approximately 80,000 square miles. Of particular interest to the Safety Board was the type of equipment used at the radio stations.

Direction-Finding Equipment. The Prince Rupert MCTS is one of three MCTS stations that have radio DF equipment that, according to the officer in charge, is routinely used during search and rescue cases. The equipment identifies the geographic direction from which a received radio signal was transmitted. From a search and rescue perspective, DF equipment may be used to find a vessel when the radio operator does not, or cannot, provide the location to the Coast Guard. DF information could be used to provide directions to a lost or disoriented boater, to identify and locate a hoax caller, or to render assistance to a vessel in distress. The DF system used by the Canadian Coast Guard was commercially available and was purchased "off the shelf" in 1992.

The DF system at Prince Rupert consists of a number of DF receiving antennas located along with the normal VHF antennas at the outlying peripheral antenna sites. The signal received at the DF antennas is relayed to the communications center and processed by the DF system. The DF system superimposes a line of bearing or a position fix from a transmitting vessel onto an electronic chart of the area. Watchstanders have almost instantaneous information concerning the location of any transmitting vessel within their area of responsibility. The officer in charge of the Prince Rupert MCTS stated that the equipment is easy to use and very accurate. The effective range of the DF system is between 40 and 60 miles, and the bearing error is about three to six degrees. Furthermore, he stated that the system is connected to a printer that automatically prints out the bearing and the time of every transmission received. The bearing information is also digitally recorded and can be played back to review the data at a later time, and the bearing information could be matched to recorded voice communications.

According to the Prince Rupert officer in charge, the DF system has worked so reliably and well that the Canadian Coast Guard is satisfied that it has reduced search and rescue response time by eliminating the need to conduct time-consuming searches for vessels in distress. As soon as the MCTS receives a transmission from a vessel in distress, the position of the vessel is known. It has been used successfully to locate vessels in distress when an incomplete mayday transmission was made, to provide navigation information to vessel operators who have become lost in fog, and to locate vessels with open microphones.²²

²² A radio with its microphone's transmit key stuck in the open or "on" position so that it continuously transmits on VHF-FM channel 16 prevents the use of the channel by others who may be in need of assistance.

Recording/Playback Equipment. The MCTS also has recording equipment that is used to record all incoming and outgoing radio communications. The recording of communications is handled on two levels: one for instantaneous recall (referred to as a "call check recorder") and another for longer term storage or archival purposes. According to the officer in charge at Prince Rupert, the call check recorder provides the radio watchstander the ability to rapidly replay the last transmission received by pressing a single button. With repeated presses of the button, the watchstander can access up to the last 99 messages or 30 minutes of transmissions.

For longer term storage, a separate recording device is used that permits access to recorded messages received in the previous several weeks. Retrieval of archived recorded messages is less direct and may take several minutes to locate and play back the desired communication. The officer in charge at Prince Rupert MCTS told the Safety Board that watchstanders have found the call check recorder to be a valuable tool, and they use it extensively when they are unsure of the content of a message. He said watchstanders are instructed not to rely on the call check recorder as a substitute for vigilant communications guard, but rather to use it as a tool to improve their watchstanding effectiveness.

In cooperation with the Delft University of Technology of Holland, the Safety Board recently sponsored a research study (which is still ongoing) to determine the extent of the use of DF and recording systems throughout the world. The study gathered information through the use of questionnaires sent to the search and rescue organizations in 86 countries. To date, 42 countries have responded. Of these, 12 stated that they were using or had used DF systems. Most of these DF systems were purchased between 1980 and 1990. Also, 21 countries responded that they use voice recording equipment, and virtually all of the countries that use recording equipment reported that they also have the capability to instantly replay messages.

The Incident Command System

Accidents and disasters bring together a variety of agencies and organizations, such as city, State, and county police departments, firefighting and rescue organizations, the coroner/medical examiner and other medical personnel, State and Federal emergency management organizations, and the Red Cross and other social services organizations. In order to efficiently manage and control the large numbers of people and the large amount of equipment that come together in such cases, the National Interagency Incident Management System, known as the ICS, was developed to provide procedures to efficiently structure and control personnel, facilities, equipment, and communications during all phases of a response.²³

Under the ICS, the incident organizational structure usually is headed by a fire department official, law enforcement official, or Federal official, depending on the type of response. This person heads a central command post and is supported by representatives

²³ In 1980, the ICS, which was originally developed in California under the FIRESCOPE (Fire Fighting Resources of California Organized for Potential Emergencies) program, became a national program called the National Interagency Incident Management System.

of all the responding agencies or organizations. The organizational staff builds from the top down, and the structure develops in a modular fashion as needed, based on the size of the accident or disaster. While one person usually can manage smaller accidents or incidents, larger and more protracted operations require independent management of the various command responsibilities that may include a command staff and operations control, planning, logistics, and finance sections. Thus, the ICS is adaptable to any type of accident or incident and can be a small, one-person operation or a complex organization. The ICS is used throughout the United States.

The coroner testified at the Safety Board's public hearing that the ICS in effect in response to the *Morning Dew* accident allowed the agencies to coordinate their response and share information. She further stated that the coroner's office told the Coast Guard the identities of the boys whose bodies had been found and was surprised later to hear the information broadcast on radio. She stated that participation by the Coast Guard in the ICS would have resulted in having one spokesperson to answer questions from the media pertaining to the overall response instead of the Coast Guard's providing information to the media independently.

Boating Safety Responsibilities of the Coast Guard and the States

Under the Federal Boat Safety Act of 1971, recreational boating safety became a shared responsibility of the Coast Guard and the States. The responsibilities of each party were typically spelled out in negotiated and periodically updated agreements between each Coast Guard district and each of the States within the district's area of responsibility. In the case of South Carolina, a memorandum of understanding (MOU) between the Seventh Coast Guard District and the State was signed in 1984 and reviewed in 1994.

The Boat Safety Act was enacted, in part, to foster cooperation between State and Federal governments in reducing deaths, injuries, and property damage from recreational boating accidents. The act specified cooperative agreements of the type in place between South Carolina and the Coast Guard as one method of ensuring the desired coordination. These agreements usually cover such subject areas as law enforcement, public education and training, boating casualty reporting and investigative reports, search and rescue, aids to navigation, and use of the Coast Guard Auxiliary.

The MOU the Coast Guard entered into with the State of South Carolina states that the State has primary responsibility concerning recreational vessels on the waters subject to joint State/Federal jurisdiction. The MOU gives to the State of South Carolina the responsibility for investigating recreational boating accidents involving one or more fatalities and requires State officials to forward a copy of the casualty report to the commanding officer of the Coast Guard Marine Safety Office in Charleston. The MOU discusses search and rescue in cases of joint responsibilities but does not address the State/Coast Guard participation and responsibilities in the incident command system nor how to coordinate notification of next of kin. The commanding officer of Group Charleston stated that he was unaware of the MOU between the Coast Guard and the State.

ALDIST 041/99, which Coast Guard Headquarters issued in February 1999, directs district commanders, as part of an effort to “establish sound working relationships with counterpart agencies,” to review for currency existing agreements or MOUs between the districts and other agencies within their areas of responsibility.

Required Equipment for Recreational Vessels

Coast Guard regulations do not require pleasure craft to carry a VHF marine radio,²⁴ an emergency position indicating radio beacon (EPIRB), Loran, radar, a global positioning system (GPS) receiver, navigational charts, or a compass. For the class of vessel to which the *Morning Dew* belonged, the Coast Guard does require the carriage of PFDs (one for each person on board), one throwable flotation device, visual distress signals, fire extinguishers, a sound-producing device, navigation lights, a marine sanitation device (if a vessel has toilet facilities), special shapes and lights to alert other vessels of conditions that may be hazardous, and a pollution regulation placard.

Recreational Boating Safety: Previous Safety Recommendations

The Safety Board began addressing recreational boating safety in 1969 and has made safety recommendations since that time that have addressed the need for the following:

- Chemical tests to determine the blood alcohol concentration of recreational boat operators involved in fatal boating accidents;
- A national safety program, with education and enforcement elements, to address the hazards of alcohol use in recreational boating;
- Boating safety courses that include information regarding the hazards of alcohol use and its effects on recreational boat operations;
- State minimum recreational boating safety standards and requirements, including use of PFDs, demonstration of operator knowledge of safe boating rules and skills, and operator licensing;
- Recreational boating safety legislation requiring the carrying of approved lifesaving devices on all watercraft; and
- A uniform component of standards that establishes an age at or below which children should be required to wear PFDs while in recreational boats.

Postmortem tests for alcohol were performed on the operator in this accident. Also, the operator had taken a Coast Guard boating course, had onboard PFDs and other safety equipment as required by the Coast Guard, and was an experienced recreational boater. Further, the young boys onboard were above the age of 12. Therefore, the implementation of previous recreational boating safety recommendations does not bear specifically on this accident.

²⁴ As a result of the 1996 Telecommunications Act, the Federal Communications Commission no longer requires operators of recreational vessels to have a license to operate VHF marine radios. The former requirement entailed the payment of a fee, but no examination was required.

Analysis

The Accident

According to statements of several members of the victims' family, the operator of the *Morning Dew* planned to make the entire trip from South Carolina to Florida within the confines of the ICW. While transiting Winyah Bay, however, the operator left the ICW and proceeded into the Atlantic Ocean.

From all available evidence, sometime in the early morning hours of December 29, 1997, the *Morning Dew* struck the north side of the north rock jetty extending from the harbor at Charleston. The paint markings and debris path documented by the SCDNR show that the vessel was carried over the jetty, probably by waves in combination with the rising tide, resulting in the vessel's coming to rest submerged in about 12 feet of water on the south side of the jetty.

Autopsies determined that all four occupants of the *Morning Dew* died from drowning, with a contributing cause of hypothermia. None of the bodies showed evidence of physical trauma sufficient to have caused death. The state of dress of the three boys indicates that they were not on deck at the time of the allision and had probably been sleeping. One boy was wearing a PFD. Since it is unlikely that he would have worn a life jacket to bed, he probably donned it when he was forced to enter the water, indicating that he probably survived the allision.

A call later determined to be a distress call was received by Coast Guard Group Charleston at 0217. The family of the victims identified the youngest boy as the sender of the call, indicating that he had survived the allision. The bodies of the youngest boy and his 14-year-old cousin were later found on the south side of the Charleston north jetty on the beach at Sullivans Island. Nearby was a horseshoe buoy from the *Morning Dew* and a PFD. Since it is unlikely that both boys would have drifted to the same location if one of them had been unconscious or dead, both boys were probably conscious and able to hold onto the horseshoe buoy and the PFD after the allision. Based on this evidence and the absence of trauma injury to any of those aboard, including the operator, the Safety Board concludes that the operator and all three passengers aboard the *Morning Dew* probably survived the allision with the north jetty.

The actual circumstances surrounding the actions of the occupants and the time they entered the water are unknown. The occupants may have remained with the boat as long as they could, hoping their mayday would bring assistance and believing, correctly, that they would have the greatest chance for rescue if they stayed with the boat. But even if they had been able to stay with the boat initially, they would certainly have had to enter the water after the vessel was carried over the jetty and sank. Based upon the 54° F water

temperature, their expected survival time in the water would range from 1 to 6 hours,²⁵ which means that even if the occupants of the *Morning Dew* had had to enter the water almost immediately after the allision, any or all of them could have survived until about 0830.

About 0620 on the morning of December 29, the boatswain of the inbound freighter *Pearl Ace* reported hearing cries for help coming from the water near buoy 22 as the ship entered Charleston Harbor. The Safety Board considered whether one or more occupants of the *Morning Dew* could have been near that location at that time.

The bodies of the two younger boys were found about 1100 near Fort Moultrie, about 1/2 mile from buoy 22. The distance from the point where the *Morning Dew* struck the jetty to buoy 22 is about 1 1/2 miles. The two younger boys, perhaps clinging to the horseshoe ring or the PFD, or both, could, by 0620, have reached the area where the cries were reported. The body of the operator was not found until 3 weeks after the accident. He possibly could have been near buoy 22 when the cries were reported. Given that no one else was reported or found to be in need of assistance in the vicinity of buoy 22 on the morning of December 29, 1997, the Safety Board concludes that the cries for help reported by the boatswain of the *Pearl Ace* most likely came from one or more of the occupants of the *Morning Dew*.

When the master of the *Pearl Ace* reported to the pilot that the boatswain had heard someone calling for help from the water, he immediately contacted the pilot dispatcher and asked him to relay the information to the Coast Guard. He also called the operator of the pilot boat *Palmetto State* and asked him to search the area where the calls for help had been heard. The pilot was occupied with piloting a large ship in restricted waters and could not, in the view of the Safety Board, have reasonably done more than he did under the circumstances. The safety of the *Pearl Ace* and its crew, as well as the safety of the marine environment, demanded that the pilot concentrate his efforts on the safe navigation of the vessel.

Similarly, immediately upon receiving the pilot's instructions to do so, the pilot dispatcher contacted Coast Guard Group Charleston to relay the information that calls for help had been heard coming from the water in the vicinity of buoy 22. The transcript of the telephone call indicates that the dispatcher provided accurate information about the call for help and the specific location where it had been heard. The Safety Board therefore concludes that the master and boatswain of the *Pearl Ace* and the Charleston Harbor pilot and pilot dispatcher acted appropriately under the circumstances to provide a timely report to the Coast Guard of cries being heard from the water.

The operator of the *Palmetto State*, responding to the pilot's instructions to do so, proceeded to buoy 22 without delay and conducted a search. In view of the fact that the operator had no search and rescue training or experience, that his was the only vessel conducting the search, and that the weather and sea conditions made detecting a person in

²⁵ Source: Coast Guard SAR Manual. Survival times would depend on such factors as the water temperature, protective clothing, body weight, and actions of the person.

the water difficult at best, it is not surprising that the search was unsuccessful. The Safety Board concludes that the operator of the *Palmetto State* did what was within his power by way of conducting a search for possible victims of a marine distress situation, and his actions, though unsuccessful, were timely and appropriate.

Exclusions

The *Morning Dew* was designed for coastal sailing, and no information was found to indicate that the vessel had been modified or permitted to deteriorate in a way that would have rendered it incapable of withstanding the weather conditions experienced during the accident voyage.

According to statements of family members, the operator intended to make the entire trip using auxiliary power. The sails of the boat were furled when the boat was last seen and were still furled when the submerged boat was located, indicating that the sails were not used during the final leg of the voyage.

By the time the Safety Board was asked to initiate an investigation of this accident, the vessel and its systems were not available for examination. Sufficient evidence was available, however, to indicate that mechanical failure in the boat's propulsion system did not cause or contribute to the accident. The strongest evidence suggesting that the auxiliary propulsion engine did not fail during the voyage is that the time that elapsed between the last sighting of the boat and the receipt of the distress call is consistent with what would be expected if the boat had proceeded continuously under power before striking the jetty.

Furthermore, the failure of the auxiliary propulsion engine as a result of running out of fuel can be discounted, because the operator was known to have purchased a full tank of fuel at the start of the voyage. The distance from where the fuel was purchased to where the accident happened is about 80 nautical miles, and the expected range for the fully fueled vessel would have been about 140 nautical miles.

The engine could have failed as a result of the fuel system's becoming clogged with microorganism sludge. But such a failure was not likely in this case, since the operator was known to have purchased enough, presumably fresh, fuel to completely fill the main tank and an auxiliary fuel container. Moreover, had the fuel system been afflicted with biomass sludge, the problem would have been manifest much earlier in the voyage, shortly after wave action had agitated the fuel in the tank. And because of the close correlation between the underway time and the distance traveled, an engine failure early in the sea portion of the voyage is not likely.

Had the operator experienced a mechanical problem during the latter part of the voyage, he would probably either have attempted to raise the sails or to use his VHF-FM radio to request assistance. As noted earlier, no evidence was found of any attempt to raise the sails. And a review of the recorded radio traffic on the night of the accident did not reveal any distress calls from the *Morning Dew* other than the 0217 mayday call. Finally, the fact that all blades of the propeller were bent suggests that the engine was running at

the time the vessel grounded on the rocks of the jetty. The Safety Board therefore concludes that neither the material condition of the vessel's hull, the hull design, the mechanical condition of the main engine, or the fuel and fuel system contributed to or caused the accident.

Postmortem drug tests were negative for all vessel occupants, and alcohol tests were negative for the three passengers. Tests of vitreous fluids of the operator, which would have indicated whether or not the operator had ingested alcohol prior to the accident, were not performed. The alcohol level that was present in the body of the operator most likely was the result of decomposition. The Safety Board concludes that neither the operator nor the three passengers were under the influence of drugs at the time of the accident. None of the passengers were under the influence of alcohol, and the postmortem evaluation and toxicology findings on the operator were consistent with postmortem alcohol production.

Before going on duty on the evening before accident, the watchstander had been off duty for 24 hours, having gone from the day shift on December 26 and 27 to the night shift on the December 28. Prior to December 26, he had been on leave for 5 days. Thus the watchstander had sufficient opportunity to rest before coming on duty, and he stated that he was well rested. The duty officer involved in this accident response had worked one 24-hour shift in the 5 days preceding the day of the accident and had been off duty for 2 days before going back on duty at 0600 on December 29. He stated that he was well rested when he reported for duty. The Safety Board therefore concludes that neither the Coast Guard watchstander nor the operations duty officer was suffering from fatigue during the postaccident period.

The balance of this analysis addresses (1) the events and circumstances that may account for the *Morning Dew*'s presence at the location where the accident occurred, (2) the actions and inaction of Coast Guard Group Charleston in the immediate aftermath of the accident, and (3) the actions of the Coast Guard during and after the accident investigation carried out by the SCDNR.

The major safety issues identified in this investigation are the adequacy of the reasoning and decision-making of the operator; the fatigue and possible hypothermia suffered by the operator; the adequacy of the reasoning and decision-making of Coast Guard Group Charleston's watchstanders; the adequacy of Coast Guard Group Charleston's personnel, equipment, and procedures for responding to an emergency, and the role of the Coast Guard in providing factual information for safety investigations.

The Actions of the Operator of the *Morning Dew*

Preparing for the Voyage

The vessel operator attempted to sail the *Morning Dew* from South Carolina to Florida, a voyage of more than 300 nautical miles, during winter, when unpredictable weather and less-than-favorable temperatures could be expected. He would have known that the voyage would require more than 60 hours of actual sailing; and considering his

many years of sailing experience, he must have known that such a journey was not without its dangers, even if the trip was confined to the ICW, and especially if any part of it was to take place at night.

Despite the potential risks associated with the trip, only limited advance preparations were undertaken beforehand. When the operator and his passengers arrived in Myrtle Beach, the vessel was not ready to sail. It was not provisioned, and the necessary charts were not on board. Also, the engine starting battery was dead, which was not discovered until the operator attempted to start the engine on the morning of the planned departure.

Departing the ICW at Winyah Bay

The Safety Board considered whether the operator's departure from the ICW was the result of a navigation error. Witnesses stated that southbound boaters following the ICW through Winyah Bay sometimes lose track of the ICW and inadvertently follow the main shipping channel toward the ocean. Moreover, ICW charts are broken into sections and therefore require some diligence on the part of a boater to follow as the trip progresses. Nonetheless, the charts clearly show the progression of the ICW through Winyah Bay, including indicating the route with a magenta line.

Even if an operator, while transiting the bay, is not making constant reference to the charts—as the prudent mariner will do if unfamiliar with the waterway—the appearance of a buoy or other marker without the yellow ICW symbols will signal the boater that the vessel has left the ICW. Reference to the chart will then verify the vessel's location and the course change needed to return to the intended route. In no case should it be necessary to pass more than one navigation aid before the attentive boater recognizes the mistake. Even if the first marker is missed, continuing in the shipping channel and entering the Atlantic Ocean requires sailing more than 8 miles and passing within sight (in daylight) of some 16 buoys, the identification of any one of which will, with reference to the proper chart, show the vessel's actual location.

The Safety Board therefore concludes that the route of the ICW through Winyah Bay is marked on the ICW charts and navigation aids such that any boater who properly uses them should recognize and be able to follow the ICW routing through the bay. The Safety Board is concerned, however, about reports that some boaters mistakenly follow the ship channel in Winyah Bay rather than the ICW. The Safety Board therefore believes that the Coast Guard should review the navigation aids marking the route of the ICW at Winyah Bay and make any changes necessary to reduce the likelihood that southbound recreational boaters intending to follow the ICW will inadvertently depart that waterway and follow the main shipping channel toward the open ocean.

The operator and his wife had reportedly taken a boating course in the early 1970s and had supplemented their training by reading a number of books on the subject. They also had lived aboard a sailboat, and the operator had gained considerable experience at ocean sailing. He also had owned a number of boats and sailed them in and out of various ports and on lakes. He was thus an experienced sailor. On this trip, he had successfully

navigated from Little River to Georgetown and was thus capable of using the ICW charts he was known to have had on board when the vessel started the trip.

The operator was more than capable of following the ICW, and if he did inadvertently remain in the shipping channel at Winyah Bay, he was competent and experienced enough to recognize the mistake in time to correct it well before reaching the open ocean. Even if he had been preoccupied with some matter and was completely inattentive to the navigation aids or to the shoreline as he progressed along the shipping channel, he would certainly have realized that he was entering the open ocean when he exited Winyah Bay. At that point, even a novice sailor would have recognized that what lay ahead was the open ocean and not the inland waters of a bay, and certainly not the ICW. The Safety Board therefore concludes that although the Safety Board could not determine whether the operator of the *Morning Dew* departed from the ICW deliberately or by mistake, he at some point made a conscious decision to take the vessel to sea.

Making the Decision to Leave Protected Waters

Whether or not the boating course or courses taken by the operator specifically covered the dangers of this trip, all boating courses stress the importance of not taking unnecessary risks in small boats. The operator clearly had adequate background, experience, and training to understand the risks involved when he made the decision to go to sea. The Safety Board considered why, given the circumstances and the operator's knowledge and experience, he made the decision he did.

Evidence suggests that the operator may have been frustrated at not making more progress during the first day of the trip. When he called a family member on the evening of December 27, he remarked on the fact that the travelers had made only about 20 miles because of a late start. Reports of the vessel having been seen the next day moored at a closed marina in Georgetown, which is about 10 miles from the location from which the telephone call was made, suggest that it may have spent most of the night there. Based on the time of the telephone call, the operator and his passengers should have been able to go to bed fairly early and resume the trip early on the morning of December 28. Apparently, however, and for unknown reasons, the operator did not begin the transit through Winyah Bay until about noon or later. Such a late start would have accounted for the vessel's having been seen by the salvage master about 1430 near buoy 26 and proceeding toward the ocean. Thus, it is clear that the *Morning Dew* got a late start for the second day of its planned journey and that it left the ICW at Winyah Bay.

Assessing the Risks of a Voyage Into the Open Sea

The operator and his passengers faced a number of risks that the operator should have considered before deciding to venture into the open ocean:

The operator was the only adult on board. No experienced adult would be available to take over the helm if he should become incapacitated. Similarly, he had no relief if he became fatigued or if he were to be adversely affected by exposure to the elements. Although two of the boys were reported to be experienced at sailing, they were

unlikely to be either mature or experienced enough to be able to safely handle the boat in the open ocean, especially in darkness.

The weather was marginal, with potentially hazardous conditions predicted. Nighttime air temperatures were between 45 and 50° F as the vessel headed into the North Atlantic. The National Weather Service had been issuing small craft advisories for the area all day Saturday. Throughout the day on Sunday, December 28, forecasts were for nighttime variable winds 10 to 20 knots with 3- to 4-foot seas. Rain was predicted to begin late, and small craft advisory conditions were expected on Monday. Such weather was not favorable for taking small craft on a coastal voyage, even in the daytime.

The seaworthiness of the vessel was unknown. The operator had only a few hours' experience with the *Morning Dew*, and he could not have known whether the auxiliary engine or the boat's other mechanical and electrical systems would hold up at sea. The failure of any of those systems, particularly the engine, could have seriously jeopardized the safety of the vessel and its passengers.

Much of the trip would take place in darkness. Given their likely progress from buoy 26 at 1430, it would have been about 1600 when the vessel departed Winyah Bay. Sunset at that location was about 1722, leaving less than 1 1/2 hours of remaining daylight. The operator had only a magnetic compass with which to determine the vessel's heading, and only a limited number of lighted reference points on the shore would be visible from the sea. Safely navigating the vessel would thus be a difficult challenge, made more so by the likelihood that at some point in the journey, fatigue would reduce the operator's powers of observation and analysis and could cloud his judgment.

The operator had not adequately prepared the vessel or its passengers for the risks presented by a winter voyage at night on the open sea. The *Morning Dew* was equipped with ICW charts,²⁶ PFDs of unknown type, quality, and age; a strobe light; signal flares; a horn; a fire extinguisher; and a VHF radio. Except for the radio and strobe light, all this equipment falls into the category of equipment and devices the Coast Guard requires this type recreational vessel to have. Thus, based on the findings of the investigation, the *Morning Dew* had only the VHF radio and strobe light as additional safety devices beyond those required for all vessels of its type, with no regard to whether those vessels are used on the open sea or on protected waters. In addition to not having another experienced adult sailor aboard, the *Morning Dew* operator did not carry a liferaft, immersion suits to protect the occupants from hypothermia, a GPS unit to assist in navigation, a backup means of communication, such as a handheld VHF radio or cellular telephone, or an EPIRB that could be used to signal an emergency and direct rescuers to the vessel's location. The lack of these additional devices would not have been so critical if the vessel had remained within the ICW, where the vessel would have been sailing within a short distance of the

²⁶ ICW charts do not show the entrance to Winyah Bay or the coastal area between the bay and Charleston Harbor. Unless the operator had additional charts on board, for which no evidence was found, he did not have a chart that would have shown the navigation aids that would have helped him track the vessel's position as it moved down the coast.

shore for most of its trip and where help would have been much more readily available in case of an emergency.

In the view of the Safety Board, these factors made the risk of the voyage such that the trip into the open sea should not have been undertaken. If the operator had decided to anchor inside the bay and await daylight and perhaps better weather, he still would have been the only adult aboard a vessel embarking on a voyage in unprotected waters. If the vessel had been better equipped and all its systems proven seaworthy, the skills and awareness of an alert, rested operator would still have been required to ensure its safety. Even a working EPIRB may not have brought help in time to have prevented deaths due to hypothermia once the occupants were in the water. Other safety equipment, even had it been on the vessel, may very well have been rendered unusable or inaccessible by a catastrophic event such as an allision with the jetty.

The Safety Board therefore concludes that neither the *Morning Dew*, its operator, nor its passengers were adequately prepared or equipped for a trip into the open ocean, and the ocean voyage should not have been attempted.

Factors That May Have Led to the Accident

Although, in the view of the Safety Board, the risks of taking the *Morning Dew* into the open ocean were so great that the trip should never have been attempted, this does not mean that successfully navigating the *Morning Dew* from the entry to Winyah Bay to Charleston Harbor was impossible. The vessel apparently was seaworthy until it was damaged by the allision with the jetty. The weather, while challenging and potentially hazardous, was probably not such that it alone would have caused the loss of the vessel. It would have been possible, then, for a vessel like the *Morning Dew* to have sailed around the jetty and into the harbor—if that, in fact, had been the operator's plan. The Safety Board considered possible reasons why the vessel struck the jetty:

The operator may not have known that the jetty was there. He had no previous sailing experience in the area and therefore would not have been familiar with the visual aspect of the harbor entrance from sea. He did, however, carry charts for the ICW, and one of those charts²⁷ does display the entrance to the Charleston Harbor, with the jetties clearly shown.

If the operator knew about the existence of the jetty, he may not have known his vessel's position in relation to it. The unlighted jetty may have been difficult or impossible to distinguish from the dark background of sea and sky when viewed from the cockpit of the *Morning Dew*. Furthermore, based on the state of dress of the three teenagers, the operator was probably alone topside with no lookout posted when the allision occurred.

It may have been possible for the operator, upon exiting Winyah Bay, to plot a compass course that, if followed, would have taken the *Morning Dew* outside the jetties

²⁷ ICW chart 11518, Casino Creek to Beaufort River.

extending from Charleston Harbor. At that point, the operator could have used the buoys marking the shipping channel to guide him into the harbor, where he could rejoin the ICW. Attempting to steer such a course using the compass alone carried substantial risk, however, especially considering that the trip took place mostly at night and in poor weather. Unless the operator could refer to the appropriate nautical chart(s) and use landmarks (few of which would have been visible at night) or floating navigation aids to confirm his position as he progressed down the coast, he would not have been able to accurately gauge his distance from the jetty or determine how much the wind and current may have taken him from his intended course. Based on reported winds from the east, he could have found himself sailing closer to the shore, and thus closer to the rock jetty, than he intended.

If the operator had had the appropriate chart(s) that he wished to use to track his progress and ensure a safe entry into Charleston Harbor, he would have needed to be able to read the chart(s) as he progressed along the coast in the dark. He would have needed a portable light in the cockpit, a plastic sleeve protector or other device to protect the chart(s) from the wind and water, and—most importantly—the ability not only to focus on the chart(s) and any aids to navigation but to discern their meaning.

The operator may have been impaired by fatigue and hypothermia. The investigation could not determine at what time the operator and his companions arose on the morning of December 28. Assuming that they arose late, say 0900, the operator would have been awake for more than 17 hours at the time of the accident. Furthermore, at the time of the accident, the operator was in the nadir of his biological rhythm. Moreover, he was operating in a severe environment that exposed him, for as long as 9 hours, to wind and possibly rain, to spray from waves, to constant vibration from the engine, and to air temperatures between 45 and 50° F. These conditions, exacerbated by the continual pounding of the vessel by waves and the stress of constant steering to counter the effects of the following and increasingly stronger quartering winds, certainly would have been conducive to producing severe physical fatigue.

In addition to fatigue, the operator also faced the threat of hypothermia. Hypothermia is defined as the gradual lowering of the body's core temperature below the normal 98.6° F by prolonged exposure to cold air or water. It is an insidious condition, since its victims often do not recognize its symptoms. The onset of hypothermia is usually marked by muscle stiffness and increasing shivering. As the body's core temperature continues to decrease, vasoconstriction and numbness occurs, followed by increased and sometimes uncontrollable shivering. Reduced body core temperatures cause mental confusion with uncoordinated gross muscle action, characterized by stumbling and the inability to use the hands. Unconsciousness will occur soon thereafter if nothing is done to reverse the condition.

The first protection against hypothermia is the knowledge of what it is and the recognition of the conditions under which it can occur. For example, hypothermia can occur, as in this accident, under conditions that do not involve extremely cold temperatures. In this case, the *Morning Dew* operator should have prepared himself by having clothing at hand commensurate with the expected air temperature of 45 to 50° F

that occurred on the night of December 28-29. Such clothing would generally consist of several loose layers of clothing, at least one of which is wool. Additionally, a waterproof outer garment can prevent clothing from becoming wet and thus losing its insulating value. Finally, a wool hat (to prevent heat loss from the head) should be available, along with mittens or insulated gloves and wool socks.

The body of the operator was found dressed in a nylon jacket, a windbreaker, two T-shirts, a sport shirt, a pair of nylon foul-weather pants, a pair of blue jeans, jockey shorts, dress socks, and boat shoes. The unusual combination of clothing suggests that he became increasingly colder as the trip progressed and that he added layers of clothing as he found them in his personal belongings. Unfortunately, the clothing he brought for the trip was not designed for the environment in which he found himself and did not adequately insulate him against the cold and wet conditions for any length of time.

Thus, the Safety Board concludes that after about 13 hours under way, with 9 of those hours at sea, the *Morning Dew* operator was probably severely fatigued and hypothermic to such a degree that his judgment and ability to keep track of his position may have been severely impaired. The Safety Board concludes that the dissemination of information about the circumstances surrounding this accident will help dissuade other boaters from taking such unnecessary risks and may thereby prevent a similar tragedy in the future. The Safety Board therefore believes that the major boating organizations should, in their recreational boating education programs, use the circumstances and lessons learned from the accident involving the sailing vessel *Morning Dew* as a means of educating boaters about the relationship of good judgment and decision-making to boating safety.

Coast Guard Notification and Response

The Coast Guard has a mandate, which it executes, in part, through its communications program, to attempt to save lives on the water. Regrettably, in the case of the *Morning Dew*, the Coast Guard did not make the effort that might have saved the life of at least one, and possibly more, of the survivors of the *Morning Dew* allision.

The 0217 Mayday Call and the Conduct of the Watchstander

Although the watchstander was trained and had had some experience in monitoring radio transmissions, the Safety Board could not conclusively determine whether he should have been able to hear and comprehend the word "mayday" when the 0217 call from the *Morning Dew* was originally transmitted. Although the tape recording captured the output of the radio, it also added background noise of its own to the tape and thus did not and could not exactly duplicate what the watchstander heard at 0217 on December 29. His physical location at the time, the layout, location, and technical specifications of the equipment, and the presence or absence of other ambient sounds all would have affected his subjective assessment of the transmission.

The watchstander said that he was across the room when the 0217 call came in and was thus not in an optimum position to hear the transmission. He testified that he did not

hear the words “may... mayday,” but only heard “U.S. Coast Guard” repeated twice. He said he heard what he had heard on many occasions—a young voice shouting on the radio. When the caller did not respond to his call outs, the watchstander dismissed the call as requiring no further attention. In doing so, he did not consider such factors as the unusual hour at which the call was received or the prevailing weather, which was not conducive to recreational boating.

Based on the Safety Board’s replaying of the tape recording, if the watchstander had taken a few moments to replay the tape of the 0217 radio call, he would have recognized immediately that a potential emergency existed. Watchstanders were certainly aware of the existence of the recorder and their ability to replay radio calls. The watchstander, in fact, mentioned the possibility of playing back the call when he phoned the duty officer after the first two bodies had been found. But it apparently never occurred to the watchstander earlier that morning that he might not have heard or understood the complete 0217 transmission when it was first received or that the circumstances surrounding the call suggested that additional attention or follow up might be appropriate.

Judging from the watchstander’s actions, neither his training nor his experience had made him fully aware of the limitations of the equipment or the listening environment, and he obviously had not been trained to use all available means to aggressively follow up on all uncertain calls—especially those received under unusual circumstances—in an attempt to determine their nature. Thus, the Safety Board concludes that if the watchstander had properly analyzed the circumstances surrounding the 0217 distress call from the *Morning Dew*, such as his listening position, the time of day, and the weather, he might have decided to replay the recording of the radio transmission, which would have enabled him to determine the true nature of the call.

If the watchstander had replayed the recording and thus recognized the transmission as a distress call, he doubtless would have alerted the duty officer, who would then have been available for consultation and decision-making. At a minimum, an urgent marine information broadcast (UMIB) could have been issued that would have alerted other mariners of the distress call and offered additional rescue opportunities. And even if no immediate search and rescue effort was launched and no response to the UMIB was received, the known receipt of a mayday call would probably have affected the response to the 0628 call reporting cries from the water. As the situation was handled, however, no connection was made between the 0628 report and the earlier transmission.

About 0628 on December 29, while the watch was being changed at the communications center and the oncoming (day) and outgoing (night) watchstanders and the 0600 operations duty officer were present, the harbor pilot dispatch office called to relay the report that the boatswain of an inbound ship had heard cries for help coming from the water near buoy 22. The call was answered by the night watchstander, who had also received the 0217 call earlier that morning. The watchstander told the caller that he would “alert the station and they’ll determine if they want to get underway also.” Unfortunately, because he did not attach any importance to the call he had received at 0217, the watchstander did not link the two calls. Only when he was later called by the operations duty officer at home did he consider a possible link between the two calls. To

his credit, he called the duty officer back and informed him of the earlier call, which ultimately led to a review of the Stancil data recorder machine tape and an analysis of the events surrounding that call.

The Conduct of the Operations Duty Officer

The 0600 duty officer, after learning of the telephone report, took no action. Faced with an undeniable indication of a mariner in distress and the location of the emergency, he apparently never seriously considered launching available Coast Guard resources. He stated that he believed that no action was necessary because a pilot boat was on its way to search the area. He surely was aware of the difficulty of seeing a person in the water, especially under conditions of darkness and rough seas, yet he acknowledged that he knew nothing about the pilot boat's capability or the equipment it had with which to conduct a search. He did not know whether the operator of the pilot boat was experienced in establishing and following a preplanned search pattern or knowledgeable about other search techniques that can optimize the success of a search mission. He did not know whether the boat would be called away for some commercial task before it could complete a search. Furthermore, the duty officer did not inform his supervisor of his decision not to respond, nor did he log the call.

The duty officer also implied some uncertainty or doubt about the validity of the call. And yet, the report of hearing cries for help was sufficiently credible for experienced professional mariners to have relayed the report to the Coast Guard and to have directed that a commercial vessel leave its assigned station and conduct an impromptu search. If the duty officer had doubted the validity of the apparent distress and the credibility of the report, he could have used the VHF-FM radio to call the *Pearl Ace* to make inquiries that could have resolved his uncertainties. He did not do so. The Safety Board therefore concludes that the operations duty officer at Group Charleston disregarded clear indications of a marine distress situation when he took no action in response to the report of cries for help being heard from the water.

Search and Rescue

After receiving the 1115 call from the police department reporting two bodies in the surf in the vicinity of Fort Moultrie, the duty officer briefed the operations officer, and they initiated a search and rescue response. At 1144, the duty officer received a call from the operator of a pilot boat stating that he had located a sailboat mast on the south side of the north jetty between buoys 16 and 20. Based on this information, the Group had sufficient information to develop a search and rescue action plan using a computer-based system to determine the probable search areas. Adequate resources were available to execute the plan.

At 1128, a helicopter was requested from the Seventh District Operations Center, and the request was approved at 1137. The helicopter was on scene near the north jetty at 1151. The 41-foot utility boat was underway at 1159, after the helicopter had been requested, and arrived on scene 100 yards from the sailboat at 1217. Although the utility boat was at the Coast Guard boat station and should have been launched sooner, the delay

did not hamper the search and rescue efforts. Helicopters and the utility boat were prepared to launch within 30 minutes of being notified. Two helicopters and a utility boat completed five parallel searches that included the area where the sailboat mast was located, along the shoreline, the harbor entrance, and the jetties.

The National Park Service, the sheriff's department, and local volunteers assisted in the search and in the transport of emergency responders to the north jetty. The Safety Board concludes that the Coast Guard's search efforts were appropriate, even though the search was not initiated in a timely manner.

Despite the fact that the search efforts in response to this accident were appropriate, the Safety Board concludes that if Coast Guard search and rescue personnel were made aware of all the circumstances of this accident, they may have a heightened awareness of the full range of elements that contribute to a successful search and rescue effort. The Safety Board therefore believes that the Coast Guard should disseminate the Safety Board's report on the *Morning Dew* accident to its search and rescue personnel as a way of informing them of the circumstances of the accident and the lessons to be learned from it.

Communications Center Watchstanding

Watchstander Experience and Training

Formal and On-the-Job Training. The watchstander on duty when the mayday call was received from the *Morning Dew* had completed on-the-job training on the qualification guide in "3 to 4 weeks" and spent only 20 to 30 minutes before his oral qualifications review board. At the time of the accident, his entire experience as a communications watchstander consisted of 6 months' duty at Group Charleston.

The *Group and Stations Communications Watchstander Qualification Guide* provides excellent additional training for the novice watchstander candidate. The document contains 5 divisions of qualification tasks comprising reading assignments and a number of tasks in each division (22 in all) to be completed and practiced in sequence by the student, with the help of the instructor.

In order to complete the guide in 4 weeks, as the Group Charleston watchstander did, the candidate watchstander must, two or three times each week, complete and master more than two tasks, including completing the associated reading assignments. The Safety Board considers this pace of learning, even for the less complicated tasks, to be too fast to allow the candidate watchstander to grasp the material or to be able to thoroughly practice the task to the extent necessary to achieve proficiency.

The Safety Board contends that novice watchstanders should be provided with ample opportunity to practice what they are taught during their formal schooling and on-the-job training and to demonstrate a suitable level of proficiency before they are deemed qualified to stand watch. The Safety Board concludes that the Coast Guard search and rescue communications effort would benefit if novice radio watchstanders were provided with ample opportunity to practice what they are taught during their formal schooling and

on-the-job training and to demonstrate their knowledge or proficiency at regular intervals until they reach the journeyman level. The Safety Board thus believes that the Coast Guard should improve its telecommunications specialist qualification program, in concert with the telecommunications school and the guidance in the *Group and Stations Communications Watchstander Qualification Guide*, to provide for increasing levels of watchstanding responsibility under the direct supervision of experienced mentors and to allow for full telecommunications specialist certification only after candidate watchstanders have passed comprehensive proficiency tests that demonstrate their skills.

Training in Decision-making. The current focus of the training for communications watchstanders is on the proper operation of hardware and the use of standardized responses to typical situations. However, communications watchstanders do not handle only typical situations. They also encounter atypical situations that require them to use analytical skills to make judgments and formulate decisions that may have life-and-death implications.

For example, the watchstander in the *Morning Dew* accident failed to take into account such factors as his location when the call was received, the urgency in the voice of the caller, the time of night, and the prevailing weather when he concluded that the 0217 call from the vessel did not require action. Similarly, in regard to the 0628 report of cries from the water in the *Morning Dew* accident, the operations duty officer at Group Charleston did not take into account the nature of the report, the credibility of those making the report, or the potential effectiveness of the pilot boat when he allowed that vessel to conduct an independent search even when Coast Guard resources were available.

Questionable decision-making was also an issue in a 1995 recreational boating accident the Safety Board investigated in Oswego, New York.²⁸ In that accident, a boater saw a capsized boat in about 16 feet of water and reported the sighting and the location to someone at a local marina. The marina operator called Coast Guard Station Oswego and relayed the report. The watchstander at Station Oswego notified the duty officer of the call, but the duty officer decided that no immediate action should be taken. The boat was found the next day by a local law enforcement marine patrol boat after the boat was reported overdue. Three people died in the accident.

In order to appropriately assess the situation and respond correctly in atypical situations, watchstanders must have the ability to skillfully apply judgment and analytical thinking to the watchstanding task. Review of the telecommunications school curriculum indicates that the telecommunications specialist school did not offer courses in judgment and analytical and decision-making skills. Such courses have been developed for personnel in other transportation modes, particularly general aviation, to prepare students to apply critical judgment to rapidly evolving situations, and such training has proven effective in accident prevention. The Safety Board therefore concludes that specialized training designed to enhance analytical and decision-making skills could better prepare

²⁸ For more information, see Marine Accident Brief DCA95MM031, "Capsizing of 18-Foot-Long Thunderbird Cheyenne Motorboat, PA 1980 BH, and Drowning of Three Occupants, Mexico Point, Lake Ontario, Near Oswego, New York, on April 14, 1995." Adopted March 27, 1997.

Coast Guard watchstanders to make appropriate judgments about matters affecting public safety. The Safety Board therefore believes that the Coast Guard should, for all its operations and communications center watchstanders, develop and implement a course or training program designed to develop or enhance those individuals' judgment and decision-making skills.

Coast Guard Telecommunications Procedures

The watchstander was not guided by any formal procedures that may have helped him deal with the situation. The circumstances surrounding the receipt of the 0217 call were not unique. By their very nature, distress calls cannot be expected always to be transmitted or received under ideal conditions. Those initiating the call are often inexperienced in using the radio, untrained in radio procedures, and in dire circumstances that are distracting, if not life-threatening. Their transmissions are often hurried or incomplete. The Coast Guard's telecommunications guidance document that was current at the time of the accident noted that small vessels may not follow prescribed procedures when sending a mayday distress call and, in fact, that their operators may call an individual Coast Guard unit when in distress and not issue a mayday alert at all. At the same time, watchstanders do not remain at the optimal listening location during every minute of their tours of duty, or they may be managing several matters simultaneously when a distress call is received. The Safety Board reviewed the Coast Guard's telecommunications procedures to determine whether they addressed these contingencies.

Evidence gathered during the investigation suggested that no procedures were in place at the time of the accident to provide guidance to watchstanders on actions to take when the purpose of a radio call to the Coast Guard could not be ascertained and when repeated call outs did not receive a response. Safety Board investigators reviewed all of the documents the Coast Guard believes were in place at the time of the accident that would have provided guidance to the watchstander in handling uncertain calls. The documents are the *National SAR Manual*, with Coast Guard *Addendum*, the Group Charleston SOP: *Distress Traffic*, *USCG Telecommunications Manual M2000.3B*, and *GRUCHASNINST* [Group Charleston Instruction] 16100.1B. Although each document addressed notification and other procedures for various types of calls, none of them addressed the handling of an uncertain call that could, in fact, be a distress call. The instructions did not address the usefulness of reviewing recorded radio transmissions to help ensure that a distress call would not be missed. Only after the accident did the Coast Guard group commander establish explicit instructions for the playback of recordings by Group Charleston watchstanders.

Work Schedules

Coast Guard telecommunications specialists operate the equipment and monitor the radio 24 hours a day for distress calls. This work consists of enduring long hours of tedium, making routine radio broadcasts, performing routine administrative tasks, and listening to a constant drone of routine radio chatter. The monotony is interrupted only by the occasional spurt of intense activity and stress when an actual distress call is received. Because of the life-or-death nature of the work that these watchstanders perform, the

staffing of these communications centers must be adequate both in terms of numbers and quality of watchstanders.

ALDIST 209/99 established interim policy on staffing levels and watch duty length at group/activity command and communications centers. Staffing for a 12-hour watch was established at one supervisor and five watchstanders per watch position, and duty length was established at a maximum of 12 hours. This interim policy was established pending the results of an analysis of workload and staffing of all group/activity functions by the CNA. In the view of the Safety Board, the permanent communications center staffing level policy the Coast Guard will eventually adopt, whether based on the work of the CNA or others, must take into account the factors discussed below.

Single-Person Watches. Current Coast Guard policy allows a single watchstander to stand the communications center watch. A single watchstander is typical during the night, for example, when the operations duty officer is sleeping. In the *Morning Dew* accident, a newly qualified and inexperienced communications watchstander was on duty alone for 6 to 8 hours, and it was during this time that he failed to detect the word "mayday" in the 0217 transmission and subsequently misidentified the call.

In the view of the Safety Board, permanent staffing policies should require at least two alert, attentive persons on watch. The purpose of having more than one alert watchstander is to provide oversight and supervision of relatively inexperienced watchstanders, to have a backup in evaluating incoming radio calls, and to generally provide redundancy in the overall listening and decision-making process.

For example, radio transmissions do not always come in "loud and clear." Electronic interference, adverse atmospheric conditions, other vessel transmissions, and equipment malfunctions are some of the causes for partial or indistinct transmissions. Such transmissions may in fact be attempts by vessels in distress to communicate their need for immediate assistance. A single watchstander may be less likely to correctly decipher a partial or indistinct transmission.

A second watchstander present and alert would provide a second pair of ears to listen to the incoming transmissions and would further provide someone with whom the watchstander could contemporaneously discuss and evaluate the significance of the transmission. Had there been a second watchstander present and alert at Group Charleston when the *Morning Dew* distress call was received, it is possible that the second watchstander might have heard the first words of the transmission (at least one of which was revealed by the recording of the transmission as "mayday") or that a discussion between the watchstanders might have resulted in the replaying of the transmission for further evaluation. In either event, the outcome of the accident might have been different. In cases in which more than one incident requires Coast Guard attention simultaneously, one watchstander could concentrate on prosecuting the first incident while the other watchstander prosecutes the second.

12-Hour Watches. Either as a quality-of-life issue or a perceived requirement brought on by personnel shortages, many Coast Guard activities operate with 12-hour

shifts for watchstanders. All work schedules, whatever the duration of a shift, must take into consideration human limitations to achieve acceptable performance. Vigilance²⁹ is particularly susceptible to degradation due to lengthy time on task, residual effects of sleep loss, distraction by other tasks, and other factors. Establishing an appropriate watch duration and rotation is therefore paramount.

Despite the Coast Guard's current practice of maintaining 12-hour and 24-hour watch regimens at group headquarters, the Coast Guard has apparently not undertaken any systematic study of communications watchstanders' work hours or conducted a scientific study to assess the optimum work schedule for attaining maximum vigilance and the highest levels of overall watchstander performance at its communications centers.

Moreover, as discussed elsewhere in this report, the Coast Guard currently lacks a mechanism for effectively monitoring watchstander performance. In the absence of such a mechanism, decreased alertness and diminished vigilance can persist unchecked. Watchstanders cannot know what they do not hear; lapses in vigilance are thus undetectable and uncorrectable without intervention. Because the communications watchstander cannot control the timing or distribution of incoming radio transmissions, he or she must maintain a heightened level of alertness always. And, while individuals experiencing sleep loss can usually rally momentarily to perform at their non-sleep-deprived levels, their ability to maintain that performance becomes increasingly limited in duration as sleep loss progresses. Because vigilance necessitates *consistent* and *constant* alertness, the impact of insufficient sleep can have severe consequences for performance.

Sleep loss has immense potential to exacerbate the problems of excessive shift length, monotony, and boredom. If split shifts or other rotations are considered as a means to mitigate the limitations posed by time on task without significantly increasing personnel requirements, the impact of these alternatives on watchstanders' ability to obtain sufficient sleep must be addressed. Perhaps most troubling is research indicating that performance decrements are more likely to be found in those with less experience³⁰ and to negatively impact reasoning tasks³¹ or nonstimulating tasks.³²

Watchstander vigilance and overall performance should be the primary criteria in determining whether a watch duration of 4 hours, 6 hours, or 8 hours should be employed.

²⁹ Vigilance is defined as a readiness to respond to infrequent, low-intensity signals (or those which are not easily differentiated from non-meaningful information) occurring at unpredictable temporal intervals.

³⁰ Light, A.I., Sun, J.H., and McCool, C. "The Effects of Acute Sleep Deprivation on Level of Resident Training," *Current Surgery*, 46 (1976), pp. 29-30.

³¹ Beatty, J., Ahern, S.K., and Katz, R. "Sleep Deprivation and the Vigilance Of Anesthesiologists During Simulated Surgery," in R.R. Mackie [Ed.], *Vigilance: Theory, Operational Performance, and Physiological Correlates*, New York: Plenum Press, (1977), pp. 511-527; and Hawkins, M.R., Vichick, D.A., Silsby, H.D., "Sleep and Nutritional Deprivation and Performance of House Officers," *Journal of Medical Education*, 60, 1985, pp. 530-535; and Poulton, E.C., Hunt, G.M., Carpenter, A., and Edwards, R.S., "The Performance of Junior Hospital Doctors Following Reduced Sleep and Long Hours of Work," *Ergonomics*, 21 (1978), pp. 279-295.

³² Friedman, R.C., Bigger, J.T., and Kornfeld, D.S., "The Intern and Sleep Loss," *New England Journal of Medicine*, 285 (1971), pp. 201-203.

What is clear from research relating to fatigue and worker vigilance is that 12-hour shifts are detrimental to optimum worker performance, especially in positions requiring high levels of alertness and responsiveness. While the Safety Board acknowledges the quality-of-life issues integral to watch scheduling, the Safety Board nevertheless holds the view that the criticality of the communication watchstander's function necessitates that watchstander performance be regarded as the driving force in the determination of shift length and the constitution of the watch rotation.

The Safety Board, therefore, concludes that measures to improve safety and performance at Coast Guard communications centers must look beyond staffing allocations for an effective solution and must include systematic consideration of watchstanders' tasks, shift lengths, and shift rotation. Consequently, the Safety Board believes that the Coast Guard should ensure that the workload and staffing analysis for which it has contracted with the CNA fully incorporates existing human performance research on vigilance, attention, and fatigue in the determination of shift length, shift rotation, and staffing levels at Coast Guard search and rescue communications centers.

Management Oversight of Watchstander Performance

Coast Guard search and rescue responses are predicated upon the Coast Guard's receiving and properly evaluating distress calls. Under the Coast Guard's search and rescue communications system, the evaluation is performed by individuals making decisions and judgments more or less autonomously. Under such circumstances, a consistently high level of performance can be achieved and maintained only through effective and ongoing management oversight. Unfortunately, as shown by the accident involving the *Morning Dew* and several other accidents the Safety Board has investigated, the Coast Guard does not always exercise effective oversight of its operations and communications centers.

For example, communications watchstanders sometimes stand solo watches in the evening, with no immediate oversight. Further, in the *Morning Dew* accident, the operations duty officer's decision to do nothing when he received a report of cries for help coming from the water was not subject to any review. Moreover, even though all communications over the distress frequency (VHF-FM channel 16) and all telephone calls are recorded, it is not standard Coast Guard practice to review tape recordings of radio broadcasts and telephone conversations. Even after a search and rescue case, the tapes are not routinely reviewed unless the review is considered necessary because of special circumstances.

The distress call that was received at 0217 from the *Morning Dew* would never have come to light if the watchstander had not brought it to the attention of the command. Similarly, in a June 1998 accident the Safety Board is investigating involving the recreational boat *Florida Air Specialist*, a distress call from the sinking boat was logged by Coast Guard Auxiliary watchstanders as a hoax. The Coast Guard did not initiate a review of the recorded radio communications until after the only survivor of the accident reported that a distress call had been transmitted. Had no one survived the *Florida Air* accident, the Coast Guard would never have known that the distress call had been made.

At Group Charleston, transcripts of radio transmissions and telephone conversations recorded around the time of the *Morning Dew* accident revealed a large number of personal telephone calls made by watchstanders, which could conflict with the level of attentiveness with which they should conduct their watchstanding duties. Without a Coast Guard program to routinely review the telephone recordings, any detrimental impact such conversations may have on the watchstanders' attentiveness cannot be addressed and corrected.

Also, without a program to maintain oversight of the full range of communications center activities, the Coast Guard cannot know if its procedures and protocols are effective or if they are even being followed. For example, in a January 1999 accident the Safety Board is investigating involving the fishing vessel *Adriatic*, the operator of the rapidly sinking vessel radioed a mayday that was received by the Coast Guard. Radio watchstanders from three units—Group Atlantic City, Barnegat Light Station, and Station Manasquan Inlet—converged on the airwaves all within the first few seconds, overlapping one another in response to the mayday call. Commandant Instruction M2300.7 (*Radiotelephone Handbook*) states that “all stations hearing a distress call shall immediately cease transmissions capable of interfering with the distress traffic and shall continue to listen on the frequency on which the call was heard.” This procedure was not followed by Group Atlantic City, Barnegat Light Station, and Station Manasquan Inlet.

In that same accident, another Coast Guard unit, Group Philadelphia, made an unscheduled marine information broadcast at the same moment the call outs were initialized. Commandant Instruction M16120.5A³³ states, “Units hearing the distress signal should cease transmitting and listen for at least 3 minutes before resuming communications.” No one knows whether the operator of the *Adriatic* attempted to transmit a second distress call because such a call may have been overridden by the four other units broadcasting over VHF channel 16.

Similarly, events surrounding the accident involving the Coast Guard Auxiliary vessel *Puppet* suggest that the search and rescue response was hampered by confusion wrought by the undisciplined use of VHF-FM channel 16 by participants in a fishing derby.³⁴ In its November 1996 report of this accident, the Safety Board stated:

The Coast Guard made no attempt to minimize inappropriate use of channel 16 on August 21, 1994. Planning for the use of one or more public working frequencies during special events such as the derby could have alleviated the congestion on channel 16, the Coast Guard's distress, safety and calling frequency.

As a result, calls for assistance related to the *Puppet* were suppressed by the sheer volume of radio operators transmitting routine calls over the distress frequency.

³³ Chapter 3. SAR communications, Section 312 (B).

³⁴ For more information, see Marine Accident/Incident Summary Report—*Capsizing of Questar Motorboat and Drowning of Operator South of Shelter Island Near Juneau, Alaska, August 21, 1994*. (NTSB/MAR-96/01/SUM).

In its investigation of the *Rite of Passage*³⁵ accident, the Safety Board learned that the Coast Guard Group Charleston communications watchstander did not follow proper procedures to obtain critical information concerning the physical condition of a boat operator calling to report that his engine would not start. The operator died after apparently falling overboard in violent surf while the Coast Guard was preparing to tow the vessel. Had proper procedures been followed, the Coast Guard might have realized the true seriousness of the situation and would likely have initiated a more timely response and would have reached the operator before his situation became hazardous.

Such instances show that breakdowns in communications and operations center responses to distress situations occur and indicate that improved management oversight of communications and operations center personnel is needed. Such oversight would provide an opportunity for the Coast Guard to prevent or correct mistakes and to improve overall mission performance.

In the view of the Safety Board, recorded transmissions represent an opportunity for the Coast Guard to evaluate watchstander performance and to discern areas where improvements may be needed. Review of tapes need not be of the entire recording in "real time." An effective review program could be instituted by listening to a sampling of recorded broadcasts for each watchstander or by reading a transcription of a sample portion of the tape-recorded transmissions on a regular basis. Just having the knowledge that such sampling is taking place would, in all likelihood, spur watchstanders to improve their performance and their adherence to established procedures.

The Safety Board therefore concludes that watchstander and duty officer performance would be improved by the establishment of a program of effective management oversight that includes a regular review of recorded radio transmissions and telephone conversations at Coast Guard communications centers. Consequently, the Safety Board believes that the Coast Guard should immediately institute procedures to provide improved management oversight of communications and operations center performance, including instituting a program to periodically review the tapes of recorded radio transmissions and telephone calls.

Adequacy of Watchstanding Equipment and Other Resources

The Safety Board's examination revealed that the watchstander's radio equipment was functioning and that he knew how to use it. All radio transmissions and telephone calls were recorded, and the watchstander could have replayed the 0217 distress call to help him discern its contents. Although the Stancil recording system was cumbersome, it was functional, and the watchstander testified that he knew how to use it. (See "Critical Elements of Coast Guard Search and Rescue Communications" below for more detail on watchstander hardware and equipment.)

³⁵ For more information, see Marine Accident Brief Report No. DCA93MM023, "Falling Overboard from U.S. Recreational Boat *Rite of Passage*, Isle of Palms, Near Charleston, South Carolina, on August 4, 1993." Adopted March 25, 1994.

One of the primary resources of the watchstander was the duty officer, who was sleeping nearby. The watchstander could have awakened him and asked his assistance and advice. He said he knew procedures were in place that directed him to awaken the duty officer if he had any question about a transmission he received. He also stated he had no negative pressure or reluctance to awaken the duty officer; he simply did not think it was necessary.

Likewise, the Safety Board determined that the duty officer's response following the 0628 call were not influenced by a lack of manpower or equipment. The duty officer had two telecommunications specialists at his disposal who could have taken some of his workload, made telephone calls, or gotten in touch with the pilot on the *Pearl Ace* to verify or get more information related to the report of the cries from the water. Or, if he had any doubt about the nature of the 0628 message, he could have had one of the watchstanders play back the telephone conversation between the watchstander and the pilot boat dispatcher. Finally, he had at his disposal a boat that he could have launched on his own authority to search the area of the ship channel in the vicinity of buoy 22. The Safety Board therefore concludes that the communications watchstander who received the 0217 transmission and the operations duty officer who received the 0628 telephone call had resources available that, had they been used, could have resulted in a more timely response to the *Morning Dew* accident.

Critical Elements of Coast Guard Search and Rescue Communications

Critical to the Coast Guard's timely search and rescue response to a request for assistance is the effective detection, identification, and evaluation of a radioed call for help and a means of determining the origin of the call. Because distress calls to the Coast Guard may be weak, incomplete, garbled, or barely audible, the Coast Guard's ability to easily locate and replay radio transmissions is crucial. But detection and analysis of a radio signal includes not only knowing what is said but where the call originates. Radio DF systems have traditionally been used to determine the *direction* of a radio call; however, a DF system that includes a suite of DF receivers working together can fix the actual *position* of a call, and such a capability, in the view of the Safety Board, has the potential to save lives.

Recording/Playback Capability

To be effective in the performance of their duties, communications watchstanders must be able to quickly and easily play back recorded transmissions. The emphasis should be on "easily" because the easier the task, the more likely it will be performed.

The Coast Guard has initiated a program to replace the current recorders with new DVLs. While these recorders are more intuitive and user-friendly, they still lack the important capability to rapidly replay the last recorded transmissions. It is noteworthy that the Canadian Coast Guard's recording equipment at Prince Rupert MCTS is capable of replaying the last transmissions received by simply pressing a single button. In the case of the *Morning Dew*, the watchstander stated that he never considered that he might need to

replay the recording of the 0217 call. However, had he analyzed it correctly and had he been able to rapidly replay it, he may have correctly identified it as a distress call.

The Safety Board concludes that the capability to instantly replay radio transmissions could assist radio watchstanders in the performance of their duties and thereby enhance the effectiveness of the Coast Guard's search and rescue efforts. The Safety Board acknowledges the Coast Guard's efforts to upgrade its DVLs to include an instant playback capability. However, the addition is part of an overall upgrade that may take years to complete. In the view of the Safety Board, this capability is too important to delay when equipment that could perform the job is already available. The Safety Board therefore believes that the Coast Guard should take the steps necessary to immediately begin to provide its search and rescue communications centers with the capability for watchstanders to easily and instantly replay the most recent recorded radio transmissions.

Direction-Finding Capability

With the communication system in place at Group Charleston at the time of the *Morning Dew* accident, the watchstander who received the 0217 call could determine only that the call had been received by the Mount Pleasant high-site antenna. Had he properly analyzed the situation, played back the recording of the call, and recognized it as a distress call, he still would have had no information about the location of the vessel, since Group Charleston's DF was minimally functional and, according to reports of watchstanders, was usually turned off. Even had it been turned on, the DF screen was located behind him, and unless he was watching it at the time the call was received, he would have gotten no useful information from it. In any event, the best he could have gotten would have been a single line of bearing of the transmission rather than a position fix of the vessel.

The need for the Coast Guard to have effective DF receivers was also highlighted in the accident involving the *Adriatic*. In this case, the Coast Guard communications watchstanders knew they were dealing with a vessel in distress, but they had no idea of the vessel's identity or location. Even without its identity, if Group Atlantic City had been equipped with a DF system similar to that employed by the Canadian Coast Guard at Prince Rupert, it may have been able to obtain a position fix and could have immediately initiated search and rescue procedures.

According to Coast Guard search and rescue statistics,³⁶ the Coast Guard, in FY 97, spent more than 400,000 hours on search and rescue sorties. Yet, the service reports that 287 lives were lost after the Coast Guard was notified. A DF system that could help pinpoint the location of a distress call could, in the view of the Safety Board, reduce the amount of time needed to locate mariners in distress. And some of this time savings could translate to lives saved. If the Coast Guard had had an effective DF system in FY 97, at least some of the 287 people who died after Coast Guard notification may have been saved. The Safety Board concludes that the Coast Guard's ability to respond effectively to distress calls, and thereby to save lives, would be improved significantly through the

³⁶ "Servicewide Statistics for Fiscal years 1984–1997;" <<http://www.uscg.mil/hq/g-o/g-occ/servicewide.htm>>.

installation of DF systems that provide position fixes for incoming calls and the capability to record, retrieve, and review DF data.

The Safety Board notes that the Coast Guard reports that, in the near term, it is providing funds to its communications centers that are not currently equipped with DF systems for the purchase of such equipment. According to the Coast Guard, however, the expectation is that the purchased equipment will be similar to that now in place at Group Charleston and other communications centers. Because the existing equipment has been shown by the NSWC-CD survey and by testimony of Coast Guard members to be ineffective to the point that it is often not turned on, the Safety Board fails to understand how this program will significantly improve the Coast Guard's search and rescue response capability.

The need to modernize the NDS, including adding state-of-the-art DF capability, is well known and fully appreciated by the Coast Guard; however, the Coast Guard's ongoing efforts to develop a modern distress communications system have not accomplished that goal and will not do so for at least another 5 years. While the Safety Board recognizes that some technologies require further research and development in order to be used effectively in a search and rescue application, DF is one technology that has been available for years and is immediately available to the Coast Guard "off the shelf." DF systems have been used in search and rescue operations internationally by a number of developed countries, including Canada, for at least 7 years. The Safety Board therefore believes that the Coast Guard should immediately begin to equip its search and rescue communications centers with currently available, commercial, off-the-shelf DF systems that provide, at a minimum, the capability to establish a position fix and to record position data for later retrieval and analysis.

Assessment of Group Charleston and Group Mobile Communications System Performance

The NSWC-CD examination of the type and quality of communications equipment and resources available to watchstanders at Group Charleston revealed that the watchstander's radio equipment was adequate and functioning. All radio transmissions and telephone calls were recorded, and the watchstander could have replayed the 0217 distress call to help him discern its contents. Although the Stancil recording system was cumbersome, it was functional, and the watchstander testified that he knew how to use it.

However, the NSWC-CD's evaluation of communications system performance at Group Charleston and Group Mobile found deficiencies in programmed maintenance that would affect the early detection of faults; a lack of frequency management that contributed to signal interference; a lack of condition-based monitoring that would provide continuous remote monitoring of vital equipment; degradation of antenna signal through the existing phone line service; recording/playback equipment of limited capability or user-friendliness; and inaccurate, unreliable, and obsolete DF equipment.

The Safety Board considers it noteworthy that the NSWC-CD found that the same or similar problems existed in the communications systems at Coast Guard group offices

in two widely separated locations. Since the Coast Guard employs the same basic communications infrastructure throughout most of the country, the Safety Board concludes that problems similar to those identified by the NSWCD at Group Charleston and Group Mobile may be present at other Coast Guard groups throughout the Nation. The Safety Board therefore believes that the Coast Guard should conduct a comprehensive review, similar to the one conducted by the NSWCD at Group Charleston and Group Mobile, of the communications infrastructure at all group communications centers and take steps to correct any deficiencies found.

Ergonomic Assessment of Coast Guard Communications Facilities

The Safety Board considers it vitally important to the efficient and effective performance of communications watchstanders that important equipment be conveniently located. If watchstanders have to leave their normal station to perform a task, they are removed from other equipment necessary for the performance of their duties which, in the Board's view, is a disincentive to perform the task.

The NSWCD's ergonomic assessment of Coast Guard communication facilities at Group Charleston and Group Mobile found that the Stancil recording and playback device was not located conveniently to the watchstander. The NSWCD further reported that in the Group Charleston center, the DF equipment was mounted behind the watchstander. Once a modern DF system is installed, it should quickly become something that the watchstander will come to rely on for position data on incoming radio calls. It should be mounted for easy viewing and convenient operation.

All auditory and visual elements should be afforded special consideration in laying out the watchstander's workstation. For example, all equipment that must be viewed during the handling of a call should be located at an appropriate distance and angle for concurrent, effective viewing. Similarly, care should be used in the placement of speakers within the workstation. By separating speakers horizontally, auditory masking of one speaker's transmission by another is minimized, enabling the watchstander to selectively attend to the transmission of interest. Also, horizontal speaker separation enhances the watchstander's ability to identify the source of the transmission, which can aid in differentiating transmissions related to more than one concurrent case. The Safety Board concludes that all the equipment necessary for watchstanders to carry out their responsibilities should be installed in such a way as to facilitate the performance of the work and to minimize the likelihood of errors and omissions.

In order to make the appropriate ergonomic changes at its group communications centers, the Coast Guard needs to conduct a watchstander task/activity analysis to identify the essential task elements. Once these elements are identified, the relationships among the tasks can be determined so that equipment can be placed correctly. In carrying out this analysis, the Coast Guard should consider related activities, such as use of the restroom or the coffeemaker, during a normal watch routine. This information should be used, in conjunction with appropriate techniques such as operational sequence diagramming or link analysis,³⁷ in arranging components within the watchstander workstation so as to facilitate the performance of all job functions.

The Safety Board believes that the Coast Guard should review the ergonomic adequacy of equipment layouts in Coast Guard group communications centers and make changes as necessary to ensure that equipment critical to the proper performance of the watchstanders' duties is placed in the optimum ergonomic arrangement.

Operational Readiness

The overall effectiveness of the Coast Guard's search and rescue mission is largely a function of the readiness of its operations and communications centers. These centers are the primary links between mariners in distress and people who have the assets and the skills to render assistance. If those links are weak, the effectiveness of the overall search and rescue effort may be compromised. Evidence gathered during the Safety Board's examination of the *Morning Dew* and other accidents indicates that operational readiness at some Coast Guard communications centers may have become substandard.

For example, the operations duty officer who did not respond to a report of cries for help from the water in the *Morning Dew* accident was an experienced watchstander with more than 17 years of Coast Guard experience and 3 years as a watchstander at Group Charleston. Yet, he did not launch available resources. The fact that he had received a report of cries for help and had been given a specific location in which to search and yet took no action suggests that his level of readiness was below what it should have been.

A similar failure to respond appropriately to clear evidence of a potential distress situation occurred in the Oswego, New York, boating accident in which the Coast Guard received specific information regarding a capsized vessel and its location, but the person in charge opted to do nothing.

At Group Charleston, transcripts of radio transmissions and telephone conversations recorded around the time of the *Morning Dew* accident revealed a large number of personal telephone calls made by watchstanders, which could conflict with the level of attentiveness with which they should conduct their watchstanding duties.

In both the *Morning Dew* and Oswego cases, the responsiveness and overall performance of operations center personnel would appear to fall below what would have been expected by higher levels of Coast Guard management. Yet, unless the Coast Guard carries out ongoing oversight and evaluation of its land-based commands, groups, and units, degradations in the readiness of those units can occur gradually over a long period of time and remain hidden until brought to light by a tragedy such as the sinking of the *Morning Dew*.

³⁷ Link analysis and operational sequence diagramming are analytical techniques used in optimizing the location and relationships among functional components within a work space. For more information, see Laughery, K.R., Sr. and Laughery, K.R., Jr., "Analytic Techniques for Function Analysis," in G. Salvendy [Ed.], *Handbook of Human Factors*, Wiley-Interscience (1987); and "Physical Space and Arrangement," in Sanders, M.S. and McCormick, E.J., *Human Factors in Engineering and Design* (Sixth Edition), McGraw-Hill (1987).

The *Morning Dew* investigation revealed that the Coast Guard has no program or requirement for periodic inspections to measure the proficiency of its subordinate districts, groups, or other land-based units. For many military organizations, productivity and operational readiness are continuously measured at the command level through periodic inspections of subordinate command elements, including conducting unannounced exercises designed to measure the unit's readiness for its assigned tasks. Such exercises typically include both the knowledge and expertise of the command's personnel. The possibility of being subjected to an operational readiness inspection provides the incentive for subordinate commands and their personnel to remain current and proficient and to sustain a high level of performance.

The Safety Board concludes that the operational readiness of Coast Guard communications centers could be improved and gradual degradations in performance prevented by a program of periodic operational readiness inspections. The Safety Board therefore believes that the Coast Guard should institute a system of periodic operational readiness inspections for its subordinate land-based search and rescue communications commands, groups, and units as a means of evaluating and improving the search and rescue communications efforts at those activities.

Investigation Coordination and the Incident Command System

Throughout the response to the *Morning Dew* accident, the SCDNR, the coroner, and local agencies participated in an ICS that allowed them to manage their personnel and resources and to control their communications. The fact that the Coast Guard did not participate in this system resulted, in several instances, in a lack of coordination between the Coast Guard and local agencies.

For example, both the coroner and the Coast Guard needed information from the families of the deceased. The Coast Guard needed to know how many people had been on the vessel, and the coroner needed to establish their identities. Had the Coast Guard participated in the ICS, Coast Guard representatives would have been aware of the coroner's procedures, and the notification process would have been much better coordinated.

In another instance, the SCDNR investigator-in-charge arrived on scene and was told that the Coast Guard had already requested that a commercial salvor send divers to identify the name on the sailboat. The SCDNR investigator-in-charge, wanting to preserve any evidence in case of a criminal investigation, had to tell the divers not to disturb any of the evidence. The preservation of evidence should have been discussed before divers were deployed.

It is true that a Coast Guard representative was in telephone contact with an SCDNR representative and Sullivan's Island police officers during different phases of the response; however, the absence of a representative at the command post where decisions were being made resulted in the Coast Guard representative's not being able to efficiently track the progress being made in the joint investigation or to answer any questions.

Moreover, by not being privy to the evolving investigation, he was not able to provide information known to the Coast Guard that may have facilitated the SCDNR investigation.

The problems in coordination that arose during this accident could have been avoided if the Coast Guard, the SCDNR, and local responders had been using a system that allowed them to manage a joint search and rescue operation. The ICS allows different agencies with different operating procedures to work together in one system to accomplish a common goal. The ICS also reduces the duplication of effort and the burden that can be placed on people involved in an accident investigation who must obtain similar information from different agencies. As noted earlier, in this accident, both the SCDNR and the Coast Guard needed information from the families of the deceased. Both agencies had standard operating procedures for obtaining the information. By working together and sharing information within the ICS structure, decisions could have been made initially about how to obtain the information without compromising the other agency's procedures. Furthermore, if the Coast Guard search and rescue personnel and the SCDNR and local agencies had participated in joint drills that used the ICS, Coast Guard personnel would have known about the other agencies' procedures and the SCDNR's desire to preserve evidence and may have contacted the SCDNR before having divers attempt to identify the sunken vessel. Also, information needed by other agencies, such as the SCDNR, could have been disseminated within the ICS before being given to the press. In this case, the SCDNR learned about information vital to the investigation from press releases issued by the Coast Guard.

The Safety Board concludes that the postaccident activities of the Coast Guard were not well coordinated with the activities of the other emergency responders because the Coast Guard did not participate in the ICS that was established in response to the accident. The Coast Guard's postaccident implementation of an ICS training program should help search and rescue personnel understand the structure and benefits of the ICS in responding to an accident. But in the view of the Safety Board, such training should be augmented by drills that allow all participating agencies to identify and correct any problems before the need arises to respond to an actual incident. The Safety Board therefore believes that the Coast Guard should implement a program whereby Coast Guard emergency response personnel participate in drills with local agencies within their area of responsibility in order to exercise their role in the incident command structure and gain experience in using the ICS.

Release of Information by the Coast Guard

The SCDNR was not given immediate access to information the Coast Guard had that was vital to the SCDNR's investigation. This information included the report of the witness who saw the *Morning Dew* leaving Winyah Bay and the fact that Group Charleston had received two calls that were determined to have been distress calls from or involving the *Morning Dew*. Notwithstanding the fact that this information was critical in determining the time and nature of the accident, the SCDNR only acquired it from accounts in the local newspapers or from second-hand reports from the family of the deceased operator months after the accident.

Coast Guard officials were aware as early as the evening of December 29 that a mayday call had been received between 0200 and 0230 that same day; yet no one outside the Coast Guard was told about it for more than 2 1/2 months, and then only after a FOIA request from the press made almost inevitable the eventual release of the tape recording of the call.

On December 30, an investigator from the SCDNR saw a newspaper and learned for the first time about the report from the *Pearl Ace* about voices from the water. The investigator called Group Charleston to inquire about this report. He specifically asked the group operations officer if any distress calls had been received in the hours preceding the accident. The carefully worded response led the SCDNR representative to believe the answer was no. The group operations officer's actual answer was that the watchstander had not "perceived" any mayday calls. But this answer, while perhaps technically accurate, was clearly, if not intentionally, misleading. The Coast Guard was well aware that, whether or not the watchstander had recognized it as such at the time, a mayday call had been received at 0217.

The SCDNR was prosecuting a death investigation as the responsible South Carolina marine law enforcement agency. As such, the agency had a right to all pertinent search and rescue information and should have been provided such information as soon as it became available. The information concerning the distress call and the timing of the call was crucial and had to be factored into the SCDNR investigation to determine the time of the accident and the time of death.

The SCDNR was also the South Carolina agency responsible for investigating recreational boating accidents under the State recreational boating safety laws. Since the Coast Guard does not investigate recreational boating accidents and the Safety Board rarely conducts such investigations, an SCDNR investigation would usually be expected to be the only safety investigation an accident such as this one would receive. It is therefore crucial to the interests of boating safety that organizations such as the SCDNR have access to all pertinent search and rescue information so that they can accurately assess safety lessons that might help prevent similar accidents in the future.

Asked about withholding information about the 0217 call, Coast Guard officials at every level of command, from Group Charleston to the Commandant's staff at Coast Guard Headquarters, cited their understanding that Coast Guard policy prohibits releasing information that is subject to an internal Coast Guard administrative investigation until the investigation is complete. But no written policy of withholding information existed. Furthermore, the Coast Guard official who responded to the SCDNR investigator's inquiry about a possible distress call did not tell the investigator that an ongoing investigation prevented him from releasing information pertinent to the accident. Had he done so, the investigator could have pursued the matter with higher levels of Coast Guard management, and the policy, or lack of such a policy, would have been clarified, and the information would probably have been released. Instead, the Coast Guard officer provided an answer that essentially shut off one avenue of the investigation. The answer may also have been seen to help the Coast Guard avoid embarrassment.

The Safety Board concludes that the Coast Guard erred in not immediately providing all pertinent search and rescue information about the *Morning Dew* accident to the SCDNR, and the failure to provide the information hampered the department's investigation of the accident.

In ALDIST 041/99, the Coast Guard provides guidance to Coast Guard field units for disseminating search and rescue information, whether or not an administrative investigation is ongoing. ALDIST 041/99 shifts authority for release of the information down the chain of command to the search and rescue controller (operations duty officer level) and mandates that search and rescue information be provided to State and local agencies in the absence of some overriding reason to withhold it.

Any decision at the controller level to withhold search and rescue information must have the concurrence of the district staff; thus, at least on the surface, the ALDIST appears to display a bias in favor of disseminating search and rescue information. The ALDIST does not, however, specify the nature of the "overriding reason" that would be considered sufficient to support the withholding of the information. Therefore, the Safety Board concludes that the new Coast Guard guidance regarding the release of search and rescue information, because it does not specify and limit the conditions under which such information can be withheld, leaves open the possibility that pertinent information can still be inappropriately withheld from duly authorized agencies or individuals.

Furthermore, an ALDIST is only temporary guidance, effective either for a limited time or until it is made a part of a standing instruction. Because, according to the chief of the Office of Search and Rescue, the issue of releasing information is still under study by the Coast Guard, the final disposition of the issue and resulting policy statement may be markedly different from the ALDIST. The Safety Board sees no justification for withholding from bona fide local, State, and Federal investigative agencies any facts about the Coast Guard's search and rescue activities that would be relevant to an accident or an accident investigation. The Safety Board therefore believes that the Coast Guard should institute a permanent policy of promptly sharing pertinent search and rescue information with properly constituted local, State, and Federal investigative agencies so long as the release of such information does not compromise the ability of the Coast Guard to perform its search and rescue mission.

Boating Safety Coordination

As documented elsewhere in this report, the investigation of the *Morning Dew* accident revealed, in several instances, inadequate coordination or misunderstandings between the Coast Guard and the SCDNR as they carried out their respective responsibilities in the wake of the accident. This lack of coordination occurred despite the existence of an MOU between the State of South Carolina and the Coast Guard that spelled out the duties and jurisdictions of each party in the event of a recreational boating accident. The commanding officer of Group Charleston stated that he was unaware of the MOU, even though it had been in place since 1984. Had he had knowledge of the

agreement and its provisions, the coordination between the Coast Guard and the SCDNR in the aftermath of this accident may have been significantly improved.

Two issues concern the Safety Board in regard to the agreements now in place between the Coast Guard and the States. First, with both State and Federal government boating safety programs responding to shifting responsibilities and sometimes erratic funding, the circumstances under which a particular MOU or statement of agreement was prepared can change. These changes need to be reflected in revised agreements. Second, turnover of personnel in State agencies, as well as in the Coast Guard, can lead to a situation such as that occurring in the *Morning Dew* accident in which a responsible Coast Guard individual was not aware that an agreement existed.

The Safety Board notes that at least some of the Coast Guard's agreements with the States delegating boating safety responsibilities have been updated since they were originally signed. The Safety Board further notes that the MOU the Coast Guard signed with the State of South Carolina was reviewed in 1994. However, in the 5 years since the update, personnel changes have undoubtedly occurred both in State agencies and in the Coast Guard, and relevant telephone numbers, points of contact, and agency responsibilities may also have changed. Such changes can quickly render agreements out of date, making them less effective in promoting the degree of cooperation and coordination envisioned when the agreements were originally prepared. And although ALDIST 041/99 directs district commanders to review existing agreements or MOUs for currency, the guidance does not provide a time frame for the completion of the reviews, nor does it provide for follow-up periodic review and updating, which is necessary to ensure that the agreements are kept current.

The Safety Board concludes that in order to ensure effective coordination and cooperation between the Coast Guard and the States in boating accident cases, the agreements between the Coast Guard and the States that govern such cases must be jointly revised or updated on a regular basis to keep them current and to keep the appropriate personnel aware of their contents.

The Safety Board is concerned that the Coast Guard's agreements with some other States are likely out of date and not well coordinated between the Coast Guard and State agencies with whom Coast Guard personnel must interact. The Safety Board therefore believes that the Coast Guard should, within 6 months and at least biennially thereafter, review and revise, as necessary, all boating safety agreements between the Coast Guard and the States to ensure that those agreements (1) are coordinated between local Coast Guard authorities and the appropriate agencies within the States and (2) accurately reflect current responsibilities and jurisdictions in such areas as boating casualty accident investigation and reporting, search and rescue, and related boating safety issues.

To assist the Coast Guard in its efforts, the Safety Board believes that the States should work with the Coast Guard to review and revise their joint boating safety agreements.

As shown by this accident, both the States and the Coast Guard may benefit by updating the agreements to address such issues as Coast Guard support for State boating safety procedures, responsibilities regarding the preservation of the accident scene, Coast Guard participation in the ICS, and coordination of notification of kin.

By coordinating the agreements with local Coast Guard authorities and State agencies, the Coast Guard will ensure that the individuals who will be responsible for implementing the provisions of the updated agreements are aware of those provisions. And by performing the review on at least a biennial basis, personnel turnover and changes that affect either the State or the Coast Guard can be accommodated in a timely fashion. Even if the review determines that no changes to an existing agreement are needed, the review process itself will be of value because it will bring together the individuals who may be called upon to work together in future incidents involving boating safety.

Postaccident Drug and Alcohol Testing

The Coast Guard watchstander and duty officer were asked during comprehensive interviews whether they smoked, drank alcohol, or used illegal drugs. The Safety Board found no reason to suspect that drugs or alcohol might have been involved in the accident. However, the effects of alcohol and drugs could not be positively ruled out because the two men were not toxicologically tested.

In the view of the Safety Board, toxicological tests for alcohol and drugs were indicated in this case. The Safety Board did not become involved in the *Morning Dew* investigation until 4 months after the accident. At that point, it would have been useless for the Safety Board to have required alcohol and drug testing of the people involved in the accident. However, the commanding officer of Group Charleston knew within a day of the accident that at least one of his watchstanders was involved in the accident. He could have ordered the person involved to submit to an alcohol and drug test at that time; however, no Coast Guard guidance or directive required a toxicological test in cases not involving a Coast Guard accident (mishap) investigation.

The Board has previously addressed the need for toxicological testing of Coast Guard personnel who are directly involved in the circumstances leading up to an accident. Coast Guard regulations require toxicological testing of its personnel during a mishap investigation when their actions can be causally linked to the accident. In the case of the *Morning Dew* accident, however, the Coast Guard never convened a mishap investigation; instead, it conducted a single-officer administrative investigation.

The Safety Board concludes that the Coast Guard's procedures for the testing of its personnel for drugs and alcohol are inadequate in that they do not in all cases provide for the testing of personnel whose work performance may be linked to an accident. In the view of the Safety Board, involved personnel should be tested whether or not the Coast Guard decides to convene a mishap investigation. Since the determination of a possible causal link may well have to be made at the local level, such as was the case in the *Morning Dew* accident, procedures should be established to provide local commanders

and unit safety officers with the necessary guidance to accomplish such testing. The Safety Board therefore believes that the Coast Guard should establish procedures for toxicological testing for alcohol and drugs of Coast Guard personnel in group and unit operations and communications centers whose work performance may be linked to an accident.

Findings

Conclusions

1. Neither the material condition of the vessel's hull, the hull design, the mechanical condition of the main engine, or the fuel and fuel system contributed to or caused the accident.
2. Neither the operator nor the three passengers were under the influence of drugs at the time of the accident. None of the passengers were under the influence of alcohol, and the postmortem evaluation and toxicology findings on the operator were consistent with postmortem alcohol production.
3. Neither the Coast Guard watchstander nor the operations duty officer was suffering from fatigue during the postaccident period.
4. The master and boatswain of the *Pearl Ace* and the Charleston Harbor pilot and pilot dispatcher acted appropriately under the circumstances to provide a timely report to the Coast Guard of cries being heard from the water.
5. The operator of the *Palmetto State* did what was within his power by way of conducting a search for possible victims of a marine distress situation, and his actions, though unsuccessful, were timely and appropriate.
6. The route of the Intracoastal Waterway (ICW) through Winyah Bay is marked on the ICW charts and navigation aids such that any boater who properly uses them should recognize and be able to follow the ICW routing through the bay.
7. Although the Safety Board could not determine whether the operator of the *Morning Dew* departed from the Intracoastal Waterway deliberately or by mistake, he at some point made a conscious decision to take the vessel to sea.
8. Neither the *Morning Dew*, its operator, nor its passengers were adequately prepared or equipped for a trip into the open ocean, and the ocean voyage should not have been attempted.
9. After about 13 hours under way, with 9 of those hours at sea, the *Morning Dew* operator was probably severely fatigued and hypothermic to such a degree that his judgment and ability to keep track of his position may have been severely impaired.
10. The operator and all three passengers aboard the *Morning Dew* probably survived the allision with the north jetty.

11. If the watchstander had properly analyzed the circumstances surrounding the 0217 distress call from the *Morning Dew*, such as his listening position, the time of day, and the weather, he might have decided to replay the recording of the radio transmission, which would have enabled him to determine the true nature of the call.
12. The cries for help reported by the boatswain of the *Pearl Ace* most likely came from one or more of the occupants of the *Morning Dew*.
13. The operations duty officer at Group Charleston disregarded clear indications of a marine distress situation when he took no action in response to the report of cries for help being heard from the water.
14. The communications watchstander who received the 0217 transmission and the operations duty officer who received the 0628 telephone call had resources available that, had they been used, could have resulted in a more timely response to the *Morning Dew* accident.
15. The Coast Guard's search efforts were appropriate, even though the search was not initiated in a timely manner.
16. If Coast Guard search and rescue personnel were made aware of all the circumstances of this accident, they may have a heightened awareness of the full range of elements that contribute to a successful search and rescue effort.
17. The dissemination of information about the circumstances surrounding this accident will help dissuade other boaters from taking such unnecessary risks and may thereby prevent a similar tragedy in the future.
18. The postaccident activities of the Coast Guard were not well coordinated with the activities of the other emergency responders because the Coast Guard did not participate in the incident command system that was established in response to the accident.
19. The Coast Guard erred in not immediately providing all pertinent search and rescue information about the *Morning Dew* accident to the South Carolina Department of Natural Resources, and the failure to provide the information hampered the department's investigation of the accident.
20. The new Coast Guard guidance regarding the release of search and rescue information, because it does not specify and limit the conditions under which such information can be withheld, leaves open the possibility that pertinent information can still be inappropriately withheld from duly authorized agencies or individuals.
21. In order to ensure effective coordination and cooperation between the Coast Guard and the States in boating accident cases, the agreements between the Coast Guard and the States that govern such cases must be jointly revised or updated on a regular basis to keep them current and to keep the appropriate personnel aware of their contents.

22. Measures to improve safety and performance at Coast Guard communications centers must look beyond staffing allocations for an effective solution and must include systematic consideration of watchstanders' task, shift length, and shift rotation.
23. The Coast Guard search and rescue communications effort would benefit if novice radio watchstanders were provided with ample opportunity to practice what they are taught during their formal schooling and on-the-job training and to demonstrate their knowledge or proficiency at regular intervals until they reach the journeyman level.
24. Specialized training designed to enhance analytical and decision-making skills could better prepare Coast Guard watchstanders to make appropriate judgments about matters affecting public safety.
25. Watchstander and duty officer performance would be improved by the establishment of a program of effective management oversight that includes a regular review of recorded radio transmissions and telephone conversations at Coast Guard communications centers.
26. The operational readiness of Coast Guard communications centers could be improved and gradual degradations in performance prevented by a program of periodic operational readiness inspections.
27. The capability to instantly replay radio transmissions could assist radio watchstanders in the performance of their duties and thereby enhance the effectiveness of the Coast Guard's search and rescue efforts.
28. The Coast Guard's ability to respond effectively to distress calls, and thereby to save lives, would be improved significantly through the installation of direction-finding (DF) systems that provide position fixes for incoming calls and the capability to record, retrieve, and review DF data.
29. All the equipment necessary for watchstanders to carry out their responsibilities should be installed in such a way as to facilitate the performance of the work and to minimize the likelihood of errors and omissions.
30. Problems similar to those identified by the Naval Surface Warfare Center, Carderock Division, at Group Charleston and Group Mobile may be present at other Coast Guard Groups throughout the Nation.
31. The Coast Guard's procedures for the testing of its personnel for drugs and alcohol are inadequate in that they do not in all cases provide for the testing of personnel whose work performance may be linked to an accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the sinking of the recreational sailing vessel *Morning Dew* was the operator's failure to adequately assess, prepare for, and respond to the known risks of the journey into the open ocean that culminated in the vessel's allision with the jetty at the entrance to Charleston Harbor. Contributing to the loss of life in this accident was the substandard performance of U.S. Coast Guard Group Charleston in initiating a search and rescue response to the accident.

Recommendations

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

to the U.S. Coast Guard:

For all your operations and communications center watchstanders, develop and implement a course or training program designed to develop or enhance those individuals' judgment and decision-making skills. (M-99-2)

Improve your telecommunications specialist qualification program, in concert with the telecommunications school and the guidance in the *Group and Stations Communications Watchstander Qualification Guide*, to provide for increasing levels of watchstanding responsibility under the direct supervision of experienced mentors and to allow for full telecommunications specialist certification only after candidate watchstanders have passed comprehensive proficiency tests that demonstrate their skills. (M-99-3)

Immediately institute procedures to provide improved management oversight of the performance of all your communications and operations centers, including instituting a program to periodically review the tapes of recorded radio transmissions and telephone calls. (M-99-4)

Institute a system of periodic operational readiness inspections for all your subordinate land-based search and rescue communications commands, groups, and units as a means of evaluating and improving the search and rescue communications effort at those activities. (M-99-5)

Institute a permanent policy of promptly sharing pertinent search and rescue information with properly constituted local, State, and Federal investigative agencies so long as the release of such information does not compromise the ability of the Coast Guard to perform its search and rescue mission. (M-99-6)

Take the steps necessary to immediately begin to provide all Coast Guard search and rescue communications centers with the capability for watchstanders to easily and instantly replay the most recent recorded radio transmissions. (M-99-7)

Immediately begin to equip all your search and rescue communications centers with currently available, commercial, off-the-shelf direction-finding systems that provide, at a minimum, the capability to establish a position fix and to record position data for later retrieval and analysis. (M-99-8)

Review the ergonomic adequacy of equipment layouts in all Coast Guard group communications centers and make changes as necessary to ensure that equipment critical to the proper performance of the watchstanders' duties is placed in the optimum ergonomic arrangement. (M-99-9)

Conduct a comprehensive review, similar to the one conducted by the Naval Surface Warfare Center, Carderock Division, at Group Charleston and group Mobile, of the communications infrastructure at all group communications centers and take immediate steps to correct any deficiencies found. (M-99-10)

Ensure that the workload and staffing analysis for which you have contracted with the Center for Naval Analysis fully incorporates existing human performance research on vigilance, attention, and fatigue in the determination of shift length, shift rotation, and staffing levels at all Coast Guard search and rescue communications centers. (M-99-11)

Implement a program whereby Coast Guard emergency response personnel participate in drills with local agencies within their area of responsibility in order to exercise their role in the incident command structure and gain experience in using the incident command system. (M-99-12)

Within 6 months, and at least biennially thereafter, review and revise, as necessary, all boating safety agreements between the Coast Guard and the States to ensure that those agreements (1) are coordinated between local Coast Guard authorities and the appropriate agencies within the States and (2) accurately reflect current responsibilities and jurisdictions in such areas as boating casualty accident investigation and reporting, search and rescue, and related boating safety issues. (M-99-13)

Disseminate the National Transportation Safety Board's report on the *Morning Dew* accident to all your group operations and communications center personnel as a way of informing them of the circumstances of the accident and the lessons to be learned from it. (M-99-14)

Establish procedures for toxicological testing for alcohol and drugs of Coast Guard personnel in group and unit operations and communications centers whose work performance may be linked to an accident. (M-99-15)

Review the navigation aids marking the route of the Intracoastal Waterway (ICW) at Winyah Bay and make any changes necessary to reduce the likelihood that southbound recreational boaters intending to follow the ICW will inadvertently depart that waterway and follow the main shipping channel toward the open ocean. (M-99-16)

to the Governors of the 50 States and the U.S. Territories:

Within 6 months, and at least biennially thereafter, work with the Coast Guard to review and revise, as necessary, all boating safety agreements between your State and the Coast Guard to ensure that those agreements accurately reflect current responsibilities and jurisdictions of each entity in such areas as boating casualty accident investigation and reporting, search and rescue, and related boating safety issues. (M-99-17)

to the National Association of State Boating Law Administrators: (M-99-18)**to the U.S. Coast Guard Auxiliary: (M-99-19)****to the U.S. Power Squadrons: (M-99-20)****to the National Safe Boating Council: (M-99-21)****to the Boat Owners Association of the United States: (M-99-22)**

Use, in your recreational boating education programs, the circumstances and lessons learned from the accident involving the sailing vessel *Morning Dew* as a means of educating boaters about the relationship of good judgment and decision-making to boating safety.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: October 5, 1999

Acronyms and Abbreviations

ALDIST	a message to all Coast Guard districts
CNA	Center for Naval Analysis
COMDTINST	commandant instruction to Coast Guard personnel
COTS/GOTS	commercial/government-off-the-shelf
DF	direction finding
DSC	digital selective calling
DVL	digital voice logger
EPIRB	emergency position indicating radio beacon
FOIA	Freedom of Information Act
GPS	global positioning system
ICS	incident command system
ICW	Intracoastal Waterway
MCTS	marine communications and traffic services
NDRSMP	national distress and response system modernization project
NDS	national distress system
NSWC-CD	Naval Surface Warfare Center, Carderock Division
PFD	personal flotation device
SAR	search and rescue
SCDNR	South Carolina Department of Natural Resources
UMIB	urgent marine information broadcast