

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

ISSUED: June 1, 1978

Forwarded to:

Admiral Owen W. Siler
Commandant
U.S. Coast Guard
Washington, D. C. 20590

SAFETY RECOMMENDATION(S)

M-78-16 through -30

About 1915 e.s.t., on November 10, 1975, the Great Lakes bulk cargo vessel SS EDMUND FITZGERALD, with 29 crewmen and fully loaded with taconite pellets, sank in eastern Lake Superior at 46°59.9' N, 85°06.6' W, approximately 17 miles from the entrance to Whitefish Bay, Michigan. The ship was en route from Superior, Wisconsin, to Detroit, Michigan, and was proceeding at a reduced speed in a severe storm. No distress call was heard and no survivors or bodies were located, although the vessel's two inflatable liferafts, several personal flotation devices, and other debris were found. 1/

The Safety Board's analysis of the evidence developed in its investigation of this accident indicated that topside damage to ballast tank vents and hull plating allowed flooding into the vessel's ballast tanks and its tunnel and significant amounts of water entered the cargo hold of the FITZGERALD through nonweathertight hatch covers. Because the 1969, 1971, and 1973 amendments to the Great Lakes Load Line Regulations (46 CFR Part 45) allowed the FITZGERALD's minimum freeboard to be reduced, greater amounts of water washed over the deck from boarding seas. This greater amount of water increased the rate that flooding water entered the damaged ballast tanks and tunnel and the cargo hold. The analysis indicated that the flooding further reduced the vessel's freeboard and increased its list until the boarding seas caused a failure of one or more hatch covers. The hatch cover failure allowed rapid and massive flooding of the cargo hold.

1/ For more detailed information about this accident, read "Marine Accident Report - SS EDMUND FITZGERALD Sinking in Lake Superior November 10, 1975," (NTSB-MAR-78-3).

U.S. Coast Guard Marine Inspectors, during the winter of 1976 and the spring of 1977, and Safety Board personnel, during the summer of 1977, observed that hatch covers on some Great Lakes bulk cargo vessels were not weathertight as required by the Great Lakes Load Line Regulations. This nonweathertight condition existed even though the hatch covers were in place and the clamps were fastened. In order for the hatch covers to be weathertight, the hatch cover clamps must be properly adjusted. It was observed that many of the hatch cover clamps were not properly adjusted.

The investigation of this accident uncovered several problems related to the 1973 Great Lakes Load Line Regulations. 46 CFR 45.105 requires a master to be provided with Coast Guard-approved information on how to load and unload his vessel; however, some information approved by the Coast Guard does not contain information on the proper sequence for simultaneous loading and deballasting or for unloading and ballasting. These sequences are common practice on the Great Lakes and need to be included. Furthermore, some Great Lakes bulk cargo vessels are not covered by 46 CFR 45.105. Proper loading and unloading procedures are no less important for these vessels. All Great Lakes bulk cargo vessels should have loading information.

Since the FITZGERALD and other Great Lakes bulk cargo vessels are not required to meet any subdivision or damage stability standards, flooding of one cargo hold on the FITZGERALD would have propagated throughout all cargo holds and eventually could have led to the sinking of the vessel. If the FITZGERALD had been designed to withstand flooding of one cargo hold, this would have improved the chances for vessel or crew survival.

No means of detecting water in the cargo holds of the FITZGERALD was provided other than by a visual inspection of the hold, nor was there a means of dewatering the cargo hold if flooding occurred in the forward hold. The only suctions for the bilge pumping system were located at the after end of the aftermost cargo hold. Flooding in the forward hold would have caused trim by the bow. By the time enough water had entered the cargo holds so the bilge systems could be used, the vessel already might have been in danger of sinking. Instruments to detect changes in both trim and heel would have provided the master with an early indication of flooding.

No survivors were found, nor was there any indication that the FITZGERALD's survival equipment was used. Information on the vessel's ability to survive flooding might have permitted the master time to take appropriate corrective measures or to formulate plans to effect crew evacuation. Also, an emergency position indicating radio beacon (EPIRB) would have provided a means of alerting shore rescue units of the serious condition of the FITZGERALD even if the vessel's radio communications

equipment was not working. In that situation, the distress signal transmitted by an EPIRB would have provided rescue units with a means of locating the FITZGERALD. In case of unexpected sinking, the EPIRB would have floated free and automatically transmitted a distress signal. The automatic distress signal would have reduced the search area and increased the probability of finding survivors.

Great Lakes vessels are designed for certain seaway conditions and hatch covers are designed for the imposed loading. Because of their relatively short voyages and the availability of shelter or protected harbors, Great Lakes vessels normally can avoid severe storms and not get caught in exposed waters as did the FITZGERALD. In order to determine when a vessel must seek shelter, the limiting sea state for Great Lakes cargo vessels should be determined. After this sea state has been determined, procedures should be established to prohibit the operation of vessels in sea states above this limiting value and these procedures should be enforced.

The shoal waters near Michipicoten Island and Caribou Island, as well as other locations in Lake Superior, are not isolated spots. The bottom contours around these shoal areas is usually gradual enough that the change of water depth will provide adequate warning that a vessel is approaching a shoal area if the water depth is measured with a fathometer.

A fathometer can be used to determine a trackline made good in most areas by comparing a series of observed depths to the charted depths. This determination of a vessel's position and progress would be a significant aid to a mariner in the event other navigational instruments fail, as was the case on the FITZGERALD.

The Coast Guard's surface search and rescue capability was extremely limited on November 10, 1975. The only Coast Guard surface unit that was large enough to cope with the weather and sea conditions, that was not under repair, and that was close enough to respond within a reasonable time, was 300 miles away. Additional surface search and rescue units on the Great Lakes that are capable of operating in severe weather conditions are needed.

Because the annual inspections of Great Lakes bulk cargo vessels were in progress, the Safety Board submitted four recommendations to the Coast Guard on March 23, 1978. As a result of our investigation of the accident, other recommendations have been developed.

Therefore the National Transportation Safety Board recommends that the U.S. Coast Guard:

Determine if reduction in the minimum freeboard requirements for Great Lakes vessels permitted by the 1969, 1971, and 1973 amendments to 46 CFR Part 45 increases the potential for vessel flooding because the designs of weathertight closures are not adequate and report the findings. (Class II, Priority Action) (M-78-16)

Initiate a design study to improve the current weathertight hatch cover and clamp designs used on Great Lakes bulk cargo vessels with a view toward requiring a more effective means of closure of such fittings. (Class II, Priority Action) (M-78-17)

Insure that the masters of Great Lakes bulk cargo vessels have the loading information required by 46 CFR 45.105, including the proper sequences for simultaneous loading and deballasting or unloading and ballasting. (Class II, Priority Action) (M-78-18)

Require that the masters of all Great Lakes cargo vessels that are not required by 46 CFR 45.105 to have loading information be provided with such information, including the proper sequence for simultaneous loading and deballasting or unloading and ballasting. (Class II, Priority Action) (M-78-19)

Require that a Great Lakes cargo vessel meet a minimum level of subdivision and damage stability to prevent the foundering of the vessel because of flooding through one hatch or flooding because of damage in a limited area of the vessel. (Class II, Priority Action) (M-78-20)

Require a means of detecting water in the cargo holds of a Great Lakes vessel so that her master will have an early indication of flooding and can take any necessary corrective action. (Class II, Priority Action) (M-78-21)

Amend 46 CFR 56.50-50 to require an effective bilge pumping system on Great Lakes bulk vessel so that if the vessel has trim by the bow and is listing, water can be removed from any portion of the cargo hold. (Class II, Priority Action) (M-78-22)

Require instruments in the wheelhouse to detect changes in both trim and heel on Great Lakes bulk cargo vessels so that changes in trim and heel caused by the presence of water or a change in cargo configuration can be detected. (Class II, Priority Action) (M-78-23)

Require that the information supplied to the master of Great Lakes cargo vessels on loading and stability also include information on the vessel's ability to survive flooding (e.g., trim and heel results after assumed damage) so that the master can take appropriate corrective action or formulate timely plans to effect crew evacuation. (Class II, Priority Action) (M-78-24)

Require that Great Lakes vessels have emergency position indicating radio beacons (EPIRB's) so that vessels lost or in serious danger can be located rapidly and accurately. (Class II, Priority Action) (M-78-25)

Determine, in conjunction with the American Bureau of Shipping, the limiting sea state applicable to the design of Great Lakes bulk cargo vessels including freeboard and longitudinal strength, and report the findings. (Class II, Priority Action) (M-78-26)

Prohibit the navigation of Great Lakes vessels in wind and wave conditions which exceed the limiting sea state used for vessel design. (Class II, Priority Action) (M-78-27)

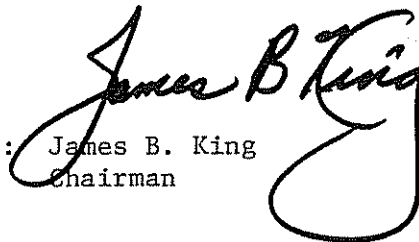
Determine, in conjunction with the American Bureau of Shipping, the design criteria used to determine the structural adequacy of hatch covers and report the findings. Evaluate the design criteria and impose more stringent standards if indicated. (Class II, Priority Action) (M-78-28)

Require that all Great Lakes bulk cargo vessels have a fathometer. (Class II, Priority Action) (M-78-29)

Increase the surface search and rescue capability on
the Great Lakes during severe weather periods.
(Class II, Priority Action) (M-78-30)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred
in the above recommendations.

By: James B. King
Chairman

A large, stylized handwritten signature in black ink, reading "James B. King". The signature is written in a cursive style with a large, looping "K" at the end.