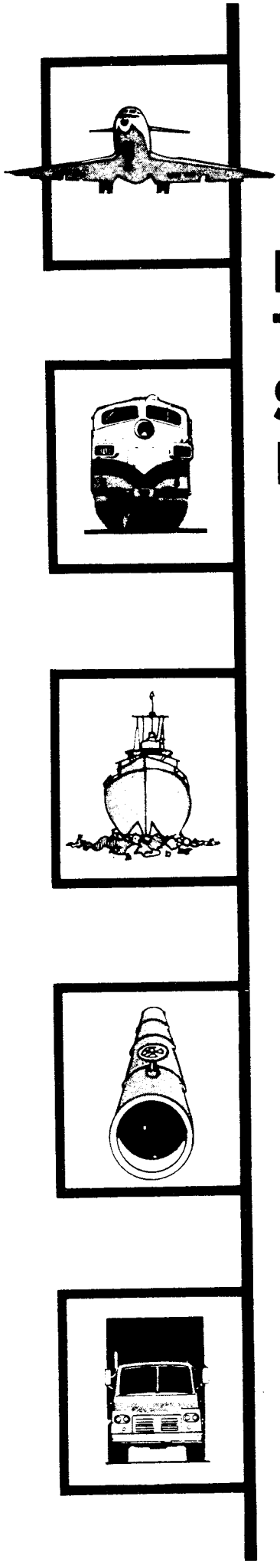

PB87-916401

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

CAPSIZING AND SINKING OF THE U. S. SAILING VESSEL PRIDE OF BALTIMORE IN THE ATLANTIC OCEAN MAY 14, 1986

NTSB/MAR-87/01

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB/MAR-87/1	2. Government Accession No. PB87-916401	3. Recipient's Catalog No.
4. Title and Subtitle Marine Accident Report—Capsizing and Sinking of the U.S. Sailing Vessel PRIDE OF BALTIMORE in the Atlantic Ocean, May 14, 1986		5. Report Date January 21, 1987 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Accident Investigation Washington, D.C. 20594		10. Work Unit No. 4533 11. Contract or Grant No.
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20594		13. Type of Report and Period Covered Marine Accident Report May 14, 1986 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

On May 14, 1986, the U.S. sailing vessel PRIDE OF BALTIMORE capsized and sank in the Atlantic Ocean, about 250 nmi north of Puerto Rico while en route from St. John, U.S. Virgin Islands, to the Chesapeake Bay. The vessel, a replica of a Baltimore clipper, was returning to Baltimore, Maryland, after an extended European good will tour promoting the port of Baltimore. The vessel encountered a sudden gust of wind that heeled it over on its port side. Eight of the twelve crewmembers survived after drifting for over four days in a liferaft.

The National Transportation Safety Board determines that the probable cause of the capsizing and sinking of the PRIDE OF BALTIMORE was the sudden onset of high velocity wind that exceeded the limits of the vessel's stability causing the vessel to heel until downflooding occurred. Contributing to the extensive downflooding was the lack of watertight bulkheads in the hull. Contributing to the loss of life was the inability of the crew to retrieve life preservers from their stowage below deck and the malfunction of the vessel's liferafts.

17. Key Words	18. Distribution Statement
liferafts; life preservers; microburst; sailing vessel; uninspected vessel; EPIRB; navigation equipment; radio communications; weather forecasts; swimming; capsizing; knockdown; topping-off valves; liferaft servicing; safety harness; sailing vessel design	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	64	

NTSB Form 1765.2 (Rev. 9/74)

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EXECUTIVE SUMMARY

On May 14, 1986, the U.S. sailing vessel PRIDE OF BALTIMORE capsized and sank in the Atlantic Ocean, about 250 nmi north of Puerto Rico while en route from St. John, U.S. Virgin Islands, to the Chesapeake Bay, Maryland. The vessel, a replica of a Baltimore clipper, was returning to Baltimore, Maryland, after an extended European good will tour promoting the port of Baltimore.

The PRIDE OF BALTIMORE left St. John about 1100 on May 11, 1986, and after clearing the harbor, set sails and proceeded out to sea. After experiencing some calm periods during the first night, the wind filled in during the nights of May 12 and 13 and by the morning of May 14, the wind had increased to about 25 to 28 knots. The sails were shortened accordingly and all hands, except for the cook, were on deck coiling lines, clearing away gear, and securing all but two of the sails.

Shortly after noon, a sudden gust of wind struck the PRIDE OF BALTIMORE heeling it to port until it was on its beam end with the masts and sails lying on the water. Crewmembers were thrown into the water and the cook managed to escape from below. Two inflatable liferafts deployed but did not remain inflated. One raft was damaged by the ship's rigging while the second raft deflated through the open topping-off valves. The PRIDE OF BALTIMORE, valued at $1,080,000, flooded and sank in a matter of minutes.

After about 6 hours, the eight surviving crewmembers managed to inflate one of the six-man liferafts by mouth. After drifting for over 4 days, the survivors were rescued on May 19, 1986, by the crew of the M/V TORO, a Norwegian tanker, who notified the Coast Guard of the accident.

The safety issue in this accident investigation dealt with the operation of historic sailing vessels where authenticity seemed to be the guiding factor in the design. Other safety issues taken into consideration include:

1. Survivability of replicas of historic sailing vessels.
2. Enhanced safety measures aboard uninspected vessels.
3. Adequacy of inflatable liferaft servicing.
4. Stowage of life preservers and Emergency Position Indicating Radio Beacons (EPIRB).
5. Weather forecasts.
6. Communications schedule.
7. Future design of historic vessels.

Recommendations concerning these issues were made to the U.S. Coast Guard, to the manufacturer of the liferafts carried aboard the PRIDE OF BALTIMORE, to the Society of Professional Sailing Ship Masters, to the Pride of Baltimore, Inc., and to the National Weather Service.

The National Transportation Safety Board determines that the probable cause of the capsizing and sinking of the PRIDE OF BALTIMORE was the sudden onset of high velocity wind that exceeded the limits of the vessel's stability causing the vessel to heel until downflooding occurred. Contributing to the extensive downflooding was the lack of watertight bulkheads in the hull. Contributing to the loss of life was the inability of the crew to retrieve life preservers from their stowage below deck and the malfunction of the vessel's liferafts.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

Adopted: January 21, 1987

CAPSIZING AND SINKING OF THE U.S. SAILING VESSEL PRIDE OF BALTIMORE IN THE ATLANTIC OCEAN, MAY 14, 1986

INTRODUCTION

This accident was investigated jointly by the National Transportation Safety Board and the U.S. Coast Guard. Public hearings were held in Baltimore, Maryland, from May 22 to May 30, 1986. This report is based on the factual information developed by the investigation and analyses made by the Safety Board. The Safety Board has considered all the facts that are pertinent to the Safety Board's statutory responsibility to determine the cause or probable cause of the accident and to make safety recommendations. The Safety Board's analyses and recommendations are made independently of the Coast Guard.

INVESTIGATION

The Accident

On May 11, 1986, the PRIDE OF BALTIMORE (PRIDE) a topsail schooner, built as a replica of an 1800 Baltimore Clipper ship (see figure 1) departed St. John, U.S. Virgin Islands, bound for the Chesapeake Bay, Maryland. The vessel was on the last leg of a transatlantic voyage that started in Malaga, Spain. The PRIDE with its crew of 12, departed the anchorage at St. John about 1100 1/ and motored clear of the harbor. The departure was delayed due to rain squalls which had frequented the area throughout the morning. As the vessel cleared the anchorage and headed for sea, the anchors and a rigid hulled inflatable rescue boat (RHINO) 2/ were lashed securely on deck. By the time the PRIDE had cleared St. John, the sails were set and the engine shut down. At that time, the foretopsail and four lower sails (jib, staysail, foresail, and mainsail) were set. (See figure 2.) A course was set for the Chesapeake Bay entrance in an easterly breeze which gave the PRIDE a speed of about 8 knots.

Sea watches were set for the crew and they settled down to a normal "at sea" routine. Of the 12 persons aboard, only the master and the cook did not stand a watch. The master was always on duty and was subject to call at any time of the day or night. The cook worked to a schedule that provided three meals daily for all hands. The remaining 10 crewmembers were divided into three watches. The first mate's watch consisted of the first mate, the carpenter, and two deckhands while the other two watches had three persons each. The engineer was on the second mate's watch with a deckhand and the bos'n had two deckhands on her watch. During sail handling exercises when all hands were called out, the master usually took the helm.

1/ All times herein are eastern daylight time based on a 24-hour clock.
2/ The inflatable boat mentioned herein was called RHINO by the crew.

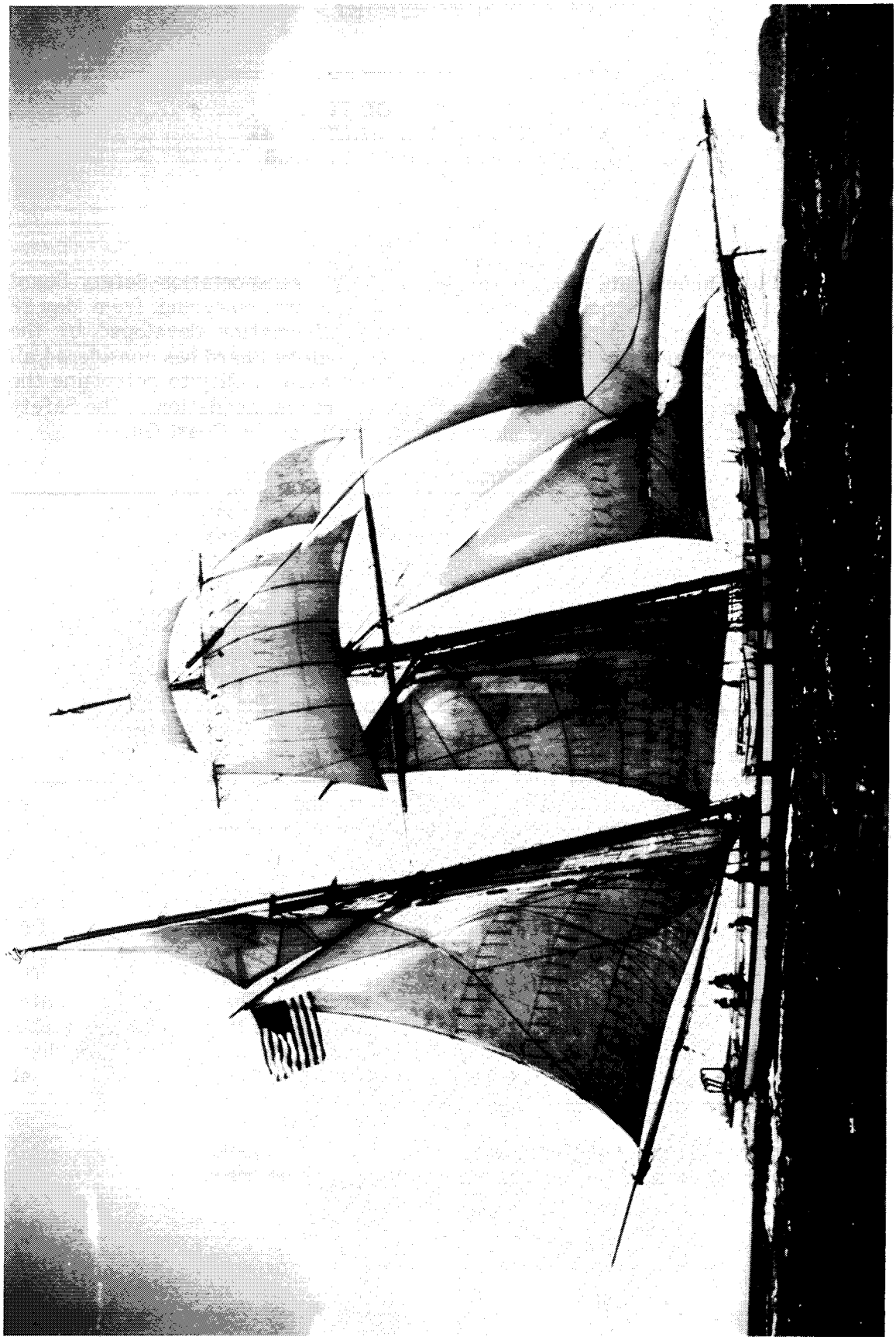


Figure 1.—PRIDE OF BALTIMORE
(Photographed by a crewmember on May 7, 1986.)

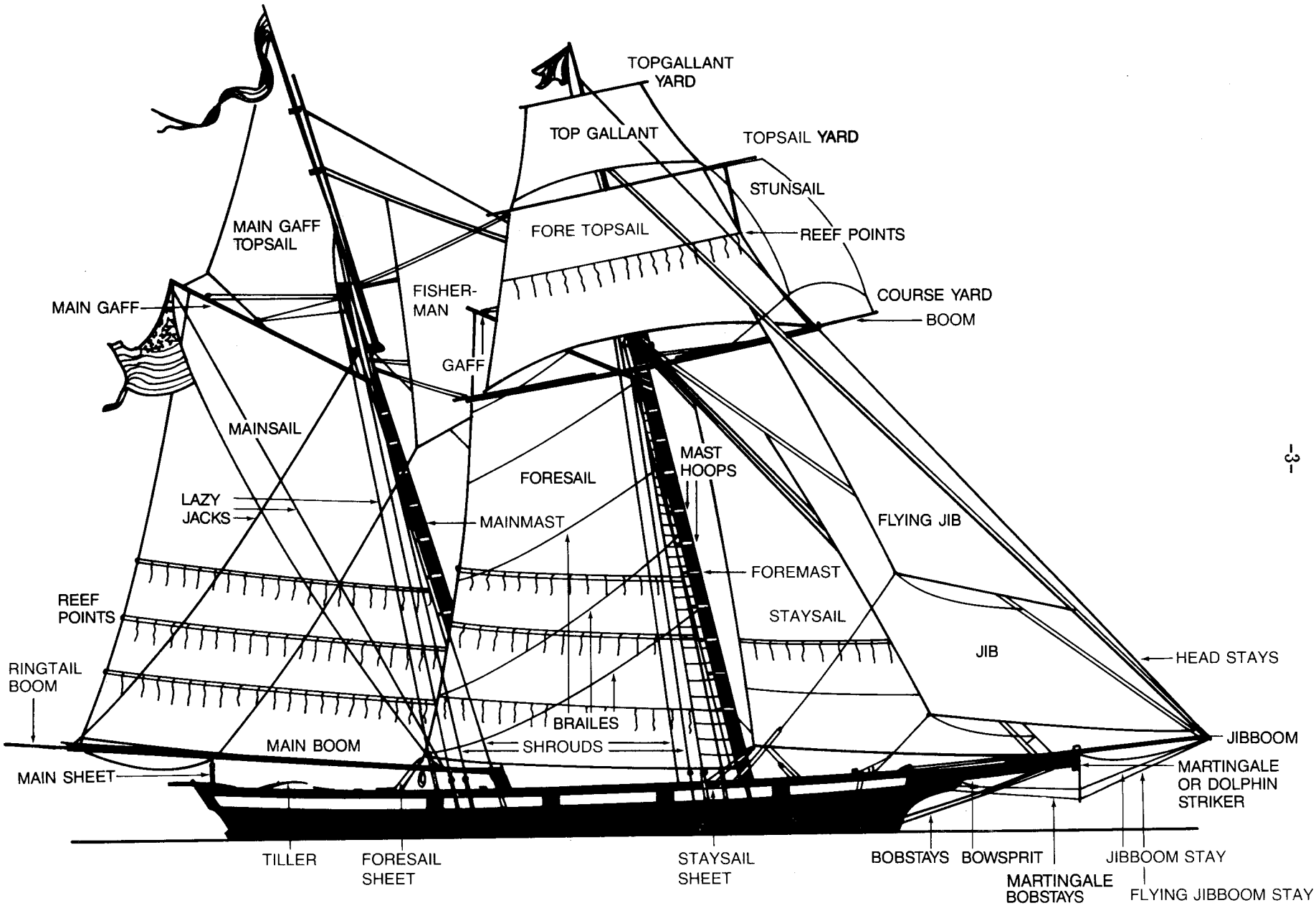


Figure 2.—Sail plan of the PRIDE OF BALTIMORE.

The master's log indicated that sails carried aloft were usually set during daylight hours and struck at nightfall to avoid sending crewmembers into the rigging at night. The watch officer as well as the master kept a wary eye on the weather so that sail changes could be made quickly. It was the master's responsibility to order sail changes and to authorize the use of the auxiliary engine when necessary.

The wind held throughout the day and into the evening. Early the following morning, on May 12, the wind went light and the topsail was struck. 3/ The engine was started and the PRIDE motor-sailed for the remainder of the day at a speed of approximately 4 knots. There was just enough wind to keep the vessel from rolling excessively. The ship's officers were concerned that with the slatting 4/ of the sails, there would be a lot of chafing of the gear, a constant problem on sailing vessels. Sometime during the daylight hours of May 13, when the winds were exceptionally light, the master dropped the sails, stopped the vessel, and allowed the crew to have a swim period. Toward the end of the day, the wind started to increase gradually and by 1900, the PRIDE was making 6.7 knots with the engine throttled back.

By 2300 the wind had freshened, and the master called out all hands and ordered a double reef 5/ put in the mainsail. The master relieved the helmsman while the crew worked the sails. With the increased wind and sea, each crewmember wore a safety harness while tending the sails. The safety harness' tether was clipped onto a safety line that was rigged fore and aft on each side of the vessel. The task of reefing the main was completed about 0030 on May 14, and the off-watch crewmembers went below. The first mate and his three watch partners remained on deck. The crewmembers described the PRIDE as sailing "comfortably." Occasionally, a sea would come over the bow so the bow lookout, instead of standing watch forward, was kept aft near the steering station with two persons keeping watch--one on the starboard side and one on the port side.

The course steered was 350° by the PRIDE's magnetic compass. The rhumb line 6/ course between St. John and the Chesapeake Bay entrance was 332° true (342° magnetic); the wind was east by north (079°). According to witness testimony the vessel was sailing on the starboard tack 7/ with the apparent wind slightly abaft the starboard beam and heeled to port with the deck edge almost even with the water. Frequently, the sea would come through the port side freeing ports, keeping the deck wet along the bulwarks. A heavy hinged hatch to the fo'c'sle (forecastle) was normally propped open a few inches for ventilation.

At 0300, when the next watch came on deck, the wind had eased off somewhat to about force 5. 8/ By 0600, however, the wind increased once again to about force 6 (strong breeze, 22 to 27 knots) with 4 1/2 foot seas. The watch officer (the bos'n) called the master to come up on deck and look at the situation. The watch officer testified:

> I didn't feel we were over-canvased at all, it's just [that] we were catching an odd wave every once in awhile that would get a lot of water on the leeward side, and I was. . . I wasn't all that uncomfortable about it, but it was something I thought that I needed to let him [the master] know was happening.

3/ To lower a sail.
4/ Whipping or thrashing of sails when there is insufficient wind to keep them filled.
5/ To shorten or reduce the area of a sail by lowering it sufficiently so one or more of the reef points can be lashed to the foot (lower edge) of the sail.
6/ A straight line on a mercator chart crossing all meridians at the same angle.
7/ Sailing with the wind on the starboard side.
8/ Beaufort scale numeral indicating a fresh breeze, 17 to 21 knots.

They concluded that shortening sail at that time would have reduced the vessel's speed where it "would have wallowed in them [the seas] instead of kept [sic] moving with them." The main hatch was secured with battens and wedges, and the fo'c'sle hatch was closed but was not lashed. Only the companionway hatch on the port side of the main cabin trunk (see figure 3) was open, although the master did put in two "washboards" 9/ to keep any excess water on deck from splashing into the cabin below.

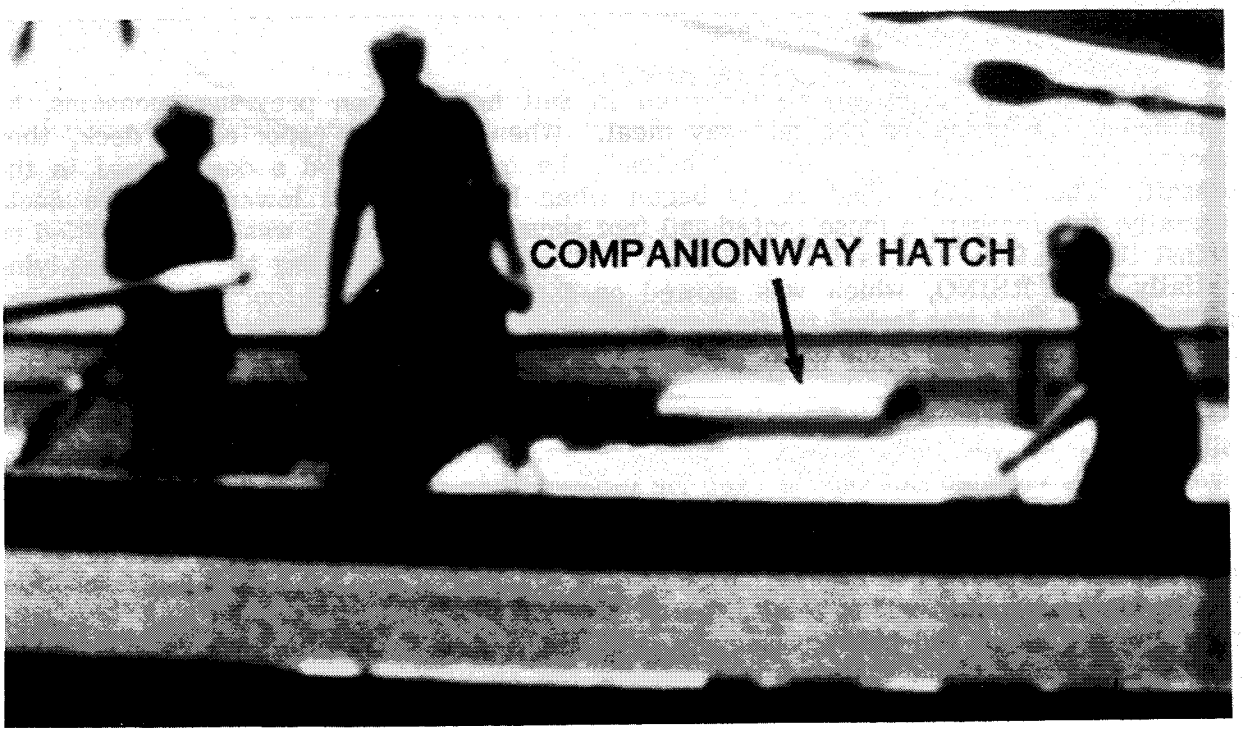


Figure 3.—Companionway hatch in main cabin trunk.

The regular watch routine included a "boat check." This entailed the helmsman after one hour at the tiller to go below deck, to make a log entry, and to conduct an internal inspection of the vessel. Weather forecasts were received twice daily and recorded in a weather log by a crewmember on watch; however, on the morning of May 14, the master copied the 0600 weather forecast. The watch routine also included pumping the bilges hourly using a manual pump, although they also could have been pumped with the engine-driven pump (Lister). At the beginning of the watch (0300-0700) on this date, the bilges were pumped every half hour while near the middle of the watch, they were pumped every 15 minutes. On the final boat check of her watch, the watch officer noticed an excessive amount of leakage forward and ordered the bilges pumped every 5 minutes to keep the bilge level especially low to enable the water forward to run aft faster. A deckhand stated that at no time during his watch (0300-0700) did he notice water above the keelson 10/ in the engineroom.

At 0700, when the second mate assumed the watch, he estimated the wind was about 25 to 30 knots with 6-foot seas. The PRIDE was making about 8 knots. The master had left orders earlier to steer off the particularly big waves.

9/ Hatchboards.
10/ An internal longitudinal structural strength member located in the bottom of the hull at the centerline.

Between 1030 and 1100, the master came up on deck to assess the weather and the manner in which the vessel was sailing. Admonishing the second mate and other crewmembers for not wearing safety harnesses, the master ordered them to clip the tether onto the safety line while on deck. After observing the weather for a period of time, at 1130 the master ordered all hands on deck to shorten sail and he relieved the helmsman. The watch officer estimated the winds to be between east-northeast and northeast by east (067 1/2° - 056 1/4°) at approximately 25 to 30 knots with east northeasterly seas averaging about 6 feet. The vessel was on a beam reach 11/ while continuing on a compass heading of 350°.

Although the cook had participated in sail handling on previous occasions, he remained below preparing the mid-day meal. When all hands reported on deck, they expected to strike the jib first, but instead, the master ordered a double reef in the foresail. The procedure had barely begun when he ordered it lowered to the deck. Normally, the foresail, a loose footed sail (not secured to a boom), was brailed (pulled up against the mast and the gaff) (see figure 2). The foresail, including the gaff, was lying partially over RHINO, which was stowed on top of IRIE, a 14-foot Chesapeake Bay crabbing skiff that was lashed to the port side of the main hatch. The remainder of the sail fell onto the leeward side of the deck.

After the foresail was lashed down and before the brailes 12/ and the sheets were coiled, the crew went forward and struck the jib. Since the jib must be hauled down, several hands crawled out on the head rig (bowsprit) to gather the sail as it came down while the other hands manned the halyard, sheet, and downhaul. Stops or lashings were put in to prevent the sail from being caught by the wind. After getting the jib under control, it was triced up to the head stay. 13/ The master steered the PRIDE off the wind to a heading of about 320° to lessen the chance of the vessel pitching into the sea while the crew was out on the jibboom (see figure 2) securing the sail. He also had one of the deckhands ease out the mainsheet to reduce the amount of weather helm 14/ on the vessel.

Meanwhile, the deckhands were clearing the deck of the lines from the foresail. The engineer had gone below to use the Lister engine to pump the bilges. Returning from below deck, the engineer watched the bilge discharge to determine when they were pumped dry. After they were pumped dry, he went below, shut off the pump, and returned on deck.

After tricing up the jib, the first mate went aft to confer with the master who was still at the helm. The PRIDE was now sailing with only the staysail and a double reefed mainsail. The master and the first mate were satisfied that they had reduced sail sufficiently for the current weather conditions. The first mate, estimating that it was shortly before noon, had noticed several rain squalls off the starboard quarter.

11/ Sailing with the apparent wind on the vessel's beam.
12/ A number of horizontal lines made fast to the leech or after end of a fore and aft sail and led to the mast or gaff. Used to gather the sail and secure it to the mast or gaff.
13/ The jib was rolled in a tube-like fashion and lashed to the head stay to prevent it from catching sea water as the vessel pitched. Sea water trapped in a sail can add unwanted weight forward.
14/ A sailing vessel with a fore and aft rig may tend to round up (turn) towards the wind. To correct this tendency, the tiller is moved to windward, thus the term weather helm. To correct excessive weather helm, the mainsail is eased to better balance the sails.

After conferring with the master, the first mate went below to check the vessel's speed and position. Shortly after noontime, when he returned on deck, the master asked him to standby the mainsheet. While the first mate was preparing to ease the mainsheet, it became evident to him that they were about to be hit by "somewhat of a squall." As the wind increased, the master shouted to the crew to clip their tethers on the safety line and to hold on. He told the first mate to ease out the mainsheet. The first mate shouted for someone to start easing out the staysail sheet. The mainsheet was eased out until the main boom hit the water. The master "had the helm all the way up [the tiller to windward] to drive the boat off the wind some more." A deckhand unclipped his tether and ran forward to tend the staysail sheet. A deckhand later testified:

> At that time, the winds just went from the 30 knots that we had been sailing under to God knows what, 70 and above I've been told, but I couldn't judge. Looking back aft, I could see horizontally-blown spray coming up off the top of the waves, and I could see the wind—actually, the wind hit the sail, and at that time the boat just started to slowly roll. . .roll over on her side. It wasn't a fast motion, it wasn't a. . .a rapid motion, it was just a slow heeling over.

The deckhand who had attempted to get to the staysail sheet stated:

> I . . . went forward to get to the staysail sheet. At that point the vessel is heeling over so much that you couldn't see the. . . the sheet leads to a cleat on the deck; you couldn't see the cleat. . . . I remember. . . taking a breath and putting my whole head down trying to get down onto the deck and feeling for the sheet and with one hand holding onto the. . .to the boat.
>
> I felt the vessel go over on her side. . . . I saw light and swam up to the surface. . . . It was a bit of a swim to the top. . .to get to the surface. When I surfaced. . . the ship was definitely on her side and the next thing that happened to me was the foremast hit the surface of the water in front of my eyes.

The PRIDE flooded through the open companionway hatch. It rolled over to port in less than a minute in a slow easy fashion and never recovered. As the vessel sank, it righted itself so that the masts were upright as they disappeared beneath the surface. The survivors made various estimates which ranged from less than 1 minute to as much as 5 minutes on the length of time it had taken the vessel to flood and sink. About 1230 on May 14, 1986, the PRIDE OF BALTIMORE disappeared from sight in an approximate position of 23° north latitude and 67° west longitude (see figure 4).

Injuries to Persons

Injuries	Total
Fatal	4
Nonfatal	1
None	7
Total	12

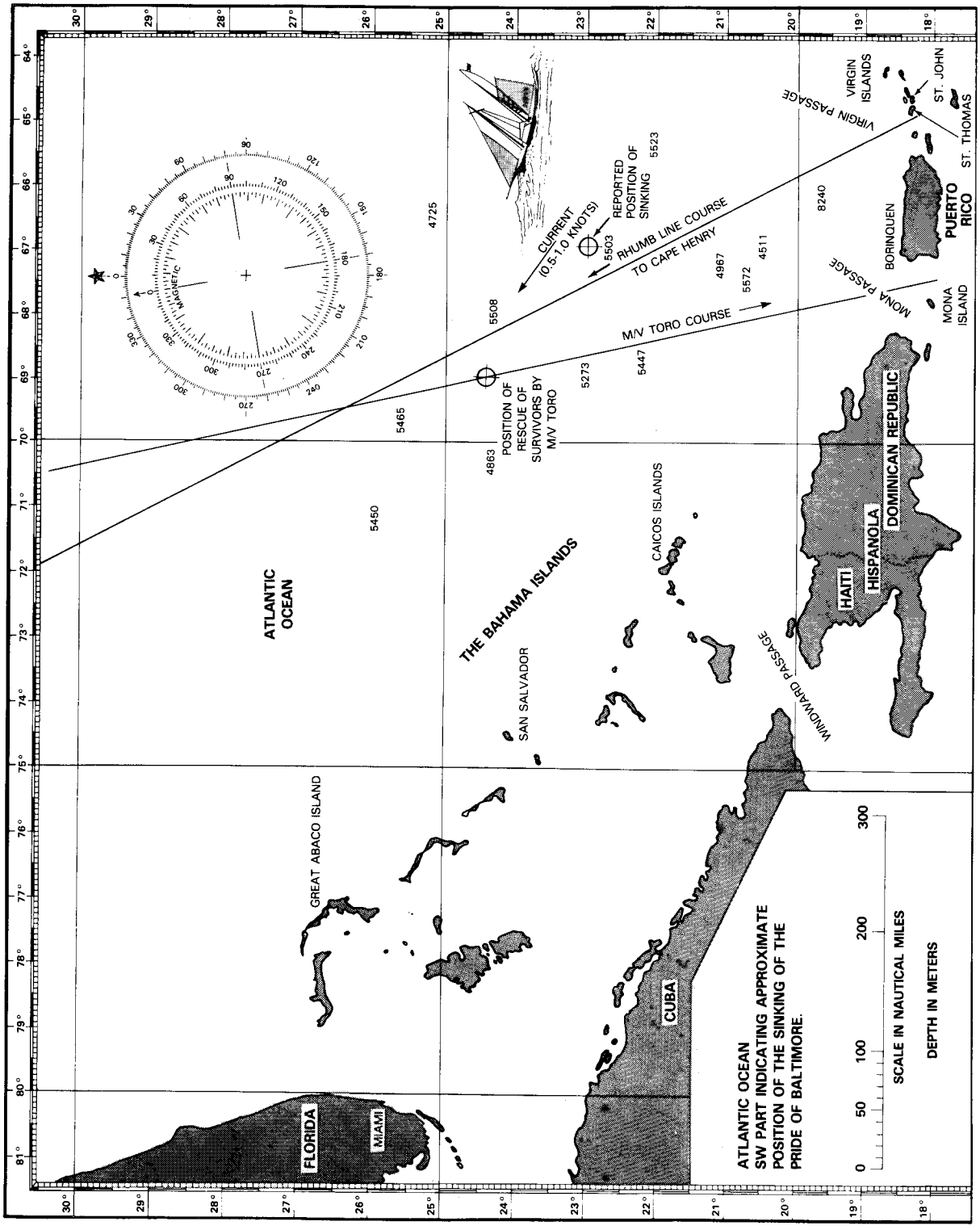
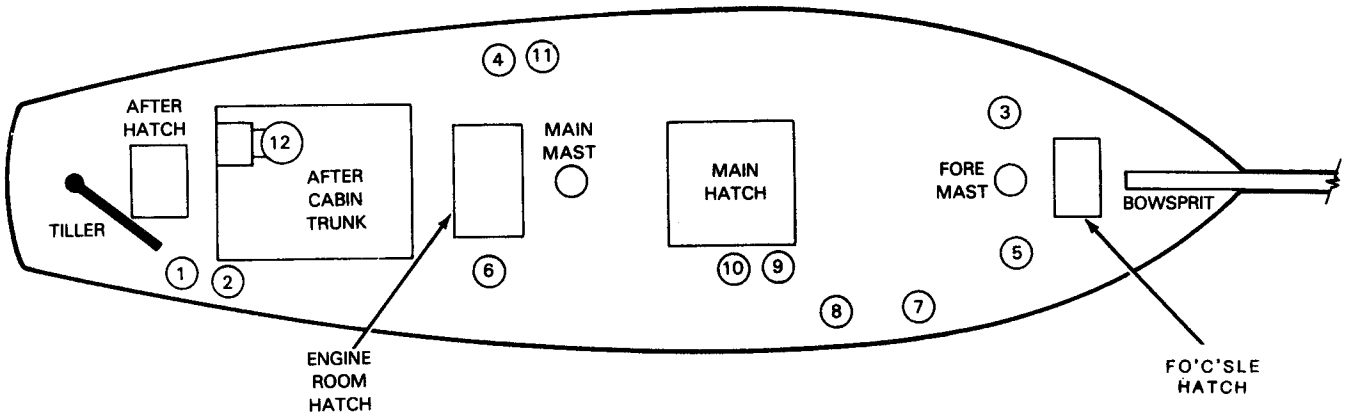


Figure 4.—Chart of the Atlantic Ocean showing the approximate position of the sinking of the vessel and the position of the rescue.

Survival Aspects

Immediately prior to the knockdown 11 of 12 crewmembers were on deck. Four deckhands were on the starboard side between the mainmast and the foremast; the second mate was on the port side near the foremast; the carpenter was on the starboard side near the foremast; a deckhand and the bos'n were on the port side near the engineroom hatch; the engineer was on the starboard side of the engineroom hatch; the cook was below deck in the aft cabin near the companionway ladder; and the first mate was at the stern with the master, who was steering the vessel. (See figure 5.)



LEGEND

1 – MASTER(MISSING)	5 – CARPENTER (MISSING)	9 – DECKHAND (MISSING)
2 – FIRST MATE	6 – ENGINEER (MISSING)	10 – DECKHAND
3 – SECOND MATE	7 – DECKHAND	11 – DECKHAND
4 – BOS'N	8 – DECKHAND	12 – COOK

Figure 5.—Location of crewmembers at the time of knockdown.

The crew on deck were thrown into the water, most still tethered to the vessel. The safety harnesses only were equipped with a hook on the tether end, not at the harness end. In order to unhook, it was necessary to go to the tether end. Realizing this, the second mate cut his tether with a knife and cut two or three more tethers of the crewmembers around him. The cook was still below and, after several attempts, swam out of the companionway hatch in the main cabin trunk. (The hatch, located to port of the vessel's centerline, was under water.) The first mate, who had been easing off the mainsheet when the vessel heeled over, shouted to the crewmembers in the water to go aft to the liferafts. Since he was close to the liferafts which were stowed under the tiller, the first mate attempted to dive under the water to locate the hydrostatic releases to the rafts. The bos'n was able to pull the fabric cover off the rafts to expose the liferaft cannisters. By then, the tiller was swinging uncontrollably and prevented the first mate from releasing the two liferafts manually; however, the hydrostatic releases functioned properly and the liferaft canisters floated to the surface.

The master, meanwhile, had remained at the helm until he also was thrown into the water. He shouted to the other persons, "Get the liferafts." The first mate swam over to one of the liferaft cannisters and pulled on the attached line until the cannister opened and the raft inflated automatically. He recalled that several crewmembers climbed into the raft as it was being blown about by the high winds. The other raft also inflated automatically after it reached the limit of the line that attached it to the ship.

As the ship sank, several of the crewmembers swam to the rafts and some began boarding them, but they soon discovered that both rafts were deflating. The first mate testified that after he climbed into the liferaft, it drifted through the PRIDE's rigging and was damaged. He believed that the raft caught on a sharp object which tore the fabric of an air chamber causing it to deflate. The second mate, meanwhile, had grabbed the line to the second liferaft and waited for it to self-inflate. He testified that the raft became fully inflated and then slowly deflated. The topping-off valves were not seated in their valve openings in the rafts. Instead, they were hanging loose from the lanyards that secured each of the plugs to the raft adjacent to the valve opening. The rafts subsequently deflated completely and were unusable as liferafts and were only functional as flotation devices. The crew had to remain in the water clinging to the deflated rafts to remain afloat.

As the crew gathered around the deflated rafts, they observed survival equipment that had been packed with the rafts or stowed in IRIE floating around them in the water. Several crewmembers retrieved some of these loose items for later use. The following equipment was salvaged:

Number	Item
1	5-gallon container of water
7	10 2/3 ounce cans of water
3	parachute flares
2	flashlights
1	first aid kit
1	package containing 20 biscuits of concentrated food
1	hand inflation pump
2	plastic buckets
1	boat hook

One deckhand stated, ". . . we were looking for the hand pump to pump up the rafts, and I found the bag of food [biscuits]; I thought it was the pump and cut it out of the life raft, held onto that for a couple [of] hours." A signalling mirror provided with the emergency equipment may have been lost at this time.

The master was last seen swimming back toward the area where the PRIDE sank; he did not respond to the crew's calls to come to the liferafts. One deckhand also saw the engineer swimming and holding a female deckhand. About 30 minutes later, this same female deckhand was seen floating face down in the water and was pulled over to the liferafts and then let go when it was determined she was dead. No one saw the master or engineer again. Shortly after, the carpenter was seen floating on his back. The first mate managed to swim to him and pull him to the rafts. The carpenter was described as very cold; his lips were blue and his stomach distended. With the assistance of other crewmembers, the carpenter was kept afloat for approximately 1 1/2 to 2 hours before he died.

After the knockdown the wind continued to blow between 70 to 90 mph with visibility only about 50 feet in the spray. These conditions lasted about 15 to 30 minutes. The wind moderated to about 35 knots and seas were 4 to 6 feet. Occasionally 8- to 10-foot waves would drive all the survivors under water. To keep the deflated liferafts afloat and useful as a buoyant device, they were turned upside down and buckets of air were forced under the water into the canopy area.

As the weather and sea conditions improved, the survivors attempted to inflate one of the two liferafts using the accordion-style hand pump which they connected, as designed, to the topping-off valves. 15/ Because both hands were required to operate the pump, it was physically impossible to hold onto the raft (to remain afloat) and use the pump at the same time. An earlier attempt to inflate one raft by mouth using the topping-off valve openings was unsuccessful because that raft had been damaged and holed. Inflation of the other raft by mouth was ultimately successful, and the eight survivors were able to enter it after approximately 5 1/2 hours in the sea. The damaged raft was secured to the "good" raft with the expectation that it could also be inflated and used to carry half of the survivors. About three days after the sinking, however, the damaged raft broke away. Although an attempt was made to retrieve the raft, it could not be pulled back. When the raft broke away one plastic bucket and the 5-gallon water container also were lost.

About an hour before the survivors entered the raft, a jet aircraft was sighted and a parachute flare was fired, but it did not attract the attention of anyone in the airplane. After the first night in the raft the survivors developed a watch schedule and a water and food rationing plan. Each person assumed the watch for 2 hours. The watch routine required that person to stand up and scan the horizon every 15 minutes during daylight hours and every 30 minutes at night. Each person was given about a 1/2 cup of water and 1/4 of a biscuit a day. Some rainwater was collected off the canopy to supplement the water supply.

The liferaft was designed for six persons and provided about 24 square feet of space for the eight survivors. They reported that the stability of the raft in its partially inflated condition was not very good and any movement about the raft had to be planned and carried out carefully. In addition, each time a watchstander had to stand up to scan the horizon or move in the area of any topping-off valve plug, someone had to place their hand over the plug to prevent it from inadvertently being knocked out of the valve and deflating the liferaft.

The first morning after the accident, the survivors sighted a cruise ship. When it was about 2 miles away, they fired two parachute flares but to no avail. By the early evening of May 18, four more ships had been sighted. The survivors waved a yellow foul weather jacket by day and signaled by flashlight at night. Neither signal was seen by anyone aboard the ships.

At 0140 on May 19, two watchstanders on the bridge of the 680-foot long Norwegian motor tankship TORO, sighted a flashing light forward of their starboard beam. They thought it was a vessel flashing its navigation lights to advise vessels of their location. The watch officer attempted to contact the vessel (liferaft) by radio and megaphone but received no answer. He then noted that the sequence of the flashing had changed to an SOS 16/ pattern. About this time, the master of the TORO, who had been unable to sleep, arrived on the bridge. After discussing the situation with the watchstanders, the master

15/ Inflation/deflation valves located in the air chambers of inflatable liferafts.
16/ Distress signal in Morse code.

gave the order to steer towards the flashing light which was about 2 miles away. When the master determined that the light was coming from a liferaft, he stopped his vessel and ordered the TORO's rescue boat launched. After the eight survivors were taken aboard the rescue boat, the liferaft was slashed and allowed to sink. By 0300, the eight survivors were safely aboard the TORO and the rescue boat was hoisted back aboard. The TORO got underway again headed for Amuay Bay, Venezuela, via the Mona Passage. 17/ The position of the rescue was latitude 24°26'06" N and longitude 69°01'07" W, about 370 miles north-northwest of Puerto Rico. (See figure 4.)

Search and Evacuation

At 0330 May 19, the TORO sent a message to the Coast Guard in New York notifying them of the rescue and the loss of the PRIDE OF BALTIMORE on May 14. At 0914 on May 19, the first of four Coast Guard aircraft was on scene and searching for the missing crewmembers. The search continued for 5 days and used a Coast Guard cutter and a total of 24 aircraft from the Coast Guard, Navy, Marine Corps, and Air Force. The search effort encompassed 61,800 square miles of ocean; a total of 77 cutter hours and 164 aircraft hours were used. An Air Force photographic reconnaissance aircraft also covered 120,000 square miles of ocean to supplement the air/sea search. There were numerous debris sightings and objects recovered by the Coast Guard cutter but none that could be positively identified as having been aboard the PRIDE. The search was terminated during the evening of May 23.

On May 19, the Coast Guard determined that the survivors on the TORO should be evacuated for medical reasons. The most appropriate place for the transfer would be in the Mona Passage. At 0648 on May 20, the TORO was about 5 miles east of Mona Island. At that time two helicopters from the Coast Guard Air Station Borinquen, located at the northwest corner of Puerto Rico, each airlifted two survivors of the PRIDE. At 0800, the two helicopters returned to the TORO and airlifted two additional survivors while the press photographed the operation from the second helicopter. After refueling, the helicopters returned and airlifted the remaining survivors of the PRIDE. The next day the survivors were flown by private aircraft to Baltimore, Maryland.

Vessel Information and History

The PRIDE was built in Baltimore, Maryland, in 1977, on a half-acre site in the Inner Harbor. Its design characteristics were:

Characteristics	Dimensions
Length on deck	89 feet 9 inches
Length overall	137 feet
Beam	23 feet
Maximum designated draft	9 feet 9 inches
Displacement	121.2 long tons
Total sail area	9,523 square feet

17/ A 61-mile wide passage between Puerto Rico and Hispanola, an entrance to the Caribbean Sea.

The PRIDE was known as a Baltimore Clipper. Its original lines were taken from several sources, foremost of which were the British Archive records and a book 18/written by a French engineer in the early part of the 19th century. The builder of the PRIDE first became involved with the project as president of the International Historical Watercraft Society, Inc. In keeping with the revitalization of Baltimore's Inner Harbor, he proposed to the city of Baltimore, that the vessel be constructed on the edge of the Inner Harbor in full view of the public. He engaged a naval architect, who was an authority on historic sailing vessels, to design a typical Baltimore Clipper ship, not as a replica of any particular vessel, but as a design unto itself. The vessel was to be an authentic image of how the many vessels of its class were built in Baltimore after the American Revolution. In 1975, the Baltimore City Council appropriated funds to build the ship and after the drawings were approved, construction was started in May 1976.

A portion of the Inner Harbor waterfront was set aside and construction began, similar to the method used during the 1800's. The various woods used in the hull were brought in from different parts of the world; metal fastenings were wrought iron and forged on the site by a blacksmith. The ship took 10 months to construct, and on February 27, 1977, the PRIDE OF BALTIMORE was launched into Baltimore harbor. After it was rigged and outfitted the PRIDE was commissioned on May 1, 1977, by the Mayor of Baltimore and sailed on its maiden voyage for Bermuda the same day.

The PRIDE functioned as a goodwill ambassador to promote the city of Baltimore. Its voyages took it to many ports along the east coast of the U.S., Canada, the Great Lakes, the Gulf Coast, and the Pacific Coast as far north as Vancouver, British Columbia. After its many promotional successes around the U.S. and Canada, the PRIDE sailed across the North Atlantic Ocean in 1985 and called on many ports in northern Europe from the Baltic Sea to Spain. Following a winter layup in Malaga, Spain, a voyage was planned through the Mediterranean Sea in 1986 but was cancelled due to the terrorist activities in the area at the time. Instead, the PRIDE was ordered back to Baltimore in sufficient time to participate in the tall ships parade scheduled for the July 4 Liberty Weekend in New York. It was during the final ocean leg of this return trip that the PRIDE sank.

Construction.--The PRIDE was a two-masted topsail schooner that carried five lower working sails and could rig an additional six sails (see figure 2), which included the fore topsail, top gallant, stunsail, fisherman, main topsail, and the ringtail. (Figure 1 shows the PRIDE with each of these sails set except for the fisherman and ringtail.)

The masts and spars were made from Douglas fir. The standing rigging consisted of steel-core hemp-covered rope shrouds set up with deadeyes and lanyards while the stays were galvanized steel wire rope, wormed, parceled and served, and preserved with pine tar. 19/ The blocks were made of rope-stropped ash. The running rigging (sheets, halyards, brailes, and braces) were manila rope while other cordage was either Dacron or manila. The builder stated that he had to use modern materials in the rigging of the vessel because the original type of hemp used in the early designs was not available.

18/ Memoire sur les Bateaux a Vapeur des Etats-Uis, M. Marestier, 1822.
19/ Covering and preserving steel cable to inhibit corrosion.

The hull was built of tropical hardwoods with double-sawn frames of Santa Maria 20/ locked in place over the lignum vitae 21/ keel (from a tree estimated to be over 1,200 years old). The keelson, made of bulletwood, 22/ was then laid over the frame ends and the entire assembly was held together with wrought-iron bolts. The 2 1/4 inch pine planking, similar to long leaf Georgia pine, was laid over the frames to complete the hull.

There were no watertight bulkheads within the hull to maintain its authenticity as a historic vessel. The designer of the PRIDE testified that water flooding through an open hatch on a continuous basis could extend throughout the hull and sink the vessel. He stated that the early Baltimore clippers were generally built by boatmen with little or no technical education.

The PRIDE's sails were made of various weights of cotton duck or flax. The lower three working sails, the mainsail, foresail, and staysail, were heavy cotton duck; the jib and the foretopsail were made of flat woven flax sailcloth. The remaining sails (uppers) were made of lighter weight cotton. While the vessel was in Malaga preparing for the voyage home, a new jib made of duradon, a synthetic canvas material, was substituted for the older jib. It was lighter and, therefore, easier to work and reduced the strain on the jibboom.

The PRIDE had two decks—the main or weather deck and the lower deck. The lower deck was divided into five compartments by athwartship non-watertight bulkheads. The compartments from forward to aft were the forepeak, main hold, engineroom and storage space, after cabin, and lazarette. There were 10 built-in berths in the main hold; 2 upper and 2 lower berths on the port side and 3 upper and 3 lower berths on the starboard side. Also in the main hold was the galley with a diesel oil range on the port side aft. The engineroom space occupied the port and center area and in the starboard area was the toilet, single side-band radio, weather facsimile receiver, and food stores. The berths for the master and the first mate were in the after cabin. Electronic navigation equipment was also located in this space. (See figure 6 on pages 16 and 17.) There were five hatches on deck from forward to aft as follows: fo'c'sle hatch, main hatch, engineroom hatch, companionway hatch, and the after hatch. The companionway hatch was to port of the centerline of the vessel and the other four hatches were aligned with the centerline.

Between the lower deck and the hull under the engineroom were two 150-gallon and one 75-gallon diesel fuel tanks. There was also a 200-gallon water tank located under the dining table in the main hold. Below the main hold there was about 40 to 43 tons of ballast consisting of 15 tons of lead blocks, covered by 15 tons of epoxy impregnated iron blocks, which in turn were covered by about 10 to 13 tons of Belgian granite blocks. On deck between the main mast and the engineroom hatch, two 55-gallon drums of diesel oil were secured. Three 45-gallon casks of fresh water were stowed in racks between the engineroom hatch and the aft cabin hatch.

Mechanical propulsion, when needed, was provided by an 85-horsepower Caterpillar diesel engine, model 3304. Electrical power was provided by a generator driven by the main engine, by the Lister auxiliary diesel-generator, or by batteries. There were three bilge pumps installed on board: a manual deck pump, a pump which operated off of the main engine, and a pump operated by the Lister engine. The bilge pump on the Lister engine could also be operated as a fire pump. In addition to these pumps there was a 300-gallon per minute portable gasoline driven pump.

20/ A hardwood, similar in weight to white oak.
21/ A dense non-buoyant hardwood.
22/ A dark-grey hardwood of great density.

The rudder was controlled manually from aft by a 7-foot long tiller. When necessary the helmsman used quarter tackle (block and tackle) 23/ on the tiller when necessary to provide additional mechanical advantage to move the rudder. (See figure 7.)

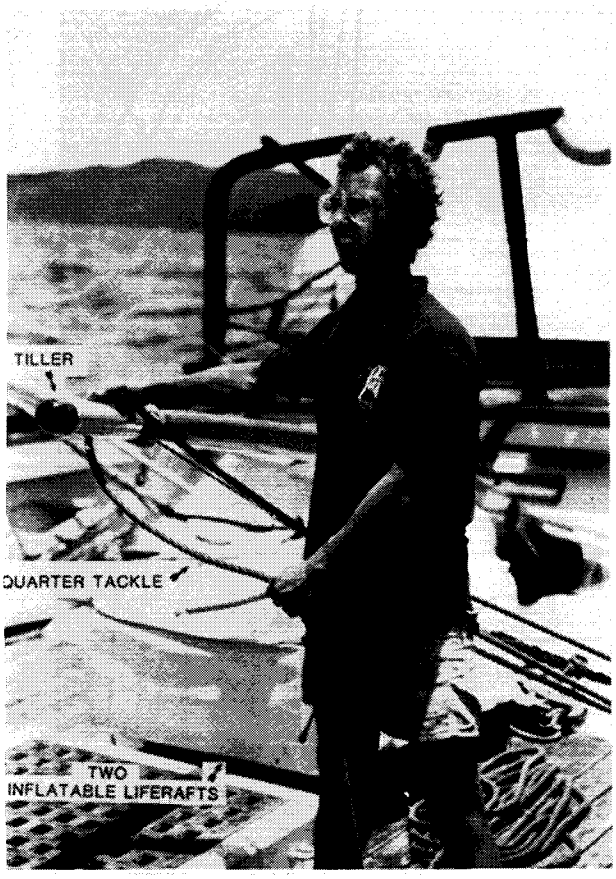


Figure 7.—Helmsman steering with tiller and quarter tackle.

Navigation and Communication Equipment.--Navigation equipment on deck consisted of a magnetic compass that was mounted on the aft cabin trunk forward of the helm station. A taffrail log was rigged to the taffrail to measure distance traveled. A portable Mariners Pathfinder Radar, model 2600, could be mounted on the aft cabin trunk when needed. It was normally stowed below when not in use. Below deck in the aft cabin there was a DECCA Yacht Navigator Mach 3, a Meico C-Master II Micro-Processor Loran C, a Magnavox MX-402 Satellite Navigator, a Stevens C-106 Synthesized 150 watt HF-single side-band radiotelephone, two VHF radiotelephones, a portable VHF radio, an Alden Marine Fax Recorder for weather, a Raytheon Depth Finder, and a Sailor Radio Direction Finder. This vessel was not required by Coast Guard regulations to have any of this equipment.

Fire Fighting Equipment.--There were six portable fire extinguishers located throughout the vessel, one semi-portable extinguisher in the engineroom, and one fire axe amidships.

23/ Sometimes referred to as a tiller tackle.

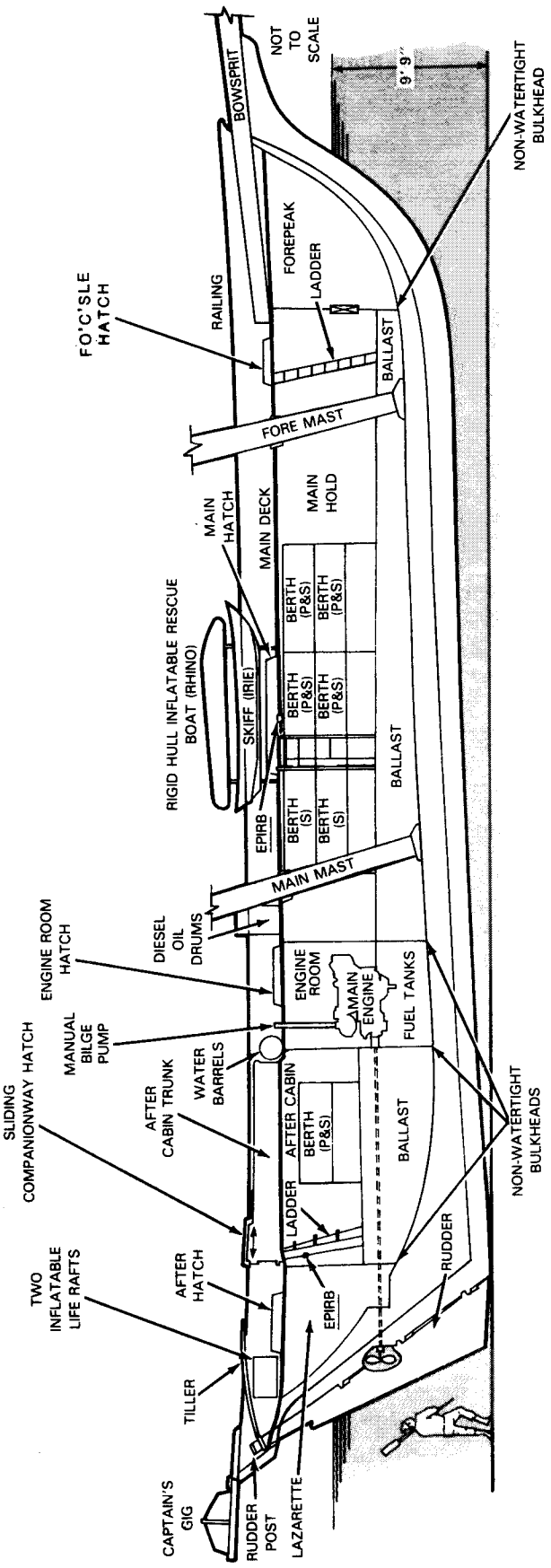


Figure 6a.—Inboard profile of the PRIDE.

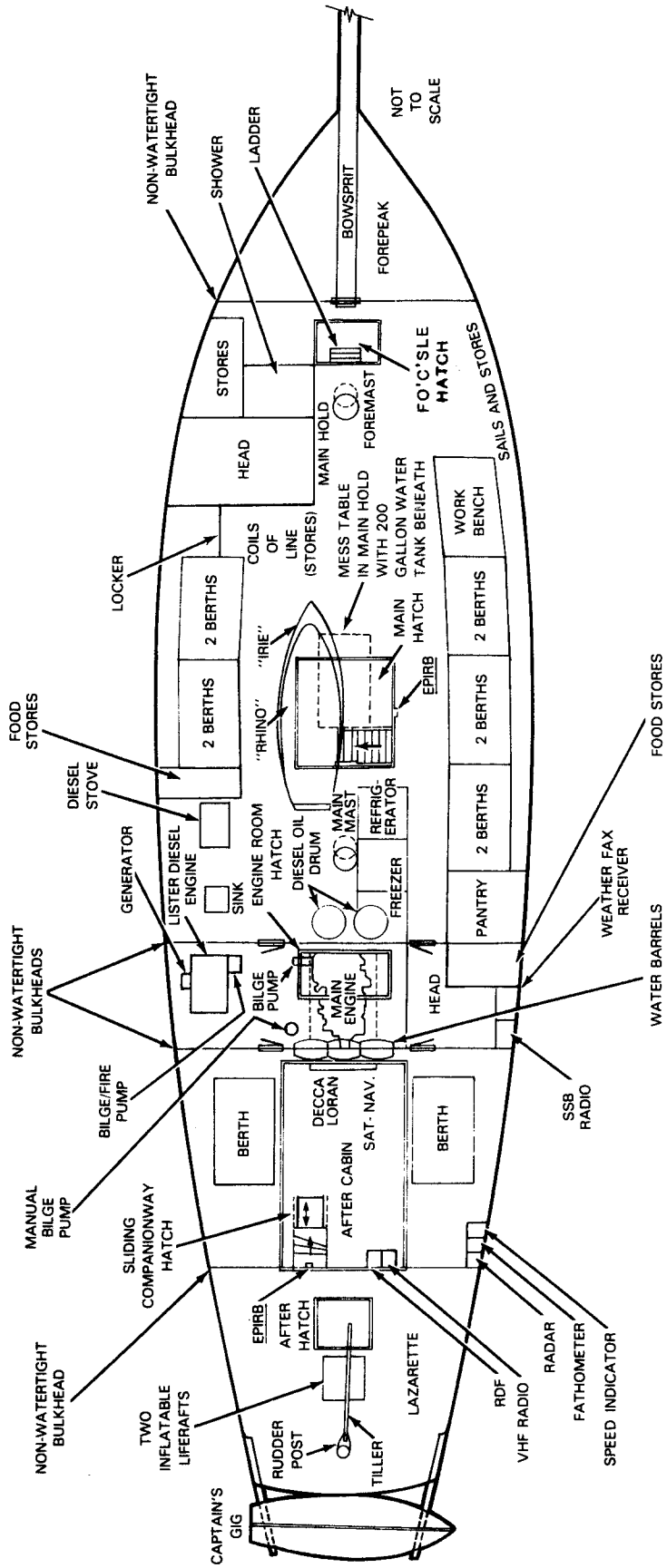


Figure 6b.—Plan view of the PRIDE.

Vessel Maintenance.—In October 1982, the vessel was surveyed by an independent marine surveyor and consultant 24/ who determined that the vessel was in "very good condition." Inspection reports and work lists of maintenance and repairs performed by the crew as well as ship yard repairs were submitted to the operator periodically by the master. Generally, the master's recommendations were acted upon by the operator.

Certificate of Inspection.--The PRIDE was solely employed in activities for the promotion of the city of Baltimore as an authentic historic craft, a topsail schooner of the early 1800's. After it was built, discussions between the Coast Guard and the PRIDE's operator, Pride of Baltimore, Inc., were initiated to determine the PRIDE's inspection status.

The Coast Guard classifies vessels as inspected, uninspected, or recreational. A vessel inspected by the Coast Guard is issued a Certificate of Inspection (COI) when it is involved in certain commercial operations (carrying passengers or cargo for hire or involved in the training of seamen). A vessel under 100 gross tons, such as the PRIDE, need not meet Coast Guard inspection requirements when underway unless it carries more than six passengers. An inspected vessel must meet the minimum standards for equipment, stability, personnel manning, and material condition required by Title 46 United States Code, Parts A, B, and F. An uninspected vessel is not inspected by the Coast Guard and therefore is not subject to the requirements for inspected vessels or for recreational boats. Although an uninspected vessel does not receive a COI, it still must meet the requirements for lifesaving and firefighting equipment as stated in the uninspected vessel regulations at Title 46 Code of Federal Regulations 24, 25, and 26 (Subchapter C).

In May 1978, the PRIDE's operator applied to the Coast Guard in Baltimore for inspection to carry passengers for hire on a rivers and bays route. The Coast Guard asked for additional stability information on August 1 and December 26, 1978. In October 1979 the inspection was started and the PRIDE underwent inspection for safety equipment and drydocking in October 1979. To qualify the PRIDE for certification to carry passengers while underway Coast Guard regulations required watertight bulkheads, higher main deck rails, and a higher freeboard. The designer of the PRIDE believed that the "PRIDE OF BALTIMORE's total value is in her authenticity as a real Baltimore Clipper. To try to adapt her to modern Coast Guard standards for documentation [certification] requires alterations that would wipe all this out." As a result, the Executive Director of the Pride of Baltimore, Inc., did not pursue further any request to the Coast Guard to carry passengers for hire while underway.

Although it did not require a COI to board visitors while moored alongside a dock, the PRIDE was issued a certificate on October 22, 1979 that stated, "Passengers may be carried at the dock only." This allowed the vessel operator to charge admission to visitors. This certificate was renewed in 1980, 1981, and 1982, but not after October 20, 1983, when the 1982 certificate expired. By only allowing visitors to board at the dock, the PRIDE was not required to have a magnetic compass, Emergency Position Indicating Radio Beacon (EPIRB), visual distress signals, a lifefloat, or buoyant apparatus, or an inflatable liferaft, nor other equipment required by an inspected vessel when underway. When underway as an uninspected vessel, the PRIDE, was required to have a lifejacket for each person on board, a ring buoy, and three portable fire extinguishers.

24/ Captain G. W. Full, Marblehead, Massachusetts.

Also, the international or Safety of Life at Sea (SOLAS) regulations are not applicable unless more than 12 passengers are carried or the vessel is more than 500 gross tons and is on an international voyage.

Emergency Training and Drills.-- When each PRIDE crewmember was employed, he or she was supplied with a crew handbook. The handbook defined the responsibilities of a crewmember in general and explained the rules and procedures they were expected to follow aboard the ship. The handbook briefly addressed emergency procedures. (See appendix E.)

The PRIDE maintained a station bill (muster list) that was posted in the vessel's main hold and aft cabin. The station bill addressed three potential emergencies: abandon ship, fire, and man overboard. Each member of the crew was assigned specific responsibilities by the master that included securing areas of the ship, communicating the emergency, and retrieving equipment for each of these emergencies.

The posted station bill was lost with the vessel, but the following reconstruction of abandon ship and fire emergency positions was provided by the first mate.

Position	Abandon Ship	Fire
Master	In command of ship	In command of ship
First Mate	Life rafts	In charge of firefighting
Second Mate	EPIRB and radio communications	Radio communications
Bos'n	Exposure suits	Hose
Engineer	Engineroom	Pump
Carpenter	Survival food	Helm
Cook	Survival food	Galley
Deckhand	Medical supplies	Extinguisher
Deckhand	Water rations	Hatches
Deckhand	EPIRB	Assist on hose
Deckhand	Navigation package	Ax
Deckhand	Flares	Extinguisher

The crew had practiced donning life preservers and exposure suits, adjusted the equipment individually for size, and tested the lights and whistles. The master explained emergency procedures in detail and drilled the ship's crew for abandon ship and fire emergencies on at least two occasions prior to the accident. Emergency drills were conducted in port and at sea. Although man overboard emergency drills were not conducted, the survivors testified that lengthy verbal instructions were provided by the master and watch officers, during which individual crewmembers demonstrated their knowledge of rescue skills through challenge and response questioning. No specific duty assignments were made for man overboard due to the rotating watch schedule.

Survivors testified that no instructions for a rapidly occurring emergency, such as a knockdown or sudden flooding and sinking after a collision, existed. A previous master of the PRIDE testified that he had never considered or conceived of a situation that would not permit a planned evacuation of the vessel.

Lifesaving Equipment.--The following lifesaving equipment was aboard the vessel at the time of the casualty:

Ship Lifesaving Gear	Quantity
Ring buoy with line attached	2
Horseshoe buoy with strobe light	2
Rescue pole	1
Flare gun with ten cartridges	1
Flare, red	12
Flare, orange	12
Rigid hull inflatable rescue boat, motorized (RHINO)	1
Life preserver, Type I (in rescue boat)	4
EPIRB, manually activated	2
Inflatable liferaft, 6-person	2

Crew Lifesaving Gear	Quantity
Exposure suits	12
Safety harness with tether	12
Life preserver, Type I (with strobe light and whistle attached)	12
Life preserver, Type III (work vest, with light and whistle attached)	12

In addition to RHINO, the 14-foot Dunlop rigid hulled inflatable rescue boat, the PRIDE had a 13-foot captain's gig stowed upside down on the stern davits aft of the taffrail, and a 14-foot Chesapeake Bay crabbing skiff (called IRIE by the crew) stowed on deck in a cradle over the main hatch.

EPIRBs.--The PRIDE was equipped with two EPIRBs, a Halotech, Inc., model SRB 100, and an Xcelatron Inc. model ELB-502; each had to be manually activated in the event of an emergency. Both units were stowed below deck, the first just inside the main hatch amidship in an open wooden box mounted adjacent to the access ladder. According to the crew, the manner of stowage of this unit would have permitted it to float free of the box and possibly out of the main hatch if the main hatch had not been closed. The second unit was stowed just inside the aft cabin hatch in a metal clasp mounted adjacent to the companionway steps. The stowage of this unit did not permit it to float free nor was it required to. Both units were easily accessible from the deck to any crewmember by reaching through the hatch provided the hatches were open. Stowage of these non-required EPIRBS was at the discretion of the master.

As a result of its investigation of the sinking of the uninspected fishing vessel M/V LOBSTA-1 25/ in the Atlantic Ocean, the Safety Board on April 24, 1980, recommended to the Coast Guard:

M-80-23

> Seek authority to require the carriage of emergency position indicating radio beacons (EPIRB) on documented U.S. fishing vessels and, in the interim period, pursue all available means to encourage their use.

25/ For more detailed information, read Marine Accident Report--"Fishing Vessel M/V LOBSTA-1, Capsizing and Sinking in the Atlantic Ocean, Point Judith, Rhode Island, September 23, 1978" (NTSB/MAR-80-6).

This recommendation was also reiterated in the Safety Board's investigation of the loss of the uninspected fishing vessel AMAZING GRACE 26/ in the Atlantic Ocean, in 1984.

On September 19, 1985, the Coast Guard replied:

> This recommendation is concurred with. The Coast Guard will seek legislative authority to require EPIRBs on documented U.S. fishing vessels. In the interim, the Coast Guard continues to stress the importance of carrying EPIRBs on fishing vessels. Coast Guard District Commanders are presently required to use any practicable means to encourage fishing vessels going more than 20 miles offshore to carry EPIRBs. The Coast Guard's position on this subject has recently been reiterated in Navigation and Vessel Inspection Circular (NVIC) 6-85, dated June 4, 1985. This NVIC (copy enclosed) establishes voluntary minimum standards for radio and shipboard navigation equipment on U.S. uninspected commercial fishing vessels.

On October 16, 1986, Public Law 99-640 was passed which amended Title 46, U.S. Code, Section 4102 by adding paragraph (e) requiring uninspected fishing vessels operating on the "high seas" to be equipped with EPIRBs. The number and type of EPIRBs will be prescribed by regulation which on the date of this report, has not yet been published. Recommendation M-80-23 is therefore classified as "Closed--Acceptable Action."

In the future, fishing vessels which are part of the uninspected vessel category will be required to be equipped with EPIRBs. However, other uninspected vessels which operate offshore and face the same hazards still will have no requirements concerning the carrying or stowage of EPIRBs.

Primary Lifesaving Equipment (liferafts).--The PRIDE was equipped with two six-person inflatable liferafts to accommodate the entire crew. (See appendix D for a description.)

Manufacturer:	Zodiac Espanola, Figueras, Spain
Date manufactured:	Between January 23 and March 2, 1979
Assembled by:	Zodiac of North America, Stevensville, Maryland
Date equipment installed in liferafts:	July 22, 1982
Model:	MPUS-6 standard*
Lot number:	642/79
Serial numbers:	647 and 667
Donated by:	Zodiac of North America
Date donated:	October 29, 1982

* This model liferaft is no longer in production.

The rafts and survival equipment were packed in standard fiberglass canisters and were mounted on runners on the deck of the vessel near the helm station, below the tiller. They were under a heavily painted canvas cover to keep them from view. The cover was

26/ For more detailed information, read Marine Accident Report--"Loss of the U.S. Fishing Vessel AMAZING GRACE about 80 Nautical Miles East of Cape Henlopen, Delaware, About November 14, 1984" (NTSB/MAR-85/07).

not lashed or secured and would not prevent the liferafts from deploying automatically. The liferafts were each secured to the deck by a synthetic line (painter) with a breakaway link. Hydrostatic releases were installed to facilitate deployment in the event of a sinking, although they also could be manually launched. According to Zodiac, the MPUS-6 standard pack liferaft is manufactured and equipped to "withstand the rigors of open ocean survival." (See appendix D.)

The rafts had been serviced on February 13, 1986, in Algeciras, Spain, by Servimar-Sur, a service facility approved by the manufacturer. The rafts were inspected, equipped, and repacked.

Life Preservers.—The majority of the life preservers aboard the PRIDE were stowed below deck in the crew's quarters. Each crewmember had been issued Coast Guard approved Type I and Type III life preservers fitted with lights and whistles and an exposure suit. Type I life preservers are designed for prolonged use with 25 pounds of bouyancy; the Type III life preservers (work vests) are designed for shorter use with 15 1/2 pounds of bouyancy. Surviving crewmembers testified that this equipment was stowed at their berths and was readily accessible. They generally agreed that retrieval of life preservers from below would take a person approximately 30 seconds to 1 minute via the aft cabin hatch, excluding any congestion caused by other crewmembers using the same route. Four life preservers were secured in the inflatable/rigid hulled rescue boat (RHINO) on deck for use by the crew in the event of a man overboard emergency.

The builders and previous masters of the PRIDE testified that life preservers originally had been stowed in wooden deck boxes and were available to persons on the deck. The crewmembers did not know why the life preservers were stowed in the crew's quarters rather than in the wooden deck boxes. These boxes were still in use aboard the vessel at the time of the accident and contained other equipment.

The Safety Board previously has addressed the manner in which life preservers are stowed aboard inspected vessels. As a result of its investigation of the grounding of the U.S. passenger vessel PILGRIM BELLE, 27/ the Safety Board recommended to the Coast Guard:

M-86-62

> Conduct research to determine the best location for stowing life preservers on all passenger vessels. In the interim, require that life preservers be stowed outside of passenger and crew berthing rooms and closer to or at emergency stations.

The recommendation was reiterated to the Coast Guard following the Safety Board's investigation of the collision of the U.S. passenger vessel MISSISSIPPI QUEEN and the U.S towboat CRIMSON GLORY. 28/ The Coast Guard has not replied to the recommendation.

27/ For more detailed information, read Marine Accident Report—"Grounding of the U.S. Passenger Vessel PILGRIM BELLE on Sow and Pigs Reef, Vineyard Sound, Massachusetts, July 28, 1985" (NTSB/MAR-86/08).
28/ For more detailed information, read Marine Accident Report—"Collision Between U.S. passenger Vessel MISSISSIPPI QUEEN and U.S. Towboat CRIMSON GLORY in the Mississippi River Near Donaldsonville, Louisiana, December 12, 1985" (NTSB/MAR-86/09).

The Type III work vests were not used by the crew when working on deck and aloft in the rigging when the vessel was underway. They were considered to be a liability because they were bulky and interfered with movement and the ability of the crew to function effectively. Instead, the crew used safety lines and harnesses to prevent loss of a crewmember overboard in the belief that this would eliminate the need for a life preserver.

Waterway Information

The PRIDE sank in the southwest portion of the Atlantic Ocean in about 3,000 fathoms (18,000 feet) of water while sailing a rhumb line between the Virgin Islands and the Chesapeake Bay entrance, a distance of approximately 1,340 nmi. Ship traffic in the area would be limited to vessels headed for Mona Passage, Puerto Rico, or the Virgin Passage. Cruise ships sailing from Miami to the Caribbean Islands would probably pass southwest of the area where the PRIDE was lost. Ocean currents in the area generally set northwest by west (305°) at a mean current speed of 0.5 to 1.0 knots. 29/ The mean sea surface temperature in May is about 26° Celsius (78.8°F) while the air temperature averages 25° Celsius (77.0°F). In May, the winds for the area were generally easterly, force 4 (moderate breeze, 11 to 16 knots). During periods of favorable weather, sailing vessels bound for U.S. ports north of Cape Hatteras take advantage of the easterly winds and reach 30/ along a rhumb line course being cautious of any westerly set towards the Bahamas.

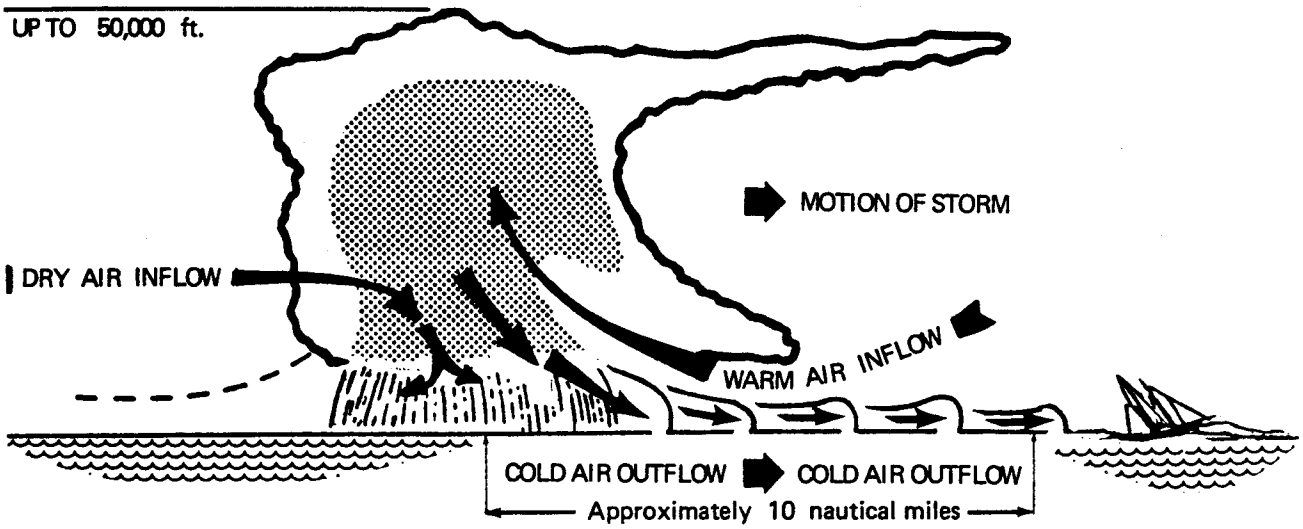
Meteorological Information

The PRIDE encountered a sudden onset of high winds or gust front (see figure 8) which heeled it over on its beam. The National Weather Service (NWS) surface weather analysis near the time of the accident showed a surface trough of low pressure oriented northeast-southwest in the vicinity of the accident and satellite photographs indicated thunderstorms in the area.

Synoptic Information.—The 0800 surface weather map for May 14 prepared by the NWS showed a low pressure area centered about 40.5° north and 51.5° west with a trough extending south then southwest to about 31° north and 56° west. There was a stationary front aloft extending west-southwest from 39° north and 33° west to 22° north and 67° west. In preparation for the 0800 surface weather map, a ship about 140 miles northwest of the accident site (24.1°N, 69.6°W) reported broken clouds with light rain showers, a northeast wind at 20 knots, a 7 1/2-foot, 6-second sea, and an 8-second swell from 070°. The swell height was not reported. A ship about 180 miles east-southeast of the accident site on the east side of the trough reported overcast skies with light rain, an east-southeast wind at 20 knots, a 6-foot, 6-second sea, and 6-foot, 9-second swell from 150°. The 0800 Geostationary Operational Environmental Satellite (GOES) infrared photograph showed the western edge of a large area of cloud cover to be oriented north-south at about 68° west. The accident site was under an area of broken clouds near the western periphery of the cloud cover.

The 1200 GOES infrared photograph for May 14 showed the area of cloudiness extending east from approximately 67° west with diffused clouds on the western edge of the area. In the area of the accident, 23°N, 67°W, there were scattered apparent

29/ Pilot chart of the North Atlantic Ocean, May 1986.
30/ Sailing off the wind but not running before it.



TYPICAL GUST FRONT

Figure 8.—Typical thunderstorm gust front.

thunderstorms and a thin line of clouds extending from about 73.4°N, 67.3°W to about 24.5°N, 67.0°W. Cloud cover in the vicinity of the accident was broken to overcast with low clouds and some higher topped convective clouds.

The 1230 enlarged GOES visual light photograph (see figure 9) showed cell structures in the vicinity of the accident that appear to indicate clouds developed on the periphery of a surface outflow from thunderstorms. Due to the uncertainty of the exact location of the PRIDE, it is not possible to determine which structure influenced the vessel.

On the 1400 surface weather map the analysis showed that the front had dropped and the disturbance was a northeast-southwest oriented trough in the area of the accident. A shift of wind from the northeast on the western side of the trough to east-southeast on the eastern side confirms the approximate position of the trough. A ship about 150 miles northeast of the accident site (24.8°N, 65.0°W) reported overcast skies with cumulonimbus clouds and moderate drizzle. The wind was from the south-southwest at 15 knots. There was a 4 1/2-foot, 3-second sea, and a 6-foot swell. The swell direction and period were not reported. Another ship about 145 miles northwest of the accident site reported overcast skies with cumulonimbus clouds and heavy rain. The wind was from the east-northeast at 30 knots. There was a 16 1/2-foot, 12-second sea; no swell was reported. This was the highest sea reported in that area of the North Atlantic Ocean during the period.

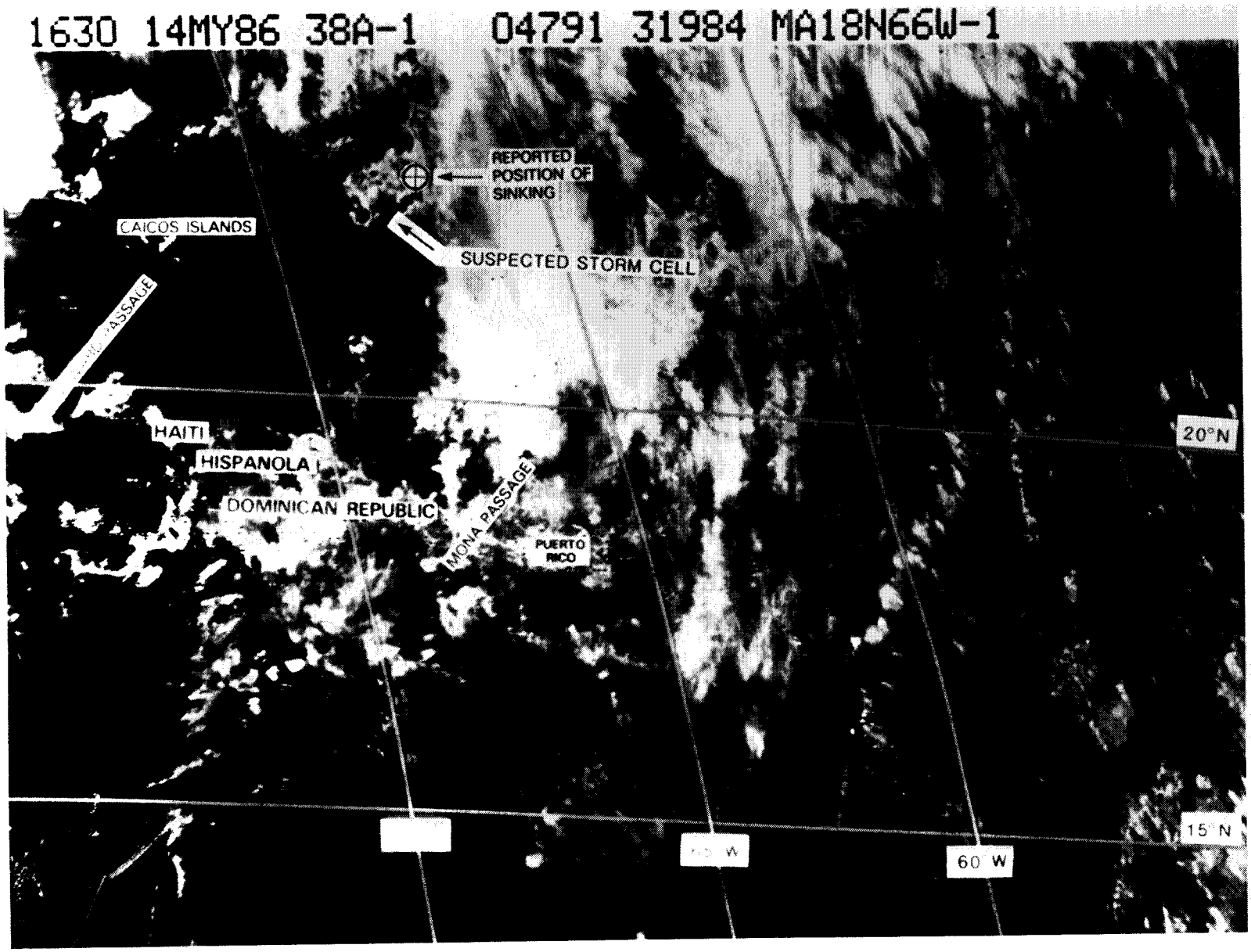


Figure 9.--Geostationary Environmental Operation Satellite visual light photograph taken at 1230 local time on May 14, 1986.

Weather Conditions Observed by the Crew at the Time of the Accident.--Based on the testimony of the crewmembers, a composite description of weather conditions has been developed. It must be recognized that the descriptions of conditions were based upon the recall of subjective observations at a time of physical and mental stress. Some elements such as the wind were commented on by all surviving members of the crew giving it the credibility of consensus. Other elements such as the duration of the winds and visibility were commented on by only one or two of the survivors.

Wind: From 070° to 080° at 18 to 25 knots increasing to 30 to 35 knots just prior to the squall (the high wind that caused the accident). The wind in the squall was probably greater than 60 knots from approximately the same direction for a duration of 15 to 30 minutes.

Sea: 3 to 6 feet increasing to 4 to 8 feet during the squall.

Precipitation: Rain mixed with spray for about 10 minutes after the onset of the squall with spray continuing for 1/2 hour to 1 hour.

Clouds: Overcast with darker areas in the vicinity of rain showers.

Visibility: About 2 miles reduced to 50 to 75 feet after the onset of the squall.

Climatology.—The following climatological data is based upon information from the Pilot Chart of the North Atlantic Ocean, May 1986, published by the Defense Mapping Agency of the Department of Defense. It represents conditions in the grid square between 20 and 25° N latitude, and between 65 and 70° W longitude.

Wind Direction	Percentage of Observations	Average Beaufort Force	Speed Range (Knots)
North	5	3	7-10
Northeast	12	4	11-16
East	43	4	11-16
Southeast	28	4	11-16
South	7	4	11-16
Southwest	4	3	7-10
West	4	3	7-10
Northwest	4	3	7-10
Calm	2	-	-

Current: The average current is 305°, 0.5 knots.

Temperature: The average sea and air temperature is approximately 26°C (79°F).

Gales: Zero percent of the wind observations are Beaufort force 8, (fresh gale, 34-40 knots) or greater.

Visibility: Fewer than 5 percent of the visibility observations are less than 2 miles.

> Weather Forecasts: The Marine High Seas weather forecasts for the southwest Atlantic south of 32°N and west of 65°W were issued by the NWS Office, Miami, Florida, and broadcast by the Coast Guard from radio station NMN, Portsmouth, Virginia. (The forecasts beginning at 0539 on May 13, 1986, are in appendix E.)

A forecaster from the NWS forecast office in Miami, Florida, testified that the weather service does not have the observation capability to put out local weather warnings in the offshore waters. Their main source of information in the area where the PRIDE went down is from ship reports. The NWS forecaster also stated,

> . . .there aren't very many ships that are sending back observations to the Weather Service routinely. You might have one ship every 300 or 400 miles which is not very detailed when you try to get down to a small scale occurrence. Much of the weather originates out in the ocean and we don't have any observations. If it weren't for the satellite, we wouldn't know what was going on out there half the time.

The day and night satellite photographs are used with the ship observations to provide the information necessary to produce the offshore forecasts. High altitude weather observations from aircraft overflights usually give wind speed and direction, temperature, turbulence, and other high level phenomena, unrelated to surface events. Cloud observations, cloud heights, and information describing the vertical structure of the atmosphere, which may be observed from aircraft during daylight hours, are received infrequently to be useful in the preparation of high seas surface weather forecasts.

Medical and Pathological Information

The master, the engineer, and a deckhand who was observed floating motionless in the ocean by survivors following the knockdown, were reported to have drowned as a result of the severe environmental conditions experienced at the time of the accident. Although the potential for incapacitating injury existed, none could be documented.

The ship's carpenter, who survived for approximately 2 hours after the knockdown, drowned despite the efforts by other crewmembers to keep him afloat while they attempted to inflate the liferafts. The ship's carpenter lacked survival swimming and breath control skills 31/ necessary to cope with the sea conditions.

All of the survivors suffered from skin infections due to exposure to sea water. The cook also received fractures to three ribs when he escape from below deck through the companionway hatch as the vessel flooded. He was hospitalized for several days on his return to Baltimore, Maryland.

Crew Information

The master of the PRIDE was hired by the Executive Director of Pride of Baltimore, Inc., the operator of the vessel, with the approval of the Board of Directors. Under the terms of the charter party between the city of Baltimore, owner of the vessel, and Pride of Baltimore, Inc., the operator, the city of Baltimore retained the option to hire and firethe master and the engineer but never exercised that authority. The crewmembers

31/ The ability to remain afloat without the aid of a flotation device, sometimes referred to as drownproofing.

then were hired by the master after preliminary screening by the Executive Director. She stated, "He [the master] has to sail with them, he has to live with them, and they're . . . his responsibility." Occasionally, the Executive Director would receive a letter addressed to the Mayor's office forwarded with a request by someone to sail on the PRIDE. These requests were handled in the same manner -- submission of a resume followed by an interview and then consideration by the master.

Crewmembers were usually hired based on their experience and sailing background, (see appendix B) especially if the prospective crewmember had sailing experience in similar type vessels, offshore experience, and perhaps a letter of recommendation from other masters of sailing vessels. In many instances, crewmembers aboard the PRIDE had previous sailing knowledge or had sailed together before. The professional sailing community is relatively small and as the Executive Director stated, "It's most unusual if somebody comes aboard the boat who hasn't sailed with somebody else who we know or respect."

An important element in the crew selection process was personality, as manifested in the ability to live together in cramped quarters for long periods of time, and in the ability to work together as a team to sail a historic vessel such as the PRIDE. The Executive Director also stated, "Living conditions on PRIDE OF BALTIMORE are. . . are very tight and you can't go into your cabin and close the door and have any privacy, so that you have to be able to live in a very unique environment."

Among the requirements for employment aboard the PRIDE was a certificate or letter from a medical doctor stating that a prospective crewmember was in good health. The PRIDE officials were not aware of any health problems among the crew. Swimming ability was not one of the requirements for employment nor had it been discussed.

The PRIDE was designated as an uninspected vessel; therefore, it was not required to have any Coast Guard licensed or documented persons aboard in order to operate. Several of the officers, however, were licensed. (See appendix B.)

Tests and Research

Vessel Stability.—The designer of the PRIDE was instructed to design a typical Baltimore clipper sailing craft without meeting any Coast Guard standards. Although it was originally planned to sail the PRIDE only in protected waters, about halfway through construction it was decided to extend the range of the vessel and do ocean sailing to foreign ports and represent the city of Baltimore. No changes in the structural design of the vessel were deemed necessary, only some modifications such as the installation of an auxiliary engine and navigational gear as well as the crew's living quarters were needed. The designer stated, "I was not disturbed by this because I felt the vessel was certainly built strong enough and safe enough to go to sea, and I was anxious to see how she would perform."

Sometime in 1978, after the vessel was in service, the operator of the PRIDE met with the designer to discuss Coast Guard inspection and certification. During the meeting, the Coast Guard stability requirements for sailing vessels were discussed. The designer believed that PRIDE was not suitable to meet all the requirements for an inspected vessel to carry passengers even though he thought it would meet the stability [static] requirements and the mechanical and safety requirements. The vessel was constructed without watertight bulkheads and had a relatively low freeboard and any alteration in the design would detract from its authenticity as a historic vessel. The

operators, nevertheless, submitted plans and information to the Coast Guard, but after several questions were raised by the Coast Guard concerning additional stability calculations and structural changes, the matter was not pursued.

The first stability study to determine the PRIDE's stability characteristics was performed shortly after it was launched and rigged in 1977. It was in a pre-ballasted light-ship 32/ condition at the time and the designer wanted to get a "feel" for where the vertical center of gravity (VCG) was. From the results, the amount and location of the ballast was determined.

No dynamic stability calculations were made to compare heeling energy with righting energy under various conditions of sail. The designer believed they were hypothetical and of no particular value as far as the design was concerned although under Coast Guard regulations, these calculations would be required.

In 1984 after its return from a trip to the Pacific Coast, the designer of the PRIDE performed another stability study prior to a shipyard overhaul period and found that the KG 33/ had risen and its displacement (weight) had increased. The designer recommended that the VCG be lowered by the removal of any unnecessary gear that may have accumulated aboard. He pointed out that with age, vessels tend to increase in weight. In March of 1985, prior to departing on the transatlantic voyage, the vessel's stability was checked once again and the results showed significant improvement. The master was given some stability information by the designer for guidance, with a recommendation that the metacentric height (GM) not be allowed to go below 5.55 feet. (See appendix A.) The master's instructions, however, did not include any information or recommendations on the amount of sail that could be carried safely in various wind velocities or direction. Although the master held a Coast Guard license as ocean operator for sailing vessels not to exceed 100 gross tons, it is uncertain whether his background and education included any training in stability. (See appendix B.)

After the accident, the Coast Guard's Marine Technical and Hazardous Materials Division in the Office of Merchant Marine Safety made a stability study 34/ of the PRIDE. Several assumptions were made to facilitate the calculations and to determine a "most likely" value for displacement and KG at the time of the loss. Righting arm curves 35/ (see figure 10) were developed using 122 long tons displacement and three values of KG (8.8 feet, 9.3 feet, and 9.8 feet) which the PRIDE could have had. Using this information, the PRIDE's stability characteristics were evaluated for compliance with existing sailing passenger vessel stability regulations and the newer sailing school vessel stability regulations 36/ using four conditions of sail (see excerpts from Coast Guard Stability Study in appendix C). The stability characteristics also were compared with those of other sailing vessels in the schooner technical files at the Coast Guard's Marine Safety Center.

32/ Without permanent ballast, fuel, and stores.
33/ Height of the vertical center of gravity above the keel.
34/ U.S. Coast Guard Stability Study, PRIDE OF BALTIMORE, September 22, 1986.
35/ The horizontal distance between the vertical lines of force of gravity and buoyancy when a vessel is inclined. Since the righting arm multiplied by a vessel's displacement equals the righting moment; righting arm may be used to indicate a vessel's static stability.
36/ Title 46 CFR Parts 170, 171, and 173.

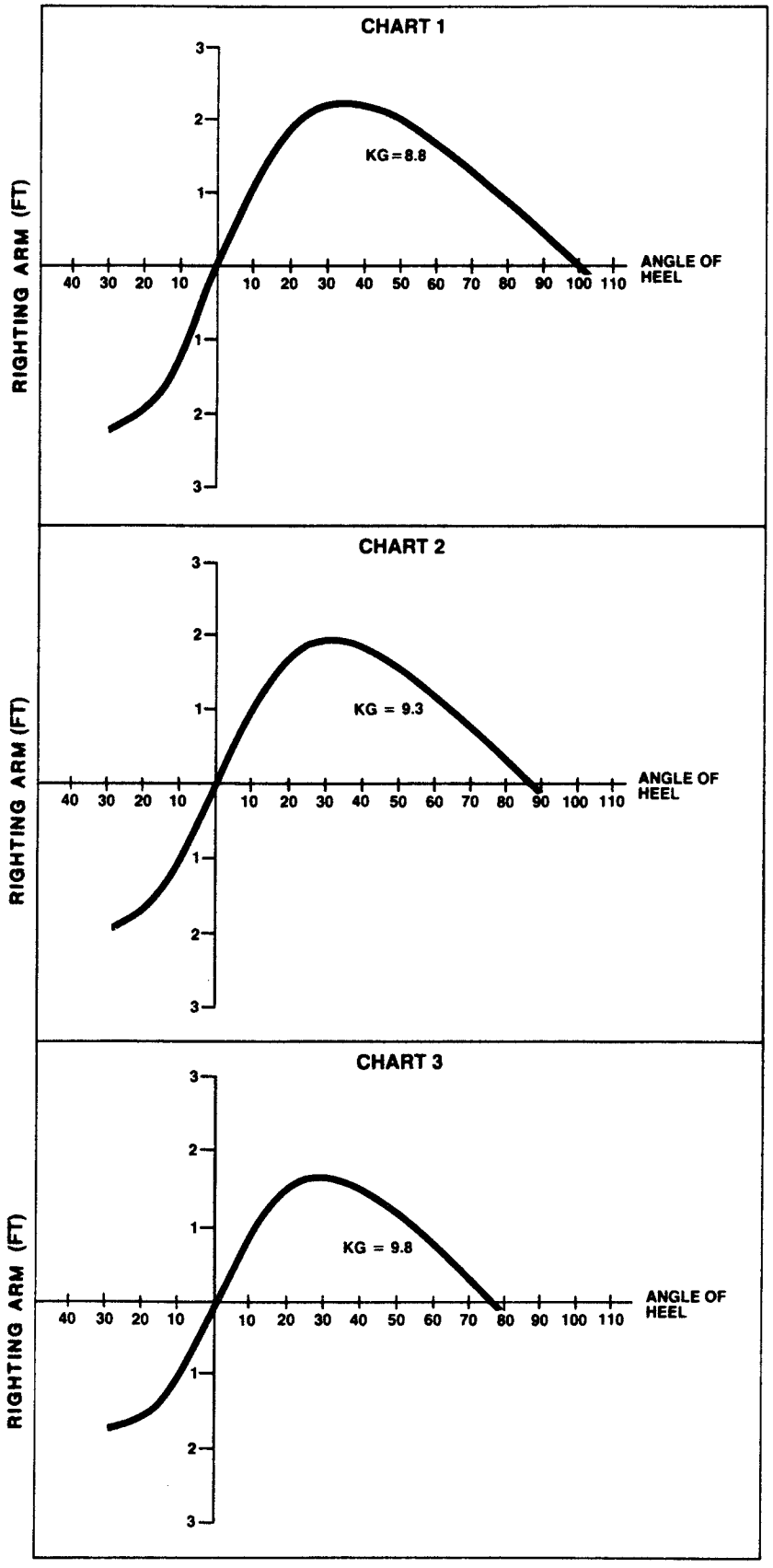


Figure 10.—Righting arm curves.

The study pointed out that a full suit of sails for the 122-ton PRIDE amounted to nearly 10,000 square feet of sail. By comparison, the Coast Guard's 1,816-ton training vessel EAGLE has 21,350 square feet of sail. The study showed that if its sails were reduced to the lower sails only, the PRIDE could have complied with the rules for passenger sailing vessels on partially protected waters, but not for ocean service. The study also showed that if its sails were further reduced to the forestaysail and a full mainsail and it had the lowest assumed KG (8.8 feet), the PRIDE could have complied with the rules for passenger sailing vessels for ocean service. With the sails in the same configuration as at the time of the accident, forestaysail and a double-reefed mainsail, the vessel still only would have met the passenger sailing ship criteria for ocean service if its KG was 8.8 feet or lower. Most Coast Guard certificated passenger sailing vessels are restricted to only the lower sails in order to comply with the regulations.

The study further states that under the new sailing schoolship regulations 37/, the PRIDE, with all its lower sails set, could have been certificated as a sailing school vessel for ocean service if its KG was 8.8 feet or lower. With a foresail and a full mainsail or with the sails in the same configuration as at the time of the accident, a forestaysail and a double-reefed mainsail, the PRIDE would have met the sailing school vessel criterion for ocean service if its KG was 9.3 feet or lower. Under the same sail conditions in partially protected waters, the PRIDE would have met both criteria if its KG was 9.8 feet or lower, the three assumed values used in the Coast Guard study.

The Coast Guard rules for sailing passenger and sailing school vessels in partially protected waters differ slightly. The sailing passenger vessel rules, when they were formulated, were not based on the improved data base used in the newer sailing school vessel regulations. This anomaly will be corrected during the upcoming revision of the Coast Guard regulations for passenger carrying vessels under 100 gross tons.

When the PRIDE was compared to other schooners to determine if there were any unique technical characteristics which might have induced the accident, the technical files disclosed that all factors (hull proportions, light-ship KG, down flooding angle, deck edge immersion angle, GM, 38/ freeboard, and range of stability) were consistent with other schooners. The weight of the ballast carried as a percentage of full load displacement was high in comparison.

Inflatable Liferafts.—With the assistance of Zodiac of North America Inc., in Stevensville, Maryland, several experiments were conducted on a liferaft for Safety Board and Coast Guard investigators in an attempt to duplicate the problems the survivors of the PRIDE experienced.

An MPUS-6 standard liferaft was manually deployed from a fiberglass canister, and it functioned and inflated as described in the Zodiac manual. The topping-off valve plugs did not unseat from their respective valve openings under pressure when inserted with a mallet as servicing requires, or even when inserted hand-tight, due to the protection of the two over-pressure relief valves. Deflation did not occur in these two tests. Deflation of the raft occurred only when all three plugs were removed from their respective valve openings, and nearly total deflation took 12 to 15 minutes.

The service and installation of the topping-off valve plugs is addressed by the Zodiac Liferaft Manual as indicated.

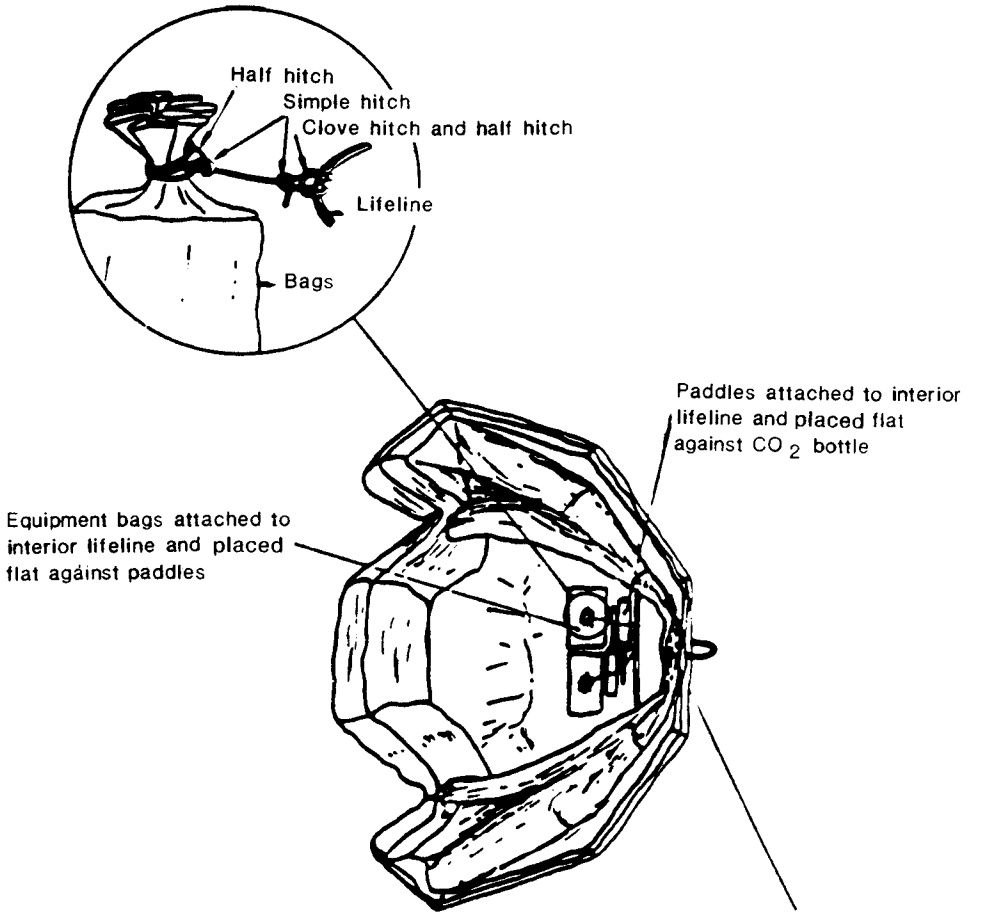
37/ Title 46 CFR Part 169, effective January 9, 1986.
38/ The measure of a vessel's ability to return to an upright position after it is heeled by an external force.

Never:

Forget to place the plugs in inflation/deflation valves (new models, SY MPS, some MP 6) and tighten with a mallet after cleaning out talc with toluene. (Talc is necessary for insertion of plastic deflation pipe when inspection is completed.)

A technician employed by Zodiac, who has packed over 500 Zodiac liferafts, reported that there is sufficient volume in a canister to accommodate a liferaft and the quantity of air that would be found in it if the topping-off plugs had not been installed after servicing, providing that the raft is properly folded.

The survival equipment and rations in the experimental raft were packed in a tied draw-string bag and securely tied to the interior of the raft to prevent loss, as described in the Zodiac Liferaft Manual. (See figure 11.)



Draw the canopy entrace towards you to reveal the lower hull chamber on the side with CO_2 bottle, and place the paddles and equipment bags against the bottle, inside the raft.

Figure 11.—Placement of equipment bags in liferaft.

9.2.4 PLACING EQUIPMENT BAGS

The raft being deflated, stand at the CO_2 bottle side and draw the canopy opening toward you to reveal the hull chambers inside the raft on the bottle side.

Bags and equipment should have already been inspected and faulty or outdated material replaced. Draw strings tight and tie bags as shown.

> Place the paddles together head to foot, flatten them against the bottle, and tie the attached cord to interior lifeline. Then place equipment bags snug against the paddles, and tie the bags to the same lifeline, so that a compact block or pile is formed. Spread the raft out flat, canopy covering the equipment bags, with the hull tubes well aligned one on top of the other.

On August 8, 1986, a Safety Board investigator visited the facilities of Servimar-Sur in Algeciras, Spain. The managing supervisor of the facility had operated the business for about 12 years; he employed two part-time workers who were called in as needed. On the day of the visit, there were no similar liferafts available for inspection. The managing supervisor could not produce any shop records pertaining to the testing of the PRIDE's liferafts. The "test inspection card" produced merely listed the equipment that was replaced. He did describe his procedure for servicing liferafts according to instructions furnished by Zodiac.

The managing supervisor volunteered his opinion that the topping-off valve plugs on the PRIDE's liferafts were "no-good" because a high momentary pressure could cause them to pop out. However, he had not seen this happen and believed that they could never come out at the normal service pressure. He stated emphatically that the plugs were inserted in the rafts before packing and he demonstrated with a mallet how the plugs were pounded into place. He stated that the section of the raft at the topping-off valve was raised above any supporting surface to ensure the plugs could enter and seat. He also displayed what he called a well-designed plug which screwed into the opening and did not protrude.

When asked about the equipment bags that were secured in the rafts, the managing supervisor stated that after the contents were checked and replaced as necessary, the bags were cinched tight and tied at the bag before they were secured to the lifeline inside the raft. He believed that the only way the bags could come loose would be for the drawstring to break.

Other Information

History of the Baltimore Clipper.--Baltimore clipper schooners first made their appearance during the early days of the American colonies when the young country became interested in shipbuilding. Constant warring among Europeans nations, notably England and France, created a need for fast, highly maneuverable vessels. Both England and France ignored American neutrality which resulted in the impressment of American seamen, the seizure of American cargo, and the capture of American ships. As a result, Americans developed the Baltimore clippers which could run the British blockade. Unimpeded by rules of design as were European shipbuilders, American shipbuilders, particularly those in the Chesapeake Bay region, were free to use innovations that made the Baltimore clipper "one of the fastest vessels afloat." With their light displacement and fine hull form, they were demanding vessels to sail, often wet in most seas. Their large spars and heavy sails caused many Baltimore clippers to be driven under or to capsize unless handled with extreme care. Howard Chapelle, a noted historian of sailing vessels, wrote: 39/

39/ Chapelle, Howard I., "The Baltimore Clipper," page 103, Marine Research Society, Salem, Massachusetts, 1930.

> There are numerous instances of schooners and brigs being driven under while in chase of an enemy or while being pursued. This was true of the Baltimore Clipper and was due to fullness in the forward sections. This type of hull form tends to bore or fall by the head when driven hard, which, added to the lever of the masts and press of sail, tended to drive them under, headforemost. Man-of-war brigs of 1800-1850 were particularly liable to this. The 10-gun brigs of that time were known as "coffins" because of their tendency in this direction. One Royal Navy gun-brig, while running off before a gale, pitch poled, or capsized, end over end, alongside a ship-of-the-line. All that was found floating was a sailor's cap. Baltimore Clipper brigs were more prone to this than the schooners, as brigs, for some reason, were fuller in their waterlines forward than schooners, and often had their greatest beam further forward. This was perhaps due to the weight of the foremast and yards, together with the long bowsprit, jibboom and flying jibboom so popular in the brigs of this period.

and:

> It is also stated that they were very fast in moderate weather, but unseaworthy, wet, and most uncomfortable in a blow. This checks up with the remarks of Royal Navy officers in regard to captured American privateer schooners after 1812, and their wetness, in particular, seems to have been the worst fault of the Baltimore Clipper throughout its existence as a type.

R.J. Holt, Director of the Chesapeake Bay Maritime Museum, 40/ wrote a paper in which he states:

> Literally thousands of these vessels were built along the Atlantic Seaboard and those built in New England and to the South followed the successful Chesapeake model. It is interesting to note that during the two wars with England, 90 percent of America's foreign trade was carried in the holds of Baltimore type vessels. While Washington was attempting to hold together his dwindling army of less than 5,000 men, at Valley Forge during the winter of 1777-1778, more than 30,000 American seamen were manning the blockade runners and privateers that were harassing British commerce. During the War of 1812, more than 1,700 British ships were captured by these sleek, rakish American privateers.

Following the War of 1812, the Baltimore clipper became unprofitable to operate. The shape of its hull, built for speed, limited the amount of cargo it could carry. The popularity of the design dwindled as larger vessels were designed. Holt further states:

> The day of the Baltimore clipper in European and United States waters was gone. In 1816, however, about 70 Baltimore clippers with captains and crews shifted their allegiance and became privateers for Latin American countries in their fight for liberation. Many went into the slave trade and about 20 fell into the hands of lawless officers and crews and hoisted the black flag. Another group became famous in the China opium trade. By 1850, the last Baltimore Clipper had disappeared from the oceans of the world.

40/ Chesapeake Bay Maritime Museum, St. Michaels, Maryland, 1983.

Events Preceding the Accident.—After completing a tour of northern European port cities in 1985, the PRIDE was laid up for the winter months in Malaga, Spain, a port on the Mediterranean Sea about 60 miles east of Gibraltar. During this period, considerable maintenance work was performed by the layup crew including drydocking in Malaga from February 12-26, 1986. After leaving the shipyard, the task of making the PRIDE ready for sea continued. On March 3 the remainder of the crew arrived and the PRIDE sailed from Malaga on March 15. After giving the crew several hours of practice setting sails and tacking, 41/ the PRIDE headed for sea.

After arrival at St. John, on April 29, the vessel was cleared by the local authorities and sailed to St. Thomas to repair the refrigeration machinery. Three days were spent in St. Thomas and on May 2, the PRIDE returned to St. John. Most of that day's activities involved sail handling, and generally training the crew in the teamwork necessary to sail a topsail schooner properly. With the cancellation of the Mediterranean tour, the PRIDE had been scheduled to participate in the July 4 Liberty Weekend activities in New York Harbor and additional training in sail handling was necessary. Pride of Baltimore, Inc., had authorized 1 week of sailing in the Virgin Islands because the voyage from Europe did not give them enough sail handling experience.

On May 10 the PRIDE anchored off St. John. The day was spent cleaning the vessel and securing for sea in anticipation of the final leg of the voyage to Chesapeake Bay. The master wanted the crewmembers to get a good night's rest before departing the following morning.

Communications.—On the eastbound voyage to Europe in 1985, a communication schedule was established between the PRIDE and the Pride of Baltimore, Inc., office in Baltimore, Maryland. A letter of instruction was issued by the Executive Director to the master of the vessel requiring the master to report daily by radio while at sea. After leaving Europe on the westbound crossing, however, the communications schedule was modified to require radio reports every third day since there were periods of time when the radio traffic was quite heavy which made contact with shore stations difficult and time consuming. Nonetheless, the practice of telephoning upon arrival at and prior to departure from port was continued.

The Safety Board's investigation of the loss of the fishing vessel AMAZING GRACE also addressed the establishment of a radio communications schedule to reduce delays in initiating a response in case of an emergency in which the vessel is unable to communicate. The Coast Guard, in its response to the Safety Board's recommendation (M-85-71) has published in its voluntary guidelines for commercial fishing vessels 42/ a section concerning position reporting with procedures to establish a reporting schedule. (See appendix F.) The recommendation has been classified as "Closed—Acceptable Action."

After arriving in Barbados, the radio schedule was discontinued and all communications to the Pride office were made every few days by telephone from the various stopovers in the West Indies. During the last telephone communication from St. Thomas on May 9, the master and the Executive Director agreed that no further radio messages were necessary and their next contact would be after the PRIDE arrived in Chesapeake Bay.

41/ Turning a sailing vessel in the direction of the wind to bring it in on the opposite side.
42/ U.S. Coast Guard Navigation and Vessel Inspection Circular No. 5-86, August 18, 1986.

Except for obtaining weather reports, the PRIDE's master handled most of the radio communications. He made contact with other sailing vessels, mostly to exchange weather data. He also made a weekly report to a Baltimore radio station which broadcast news of the PRIDE's progress. The last weekly report was made and broadcast in the Baltimore area on May 9, 1986, when the master related the latest news about the PRIDE. The broadcast was mainly a public relations exercise without any specific details of the voyage.

ANALYSIS

The Accident

In the moments before the PRIDE capsized, the master probably realized that the vessel was encountering stronger winds than he had anticipated when he last shortened sail including the double reef in the mainsail. He had ordered the first mate to start easing out the main sheet while a deckhand was ordered to ease the staysail sheet; both actions were necessary to reduce the effects of the wind on the sails. Although there was another reef that could have been taken on the mainsail, the rapid onset of the gale winds precluded any such action at the time. A deckhand observed the helm was all the way to windward just as the PRIDE capsized which indicates that the vessel was tending to head up to windward (turn into the wind). It is uncertain whether the rudder was having any effect at that moment.

There were two courses of action that the master could have taken when the wind started to increase. He could have rounded up, that is, turned the vessel into the wind or turned it downwind which would have relieved the wind in the sails. It is remotely possible that if the main sheet had been let out a few moments earlier, the rudder may have been able to exert control and turn the vessel more downwind and the vessel may have survived the high winds. From the first mate's description of the master's actions when PRIDE started to heel, it appeared that he was attempting to turn downwind. According to the first mate's testimony, he believed that the master was attempting to turn to port but with the amount of sail up and the almost instant increase in wind velocity, he believed there was not enough change in the vessel's heading to reduce the wind's effect. When asked his opinion about what course of action he would have taken in the same situation, the first mate stated that because the wind was slightly aft of the beam, he would have chosen to turn downwind rather than turn upwind and expose the vessel to a beam wind during the attempt.

The Safety Board believes that the master's attempt to turn downwind to reduce the effect on the sail area by wind was correct, but the time taken to make a decision and execute the maneuver was too great or the vessel failed to react to the rudder action. If the main sheet had been eased out sooner changing the angle of the mainsail, the rudder may have had more effect and turned the vessel downwind quicker. There may have been too much mainsail up for the amount of wind that struck the vessel, a phenomenon that the master could not have foreseen.

The master had shown concern for his crew earlier when he shouted to the first mate to get the jib down quickly and secure it to avoid prolonged exposure of the crewmembers to the sea while out on the jibboom. Several crewmembers believed that the master had turned downwind about 30° during the sail handling operation, but they were not certain whether he had brought the vessel back to its original course before the wind struck. They recalled hearing him call for a head count as soon as the PRIDE went over. Given the inherent danger that ocean sailing entails, it can be concluded that the master exhibited the proper concern for his crew and tried not to expose them to needless dangers.

As the PRIDE heeled over to port, the crewmembers believed that it would right itself momentarily but when the more experienced crewmembers failed to detect any righting motion and observed that the open companionway hatch was underwater, they realized there was no possible chance for recovery. Because the hatch was located on the port side of the centerline, it was quickly submerged as the vessel heeled 90° to port. If the circumstances were reversed and the vessel heeled to starboard, the hatch would have been above the surface of the water and downflooding may not have occurred as rapidly. The PRIDE may have then survived the knockdown and recovered. It is not certain whether the heavy fo'c'sle hatch remained closed or swung open as the vessel heeled to 90° which would have contributed to the rapid downflooding.

Vessel Operation

The PRIDE was operated by Pride of Baltimore, Inc., for the city of Baltimore under a charter agreement to represent the city and promote trade. As a goodwill ambassador, the vessel was well received in the many ports it visited. Because of its success, the mission was continually expanding and reaching out to more distant ports. The designer, builder, and the operator, in their desire for an authentic 19th century sailing vessel, did not include additional safety features such as compartmentation using watertight bulkheads which would not have detracted from the vessel's overall appearance and substantially decreased the extent of downflooding. They did include modern safety features, an auxiliary engine and generator, radio equipment, and survival gear. If a similar project is contemplated in the future, the entire program, including the extent of the voyages by the vessel, should be reviewed before construction and current standards of safety incorporated in the design. The Safety Board believes that the use of current standards of design and safety would not necessarily compromise the aesthetic appearance of a historic vessel.

Vessel Stability.--The PRIDE was designed as an authentic replica of a historic vessel without any requirements to meet Coast Guard standards for vessel stability. Further, it was operated as an uninspected vessel and did not have to meet the Coast Guard's stability regulations for inspected vessels. When the transatlantic voyage was contemplated and the question of vessel stability arose, the naval architect made several recommendations to the operator affecting the displacement and the KG of the vessel. This concern was manifested in the findings of the stability study performed in 1984. Because the KG was higher than originally determined in 1977 due to the additional gear that normally accumulates aboard a vessel, the designer was prudent in his recommendation that excess weight be removed and the KG of the vessel be kept below an established limit which was confirmed in 1985. Although the master was given some instructions in this regard, it is uncertain that in preparation for the return voyage, the KG was calculated prior to departure. The Safety Board cannot conclude that the master of the PRIDE performed any such calculations before leaving Spain. Removal of excess gear from the vessel before departure did indicate, however, that the master had concern about the stability.

In the Coast Guard's stability study, it was pointed out that several assumptions had to be made to determine the "most likely" value for KG (9.3 feet) and displacement (122 long tons) at the time of the accident. A comparable GM of 6.1 feet derived from these values compared favorably with the minimum GM recommended by the designer. The study found that the KG values were critical to the operation of the vessel under Coast Guard standards for sailing vessels in ocean service. However, the Safety Board believes that should the PRIDE be replaced, its design should incorporate current Coast Guard standards for sailing vessels in ocean service. Therefore, based on the review of the

Coast Guard's study, the Safety Board concludes that the PRIDE was designed with sufficient stability to meet some but not all of the Coast Guard stability criteria for inspected passenger sailing vessels.

Vessel Maintenance.—Testimony and evidence presented during the investigation indicated that the PRIDE was well maintained and that the several masters, in whose care the vessel was committed, each exhibited an excellent sense of responsibility to the vessel and its crew. The operator appeared to have honored any reasonable request by them in the care and upkeep of the vessel. The crewmembers were diligent in their daily work routines, constantly looking to the sails and rigging for chafing and wear. Vessel maintenance was not a factor in the cause of the accident.

Regulations.—The PRIDE was equipped with more than the minimum equipment required for uninspected vessels (life preservers, fire extinguishers, and back fire flame arrestors on gasoline engines); the PRIDE's operators could have legally sent it anywhere in the world, although a prudent sailing ship master would not consider such a voyage, without navigation equipment or additional lifesaving equipment. While there are no regulations for ocean voyage equipment requirements for uninspected vessels, there are regulations (33 CFR Part 177) which allows the Coast Guard to terminate a voyage that they consider unsafe for those on board. In the case of the PRIDE, the Coast Guard would be precluded from terminating such a voyage because the vessel is owned by the city of Baltimore and as public vessel, is exempt by regulation from 33 CFR Part 177.

There is no requirement for uninspected vessels to have a compass, fathometer, electronic position fixing device, visual distress signals, or a primary lifesaving device that prevents immersion of survivors in the water (liferaft) which the PRIDE was equipped with. The PRIDE's lifesaving and navigational equipment exceeded that required for inspected vessels under 100 gross tons operating offshore. Realizing the necessity and the importance of this equipment, the operator of the PRIDE equipped the vessel accordingly, despite the lack of Coast Guard regulations in these areas. If a vessel operator, such as Pride of Baltimore, Inc., can recognize the shortcomings of the uninspected vessel regulations, it is clear that these regulations need to be upgraded. However, the weakness in the uninspected vessel regulations did not necessarily contribute to the loss of the PRIDE. The regulations for uninspected vessels, 46 CFR Parts 24, 25, and 26, only list fire extinguishers, life preservers, and gasoline engine safety devices as required equipment. Recreational boats on coastal waters and the high seas are also required to carry visual distress signals but uninspected vessels on the same waters are not required to do so. Presently, 46 U.S. Code Chapter 41 does not contain authority to require this additional equipment on uninspected vessels. This law should be expanded to include primary lifesaving equipment (liferafts, etc.) and navigation equipment aboard uninspected vessels that operate offshore.

An inspected passenger vessel of the same size as the PRIDE (67 gross tons) would be required to have the following safety and navigation equipment: a life preserver for each person on board, three ring buoys, a lifefloat or buoyant apparatus or inflatable liferaft for all persons on board, a Class A EPIRB, 43/ visual distress signals, six portable fire extinguishers, and a magnetic compass. The deficiency of any requirements for navigation equipment for an inspected vessel of less than 100 gross tons was addressed in the Safety Board's investigation of the grounding of the U.S. passenger vessel PILGRIM BELLE in Vineyard Sound, Massachusetts.

43/ Float free and automatic activation capabilities.

Communications Schedule.—The failure of the operator to require and the master to initiate a daily radio communications schedule is a serious omission. This omission did not contribute to the deaths of the four crewmembers. However, it did prevent more timely notification of search and rescue forces that would have been mobilized after the vessel had failed to meet the appointed communications schedule. In addition, the extended exposure of the survivors to the environment in an overcrowded and malfunctioning liferaft would have been significantly reduced. In future operations, Pride of Baltimore, Inc., should maintain a communications schedule similar to those found in the U.S. Coast Guard's Voluntary Guidelines for Commercial Fishing Vessels, so that failure to meet an established schedule would indicate a potential emergency.

Weather

The PRIDE encountered a gust front developed by a thunderstorm downburst. (See figure 9.) The severe thunderstorm activity was probably spawned along the periphery of the outflow from a meso-high 44/ in the vicinity of the intersection of the outflow and the trough line that was in the vicinity of the accident site.

The evidence for this conclusion is the narrow band of clouds that appeared on the 1200 infrared satellite photograph to the west of the edge of the large area of cloudiness with apparent thunderstorm cells in the vicinity of the southerly end of the narrow band of clouds. 45/ This is a recognized mechanism for the development of severe weather and, although the evidence is limited, offers a reasonable explanation for the intense convective activity that would develop a gust front of the intensity that struck the ship.

Further evidence of downbursts and the associated gust fronts is evident in the 1230 enlarged visual light satellite photographs which showed apparent areas of outflow with rings of clouds appearing as cells showing the periphery of the outflow.

Based upon the composite description of the weather conditions given by the crew of the PRIDE, the vessel was probably at least 5 miles from the thunderstorm that generated the gust front. Thunderstorm clouds would have been hidden by the overcast, and although the rain shaft would have been visible from the surface, it was not reported. The crew estimated the visibility at 2 miles. None of the crew reported seeing lightning or hearing thunder. The maximum range of hearing thunder is generally 5 to 10 miles due to the sound refraction in an atmosphere conducive to thunderstorm formation and the sound attenuation in the turbulent atmosphere. In this case, its detectability can be further reduced by the ambient noise associated with a sailing vessel underway in a stiff breeze.

Rain was reported at or shortly after the onset of the high winds. This rain could have been a result of clouds developed by the lifting action of the gust front. Such clouds on the periphery of the outflows in the area of the accident are readily visible in the enlarged satellite photograph. In the tropics, rain showers are frequently observed in relatively shallow cumulus clouds without apparent electrification. Up to the time of the accident, the crew had no visible rain which could have provided a warning that high winds were approaching.

44/ A small scale high-pressure area about 10 to 100 miles in diameter.
45/ Some Uses of High Resolution GOES Imagery in the Mesoscale Forecasting of Convection and Its Behavior, James F. W. Purdum, Monthly Weather Review, Volume 104, December 1976.

The weather conditions encountered were worse than forecast by the offshore marine forecasts. Although thunderstorms were predicted, there was no mention of the severity of the thunderstorms. In this case, it was probably impossible to forecast the occurrence of severe thunderstorms due to the small number of surface observations in the open ocean and the almost complete lack of information describing the vertical structure of the atmosphere. It can be reasonably concluded that the crew had no advance warning of the high winds or of the possibility of high winds in the area. The NWS should include in its marine weather forecasts a warning of the potential for rapidly developing high winds in the vicinity of thunderstorms.

Accurate and timely information about weather phenomena in sparsely transited ocean areas is limited. Some information can be obtained by aircraft overflying the area. The means to provide and disseminate pilot observations currently exist within the International Civil Aviation Organization (ICAO) reporting and NWS procedures. Pilots are supposed to report weather observations with their routing over water position reports or when certain unusual weather conditions are noted. The Safety Board, however, does not believe that these reports are given sufficient emphasis by pilots and that the information provided by overflying aircraft is generally limited to the upper level wind and temperatures encountered during flight. The Safety Board believes that the NWS should make a more active effort to enhance pilot weather reporting by soliciting the cooperation of both the Air Transport Association and the International Air Transport Association to emphasize the value of the ICAO reporting standards.

Survival Gear

Primary Lifesaving Equipment (Liferafts).—The two Zodiac MPUS-6 standard liferafts in use aboard the PRIDE were considered sufficient lifesaving equipment for open ocean survival. The design and equipment incorporated in this model were believed to be adequate for the rigorous requirements of ocean service by the manufacturer as described in their product literature. (See appendix D.) The replacement of these liferafts with models containing additional equipment more suitable for "deep-sea" or long range ocean service (a radar reflector, rain water catchment devices, and floors offering thermal protection) would have been prudent and advisable. This may not have been considered by the operator or the master(s) due, perhaps to a belief that the PRIDE's liferafts were adequately designed for long range ocean service.

The liferaft malfunction, specifically the deflation of the liferafts after they were initially deployed and inflated, is related to the design and service requirements of the topping-off valve (plug) assembly. The topping-off valve design, which is not used on rafts currently manufactured by Zodiac, caused the difficulty the survivors experienced in keeping the plugs seated when they were adrift in the ocean. Once the plugs are removed from the valve, which is routinely required for increasing air pressure in the raft due to ambient temperature variations, they are difficult to re-seat securely. When they are not re-seated securely, they are susceptible to accidental dislodging with resultant pressure loss.

The difficulty in securing the plug manually in the valve opening is addressed in the Zodiac Liferaft Manual servicing instructions. These instructions require that during servicing, the plugs must be inserted in the topping-off valve openings using a special procedure with a mallet. This procedure assures that the valve plugs are properly seated in the valve openings during initial inflation. Experiments conducted at the headquarters of Zodiac of North America indicated that the liferaft malfunction described by the survivors could be traced to the servicing of the liferafts conducted in Algeciras, Spain, 3 months before the accident. Once again, the design of the topping-off valve assembly is

considered to have indirectly contributed to the liferaft malfunction reported by the crew of the PRIDE. The design of the plug precluded any positive closure, which a threaded fitting would provide. Without a threaded or similar type fitting to ensure proper closure of the valve opening, the seating of the plugs in the PRIDE's liferafts could not be taken for granted. As a result of the experiments it is concluded that the topping-off valve plugs were not inserted into the topping-off valve during servicing in accordance with the requirements of the servicing manual. This is further substantiated when the damaged liferaft deflated completely instead of retaining air in the undamaged chambers according to its design. The liferaft deflation can be attributed to the failure of servicing personnel to install the plugs resulting in the loss of pressurized air through the opening and deflation.

Zodiac liferafts incorporating this topping-off valve assembly design are no longer manufactured, but it is estimated that over 300 of these liferafts are currently in use in the U.S. Although proper servicing of this equipment may eliminate the potential for deflation following deployment of the raft, it would be appropriate for Zodiac to require a retrofit installation of a valve assembly with a different design when servicing rafts that are currently in use. A valve design, which eliminates the problems encountered as a result of hand-seating the valve plug after removal for topping-off purposes is available and would eliminate the design-induced limitations of the equipment.

The drowning of the ship's carpenter can be attributed to the failure of the liferafts to function properly and his lack of survival swimming skills. Although he was in the water for 30 minutes before he was located and he appeared to be suffering from the effects of ingestion of seawater, he may have survived the immersion if a liferaft had been available. It is doubtful, however, if he could have withstood the rigors of 4 days in the overcrowded liferaft. The Safety Board believes that the ship's carpenter would not have drowned if the liferaft malfunction had not occurred, but his chances of survival in the overcrowed liferaft were minimal.

The loss of various items of survival equipment stowed in the liferaft also could be attributed to improper servicing as a result of a failure of servicing personnel to properly tie and secure the equipment bags to the interior of the raft. However, it is more likely that survivors may have inadvertently released the equipment during their initial attempts to board the liferafts.

Life Preservers.—The manner in which life preservers were stowed aboard the PRIDE, below deck in the crew's quarters, precluded their availability following the knockdown and rapid sinking of the vessel. At the time of the accident, only four life preservers were available to the crew on the deck, and they were stowed and secured in the inflatable, rigid-hulled, rescue boat (RHINO).

This below deck stowage of life preservers prevented their retrieval by the crew, since all but one crewmember were on deck when the knockdown occurred. Their retrieval from below, as generally agreed by the survivors, would require a minimum of 30 seconds to accomplish--time which was not available to the crew during the emergency. Although there were a total of 28 life preservers (16 Type I and 12 Type III) aboard the vessel, none were easily accessible or unsecured so as to float free, and therefore, the equipment sank with the vessel.

According to the builders and former masters of the vessel, life preservers had not always been stowed in this manner aboard the PRIDE. Wooden deck boxes previously had been used for stowing life preservers which enhanced their availability. At the time of

the accident, these deck boxes were used for stowage of other equipment. The accessibility of life preservers in the severe environmental conditions that existed at the time of the knockdown is considered critical to the ability of the crewmembers to survive the accident. The loss of at least one crewmember, the carpenter, and possibly all who perished, may have been avoided if life preservers had been stowed on deck and readily accessible.

The stowage of life preservers at muster station locations or close to the exterior of all vessels, not only passenger vessels, would improve access to them during emergency situations. In addition, the life preservers could float free in case of a rapid sinking. The application of such stowage should be considered for all vessels, regardless of size or service.

The master and crew of the PRIDE believed that use of safety harnesses and lines provided the necessary freedom of movement required for sailing and working aloft in the rigging. The safety afforded by the harness would be enhanced by providing a release at both ends of the tether. Such a device would enable the wearer to release himself from the vessel without cutting or releasing the outer end of the tether. Safety harnesses that incorporate compact inflatable devices for emergency flotation have recently been developed which can afford increased protection.

Emergency Training and Drills.—The crew of the PRIDE was adequately furnished, trained, and drilled in the use of emergency equipment and in emergency procedures by the master. A station bill (muster list), appropriately posted, assigned emergency duties to crewmembers in accordance with their individual capabilities and responsibilities aboard the ship. There is a belief that downflooding and sinking of a vessel will occur at a slow rate and, therefore, the crew can respond to the emergency according to procedure. The rapidly occurring scenario as experienced by the crew of the PRIDE demonstrates that this is not always the case. In addition to the training and drilling of the crew in emergency procedures as outlined in the station bill, a response to a sudden and catastrophic situation should have been included.

Generally, the emergency procedures that were rehearsed during the drills and included in the posted station bills entailed emergency situations, but not the type of catastrophe that occurred to the PRIDE. Without life preserver stowage on deck where they may have floated free, the preparations for such a disaster were incomplete. There is little doubt that the master of the PRIDE was safety conscious and took many precautions for the safety of the crew and the vessel. However, in the opinion of the Safety Board, the master failed to anticipate the consequences of a knockdown and a rapid downflooding of the vessel that prevented the crew from getting their life preservers.

Emergency Position Indicating Radio Beacons (EPIRBs).—The two manually activated EPIRB transmitters aboard the PRIDE had been stowed below deck adjacent to hatch openings which made them inaccessible from the deck in this emergency. The unit stowed inside the aft cabin hatch was secured by a metal clasp and was prevented from floating free. The other unit, stowed in an open box inside the main hatch, was not fastened to the ship and could not float free because the main hatch was secured at the time of the knockdown. Even if the main hatch had been open, it is uncertain if the unit would have floated out of the interior of the ship; in addition, it would had to have been manually switched on to function. EPIRBs carried by Coast Guard inspected ocean-going merchant vessels are required to be a Class A type, self activating in a float free stowage. A Class A EPIRB, mounted in the required manner on the PRIDE, would have

provided a more timely distress notification and for the initiation of the search and rescue operation. Although the amendment to Title 46 U.S. Code Section 4102 now requires uninspected fishing vessels to be equipped with an EPIRB, other vessels in the uninspected category are still not included in the requirement. The Safety Board beleives that all uninspected vessels should be equipped with EPIRBs and therefore, the Board urges the Coast Guard to seek authority to require those remaining uninspected vessels that operate offshore to carry EPIRBs.

Crew Qualifications.—Each member of the PRIDE's crew was qualified for the position he/she held at the time of the accident. The drowning of the carpenter due to poor survival swimming and breath control skills suggests that there was a deficiency in the selection requirements. During pre-employment screening the operator did not establish basic survival swimming skill levels for applicants. Proficiency in survival swimming techniques should be considered a basic skill that each crewmember should possess to enhance survival at sea during emergency situations. The lack of survival swimming skills of an applicant for a position aboard a sailing vessel should be cause for rejection for employment or the imposition of a training requirement to attain the requisite skills.

Since it was impossible to get the life jackets from crews' quarters and there were no life preservers on deck, the crewmembers had to rely on their swimming ability to stay afloat until the liferafts could provide support. It was fortuitous that the crew, except for the cook, were on deck during the knockdown. The accident points out, however, that swimming skills, at least the ability to stay afloat, became an important survival factor when the crew was in the water. Hypothermia was not a critical factor in survival due to the relatively warm water.

No Coast Guard regulation exists that requires any level of proficiency in basic survival swimming techniques for documented seamen on inspected vessels. The PRIDE, a vessel not required to be inspected by the Coast Guard, would not have been subject to such a regulatory requirement. Therefore, even if a such requirement were mandated, it could not be applied to a vessel such as the PRIDE. The responsibility in such a case would rest solely with the operator and master of the ship.

Search and Rescue.—Search and rescue (SAR) efforts were extensive, although delayed over 4 days because the PRIDE's crew did not have time to use the radio equipment to transmit a distress message. A review of the SAR summary indicated that the 5-day search by aircraft and ships for the missing crewmembers could have been started much earlier and the search area of 61,800 square miles substantially reduced if one or both of the PRIDE's EPIRBs had been activated.

CONCLUSIONS

Findings

1. The "knockdown" suffered by the PRIDE OF BALTIMORE from which it did not recover was caused by a sudden high wind from a gust front developed by a thunderstorm downburst.

2. The downflooding of the PRIDE was a result of the open companionway hatch in the main cabin trunk.

3. The extensive flooding of the vessel was due to the lack of watertight subdivisions (bulkheads) in the hull.

4. The amount of mainsail set probably caused the vessel to respond slowly to the helm when the master was attempting to turn downwind.

5. The master's decision to turn the vessel downwind as the wind started to increase in velocity was the correct one in the situation that prevailed.

6. The vessel may have been able to turn downwind if the mainsheet had been eased out sooner.

7. The master exhibited concern for the safety of his crew and vessel when underway, especially during the handling of the sails.

8. The use of safety harnesses and lifelines is generally regarded as the proper protection for crewmembers of ocean-going sailing vessels when working on deck. The cutting of the harness tethers probably saved several lives.

9. The crew of the PRIDE OF BALTIMORE had no forecast of the high winds nor of any warnings of the potential for rapidly developing high winds in the vicinity of thunderstorms. The weather conditions encountered by the vessel during the accident were worse than predicted by the National Weather Service offshore forecasts.

10. There is a need to increase efforts to encourage aircrews flying ocean routes to include visual observations of weather in the Air Reports (AIREPS).

11. Although the PRIDE OF BALTIMORE was designed with stability characteristics not unlike other sailing vessels of similar design, it failed to meet some of the Coast Guard requirements for an inspected sailing vessel in ocean service.

12. The metacentric height (GM) shown in the Coast Guard study compared favorably with other schooners of comparable size and was higher than the prohibited minimum value established by the designer.

13. The open companionway hatch on the port side of the main cabin trunk was quickly submerged in water when the vessel heeled to port. If the vessel had heeled to starboard, rapid downflooding may not have occurred and the vessel may have recovered.

14. Maintenance and repair of the vessel was adequate and was not a factor in the accident.

15. Compartmentation of the hull by watertight bulkheads would have substantially decreased the extent of downflooding.

16. All crewmembers who died are believed to have drowned. Liferaft malfunctions contributed to the death of one crewmember who drowned due to a lack of survival swimming and breath control skills. His physical condition would have precluded his survival for over 4 days in the overcrowded liferaft.

17. The Coast Guard uninspected vessel regulations are inadequate because they do not require sufficient lifesaving and navigation equipment for documented vessels that operate offshore.

18. The PRIDE OF BALTIMORE was equipped with lifesaving equipment that exceeded the limited Coast Guard requirements for uninspected vessels.

19. The vessel was suitably equipped with lifesaving equipment for ocean service except for the liferafts.

20. The liferafts malfunctioned and deflated after deployment as a result of improper servicing. The inadequate design of the inflation/deflation topping-off valves and the improper servicing of the rafts contributed to the liferaft malfunction.

21. The life preservers would have been more accessible in a sudden emergency if they had been stowed on deck.

22. The crew was adequately equipped, trained, and drilled in the use of fire-fighting and emergency equipment.

23. The master of the PRIDE OF BALTIMORE failed to develop emergency procedures for the vessel and the crew in the event of a knockdown.

24. The operator and master of the vessel should have required crewmembers to have survival swimming skills.

25. The prolonged exposure by the survivors to the elements may have been shortened if the communication schedule has been maintained.

26. The Emergency Position Indicating Radio Beacons (EPIRB) were stowed below deck which made them inaccessible at the time of the accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the capsizing and sinking of the PRIDE OF BALTIMORE was the sudden onset of high velocity wind that exceeded the limits of the vessel's stability causing the vessel to heel until downflooding occurred. Contributing to the extensive downflooding was the lack of watertight bulkheads in the hull. Contributing to the loss of life was the inability of the crew to retrieve life preservers from their stowage below deck and the malfunction of the vessel's liferafts.

RECOMMENDATIONS

As a result of this accident, the National Transportation Safety Board made the following recommendations:

—to the U.S. Coast Guard:

Seek authority to require uninspected vessels on voyages offshore to carry a Class A Emergency Position Indicating Radio Beacon (EPIRB) and in the interim period, continue to encourage their use. (Class II, Priority Action) (M-87-1)

Publicize the advantages of stowing Emergency Position Indicating Radio Beacons (EPIRB) that are not required to float free (Classes B and C) in such a manner to afford immediate access and/or float-free deployment in the event of a sudden, catastrophic event. (Class II, Priority Action) (M-87-2)

Seek legislation to amend Title 46 U.S. Code Section 4102 to require uninspected vessels that operate offshore, in addition to the equipment listed therein, to carry navigation equipment, visual distress signals, and liferafts; in the interim period, pursue all available means to encourage their use. (Class II, Priority Action) (M-87-3)

Require stowage of life preservers close to or at emergency stations, if designated, or close to the exterior of each uninspected vessel to facilitate immediate access in the event of a sudden, catastrophic event. (Class II, Priority Action) (M-87-4)

—to Zodiac of North America:

Provide material to and require that authorized Zodiac service stations retrofit Zodiac MPUS-6 standard liferafts with improved topping-off (inflation/deflation) valves when servicing to eliminate the potential hazards of improper valve-plug placement during servicing and inadvertent valve-plug unseating and pressure loss experienced with the current valve design. (Class II, Priority Action) (M-87-5)

—to the Society of Professional Sailing Ship Masters:

Urge the members who serve as masters aboard sailing vessels to take the following steps to ensure the safety of their passengers and crew while underway:

- o Provide on-deck float-free stowage for life preservers.
- o Equip the vessel with a Class A (self-activating and float-free stowage) Emergency Position Indicating Radio Beacon (EPIRB).
- o Provide crewmembers with safety harnesses that incorporate compact inflatable devices for emergency flotation and tethers that also unclip at the harness.
- o During future servicing of any Zodiac inflatable Model MPUS-6 standard liferafts that may be in service aboard your vessels, specify that the liferafts be retrofitted with improved inflation/deflation valves as recommended by Zodiac.
- o Specify that inflatable liferafts be Coast Guard-approved rafts or equipped according to International conventions (SOLAS).
- o Disseminate to the members of your society, the details of this accident report including the associated recommendations.

(Class II, Priority Action) (M-87-6)

—to Pride of Baltimore, Inc.,:

Comply with the current Coast Guard regulations for passenger sailing vessels in ocean service in any future design, construction, and operation of sailing vessels including historic sailing vessels. (Class II, Priority Action) (M-87-7)

Develop and adhere to a 24-hour routine communications schedule in any future operations, so that any failure to meet the schedule would be immediately apparent. (Class II, Priority Action) (M-87-8)

—to the National Weather Service:

Intensify efforts to obtain visual observations of weather phenomena from aircraft transiting oceanic regions to improve Marine High Seas forecasts. (Class II, Priority Action) (M-87-9)

Include a warning of the potential for rapidly developing high winds in the vicinity of thunderstorms such as the warning used with the aviation Area Forecasts, with the Marine High Seas forecasts where no specific knowledge of thunderstorm intensity is available. (Class II, Priority Action) (M-87-10)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

PATRICIA A. GOLDMAN, Vice Chairman, did not participate.

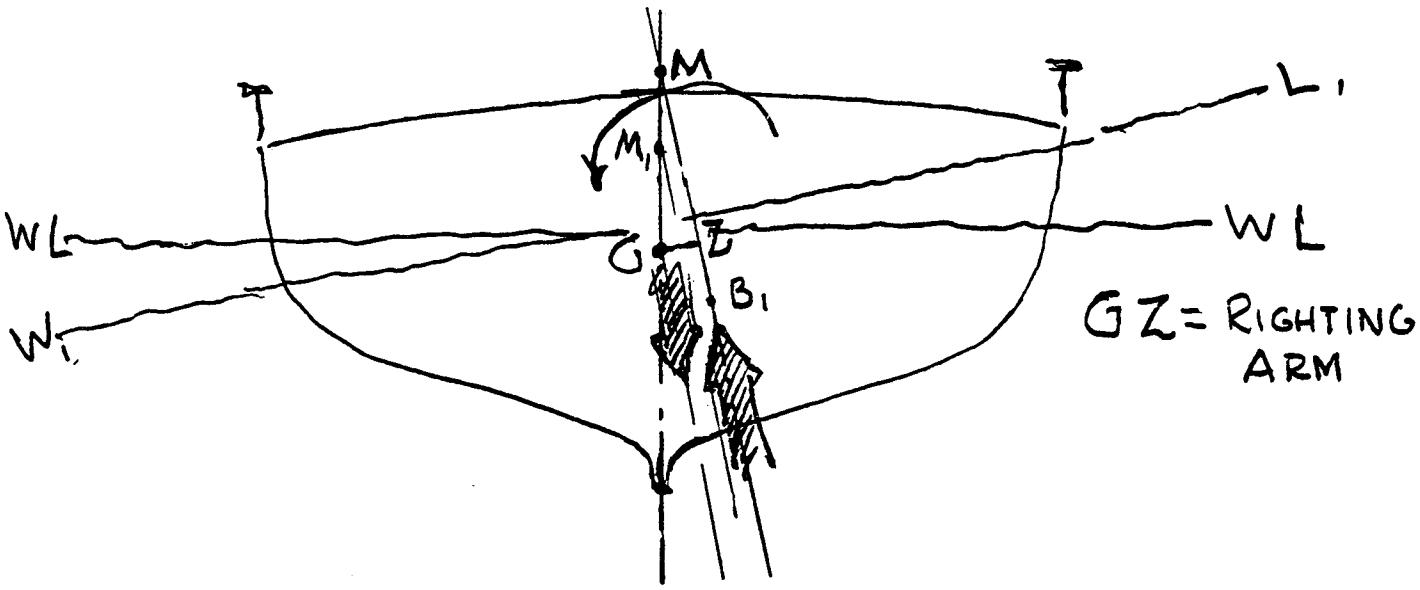
January 21, 1987

APPENDIXES

APPENDIX A

MASTER'S STABILITY INFORMATION

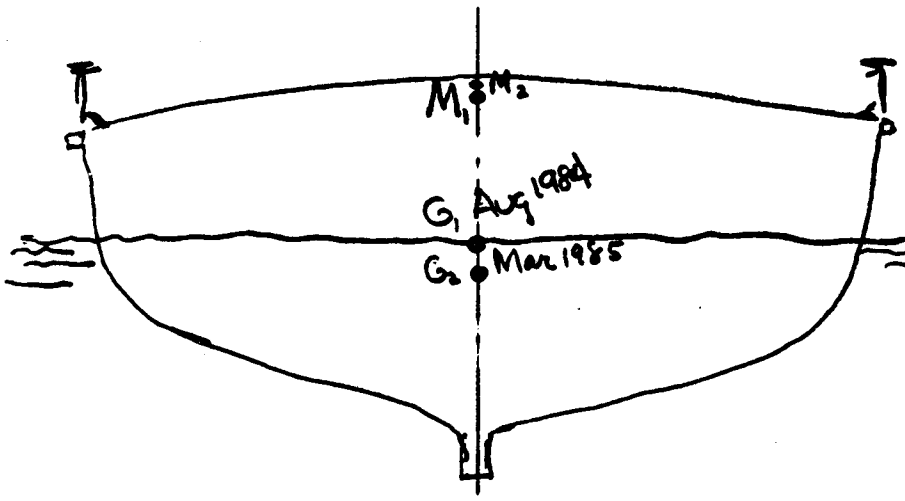
This is a cross-section of your boat, roughly in the middle.



Distance between G and M is called the GM Metacentric Height.

It is the measure of initial stability, or stiffness, up through seven to ten degrees. The higher M is and/or the lower G is the greater is this stability, and vice versa. M depends upon the amount of immersed hull volume and there is very little you can do about it. However, the center of GRAVITY, G, depends on where you stow weight, either on-board weight, or added or removed. Remember, G moves in response to the change in the system of weight distribution in the entire ship. The position of G moves proportionally toward or away from the added or removed or shifted weight.

PRIDE OF BALTIOMRE'S CURRENT STABILITY CONDITION



Aug '84, G_1 = 9.75'
Mar '85, G_2 = 8.84'

above keel

Lower G by 11 inches

Aug '84,
G_1M = 5.55'

Mar '85
G_2M = 6.36'

Increased GM by
9.72 inches

before top hamper

after top hamper

G_3M = 5.78 feet

with fuel and water on deck

GM = 5.72

DON'T RETURN TO 5.55 FEET

APPENDIX B

PERSONNEL INFORMATION

Armin E. Elsaesser III (deceased)

Armin E. Elsaesser III, 42, master of the PRIDE was experienced in all phases of boat operation from construction to sailing, both coastwise and offshore. He graduated from the University of Pennsylvania in 1966 with a BA degree with special courses in nautical science and oceanography. After a 3 year tour of duty in the U.S. Navy as an officer, he was a partner in a wooden boatbuilding firm in Maine. From 1973 to 1978, he was associated with various coastal vessels and sailing vessels as mate and master, including the 125-foot auxiliary schooner WESTWARD. He held a U.S. Coast Guard license as ocean operator (auxiliary sail) for vessels not over 100 gross tons, not over 100 miles offshore with a radar observer's endorsement. He also held a third class radiotelephone operator's license issued by the Federal Communications Commission.

John Flanagan

John Flanagan, 27, first mate had been a sailing instructor and had sailing experience on smaller sailing yachts prior to 1980. Since then, he has sailed on several larger sailing vessels including the schooners VOYAGER, MYSTIC WHALER, and the PRIDE OF BALTIMORE. He has sailed to the West Indies, the Pacific Coast, the Great Lakes, and has made various yacht deliveries between New Zealand, Australia, and Cypress in the Mediterranean Sea. He sailed aboard the PRIDE on two previous occasions. He possessed a 100 gross ton ocean operators license for both motor and sail.

Joseph K. McGeady, Jr.

Joseph K. McGeady, Jr., 26, second mate, graduated from college in 1982 with a BA degree in urban affairs. From an early age, he had extensive sailing experience on the Chesapeake Bay, both cruising and racing on sailing yachts up to 45 feet in length. He had served on the PRIDE for three prior voyages: Baltimore to San Francisco; Baltimore to Quebec, Canada; and Baltimore to Europe. He also had served on the APPLEDORE, an 85-foot topsail schooner on a voyage to the Dominican Republic and Haiti. He held a 75-ton auxiliary sail license for inland waters.

Leslie McNish

Leslie McNish, 30, bos'n, graduated from the University of California in 1978 with a BS degree in bio-chemistry. She sailed extensively offshore since 1977 on a large number of sailing yachts and schooners across the north Atlantic, Pacific, and Indian Oceans, the Mediterranean Sea, and the Caribbean Sea. She also was a Red Cross Water Safety Instructor and has an Advanced First Aid Certificate. She held a 100 gross ton ocean operators license for sail and power for coastal California waters.

Vincent Lazzaro (deceased)

Vincent Lazzaro, 27, engineer, graduated from the Fisheries and Marine Technology program at the University of Rhode Island in 1986. He served aboard various fishing vessels out of Portland, Maine, for approximately 4 years, fishing in the Gulf of Maine and Georges Bank. He had experience with gasoline and diesel engine as well as

marine hydraulic and electrical systems. Before joining the crew on the PRIDE he worked at the Hurricane Island Outward Bound School in Rockland, Maine, teaching boating courses and operating support power boats. He held a U.S. Coast Guard 100 gross ton ocean operators license.

Barry Duckworth (deceased)

Barry Duckworth, 29, had about 8 years experience on sailing vessels of various sizes including the 177-foot barkentine GAZELA OF PHILADELPHIA and the 128-foot schooner MYSTIC CLIPPER. Besides sailing, he worked as a carpenter and rigger on various vessels. He studied with the Westlawn School of Yacht Design for two summers while attending high school. His offshore experience includes passages along the east coast as far north as Nova Scotia and to the Virgin Islands.

Robert Foster, Jr.

Robert Foster, Jr., 23, deckhand, graduated from the U.S. Merchant Marine Academy in 1985 with a BS degree in nautical science. He also possessed a U.S. Coast Guard license as third mate, unlimited tonnage, oceans; he also possessed a U.S. Naval Reserve Commission. Beside his deep sea experience aboard commercial vessels during his training, he participated in sailing activities while at the Merchant Marine Academy and also served as a sailing instructor and a marina manager.

Scott A. Jeffrey

Scott A. Jeffrey, 26, received a BS degree in geography from the University of Maryland and earned a MS degree from Louisiana State University in 1984. Prior to joining the PRIDE, he had worked as an assistant scientist aboard an oceanographic research vessel, the R/V WESTWARD, a 135-foot staysail schooner for a period of about 6 months. His duties included oceanography, meteorology, and geology. The voyages were limited to the east coast of U.S. and Canada.

Susan M. Huesman

Susan M. Huesman, 23, graduated from Bucknell University in 1984 with a BS degree in civil engineering. She attended training courses aboard the schooner BRILLIANT at Mystic, Connecticut, and the Hurricane Island Outward Bound School in Rockland, Maine, for 3 weeks. She also had about 6 weeks experience aboard the PRIDE, first as an apprentice and then as a deckhand in 1984.

Daniel E. Krachuk

Daniel E. Krachuk, 22, had sailing experience aboard several larger sailing vessels such as the 130-foot brigantine YOUNG AMERICA, and the 115-foot brigantine ROMANCE. His offshore sailing experience consisted of a voyage from the Virgin Islands to Canada and to Martinique, French Antillies. He worked for the Philadelphia Maritime Museum aboard the 177-foot barkentine GAZELLA OF PHILADELPHIA as a shipwright's helper. He also served aboard the three-masted schooner VICTORY CHIMES for 2 months before joining the PRIDE in Spain.

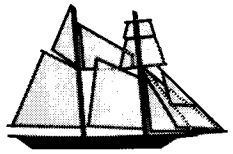
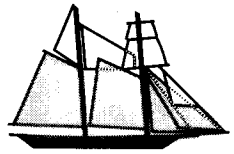
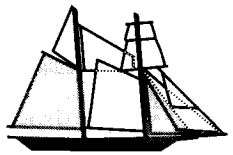
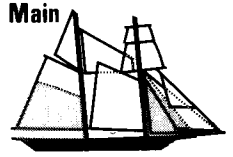
Jeanette F. Schack (deceased)

Jeanette F. Schack (Nina), 23, had attended Cornell University, majoring in landscape architecture. Her sailing experience included one summer of sailing aboard a 30-foot sloop in Hawaii in 1984 and as a trainee aboard the PRIDE for 2 weeks in 1984 on a voyage from Baltimore to Washington, D.C.

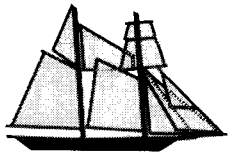
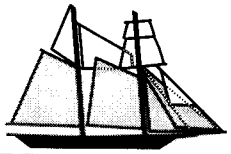
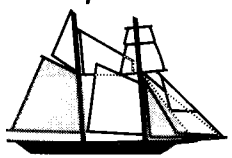
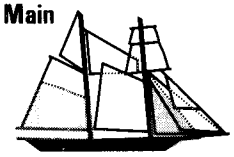
James C. Chesney

James C. Chesney, 25, the cook attended the University of New Hampshire as a part-time student and had completed course work as an emergency medical technician (EMT). He also studied navigation and marine biology at the Sea Education Association, Woods Hole, Massachusetts, aboard the research vessel R/V WESTWARD for 7 weeks. He was employed as cook in a number of restaurants and served as a crewmember of an oyster fishing vessel. His outdoor training included survival skills.

PRIDE OF BALTIMORE
Passenger Vessel Criteria

Ship Configuration / Parameter		OCEAN SERVICE					PARTIALLY PROTECTED WATERS				
		GM - Wx	Rt. Arm	Dk. Edge	DnFlood	Knockdn	GM - Wx	Rt. Arm	Dk.Edge	DnFlood	Knockdn
	Req. Value	6.64	90°	1.50	1.70	1.90	3.34	70°	1.00	1.10	1.25
Condition 1 Full Sail 	KG 8.8′	6.6′	97.9°	0.60	0.89	1.16	6.6′	97.9°	0.60	0.89	1.16
	9.3′	6.1′	LESS	STABILITY	- DEFICIENT		6.1′	LESS	STABILITY	- DEFICIENT	
	9.8′	5.6′	LESS	STABILITY	- DEFICIENT		5.6′	LESS	STABILITY	- DEFICIENT	
Condition 2 "Schooner" 	8.8′	6.6′	97.9°	1.20	1.78	2.33	6.6′	87.9°	1.20	1.78	2.33
	9.3′	6.1′	87.7°	1.10	1.55	1.80	6.1′	87.7°	1.10	1.55	1.80
	9.8′	5.6′	75.8°	1.00	1.31	1.30	5.6′	75.8°	1.00	1.31	1.30
Condition 3 Forestays'l & Full Main 	8.8′	6.6′	97.9°	1.98	2.95	3.85	6.6′	97.9°	1.98	2.95	3.85
	9.3′	6.1′	87.7°	1.82	2.56	2.98	6.1′	87.7°	1.82	2.56	2.98
	9.8′	5.6′	75.8°	1.66	2.16	2.15	5.6′	75.8	1.66	2.16	2.15
Condition 4-Casualty Forestays'l & Reefed Main 	8.8′	6.6′	97.9°	3.37	5.00	6.54	6.6′	97.9°	3.37	5.00	6.54
	9.3′	6.1′	87.7°	3.09	4.34	5.06	6.1′	87.7°	3.09	4.34	5.06
	9.8′	5.6′	75.8°	2.81	3.67	3.65	5.6′	75.8°	2.81	3.67	3.65

PRIDE OF BALTIMORE
Sailing School Vessel Criteria

Ship Configuration / Parameter		OCEAN SERVICE					PARTIALLY PROTECTED WATERS				
		GM - Wx	Dk. Edge	Rt. Arm	DnFlood	Knockdn	GM - Wx	Dk.Edge	Rt. Arm	DnFlood	Knockdn
	Req. Value	6.64	0.6	See Ocean Service Plots			3.34	0.6	See Prot. Waters Plots		
Condition 1 Full Sail 	KG 6.8′	6.6′	0.6	OK	NO	OK	6.6′	0.6	OK	NO	OK
	9.3′	6.1′	LESS	STABILITY	- DEFICIENT		6.1′	LESS	STABILITY	- DEFICIENT	
	9.8′	5.6′	LESS	STABILITY	- DEFICIENT		9.6′	LESS	STABILITY	- DEFICIENT	
Condition 2 "Schooner" 	8.8′	6.6′	1.20	OK	OK	OK	6.6′	1.20	OK	OK	OK
	9.3′	6.1′	1.10	OK	OK	OK	6.1′	1.10	OK	OK	OK
	9.8′	5.6′	1.00	NO	OK	NO	5.6′	1.00	NO	OK	NO
Condition 3 Forestays'l & Full Main 	8.8′	6.6′	1.98	OK	OK	OK	6.6′	1.98	OK	OK	OK
	9.3′	6.1′	1.82	OK	OK	OK	6.1′	1.82	OK	OK	OK
	9.8′	5.6′	1.66	NO	OK	NO	5.6′	1.66	OK	OK	OK
Condition 4-Casualty Forestays'l & Reefed Main 	8.8′	6.6′	3.37	OK	OK	OK	6.6′	3.37	OK	OK	OK
	9.3′	6.1′	3.09	OK	OK	OK	6.1′	3.09	OK	OK	OK
	9.8′	5.6′	2.81	NO	OK	NO	5.6′	2.81	OK	OK	OK

APPENDIX D

CHARACTERISTICS AND EQUIPMENT FOR THE ZODIAC MPUS-6 STANDARD PACK LIFERAFT

MPS — 6-8-10

MPS (Marine Pleasure Solas) liferafts are designed specifically for "deep-sea" or long range yachts. They are fully fitted out with standard safety equipment, and their design features make them excellent liferafts for those who cruise more than 100 miles offshore. You must be equipped for any eventuality out at sea. The MPS liferaft is built for any eventuality.

CHARACTERISTICS AND STANDARD EQUIPMENT

TYPE	DIMENSIONS INFLATED	# OF COMP.	COLOR	DIMENSIONS AND WEIGHT PACKED BAG	CANNISTER
Zodiac MPS 6 man	6'7"	3 + 1	Black with Orange Canopy	2'7"x1'7"x11½" 105.8 lbs.	2'7"x1'8"x1' 116.9 lbs
Zodiac MPS 8 man	9'2"			2'11"x1'8½"x1'1" 141.1 lbs.	2'11"x1'9½"x1'2" 154.3 lbs
Zodiac MPS 10 man	9'8"			3'x1'8"x1'1" 165.4 lbs.	3'2"x1'10"x1'2" 180.8 lbs

LOOSE EQPMT	FIXED EQPMT	DISTRESS EQPMT	MEDICAL EQPMT	SURVIVAL RATIONS
1 Rescue Quoit 1 Floating Knife 1 Bailer 1 Drogue Anchor 2 Paddles 2 Sponges 1 Repair Kit 1 Hand Pump 1 Sea Survival Instructions 1 Raft Operation Instructions 1 Fishing Kit	2 Boarding Ladders Interior Lifelines Exterior Lifelines Righting Handles on Bottom 1 CO2 Cylinder for Automatic Inflation 1 Lanyard	1 Signaling Mirror 1 Whistle 1 Waterproof Flashlight and Spare Set of Batteries and Bulbs 2 Parachute Flares 6 Hand Held Flares Rescue Signal Guide	50 g Antiseptic Cream 50 g Cream for Burns 1 Pair of Scissors 1 Tourniquet Assorted Bandages and Bandaids 6 Anti-seasickness Tablets per person	500 g of Emergency Rations of 2,250 Calories per person Over 2½ pints of water per person 3 Can Openers 1 Plastic Graduated Drinking Cup

MPUS-6 STANDARD PACK

Well proven over many years of service, the Zodiac MPUS-6 liferaft was redesigned to the present square hull configuration to prevent raft-spin. Manufactured to a precise standard, not down to a price, this raft is equipped to withstand the rigors of open ocean survival.

TYPE	DIMENSIONS INFLATED	# OF COMP.	COLOR	DIMENSIONS AND WEIGHT PACKED BAG	CANNISTER
Zodiac MPUS 6 man	Primary Tube Ø 10' Secondary Tube Ø 7' Canopy Tube Ø 6' Height 3'3" Length/Width 6'7"	3	Black with Orange Canopy	32"x20"x16" 66 lbs.	33"x21"x12" 77 lbs.

LOOSE EQPMT	FIXED EQPMT	DISTRESS EQPMT	MEDICAL EQPMT	SURVIVAL RATIONS
Floating Knife Drogue Anchor Rescue Quoit with Line Repair Kit and Instructions Bailer Sponge 2 Paddles Bellows	Interior and Exterior Grablines Boarding Ladder Towing Bridle Lanyard Interior and Exterior Lights with Seawater Activated Batteries Righting Handles on Bottom CO2 Cylinder and Firing Head DOT 3AA Overpressure Release Valve	2 Parachute Flares 3 Hand Held Flares Waterproof Flashlight Signaling Mirror Whistle	First Aid Kit Anti Seasickness Tablets	Fishing Kit 6 Canned Water 2 Canned Biscuit Ration 3 Can Openers Drinking Cup Survival Instructions

SY 6

The Zodiac SY 6 (Special Yachting 6 Man) is the only solution for skippers who realize the necessity for a liferaft, but have limited space and budget. This liferaft is ideal for owners of small craft who sail bay or coastal waters.

TYPE	DIMENSIONS INFLATED	# OF COMP.	COLOR	DIMENSIONS AND WEIGHT PACKED BAG	CANNISTER
Zodiac SY 6 man	7'5"	2	Black with Orange Canopy	2'3"x1'4"x7" 46.3 lbs.	2'4"x1'4"x7" 47.4 lbs.

LOOSE EQPMT	FIXED EQPMT	DISTRESS EQPMT
1 Drogue Anchor 1 Floating Knife 1 Paddle 1 Repair Kit 1 Hand Pump 1 Bailer Rescue Quoit with Line	1 Automatic Inflating CO2 Cylinder Interior Lifelines Exterior Lifelines 1 Water Ballast Pocket 1 Orange Canopy (manually erected) Righting Handles on Bottom 1 Lanyard	1 Signaling Mirror 1 Whistle 1 Waterproof Flashlight 2 Parachute Flares 6 Hand Held Flares

Zodiac strongly recommends liferafts be inspected yearly by a Zodiac approved liferaft service station. Contact your Zodiac dealer to obtain a list of authorized service centers.

2.2 THE MPUS 6 STANDARD PACK LIFERAFT

2.2.1 DESCRIPTION

A raft consisting of an inflatable hull of 2 main buoyancy tubes, fitted with a fabric bottom and a protective canopy

Inflatable Hull—The hull is formed of 2 separate buoyance tubes, square or hexagonal, one on top of the other; the upper tube supports an inflatable canopy arch.

Each tube is fitted with a CO_2 coupling, an overpressure relief valve, and a valve for manual inflation and deflation.

The canopy arch is automatically isolated from the upper chamber, after inflation and it also has a manual inflation/deflation valve.

Made of nylon fabric coated with neoprene, assembled by cold gluing, the raft's air-tightness is assured by sealing interior seams with glue.

Inflation—Inflation is assured by an automatically-fired CO_2 bottle fixed under the raft and connected to the buoyance tubes by a flexible hose and a T-shaped fitting with two non-return valves

A hand bellows provides for continued maintenance of pressure.

Bottom—Construction materials and methods are identical to those of hull.

Canopy—An international orange canopy is stretched between the arch and upper buoyance tube. It has one zippered opening.

Fabric coated on its exterior surface with PVC, assembled by stitching, is glued to the arch and upper buoyance tube.

Water Ballast Pocket—One water pocket is shaped and positioned to provide the best stability, whatever the load in the raft. It is constructed of hull fabric, stitched into shape, glued to the bottom.

Accessories

- Righting strap permits one person to right an overturned raft.
- Exterior lifeline permits persons in the water to move around raft to gain access to the canopy openings.
- Ladders, placed at each opening, facilitate boarding from the water.
- Interior lifeline allows crew to hold on while on board.

Visibility—Raft is made more visible to other vessels by an electric signal inside and outside, powered by seawater-activated batteries automatically opened and filled at the moment of inflation.

APPENDIX E

NATIONAL WEATHER SERVICE AREA WEATHER FORECASTS

Issued 0539, May 13, 1986 (local time)

Synopsis: High pressure over the forecast area will slowly move east and weaken while a weak low pressure trough will move off the southeast U.S. coast today and move east through Wednesday.

East of 72° west: Wind northwest to north around 15 knots becoming northeast 10 to 15 knots tonight and Wednesday. Sea 3 to 5 feet.

West of 72° west and south of 28° north: Wind east around 10 knots through Wednesday. Sea 2 to 4 feet. Elsewhere wind variable mostly southwest or west around 10 knots through Wednesday. Sea 2 to 4 feet. Scattered showers over the northwest part. Scattered showers and thunderstorms over the extreme southeast part. Elsewhere a few showers.

Issued 1139, May 13, 1986

Synopsis: High pressure ridge through 32° north, 73° west to 25° north, 65° west about stationary. A low pressure trough from the Windward Passage North over the southeast Bahamas is drifting west.

Northeast of the ridge line: Wind northwest 15 knots except up to 25 knots through tonight near Burmuda. Sea 3 to 5 feet except 6 to 9 feet with moderate to large northeast swells. Southwest of the ridge line: wind east to southeast 10 to 15 knots and sea 4 feet or less. Scattered showers and thunderstorms associated with trough between 65° and 75° west and south of 24° north. Elsewhere a few showers.

Issued 1739, May 13, 1986

Synopsis: High pressure ridge through 32° north, 73° west to 25° north, 65° west about stationary. A low pressure trough from the Windward Passage north over the southeast Bahamas is drifting west.

Northeast of the ridge line: Wind northwest 15 knots except up to 25 knots tonight near Bermuda. Sea 3 to 5 feet except 6 to 9 feet with moderate to large northeast swells. Southwest of the ridge line: Wind east to southeast 10 to 15 knots and sea 4 feet or less. Scattered showers and thunderstorms associated with trough between 74° west and 65° west south of 24° north. Elsewhere a few showers.

Issued 2359, May 13, 1986

Synopsis: High pressure ridge 32° north, 73° west to 25° north 65° west will move little through Wednesday night.

Northeast of ridge line: Northwest wind 15 knots except up to 25 knots tonight near Bermuda. Sea 3 to 5 feet, except 6 to 9 feet with moderate to large northeast swells near Bermuda. Southwest of the ridge line: east to southeast wind 10 to 15 knots and sea 3 to 5 feet. Scattered showers and thunderstorms extreme southeast part. Widely scattered showers and a few thunderstorms elsewhere.

Issued 0539, May 14, 1986

Synopsis: A ridge of high pressure along 30° north will move little through Thursday.

North of ridge: Wind west to northwest 10 to 15 knots except up to 20 knots east of 70° west. Sea 3 to 5 feet but up to 7 feet east of 70° west.

South of the ridge: Wind east to southeast 15 knots. Sea 3 to 5 feet. Wind and sea higher near scattered showers and thunderstorms east of 70° west. Widely scattered showers or thunderstorms elsewhere.

APPENDIX F

EXCERPTS FROM CREW HANDBOOK

EMGERGENCY PROCEDURES

The Station Bill is posted in the main hold and aft cabin. It prescribes duties for each crewmember and must be learned at once upon joining Pride. Emergency drills will be carried out periodically. Be sure to keep your life jacket in your bunk and accessible at all times.

Vigilence, forehandedness and common sense will safeguard against emergencies. If one should occur, action must be prompt and decisive. Know beforehand what you will do.

Man Overboard: In most situations a man overboard at sea is a man lost. However, every effort must be made to recover the person. Sing out, "Man overboard port/starboard side", post a lookout, throw MOB buoys overboard, prepare to handle sails and maneuver ship, engine on standby, notify the captain.

Fire: Know the location and type of each fire extinguisher aboard Pride. If you see or sense a fire, sing out immediately to let others know and prepare to extinguish the flame. May require starting the fire pump (Lister) and donning life jackets.

Abandon Ship: Don life jackets, prepare to launch inflatable life rafts. Secure food, water, navigational instruments, EPIRB.

APPENDIX G

EXCERPTS FROM U.S. COAST GUARD NAVIGATION AND VESSEL INSPECTION CIRCULAR 5-86, AUGUST 18, 1986

Chapter 2.

H. Position Reporting

1. The Master should inform the owner or other responsible person of his departure from port, the proposed area of fishing and approximate duration of the voyage. A float plan, similar to one recommended in the NPFVOA/USCG Vessel Safety Manual, should be completed and left ashore prior to departure. The Master should notify the same person of his return to port. Whenever possible, position reports should be sent at not more than 24 hour intervals so the last known position can be fixed with reasonable accuracy in the event of any mishap.

2. Voice privacy devices are available on the open market for persons who want their positions to remain private.

3 In case of radio failure, the captain should verbally pass his position to a nearby vessel (with radio facilities) so that it may be reported.

4. As required by the "Maritime Safety Act of 1984" (PL 98-498), an owner or other responsible person having reason to believe (because of the lack of communication with or non-appearance of a vessel or any other incident) that the vessel may have been lost or imperiled shall notify the Coast Guard and use all available means to determine the status of the vessel. The person notifying the Coast Guard should provide the:

   a. Name and identification number of the vessel; and

   b. Names of individuals on board.

5. The Act also states that the owner or other responsible person shall also submit written confirmation to the Coast Guard within 24 hours after verbal notification.

6. Notification required by the Act should be made to the cognizant Rescue Coordination Center (RCC) or local Search and Rescue (SAR) authority.

* U. S. GOVERNMENT PRINTING OFFICE: 1987- 181-101:40071