Log M-393

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C. 20594

Safety Recommendation

Date: September 14, 1994

In Reply Refer To: M-94-21 through -26

Admiral Robert E. Kramek
Commandant
U. S. Coast Guard
Washington, DC 20593-0001

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.[1] The National Transportation Safety Board determined 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 U.S. Coast Guard Navigation and Vessel Inspection Circular (NVIC) 1-63 contains the existing guidance for Coast Guard inspections of wooden-hulled vessels; however, it neither

[1]For more detailed information, read Marine Accident Report--*Sinking of U.S. Small Passenger Vessel EL TORO II near Point Lookout, Maryland, Chesapeake Bay, December 5, 1993* (NTSB/MAR-94/03).

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 Marine Safety Office (MSO), Baltimore, Maryland, 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.

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. 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. 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 and expects the revision to be completed by December 1994. 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.

The potential of structural damage while removing nails, unless demonstrable cause for pulling nails exists, can deter the owner and the Coast Guard inspector from pulling nails. Nondestructive inspection (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.

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. 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.

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.

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.

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. A 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.

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 May 1973 sinking of the charter fishing vessel COMET,[2] 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 March 1985 sinking of the small passenger vessel CAPTAIN CRUNCH,[3] 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[4] (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.

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

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[2]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).

[3]The 29-year-old, 65-foot-long, Coast Guard-inspected wooden-hulled small passenger vessel was capable of carrying up to 50 people.

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

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.

Coast Guard regulations also 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 the Safety Board investigation of the July 1985 grounding of the PILGRIM BELLE,[5] 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[6] 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

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[5]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).

[6]Marine Accident Report--*Sinking of the Passenger Vessel COUGAR off the Coast of Oregon, September 15, 1988* (NTSB/MAR-90/02).

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 that do not provide out-of-water support, if considered serviceable, for an indefinite time. Because retaining inadequate, yet serviceable, survival craft that do not provide out-of-water support 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.

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.

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, has classified 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.

Therefore, the National Transportation Safety Board recommends that 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)
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> 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)
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> 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)

Also, the Safety Board issued Safety Recommendations M-94-27 through -29 to the National Partyboat Owners Alliance, Inc.; the National Association of Charterboat Operators; the Passenger Vessel Association; and the Maryland Charterboat Association. If you need additional information, you may call (202) 382-6860.

Acting Chairman HALL and Members LAUBER, HAMMERSCHMIDT, and VOGT concurred in these recommendations.

By: Jim Hall
Acting Chairman