

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Ray M-282

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Forwarded to:

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Commandant
U.S. Coast Guard
Washington, D.C. 20593

SAFETY RECOMMENDATION(S)
M-85-67 through -75

About November 14, 1984, the 86-foot-long, uninspected U.S. fishing vessel AMAZING GRACE sank while on a fishing trip for scallops about 80 nautical miles east of Cape Henlopen, Delaware; there probably were seven crewmembers aboard. A 16-day search by the U.S. Coast Guard (USCG) resulted in finding only one of the two liferafts on the vessel. The liferaft was empty. The crewmembers are missing and presumed dead. As of the date of this report, the AMAZING GRACE has not been located. The vessel's estimated value was \$500,000. ^{1/}

The AMAZING GRACE probably sank sometime on the morning of November 14 before any crewmember could transmit a distress signal. The USCG was not notified that the AMAZING GRACE possibly had a problem until the morning of November 15. If the vessel had been equipped with an emergency position indicating radio beacon (EPIRB), its sinking might have been detected earlier, and the search effort could have been confined to a smaller area. The last reported position of the AMAZING GRACE was near major aircraft routes where aircraft could have picked up an EPIRB signal; moreover, a properly operating EPIRB probably would have been detected by satellite and reported to the USCG within 6 hours. Fishing vessels are not required to carry EPIRB's, and the owner of the AMAZING GRACE did not equip the boat with an EPIRB. In 1980 the Safety Board issued Safety Recommendation M-80-23 which recommended that the USCG seek legislative authority to require EPIRB's on fishing vessels. The USCG replied that since it would take 4 or 5 years to obtain and implement such legislation, the USCG would not seek legislation until there was a satellite EPIRB system.

Before the COSPAS-SARSAT satellite EPIRB system design is made final, the participating countries must decide which frequency is the best to use, determine the extent of possible system use beyond the marine and aviation modes, and adopt user identifications. Until these issues are resolved, which may take much longer than the current target date of 1996, U.S. fishing vessels should avail themselves of the safety offered by the existing satellite detection system, which has been proven successful in detecting signals emitted by EPIRB's on the 121.5 MHz and 243 MHz frequencies.

^{1/} For more detailed information, read Marine Accident Report--"Loss of the U.S. Fishing Vessel AMAZING GRACE about 80 Nautical Miles East of Cape Henlopen, Delaware, about November 14, 1984" (NTSB/MAR-85/07).

In the 5 years since the Safety Board made Safety Recommendation M-80-23, about 1,000 fishing vessels and more than 200 lives have been lost in accidents. Although the USCG actively has promoted voluntary installation of EPIRB's on fishing vessels, most fishing vessels still do not carry them. The cost of providing the approximately 33,000 documented U.S. fishing vessels with EPIRB's is estimated at less than \$10 million. The search for the AMAZING GRACE alone cost about \$12 million. Because the date for implementation of a full satellite system is still indefinite, and many issues are yet to be resolved, the Safety Board believes that there is no justification for the USCG to delay requiring EPIRB's on U.S. fishing vessels. The USCG has indicated that legislative authority is necessary to require EPIRB's; if this is the case, the Safety Board believes that the USCG should seek the appropriate legislative authority immediately so that regulations requiring U.S. fishing vessels to be equipped with current EPIRB's can be promulgated without further delay. On June 26, 1985, the Safety Board sent the USCG a letter reiterating its concern that the USCG has not implemented Safety Recommendation M-80-23.

As a result of its investigation of the capsizing of the 82-foot-long fishing vessel PATTI-B in 1978, 2/ the Safety Board on June 25, 1979, issued Safety Recommendation M-79-69 to the USCG:

Conduct a design study to determine if current published intact stability criteria are adequate for vessels similar in design to the PATTI-B.

On December 16, 1980, the USCG replied that ". . . there is no fully satisfactory stability standard . . . for small vessels like the PATTI-B . . ." The USCG has "encouraged research into the seakeeping characteristics of small vessels on the international level, but is no longer able to continue small vessel research due to limited funds and other priorities." The Safety Board classified Safety Recommendation M-79-69 as "Closed--Acceptable Alternate Action," but urged the USCG to reevaluate its position with regard to such research.

In the USCG stability calculation report on the AMAZING GRACE, the USCG again reiterated that there are no fully satisfactory stability standards for small fishing vessels like the PATTI-B and the AMAZING GRACE. The USCG has announced that, because of the high rate of loss of fishing vessels and crewmembers, it intends to embark on a program to reduce the number of commercial fishing vessel casualties by not less than 10 percent by 1991 through the formulation of voluntary standards including stability standards. A 1984 study by the USCG shows that about 38 percent of the total losses of fishing vessels are the result of flooding, foundering, or capsizing. If the USCG is going to reduce the number of fishing vessel accidents, the USCG needs to develop adequate stability criteria for small fishing vessels. The USCG should reconsider its priorities and resume its research on the seakeeping capabilities of small vessels.

The crew of the AMAZING GRACE was typical of most fishing vessels. The captain had no formal training in vessel safety. He had learned to be a fishing vessel captain by serving as a deckhand and mate under other fishing vessel captains who probably had little formal knowledge of stability, firefighting, or the use of the lifesaving equipment. Likewise, his crew probably would have had little knowledge of these subjects. There is little incentive for a fishing vessel captain to seek training since the evaluation for a good fishing vessel captain is based on how many fish he catches. Taking time off from fishing to attend courses, seminars, or expositions results in less fish caught and loss of income.

2/ Marine Accident Report--"Grounding and Capsizing of the Clam Dredge PATTI-B, Ocean City Inlet, Ocean City, Maryland, May 9, 1978" (NTSB-MAR-79-9).

The large number of fishing vessel losses with the accompanying large loss of life each year indicates a need for higher safety standards. The USCG has recognized the problem and hopes to achieve an improvement in safety over the next 6 years through voluntary programs for fishermen. Voluntary participation in the past has not been successful, and there is no reason to believe that voluntary education programs for fishermen will be any more successful in the future. The Safety Board believes that the only remedy for the high loss rate of fishing vessels and the loss of lives is a licensing program, similar to that required of operators of uninspected towing vessels, which includes a mandatory safety training program. Currently employed fishing vessel captains should be required to attend basic training courses in safety, and future captains should be required to attend and pass these courses before becoming fishing vessel captains. These courses would become available in the private sector if there was a mandatory education program. Failure by fishing vessel captains to comply with basic safety procedures should be subject to USCG investigation and penalties if necessary.

The Safety Board was unable to determine precisely who was aboard the AMAZING GRACE. The captain of the ATLANTIC PRIDE identified his brother and the mate on the AMAZING GRACE from radio conversations, but as of the date of this report the Safety Board has not found anyone who saw the AMAZING GRACE leave Hampton, Virginia. The owner had no positive record of who was aboard.

As a result of its investigation of the sinking of the USCG-certificated charter fishing boat JOAN LA RIE III, ^{3/} the Safety Board on February 7, 1984, issued Safety Recommendation M-84-14 to the USCG:

Require that operators of charter fishing boats making an offshore trip or voyage prepare a crew and passenger list and deposit the list, or copy thereof, at a suitable location ashore before departure.

On May 15, 1984, the USCG replied that it intends to revise the USCG regulations for small passenger vessels to require that operators deposit a crew and passenger list ashore before departure. The Safety Board has classified Safety Recommendation M-84-14 as "Open--Acceptable Action." The Safety Board believes also that commercial fishing vessel owners should require their captains to deposit a crew list ashore before departure.

The Daniels family owned and operated 10 fishing vessels, including the AMAZING GRACE, and 3 fish-processing and -packing facilities in North Carolina and Virginia. The owners also operated fishing vessels out of New Bedford, Massachusetts. However, they had no contingency plan in case one of their vessels had an emergency such as a fire or flooding or a medical problem involving one of the crewmembers. The owners did not know what day the AMAZING GRACE departed Hampton, nor exactly who or how many persons were aboard. It took several days for them to determine that there were two liferafts and not just one aboard. It was fortunate that the approximate position of the AMAZING GRACE was known by the captain of the ATLANTIC PRIDE because the owners did not maintain regular radio communication with their vessels. In time of an emergency, complete and accurate information must be available to search and rescue authorities as quickly as possible. The owners of fishing fleets should develop contingency plans that include: (1) detailed information about each vessel, its communication equipment, and its crew; (2) procedures for contacting the USCG; (3) a list of other individuals or organizations to be contacted; and (4) procedures for coordinating search and rescue efforts with the USCG. The better the information provided to search and rescue authorities, the more effective will be their ability to respond to an emergency.

^{3/} Marine Accident Report--"Sinking of the Charter Fishing Boat JOAN LA RIE III Off Manasquan Inlet, New Jersey, October 24, 1982" (NTSB/MAR-84/02).

The National Council of Fishing Vessel Safety and Insurance, which represents the major fishing fleets in the United States and marine insurance companies, should promote the development of contingency plans by owners and operators, safety education programs for fishermen, and scheduled reporting by fishermen to keep shoreside personnel informed of their movements. Similarly, the USCG should encourage the development of contingency plans for fishing vessels and develop standard formats which are compatible with USCG search and rescue procedures so that the USCG can obtain quickly the information it needs in time of an emergency. Such contingency plans would increase the probability of rescuing fishermen and at the same time reduce the effort of the USCG in obtaining vital information.

A simple method to minimize the loss of life on commercial fishing vessels operating offshore for extended periods of time would be to require such vessels to establish scheduled radio communications with designated shore facilities or other fishing vessels. For business purposes, most commercial fishing vessels are equipped with radio equipment that is capable of communicating with shore facilities and of contacting another fishing vessel if they are not capable of communicating directly with shore stations. Fishing vessel captains often do not communicate with shore facilities for days or weeks. If the fishing vessel has an accident and is unable to send a distress message, days may elapse before anyone is aware of a problem. The captain of the ATLANTIC PRIDE did not become concerned for 24 hours after the probable time of the accident, even though he had not been able to contact the AMAZING GRACE during that time, because shutting down radio communications is not unusual.

The arguments that fishing captains do not want to disclose their position or other information to other fishermen can be overcome through the use of codes or other means. Also, if scheduled radio communications become commonplace, the failure to meet a scheduled communications check would alert shore facilities or other fishing vessels immediately of a potential problem. If fishing vessel captains were required to report their position regularly, rescue units would know where to begin looking to render assistance. Owners, insurance companies, and the USCG should all encourage scheduled communications by fishing vessel captains.

Although the computer-assisted search planning (CASP) program involves approximations, it is an effective tool for planning search and rescue operations, and it is being refined constantly. The USCG has done extensive research into ocean drift patterns, and the latest information is continually being incorporated into the program. One of the first operations conducted by the USCG was to deploy a datum marker buoy near the last reported position of the AMAZING GRACE. Information from the datum marker buoy was used daily to predict the drift of the AMAZING GRACE or one of its liferafts. Gulf Stream information also was used. The drift characteristics of the liferafts aboard the AMAZING GRACE fell within the drift prediction of the CASP computer program. Therefore, the USCG's prediction of the drift of the Givens liferafts aboard the AMAZING GRACE was reasonably accurate at the time of the search. However, the CASP program should be improved in the future by including the drift characteristics of a heavily ballasted liferaft.

The message that a Givens liferaft had been recovered did not reach the USCG Operations Center until about 10 hours after it was sent by the Danish containership CLIFFORD MAERSK to the USCG via Chatham Radio, a commercial radio station that serves commercial marine vessels. The message was misrouted through the Radio Corporation of America (RCA) telecommunications network to the USCG AMVER center in New York instead of to the USCG Operations Center in New York. Even after the

message was received, it was 10 hours before the USCG Operations Center realized that the message might be related to the search for the AMAZING GRACE. The delay in recognizing the significance of the liferaft message appears to have stemmed from two primary causes: the volume of message traffic and the methods used to screen messages so that they receive appropriate attention.

Two methods are used to help watchstanders select important messages in the large volume of traffic: an amorphous group of "keywords" and a formal message classification system (routine, priority, and immediate). One problem in message screening arises from the varying sources of messages. There is no formal convention for the maritime public to use in formatting messages when it wants to inform the USCG about emergencies. Over the years, however, a common practice has emerged of putting the words "medico" or "search and rescue" in the top line of the message. The word "liferaft" was not a keyword in the AMVER list.

Although individuals and agencies outside the USCG could not be relied upon to use keywords in their messages, significant benefits could be derived from the internal use of keywords by the USCG. A keyword list need not and should not be very long. A short list (a dozen words or so) would be relatively easy for personnel to recall and apply to numerous emergency situations. The first USCG organization to receive a given message still would be required to screen the message for keywords and assign a keyword if one would be appropriate. The USCG message format should be amended to position keywords in a prominent location at the top of the message. This procedure would assist any party to whom and through whom the message is routed. Messages containing keywords could be discriminated easily for special attention.

It might be argued that the existing system for assigning priorities to messages (routine, priority, and immediate) was a sufficient screening procedure. However, sometimes there are too many nonroutine messages. On November 21 and 22, the number of immediate messages was voluminous, according to the USCG Operations Center. Messages for which a keyword is necessary should not be too numerous, if the established keyword list is not too long and is used with discrimination.

At times, the search for the AMAZING GRACE and survivors achieved probabilities of detection (POD's) of over 90 percent. The USCG Chief of Search and Rescue (SAR) in New York explained that a POD of 78 percent usually is considered "about the best you can do on a search." On November 21, the search was suspended for the first time, "based on the cumulative POD in excess of 90 percent." This was on the same day that the CLIFFORD MAERSK recovered the liferaft from the AMAZING GRACE.

To a great extent the success of USCG search efforts is based upon the ability of human observers to detect the presence of relatively small objects located on the water. Parameters affecting the performance of observers vary tremendously, e.g., the sea conditions as they affect the contrast of the search object, the lighting conditions, etc. Vessels and aircraft serve merely as platforms for the observers. The human factors involved in search operations also need to be accounted for adequately to arrive at the level of confidence to be placed in POD as a major decisionmaking tool. This concern has been expressed in at least two USCG research studies in 1981 and 1982 on the subject. 4/

4/ Edwards, N.C., Jr., et. al., "Factors Affecting Coast Guard SAR Unit Visual Detection Performance," United States Coast Guard Report No. CG-D-09-82, Interim Report, August 1981; Remondini, D.I., et. al., "A Pilot Study of Human Factors in SAR," United States Coast Guard Report No. CG-D-19-82, Interim Report, May 1982.

In spite of acknowledging that fatigue and other human factors influence observer performance, the SAR Manual makes no attempt to quantify their effect on POD. The scanning performance of all categories of observers involved in a search is treated as being homogeneous.

The 1981 research study states: "Of the 25 variables listed . . . only five are used at present [none of the interdependent human factors] and the magnitude of their influence is uncertain. Thus, World War II visual search techniques, which have been updated once from sighting report data collected 24 years ago, are utilized in SAR planning." The report recommended that the CASP program used by search planners be updated to incorporate the study's findings on human performance and other factors. It further recommended that the CASP method "replace the present SAR manual search planning method and POD predictions."

Since the 1982 report, the USCG has not conducted further studies of this subject. The Coast Guard is considering the adoption of a new visual detection model (called the Wagner Model) which makes some allowances for time on task: "There are two categories --low and high. For surface searchers the cutoff is 2 hours; for aircraft the cutoff is 1 hour." 5/ However, fatigue is only one of many human factors which should be considered, and the developer of the Wagner Model admits "some key search parameters such as searcher type (for example, cutter or helicopter) are not built into the model." Nevertheless, the Wagner Model, if proved valid, could be a significant and overdue advancement to update SAR procedures. The findings of research disclose that the human factors involved in search operations are not being accounted for adequately. There is evidence that search planners have unjustified confidence in POD as a decisionmaking aid. The USCG should continue to support research efforts in human factors and incorporate the findings of these studies into SAR mission planning.

The tracking of the liferaft found by the CLIFFORD MAERSK to the AMAZING GRACE by the USCG took a number of hours, which in other cases directly could have affected the possibility of rescue. When a liferaft is found at sea, the USCG must call the manufacturer who in turn has to search its records to determine to whom the liferaft was sold. The vessel owner then must be contacted for verification. Further research is required if the purchaser of the liferaft was not the owner of the vessel. Delays in identifying the vessel using the liferaft may delay a decision by the USCG to initiate a search or affect continuation of one that already is in progress, and may affect decisions on how to deploy search planes and ships. One central office within the USCG responsible for maintaining an up-to-date computer list of vessels with liferafts onboard may be a solution. Some of the information necessary to establish a computer data file for liferafts presently is manually maintained in the USCG Merchant Vessel Inspection Division in Washington, D.C. However, the files normally are available only during working hours.

It was unfortunate that the crew of the CLIFFORD MAERSK destroyed the liferaft from the AMAZING GRACE since it was the only item recovered related to the fishing vessel and might have aided in this investigation. The examination of recovered lifesaving equipment and an evaluation of its effectiveness can aid in the development of better equipment. The USCG should develop guidance, possibly through AMVER, for the retention and examination of recovered lifesaving equipment for subsequent examination.

5/ Weisinger, J.R., Analytical Techniques to Estimate Lateral Range Functions for Visual Detection, prepared for the United States Coast Guard by Daniel H. Wagner, Associates, Report No. 1-84, January, 1984.

Therefore, the National Transportation Safety Board reiterates Safety Recommendation M-80-23 made to the U.S. Coast Guard on April 24, 1980:

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

and further recommends that the U.S. Coast Guard:

Resume research into seakeeping characteristics of small vessels to develop stability standards for fishing vessels such as the AMAZING GRACE. (Class III, Longer Term Action) (M-85-67)

Seek legislative authority to require the licensing of captains of commercial fishing vessels, including a requirement that they demonstrate minimum qualifications in vessel safety including rules of the road, vessel stability, firefighting, watertight integrity, and the use of lifesaving equipment. (Class II, Priority Action) (M-85-68)

Promote the preparation of crew lists by the captains of commercial fishing vessels and the deposit of such lists at a suitable location ashore before departure. (Class II, Priority Action) (M-85-69)

Promote the development of contingency plans by the fishing industry to reduce delays in alerting U.S. Coast Guard search and rescue forces of the need for assistance. (Class II, Priority Action) (M-85-70)

Urge commercial fishing vessels to schedule frequent radio communications which include a report of their position with shore or other fishing vessels to reduce delays in initiating a response in case of an emergency in which the vessel is unable to communicate. (Class II, Priority Action) (M-85-71)

Modify the search and rescue computer program (CASP) to include the drift of a heavily ballasted liferaft similar to the liferafts carried aboard the AMAZING GRACE. (Class II, Priority Action) (M-85-72)

Develop a keyword list for use by U.S. Coast Guard personnel to facilitate screening of emergency messages received at U.S. Coast Guard AMVER and Operations Centers. (Class II, Priority Action) (M-85-73)

Incorporate human factors affecting search operations, as identified in recent U.S. Coast Guard studies, into search and rescue mission planning. (Class II, Priority Action) (M-85-74)

Develop guidelines for the retention of recovered lifesaving equipment for examination by accident investigators to evaluate its effectiveness. (Class II, Priority Action) (M-85-75)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and BURSLEY, Member, concurred in these recommendations.

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