

DEPARTMENT OF TRANSPORTATION



**COAST GUARD**

**MARINE CASUALTY REPORT**

**FOUNDING OF THE M/V MARYLAND  
IN ALBEMARLE SOUND, NORTH CAROLINA  
ON 18 DECEMBER 1971 WITH LOSS OF LIFE**

**U.S. COAST GUARD  
MARINE BOARD OF INVESTIGATION REPORT  
AND COMMANDANT'S ACTION**

**ACTION BY  
NATIONAL TRANSPORTATION SAFETY BOARD**

**REPORT NO. USCG/NTSB - MAR-74-3**

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NATIONAL TRANSPORTATION SAFETY BOARD  
DEPARTMENT OF TRANSPORTATION  
WASHINGTON, D.C. 20591

M/V MARYLAND, ALBEMARLE SOUND  
NORTH CAROLINA, DECEMBER 18, 1971

ACTION BY THE NATIONAL TRANSPORTATION SAFETY BOARD

This casualty was investigated by a U.S. Coast Guard Marine Board of Investigation which convened at Portsmouth, Va., on December 23, 1971. A representative of the National Transportation Safety Board observed part of the proceedings. The National Transportation Safety Board has considered only those facts in the investigative record which are pertinent to the Safety Board's statutory responsibility to determine the cause or probable cause of the casualty and to make recommendations.

SYNOPSIS

On December 18, 1971, as the uninspected motor vessel MARYLAND, towing the barge BALTIMORE No. 2, proceeded into Albemarle Sound, N.C., the barge began to shear from side to side under the influence of heavy seas and wind. High tripping forces were imparted to the MARYLAND through the towing hawser, which had been set at a length shorter than that which good practice would require. After the master stopped the vessel to facilitate extending the hawser, a loose bight of hawser fouled the propeller and prevented the MARYLAND from regaining power to align the tow. As a result, the heavy winds caused the barge to tow the disabled tug obliquely, first off the MARYLAND's starboard quarter, then off the port quarter. The forces imparted by the hawser and wind caused the MARYLAND to heel to port for more than 2 hours, which led to flooding and the subsequent sinking of the MARYLAND.

The crew was unable to broadcast a distress message because electrical power to the radio had been lost. As a result of late and disorganized efforts to abandon ship, most crewmembers were forced to enter the cold water of Albemarle Sound without suitable life preservers. By the time a passing yacht came upon the casualty, exposure and drowning had killed six of the seven crewmembers.

The National Transportation Safety Board determines that the probable cause of this casualty was the fact that the portside watertight door which led from the weatherdeck to the lower crew berthing compartment was left open at some time while the vessel was heeled over to port. This provided a relatively low point of water ingress, and the subsequent flooding sank the vessel.

Contributing to the sinking and loss of life were:

1. Inadequate training and guidelines which resulted in the following serious errors:
  - . Setting the towline too short for existing wind and sea conditions;
  - . Failing to secure adequately the unused section of hawser and the oil drums;
  - . Failing to prepare the crew for abandoning the ship when difficulties with the tow were first recognized; and
  - . Failing to release the towing hawser before flooding caused loss of buoyancy.
2. Lack of towing vessel stability criteria which take into account the pull of the towline under adverse operating conditions, such as disablement of the towing vessel, and which are necessary to the development of operational guidelines.
3. Inability to broadcast a distress message, because of a circuit arrangement in which the radio was subject to a loss of power when the main electrical system malfunctioned.
4. Lack of adequate provisions for surviving exposure in the waters normally transited by the MARYLAND.
5. Lack of provisions to allow the crewmembers of the tug to board the barge from the water, as a last safe refuge.

#### Factors Contributing to Error

Charleston to Albemarle Sound. The Norfolk, Baltimore, and Carolina Line Inc. (NBC), the owner/operator of the MARYLAND and its tow, had issued no guidelines on the preparations necessary for a voyage through the inter-coastal waterway. On December 15, as the MARYLAND departed Charleston, S.C., the master had to rely on his own experience and discretion. The errors in judgment made throughout the voyage indicate that the discretion of the master and his mate did not assure a safe passage.

Certain safe towing practices should be familiar to every experienced master. These practices include lashing down any movable objects and maintaining a watertight hull. Furthermore, despite the absence of specific criteria for hawser length, an experienced master should extend enough hawser to accommodate prevailing sea and wind conditions. In this regard, the Marine Supervisor of NBC testified that (1) the oil drums stowed on the

afterdeck were normally secured by blocking with chocks of wood and were made fast with  $\frac{1}{2}$ -inch or larger rope, and (2) he would use no less than 1,000 feet of towline under the weather conditions which existed on Albemarle Sound at the time of the casualty. However, since NBC had not documented the practices which it considered important for safe vessel operation, there could be no assurance that its masters and crews knew of the company's unwritten policies.

This failure to disseminate operational guidelines permitted the master and the crew of the MARYLAND to take several inappropriate actions. First, only wooden chocks were used to wedge the six oil drums against the bulwark; use of rope fastening would have provided a more positive securement. Second, the unused portion of hawser was left unsecured and free to wash overboard. Third, the towline length was set between 150 and 200 feet immediately before the ship entered Albemarle Sound, even though a forecast of adverse weather conditions had been received and discussed by the master and mate.

It is doubtful that the master would have intentionally carried out unsafe practices. He may have risked making the 2-hour transit of Albemarle Sound on the shortest possible tow, since the tow would have had to be shortened when the MARYLAND entered the North River. He may not have been aware of the hazards of towing on a short hawser in adverse sea and wind conditions. If, however, the master and crew of the MARYLAND had been issued a written set of safe-towing practices and a checklist of mandatory precautions, a number of factors which contributed to this casualty might have been averted.

Entry into the sound. As the MARYLAND entered Albemarle Sound at about 4 a.m. on December 18, the force of winds and seas off the tug's port bow caused the tow to shear erratically from side to side, with the tug yawing considerably. Shortly thereafter, the mate, who was on watch, expressed concern to the deckhand about the handling of the tow. Although the mate at that time realized that the tow was set too short, he took no action to lengthen the tow or to call the master. Rather, he choose to continue into the sound with the towline too short. Although the extreme motions of the tug might possibly have alerted the master, he remained in his quarters until the change of watch 2 hours later. There are a number of possible explanations for the actions of the mate and the master:

- . The mate felt that the master was solely responsible for altering the tow, since the master had initially taken charge of setting the tow during the mate's watch and had issued no instructions to the contrary.
- . Neither the mate nor master realized the severity of conditions created by towing with a hawser set too short.
- . The master felt confident that his mate, who had prior experience as the master in charge of towing operations, would act appropriately.

If the mate had acted when he first realized the danger of his situation, he might have been able to extend the towing hawser and would thereby have afforded the MARYLAND a better chance of successfully crossing Albemarle Sound.

### The Sinking

Loss of power. Since the MARYLAND proceeded for nearly 2 hours under power into Albemarle Sound, it is likely that she could have continued to progress, if she had regained propulsion. As a consequence of her loss of propulsion, the MARYLAND came to be towed by the wind-driven barge at an oblique attitude which, together with the wind, caused the MARYLAND to heel over until her weatherdeck doorsills were immersed. If the hawser had been released, the forces tending to heel the vessel, i.e., the wind and the tripping forces, would have been significantly reduced and the vessel would have drifted without imminent danger of sinking. Since alternatives were thus available to the MARYLAND either with or without propulsion, the loss of propulsion cannot be considered contributory to this casualty.

Tripping forces and progressive flooding. With available evidence, it is not possible to calculate the extent of heeling which the barge BALTIMORE No. 2 could have imposed on the MARYLAND. However, an evaluation of the facts and the testimony supports the conclusion that the sinking of the MARYLAND was caused by a major ingress of water through the open portside watertight door to the crew's berthing quarters which occurred as the vessel was being heeled to port by the tripping forces of the tow. Specific factors lead to this conclusion:

- . The tripping forces, although not independently sufficient to capsize the MARYLAND, combined with the wind to cause a relatively large heel. The MARYLAND had been able to sustain these forces for a considerable time, 2 hours while the tug was underway and possibly another 30 minutes after the tug stopped. Since, during this time, the wind moderated slightly, the heeling should have decreased if no flooding had occurred.
- . The MARYLAND had only two major compartments which if flooded could have sunk the vessel. These compartments were the crew's berthing quarters and the engine room, located directly aft of the berthing quarters.
- . The lazarette probably flooded early, since its scuttle had so deteriorated that it was no longer watertight and since waves were continually washing over it. Since the manhole cover between the lazarette and the aft peak ballast tank was not watertight, the tank would essentially have been ballasted. The additional water in the lazarette and ballast tank, estimated to be less than 25 tons, would have caused a greater trim by the stern. However, since the two compartments were small and below the main deck,

the flooding would not have significantly changed the tug's vertical center of gravity and, thus, would not have appreciably reduced the tug's ability to resist the lateral forces of wind and towline tripping.

- . Furthermore, the flooded lazarette could not have contributed to a major ingress of water to the shaft alley directly forward of it. Its drain to the shaft alley consisted of a  $\frac{1}{2}$ -inch pipe nipple which had been capped, and the nontight collar around the penetration for the steering engine cable would have restricted water ingress to less than 10 tons per hour. Even if enough water had entered the shaft alley from the lazarette to flow over the doorsill to the engine room, the water most likely would have been noticed by the crewmembers in the engine room.
- . Direct flooding of the engine room through either of its watertight doors or portholes from the weatherdeck would have been observed by crewmembers entering the engine room during the extreme heeling. This group included both the chief and assistant engineers, the master, and the deckhand. The deckhand reported that he did not see any water, although he heard sounds of running water coming from aft. (These sounds could have been caused by small volumes of water entering from the shaft alley or through the door between the engine room and berthing quarters.) Although the starboardside watertight door to the engine room was found open by the salvage divers, this door was on the high side during heeling and therefore could not have been the initial point of water ingress.
- . Before flooding began, heel angles of between  $35^{\circ}$  and  $45^{\circ}$  would have been necessary to bring water to the height of the doorsills. Considering the MARYLAND's hull form, the flooding of the lazarette and aft peak ballast tank, and the tripping forces pulling at the towing bitt, the vessel must have been trimmed by the stern considerably as she heeled. Such an attitude would require heel angles of more than  $60^{\circ}$  to enable initial flooding through the portholes and even greater angles to bring water up to the air scoop located forward.
- . The deckhand reported that the vessel was heeled over at about  $45^{\circ}$  and that water was up to the edge of the boat deck at the time of the abortive attempt to launch the lifeboat. Just before this time, no water had been observed in the engine room, although a  $45^{\circ}$  angle of immersion at the edge of the boat deck indicated that significant flooding had already occurred.
- . The cook who was assigned to the crew berthing quarters was not normally involved in the change of watch and there is no



indication that he was on deck before the vessel lost propulsion. The only three exits from his quarters were a portside watertight door,<sup>1/</sup> a forward hatch to the weatherdeck, and a watertight door between the berthing quarters and the engineroom. The salvage divers found the portside watertight door, which exited to the main deck, open but found the other two exits closed.

- After the vessel stopped, the cook, possibly alerted by the extreme vessel heel or the crew activities, left his quarters by way of the portside watertight door. He was inexperienced and might have inadvertently left the door open. The open door would not have been observed by the other crewmembers, all of whom had either sought refuge or were working on the high (starboard) side of the vessel. The rolling motions of the vessel would have allowed waves to wash over the doorsill until continuous flooding ensued. Once water in the berthing compartment had reached the height of the doorsill to the engineroom, flooding of the engineroom could have begun through the partially dogged door between the two compartments. The divers had considerable difficulty in sealing this door during salvage.

If the portside watertight door had not been opened, the MARYLAND could have probably sustained the tripping forces and would have drifted southeast until it grounded, rammmed a structure, or received assistance. However, it must be emphasized that the flooding could not have occurred without the presence of the towline tripping forces, and if the line had been released before the vessel lost its buoyancy, the MARYLAND could have been saved.

Failure to release the towline. The crewmembers of the MARYLAND were prevented from working in the welldeck area for any extended time by the rolling oil drums and washing seas. Thus, any effort to pay out additional towline or to remove the towline from the bitts was not possible. However, if the crew had cut the towline with an axe, the risk to their safety would have been minimized. Although there are hazards and difficulties associated with cutting a nylon towline, testimony indicates that other issues regarding the merits of keeping or releasing the barge were of more concern to the master and mate.

In determining when the MARYLAND no longer could withstand the tripping forces, the master had to assess the effect of the wind on the barge and tug, and the tug's ability to resist these overturning forces. To make this assessment the master would have had to know the operating characteristics of the tug and barge and to have time to evaluate the situation and then to take appropriate action. As discussed above, the master had ample time to evaluate the situation, but he lacked information regarding the operating characteristics of the tow and the means to measure the significant variables which were affecting the performance of the tow. The tow could have appeared

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<sup>1/</sup> Although these doors are referred to as "weathertight" in the Marine Board of Investigation report, they have been determined to be watertight.

to be a safe refuge, in view of the loss of propulsion, the pump failures, and the master's uncertainty about the source of flooding. Thus, without sufficient information or previous experience in a similar situation, the master was not in a position to judge whether the greatest hazards lay in keeping or releasing the tow.

Other factors. The MARYLAND was not able to drain her welldeck adequately in the seas encountered on Albemarle Sound. The effect of this captured water on the initial stability was of little consequence, since the tripping forces caused a sustained heeling which kept the top of the bulwark immersed. Thus, the freeing characteristics of the tug, although inadequate to prevent a buildup of water, did not significantly affect this casualty.

The crew was unable to start either the main or the portable pump on the MARYLAND. However, since water flooded through the open portside watertight door to the berthing quarters at a rate which greatly exceeded the pumping capacity, the malfunctioning of the pumps cannot be considered contributory to the MARYLAND's sinking as long as the door remained open.

#### Loss of Life

The evidence was insufficient to determine why the lifeboat capsized during the launch. The fact that it again capsized while it was being towed to the Coast Guard station at Coinjock indicates that it might not have possessed adequate stability. The simplicity in operating the radial davit launching system should not have overtaxed the crew's skills, especially since the master supervised the launching. Since there are no inherent characteristics in the launching system that would preclude operation at large angles of heel, the master's tardiness in ordering the lifeboat launching cannot be considered a direct cause of the capsizing. Thus, inadequate stability rather than personnel error possibly accounted for the lifeboat's capsizing during launch.

Use of the PFD's. The life of only one crewmember, the deckhand, was saved by the use of a personal flotation device (PFD)<sup>2/</sup>. The deckhand was able to insert himself within a lifering and, although semiconscious, was able to assist in his own rescue. The master, who had donned a lifejacket, and another crewmember, who had jumped overboard with a lifering, died from drowning and exposure to the cold water. The other crewmembers drowned, although exposure could have contributed to the drowning.

Throughout the efforts to save the tow, the master did not advise the crew to prepare to abandon ship. By the time the crew became aware of the need for PFD's, the flooding and vessel heel probably prevented their return to the crew berthing compartment, where six of the nine Coast Guard approved PFD's were stowed. Some crewmembers may have not known where the remaining approved PFD's were located, and others may have not realized the difference between their cork work vests and the approved lifejackets.

<sup>2/</sup> PFD's are Coast Guard approved life-preserving devices which can be worn, e.g., lifejackets and buoyant vests, or thrown, e.g., liferings.

The master's body was recovered with a lifejacket on. It is possible that two of the five dead crewmembers whose bodies were found without PFD's had donned work vests or had improperly donned lifejackets and that the vests or jackets were subsequently torn loose. A third crewmember may not have been able to insert himself within the lifering he was using. The other two dead crewmembers entered the water without any flotation device. Thus, five of the six victims may have been in the cold waters of Albemarle Sound without PFD's before death ensued. If the master had advised the crew to don their PFD's when he first recognized the MARYLAND's possible peril, there would have been enough time for each crewmember to find and properly don an approved PFD. Although exposure would have made life expectancy marginal in any case, the use of the PFD's in "good and serviceable" condition would have protected the crewmembers against early drowning and until their bodily functions began to fail.

During the search and rescue operations, two cork-type, badly deteriorated life preservers used as work vests were found near the scene of the casualty. Federal regulation (46 CFR 25.25) require that lifesaving equipment, including work vests, be in "good and serviceable condition."

Lack of exposure protection. Without sufficient thermal protection, a person immersed in cold water will experience accelerated body heat loss which can lead to failure of various body functions and to death. (Causes of death can vary from immediate cardiac arrest to a drop in body core temperature to a level too low to sustain life.) The effect of body heat loss caused by immersion in cold water is known as immersion hypothermia. Survival time depends upon numerous factors, including the victim's physical condition, the water temperature, and the insulating effect of clothing. One study of immersion hypothermia has challenged the use of lifejackets as a vehicle for survival and recommends that the kind of inflated suit used by submariners be considered as an alternative. (1) Another study has examined survival times in experiments and in actual casualties. (2) These two studies suggest that the crew of the MARYLAND was inadequately equipped for surviving in the cold waters of Albemarle Sound.

Shortly after the MARYLAND sank, the water temperature in the vicinity was recorded to be about 53° F. A person exposed to 53° F. water would have a 50-percent chance of surviving for about 2.5 hours. (2) (This statistic reflects generally persons who were wearing lifejackets and aviator's garb.) The expectancy of death is 100 percent after about 5 hours of exposure to the water at 53° F. However, long before death, unconsciousness would occur and the victim would drown without a PFD. Accordingly, most crewmembers on the MARYLAND would be expected to have been dead by the time the first rescue vessel arrived about 2 to 3 hours after the sinking.

It is well within the state-of-the-art to provide survival protection for the conditions which confronted the crew of the MARYLAND. One commercially available survival suit afforded protection in 35° F. water for periods of more than 13 hours during U.S. Navy tests. (3) By extending the survival time in water, a survival suit increases the time available for rescue. However, thermal protection is not required as a feature in PFD's

used on U.S. commercial vessels. The required PFD's, at best, can aid in lifesaving until the victim succumbs to immersion hypothermia. If the crew of the MARYLAND had donned survival suits which afforded both thermal and buoyancy protection, it is likely that they would have been saved.

Barge as a safe refuge. There have been towing-vessel casualties in which crewmembers saved themselves by boarding a barge in the tow. After this accident, the barge was still attached to the MARYLAND, as is often the case when a towing vessel is capsized by tripping forces. At least two members of the crew, and possibly more, approached the barge but were unable to board because of its 3-foot freeboard and the heavy seas. Additional lives may have been saved if the BALTIMORE No. 2 had had provisions to facilitate boarding from the water in rough seas and if the crew had been familiar with such provisions.

### Towing Operations

Stability criteria. When a tow does not follow astern of its tug, the tug can be subjected to large forces which pull on the towing bits at angles off the tug's centerline. This situation can occur when a tug is maneuvering, when wind and other asymmetric forces offset a tow, or when a barge overruns its tug. When a tug is maneuvering, the tug's steering forces may become the predominate cause of tripping. In such a case, sufficient righting characteristics and watertight integrity can be incorporated into the vessel's design to prevent heeling to an angle where downflooding or loss of stability would occur. In other cases, the causes of excessive towline forces are not well defined, since they depend on the manner of towing operations and the characteristics of the barge. After losing propulsive power, the MARYLAND came to be towed nearly sideways by the barge. However, the magnitude of tripping forces in such cases can be limited by properly matching the tug and barge(s) and by adhering to safe operating practices. Since both of these precautions depend upon the existence of stability criteria for towing vessels, it is necessary to examine briefly how existing stability criteria could have been used to determine the MARYLAND's suitability for service.

The U.S. Coast Guard requires that certain oceangoing tugs provide a metacentric height (GM) sufficient to keep the deck dry under normal steering forces and to meet specific righting-energy and weather criteria. (4) However, the MARYLAND was not subject to these Coast Guard criteria. (5) Other criteria which have been proposed would provide a GM sufficient to prevent deck-edge immersion in the event that the tug is towed sideways by an overrunning barge after a maneuver or loss of propulsion. (6) Neither these criteria nor the Coast Guard criteria nor any other currently used criteria account for the forces and overturning moment which caused the MARYLAND to heel to the angle of downflooding, i.e., the wind on the vessel's superstructure and the simultaneous towline pull.

The weather criterion used by the Coast Guard would not assure sufficient stability because it accounts for heeling due to wind alone and does not account for the combined effects of wind and towline pull. For high-powered tugs, the towline pull criteria based upon steering forces might be

a more stringent and acceptable criterion, but for the MARYLAND, which is a relatively low-powered vessel for her size, the resultant towline and wind forces may be more critical than steering forces.

Towline length. The length of towline is also important to safety in towing operations. A master must normally keep his towline relatively short (about 200 to 300 feet) to avoid collision or grounding in congested waterways. However, in open waters, where little protection is afforded from the weather, a longer towline improves the handling characteristics of the tow when sea conditions and wind cause the barge to move erratically about the towing course. First, since with a longer towline the barge requires more time to move a given angular increment about the towing vessel, the master has more time to sense and assess the affects of barge movements and to make compensating maneuvers. More importantly, the sudden shock loadings caused by large waves are reduced by the spring effect which results from the increased stretch, catenary, and the weight of longer towline.

The minimum length of towline for safe towing depends on a number of factors, which include the resistance to towline pull for the tug and the size, hydrodynamic, and aerodynamic characteristics of the barge. However, there is virtually no written information on this subject which could be used to determine the minimum towline length for safe towing. Towing vessel masters must rely upon their experience in choosing the length of towline. Such experience is not always adequate to assure safety. Thus, in the case of the MARYLAND, the master may have set the towline too short for the conditions of towing without realizing that he was placing his crew and vessel in jeopardy.

The Safety Board has previously analyzed two other casualties to which tripping forces contributed significantly. (7&8)

#### Towing Vessel Classification, Inspection, and Survey

The tug MARYLAND was an uninspected vessel, as are most towing vessels less than 300 gross tons. These vessels are not required to be built to specific standards of construction. Federal regulations (46 CFR24 through 26) require the use of navigation lights and of certain items of lifesaving and firefighting equipment, and specify ventilation and backfire flame control. An approved lifepreserver for each person on board is required to be stowed in a readily accessible location. Work vests are allowed for working near or over the water in favorable weather. Lifeboats or life-rafts are not required. Although the regulations state that the required lifesaving equipment "shall be in good and serviceable condition," the Coast Guard does not have a program for regular inspection to assure that the lifesaving equipment aboard towing vessels is properly maintained. Thus, the condition of the vessel and its equipment is left to the discretion of the vessel's owners and operators.

At the request of the insurance underwriters, the United States Salvage Association (USSA) surveys vessels to ascertain their condition and to evaluate their suitability for service. These requests typically involve uninspected vessels, since no other surveys or inspections which would

assure or describe the vessels's suitability are required. USSA makes recommendations regarding the correction of deficiencies noted in the survey, and these recommendations become a matter for resolution between the owner/operator and the underwriter. In the case of the MARYLAND, corrective action was taken on 10 of the 11 recommendations made by the USSA, and the intent of the 11th recommendation may also have been carried out.

Since the USSA is not a rulemaking organization, the criteria used by their marine surveyors generally are adapted from criteria developed by other organizations, such as the U.S. Coast Guard, the American Bureau of Shipping, and the Intergovernmental Maritime Consultative Organization. Probably because of the lack of generally accepted stability criteria, USSA did not conduct stability tests on the MARYLAND. Lifesaving gear was not checked, since the USSA is primarily concerned with suitability of the vessel for service.

Without additional legislation to extend the U.S. Coast Guard's authority to uninspected vessels, survey organizations such as the USSA are the only organizations in a position to effectively influence the safety of towing operations beyond voluntary compliance. The USSA could improve its effectiveness in surveying uninspected towing vessels by updating their criteria through a systematic analysis of the hazards inherent in towing operations. In this regard, the Safety Board has described the usefulness of fault-tree analysis in an earlier marine casualty report. (9)

#### Authority to Regulate

By authority of the Towing Vessel Operator Licensing Act, the Coast Guard can require most operators to possess and demonstrate a reasonable familiarity with the recognized hazards of towing as well as an understanding of how to avoid and handle hazardous situations. In conjunction with this licensing program, the Safety Board recommended that the U.S. Coast Guard "publish and make available to towboat operators guidelines for safe operating procedures for towing operations." (10) However, licensed masters cannot be expected to possess sufficient knowledge regarding the safe operation of towing vessels as long as criteria for vessel certification do not exist. Furthermore, without an effective inspection program by the Coast Guard there can be no assurance that a towing vessel and its safety equipment will be maintained in serviceable condition. Therefore, the Coast Guard's lack of authority to establish and enforce minimum safety standards for "uninspected" towing vessels precludes an effective means of responding to some of the factors which contributed to the sinking of the MARYLAND and the loss of life which ensued.

Although the Coast Guard has authority to require that certain items of safety equipment be in serviceable condition on uninspected vessels, the Coast Guard does not have a program for periodically examining such equipment. The Coast Guard apparently has the authority to establish such a program (14 USC2 and 89), and has assumed some responsibility by their boarding examinations of "uninspected" vessels. However, an examination which entails

the sporadic boarding of vessels does not assure that lifesaving equipment will be available in an emergency. Therefore, the Coast Guard should re-examine its responsibility in this regard.

In its conclusions, the U.S. Coast Guard Marine Board of Investigation discussed the possible lifesaving benefits which an inflatable liferaft might have afforded. The Safety Board has previously recommended that the Coast Guard evaluate the need for regulations requiring inflatable liferafts on towing vessels.(8) The Coast Guard is evaluating this matter.

The Coast Guard also recommends that the Federal Communications Commission (FCC) consider the possible need for a separate or alternate source of power for radio equipment installed on commercial vessels. Under authority of the Communications Act of 1934, as amended, the FCC requires cargo ships of 300 or more gross tons to be equipped with either a radiotelegraph or a radiotelephone station which is provided with a "reserve source of energy." This authority, however, does not extend to uninspected, towing vessels. Thus, the FCC may need additional authority to require that "uninspected towing vessels" have a separate or alternate source of power for their installed radio equipment. The Coast Guard and FCC should jointly determine the most appropriate means for requiring that radiotelephone equipment on towing vessels be provided with a reserve source of energy.

#### PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this casualty was the fact that the portside watertight door which led from the weatherdeck to the lower crew berthing compartment was left open at some time while the vessel was heeled over to port. This provided a relatively low point of water ingress, and the subsequent flooding sank the vessel.

Contributing to the sinking and loss of life were:

1. Inadequate training and guidelines which resulted in the following serious errors:
  - . Setting the towline too short for existing wind and sea conditions;
  - . Failing to secure adequately the unused section of hawser and the oil drums;
  - . Failing to prepare the crew for abandoning the ship when difficulties with the tow were first recognized; and
  - . Failing to release the towing hawser before flooding caused loss of buoyancy.
2. Lack of towing vessel stability criteria which take into account the pull of the towline under adverse operating conditions, such as disablement of the towing vessel,

and which are necessary to the development of operational guidelines.

3. Inability to broadcast a distress message, because of a circuit arrangement in which the radio was subject to a loss of power when the main electrical system malfunctioned.
4. Lack of adequate provisions for surviving exposure in the waters normally transited by the MARYLAND.
5. Lack of provisions to allow the crewmembers of the tug to board the barge from the water, as a last safe refuge.

#### RECOMMENDATIONS

The National Transportation Safety Board recommends that:

1. The Norfolk, Baltimore and Carolina Line, Inc., and other operators of uninspected towing vessels, analyze their operations to develop operating instructions, manuals, or checkoff lists which will clearly convey guidelines for safe operating methods. Safety information obtainable from the Coast Guard should be incorporated in these guidelines, and the guidelines should be updated periodically to reflect current experience. (Recommendation No. M-74-6)
2. The U.S. Coast Guard:
  - a. Develop, in its study of towing vessel stability, stability criteria which would enable an unpowered vessel to withstand the combined effect of direct wind and of lateral forces of the towline. The application of these criteria would require establishing towline pull characteristics of barges under specified wind conditions, e.g., ocean and coastwise service and partially protected and protected waters. This would enable the capabilities of towing vessels to be matched with certified towline-pull characteristics of barges. (Recommendation No. M-74-7)
  - b. Determine, in its study of towing vessel stability, the effect of towline length on towing safety. (Recommendation No. M-74-8)
  - c. Structure the results of its towing vessel stability study into operating information which could be used as a guide by the operators of towing vessels. (Recommendation No. M-74-9)
  - d. Increase the frequency and scope of its examination program in regard to insuring that required lifesaving equipment on towing vessels is in good and serviceable condition. (Recommendation No. M-74-10)



- e. Seek authority to require adequate thermal, as well as buoyant, protection to provide for survival of seaman on all commercial vessels. (Recommendation No. M-74-11)

3. The United States Salvage Association:

- a. Develop and undertake a more comprehensive survey program for uninspected towing vessels to include a determination of a vessel's adequacy for towing based on towline stability. (Recommendation No. M-74-12)
- b. Consider the usefulness of systems analysis techniques, such as fault-tree analysis, as a predictor of towing vessel characteristics which are important to safety. (Recommendation No. M-74-13)

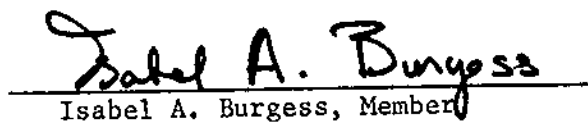
BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

Adopted this 22nd day of May 1974:

  
John H. Reed, Chairman

  
Francis H. McAdams, Member

  
Louis M. Thayer, Member

  
Isabel A. Burgess, Member

  
William R. Haley, Member

#### REFERENCES

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4. U.S. Coast Guard Merchant Marine Technical Note 2-71.
5. 46 CFR 42.03-1 and 42.09-1 Load Line Regulations.
6. Jeffrey N. Wood, "Some Comments on Tug Design Criteria," Shipyard and Boat International, First International Tug Conference, London, 1970.
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8. "M/V THERESA F. Capsizing in Gulf of Mexico," Marine Casualty Report, National Transportation Safety Board, 31 March 1971.
9. "Loss of the Motor Towing Vessel MARJORIE McALLISTER in the Atlantic Ocean," Marine Casualty Report, 29 June 1971.
10. "Tug CAROLYN and Barge WEEKS No. 254 Collision with Chesapeake Bay Bridge and Tunnel," Marine Casualty Report, National Transportation Safety Board, February 1974.



**DEPARTMENT OF TRANSPORTATION  
UNITED STATES COAST GUARD**

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80 AUG 1973  
5943/MARYLAND  
A-5 Bd

Commandant's Action

on

The Marine Board of Investigation convened to investigate circumstances surrounding the foundering of the M/V MARYLAND in Albemarle Sound, North Carolina on 18 December 1971, with loss of life

1. The record of the Marine Board of Investigation convened to investigate subject casualty has been reviewed; and the record, including the Findings of Fact, Conclusions and Recommendations, is approved subject to the following comments and the final determination of the cause by the National Transportation Safety Board.

REMARKS

1. Concurring with the Marine Board it is considered that the cause of the casualty was the progressive flooding of the M/V MARYLAND which resulted from being towed stern first by the wind driven barge. The failure of the master to cut the barge adrift after the tug's engine failed to restart contributed to the flooding. The failure of the engine to restart was caused by the propeller being fouled by a bight of the free end of the towing hawser which washed overboard through the starboard freeing port.


ACTION CONCERNING THE RECOMMENDATIONS

1. The recommendation that a study of freeing port size be conducted to determine the adequacy of current standards as they relate to different types of vessels, especially those of low freeboard which by their service require men to work on deck is concurred with. The Merchant Marine Technical Division of the Office of Merchant Marine Safety will examine the pertinent data in this casualty and determine freeing port adequacy for future designs. In addition, the Towing Industry Advisory Committee will be requested to provide recommendations and advice regarding freeing ports.

2. The recommendation that the towing industry be alerted to the dangers associated with loosely stowed hawsers in the well deck area is concurred with. The facts surrounding this casualty will be published in the Proceedings of the Marine Safety Council. In addition, wide distribution of copies will be made to industry and industry associations for use in alerting others of possible dangerous or hazardous operating procedures. The Towing Industry Advisory Committee will be requested to provide recommendations and advice relative to proper hawser storage. In addition the recommendation that questions relating to the use and securing of hawsers be made a part of the towing vessel operator license examination is considered to be worthwhile and will be accomplished.

3. The recommendation that a copy of the Marine Board Report be furnished to the Federal Communications Commission will be accomplished for their use in considering the possible need for a separate or alternate source of power for radio equipment installed on commercial vessels.

4. The recommendation that legislation be sought which would prescribe minimum standards of design, arrangement and safety equipment for uninspected towing vessels has much merit. Legislation to place towing vessels under Coast Guard inspection has been introduced in the Congress on several occasions.

  
T. R. SARGENT  
Vice Admiral, U. S. Coast Guard  
Acting Commandant



DEPARTMENT OF TRANSPORTATION  
UNITED STATES COAST GUARD

Address reply to:  
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Fifth Coast Guard District  
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431 Crawford St.  
Portsmouth, Va. 23705

5943/Tug MARYLAND  
Marine Board  
5943.230-71 (PVA)  
17 April 1973

From: Marine Board of Investigation  
To: Commandant (GMVI)

Subj: M/V MARYLAND, O. N. 270563, uninspected motor towing vessel; foundering in Albemarle Sound, North Carolina on 18 December 1971, with loss of life

FINDINGS OF FACT

1. At or about 0730 (all times EST) on 18 December 1971, the uninspected motor towing vessel MARYLAND foundered and sank in the Albemarle Sound, North Carolina approximately 800 yards southwest by south of Albemarle Sound Entrance Light "AS" (LLN 4604) (USC&GS) Chart No. 1229, 129SC and 831SC). The casualty occurred after the vessel encountered high winds and rough seas in Albemarle Sound while enroute from Charleston, South Carolina to Baltimore, Maryland via the Atlantic Intracoastal Waterway with the unmanned freight barge BALTIMORE NO. 2 in tow. Of the seven crewmembers aboard the MARYLAND, one was rescued by the passing Yacht GEORGETTA; the other six lives were lost. The unmanned freight barge BALTIMORE NO. 2, being towed by the MARYLAND at the time of the casualty, subsequently broke loose from the tug and drifted into the William B. Umstead Bridge over Croatan Sound, North Carolina, slightly damaging the barge and the bridge. The MARYLAND was raised on 13 May 1972 and moved to New Bern, North Carolina where it was placed on drydock for examination on 2 June 1972. The intentions of the salvager are unknown.

2. The following six crewmembers lost their lives as a result of the casualty:

Richard R. Haltiwanger	Master	N.O.K.: Wife, Lillian C. Same Address
110 Montague Avenue		
N. Charleston, S. C.		
SSN 249 46 8831		
Z-1063499 - Tankerman Grade "B" and below.		
Date of Birth - 22 March 1935		

Charles T. Whealton	Mate	N.O.K.: Wife, Lula C. Same Address
1561 Campostella Road		
Chesapeake, Virginia		
SSN 237 16 6899		
Z-1091937 - O. S., Wiper, Tankerman "E" only.		
Date of Birth - 26 March 1913		



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4. The Tug MARYLAND was built in 1938 by the Speeden Shipbuilding Company, Inc. of Baltimore, Maryland, as hull 279; for the U. S. Army Corps of Engineers. The vessel's original name was the STEPHEN F. AUSTIN which was later changed to the LIEUTENANT THOMAS B. SOLLUM. Norfolk, Baltimore and Carolina Lines, Inc. (NBC Lines) acquired the vessel in 1955 from the Eveready Supply Company of Bridgeport, Connecticut, who had acquired it from the U. S. Army. Review of the official U. S. Coast Guard vessel documentation and admeasurement records established that the vessel was admeasured at 160 gross tons at the time of acquisition and was assigned her official number in November 1955. In January 1956, she was readmeasured to 166 gross tons because of the addition of a raised pilothouse and conversion of the old pilothouse to an accommodation space. The vessel was issued a permanent Certificate of Consolidated Enrollment and License for the coasting trade in March 1956. The last Master's Oath of New Master, CG-1305, was executed on 14 October 1971 by Richard Ralph Haltiwanger. As a motor towing vessel operating in inland service, the MARYLAND was not subject to Coast Guard inspection under existing laws nor was she required to be manned by licensed officers. She was not classed by the American Bureau of Shipping. There was no record of a stability test ever having been conducted.

5. The MARYLAND was divided into five (5) watertight compartments below the main deck. The chain locker and forepeak tank extends 9 feet 6 inches, from the stem, to a watertight bulkhead at frame 7. An 18-inch diameter watertight scuttle provided the only weather deck access to these spaces. Accommodation, storage and fuel tank spaces extended aft, 32 feet 7 inches, to another watertight bulkhead at frame 28. This bulkhead was penetrated by a four dog watertight door leading to the machinery spaces. Immediately forward of this watertight bulkhead between frames 25 and 28, were two fuel tanks of about 2500 gallon capacity each. These tanks were located port and starboard and built integral to the bottom and side shell and to the main deck; the vents for those tanks extended to just below the overhang of the house deck terminating in a gooseneck with flame screens. The space between them formed a passageway leading from the crew space to the watertight door leading to the engineroom. This door was normally kept closed because of the high noise level emanating from the engineroom; however, there was no cautionary notice requiring the door to be kept closed and dogged. Access to the crew space from the weather deck was via a weathertight door and companionway located at frame 22 port side. There was also a 24 inch by 24 inch raised watertight escape hatch leading from the crew space to the weather deck at frame 13 on the centerline of the vessel. On the main deck, immediately to port of this escape hatch, was located a 16-inch diameter air vent with a cowl type air scoop. The lowest point of this scoop was approximately 36 inches above the deck. The crew's space was also provided with four 8-inch port lights to a side, located at their lowest point, about 2 feet 4 inches above the design waterline. These port lights were permanently secured and could not be opened by the crew. The lone survivor, who was berthed in this crew space, testified that the space was dry and that there had not been any significant problems with leakage.

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6. Below the main deck the machinery space extended from frame 28 aft, 29 feet 9 inches, to a watertight bulkhead at frame 45. Above the main deck, in the house, the machinery space extended from a bulkhead at frame 29 aft to the after end of the deckhouse at frame 45. Within the deckhouse, the main deck consisted of partial deck around the perimeter of the machinery space with steel grating inboard around the main engine. The watertight bulkhead at frame 45 was fitted with a watertight door leading to the shaft alley. The normal position of this door could not be determined; however, the lone survivor testified that he saw the door in the open position immediately prior to the casualty. The bulkhead at frame 45 was also penetrated by the propeller shaft at the deck plate level and by the steering engine cables near the overhead. The propeller shaft was provided with a packing gland and the steering engine cable penetrations were nontight collars. Below the waterline there were two skin valves providing high and low suction for engine cooling and other raw water services. All other skin valves were above the waterline. Access to the machinery space from the weather deck consisted of two weathertight doors, one each port and starboard. These doors opened onto the upper level of the machinery space. There were also six 14-inch hinged port lights in the deckhouse for the machinery space. Two of the port lights were located on each side of the house and two at the after end. On the house top, over the machinery space, there was a skylight with six 1/4 inch plate glass window lights to a side. At the after end of the skylight, starboard side, there was a 16-inch vent with an air scoop. The lowest point of the scoop was approximately 36 inches above the house top. The main engine air intake was located on the house deck forward of the skylight and stack, port side, in the protection of the pilothouse wings. It was a mushroom type breather, with the breather pipe leading directly to the main engine scavenger pump.

7. Immediately aft of the machinery space was the shaft alley. Originally, there was weather deck access to this space via two 18-inch watertight scuttles; however, these scuttles had been welded closed at some undetermined time.

8. The last watertight compartment consisted of the after peak tank and a lazarette which was common to the rudder packing gland and quadrant space. This compartment extended from a watertight bulkhead at frame 52 aft to the stern. The only access to these spaces was a 24-inch scuttle in the main deck which was secured in place by a strongback on its underside. A single through bolt in the center of the scuttle, to the strongback, was used to secure this scuttle in place. It was necessary for the engineroom watch to periodically open the scuttle in order to inspect the rudder packing gland and electrical limit switches located in the quadrant space. The lazarette and steering quadrant spaces were not provided with installed means for pumping; therefore, a drain consisting of about a 1/2 inch pipe nipple had been installed to drain the lazarette into the shaft alley. The watertight bulkhead at frame 52 was also penetrated near the overhead with nontight fittings for the steering cables, similar to those in bulkhead 45.



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9. As originally built, the MARYLAND was provided with an anchor windlass forward, but this installation had been removed at some undetermined time. At the time of the casualty the vessel was reportedly outfitted with a 125 pound Danforth anchor which could be attached to the towing, or other line, should the need to anchor arise. There are no Federal Regulations which require uninspected vessels to be outfitted with an anchor.

10. A standard towing bitt with horns was located on the after deck approximately 19 feet forward of the rudder post. At the starboard side of the bitt was located an electric capstan. The power unit for this capstan was located below the main deck in the shaft alley space. Controls from the capstan were located on the after end of the deckhouse immediately forward of the capstan.

11. The MARYLAND was a well deck type vessel with a 22-inch bulwark completely surrounding the main deck at side. Aft of the towing bitt, a caprail added about 4 inches additional height to the bulwark. As originally built, there were three 10-inch by 24-inch freeing ports on each side of the after 2/3's of the vessel. After salvage, the vessel was observed to have 4 freeing ports to a side. Total freeing port area was about 1920 square inches. The Rules and Regulations for Small Passenger Vessels, 46 CFR 178.30-5 would have required about 1637 square inches for an equivalent well deck vessel of this configuration. The Load Line Regulations for an ocean service vessel of this configuration would have required about 2160 square inches (46 CFR 43.10-97) prior to July 1968 and about 2318 square inches (46 CFR 42.15-70) after July 1968. The weather deck doors leading to below deck spaces were provided with 15-inch sills. A small passenger vessel would have required 6-inch sills for such doors (46 CFR 178.35-1). Load Line Regulations would have required 24-inch sills for such doors on a vessel in ocean service (46 CFR 43.10-60 and 43.10-75) or 18-inch sills on a vessel Great Lakes service (46 CFR 45.10-57 and 45.10-70). The American Bureau of Shipping Rules For Building And Classing Steel Vessels For Service On Rivers And Intracoastal Waterways, 1965, P4.08.06 would have required a 6-inch sill height for weather deck doors leading to spaces below the weather decks.

12. The MARYLAND was a single screw, direct drive, direct reversible diesel vessel. She was originally powered by a 450 horsepower engine; but in 1965 a rebuilt Fairbanks Morse Model 37 D 14, six-cylinder engine was installed, increasing the horsepower to 690. Fuel for the main engine was pumped from the bunker tanks to a day tank, located at the upper level of the engineroom by an auxiliary engine driven transfer pump. The fuel system was a recirculating type which provided fuel for the auxiliary diesel generators as well as the main engine. The engine is started by compressed air. For that purpose, there were four storage tanks located in the shaft alley. These tanks were reportedly capable of providing air for 15-20 starts. The American Bureau of Shipping Rules require a minimum capacity for 16 starts for reversible main engines (ABS Rules For Building And Classing Steel Vessels For Service On Rivers And Intracoastal Waterways, 1965, P 5.01.11(b)). In addition to an attached engine driven air compressor there was an electric driven compressor. With these compressors running, the air supply was reportedly adequate for an infinite number of starts. The engine had a fresh water closed cooling system. Raw

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cooling water to the heat exchanger could be taken either from a high suction sea chest on the port side or a low suction sea chest on the starboard side. Each line was about 4 inches in diameter and provided with duplex-type strainers. These same sea chests and strainers provided a common raw water cooling system for two auxiliary generators and raw water systems. There was one electric fire and bilge pump located at the lower level starboard side of the machinery spaces. The bilge suction was manifolded with separated lines serving the fore-peak, the crew's accommodation space, the engine room and the shaft alley. The manifold valves were of the stop check type; foot check valves had been installed in each bilge line in 1970 to meet insurance requirements. The machinery space was normally manned by one engineer. There was a standard bell system for giving engine orders from the pilothouse; the bell system could also be operated from the after house deck when needed. There was a voice tube from the pilothouse to the location of the engine throttles.

13. The electrical system consisted of two 120-volt DC, 20 KW diesel driven generators located on the lower level, port side, of the engine room. Each generator diesel was provided with its own starting battery. The generators were of drip-proof construction located about 24 inches above the deck plates and about 12 inches from the skin of the vessel. There was a battery bank located on the upper level, port side, which "floated" on the system. It consisted of 9 standard 12-volt diesel starting batteries. Both the generators and the battery banks were connected to the switchboard located on the port side, lower level. The switchboard extended from the deck plates to the main deck level and was of "open" type construction. Electrical supply for all vessel equipment, including the radio, came from the switchboard. There were no direct connections to the batteries.

14. The MARYLAND was outfitted with a 16-foot lifeboat built in June 1948 by the Wellen Boat and Davit Company of Perth Amboy, New Jersey. The lifeboat had a beam of 5.5 feet, a depth of 2.38 feet, an air tank capacity of 22.8 cubic feet and cubic capacity of 125 cubic feet. It had a capacity to carry 12 persons and bore manufacturer's number A15027. It was fabricated of 18-gauge metal and had been Coast Guard inspected at the time of construction. The name plate bore Coast Guard approval 148/0, which indicates that the lifeboat was built in accordance with the requirements of 46 CFR 160.035 in effect at the time of construction. The lifeboat was secured in chocks on the skylight top and served by two radial davits on the port side of the house. The exact manner in which the falls were rigged cannot be determined as the davits and falls were not recovered and neither the lone survivor nor company personnel could recall the method of rigging. The vessel was also outfitted with at least two ring life buoys, testimony indicated as many as four, stowed in racks on the deck house. Three life preservers were stowed in the pilothouse and one each in racks at each crewmember's berth. There were also an undetermined number of old cork type life preservers aboard for use as work vests when working over the side or on barges.

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15. The Barge BALTIMORE NO. 2 was originally built as a car float in 1926. It was rebuilt in 1962 by adding short rakes and a deck cargo house. The deck cargo house was about 11 feet in height and extended to within about 1 foot of the side and 12 feet of the rake headlogs. The barge was equipped with a 1-inch wire rope towing bridle. Each leg of the towing bridle was led from cleats, port and starboard, through Panama chocks and shackled to a swivel. When towed astern, the towing hawser of the tug was shackled to this swivel.

16. NBC Lines maintenance and safety program for uninspected vessels, such as the MARYLAND, was conducted by the Marine Superintendent and the Port Engineer. There was no prescribed plan for periodic inspections, drydocking or conduct of drills, nor was such a plan required by law. The Marine Superintendent and Port Engineer visited each vessel as need arose and as time permitted, usually every two weeks or when the vessel was in the port of Norfolk, Virginia. Visits were primarily to initiate corrective action for operational deficiencies as pointed out by the Master and Chief Engineer. The Marine Superintendent did indicate that he usually conducted a walk-through examination of safety equipment, primarily to ascertain that it was available and in its proper place. Responsibility for the condition of safety equipment and the conduct of drills was left entirely up to the Master. Masters were required to keep a log but this was used primarily for operational matters. There is no record or other indication that a lifeboat drill was ever held. For an inspected vessel of the cargo or miscellaneous class, 46 CFR 97.15-35 would have required a boat drill once every week and within 24 hours of leaving a port if more than 25 percent of the crew had been replaced at that port.

17. The MARYLAND was last drydocked February 22 - March 9, 1971 at which time repairs to rudder, rudder quadrant, rudder post, shaft sleeve and stern bearing were effected. Doublers were installed on the A Strake, port and starboard, in way of the engineroom because "she sounded as if she was thin in this particular area." Based on examination by members of the board after salvage, this type of doubler repair would have been permitted on an inspected vessel of similar construction, service and route by the provisions of Navigation and Vessel Inspection Circular No. 7-68.

18. The MARYLAND was surveyed afloat on August 13, 1970 by a Marine Surveyor of the United States Salvage Association, Inc. at the request of the underwriters. The purpose of this survey was to ascertain condition and evaluate suitability for service. No crewmembers were aboard at the time of the survey and operational tests were not conducted. As the result of this survey, eleven recommendations for corrective action were set forth. They were given to the Marine Superintendent on September 13, 1970. Corrective action on all recommendations was completed by November 10, 1970, except for one requiring examination in drydock. Although the vessel was in drydock numerous times subsequent to this survey, there is no evidence that it was examined by any party other than the owner's representative.

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19. Employment of personnel was controlled by the Marine Superintendent for deck personnel and by the Port Engineer for engineroom personnel. They were responsible for investigating qualifications and background of prospective employees. This was an informal procedure based primarily on personal knowledge of the prospective employee. Employees on the company's uninspected vessels were not required, as a matter of company employment policy, to possess a Coast Guard issued license.

20. The Master of the MARYLAND, Captain Haltiwanger, had been employed by NBC Lines, on and off, since 1955. During this period of time he had accumulated 8 to 10 years experience while serving as mate and master of various tugs operated by NBC Lines. He had cumulative service of over one year as Master of the Tug MARYLAND and most recently executed the oath as new master on October 14, 1970. The former master, Charles T. Whealton, was demoted to mate by reason of the company seniority system. He had been employed by the company since 1968 in various capacities of mate and master.

21. The Marine Weather Forecast for the Albemarle and Pamlico Sounds broadcast by the National Weather Service, Norfolk, Virginia for 5:00 p.m., 17 December 1971 issued small craft warnings for variable winds becoming north to northeast 15 to occasionally 25 knots later that night and continuing on 18 December 1971, clearing skies later at night, and waters becoming choppy. The 11:00 p.m., 17 December 1971 forecast for the same area continued small craft warnings, forecasting winds becoming northwest to north 15 to 25 knots and gusty that night. Waters were to become rather choppy that night and continue on 18 December. The 5:00 a.m., 18 December forecast changed small craft warnings to gale warnings, for northwesterly winds increasing to 35 to 45 knots, waters becoming choppy. Weather observations taken by FAA Flight Service at the Coast Guard Air Station, Elizabeth City, North Carolina, the nearest recording station to the scene of the casualty, were as follows:

12/17/71	10:00 PM Winds 10 knots from 240°-310°T	Temp, 53°
12/18/71	7:00 AM Winds 12 gusting to 20 knots from 300°T	Temp, 29°
	8:00 AM Winds 10 gusting to 18 knots from 320°T	Temp, 29°
	9:00 AM Winds 9 gusting to 18 knots from 320°T	Temp, 31°
	10:00 AM Winds 11 gusting to 20 knots from 330°T	Temp, 33°

All observations on 18 December recorded clear skies and visibility of 7 miles. Last daily observation is at 10:00 p.m. and first is at 7:00 a.m. Weather observations from the Oregon Inlet Coast Guard Station, located approximately 27 miles southeast from the scene of the casualty, were as follows:

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12/17/71	12:00 PM Winds west at 12 knots	Temp 53°
12/18/71	4:00 AM Winds northwest at 35 knots	Temp 48°
	8:00 AM Winds north at 30 knots	Temp 38°
	12:00 AM Winds north at 30 knots	Temp 36°

All observations recorded clear skies and visibility of 6 miles. At the scene of the casualty at about 9:00 a.m., December 18, 1971, the seas were 3 to 4 feet from the northwest and the wind was northwesterly, 25 to 30 knots. The water temperature was 53° F and the computed time of sunrise was 7:08 a.m.

22. The Tug MARYLAND departed Charleston, South Carolina late on the afternoon of December 15, 1971 with the Barge BALTIMORE NO. 2 made up ahead in the pushing mode. The BALTIMORE NO. 2 was loaded with approximately 539 short tons of paper products, which produced a draft of about 5 1/2 feet, freeboard of about 3 feet. The MARYLAND had refueled and filled her freshwater tanks in Charleston as was normal practice. They carried six drums of lube oil secured on the main deck aft because the installed lube oil storage capacity (200 gallons) was inadequate for the voyage. These drums were secured by laying them on their sides and using wooden wedges to hold them against the bulwark under the caprail. The drafts of the MARYLAND upon departure were approximately 7 feet forward and 9 feet aft. The voyage up the intracoastal waterway from Charleston, S. C. to the mouth of the Alligator River was uneventful. No problems with the machinery plant were noted and the radio was in normal operation.

23. At midnight on December 17, 1971, while proceeding north in the Alligator River the 6-hour watch was changed with the second watch consisting of the Mate, Charles Whealton; Deckhand, John Williams; and Assistant Engineer, William Morse; going on duty. At that time the Master, who had the 6:00 p.m. to 12:00 p.m. watch, advised the Mate that he had received the weather report and that the wind was forecast to shift from the northeast to the northwest during the night. At that time little could be sensed of the actual wind conditions because of the shielding effects of the woods along the river. Later, as they approached the mouth of the Alligator River, the Mate observed that the wind was already northwest and was getting fresh. At about 3:00 a.m. after passing through the Lindsay Warren Memorial Bridge, near the mouth of the river, the deckhand, on the Mate's orders, called the Master and first watch deckhand, Charles Gilbert, to assist in changing the tow from pushing to towing astern in preparation for crossing the open waters of Albemarle Sound. The shift was made inside the bar at the mouth of the Alligator River. During this change the Master was in control in the pilothouse and the Mate with both deckhands worked on deck changing the rig. The Tug was then brought alongside the barge and its 6-inch, 1200 foot, nylon towing hawser was shackled to the barge's towing bridle. With the tug going ahead hawser was payed out until the Master indicated by means of a whistle signal to secure it. This signal was given when about 150-200 feet of hawser had been

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let out and upon which the Mate secured the hawser to the towing bitt, taking enough turns on the bitt to fill it up. A hawser board was put on to prevent the hawser chafing on the stern rail. The remaining hawser was coiled up on the hawser rack on the stern. When the shift evolution was completed, the Mate and deckhand Williams resumed their normal watch. The Master and deckhand Gilbert went below.

24. Initially, the barge followed well and Williams was frequently on deck checking the adjustment of the hawser board. He recollected that at this time all deckhouse doors were closed. At about 4:00 a.m. the tug with tow passed the river bar and proceeded out onto the open waters of the Albemarle Sound following the intracoastal waterway route toward the mouth of the North River, which would call for a course of about 023°T. Upon entering the open water, the tug was met by gale-force winds from the northwest and rough seas and had to head up more toward Camden Point and the Pasquotank River, which would have called for a heading of about 340°T. The Barge began to shear from side to side and the tug began to take water on deck, in the well deck, faster than it could run off. Blowing spray was forming into ice and making the decks slippery. The Mate expressed concern to Williams about the towing arrangement; that he was afraid he couldn't handle her with the barge shearing back and forth. Williams offered to slack out (lengthen) the tow line but the Mate said that it was too dangerous for one man. Initially, Williams felt that conditions were not too bad and that if the Mate had stopped, he could have payed out more hawser. Later he noted that the oil drums had come loose and were rolling around in the well deck. He notified the mate of this condition. Williams and the Mate discussed the situation for awhile. Williams recalled the mate saying, "I don't see why in the hell he don't get up and come up here, I know he's not staying in the bed," he said, "and I'm scared of it." In spite of his concern the Mate did not have Williams call the Master or otherwise make his concern known to the Master. The Tug continued into Albemarle Sound at slow ahead, just holding her own.

25. At about 6:00 a.m. the Master and deckhand Gilbert came on deck to relieve the watch. After surveying the situation, the Master stopped the tug to pay out more hawser. However, the loose drums rolling around in the well deck made it impossible for the crew to safely reach the towing bitt and hawser. Meanwhile, the wind and sea had moved the barge around and out of line with the tug. This pulled her down aft heeling to starboard initially. The Master tried to go ahead to again bring the tug in line with the barge. Williams recalled hearing the starting air to the engine, but it did not start. The Chief Engineer came to the pilothouse, and standing on the boat deck outside of the pilothouse, discussed the situation with the Master. Williams only heard parts of this conversation. There was some discussion about the loose drums; the Chief Engineer wanted to cut the barge loose; the Master wanted to keep the barge. Meanwhile, the tug continued to be pulled down aft, alternately heeling to starboard then to port. The Chief Engineer went below again. Shortly thereafter the Master told Williams to go to the engineroom to see if he could help. He proceeded along the starboard side of the main deck and entered the engineroom from the main deck. He found the Chief Engineer and Morse, the Assistant Engineer, attempting without success to start a portable gasoline

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bilge pump that was carried for dewatering barges. Water appeared to be entering the engineroom from the after part of the vessel, but he could not see where it was coming from. Williams did not recall the water level as being above the deck grating. He did observe that the door to the shaft alley was open and he thought the vessel's lights were still on; also he heard a generator still running. Shortly after Williams arrived in the engineroom Haltiwanger appeared and stated that the radio would not work. No distress broadcast had been or could be made. Williams did not notice when the lights went out as it was becoming daylight.

26. Haltiwanger and deckhand Gilbert then went to the boat deck to attempt to launch the lifeboat. At this time the tug was heeling about 45 degrees to port and the water was up to the edge of the boat deck. When the securing gripes for the lifeboat were released, the boat rolled over and came to rest upside down along side. Williams tried to assist them in righting the boat, but because of slippery decks and the boat lunging with water washing over it they were unable to turn the lifeboat to its upright position. By this time the entire crew was gathered on the boat deck. Haltiwanger, Morse and Phillips had put on life preservers; Whealton and Williams had life rings. Baker and Gilbert had no lifesaving devices, Gilbert commenting that he could swim better without one. Baker tried to open the door to the pilothouse but could not because of the height of water; he therefore broke a window and went in to attempt again to use the radio. He came back and confirmed that the radio was no longer working. Haltiwanger and Baker then went aft to the area of the towing bitt and capstan. Williams said they were attempting to take the hawser off the bitt and place it to the capstan. He thought they did get a few turns on the capstan but was not sure that the turns had been taken off the bitt. Williams was of the opinion that if instead they had cut the barge loose with the fire axe, which was in a bracket on the house immediately forward of the towing bitt, the tug may have righted herself and survived. Shortly thereafter Williams saw Haltiwanger in the water. He was followed by Baker. It is uncertain whether they fell overboard, were washed overboard, or decided to try to swim for the barge. Gilbert followed and was last seen swimming toward the barge, which was still attached to the tug. At some point during these final minutes, the Mate observed to Williams that the scuttle plate for the lazarette was missing. The remaining crewmembers remained aboard hanging onto tire fenders on the starboard side. By this time the vessel was completely over on her port side with only the forward part of the starboard bulwark above water. As the vessel settled, the sea action on the tires knocked or forced the remaining crewmembers into the water. After entering the water, Williams placed himself inside the life ring with his arms over the top. He said he felt warmer in the water and out of the wind and that he had some ice on his clothing. Williams remembered being near the barge and that Morse was near him. He did not attempt to go nearer because of the heavy seas pounding against the barge. That is the last he remembered with any clarity. The next thing he distinctly remembered was being aboard a Coast Guard helicopter.

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27. The 68-foot Yacht GEORGETTA, owned by Mr. George E. Sarant, 4339 Hempstead Turnpike, Farmingdale, New York, was being transported to Florida by Mr. Lawrence R. Hastings, via the Intracoastal Waterway. Mr. Hastings of 9344 Applecrest Drive, Palm Beach Garden, Florida is the holder of a Coast Guard Motorboat Operator's License and has served on yachts for seventeen years in various capacities. He was accompanied by another man serving as mate and two boys as crewmembers. At about 4:00 a.m. on December 18, 1971, Hastings observed the winds becoming very strong and gusty from the northwest. The GEORGETTA departed Coinjock, N. C. at about 7:15 a.m. At that time Hastings noted gale warnings displayed at the Coast Guard Station, Coinjock. The GEORGETTA reached Albemarle Sound at about 8:45 a.m., and upon entering the Sound, encountered seas of 3 to 4 feet and winds of 20 to 30 knots from the northwest. Just after 9:00 a.m., as the GEORGETTA neared the middle of the Sound the BALTIMORE NO. 2 was sighted. As they approached nearer, the Tug MARYLAND was observed with just the pilothouse above water. The tug rested on a southerly heading and had a list of about 10 degrees to port. The barge was still attached to the tug and was slowly moving the tug in a southeasterly direction. The inverted lifeboat was drifting alongside the tug and appeared to be attached. There was considerable debris in the water, including a life ring and two life preservers. Initially, they were not sure what had happened or when the tug had sunk, as they had heard nothing about it in Coinjock. Then they sighted a body in a life preserver about 100 yards from the tug. It appeared obvious to them that this person was dead, and knowing the short survival time under the conditions, they began looking for survivors. As they moved closer to the barge, Williams was sighted in a life ring. He was thrown a line which he held onto, and was then pulled aboard the GEORGETTA. The crewmembers took Williams to the cabin, removed his clothes and covered him with blankets while Hastings notified the Coast Guard by radio. This first notification of the casualty was received by the Coast Guard Radio Station, Portsmouth, Virginia starting at 9:08 a.m. and passed by telephone to the Rescue Coordination Center, Portsmouth, Virginia.

28. The GEORGETTA then returned to the body first sighted, and tried to retrieve it with boat hooks, but could not, due to the minimum of six foot freeboard on that yacht. Hastings secured efforts to recover the body, afraid he would rip off the life preserver, and cause the body to sink. He next returned to the tug, where he thought he had seen a person inside the pilothouse. This turned out to be an inside door flapping.

29. A Coast Guard helicopter from the Elizabeth City Air Station was on scene at 9:35 a.m., and at 9:45 a.m. it lifted the survivor, Mr. Williams, from the GEORGETTA and transported him to the Albemarle Hospital, Elizabeth City. During the time the helicopter was gone, the GEORGETTA continued to search, concentrating downwind of the tug and barge. At about 10:30 a.m. the barge broke free of the tug and began drifting to the southeast. The helicopter which had just returned from Elizabeth City was so notified by Hastings. A man was lowered from the helicopter to the drifting barge to check it and then lifted back to the helicopter. The barge continued drifting to the southeast and at about 6:00 p.m. landed against the William B. Umstead Bridge over Croatan Sound. It was later



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removed and towed to Norfolk, Virginia where it was examined by a member of the Board on December 23, 1971. About 175 feet of the 6-inch nylon towing hawser remained shackled to the towing bridle at that time. The parted end was frayed for a distance of about 4 feet.

30. At about 12:50 p.m. the Coast Guard Patrol Boat CG-30475 from Light Attendant Station, Coinjock, N. C. arrived and joined the search. It was directed toward the known body by the GEORGETTA. The body was found floating feet down, head up with the chin about four inches above the water and the ears flush with the top of the life preserver. The body was recovered and examined. There were no life signs present; the life preserver, which was properly secured, was not off; and the body was identified as that of Richard R. Haltiwanger by means of a South Carolina driver's license in a billfold. The GEORGETTA was released from the search at about 1:30 p.m. The search by the Coast Guard units continued until nightfall without success.

31. On December 19, 1971 the search was resumed. The CG-30475, by pushing and pulling, released the lifeboat which was still secured at its stern to the tug by some means that was never identified. The boat was righted and pumped out and then tied off to the tug using a 20-25 foot painter that was found connected to the stern of the lifeboat. The search continued throughout the day. At about 4:30 p.m. the Coast Guard boat returned to the lifeboat and found it afloat in the same condition it had been left. The lifeboat was towed to the Coast Guard Light Attendant Station, Coinjock using the attached painter. As the patrol boat slowed for the bridge at Coinjock, the lifeboat capsized. It was then towed to the Station where it was again righted. On December 20, 1971, the lifeboat was pulled onto shore at the Station. Inspection of the boat revealed two of the eight air tanks leaking, one from deterioration and the other from a small drill-like hole of undetermined origin. The hull drain fitting was pushed in and fractured when the boat was pulled ashore. Except for several indentations of apparent recent origin the hull was sound. The seine float grab lines at the inside of the gunwales were in a state of progressing deterioration with about 30 percent missing.

32. The Coast Guard air and sea search for the missing men was continued through 21 December 1971 without success. At that time active search was suspended. Periodic searches, searches during other activities, and searches by local law enforcement agencies along the surrounding beaches continued until all bodies were recovered on 11 January 1972. Local officials took custody of all bodies and obtained necessary identification. Death certificates were issued and are on file with the North Carolina State Board of Health, Office of Vital Statistics, Raleigh, N. C. All death certificates list cause of death as drowning. Certificates for Richard Haltiwanger and Charles Whealton also list exposure as a cause.

33. On May 30, 1972, members of the Board viewed the MARYLAND while in drydock at New Bern, North Carolina. The hull was intact except for some minor damage incurred during lengthy salvage operations. Four freeing ports per side were observed. There were no doors, bars or screens on any of the freeing ports.

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A section of the 6-inch nylon towing hawser led from on deck through the aftermost starboard freeing port to the propeller. At the propeller, at least five double turns of hawser were found wrapped around the shaft and into the area between the shaft and rope guard. Upon removal a distinct bight of line was found over one blade of the propeller. The number of turns of line remaining under the rope guard could not be determined due to its shredded condition. The hawser remaining when layed out measured about 750 feet.

34. Above deck considerable damage had been incurred during salvage. The 24-inch scuttle plate for the lazarette was still aboard. It was of non-tight plate construction which seated in an ungasketed recess in the deck. The securing strongback for this scuttle was found in the lazarette. The drain from the lazarette to the shaft alley was found to be closed with a pipe cap. Several turns of the hawser were found on the capstan and on the towing bitt; however, the presence of other lines indicated that the hawser had been disturbed during salvage. A fire axe was observed still in its bracket on the deckhouse forward of the towing bitt. A second fire axe was found in a deck gear locker. Below decks numerous fire extinguishers were still in place and three kapok life preservers, in good condition, were observed. In the machinery space the long period of immersion and machinery salvage efforts precluded any significant observation other than confirmation of the machinery arrangement.

35. The diver who performed the underwater work for the salvagers testified that he found the starboard door to the engineroom and the port door to the galley open. Also that several of the machinery casing ports were hanging loose, not dogged tight. Four of the six dogs on the watertight door between the berthing space and the engineroom were down, but not tight, and the bottom two dogs were frozen in the open position. On the after deck he found about three turns of hawser on the towing bitt. The hawser then led to the capstan where there were approximately three more turns. From there he followed the line down through the freeing port to the propeller. This line was cut in order to free it from the capstan and bitt and get it out of the way of salvage efforts. The scuttle plate to the lazarette was also found to be missing and the lazarette full of mud. The cover plate was later found on deck. Weather deck doors were found in satisfactory workable condition.

## CONCLUSIONS

1. The casualty was caused by the failure of the master to cut the barge adrift. Had the towline been cut at any time during the significant time period which elapsed between the unsuccessful efforts to restart the tug's engine and the point where progressive flooding would have resulted in capsizing even without the tripping force of the tow, the tug could have remained afloat. Relieved of the tripping and stern pull-down forces of the wind-driven tow, the initial flooding could have been controlled. The reluctance of the master to cut free the barge must be attributed to psychological factors related to the traditional blemish on the record of a master who abandons his tow.
2. The failure of the engine to restart, after initial efforts to pay out the towing hawser were abandoned, was caused by fouling of the propeller by the towing hawser. A bight of the free end of the hawser, initially stowed on the well deck hawser grating, was washed overboard through the aftermost starboard freeing port at some time after leaving the mouth of the Alligator River, and encountering heavy weather, but prior to stopping the vessel to lengthen the hawser. When stopped, the drift of the tug caused the bight of trailing towline to tend under the tug in way of the propeller where it became fouled in the propeller when the direct driven diesel engine was cranked over for starting. Succeeding turns collected around the propeller shaft, between the propeller and stern frame, until sufficient restraining force developed to prevent further cranking of the engine. Without propulsion the tug was towed stern first, heeling alternately to one side or the other, by the still attached wind-driven barge. This towing action typically pulled the stern down and under. Flooding initially occurred through the loose, or open, scuttle to the lazarette space thus further submerging the stern. Simultaneously, or shortly thereafter, water began to enter the machinery space through loosely closed portholes and weather deck doors opened during the aborted towline lengthening operation. Although initial flooding of the engine room was slow, electrical power was lost almost immediately. The initial entry of water must therefore have grounded out the switchboard rendering the electric bilge pump, radio and other essential electrical equipment inoperative. Without propulsive or electrical power, and with the tripping and stern pull-down forces of the towline still in effect, flooding of the machinery space progressed at an increasing rate until insufficient stability remained to resist capsizing forces of the wind and tow. The tug finally laid on her side but still afloat. In this position she experienced rapid flooding of other spaces, finally settling to the bottom in a more or less upright position with the barge still attached by the towline slowly dragging her over the bottom until chafing action parted the towline.

3. There are numerous factors in the sequence of events which contributed to the casualty, the absence or presence of any one of which may have been significant in preventing or mitigating the consequences of the casualty:

a. The initial length of towing hawser determined by the master in the Alligator River was inadequate for the prevailing and forecast weather conditions in Albemarle Sound.

b. The securing of the lubricating oil drums stowed in the well deck was inadequate for the weather conditions. Even under fair weather conditions any heeling of the tug could have released the drums thereby making the well deck area unsafe for emergency action by the crew.

c. The failure of the mate to call the master as soon as he became concerned for the safety of the vessel upon entering Albemarle Sound precluded timely action on the part of the master before the situation became critical. This failure is attributed to psychological factors related to the mate's recent demotion from master status by reason of seniority practice.

d. The loose stowage of the unused length of hawser in the well deck area permitted the hawser to be washed overboard when heavy weather was encountered. Had the hawser been lashed or otherwise secured to prevent it being washed overboard, the propeller would not have become fouled and the master may have been able to get the tug and tow under control.

e. The non-tight scuttle to the lazarette and steering gear spaces permitted early flooding of those spaces. This flooding water reduced the tug's stability thereby magnifying the effects of the towline pull upon the tug.

f. The open, unprotected, freeing ports permitted the bight of loose towing hawser to wash overboard. Had the freeing ports been provided with guards, screens or preventive bars which would have reduced the clear opening dimensions, without significantly reducing the effective area available for flow of water, the hawser may not have been washed overboard. Even if it had been washed overboard over the bulwarks, its position would not have been as susceptible to fouling the propeller under drifting conditions.

g. The common distribution of all electrical power through the single switchboard made the electrical system susceptible to failure from any single incident involving that switchboard. Had the electrical arrangement provided for a direct battery source of power to vital auxiliary machinery and the radio, it may have been possible to bring flooding under control, or lacking that to have broadcast a call for assistance. A distress call broadcast prior to abandonment of the tug may have prevented or reduced the loss of life.

h. The lack of training in abandon-ship procedures and use of life-saving equipment resulted in disorderly lifeboat launching efforts and failure to fully utilize all available lifesaving equipment. Although there were minor discrepancies in the condition of the lifeboat and its launching equipment was antiquated, an organized launching effort should have resulted in a successful launching in spite of the adverse conditions of ship motion and weather. Further, had the master ordered the crew into life preservers as soon as he recognized the seriousness of the situation, and donned his own life preserver, the loss of life may have been reduced.

4. That, although they met or exceeded current design requirements, the vessel's freeing ports were inadequate under the prevailing weather conditions to keep the well deck reasonably clear of water. The build up of water in the well deck hampered emergency action on the part of the crew, and contributed to the towing hawser being washed overboard.

5. It is probable that more lives would have been saved had the vessel been provided with an inflatable life raft in lieu of the lifeboat. Although neither are required by law, the inflatable life raft is easier to launch with a small crew and/or under adverse weather conditions. In addition, an inflatable life raft constructed in accordance with 46 CFR 160.051 is required to be capable of being righted by one man if it inflates in an inverted position; a lifeboat built in accordance with 46 CFR 160.035 is not required to be self-righting or to meet an ease-of-righting criteria.

6. The prompt reporting, search and rescue efforts of the yacht GEORGETTA under the direction of her master, Lawrence R. Hastings, are considered to be most commendable and in the best tradition of the sea and were significant in saving the life of the sole survivor.

7. That the cause of death of the deceased crewmembers was drowning and that exposure was a contributing factor.

8. a. There is evidence of violation of 46 USC 643(1) in that the employment of the crewmembers of the MARYLAND was not reported to the Coast Guard.

b. There is evidence of violation of 46 USC 672(i) in that Charles C. Gilbert, Jr. and George E. Phillips were employed and served aboard the MARYLAND without certificates of service issued by the Coast Guard.

c. That the above violations did not cause or contribute to the casualty.

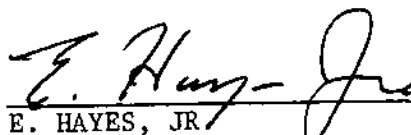
d. A report concerning the above violations has been forwarded to the Commander, Fifth Coast Guard District.

9. There is no evidence of misconduct, negligence, inattention to duty or violation of law on the part of any crewmember holding merchant mariner documents.

10. There is no evidence that the Coast Guard or any other government agency contributed to the casualty.

### Recommendations

1. It is recommended that a study of freeing port size be conducted to determine the adequacy of current standards as they relate to different types of vessels, especially those of low freeboard which by their service require men to work on deck.
2. It is recommended that the towing industry be alerted to the dangers associated with loosely stowed hawsers in the well deck area. It is further recommended that questions related to the use and securing of hawsers be made a part of the towing vessel operator license examination.
3. It is recommended that a copy of this report be furnished to the Federal Communications Commission and that the agency consider the need for a separate or alternate source of power for radio equipment installed on commercial vessels.
4. It is recommended that legislation be sought which would prescribe minimum standards of design, arrangement and safety equipment for uninspected towing vessels.



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