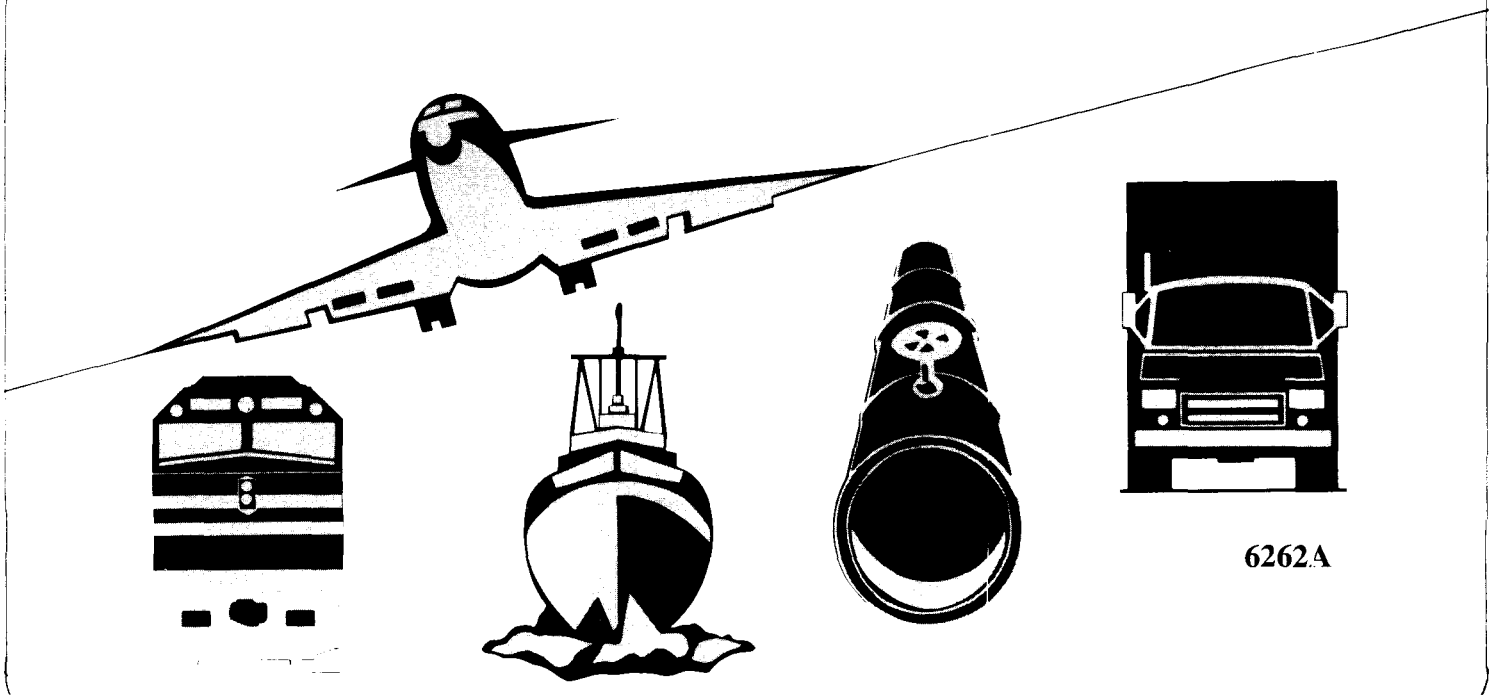
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NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

MARINE ACCIDENT REPORT

SINKING OF U.S. SMALL PASSENGER VESSEL
EL TORO II NEAR POINT LOOKOUT, MARYLAND
CHESAPEAKE BAY
DECEMBER 5, 1993



6262A

Abstract: On December 5, 1993, the U.S. small passenger vessel EL TORO II foundered in rough seas in the Chesapeake Bay. U.S. Coast Guard and U.S. Navy rescue personnel retrieved 23 survivors from the water. As a result of the sinking, three survivors died from the effects of hypothermia.

The major safety issues discussed in this report are the crew decision to embark on the fishing trip; Coast Guard, vessel owner, and industry inspection policies, procedures, and responsibilities for the detection of corroded fasteners on wooden-hulled vessels; bilge alarms for wooden-hulled small passenger vessels; survival craft aboard small passenger vessels that provide out-of-the-water flotation for passengers and crew; and adequacy of the Coast Guard utility boat as a rescue vessel.

As a result of its investigation, the Safety Board issued safety recommendations to the U.S. Coast Guard; the National Partyboat Owners Alliance, Inc.; the National Association of Charterboat Operators; the Passenger Vessel Association; and the Maryland Charterboat Association.

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

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SINKING OF U.S. SMALL PASSENGER VESSEL

EL TORO II

NEAR POINT LOOKOUT, MARYLAND

CHESAPEAKE BAY

DECEMBER 5, 1993

MARINE ACCIDENT REPORT

Adopted: September 7, 1994
Notation 6262A

NATIONAL
TRANSPORTATION
SAFETY BOARD

WASHINGTON, D.C. 20594

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EXECUTIVE SUMMARY

About 1430 on December 5, 1993, the 32-year-old wooden-hulled U.S. small passenger vessel EL TORO II foundered in rough seas while returning to St. Jerome Creek in Ridge, Maryland, from a fishing excursion in the Chesapeake Bay. U.S. Coast Guard and U.S. Navy rescue personnel retrieved the 20 passengers, 2 crewmembers, and the owner of the vessel from the water. As a result of the sinking, two passengers and the deckhand died from the effects of hypothermia.

The National Transportation Safety Board determines that the probable cause of the EL TORO II sinking was catastrophic flooding resulting from severely corroded hull fasteners that had remained undetected and uncorrected because of the lack of effective policies and procedures for inspecting, maintaining, and/or supplementing the structural integrity of wooden-hulled vessels. Contributing to the loss of lives was the lack of survival craft capable of providing out-of-the-water flotation for the passengers and crew.

The major safety issues discussed in this report are the crew decision to embark on the fishing trip; Coast Guard, vessel owner, and industry inspection policies, procedures, and responsibilities for the detection of corroded fasteners on wooden-hulled vessels; bilge alarms for wooden-hulled small passenger vessels; survival craft aboard small passenger vessels that provide out-of-the-water flotation for passengers and crew; and adequacy of the Coast Guard utility boat as a rescue vessel.

As a result of its investigation of this accident, the Safety Board makes recommendations to the U.S. Coast Guard; the National Partyboat Owners Alliance, Inc.; the National Association of Charterboat Operators; the Passenger Vessel Association; and the Maryland Charterboat Association.

INVESTIGATION

Accident

About 0815 on December 5, 1993, the EL TORO II, a 58-foot wooden-hulled U.S. small passenger vessel (see figure 1 for a vessel similar to the EL TORO II), departed St. Jerome Creek in Ridge, Maryland, with 20 passengers for a day fishing trip in the Chesapeake Bay. The crew consisted of an operator (captain) and a deckhand; the vessel owner[1] was also on board.

The owner and the operator of the EL TORO II had listened to weather forecasts before the trip on the evening of December 4 and knew the weather conditions expected in the Chesapeake Bay area for December 5. When the EL TORO II left the pier that morning, the weather conditions were light rain, calm seas, and no wind. The operator of the EL TORO II stated that he talked by radio to other boat operators in the intended fishing area (about 16 miles from the departure point) and confirmed that similar weather conditions prevailed there also. The National Weather Service (NWS) had issued a small craft advisory[2] for Chesapeake Bay on December 5, and the operator stated that he was aware of this advisory before departure.

The EL TORO II traveled to an area south of the Maryland-Virginia border. (See figure 2.) The vessel arrived about 1000 at the fishing grounds east of Smith Point, Virginia, where other charter boats were engaged in fishing the Virginia waters. (The rockfish season had closed in Maryland.) The EL TORO II party trolled for about 2 1/2 hours. The operator testified that about 1245, the wind shifted, the waves were about 1 foot, and the rain became steady and heavy. Most passengers stopped fishing and sought shelter in the passenger cabin. The operator and the owner decided about 1250 to return to St. Jerome Creek. The other charter boats from Maryland, which had started fishing in the area about 2 hours earlier than the EL TORO II, had already left the fishing area with their quota of fish.

About 1335, the waves were about 6 feet. The operator felt the vessel reacting sluggishly, as if it had taken on water, and he asked the deckhand to check the bilges[3] in the engine compartment. The deckhand raised the engine compartment hatch cover and looked in; he then reported to the operator that he had not seen any water. The vessel owner testified that the engine sputtered 15 to 20 minutes later and that the operator asked him to take the wheel. The operator checked the engine compartment and found the compartment flooded nearly to the top of the engine. Recognizing that the vessel was in danger of sinking, the operator returned to the

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[1]The individual who is referred to as the vessel owner throughout this report is the president of Chesapeake Bay Fishing Parties Inc., which was the owner of record for the EL TORO II.

[2]According to the NWS, small craft advisories are issued when sustained winds of 18 to 33 knots are occurring or expected to occur within 12 hours. The lower limit of 18 knots is adjustable upwards for certain geographic regions where boats are operated in higher wind conditions. The NWS does not have a legal definition of small craft, but the term refers conceptually to vessels that are 30 or less feet long.

[3]The lower part of holds and machinery compartments, where water may accumulate.



Figure 1. -- A vessel similar to the EL TORO II.

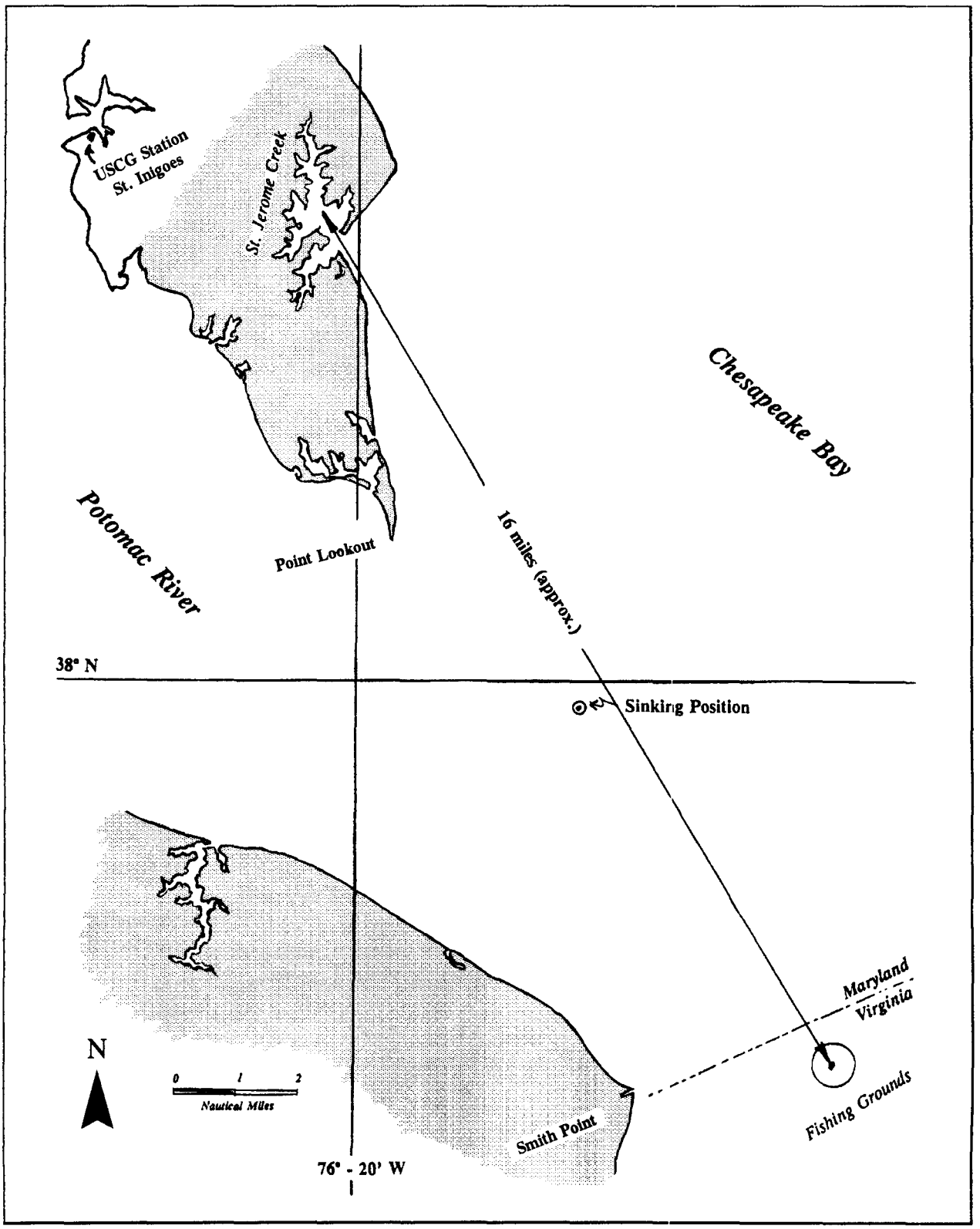


Figure 2. -- The EL TORO II route on the day of the accident.

pilothouse and instructed the owner to call the U.S. Coast Guard for assistance. The owner transmitted the first distress call at 1400 on radio VHF-FM channel 16. The operator and deckhand then went to the passenger cabin where they instructed the passengers to don life preservers[4] and assisted the passengers in doing so. While waiting for the Coast Guard to arrive, several passengers, the operator, and the deckhand bailed water from two of the hatches for about 30 minutes, but they could not keep up with the ingress of water. (Investigators later determined that all five compartments on the vessel had flooded.)

Two passengers lowered the rigid buoyant apparatus[5] (see figure 3) from atop the passenger cabin onto the main deck, and the operator and some passengers then launched the buoyant apparatus. When waves began to wash over the bow and threatened to demolish the plywood passenger cabin, the operator stated that he gave the order to abandon ship. The owner had remained on the radio with the Coast Guard until the operator gave this order at 1436. Nineteen people, including the crew and the owner, clung to the rigid buoyant apparatus in the water; three people were on top of the pilothouse, which was above the water at that time; and another passenger drifted alone. At that time, the wind gusts were estimated by the Coast Guard to be 30 to 40 knots from the northwest and the waves to be 6 to 8 feet.

The USCG Station St. Inigoes, about 16 miles from the accident site, dispatched a 41-foot utility boat (UTB) with nine crewmembers aboard at 1405 to assist the EL TORO II. At 1412, the SAR (search and rescue) Mission Coordinator (USCG Group Baltimore) requested air support (helicopters) from the Patuxent River Naval Air Station, Patuxent, Maryland, and the USCG Air Station, Cape May, New Jersey. After notification by the USCG Station St. Inigoes, the Ridge Volunteer Fire Department (RVFD) set up a command post and triage area at 1417 at Point Lookout State Park, Point Lookout, Maryland. The 14 survivors, brought in by helicopters to the triage area, were sheltered in a school bus until ambulances transported them to local hospitals. The UTB arrived at the triage area at 1820 with the nine remaining survivors, who were evaluated by emergency medical services (EMS) personnel and then transferred by ambulances to area hospitals. The deckhand and two passengers later died in the hospitals from the effects of hypothermia.

The flooded EL TORO II had sunk until only a part of the pilothouse remained above water and was towed after the accident to the Point Lookout Marina.

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[4]The EL TORO II carried cork life preservers that were manufactured before July 1965. Title 46 Code of Federal Regulations (CFR) 160.003 specifies design standards for cork life preservers that were manufactured between October 1948 and July 1965, but it does not contain shoulder-seam performance specifications or test requirements for shoulder-stitch strength. These cork life preservers are no longer manufactured because they do not meet the International Maritime Organization Safety Of Life At Sea 1960 Convention requirements that life preservers support a person's head and turn an unconscious person face up in the water. However, the Coast Guard marine safety manual (volume 2 - COMDTINST M16000.10) states that cork life preservers in good condition may continue in service.

[5]Flotation equipment with a line attached around its outer periphery. Survivors in the water hold onto this line. The apparatus lacks a platform to support survivors out of the water.

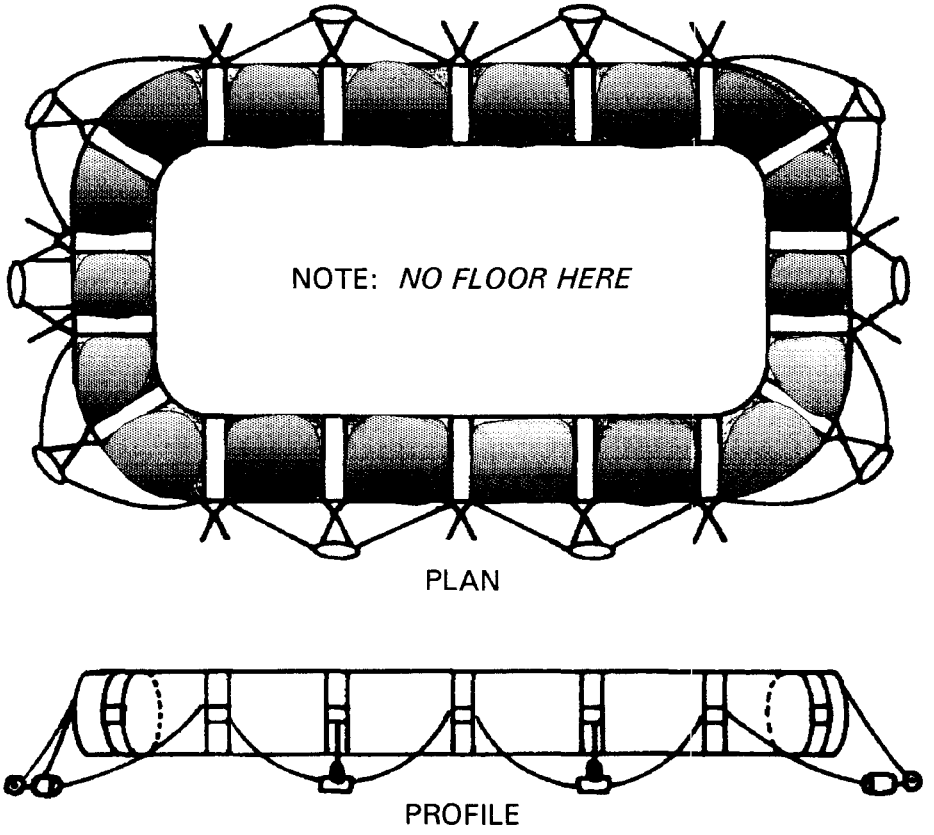


Figure 3. -- Illustration of a typical rigid buoyant apparatus.

Injuries

	Vessel Personnel	Passengers	Total
Fatal	01	02	03
Minor	02	18	20
Total	03	20	23

Vessel Damage

During a 1987 insurance survey, the value of the EL TORO II was estimated at $59,000. The EL TORO II was a total constructive loss.

Vessel Personnel

Operator -- The 30-year-old operator of the EL TORO II began working in 1979 as a deckhand on commercial fishing vessels. In 1984, the operator completed a captain's course offered by Houston Marine Services, Kenner, Louisiana, to prepare for his Coast Guard license examinations and received the Coast Guard license, Master Inland Steam or Motor Vessels of not more than 25 tons. He had operated fishing party vessels since 1984 and had operated fishing party boats for the previous owner of the EL TORO II between 1986 and 1988. The operator had worked since 1989 for his father who was the present owner of the EL TORO II.

During the 1993 fishing season, the operator had usually operated the EL TORO II and preferred to operate that vessel rather than the other company boats. He testified that he had operated the EL TORO II and other fishing boats in adverse weather conditions; however, he had not been in command or aboard a boat during an operating emergency and had never encountered an accident involving the flooding of a vessel. The operator had not received any operational or classroom training that addressed vessel flooding. He had participated in company drills using life rings and life preservers but no liferafts.

The operator had left Ridge about 0300 on December 1 to crab in Chesapeake Bay and had arrived home about 2145 on December 3. He rose about 0615 on December 4, took a fishing party out during the day, returned to Ridge about 1605, spent the evening with his family, and retired about 2100. On the day of the accident, he rose about 0630, went to the dock, checked over the EL TORO II, pumped its bilges, and loaded fishing gear on board for the trip that day.

Deckhand -- The 19-year-old deckhand had been employed by Chesapeake Bay Fishing Parties Inc. since May 9, 1993. He was considered by the owner and the operator to be competent in the performance of his duties. The deckhand was not required by Coast Guard regulations to meet any operating standards or to hold a Coast Guard license.

Owner -- The 53-year-old vessel owner had occasionally operated the Chesapeake Bay Fishing Parties Inc. head boats[6] during the busy season when it was difficult to obtain another operator for a trip. On most fishing trips, such as the one on December 5, 1993, the owner assisted the passengers with their fishing equipment. In 1984, he completed a captain's course offered by Houston Marine Services and also received the Coast Guard license, Master Inland Steam or Motor Vessels of not more than 100-gross tons. He stated that he had worked in the Chesapeake Bay commercial fishing industry most of his life, primarily in the clam, oyster, and crab trade. Other fishing boat operators stated that he is a competent boat handler and is knowledgeable about the weather.

Vessel Information

General Characteristics of the EL TORO II

Length:	58.0	feet	Gross Tons:	17
Breadth:	15.7	feet	Net Tons:	12
Draft:	3.25	feet (approximate)	Horsepower:	310

Built in 1961, the wood-constructed EL TORO II was Coast Guard certificated to carry 49 passengers with 2 crewmembers, when operating less than 12 hours in any 24-hour period. The vessel had passenger accommodations (no overnight) above deck in the plywood cabin immediately aft of the pilothouse, which was near the bow. Below the main deck, the vessel was divided into five compartments by wooden bulkheads, which were not required by Coast Guard regulations to be watertight. The hull bottom was transversely framed with 2-inch-thick pine planks from the chine to the keel. Galvanized steel nails were used to fasten the hull bottom planking. (See figure 4 for a depiction of the EL TORO II showing compartments.)

[6] A head boat operates on a fixed schedule for fishing excursions. Passengers pay individually (by the head) and do not charter the boat as a group.

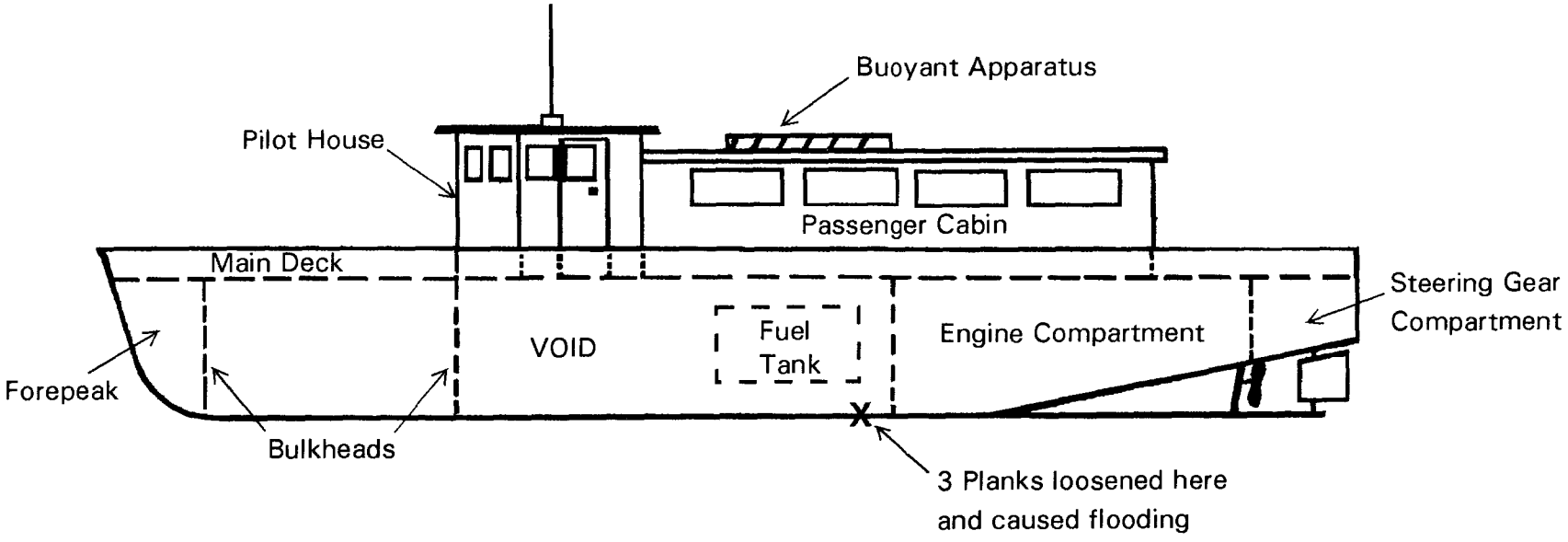


Figure 4. -- A depiction of the EL TORO II showing compartments.

Waterway Information

The EL TORO II had departed St. Jerome Creek in Maryland and travelled about 16 miles to the fishing grounds, which are south of the Maryland-Virginia border in Virginia waters about 3.5 miles east of Smith Point, Virginia. The EL TORO II foundered in the Maryland waters (approximately 39 feet deep) of Chesapeake Bay near the mouth of the Potomac River about 4.5 miles southeast of Point Lookout, Maryland (see figure 2). The nearest point on the Virginia shoreline was also about that distance from the accident site.

Operations Information

The EL TORO II is one of five wooden-hulled fishing vessels owned since 1989 by Chesapeake Bay Fishing Parties Inc. in Ridge. The small family-owned company operated three vessels as charter boats and two vessels, including the EL TORO II, as head boats for fishing in the Chesapeake Bay. The company operates boats 7 days a week during the fishing season, which is usually from May to October. (The owner decided to operate 2 extra months during 1993.) In 1993, the company employed four full-time boat operators as well as three part-time operators for the weekends. The company also usually hires three or four full-time and four or five part-time deckhands, who assist the passengers with fishing and fish cleaning.

The owner testified that he performed the drydock general maintenance on the EL TORO II at local boatyards at the beginning of each season as a regular company practice. He stated that during the drydock maintenance, he cleaned, scraped, and painted the hull; he also recaulked, where needed, and fixed visible defects. The owner replaced zinc anodes,[7] as necessary, to protect the propeller, rudder, and other metallic hull fittings from galvanic corrosion, and minor leakages from rudder and propeller stuffing boxes were also repaired during the annual drydock maintenance. He and his son (the operator of the EL TORO II) performed most of the maintenance work, including the routine preventative machinery maintenance, such as changing the engine and transmission oils and filters. The owner said that he relied on the Coast Guard recommendations and guidance for other needed repairs beyond routine maintenance.

Safety Board investigators ascertained that employees of the owner, most of whom were vessel operators with the company during the fishing season, had painted the EL TORO II in 1992 and 1993 at two different marina drydock yards. One of the yard proprietors observed that the owner had overseen the work of his employees and noted that the EL TORO II hull was in better than average condition compared with other wooden boats in the area.

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[7] A slab of zinc that is fastened to the hull to prevent corrosion due to galvanic action. The zinc wastes away and must be replaced periodically.

Meteorological Information

The NWS provides the marine weather forecasts for the Chesapeake Bay. At 0339 on December 5, 1993, the NWS had issued a small craft advisory with southwest winds at 25 to 30 knots expected to shift to northwest winds at 25 to 30 knots in the morning. Average waves were forecast at 4 feet. The 0853 and 0933 NWS forecasts indicated shifting winds of 20 to 25 knots becoming northwest 30 to 35 knots and average waves building to 6 feet with a gale warning[8] in effect. At 1218, the NWS forecasted north to northwest winds of 30 to 40 knots and average waves of 6 feet with the gale warning still in effect.

In addition, the Patuxent River Naval Air Station recorded the following surface wind observations on December 5:

Time	Winds
0555	12 knots from 170° (SSE)
0655	08 knots from 180° (S)
0755	05 knots from 130° (SSE)
0855	calm
0955	calm
1055	16 knots with gusts to 24 knots from 010° (NNE)
1155	18 knots with gusts to 36 knots from 010° (NNE)
1255	20 knots with gusts to 37 knots from 010° (NNE)
1355	24 knots with gusts to 36 knots from 360° (N)
1455	24 knots with gusts to 38 knots from 340° (NNW)
1555	23 knots with gusts to 37 knots from 340° (NNW)

See appendix A for relevant marine forecasts and surface weather observations for the Chesapeake Bay area for December 4 and 5, 1993.

Pathological and Toxicological Information

The 19-year-old male deckhand died in St. Mary's Hospital, Leonardtown, Maryland, of cardiac arrest due to hypothermia. In addition, a 64-year-old male passenger died in the Washington Hospital Center, Washington, D.C., of cardiac arrhythmia due to hypothermia, and a 45-year-old male passenger died in Patuxent River Naval Hospital, Patuxent, Maryland, of hypothermia. The remaining survivors, including some UTB crewmembers, were treated for hypothermia at area hospitals and released.

[8]Gale warnings are issued when sustained winds of 34 to 47 knots are occurring or expected to occur within 24 hours.

The owner of the EL TORO II had a blood specimen taken about 1730 during his emergency treatment assessment at St. Mary's Hospital after the accident. The operator voluntarily provided a blood specimen at 2045 to Patuxent River Naval Hospital personnel under the direction of the Maryland State Natural Resources Police (NRP). The Safety Board requested that samples remaining after the testing by the hospital for the owner and by the NRP for the operator be tested for drugs at the Center for Human Toxicology (CHT) in Salt Lake City, Utah. The CHT test results of both blood specimens were negative for all tested substances: ethanol, cannabinoids, cocaine and cocaine metabolites, opiates, amphetamine, phencylide, and acid neutral drugs.

Postaccident Vessel Examination

The flooded EL TORO II was towed after the accident to the Point Lookout Marina, where water was pumped out of the vessel. National Transportation Safety Board investigators examined the vessel after it was hauled out of the water. The investigators found that the pilothouse had broken free from the vessel and was laying on its side on the deck; the passenger cabin was missing, presumably torn off during the accident. (See figure 5.)

The wooden planks on the bottom of the hull appeared to be in sound condition with the exception of three transverse planks that had separated (sprung) from the keel[9] on the port side. (See top photograph in figure 6.) These planks were in the compartment forward of the engine compartment immediately forward of the forward engineroom bulkhead. Safety Board investigators detached the loose planks from the hull and found most of the fasteners (nails) that had attached the planks to the keel were entirely wasted due to corrosion; the few nails that remained were corroded to wire-thin proportions. However, the nails that connected those three planks to the chine,[10] (at a higher level than the keel), were in good condition. (See bottom photograph in figure 6.) Investigators found no significant visual clues, such as dark patches on the wood, to indicate that corroded nails may have been embedded within the wood. (Because wooden plugs that are flush with the exterior hull surface cover the nail heads, they are not visible from the exterior. Before a nail can be examined or pulled, these plugs must be removed.)

To assess the overall condition of the nails on the vessel, the investigators pulled three planks at random from other parts of the vessel that were unaffected by accident damage. Planks were pulled from the engine compartment, from the bow on the starboard side, and from the starboard side directly across from the sprung planks on the port side. The condition of the nails on the planks pulled from the engine compartment and the bow was substantially better than the

[9]A central fore-and-aft structural member in the bottom of a hull, extending from the stem to the stern.

[10]Intersection of the sides and bottom of a vessel.



Figure 5. -- The EL TORO II after the accident.

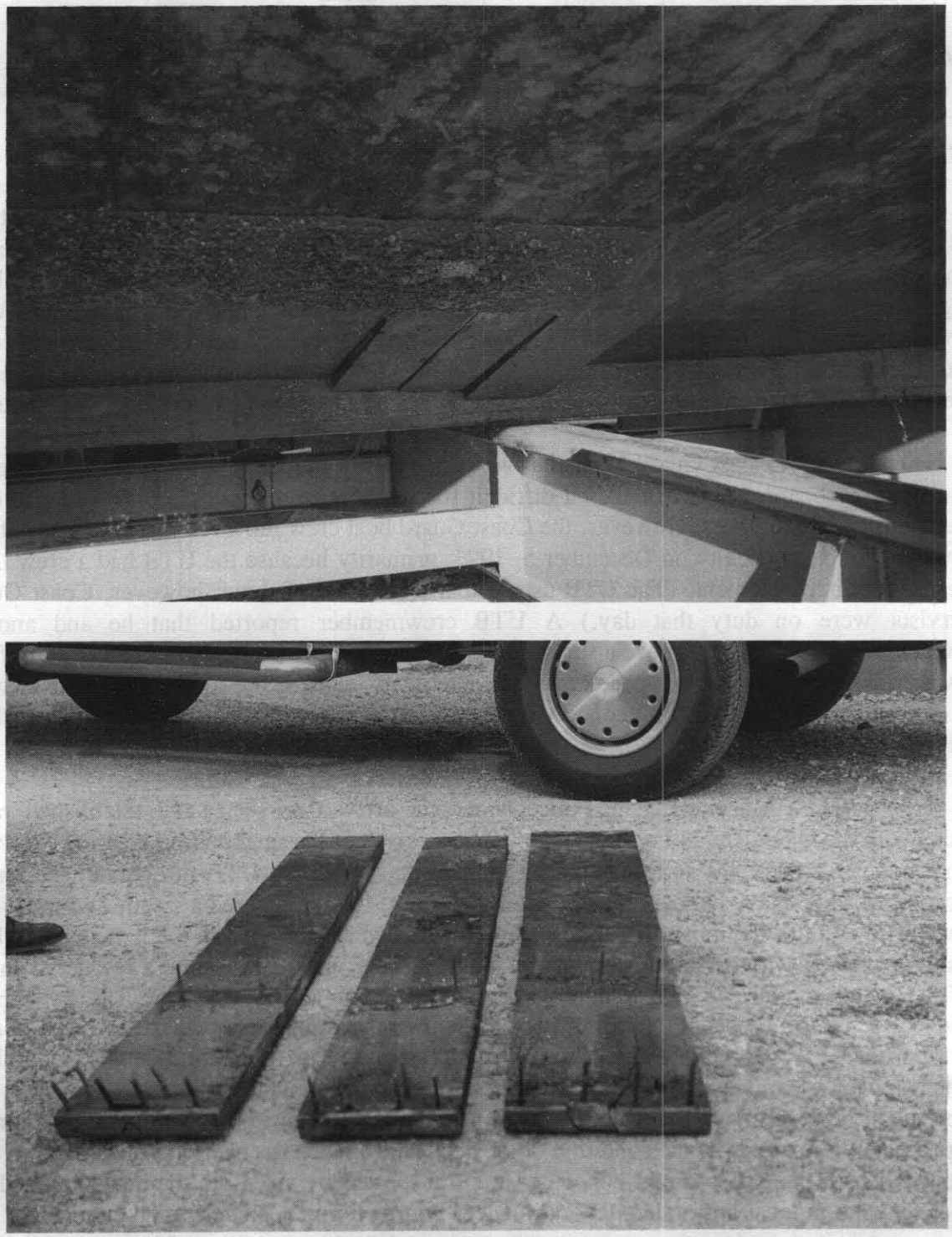


Figure 6. -- Top photograph: view of the three sprung transverse planks after the EL TORO II was hauled out of the water. Bottom photograph: the three transverse planks show few remaining corroded nails at keel (far plank end) and intact nails at chine (near plank end).

condition of the nails on the starboard side of the sprung planks near the keel. These latter nails had corrosion similar to the nails from the sprung planks.

Survival Aspects

The Coast Guard-approved rigid buoyant apparatus carried on board the EL TORO II was capable of accommodating 20 people. (See figure 3.) After abandoning the vessel, 19 people clung to the buoyant apparatus. The operator of the EL TORO II estimated that he had been clinging to the buoyant apparatus in the water about 15 minutes when the Coast Guard UTB arrived on scene. The UTB was the first rescue resource to arrive and reached the accident scene about 1450. The UTB first rescued the person drifting alone in the water and then deployed an inflatable liferaft to rescue the three people who were on top of the EL TORO II pilothouse.

The 41-foot Coast Guard UTB that was used during the EL TORO II rescue operation has a high freeboard,[11] which makes it difficult for rescuers to pull people on board from the water in 6- to 8-foot waves. However, the Coast Guard boat crew retrieved most survivors from the water without difficulty on December 5, 1993, primarily because the UTB had a crew three times its usual complement. (The UTB usually carries a crew of three; however, Coast Guard reservists were on duty that day.) A UTB crewmember reported that he and another crewmember attempted to retrieve a survivor by grabbing his life preserver and lifting him from the water. The life preserver ripped across both shoulders, causing the survivor to fall backward into the water. The survivor immediately surfaced, and the crewmembers lifted him aboard the UTB without injury.

At 1503, a Maryland State Police helicopter arrived on scene and established radio contact with the UTB. The police helicopter began a search of the surrounding area for survivors at the request of the UTB and remained in radio contact with the UTB throughout the rescue operation. A U.S. Navy helicopter arrived on scene at 1510 and lowered a rescue swimmer into the water to identify the most distressed people for immediate retrieval to the helicopter. About 12 minutes later, a Coast Guard helicopter arrived on scene and also lowered a rescue swimmer into the water to retrieve two children and a woman into the helicopters. The helicopters retrieved a total of 10 people and transported them to the triage area, where EMS personnel from the RVFD were waiting. The rescue swimmers assisted the remaining people, who clung to the buoyant apparatus and were in the water for up to 80 minutes, on board the UTB. All people were retrieved from the water by 1554, and the UTB departed with 13 survivors for the triage area. While en route, the condition of the deckhand and a passenger deteriorated, and they were lifted onto the Coast Guard helicopter and transported by air. Both the deckhand and the passenger died in local hospitals a few days later. Fourteen minutes later, another survivor and a rescue swimmer, who were suffering from hypothermia, were transferred to the Navy helicopter. They were treated and released from the hospital.

[11]The distance between the water and the continuous deck level of a ship.

The loss of a survivor's body heat to the water is usually the cause of hypothermia in marine accidents. The environment (water and air temperatures and wind velocity in combination) to which a survivor is exposed limits the time available for rescue.[12] The following table[13] lists the effects of hypothermia over time as relates to water temperature.

Water temperature in degrees fahrenheit	Exhaustion or unconsciousness	Expected time of survival
32.5	under 15 minutes	under 15 to 45 minutes
32.2 to 40	15 to 30 minutes	30 to 90 minutes
40 to 50	30 to 60 minutes	1 to 3 hours
50 to 60	1 to 2 hours	2 to 6 hours
60 to 70	2 to 7 hours	2 to 40 hours
70 to 80	3 to 12 hours	3 hours to indefinite
over 80	indefinite	indefinite

The air and water temperatures were 48 and 54 °F, respectively. The three fatalities (the deckhand and two passengers) were in the 54-°F water between 55 and 80 minutes. The rigid buoyant apparatus from the EL TORO II, onto which the 19 people held, was not designed to keep them out of the water.

Metallurgical Tests

During the investigation of the EL TORO II accident, the Safety Board laboratory in Washington, D.C., confirmed that the nails used to fasten the hull bottom planking on the EL TORO II were made of galvanized steel. The nails had square shanks (cross sections) and are typically called cut nails.

[12]Other factors that can affect the expected survival time include the survivor's initial body temperature; physical condition; activity; state of exhaustion, thirst, and hunger; and psychological stresses as well as the type and wetness of clothing worn.

[13]Source: 33 CFR 181.705.

Other Information

Accident History of Wooden-Hulled Small Passenger Vessels -- The Safety Board investigated the May 19, 1973, sinking of the charter fishing vessel COMET[14] and determined that the sinking was probably caused by major, undetected flooding due to the ingress of water through deteriorated hull planking. Since the COMET sinking, the Safety Board has investigated other accidents[15] that involved small passenger vessels and has found that older wooden vessels, including small passenger vessels, have unique safety problems inherent in their hull construction materials. The 1985 through 1991 accident statistics obtained from the Coast Guard show that a disproportionate higher number of wooden passenger vessels have accidents compared with passenger vessels constructed of other hull materials. The fleet of Coast Guard-inspected small passenger vessels is constructed primarily of wood, steel, aluminum, and fiberglass (24, 23, 26, and 25 percent, respectively). The accident statistics show as many as 41 percent of accidents that entailed vessel flooding and foundering involved wooden-hulled vessels; however, a lower number of these accidents involved vessels constructed of steel, aluminum, and fiberglass (19, 11, and 15 percent, respectively).

After the sinking of the EL TORO II, the Coast Guard inspected the OLYMPUS I, which is a vessel similar in design to the EL TORO II that belongs to the same owner. Coast Guard inspectors found severe corrosion of fasteners in a localized area near its keel, and the owner then renailed the hull of the OLYMPUS I in that area.

As a result of the March 1985 sinking of the Coast Guard-inspected small passenger vessel CAPTAIN CRUNCH, a 29-year-old, 65-foot-long wooden-hulled vessel capable of carrying up to 50 people, the Commandant of the Coast Guard issued a notice to all Coast Guard districts in March 1985 (ALDIST 091/85) about the inspection of wooden-hulled small passenger vessels. (See appendix B.) The notice emphasized the need for thorough inspection of wooden-hulled small passenger vessels over 15 years old and stated, "the hull integrity of older wooden T-boats[16] is an area of particular concern." The ALDIST advised inspectors to look for signs that might indicate problems with the integrity of the hull, such as dark areas in the hull, indicating wood decay or fastener wastage; increased working of the hull when underway; and increased use of bilge pumps; however, it did not require the pulling of fasteners for inspection.

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[14]Marine Casualty Report--*Foundering of the Motor Vessel COMET off Point Judith, Rhode Island, on May 19, 1973, with Loss of Life* (USCG/NTSB-MAR-75-4).

[15]Marine Accident Reports--*Charter Fishing Boat PEARL-C Sinking on the Columbia River Bar near Astoria, Oregon, September 13, 1976* (NTSB/MAR-77/1); *Sinking of the Passenger Vessel COUGAR off the Coast of Oregon, September 15, 1988* (NTSB/MAR-90/02); and *Brief Format Issue Number 9--Reports Issued December 3, 1992* (NTSB/MAB-92/01).

[16]Small passenger vessels are informally called T-boats because these vessels are certified by the Coast Guard under 46 CFR Subchapter T (Parts 175-187).

The Coast Guard reported after its investigation of the CAPTAIN CRUNCH:

> [T]here is strong evidence that some of the vessel's fastenings were weak. This allowed noticeable relative movement...of the strength members in a seaway, making them looser.... Ultimately an opening developed which allowed the entry of water faster than the installed pumps could dewater.
>
> The vessel was known to ship a considerable amount of water. This water entered through plank seams and other hull leaks. These problem areas were continually being caulked or plugged as they were identified. The installation of additional bilge pumping capacity enabled the vessel to stay ahead of the bilge water problem.

The safety of wooden-hulled small passenger vessels is also addressed in a 1991 Coast Guard study[17] that evaluated lifesaving systems for small passenger vessels. The accident cases analyzed in the study included only accidents in which abandonment of the vessels was necessary. Although hull construction material was not considered when selecting the vessels for the study, 15 of the 16 small passenger vessels had wooden hulls. The high proportion of wooden vessels indicates the significantly higher susceptibility of wooden vessels to develop safety problems, including undetected hull deterioration. At least four of these wooden-hulled vessels (COMET, ZEPHYR II, SUNRISE II, and ALMA III) sank after flooding that occurred when hull planking had sprung or become detached from the hulls because of its poor and aged condition. Fourteen of the 16 accidents involved small passenger vessels like the EL TORO II that were engaged in charter fishing or head boat service. (See appendix C.)

The study further concluded:

> The vessels involved in accidents had an average age of 26 years. Sixteen years is the average age of the entire small passenger vessel fleet. Older wood vessels are susceptible to undetectable deterioration of the hull.
>
> Vessels over 20 years old are more susceptible to flooding and foundering than newer vessels, and a large percentage of vessels in this age group are wood.

This study also reported the following findings in the Coast Guard investigation of the 1983 sinking of the SUNRISE II:

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[17] *A Study of Lifesaving Systems for Small Passenger Vessels, Based on an Analysis of Casualties since 1973*, R.L. Markle, U.S. Coast Guard, March 29, 1991.

> [O]f the vessel casualties reported between 1981 and 1983, 134 involved wooden vessels, and the primary cause of casualty was "failed materials, structural." These structural material failures resulted in either flooding or foundering (sinking) of all 134 vessels.... of the 134, 6[18] are Coast Guard inspected passenger vessels, the remaining are mainly various types of uninspected fishing vessels.

The Coast Guard inspects more than 5,000 small passenger vessels each year, of which about 1,400 are wooden hulled and at least 1,000 are over 15 years old. The size of this fleet is anticipated to slowly decline over the long term as the older vessels are phased out and fewer new ones are built of wood.

Inspections, Examinations, and Surveys of EL TORO II -- The EL TORO II was Coast Guard certificated[19] to carry a maximum of 49 passengers on lakes, bays, and sounds routes. To maintain its Certificate of Inspection (COI), the vessel was required to pass an annual Coast Guard inspection, which is usually done with the vessel in the water. In addition, Coast Guard drydock examinations are required for the inspection of the underwater hull and fittings of a vessel; the Coast Guard permits up to 5 years between drydock examinations, depending on operational conditions of a vessel.

The EL TORO II had a Coast Guard drydock examination in April 1988 and had none again until March 1993. The Coast Guard inspection record neither states that any nails were pulled or examined at the 1988 drydocking nor does it indicate that any defects pertaining to hull structural integrity were found. The 1988 inspection report noted "electrolysis around bolts through chine area" and recommended that "random fasteners be pulled at next ddx [drydock examination] (this vessel is 27 years old)." Neither the Coast Guard nor the small passenger vessel industry has a consistent, definitive inspection policy for the pulling of fasteners on wooden-hulled vessels during a drydock examination.

During the annual Coast Guard inspections of the EL TORO II from 1988 through 1993, the inspectors found no deficiencies in the watertight integrity of the hull structure. No nails were pulled during these inspections because it would be impractical to do so with the vessel in the water. Following these annual inspections, the Coast Guard reissued the COI for the vessel, confirming its fitness for service. However, because the Coast Guard found the electrical system in poor condition and, according to the inspector, improperly grounded, the Coast Guard required in April 1992 that the electrical system be overhauled and a new bonding system be installed. The inspectors believed that poor wiring could generate stray currents, which, in turn, could cause corrosion of fastener materials. In May 1993, the owner wrote the Coast Guard that

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[18]None of these 6 cases are included in the Safety Board discussion of the Coast Guard study by R.L. Markle.

[19]Title 46 CFR Subchapter T (Parts 175-187).

the electrical system grounding had been changed from positive to negative and that other minor deficiencies on the EL TORO II had been corrected; however, the Coast Guard did not verify whether the changes to the electrical system had satisfied the inspector's intent.

After the 1992 annual Coast Guard inspection, a note had been entered in the inspection book that advised inspectors to "check" fasteners during the next drydock examination in 1993. The lead drydock inspector[20] was aware of this note when he inspected the EL TORO II during the drydock examination of March 1993, which the EL TORO II passed. He testified that the underwater hull appeared sound and showed no signs of leakage, and therefore, he decided not to pull any nails for further examination. He consulted with another Coast Guard inspector, who concurred with his decision that pulling nails would not be necessary. Instead, the lead drydock inspector had the owner remove plugs from four locations in the chine area, and the inspector examined the nail heads that had been concealed beneath the plugs, in accordance with the Coast Guard Navigation and Vessel Inspection Circular[21] (NVIC) 1-63,[22] issued in 1963. These nails appeared to be in acceptable condition from his examination. He then tapped chine bolts with a hammer, and they appeared also to be in acceptable condition. The wooden hull of the EL TORO II had no suggestive signs to indicate the presence of corroded fasteners. (When Safety Board investigators pulled planks from the EL TORO II after the accident, they found that the corrosion had occurred in a localized area and no signs of fastener deterioration were present on the wood surface.)

The NVIC 1-63 provides general information about wooden vessel construction and contains the existing guidance for Coast Guard inspections of wooden-hulled vessels. Neither a Coast Guard regulatory requirement nor any uniform policy exists that specifically mandates physical removal of metallic fasteners. Although many Coast Guard Marine Safety Offices (MSOs) that inspect wooden boat fleets have local inspection policies to supplement NVIC 1-63, other MSOs, such as the MSO Baltimore, Maryland, do not have local inspection policies. Because the inspection policies and their implementation are not uniform among MSOs, a vessel owner who operates between two inspection zones can experience different inspection requirements, depending on the geographic location of the drydock examination. In some instances, the difference in requirements is well-founded and based on local conditions; while in other instances, the difference may be arbitrary simply because Coast Guard headquarters lacks a coordinated policy.

In addition, the Coast Guard inspection policy for wooden vessels does not address the use of nondestructive inspection (NDI) methods, such as thermal[23] or x-ray inspections, for

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[20] See appendix D for experience and qualifications of lead drydock inspector.

[21] Provides guidance and information to Coast Guard personnel about vessel inspections and other topics.

[22] *Notes on Inspection and Repair of Wooden Hulls.*

[23] Methods that employ heat-sensing devices to detect irregular temperatures in materials for locating defects.

assessing the adequacy or condition of the fastening system of a vessel. NDI techniques have not been applied to the wooden vessel industry and are not presently used by Coast Guard inspectors. No significant research effort has been made to apply NDI techniques to wooden vessel inspections; however, since the EL TORO II accident, a limited section of the industry (primarily materials testing laboratories) is exploring the application of thermal and x-ray methods.

After the EL TORO II accident, the Coast Guard increased its inspection efforts for older wooden-hulled vessels by requiring some vessel owners to pull planks for fastener examination. Within the Philadelphia, Pennsylvania, Coast Guard inspection zone,[24] inspectors found significant corrosion of galvanized steel fasteners, which required vessel refastening in many instances; however, the inspectors also found that fasteners made of the corrosion-resistant material monel[25] remained in good condition, and those vessels with monel fasteners did not require refastening. Monel fasteners were widely used on vessels in the Philadelphia inspection zone although the monel fasteners are more expensive compared with galvanized steel fasteners.

Near the end of the fishing season in November 1993, an insurance surveyor made several safety recommendations for the EL TORO II. However, the insurance surveyor, according to his testimony, believed that the EL TORO II would not operate again until the 1994 fishing season (based on a conversation that he had with the owner's wife) and, therefore, did not inform the owner of these recommendations. The owner's wife testified that she had not told the insurance surveyor that the vessel had ceased operations for the 1993 fishing season. On the day of the insurance survey, the owner and his son met the insurance surveyor when he arrived; however, the owner and his son left to attend to other business before the vessel was surveyed.

The insurance surveyor could only inspect the EL TORO II hull from the inside because the vessel was in the water, and he found no corroded hull nails or other deficiencies that related to the sinking on December 5. The surveyor recommended that the owner correct deficiencies such as poor electrical wiring, oily and dirty bilges; install automatic bilge pumps and alarms (automatic bilge pumps and alarms are not required by Coast Guard regulations); and remove the electrical bonding system for through-hull fittings.

After the EL TORO II accident, the Coast Guard contracted a company specializing in marine electrical work, Marine Services in Fort Washington, Maryland, to survey the electrical system on the vessel. The Marine Services report concluded that galvanic action[26] between a copper sheet (used to ground electronic equipment) mounted on the hull bottom and the

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[24]Extends approximately from New Jersey in the north to the Delaware-Maryland boundary (near Fenwick Island) in the south and includes Delaware Bay.

[25]An alloy of nickel and copper.

[26]Galvanic action occurs when small currents flow between dissimilar metals that are in proximity in seawater, causing one of the two metals to corrode.

galvanized steel fasteners had probably corroded the fasteners. The report also concluded that the poor condition of the electrical and bonding system had little effect on the fastener corrosion and that the changeover of the electrical system from positive to negative ground had no effect on the fasteners.

Small Passenger Vessel Owner Associations -- Small passenger vessel owner associations throughout the United States, such as the National Partyboat Owners Alliance, Inc., Groton, Connecticut; the National Association of Charterboat Operators, Washington, D.C.; the Passenger Vessel Association (PVA),[27] Washington, D.C.; and the Maryland Charterboat Association, Chesapeake Beach, Maryland, serve the concerns of owners and operators in the small passenger vessel industry, which includes charter fishing and head boats. The members of the associations are vessel owners who typically have small businesses, many of which are family-owned.

These organizations represent the owners' commercial and insurance interests, conduct government relations programs, and lobby on industry policy issues, such as small passenger vessel regulations and user fees. Owners, owner-operators, lease proprietors, and management firms of small passenger vessel operations are eligible for membership in these organizations. Association members remain informed of issues through periodic meetings and newsletters and publications that address a variety of vessel owner concerns, including general on-board safety and crew training.

The PVA has published the *Passenger Vessel Safety Audit Guide* with the objective "to address the industry's most frequent, costly and correctable accident experiences. They are an important step in controlling your business losses and interruptions." This guide cites slips and falls as a frequent source of injuries that have "a dramatic impact" on "our insurance premiums" and provides checklists for vessel operators to assess potential safety problems such as slips and falls.

Some of the small passenger vessel owner associations discussed the EL TORO II accident in their newsletters and informed members that more demanding Coast Guard inspections would likely occur as a result of the incident. However, the small passenger vessel owner associations that represent the wooden vessel industry do not generally provide specific guidance for maintaining the structural integrity of wooden hulls, especially fasteners.

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[27] PVA members mainly operate ferries and excursion, dinner cruise, overnight cruise, and riverboat gaming vessels, of which a relatively small proportion are wooden-hulled vessels.

ANALYSIS

General

The alcohol and toxicological test results for the EL TORO II owner and crew eliminated the use of alcohol or drugs as a factor in this accident. No failure of the vessel mechanical or electrical systems was found during the investigation that would be a factor in this accident. The EL TORO II was operated by experienced individuals (operator, deckhand, and owner) whose qualifications met Coast Guard requirements and were adequate.

The Coast Guard organized its response effort quickly and deployed all available rescue personnel and equipment immediately. Although the weather conditions (6- to 8-foot seas, 37-knot wind gusts, and rain) were poor at the time of the accident, the Coast Guard decision to launch the 41-foot UTB and request helicopters was proper and resulted in a safe and efficient rescue. The Coast Guard on-scene commander had the full cooperation and coordination of the Maryland State Police, the Navy, and the RVFD during the rescue of a large number of victims. The Safety Board concludes that the emergency response and rescue efforts of the Coast Guard and all other emergency rescue services were appropriate, timely, and effective.

Accident

The 32-year-old wooden-hulled small passenger vessel EL TORO II foundered in rough seas about 1430 on December 5, 1993, while returning from a fishing excursion in the Chesapeake Bay. All five compartments, including the engine compartment, of the vessel had flooded. Three transverse wooden planks had separated from the keel on the port side in the compartment forward of the engine compartment immediately forward of the forward engineroom bulkhead. Most of the nails that had attached these planks to the keel were found to be entirely wasted due to corrosion, and the few nails that remained were corroded to wire-thin proportions. Safety Board investigators identified the following five safety issues that are examined in this analysis:

1. Decision of operator and owner to embark on the fishing trip.

2. Coast Guard, vessel owner, and industry inspection policies, procedures, and responsibilities for the detection of corroded fasteners on wooden-hulled vessels.

3. Bilge alarms for wooden-hulled small passenger vessels.

4. Survival craft aboard small passenger vessels that provide out-of-the-water flotation for passengers and crew.

5. Adequacy of the Coast Guard utility boat as a rescue vessel.

Decision of Operator and Owner to Embark

Although the weather had been favorable during the week before the accident, the weather for December 5 was uncertain. A small craft advisory was in effect with southwest winds at 25 to 30 knots expected to shift to northwest winds at 25 to 30 knots in the morning. Average waves were forecast at 4 feet.

The operator said that he decided to make the trip for several reasons. He observed no wind and only a light rain at St. Jerome Creek. Based on his fishing experience of the previous week and on reports from other local fishermen, the operator expected the fishing to be so good that if he had to shorten the trip because of bad weather, the passengers would still have had a successful day of fishing. Also, he knew most of the passengers from previous trips and believed that they would not be uncomfortable or fearful if the weather should change. The operator testified that the EL TORO II had previously withstood similar weather conditions without incident and that the vessel could be operated safely during the forecasted weather conditions. Safety Board investigators questioned three local charter boat operators and determined that the operator's decision to embark on the December 5 trip represented local practices by other fishing and charter boat operators.

The operator of the EL TORO II departed from Ridge at the scheduled time to join the other boats from Maryland and Virginia that were already at the fishing grounds. While en route, the operator used his VHF/FM radio to inquire about weather conditions at the fishing area, and a charter boat operator at the area reported the conditions as "nice." The EL TORO II operator stated that when the vessel arrived at the fishing area, he found the water to be "flat calm."

The other Maryland-based charter boats that had been fishing in the area began their return trip shortly after 1000 because the customary trip schedule for group-chartered boats begins 2 hours earlier than head boats. The EL TORO II remained in the area with four fishing party boats from Virginia and several recreational boats.

The recorded wind conditions at the Patuxent River, Maryland, weather station indicate that the wind at 1100 increased to 16 knots (sustained) with gusts to 24 knots from the north. The winds recorded before that at the station had been less than 10 knots. The operator of the EL TORO II told Safety Board investigators that he checked the marine forecast about 1100. The earlier 0730 NWS forecast had been revised at 0853, and the revised forecast indicated shifting winds of 20 to 25 knots becoming northwest 30 to 35 knots and average waves building to 6 feet with a gale warning in effect for Chesapeake Bay. Although the revised forecast had increased the wind by 5 knots and the seas by 2 feet, the operator believed that any weather prediction for that day had been within safe operating conditions for the EL TORO II.

About 1245, the operator of the EL TORO II observed that the wind had increased significantly. Because the rain became heavy and continued steadily and most passengers had stopped fishing, the operator and the owner jointly decided to return to Ridge about 1250. The

operator stated that about the time they were leaving the fishing area, some Virginia-based vessels were also preparing to return to port. The operator of the EL TORO II encountered 6- to 8-foot seas during the attempted return trip; however, he stated that he expected to return safely to Ridge.

Safety Board investigators determined that the EL TORO II operator's expectations for a safe return were reasonable because the vessel was constructed of rugged wooden planks and because weather conditions were not so severe in relation to the size (58 feet) of the vessel that it would capsize or be swamped by waves. The three bottom planks disengaged from the keel because the fasteners had corroded. However, no one was aware of the corroded nails on the EL TORO II that caused severe weakness in the hull. Safety Board investigators subsequently discovered that the hull was held in place largely by the caulking and the pressure of the water-swollen planks. The vessel was found weakened to the point that had it not failed on the day of the accident, a failure could have occurred at any time in weather conditions that could be considered routine for good fishing. The wind gusts of 35 knots and the 6- to 8-foot seas on the day of the accident only accelerated the failure of the preexisting weakened hull. The Safety Board concludes that the EL TORO II sank because severely corroded fasteners caused three bottom planks to disengage from the keel in the 6- to 8-foot seas and the vessel flooded.

The operator of the EL TORO II had been attentive to the marine weather forecasts and to the observed wind and wave conditions at the fishing area (his decision to embark on the trip represented the practices of other local charter and head boat operators). The operator had over 5 years of experience on the EL TORO II and had first-hand knowledge of its operation under the weather conditions encountered on December 5. If the fasteners had not corroded causing the hull to weaken so severely, the EL TORO II would probably have returned to port without serious incident. Therefore, the Safety Board concludes that the decisions of the owner and operator of the EL TORO II to embark on the fishing trip and to remain at the fishing grounds until the weather began to deteriorate were reasonable.

Inspection Policies, Procedures, and Responsibilities

The Coast Guard NVIC 1-63 provides general information about wooden vessel construction and contains the existing guidance for Coast Guard inspections of wooden-hulled vessels. The NVIC 1-63 neither requires hull fasteners be pulled for examination nor provides guidance to inspectors about pulling fasteners. The inspectors who performed the last EL TORO II drydock examination were familiar with the NVIC 1-63 and stated that the Baltimore MSO did not provide specific guidance for examining hull fasteners, such as how often to inspect, where on a vessel to pull fasteners, and how many to pull. The inspectors stated that the decisions about examining and pulling fasteners were usually left to their discretion, based on their past experience. The inspectors, in accordance with the NVIC 1-63, did examine bolts in the chine and transom of the EL TORO II; however, they did not examine the fasteners near the keel amidships. (The NVIC 1-63 specifies the chine and transom as important areas but does not specify the keel amidships as a problem area.) The inspectors did not find deteriorated wood

planking in the hull; consequently, they did not require that any planks be replaced. Despite the age of the EL TORO II, the notes in the inspection book to check fasteners during the next drydocking, and the suspicions that stray currents existed in the vessel, the inspectors never pulled any fasteners. (The removal and the examination of fasteners are generally at the discretion of an individual inspector.) The Coast Guard does not have a consistent, definitive inspection policy for the pulling of fasteners on wooden-hulled vessels during a drydock examination, and this lack of a well-defined policy resulted in the drydock examination inspectors of the EL TORO II being uncertain whether fasteners should be pulled for examination. Because the pulling of fasteners is often an expensive and destructive process and neither a regulation nor guidance for removing hull fasteners exists, the pulling of fasteners by inspectors is likely to be an excepted occurrence without a Coast Guard requirement to remove fasteners for evaluation. Given the Coast Guard inspection policy for wooden-hulled small passenger vessels, the Safety Board concludes that the Coast Guard inspectors made a reasonable effort to evaluate the structural integrity of the EL TORO II.

Coast Guard inspectors had noted electrolytic corrosion of bolts in the chine area in April 1988 (unlike nails, bolt heads are visible from inside the vessel), and they had then recommended that fasteners be pulled at the next drydock examination. The Coast Guard inspection record indicated that stray currents, generated by a poor electrical system, may have caused the electrolytic corrosion. However, the Marine Services survey after the accident determined that galvanic action likely corroded the fasteners that failed and that the poor condition of the electrical system probably had little effect on these fasteners. The Marine Services survey report concluded that "the fasteners corroded over a long period of time (30+ years) because of galvanic action." In addition, sea water entrapped low inside the hull, such as near the keel amidships adjacent to a bulkhead, could also have contributed to the fastener corrosion. Regardless of the exact cause of the corrosion, the Safety Board agrees that corrosion had probably occurred over an extended time period. (Galvanic action and rusting, as likely occurred here, are generally long-term processes.) The wasted fasteners had passed undetected during Coast Guard drydock examinations primarily because neither the inspectors nor the vessel owner had specific guidance about when to remove fasteners for examination and from where on the hull the fasteners should be removed. Therefore, the Safety Board concludes that the Coast Guard and the small passenger vessel industry do not provide adequate guidance to inspectors or owners for conducting hull inspections of wooden vessels to check for corroded fasteners. The probability of detecting corroded fasteners would be increased by proper guidance and specific criteria for fastener removal.

Improved Policies and Procedures for Inspections -- Because Coast Guard inspectors need to remove and examine hull fasteners to confirm the integrity of fasteners, they need formal policies and procedures that would provide sound criteria for determining when to remove fasteners for inspection. The presence of dissimilar metals (copper grounding plates and galvanized steel nails) and the possibility of stray currents are factors that should be considered when developing guidance for inspectors. A policy that specifies the minimum number of fasteners to be removed, their location on the vessel, and the frequency of their removal would enable the uniform application of Coast Guard inspection procedures by all MSOs. The MSOs

should be free to conduct additional inspections, over and above the Coast Guard-established minimum, for demonstrable cause. The discretionary pulling of fasteners by individual MSOs would likely result in the nonuniform application of safety procedures. The Safety Board emphasizes that immediate action is needed to improve the safety of older wooden-hulled small passenger vessels and to fulfill the safety objectives announced by the Secretary of Transportation on December 23, 1993. (See appendix E.) In response to this announcement, the Coast Guard held a meeting with an industry working group on July 14 and 15, 1994, to discuss improving Coast Guard inspection policies and procedures for wooden-hulled vessels and developing policy for inspecting hull fasteners. The working group consisted of industry experts in surveying wooden hulls and reflected a broad range of wooden boat inspection practices and expertise throughout the United States. Safety Board representatives also attended the meeting. The Coast Guard plans to revise the NVIC 1-63 to consider the improvements recommended by the working group[28] and expects the revision to be completed by December 1994. Therefore, the Safety Board believes that the Coast Guard should expedite, with the assistance of the wooden vessel industry, the revision of the NVIC 1-63 and ensure that the revision includes effective inspection policies and procedures for maintaining the structural integrity of wooden vessels, particularly for hull fasteners.

To effectively implement inspection policies, the inspectors should have the inspection history of a vessel, especially information on certain critical items such as fasteners. A history would provide reliable data, based on experience, that should be used for formulating well-founded inspection policies and procedures and for improving future policies and procedures as more information is gained through systematic recordkeeping. The records on fasteners and hull materials are important to maintain and should be readily available to an inspector in his office, rather than be retrieved from central archives. Neither the vessel owner nor the Coast Guard possessed long-term inspection records for the 32-year-old EL TORO II to indicate fastener materials or whether fasteners had ever been pulled or replaced. Coast Guard inspectors testified that such information would have been helpful in deciding whether to pull fasteners for inspection. A fastener history would ensure that fasteners were not pulled from the same area at successive inspections unless a reason was indicated. Therefore, the Safety Board believes that the Coast Guard should require that the critical inspection history, such as the condition of fasteners and hull construction materials, of inspected wooden-hulled vessels be maintained where readily available to field inspectors.

Development of Alternative Inspection Techniques -- Although a wooden-hulled vessel has hundreds of fasteners, pulling between only 6 and 10 fasteners is practical for inspection because of the time and expense that is involved. Consequently, all fasteners in all vulnerable areas on a hull cannot possibly be checked, and fasteners are randomly selected for pulling. Corroded fasteners in localized areas can be missed as a result. Furthermore, the potential of structural destruction while removing nails, unless demonstrable cause for pulling nails exists,

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[28]The working group briefly discussed the application of NDI techniques to inspect fasteners on wooden-hulled vessels; however, the industry experts in the working group were not aware of any NDI methods now being used in the wooden vessel industry.

can deter the owner and the Coast Guard inspector from pulling nails. The Safety Board concludes that current inspection methods alone, no matter how well prescribed or accomplished, are not sufficient to ensure the integrity of fasteners in wooden-hulled vessels.

However, NDI techniques, such as thermal or x-ray inspections, could provide a reliable method for inspecting fasteners without the potential of wood plank destruction. NDI technology can be of particular assistance to an inspector for evaluating the condition of fasteners that lie embedded within the wood, especially when signs of fastener deterioration are not evident on the wood surface. NDI techniques would allow an overall survey of vessel fasteners as compared with pulling fasteners in a few preselected locations. The sinking of the EL TORO II demonstrates that invisible defects can seriously compromise the structural integrity of a vessel and highlights the need to develop a method to detect such defects. The Safety Board concludes that NDI techniques need to be developed for the inspection of fasteners on wooden-hulled vessels. Therefore, the Safety Board believes that the Coast Guard should research and develop, with the assistance of the wooden vessel industry, NDI techniques for inspecting fasteners on wooden vessels.

During the NDI research and development period, other measures, such as renailing older hulls or using screw-type fasteners or fasteners made of corrosion-resistant material, should be considered. These alternative methods use existing technology and are reliable ways of ensuring the structural integrity of wooden-hulled vessels. Refastening may be performed after extracting the existing older fasteners; however, it can be cost-effective and save time in many situations by simply driving in new fasteners and leaving the existing fasteners in place. (This approach is especially true for nails that generally are much harder to remove compared with screws.) Although the alternative approach of using improved corrosion-resistant fastener material, such as monel, is more expensive than using galvanized steel nails, Coast Guard inspectors found that corrosion-resistant monel fasteners, widely used on vessels in the Philadelphia inspection zone, last longer and significantly reduce the failure risk. The Safety Board concludes that evidence indicates that monel fasteners are much less subject to corrosion than are galvanized steel fasteners.

Vessel Safety Responsibility -- Maintaining the safety of vessels and passengers is the shared responsibility of the Coast Guard, the vessel owners and operators, and the maritime industry.

The Coast Guard responsibility includes verifying, by periodic inspection, that a vessel complies with Coast Guard safety standards and regulations to ensure a safe vessel is provided for public transportation. The structural failure of the EL TORO II demonstrates that Coast Guard policies and procedures to ensure the structural integrity of the vessel were inadequate. Because current inspection methods are not sufficient to ensure the integrity of fasteners and because NDI methods for fasteners on wooden-hulled vessels have yet to be commercially developed, remedial action is needed to ensure the structural safety of the approximately 1,000 wooden-hulled small passenger vessels that are over 15 years old. Therefore, the Safety Board believes that the Coast Guard should consider requiring the refastening of wooden-hulled

passenger vessels that are over 15 years old as a remedial action until reliable inspection methods can be developed.

The owner of the EL TORO II was responsible for maintaining the safety of the vessel and for ensuring that it was operated in a manner consistent with Coast Guard safety regulations. The owner had furnished the vessel with lifesaving, firefighting, and navigation equipment that met Coast Guard standards. The EL TORO II was operated on the day of the accident by experienced individuals whose qualifications met Coast Guard requirements.

The EL TORO II maintenance history indicates that the owner and his son acted to correct those safety deficiencies that they recognized. Coast Guard inspectors testified that the owner and/or his son were present during inspections and complied with the inspector's requests. The owner performed all Coast Guard-requested tasks, including removing wooden plugs to expose nail heads. According to the testimonies of the Coast Guard inspectors and the owner, had the inspector so requested, the owner would likely have performed additional tasks to assist an inspector. Although an insurance survey in November 1993 was critical of EL TORO II and made numerous safety recommendations to the owner, he did not have an opportunity to comply with these recommendations because the insurance surveyor had not informed him of them before the accident. No evidence was found that indicated the owner was deficient in maintaining the structural integrity of his vessel, and his level of maintenance expertise was comparable to the maintenance standards used throughout the industry. The owners and operators of wood boats generally do not possess the specialized inspection skills of a qualified Coast Guard inspector. After reviewing the available evidence, the Safety Board concludes that given the inspection and maintenance standards prevailing in the wooden vessel industry, the vessel owner made reasonable efforts to maintain the structural integrity of the EL TORO II.

The small passenger vessel owner associations throughout the United States contribute to public safety by making industry personnel aware of the safety problems that confront the industry and by providing training for and guidance to owners and operators to resolve these problems. The associations also provide an interface between individual small family-owned businesses and the Coast Guard as well as disseminate safety information to vessel owners about current Coast Guard inspection and safety policy changes. Besides these general measures to improve the overall safety of wooden small passenger vessels, the organizations could have a major role in the more specialized and technical area of maintaining wooden-hull fasteners by supporting the efforts of the joint Coast Guard and industry working group on wooden-hulled vessels. The Safety Board believes that the National Partyboat Owners Alliance, Inc.; the National Association of Charterboat Operators; the Passenger Vessel Association; and the Maryland Charterboat Association should develop maintenance standards for wooden vessels, particularly for hull fasteners, and disseminate these standards to their members. Also, these associations should recommend to their members that pending the development of nondestructive inspection techniques, vessel owners initiate alternate measures to ensure the structural integrity of wooden vessels, particularly hull fasteners. (The alternative measures could include methods such as renailing or using screw-type fasteners or fasteners made of corrosion-resistant materials.) Finally, the associations should recommend to their members that vessel owners

maintain the critical vessel maintenance history, such as the condition of hull fasteners and hull construction materials, of their wooden-hulled vessels.

Bilge Alarms

About 1335, while returning to St. Jerome Creek from the fishing grounds, the operator felt the vessel reacting sluggishly, as if it had taken on water. The operator then asked the deckhand to check the bilges in the engine compartment for flooding. All available evidence indicates that the deckhand did look into the engine compartment for flooding. A passenger, sitting on the engine compartment hatch cover, had to move off the cover for the deckhand to look into the engine compartment. That passenger testified that the deckhand had looked into the engine compartment. Furthermore, the operator stated that he was confident the deckhand knew what to look for and had carried out the order to check the engine compartment. The deckhand reported to the operator that he had not seen any water. However, the vessel owner testified that the engine sputtered 15 to 20 minutes later, and the operator then checked the engine compartment and found it almost completely flooded. At that time, he became aware that the vessel was in danger of sinking. Safety Board investigators found after the accident that the flooding had begun in the compartment forward of the engine compartment, where planks had separated from the keel, and continued into the engine compartment through the drainage holes in the bulkhead that separated the two compartments. The EL TORO II was not equipped with bilge alarms that provide an early warning of flooding. (Coast Guard regulations do not require vessels such as the EL TORO II to be equipped with bilge alarms.)

Because the vessel acted sluggishly, which concerned the operator enough to order the deckhand to check the engine compartment, water had probably begun to flood into the breached compartment forward of the engine room. However, water may not have flowed into the engine compartment through the drainage holes in the bulkhead at the precise time the deckhand looked into the engine compartment and may have begun to enter the engine compartment moments after the deckhand had checked. (The intervening 15 to 20 minutes until the operator himself checked the engine compartment could be sufficient time for the engine room to flood completely.) Given the short time in which catastrophic flooding typically occurs, manual detection is unreliable for discovering rapid flooding in an emergency. Also, manual detection usually occurs only after rapid flooding is already underway, which leaves no time for mitigating action. By the time the operator of the EL TORO II became aware of the vessel flooding, the EL TORO II was in danger of sinking.

An automatic warning system, such as a bilge alarm, would provide continuous monitoring of water in a compartment. A bilge alarm would have given an early warning that the compartment forward of the engine compartment had flooded, which would have allowed the necessary time for emergency measures, such as plugging the drainage holes in the engine compartment forward bulkhead. A temporary plug could have slowed the ingress of water into the engine compartment, and the EL TORO II would probably have stayed afloat longer, therefore minimizing the time that the survivors spent in the cold water. In addition, the

propulsion engine would have continued to run, and the operator might have been able to take the EL TORO II to an alternate harbor or to have run it aground in shallow water. The Safety Board concludes that had the EL TORO II been required by the Coast Guard to be equipped with bilge alarms, the operator may have learned of the flooding in time to prevent or delay the sinking.

When the Safety Board investigated the 1973 sinking of the charter fishing vessel COMET, it found that the operator of the COMET also did not recognize a dangerous flooding situation existed until sinking was imminent and that "[a]n earlier warning of the flooding would have provided additional time for preventive action. Even at a high rate of flooding, an early warning would have provided time to transmit a MAYDAY message."

When investigating the sinking of the small passenger vessel CAPTAIN CRUNCH, the Coast Guard found that flooding had started in the stern compartment and that:

> Such a problem in the stern compartment had no chance of being detected or remedied, since nobody entered that space.... Had the source of flooding been detected and stopped in a timely manner, possibly the vessel could have been saved again.

Although existing Coast Guard regulations do not require vessels such as the EL TORO II to have bilge alarms, the Coast Guard has submitted in its Supplemental Notice of Proposed Rulemaking[29] (SNPRM) on small passenger vessel inspection and certification that bilge alarms be installed on all vessels. However, the SNPRM proposes that these alarms be installed only in the engine compartments of small passenger vessels, including wooden-hulled vessels. The sinkings of the EL TORO II, the COMET, and the CAPTAIN CRUNCH indicate that wooden hulls are also significantly vulnerable to leaks and catastrophic flooding in compartments other than the engine compartment. Therefore, the Safety Board believes that the Coast Guard should require for wooden passenger vessels that bilge alarms be fitted in the bilges of all compartments that extend below the load waterline.

Survival Craft

The EL TORO II carried a Coast Guard-approved rigid buoyant apparatus capable of accommodating 20 people. This survival craft[30] was not designed to keep people out of the

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[29]Supplemental Notice of Proposed Rulemaking, Small Passenger Vessel Inspection and Certification (CGD 85-080), published in the *Federal Register* on January 13, 1994. This SNPRM is a complete revision of the proposed regulations published on January 30, 1989 (CGD 85-080).

[30]Survival craft that support survivors out of the water include lifeboats, inflatable liferafts, and inflatable buoyant apparatus; survival craft that do not support survivors out of the water include lifefloats and rigid buoyant apparatus.

water. Because out-of-the-water survival craft provide hypothermic protection, a survival craft, such as a liferaft, would have improved considerably the chance for survival of the three people who died from the effects of hypothermia after the EL TORO II sinking. Furthermore, out-of-the-water survival craft provide support for injured or unconscious survivors, protection against inadvertent ingestion of seawater, and a platform that permits the use of equipment such as signalling and homing devices. In addition, out-of-the-water survival craft do not require survivors to exert themselves to remain above water and afford protection against marine predators.

For vessels that are certified to operate on lakes, bays, and sounds routes, such as the EL TORO II, Coast Guard regulations require, at least, a rigid buoyant apparatus or lifefloat to accommodate a minimum of 30 percent of the total certificated passenger and crew capacity of a vessel. The EL TORO II was certificated to carry 49 passengers; however, its rigid buoyant apparatus, which met Coast Guard regulations, could accommodate only 20 people. Had more passengers been on board the day of the accident, the additional people could not have used the rigid buoyant apparatus. Without a survival craft to hold on, these additional people would have had to expend more energy to stay afloat or to swim in the open water. The risk of hypothermia would also have increased because of the increased time needed to rescue the additional people from the cold water. The Safety Board has been concerned about this issue for many years and believes that the Coast Guard should require that out-of-the-water survival craft for all passengers and crew be provided on board small passenger vessels on all routes.

After the Safety Board investigation of the July 1985 grounding of the PILGRIM BELLE,[31] the Safety Board recommended that the Coast Guard require all passenger vessels, except for ferries on river routes on short runs of 30 minutes or less, have survival craft that prevent immersion in the water for all passengers and crew. (M-86-61) The Safety Board addressed this issue again after the September 1988 sinking of the passenger vessel COUGAR in which four of the nine people on board succumbed to hypothermia. The COUGAR had a rigid buoyant apparatus on board that was not capable of supporting the crew and passengers out of the water. The Safety Board recommended that the Coast Guard require that rigid buoyant apparatus and lifefloats aboard passenger vessels be replaced with either lifeboats, liferafts, or inflatable buoyant apparatus within 5 years. (M-90-14) The Safety Board has been disappointed with the Coast Guard response to these recommendations. The Coast Guard has indicated in its response that the retrofitting of existing vessels with inflatable buoyant apparatus and liferafts would be addressed in its SNPRM on small passenger vessel inspection and certification. However, this SNPRM proposes a grandfather clause that permits existing vessels to retain survival craft, if considered serviceable, for an indefinite time. Because retaining inadequate, yet serviceable, survival craft on board existing vessels, such as the EL TORO II, would not improve vessel safety, the Safety Board has consistently been opposed to exempting such existing survival craft from replacement.

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[31]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).

The Safety Board added this issue in May 1994 to its list of "Most Wanted Transportation Safety Improvements" to emphasize its concern over delay in adopting the requirements for survival craft that prevent immersion in the water to be provided on board small passenger vessels.

Coast Guard regulations require vessels on lakes, bays, and sounds routes to carry rigid buoyant apparatus or lifefloats, irrespective of the water temperature. However, the Coast Guard SNPRM has survival craft requirements for prevailing water temperatures below 59 °F; above 59 °F, no survival craft requirements are proposed. For vessels that are certificated for operation on lakes, bays, and sounds routes, the Coast Guard SNPRM requires lifefloats with the capacity to accommodate all passengers and crew only when the vessels are in waters with temperatures below 59 °F. The Safety Board considers the Coast Guard SNPRM inadequate because the proposed safety standard falls below the existing safety standard by not requiring survival craft of any type on vessels operating in water temperatures above 59 °F. Hypothermia results from a combination of factors, including exposure time in cold water, type of clothing worn, and a survivor's physical condition, activity, and exhaustion, and has occurred with water temperatures above 59 °F. In addition, the existing and proposed standards are both inadequate because neither requires that vessels carry out-of-the-water survival craft that provide safety benefits in cold or warm waters. Neither rigid buoyant apparatus nor lifefloats keep people out of the water and, therefore, are not capable of protecting people from hypothermia in cold water. The Safety Board expressed these same views in its June 8, 1994, comments on the Coast Guard SNPRM.

After abandoning the EL TORO II, 19 people, including the three who later died from hypothermia, had clung to a rigid buoyant apparatus, which did not keep them out of the water. They were in 54-°F water for up to 80 minutes. The Safety Board concludes that had the EL TORO II been required by the Coast Guard to have out-of-the-water survival craft on board, the three deaths may not have occurred. The Safety Board, therefore, classifies Safety Recommendations M-86-61 and M-90-14 "Closed--Unacceptable Action/Superseded" and replaces them with Safety Recommendation M-94-26, which asks the Coast Guard to require that out-of-the-water survival craft for all passengers and crew be provided on board small passenger vessels on all routes.

Coast Guard Utility Boat as a Rescue Vessel

Although the 41-foot Coast Guard UTB that was used during the EL TORO II rescue operation has a high freeboard, the boat crew retrieved most survivors from the water without difficulty because on December 5, 1993, the UTB had a crew about three times its usual complement. Had the UTB carried the usual complement, as the boat would in most rescue operations, the rescue would probably have been less expeditious because the UTB did not have retrieval equipment to assist in pulling people on board.

During the rescue operation, one survivor's life preserver had ripped when two UTB crewmembers grabbed it to retrieve the survivor from the water; the survivor was not injured

as a result. The Safety Board found that a similar incident had occurred during the rescue operation of the December 1989 sinking of the small passenger vessel BRONX QUEEN.[32] After the Safety Board investigation of the BRONX QUEEN sinking, the Safety Board asked the Coast Guard on December 11, 1990, in Safety Recommendation M-90-110 to develop new methods and/or equipment for use aboard the 41-foot utility boat to expedite the retrieval of survivors from the water during search and rescue operations. The companion Safety Recommendation M-90-111 to the Coast Guard addressed the same issue for the Coast Guard 44-foot motor lifeboats. The Coast Guard responded to these recommendations on March 23, 1994, as follows:

> The Coast Guard researched several methods of recovering survivors from the water during search and rescue operations. It was determined that personnel recovery could be greatly improved with the development of an inflatable rescue ramp that would eliminate the need to lift personnel over the sides of rescue boats. The Coast Guard purchased and tested four different inflatable rescue ramp prototypes.
>
> Minor modifications have been completed on the latest version of the inflatable ramp and additional testing has been conducted. The final prototype has been approved and funding is provided to purchase this inflatable unit for every Coast Guard small boat station. The Coast Guard anticipates no further action regarding this recommendation.

This newly developed inflatable rescue ramp should greatly improve the retrieval of people from the water because it should significantly reduce the lifting height over the side of a rescue boat. (See figure 7 for a photograph of an inflatable rescue ramp.) The Safety Board understands that by the end of September 1994, a ramp should be at each Coast Guard small boat station. The Safety Board finds the Coast Guard action meets the intent of these recommendations and classifies Safety Recommendations M-90-110 and -111 "Closed--Acceptable Action."

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[32]Marine Accident Reports--*Brief Format Issue Number 9--Reports Issued December 3, 1992* (NTSB/MAB-92/01).

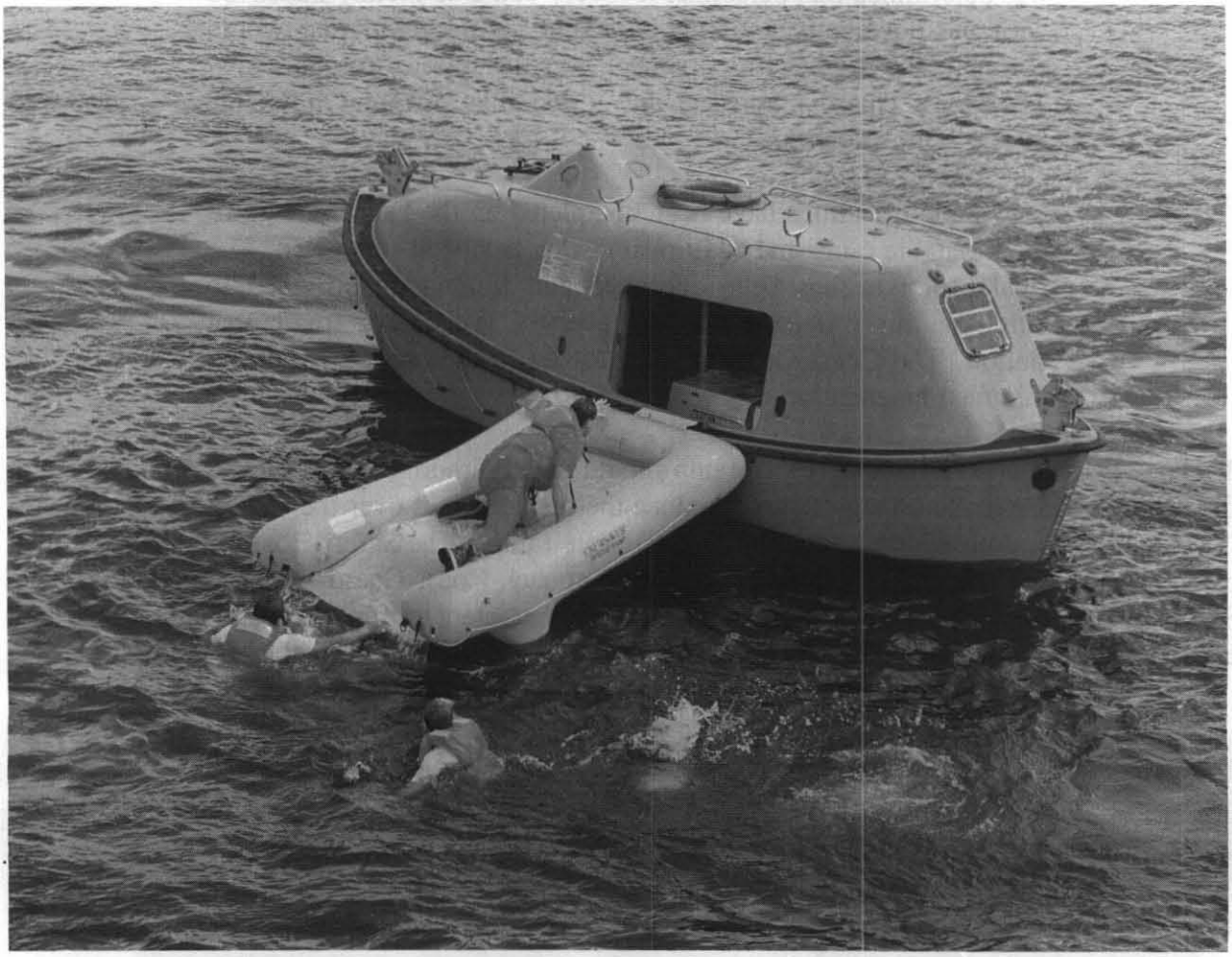


Figure 7. -- An inflatable rescue ramp.

(Photograph of CREWSAVER Rescue Ramp: courtesy of SMR Technologies, Inc.)

CONCLUSIONS

1. The qualifications and experience of the crew were adequate. Neither alcohol or drug usage nor failure of the vessel mechanical or electrical systems were found to be factors in this accident.

2. The emergency response and rescue efforts of the Coast Guard and all other emergency rescue services were appropriate, timely, and effective.

3. The decisions of the owner and operator of the EL TORO II to embark on the fishing trip and to remain at the fishing grounds until the weather began to deteriorate were reasonable.

4. The EL TORO II sank because severely corroded fasteners caused three bottom planks to disengage from the keel in the 6- to 8-foot seas and the vessel flooded.

5. The Coast Guard and the small passenger vessel industry do not provide adequate guidance to inspectors or owners for conducting hull inspections of wooden vessels to check for corroded fasteners.

6. Current inspection methods alone, no matter how well prescribed or accomplished, are not sufficient to ensure the integrity of fasteners in wooden-hulled vessels.

7. Evidence indicates that monel fasteners are much less subject to corrosion than are galvanized steel fasteners.

8. Nondestructive inspection techniques need to be developed for the inspection of fasteners on wooden-hulled vessels.

9. Given the inspection and maintenance standards prevailing in the wooden vessel industry, the vessel owner made reasonable efforts to maintain the structural integrity of the EL TORO II.

10. Given the Coast Guard inspection policy for wooden-hulled small passenger vessels, the Coast Guard inspectors made a reasonable effort to evaluate the structural integrity of the EL TORO II.

11. Had the EL TORO II been required by the Coast Guard to be equipped with bilge alarms, the operator may have learned of the flooding in time to prevent or delay the sinking.

12. Had the EL TORO II been required by the Coast Guard to have out-of-the-water survival craft on board, the three deaths may not have occurred.

PROBABLE CAUSE

The probable cause of the EL TORO II sinking was catastrophic flooding resulting from severely corroded hull fasteners that had remained undetected and uncorrected because of the lack of effective policies and procedures for inspecting, maintaining, and/or supplementing the structural integrity of wooden-hulled vessels. Contributing to the loss of lives was the lack of survival craft capable of providing out-of-the-water flotation for the passengers and crew.

RECOMMENDATIONS

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

-- to the U.S. Coast Guard:

Expedite, with the assistance of the wooden vessel industry, the revision of the Navigation and Vessel Inspection Circular 1-63 and ensure that the revision includes effective inspection policies and procedures for maintaining the structural integrity of wooden vessels, particularly for hull fasteners. (Class II, Priority Action) (M-94-21)

Research and develop, with the assistance of the wooden vessel industry, nondestructive inspection techniques for inspecting fasteners on wooden vessels. (Class III, Longer Term Action) (M-94-22)

Consider requiring the refastening of wooden-hulled passenger vessels that are over 15 years old as a remedial action until reliable inspection methods can be developed. (Class II, Priority Action) (M-94-23)

Require that the critical inspection history, such as the condition of fasteners and hull construction materials, of inspected wooden-hulled vessels be maintained where readily available to field inspectors. (Class II, Priority Action) (M-94-24)

Require for wooden passenger vessels that bilge alarms be fitted in the bilges of all compartments that extend below the load waterline. (Class II, Priority Action) (M-94-25)

Require that out-of-the-water survival craft for all passengers and crew be provided on board small passenger vessels on all routes. (Class II, Priority Action) (M-94-26)

-- to the National Partyboat Owners Alliance, Inc.:
-- to the National Association of Charterboat Operators:
-- to the Passenger Vessel Association:
-- to the Maryland Charterboat Association:

Develop maintenance standards for wooden vessels, particularly for hull fasteners, and disseminate these standards to your members. (Class II, Priority Action) (M-94-27)

Recommend to your members that pending the development of nondestructive inspection techniques, vessel owners initiate alternate measures to ensure the structural integrity of wooden vessels, particularly hull fasteners. (Class II, Priority Action) (M-94-28)

Recommend to your members that vessel owners maintain the critical vessel maintenance history, such as the condition of hull fasteners and hull construction materials, of their wooden-hulled vessels. (Class II, Priority Action) (M-94-29)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

JAMES E. HALL
Acting Chairman

JOHN K. LAUBER
Member

JOHN A. HAMMERSCHMIDT
Member

CARL W. VOGT
Member

September 7, 1994

APPENDIXES

APPENDIX A

NATIONAL WEATHER SERVICE BAY/COASTAL MARINE FORECASTS

The National Oceanic and Atmospheric Administration (NOAA) weather radio stations in Salisbury, Maryland, and Heathsville, Virginia, disseminate the bay/coastal marine forecasts. (Salisbury and Heathsville are approximately 94 nautical miles east-northeast and 15 nautical miles west, respectively, of where the El Toro II was fishing.) NOAA weather radio makes weather, river, and marine information available to the public and special user groups and provides alert to warn of hazardous conditions. VHF-FM radio transmitters provide continuous weather information over an approximately 40-mile radius. In addition, the Family of Services communications circuits disseminate the forecasts. These circuits serve the meteorological needs of users, which include radio and TV stations, outside the National Weather Service (NWS).

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The NWS forecast office in Sterling, Virginia, issued the following bay/coastal marine forecasts that were pertinent for Patuxent River, Maryland, to Windmill Point, Virginia. (All times are eastern standard time.)

Issued 1455 Saturday on December 4, 1993:
...Small Craft Advisory...
Tonight...South winds 25 to 30 knots. Average waves 4 feet. Rain and fog reducing visibility below 3 nautical miles...Possible thunderstorm.
Sunday...Southwest winds 25 to 30 knots shifting to northwest 25 to 30 knots. Average waves 4 feet. Morning showers and thunderstorms ending.
Sunday Night...Northwest winds 25 to 30 knots diminishing to 10 to 15 knots late. Average waves 4 feet then subsiding.

Issued 2258 Saturday on December 4, 1993:
...Small Craft Advisory...
Tonight...South winds 25 to 30 knots. Average waves 4 feet. Rain and fog reducing visibility below 3 nautical miles... A thunderstorm is possible.
Sunday...Southwest winds 25 to 30 knots shifting to northwest 25 to 30 knots. Average waves 4 feet. Morning showers and thunderstorms ending.
Sunday Night...Northwest winds 25 to 30 knots diminishing to 10 to 15 knots late. Average waves 4 feet subsiding to 2 feet.

APPENDIX A

Issued 0339 Sunday on December 5, 1993:
...Small Craft Advisory...
Today...Southwest winds 25 to 30 knots shifting to northwest 25 to 30 knots. Average waves 4 feet. Early day showers ending by noontime.
Tonight...Northwest winds 25 to 30 knots diminishing to 15 knots late. Average waves 4 feet subsiding to 2 feet.

Issued 0853 Sunday on December 5, 1993:
...Gale Warning...
Remainder of today...Shifting winds 20 to 25 knots becoming northwest 30 to 35 knots. Average waves building to 6 feet. Rain ending early afternoon.
Tonight...Northwest winds 30 to 35 knots diminishing to 15 knots late. Average waves 6 feet subsiding to 2 feet.

Issued 0933 Sunday on December 5, 1993:
...Gale Warning...
Remainder of today...Shifting winds 20 to 25 knots becoming northwest 30 to 35 knots. Average waves building to 6 feet. Rain ending early afternoon.
Tonight...Northwest winds 30 to 35 knots diminishing to 15 knots late. Average waves 6 feet subsiding to 2 feet.

Issued 1218 Sunday on December 5, 1993:
...Gale Warning...
This afternoon...North to northwest winds 30 to 40 knots. Average waves 6 feet. Rain and thunderstorms ending this afternoon.
Tonight...Northwest winds 30 to 35 knots diminishing to 15 knots late. Average waves 6 feet subsiding to 2 feet.

Issued 1452 Sunday on December 5, 1993:
...Gale Warning...
Remainder of this afternoon...North to northwest winds 30 to 40 knots. Average waves 6 feet. Rain ending.
Tonight...Northwest winds diminishing to 15 to 20 knots late. Average waves 5 feet subsiding to 3 feet.

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APPENDIX A

The pertinent weather synopses, issued by the bay/coastal marine forecast on December 4 and 5, 1993, follow. (All times are eastern standard time.)

Issued at 2258 on December 4:
Developing gale over southwest Virginia late this evening will (move) through the central Delmarva early Sunday afternoon. The associated cold front will move east of the bay and coastal waters by late Sunday afternoon.

Issued at 0339 on December 5:
Developing gale over southwest Virginia early this morning will move off the coast near the mouth of the Delaware Bay early this afternoon dragging a cold front through the waters by this afternoon. A weak high will build in well south of the waters.

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APPENDIX A

Approximately 25 nautical miles north-northwest of where the El Toro II was fishing, the Patuxent River Naval Air Station, Patuxent, Maryland, recorded the following surface weather observations on December 5, 1993. (All times are eastern standard time.)

Time	Sky Condition	Visibility	Weather	Winds
0055	Overcast	5	L-F	180/14
0155	Overcast	5	HF	190/14G26
0255	Overcast	6	F	180/14G22
0335	Overcast	4	L-F	180/13
0355	Overcast	2	L-F	180/12
0455	Overcast	4	L-F	170/12
0555	Overcast	2	R-F	170/12
0655	Overcast	3	L-F	180/08
0745	MC	2	L-F	180/04
0755	MC	1 1/2	F	130/05
0805	MC	1/2	F	090/05
0825	MC	3/4	F	360/04
0845	MC	1/2	F	Calm
0855	MC	1 1/2	F	Calm
0915	MC	3	F	Calm
0935	MC	1/2	F	360/05
0955	Overcast	3/4	F	Calm
1015	Overcast	5/16	L-F	330/06
1035	Overcast	5/16	L-F	340/05
1055	Overcast	3	RW-F	010/16G24
1115	Overcast	3	RW-F	360/18G31
1135	Overcast	5	F	360/20G39

1155	Overcast	5	F	010/18G36
1214	Overcast	3	RW-F	010/12G29
1215	Overcast	3	RW-F	010/14G29
1255	Overcast	1	RW-F	010/20G37
1315	Overcast	1 1/2	RW-F	020/20G33
1322	Overcast	4	RW-F	350/24G38
1336	Overcast	6	F	350/23G38
1355	Overcast	6	F	360/24G36
1415	Overcast	2 3/4	RW-F	350/23G36
1420	Overcast	6	F	360/24G39
1434	Overcast	6	F	360/24G38
1440	Overcast	6	RW-F	340/20G35
1455	Overcast	6	RW-F	340/24G38
1555	Overcast	6	RW-F	340/23G37
1655	Overcast	6	F	350/15G20
1755	Overcast	7		030/18G28

Note: A peak wind of 350 degrees at 42 knots was reported at 1343.

Key: Sky Condition--MC--mostly cloudy
Visibility in statute miles
Weather--L-light drizzle // F-fog // RW-light rain showers // H-haze // R-light rain
Winds--direction/speed gusts (G)--direction-degrees // speed-knots // gusts-knots

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APPENDIX A

Point Look Out, Maryland, and Tangier Island, Virginia, weather stations were approximately 11 nautical miles northwest and 10 nautical miles southeast, respectively, of where the El Toro II was fishing. The NWS in Norfolk, Virginia, obtained information from these stations every 3 hours. (All times are eastern standard time.)

Point Lookout on December 5, 1993 (Winds are 1-minute average winds.)

Time	Wind Direction	Speed (knots)
0100	South	09
0400	South	16
0700	South-Southeast	13
1000	West	10
1300	North-Northwest	21
1600	North-Northwest	24

Tangier Island on December 5, 1993 (Winds are peak winds.)

Time	Wind Direction	Speed (knots)
0100	South	16
0400	South	20
0700	East-Southeast	17
1000	South-Southeast	15
1300	West	20
1600	West-Northwest	32

APPENDIX B

U.S. COAST GUARD ALDIST 091/85

Archive number: K113

R 130041Z APR 85 ZDK
FM COMDT COGARD WASHINGTON DC//G-MVI//
TO ALDIST
ACCT CG-W2GARC
BT
UNCLAS //N16711//
ALDIST 091/85
COMDTNOTE 16711
SUBJ: INSPECTION OF WOOD HULL SMALL PASSENGER VESSELS
A. NVIC 1-83 (NOTAL)
1. A RECENT MARINE CASUALTY INVOLVING THE SINKING OF A WOODEN HULL SMALL PASSENGER VESSEL HAS RE-EMPHASIZED THE NEED FOR THOROUGH INSPECTIONS OF THESE VESSELS.
2. GUIDANCE FOR THE INSPECTION OF WOODEN VESSELS IS CONTAINED IN REFERENCE (A). DURING INSPECTIONS OF WOODEN T-BOATS, ALL INTERNAL SPACES SHOULD BE ENTERED AND EXAMINED. WHERE THIS IS NOT POSSIBLE, INSPECTORS SHOULD VERIFY THAT THERE IS ADEQUATE VENTILATION AND DRAINAGE FOR THESE SPACES.
3. THE HULL INTEGRITY OF OLDER WOODEN T-BOATS IS AN AREA OF PARTICULAR CONCERN. DURING THE COURSE OF SCHEDULED INSPECTIONS ON WOODEN T-BOATS 15 YEARS AND OLDER, CLOSE ATTENTION SHOULD BE GIVEN TO THOSE ITEMS WHICH MAY INDICATE PROBLEMS. IN ADDITION TO THE GUIDANCE IN REFERENCE (A), THE FOLLOWING CONDITIONS MAY BE CAUSE FOR MORE DETAILED INSPECTIONS OR FURTHER ACTION SUCH AS IMMEDIATE DRYDOCKING:
A. FREQUENT NEED TO OPERATE BILGE PUMPS=
B. INSTALLATION OF ADDITIONAL BILGE PUMPS=
C. INCREASED CAPACITY OF REPLACEMENT BILGE PUMPS=
D. DARK AREAS IN HULL INDICATING WOOD DECAY OR FASTENER WASTAGE=
E. HULL WORKING WHEN THE VESSEL IS UNDERWAY WHEN ON VARIOUS HEADINGS WITH APPROPRIATE SEA STATE FOR THE ROUTE AUTHORIZED.
4. BECAUSE THE DOCKSIDE INSPECTION OF A T-BOAT DOES NOT PROVIDE AN OPPORTUNITY TO VIEW THE HULL WORKING, INSPECTORS ARE ENCOURAGED TO CONDUCT A PORTION OF THE INSPECTION WHILE THE VESSEL IS UNDERWAY.
5. ALL HULL REPAIRS ON WOODEN T-BOATS SHALL BE THE SUBJECT OF A VESSEL INSPECTION DEFICIENCY REPORT (VIDR) IN MSIS. ENTRIES SHALL BE MADE EVEN IF THE REPAIR IS COMPLETED DURING THE COURSE OF THE INSPECTION. G-MVI SHALL BE ENTERED IN THE +NOTIFY+ FIELD FOR EACH OF THESE REPORTS.
BT
TOF:04:16:08:17:46
CRRN
:04:16:03:20:33

APPENDIX C

DETAILS FROM 1991 U.S. COAST GUARD STUDY OF LIFESAVING SYSTEMS FOR SMALL PASSENGER VESSELS

Sixteen people died when the COMET sank on May 19, 1973. The COMET was a 48-foot-long 32-year-old wooden party fishing vessel. The study stated that the hull of the COMET was in poor condition, "which can be linked to its age and wood hull material" and concluded that the "seams/butts of the COMET opened up causing the vessel to founder and sink by the stern."

The vessel operator died when the 26-year-old ZEPHYR II, carrying 12 people, sank in 1974. The study stated that "the most probable cause for the loss of the ZEPHYR II was determined to be poor hull condition, which can be linked to its age and wood hull material."

The sinking of the 29-year-old SUNRISE II in June 1983 was reported "as a result of the planking being torn away and general weakness of the hull. The casualty is therefore directly related to the advanced age of the wooden hull."

The 48-year-old ALMA III flooded and sank in 1988. A sprung plank was identified as a likely source of flooding, and the study related the loss to its wooden construction and its age.

APPENDIX C

TABLE 1. CASUALTIES

Vessel	Age(yr)	Hull	Svc type	Cause
COMET 5/73	32	wood	fishing	hull failure
ZEPHYR II 2/74	26	wood	fishing	foundered
PEARL C 9/76	33	wood	fishing	capsize (bar X-g)
DIXIE LEE II 6/77	10	wood	fishing	capsize (wind)
FINALISTA 100 10/82	12	wood	fishing	fire
JOAN LA RIE III 10/82	14	wood	fishing	capsize
SAN MATEO 2/83	25	wood	whale watching	capsize (bar X-g)
SUNRISE II 6/83	29	wood	fishing	flooding
FANTASY ISLANDER 9/84	29	wood	dinner/ tour	fire
MERRY JANE 2/86	8	FRP	fishing	near capsize
FISH-N-FOOL 2/87	23	wood	fishing	capsize
CAPT JIM 10/87	17	wood	fishing	fire
COUGAR 9/88	45	wood	fishing	flooding
ALMA III 12/88	48	wood	fishing	flooding
CONNIE D 4/89	13	wood	fishing	fire
BRONX QUEEN 12/89	47	wood	fishing	flooding?

APPENDIX D

EXPERIENCE AND QUALIFICATIONS OF LEAD DRYDOCK INSPECTOR

The lead inspector began his career as an assistant marine inspector at the Marine Safety Office (MSO) in Chicago, Illinois, and served in that capacity from 1979 to 1982. During that time, he inspected charter boats and assisted with equipment inspection on deep-draft Great Lakes vessels. He was stationed from 1988 to 1992 at the MSO in Philadelphia, Pennsylvania, where he conducted small passenger vessel inspections as well as inspections of tank vessels and barges. In 1992, he was transferred to the MSO in Baltimore, Maryland, where he inspected charter boats and deep-draft vessels. He testified that he had conducted over 100 small wooden vessel inspections before inspecting the EL TORO II.

He was a qualified U.S. Coast Guard wood boat inspector and had completed a 1-week basic course on wooden boat inspection conducted by Captain Franke Marine Surveyors Inc., Del Mar, California.

APPENDIX E

U.S. DEPARTMENT OF TRANSPORTATION ANNOUNCEMENT ON SMALL PASSENGER VESSEL SAFETY IMPROVEMENTS

U.S. Department of Transportation

News:

Office of the Assistant Secretary for Public Affairs
Washington, D.C. 20590

FOR IMMEDIATE RELEASE
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SECRETARY PEÑA ANNOUNCES COAST GUARD STEPS TO IMPROVE SAFETY ON SMALL PASSENGER VESSELS

Secretary of Transportation Federico Peña today announced that the Coast Guard will institute a series of safety steps to deal with wooden-hulled vessels that carry passengers.

The fishing boat El Toro II, which sank during a storm in Chesapeake Bay December 5, was a 32-year old vessel with a wooden hull. Results of the Coast Guard investigation into the accident will be released in early 1994.

During the interim, Secretary Peña said the Coast Guard is taking immediate steps to increase safety aboard such vessels. The actions include:

o Underway inspections of the hulls on older wooden vessels by the Coast Guard. The inspections will help inspectors and owners identify problems not visible when a boat is in dry dock or stationary at a pier.

o Guidance on the removal and inspection of hull fasteners. More emphasis will be placed on this aspect of the inspection program to provide an additional safety measure and ensure that inspection techniques are consistent.

o Refining record-keeping systems currently used to document hull repairs and fastener removals and replacements. This will provide inspectors with all available information for evaluating vessels.

o Conducting additional inspections and record reviews. Records of wooden-hulled boats throughout the country will be reviewed and additional inspections will be conducted to alert owners of problems which could go unnoticed until the next regularly scheduled Coast Guard inspection.

- more -

o Reviewing local guidelines and developing national standards to ensure a consistent nationwide policy.

Owners of this particular class of passenger vessel and vessels of similar construction will be notified if further problems are identified during the stepped-up inspections. As problems become apparent during the accident investigation, additional actions may be developed.

Adm. J. William Kime, Commandant of the Coast Guard has issued a special safety directive to all Coast Guard inspection offices to announce this program.

In a related action this week, the Coast Guard forwarded proposed regulations regarding additional safety standards for small passenger vessels for publication in the Federal Register.

The Coast Guard inspects more than 5,000 small-passenger vessels each year. Of these, about 1,400 are wooden hulled vessels and at least 1,000 are over 15 years old.

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