U.S. Department of Homeland Security

United States Coast Guard

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NOV 21 2003

FORMAL INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE SINKING OF THE FISHING VESSEL TWO FRIENDS IN THE GULF OF MAINE ON JANUARY 25, 2000 RESULTING IN LOSS OF LIVES AND PROPERTY.

ACTION BY THE COMMANDANT

The record and the report of the Formal Investigation convened to investigate the subject casualty have been reviewed. The record and the report, including the findings of fact, analysis, conclusions, and recommendations are approved subject to the following comments.

ACTION ON RECOMMENDATIONS

Recommendations 1 through 4 were addressed to fishing industry mariners.

Recommendation 1: Be cognizant of the condition of hull structure and appurtenances and of potential sources of flooding and address concerns appropriately, including rudder port fittings, hull plating, deck fittings and hatches.

Recommendation 2: Eliminate any breaches in watertight integrity between hull compartments, including bulkhead fittings and passages. Do not go to sea with missing covers, open doors, or holes of any kind in otherwise watertight bulkheads below deck. Maintain all watertight fittings and structures as such.

Recommendation 3: Renew wasted metal in-kind or seek guidance from a qualified engineer before modifying the structure of a rudder port fitting or any fitting or appurtenance vital to hull integrity or stability or that bear substantial load.

Recommendation 4: Recognize that adding metal to a structure is not necessarily going to result in a stronger structure and may even result in a weaker one. Consult an engineer when in doubt.

Action: We concur with these recommendations. Mariners of the commercial fishing industry need to be aware of the importance of properly maintaining their vessels' hull structure and watertight integrity. This includes being cognizant of and eliminating where possible potential sources of flooding and ensuring that repairs and modifications made to their vessels are done properly, consulting with a qualified engineer when appropriate. We will use this report of investigation and its findings as a source of lessons learned for published articles and training materials for our fishing vessel safety examiners.

Recommendation 5: Promulgate the findings of this investigation via "Safety Alerts", press releases, industry events, and other public awareness campaigns, particularly amongst trade press and media markets covering major fishing ports.

Action: We concur with this recommendation. We will publicize the findings of this investigation using a variety of means, including the publication of safety alerts, press releases, articles and other efforts within the Commercial Fishing Vessel Safety program as appropriate.

Recommendation 6: Continue to identify at-risk vessels, creatively pursue opportunities to board these vessels with highly trained inspectors competent in structural and stability analysis, and seek to educate the fishing industry in the hopes that they will remedy risks as identified, similar to Marine Safety Office Portland's Uniform Enforcement Template risk assessment and mitigation program.

Action: We concur with the intent of this recommendation. The Commercial Fishing Vessel Safety Division at Coast Guard Headquarters and the Atlantic and Pacific Area staffs are jointly developing a risk based process to identify and target high risk fishing vessels at the dock and during special operations. MSO Portland's risk assessment program is being evaluated and components of that program may be incorporated into the new risk-based process.

Recommendation 7: Advise political leaders that this type of incident cannot be effectively prevented within the current legislative framework. Seek endorsement from the Commercial Fishing Industry Vessel Advisory Committee (CFIVAC) on this recommendation. Further seek CFIVAC opinion on establishing training and competency standards for fishing vessel crews regarding intact stability, subdivision and progressive flooding, fundamentals of vessel structures, and advanced survival systems expertise.

Action: We concur with the intent of this recommendation. We continually provide political leaders information on the dangers and risks associated with the commercial fishing industry and the obstacles that limit the effectiveness of our efforts to improve safety and prevent the loss of lives and property. A copy of this report will be provided to the CFIVSAC Executive Director who will review this casualty at the next meeting and seek review and comment on the recommended training and competency standards.

Recommendation 8: If provided authority and funding by Congress, establish regulations for structural and watertight integrity and stability for all fishing and fish tending vessels, and for competency standards for fishing vessel crews, regardless of size or operating area. Develop fishing industry safety programs and resources of equal professional competence and of equal proportion to fleet size, as other existing marine inspection and marine personnel certification programs. Compare the fatality rate of all marine industries and apply the most highly trained resources to the industry segments found to be at the greatest risk in sufficient numbers to mitigate risk to levels comparable with other forms of marine commerce.

Action: We concur with the intent of this recommendation. Congress has not granted the Coast Guard the necessary authority to fully implement this recommendation; however, we continue to expend significant resources on commercial fishing vessel safety. We have a regulatory project moving forward that will propose stability and watertight integrity requirements for vessels between 50 and 79 feet and we intend to propose some new requirements for crew certification

and training. We intend to examine high risk fishing vessels at the dock and underway and we will use existing enforcement authority to compel compliance for these high risk vessels.

Recommendation 9: Safety management system regulation and oversight, and survival suit approval processes, should be mindful of the performance of survival suits to maintain a person face up in the water even when the person is unable to keep their arms extended.

Action: We do not concur with this recommendation. There is no indication that the performance of properly donned immersion suits is inadequate. Without discounting the difficulties Mr. Rich experienced during his 3 ½ hour ordeal in the frigid waters of the North Atlantic, floating in rough seas while holding an EPIRB in one arm and another crew member in the other is not a condition which can or should reasonably be anticipated in performance requirements or testing for type approval. Immersion suits must be designed to turn an unconscious person from any position to a face-up position in not more than 5 seconds or to allow the wearer to turn face-up within 5 seconds without assistance. Finally, while it is true that for reasons of practicality and repeatability, immersion suits are tested in calm water, there is a good deal of data correlating overall satisfactory calm-water performance with satisfactory rough-water performance.

Recommendation 10: With the exceptions stated elsewhere in this report, there is no evidence of actionable misconduct, inattention to duty, negligence, or willful violation of law or regulation on the part of licensed or certificated personnel; nor evidence of failure of inspected equipment or materiel; nor evidence that any personnel of the Coast Guard or of any other federal agency, or any other person contributed to this casualty. Therefore, it is recommended that this casualty investigation be closed.

Action: We concur with this recommendation. This investigation is closed.

[redacted]

W. D. RABB
By direction

U.S. Department of Transportation
United States Coast Guard

Commander
First Coast Guard District

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OCT 3 2002

MEMORANDUM

From: M. G. VANHAVERBEKE, CAPT
CGD ONE (m)

Reply to Attn of: moc-2
LT P. K. Mucha
617-223-8541

To: COMDT (G-MOA)
Thru: LANTAREA (Am) concur

Subj: FORWARDING OF RESULTS OF THE FORMAL INVESTIGATION INTO THE CIRCUMSTANCES SURROUNDING THE SINKING OF THE FISHING VESSEL TWO FRIENDS IN THE GULF OF MAINE ON JANUARY 25, 2000 RESULTING IN LOSS OF LIVES AND PROPERTY

Ref: (a) Marine Safety Manual, Volume V

1. Forwarded recommending approval.

2. This formal investigation was convened to determine why a fishing vessel sank with the associated loss of two lives. A post-casualty examination of the subject vessel itself was not practical and, therefore, many facts regarding the root cause of the vessel rapidly taking on water prior to sinking cannot be factually determined. However, the investigating officer has developed the most likely scenario based upon an assessment of the modifications made to the rudderpost tube shortly prior to the vessel becoming engaged in heavy sea conditions on this particular voyage.

3. I concur with Safety Recommendations 1 through 4 that are aimed at mariners of the fishing industry.

4. I concur with Recommendation 5. The findings of this investigation are relevant to many commercial fishing vessel operations where cost is often a determining factor when considering vessel repairs or modifications. Emphasis should be placed on maintaining the seaworthiness of the vessel for the conditions that it will be operating under.

5. I concur with the concept proposed in Recommendation 6. MSO Portland's Fishing Vessel Safety Coordinator (FVSC) evaluates the risk of a vessel being involved in a casualty during the course of a voluntary dockside exam and then works to educate the vessel's owner/operator towards correcting deficiencies to reduce the risks. This outreach program remains focused on education vice enforcement in light of the fact that regulatory oversight of the industry is slow in developing.

6. I concur with the concepts proposed in Recommendations 7 and 8. The bottom line is the Coast Guard has exhausted the regulatory tools available to us under the current legislative scheme. If we are to further reduce the annual cost of fishing vessel casualties, measured in terms of lives lost or search and rescue resources expended (and put at risk), we need new legislative authority from Congress. This may be for licensing, vessel construction oversight, inspection (third party or otherwise), or increased liability for owners (although that would not have made a difference in this case as the owner died).

7. I concur with Recommendation 9 with the following comments. The performance standards for immersion suits already require that a suit be designed to turn an unconscious person from any position to a face-up position without assistance in not more than 5 seconds. They also require each suit to float in a stable position with the wearer's nose and mouth above the surface of the water. Unfortunately, the performance of the suit is tested in calm conditions, which are rarely prevalent during emergency situations that require their use.

8. I recommend that this case be closed.

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Enclosures: (1) Investigating Officer's Narrative Report

Copy: CG MSO Portland, ME

PART 1: INCIDENT BRIEF

On the morning of Sunday, January 23rd, 2000, at approximately 11:00 AM, the Fishing Vessel TWO FRIENDS set sail from Portland, Maine with a crew of three for a planned 3 to 4 day trip to fish for multi species ground fish in the Gulf of Maine with less than 5000 gallons of fuel onboard. The TWO FRIENDS had an uneventful voyage until encountering rough weather the morning of Tuesday, January 25, 2000. The captain of the vessel, Mr. Harry Ross, Sr. decided to curtail the voyage and head for Portland because of weather predictions and building seas. Mid to late morning on January 25, they completed their last haul back of the voyage and headed northeast for Portland. The seas continued to build and were on the bow.

At approximately 4:00 PM, the lazarette bilge alarm sounded. The captain energized the lazarette bilge pump and the alarm condition cleared. Some five minutes later, the same alarm sounded and the captain again energized pumps, but the alarm did not clear this time. The captain and crew sensed the vessel was behaving as if the stern was flooding and the captain turned the vessel down-sea. Once heading with the sea, waves began to carry over the stern and onto the deck, occasionally allowing down flooding into the engine room and the accommodations house. The crew worked to clear the deck freeing ports but soon realized the vessel was in danger of capsizing.

The captain and crew then directed their efforts towards abandoning the vessel. They donned survival suits, but before they could deploy the life raft, the vessel capsized suddenly approximately 20 minutes after the first bilge alarm sounded. Mr. Larry Rich had fully donned his suit, but was apparently caught under the vessel as it rolled and was never seen again. Mr. Harry Ross, Sr. had partially donned his suit and died of hypothermia and drowning some minutes after entering the water while in the company of Mr. [redacted]. Mr. [redacted] had fully donned his suit with the exception of the hood and was rescued by Coast Guard helicopter at approximately 8:00 PM on January 25. Mr. [redacted], the son of Larry Rich, was treated for mild hypothermia in Portsmouth, New Hampshire and released later that evening. Mr. Ross' body was located and recovered by the USCGC WRANGLE on January 26 and turned over to the Maine State Medical Examiner.

PART 2: EXECUTIVE SUMMARY

On January 27th, the Commander First Coast Guard District convened a one-person formal investigation and designated LCDR John E. Cameron, Executive Officer of Coast Guard Marine Safety Office Portland, Maine as the Investigating Officer and LT [redacted], Supervisor, Marine Safety Field Office Portsmouth, New Hampshire as the Recorder. The Investigating Officer presided over a formal public hearing at the Holiday Inn, Riverside Street, Portland, Maine, on February 1, 2 and 3, 2000. Long Island Sea Ventures, Inc., the owner of the TWO FRIENDS, was designated a "Party in Interest" and was represented through much of the hearing by Mr. [redacted] of Looney & Grossman, Boston, Massachusetts. At other times, the Party in Interest chose not to be represented at the hearing. Ten witnesses testified. There was no attempt to find the vessel during this investigation, largely because the vessel sank in water too deep for an economical recovery strictly to facilitate the investigation. Therefore, the findings of this investigation are based primarily on testimonial and documentary evidence and are the most likely conclusions that can be derived from this evidence.

This investigation determined that a structural failure likely occurred of the hull or a hull fitting in the lazarette, most likely the rudder port fitting, thus allowing seawater to flood the space. The vessel took on water in the stern as evidenced by a bilge level alarm in the lazarette and flooding likely progressed through a passage to a void space forward of the lazarette that was left open. This passage was equipped with a watertight plate, but the vessel sailed with this plate dangling from one of its mounting studs rather than being properly secured. Calculations by the USCG Marine Safety Center show that the vessel may have retained sufficient stability with only the lazarette flooded. However, with flooding in the lazarette and the void space forward of it, the vessel's stability was insufficient.

The rudder port fitting is suspected as the most likely point of failure because it had recently been reconstructed and augmented with higher power controls in such a way that its overall structural strength was possibly reduced while its structural loading was increased. During the reconstruction of the rudder port, a critical weld was disturbed and a triangular brace was omitted. The steering control system had been augmented with hydraulic assist, replacing a manual cable and chain system. This added power to the rudder control system and strain to the rudder port structure. A certified engineer did not analyze these repairs and upgrades prior to installation and no analysis was done on the structural effect of these modifications. No standards currently exist for configuration of, or repairs to, vital hull fittings in fishing vessels of this size. Therefore, this repair is not found to be in violation of any mandatory standard applicable to this vessel. Furthermore, watertight subdivision below decks is not required on this size vessel. Therefore, the open passage between compartments was not a violation of any regulatory standard. Bilge systems were in general compliance, and in any case, could not have kept up with the rate of flooding through a severed rudder port fitting.

It is not known how Mr. Rich may have become entangled or was otherwise never seen after the vessel rolled. He had fully donned his survival suit and therefore should have had a chance of survival on the surface, barring serious injury. Mr. Harry Ross, Sr., never fully donned his survival suit. His left shoulder and arm remained exposed and his suit therefore offered no seal to protect his body from direct contact with the frigid water. He perished from hypothermia and drowning.

Lifesaving systems were found to be in general compliance. The zippers on all suits were reported serviced before sailing. However, the medical examiner reported that Mr. Ross's zipper was stiff and difficult to operate and without lubrication. His zipper was pulled up about as far as it would go due to the suit being under his left arm. The EPIRB, which floated free and activated automatically, was extremely critical to the timely rescue of Mr. Shawn Rich and the recovery of the body of Mr. Ross. Mr. [redacted] never got his survival suit hood on and was taking on water in his suit. Had he not been holding the EPIRB he very likely may not have been found before he would have succumbed to severe hypothermia.

The Coast Guard Marine Safety Office Portland Fishing Vessel Safety Team had identified the vessel as an "at-risk" vessel due to outward appearance and the known risk factors of Gulf of Mexico shrimp boats that have migrated to New England. Mr. Harry Ross, Sr., the now-deceased captain and the president of the corporation that owned the TWO FRIENDS, had been contacted and offered a voluntary commercial fishing vessel exam by the Coast Guard on numerous occasions. Mr. Ross declined all such offers. The repairs and modifications that were made to the rudder port and steering system were not proposed or known to the Coast Guard Commercial Fishing Vessel Inspection Program.

Fisheries conservation regulations appear to have influenced contributing economic decisions. The owner procured this as a second boat to extend annual days at sea. The shipyard where the rudder port work was done offered a more expensive and more extensive repair method. Expenses to maintain a two-boat fleet may have driven the owner to choose the less expensive and less comprehensive repair method.

No meaningful violations of any mandatory standards were discovered in this investigation. Contributing human factors are summarized as a general lack of understanding of structural configurations and stability parameters. The weather was certainly a factor, adding stress to the modified rudder port fitting, but the weather was not severe enough to overcome this vessel had it been in sound condition. There is no evidence that drugs or alcohol contributed in any way to this incident. Additional contributing and causal factors are listed in the modified Haddon's Matrix in Appendix I.

This investigation also concluded that Mr. [redacted] demonstrated extraordinary heroism by attempting to save his shipmates and by saving himself from becoming the third fatality of this tragic event. His father, Mr. Larry Rich, and his cousin and the vessel's captain, Mr. Harry Ross, Sr., certainly aided the survival of Mr. Rich through their final struggle onboard the vessel, buying critical time for them all to don survival equipment and broadcast a call for help.

This incident was investigated by:
LCDR John E. Cameron, Primary Investigator
LT [redacted], Recorder
LT [redacted], Investigative Team member
CWO4 [redacted], Investigative Team member
BMC [redacted], Investigative Team member
QM1 [redacted], Investigative Team member
Mr. [redacted], Technical Advisor to the Investigative Team

This investigation was conducted pursuant to the rules in 46 CFR Part 4.07 by means of a Formal Investigative Proceeding. The policy governing these proceedings can be found in the Coast Guard's Marine Safety Manual, Volume V (Investigations), COMDTINST M16000.10A.

PART 3: FINDINGS OF FACT

SUBJECTS OF THE INVESTIGATION

A. VESSELS

The following vessel was the subject of this investigation. Particulars for the vessel follow:

Vessel Name: TWO FRIENDS
Flag: US
Official Number: D285162
Call Sign: WR7488
Vessel Type: Fishing Vessel
Vessel Service: Fishery Trade endorsement, stern reel dragger
Hailing Port: Raymond, Maine
Gross Register Tons: 73
Net Register Tons: 50Length: 61.5 feet Breadth: 18.6 feet Depth: 9.5 feet
Hull Type: Shrimping hull
Hull Material: Steel, welded
Propulsion: (1) Detroit 12V-71 diesel engine with reduction
Steering: hydraulic assisted steering
Date of contract/keel laid/delivery: 1961
Built By: Master Marine, Inc.
Hull Number: unknown
Location Built: Bayou La Batre, Alabama
Owner: Long Island Sea Ventures, Inc., 54 Aquila Road, Raymond, Maine 04071, President: Mr. Harry Ross, Sr.
Captain: Mr. Harry Ross, Sr.
Classification Society: none
Date of Last Coast Guard encounter: 21Jul94
Type of Last Coast Guard encounter: 4100 boarding - violation case MV94013421 - cited for operating beyond 50 miles without the required SOLAS A pack. Vessel had a life raft onboard, but it was not Coast Guard approved and did not have a SOLAS A pack - charges were dismissed. Vessel also received a voluntary dockside examination on 02Feb94 with 14 deficiencies noted and no decal issued (MI94009357).
Automated Information System? No

B. FACILITIES AND INSTALLATIONS

The actions of the following facility were a subject of this investigation. Particulars for this facility are:

Facility or Installation Name: Gowens Marine
Facility or Installation Type: Ship repair yard
Facility or Installation Status: Active
Location: Commercial Street, Portland, Maine

C. PEOPLE AND ORGANIZATIONS

The following people and organizations were subjects of this investigation:

Long Island, Sea Ventures, Inc., vessel owner
Mr. Harry Ross, Sr., president of Long Island Sea Ventures and Captain of TWO FRIENDS
Mr. Larry Rich, vessel crew on this and past voyages
Mr. [redacted], vessel crew on this and past voyages
Mr. [redacted], employee of Long Island Sea Ventures, assisted with vessel maintenance
Mr. [redacted], regular vessel crew, though not on this voyage, assisted with preparations for this voyage
Gowens Marine, contracted for repairs and maintenance prior to this voyage
Mr. [redacted] Marine Surveyor, Casco Marine Consultants
Mr. [redacted], Marine Surveyor
(None of the above were holders of any merchant marine document at the time of their involvement.)

D. DRUG AND ALCOHOL TESTING
The following people have been determined by Coast Guard Law Enforcement Personnel and/or the Marine Employer to have been directly involved in a Serious Marine Incident as defined in 46 CFR 4.03-2:

Mr. [redacted] captain
Mr. [redacted] crew
Mr. [redacted] crew

E. PARTIES IN INTEREST

Pursuant to the rules in 46 CFR part 4.07 and Coast Guard policy, the Investigating Officer formally designated Parties in Interest on February 1, 2000. These people and/or organizations were extended the opportunity to call relevant witnesses, cross-examine each witness, and to produce relevant evidence. The following organization was designated a Party in Interest: Vessel owner

INCIDENT INFORMATION

A. LOCATION

The incident occurred in approximate position latitude 43 degrees 6 minutes north, 070 degrees 24 minutes west, off Boone Island in the Gulf of Maine.

B. SEQUENCE OF EVENTS

Event #1: On January 23, 2000 at approximately 11:00 a.m. local time, the fishing vessel TWO FRIENDS set sail from Portland, Maine with a crew of three to drag for ground fish in the Gulf of Maine following a lengthy lay up and repair period in which modifications were made to the rudder port and steering systems amongst other maintenance. See exhibit #44 testimony from witnesses [redacted].

Event #2: On January 25, 2000 at approximately 11:00 a.m. local time, the crew of the TWO FRIENDS completed their last haul back of the trip because the captain, Mr. Harry Ross, Sr., had chosen to return to Portland due to building weather. Seas were building and eventually built to 15 to 20 feet by the time the vessel capsized. See exhibit #44 at Page 1-69 to 1-72.

Event #3: On January 25, 2000 at approximately 4:00 p.m. local time, the lazarette bilge alarm sounded in the wheelhouse. The captain turned the wheel over to Mr. Larry Rich and then activated a bilge pump that successfully cleared the alarm. Some five minutes later, the same alarm sounded. Mr [redacted] took the helm while the others onboard worked to activate bilge pumps and valves. The bilge pumps failed to clear the alarm conditions this time. At this point, it was apparent to all onboard that the vessel was flooding by the stern due to the way the vessel was riding and the alarms that had sounded. The captain returned to the wheel and turned down-sea while the others worked to clear freeing ports on deck to help shed boarding seas. It is not clear why the captain choose to turn down-sea, but the survivor speculated that he thought it would be a favorable course given the condition of the vessel. With the vessel going down-sea, several waves rolled over the stern. Most of the water shed quickly, but some was sufficient to down flood into the engine room and cover all deck fittings, none of which can be considered watertight. The worst of these crashed into the house with such volume that the crew was momentarily swimming inside the vessel. By this time, the crew had shifted efforts to donning and activating survival equipment. Mr. Larry Rich fully donned his survival suit. Mr. [redacted] donned his suit with the exception of the hood, which he could not get on over his sweatshirt hood. Mr. Ross, Sr. never got his left arm into his suit. Mr. [redacted] attempted to launch the raft, but never got to it. See exhibit #44 at Page 1-85 to 1-127.

Event #4: On January 25, 2000 at approximately 4:30 p.m. local time, the fishing vessel TWO FRIENDS capsized. Mr. Larry Rich was never seen again. Mr. [redacted] climbed around the hull as it rolled and remained perched on the vessel's hull momentarily. He then entered the water, fearing the still spinning propeller, and the vessel then sank upside down and stern first. Mr. [redacted] and Mr. Harry Ross, Sr. were reunited on the surface. Mr. [redacted] retrieved the EPIRB, which had floated free, and held it and Mr. Ross awaiting rescue. Within an hour in the water, Mr. Ross died. Mr. [redacted] continued to try to hold onto his body but was unable to after a few hours. He struggled considerably to keep upright in the water while holding onto the EPIRB and Mr. Ross, Sr. See exhibit #44 at Page 1-85 to 1-127.

Event #5: On January 25 at approximately 8:00 p.m. a Coast Guard helicopter from Air Station Cape Cod rescued Mr. [redacted]. On January 26, the USCGC WRANGLE recovered Mr. Ross' body. See exhibit #44 at page 1-90 to 1-91, and exhibit #33.

C. FINAL DISPOSITION OF THE VESSELS INVOLVED

The TWO FRIENDS sank and is considered a total constructive loss. The vessel was valued at under $100,000.

D. DISPOSITION OF THE PEOPLE INVOLVED IN THE INCIDENT

The captain died from drowning and exposure as a result of this incident. See exhibit #38.
One crewmember is missing and presumed lost with search suspended. See exhibit #46.

One crewmember was rescued after a three hour Coast Guard search and was treated and released for mild hypothermia. See exhibit #44, page 1-91.

E. CONSEQUENCES TO THE ENVIRONMENT

An unknown quantity of diesel fuel, less than 5,000 gallons, was at risk for discharge into the navigable waters of the United States following this incident. See exhibit #11 at Page 7, paragraph 1. No response was attempted to remove the oil at-risk. No evidence indicated there were reportable quantities of hazardous materials onboard. During the course of the Coast Guard's investigation, no direct damage to natural resources was noted.

F. IMPACTS ON MOBILITY

There was no appreciable impact on mobility of maritime commerce or recreational craft because of this incident.

PART 4: CONCLUSIONS AND CAUSES OF THE INCIDENT

SYSTEM FACTORS

This incident is most likely the direct result of a structural failure of the rudder port tube and of the crew's failure to secure a vital below deck watertight fitting between the lazarette and the void space forward of it. Lacking authority to enforce standards defining the physical characteristics of fishing vessels and their appurtenances, understanding the environment in which the rudder port failure developed is most noteworthy in the pursuit of preventing reoccurrence. The TWO FRIENDS was purchased to expand earnings while complying with fisheries conservation regulations limiting fishing days at sea per hull. A second hull doubles the days a crew can fish and therefore doubles the opportunity to earn income. However, the overhead of the business increased with the outfitting and maintenance of a second vessel, possibly affecting economic decisions that otherwise might be more considerate of safety issues. The TWO FRIENDS had been laid up for several months while the crew used the available days at sea on the owner's other vessel. Once that vessel's quota was used up, the crew directed considerable effort and funds to shifting production to the TWO FRIENDS. This included transferring gear and focusing on the amount of maintenance they had to perform.

The TWO FRIENDS was known to have wastage in the rudder port, and the owner correctly cited this assembly for repair. At the same time, the owner opted to upgrade steering controls from manual to hydraulic assist. However, the manner he chose to complete this repair and upgrade was constrained by limited funds. Unfortunately, no standards exist to direct or even guide owners of fishing vessels of this size on how to maintain a minimal level of safety as they modify their vessels. The owner had options available on how to repair the wasted rudder port tube, and he chose the less expensive option in lieu of the more correct one. He never consulted an engineer to evaluate his repair options or to evaluate the structural aspect of the hydraulic upgrade. Good marine practice dictates that the proper repair to the rudder port would have been to drop the rudder and post and renew the wasted tube in kind. According to the yard worker who made the repair, this would have cost approximately 5 to 6 times more (exhibit 44, page 3-477). Instead, the owner chose a repair that overlaid the wastage but likely weakened the overall structure of the assembly. Lacking any regulatory standard, the owner was free to choose any repair. Lacking proper engineering analysis, the owner had no basis on which to accurately assess the risks of the various repair options. Economics were likely the predominant factor in his decision when it should have been balanced by the safety and effectiveness of the repair (exhibit 44, pages 3-475 - 3-477).

The most tangible human factor in this incident is the failure to secure the access cover between the lazarette and the void space forward of it. Even when approached by Mr. [redacted] about his concern for sailing with that access left open, the captain declined to devote time to secure the fitting. This decision was again made unencumbered by regulatory mandate or compelling guidance. There is no standard for watertight subdivision on this vessel. The captain was likely not able to accurately assess the risk of leaving that space open to progressive flooding. Had he perceived that his rudder port was now at greater risk of failure, he may have been more concerned. Instead, it is surmised he may have been emboldened by the perception that he had reduced the risk of flooding below decks with the repair to the rudder port.

Meanwhile, there is no evidence that the additional load imposed by the hydraulic steering control system was ever considered from a structural standpoint. In fact, a critical stiffening bracket was omitted that would have directly strengthened the rudderpost tube under loads imposed by the hydraulic control system. This system was installed partially by contracted shipyard staff and partially by employees of the vessel's owner. However, there was no consultation or supervision by any certified engineer. There is no regulatory standard that applies to such repairs whether performed by the yard or by the vessel's crew.

The system of oversight and regulation on this industry primarily comprises species conservation and mishap survival standards. No regulation directly addresses physical safety standards to prevent this type of mishap. Conservation issues likely influenced the development of this mishap scenario, albeit indirectly. Survival standards

that applied to the boat relevant to this mishap included the ability to de-water the hull in a minor flooding situation and the carriage of personal survival gear and an emergency position indicating radio beacon device (EPIRB). The bilge system seems to have functioned as designed as evidenced by its ability to clear the original alarm condition thought to be the result of a crack preliminary to the likely eventual catastrophic failure of the rudder port. The survival gear basically performed as designed and applied. There is no survival gear known that could have protected Mr. Larry Rich from being caught up in a capsized vessel. Mr. Harry Ross, Sr. tragically began donning his survival suit moments too late, instead heroically trying to save his crew and his vessel. However, the suit most likely would have given him a good chance at survival if he had had the chance to completely don it. An oversight system that relies on survival gear to reduce fatalities proved somewhat effective here, in that one crewmember survived. Survival gear cannot be expected to save every threatened life. The missing system element in the oversight of this industry is in regards to vessel physical characteristics aimed at preventing such mishaps.

The history of commercial vessel safety management shows excellent success by first addressing safety and survival concurrently, that is the reduction of risk of mishap and the ability to survive the mishaps that are not prevented. The direct regulation of human factors has historically proven most effective after engineering standards succeeded in limiting the possible failures down to a scope that crews could effectively manage. The fleet of vessels like the TWO FRIENDS, lacking standards for physical vessel characteristics, is not afforded a comprehensive regulatory oversight system that can effectively reduce the incidence of vessel losses. This incident exemplifies the need for further maturation of the existing oversight system to appropriately follow the proven model of successfully regulated commercial vessel fleets, e.g. regulated passenger vessels, tankers and cargo vessels. The current framework for fishing vessels, distinct in that it emphasizes mishap survivability but practically ignores mishap prevention, lived up to its potential in this case where a vessel was lost but one sole managed to survive.

Human factors, of course, were critical to the development of this accident scenario. Fundamental human factors management can prove effective in the fishing industry as it has in other maritime industries. The major difference between the captain and crew of small fishing vessels without requirements for manning and the captains and crews of most other types of commercial vessels, with perhaps the exception of the offshore mineral and oil exploitation industries, is how they accrue their professional expertise. The common path to become a master or navigating crew of a regulated seagoing vessel first involves developing general expertise in the arts of navigation and seamanship. Once those skills are mastered, the aspiring mariner then typically acquires specialty expertise for the trade in which employed, for example handling oil cargoes, supervising passengers, etc. According to testimony, the crew of the TWO FRIENDS had no extensive experience or education in other sea going industries and their professional expertise evolved with a focus on harvesting fish and operating fishing gear from the start. Navigation and seamanship expertise is not a common prerequisite in the fishing industry and typically evolves only on an as-needed basis. It is unlikely for a fishing vessel captain to pursue expertise in the sciences of stability, structural integrity, or subdivision and there is no evidence that the crew of the TWO FRIENDS or other employees of Long Island Seas Ventures had acquired such expertise. The primary human factors oversight shortcoming in the fishing industries is the distinct lack of mandated minimal seaworthiness and seamanship expertise. This expertise is required for employment in other segments of marine commerce.

Had the crew of the TWO FRIENDS been held to a minimal seamanship competency standard, they may very well have made different decisions about their rudder port fitting and the open access cover between the lazarette and the adjacent void space. Had the TWO FRIENDS been subject and held accountable to fundamental safety standards for physical characteristics common to regulated sea going vessels, this surmised tragic sequence would not have developed.

ORGANIZATIONAL FACTORS

A. LATENT UNSAFE CONDITIONS.

This investigation concludes that hands-on training on the use of survival equipment was not a priority amongst this crew (exhibit 44, pages 1-57 - 1-60 & 2-292 - 2-293). However, there is no evidence that lack of knowledge or competence in the use of survival gear contributed to the outcome.

The TWO FRIENDS participated in the voluntary dockside exam program in 1994, but did not earn a decal due to deficiencies noted. The captain subsequently denied opportunities to participate in the voluntary dockside program, though he was cordial and forthcoming as MSO Portland staff repeatedly approached him over the years, most recently in 1999. This vessel was a known risk to the fishing industry safety staff at MSO Portland and was even cited as an example of at-risk vessels when senior officers visited Portland to discuss fishing vessel safety issues. The risk factors identified were the incompatibility of the original design and construction, intended for the Gulf of Mexico, with the typical conditions in the Gulf of Maine; the visual condition of the hull; and the weight additions on deck. (See exhibit 44 pages 3-505 to 3-531.) Had an experienced Coast Guard fishing vessel examiner entered the lazarette of the TWO FRIENDS, it is the opinion of the investigating officer that a discussion of the rudder port fitting would have ensued, especially if that visit occurred during the course of repair of the

rudder post tube. It cannot be concluded if the outcome of that discussion would have changed the sequence of events leading to the tragedy.

No other unsafe organizational factors discovered are considered latent and all are expounded upon elsewhere in this report.

WORKPLACE FACTORS

A. LATENT UNSAFE CONDITIONS.

This investigation uncovered several safety issues on this vessel that are not considered particularly relevant to the development or progress of this scenario.

Each surveyor interrogated cited concerns with weight additions on deck (second net reel, concrete deck coating, etc.). These weight additions certainly reduced the intact and damaged stability of the vessel, but no standard exists so it is difficult for an inspector or a surveyor to determine satisfactory stability on a vessel that is not required to prove safe stability. In a damaged condition, again, no standards exist but estimates conducted by the Marine Safety Center indicate the vessel may have had adequate stability to remain upright with the lazarette flooded, including accounting for the second net reel and concrete deck coating (See exhibit 45). The speed with which the vessel capsized, having two flooded compartments, certainly was affected by these weight additions on deck. However, it is not likely that these weight additions were the primary cause of a lack of two-compartment survivability.

One surveyor cited thin plate on the hull for which he recommended replacement and some of these areas were in way of the lazarette. The thinnest reading was .205 inches, more than 3/16th of an inch, and the thinnest reading in the lazarette was .225 inches, nearly an inch (See exhibit 11.) While the investigation generally concurs with the surveyor's recommendations on plate replacements, the finding is that these plates were not so thin as to be prone to rapid or catastrophic failure. One plate replacement was made in the forward part of the hull based on the surveyor's recommendations. This plate replacement is not suspected because the flooding initiated aft. Also, the flooding scenario that was described in Mr. Rich's testimony is not particularly consistent with a catastrophic failure of hull plating. Therefore, hull plate failure is not suspected as a cause of this incident.

Fishing gear is prone to contact the hull on this and similarly rigged vessels. This hull had been observed to have suffered such wear. Wires can chafe on the quarters and chains, wires, and nets can chafe on the stern ramp. Doors can swing violently against the hull. The testimony in this investigation gives no indication that the vessel suffered any substantial damage from its own gear on this voyage. All haul backs and sets were uneventful and they were never hung down on this voyage. While this vessel is not immune to flooding from gear damage, the flooding scenario described in this incident is not consistent with the type of leak a chafe or punch would produce. Gear damage is therefore not suspected as a cause of this incident.

No deck fittings are determined to have been watertight. Some, including the lazarette hatches, may have been weather tight. However, it is clear the primary source of flooding was below decks in the lazarette and not via downflooding. These fittings only became involved in the progression of the mishap when they were exposed to boarding seas over the stern after the vessel turned down-sea. Downflooding through these fittings may have hastened the inevitable capsize.

The zipper on Mr. Ross's survival suit was found to be stiff and un-lubricated, though it was not seized. Since Mr. Ross never fully donned his suit, the zipper did not substantially contribute to his death. Had he fully donned his suit, he may well have been able to fully close his zipper as it was only found to be stiff and difficult, not seized.

Mr. [redacted] reported he had difficulty floating upright in his survival suit while holding the body of Mr. Ross and the EPIRB. He claimed that when his arms were drawn in, he was subject to rolling as waves passed. He described his hold on Mr. Ross as being across his chest with his arm around him. However, when he had a chance to extend his arms, he found he was much more stable and was able to remain face up with much less effort. This complication made Mr. [redacted] efforts to save Mr. Ross all the more heroic. This situation indicates his survival suit is most suitable for the survival of an able, unencumbered individual, or one who is otherwise able to keep his arms fully extended outward from his body. This limitation of this survival gear should be considered in any safety management system that relies so heavily on survival vice preventative measures.

The survival suit of Mr. [redacted] failed to maintain air in its bladder. This could well have been a problem for him if he were to have remained in the water long enough to become so fatigued from exposure that he could no longer orient himself face up in the water.

Mr. [redacted] was unable to don his hood on his survival suit. He explained that this was because it was binding on his sweatshirt hood. This is a known complication that is often discussed in professional survival suit

training sessions. Jersey style sweatshirts are very popular in the fishing fleet, partly because of their lack of buttons, tails and flaps to catch in gear. However, their material tends to bind when in contact with the materials used in survival suits. The common recommendation given is to remove sweatshirts before donning survival suits. Intuitively, an individual on his way into a raging sea is not likely to shed warm clothing first, especially if there is any doubt that there is even enough time left to get the suit on before the vessel goes over. Partly because of the problem of staying upright in the water (above), and because one may need to clutch gear and shipmates, if the hood does not go on before entering the water, it may never go on. Mr. [redacted] fortunately had the chance and a free hand to grab the EPIRB as it floated free. This allowed him to be rescued before exposure to seawater entering his suit around the neck made him the third victim of this incident. However, without his hood on, he was substantially more vulnerable in an extended survival scenario.

The light on Mr. Ross's survival suit operated only intermittently when in the water, though testimony shows that it had been checked before the voyage (see exhibit 44, pg 1-118 & 1-35). No further investigation was committed. The malfunction of the light did not substantially hinder the recovery of his body due to the effectiveness of the EPIRB.

No other latent safety conditions were identified.

PRECONDITIONS FOR HUMAN ERROR, SOFTWARE FAILURE, AND EQUIPMENT FAILURE

A. PRECONDITIONS FOR HUMAN ERROR

These preconditions are developed elsewhere in this report and can be summarized by a lack of technical knowledge of vessel structural integrity, stability and subdivision. Exemplifying this, in part, was the consistent testimony of witnesses asked what they liked about going to sea on the TWO FRIENDS. Testimony from those who had sailed on the vessel, including Mr. [redacted] said the vessel rode comfortably, partly because of its slow roll. (See exhibit 44, pg 1-50, 2-307, 2-308, & 3-502.) The parameters of the vessel's roll were not offered, which would be essential among other parameters in making a conclusive assessment of its stability, but a true slow roll can indicate limited stability. It is interesting to note that these three experienced fishermen chose comfort as a desirable virtue without mentioning stability.

B. PRECONDITIONS FOR EQUIPMENT FAILURE

Facts from the Testimony in Exhibit 44 Relative to Hypothesized Structural Failure:

The rudder port fitting at the time of the previous sailing was configured as in figure (1) below. The rudder port fitting was modified prior to the incident to the configuration shown in figure (2) below by adding an outer sleeve around the original rudder post tube fabricated from a split schedule 40 pipe that was reassembled around the rudder port tube.

The rudderpost bearing did not provide a watertight seal. The length of the rudderpost tube was between 2 and 3 feet from the hull plate to the steering arm. The top of the rudderpost tube was above the normal load waterline of the vessel. The height of the tube was the design mechanism to maintain the "watertight" envelope of the hull.

It was determined by the owner that the rudderpost tube was wasted to an unacceptable condition. The original rudderpost tube was wasted to a thickness perhaps as low as 1/16th inch. The owner hired Gowens Marine in Portland, Maine to assist in modifying the fitting in an attempt to improve the integrity of the fitting. An alternative repair was discussed, to remove the wasted rudder port tube and renew in kind, but was not pursued. The repair method ultimately chosen was largely an economic decision.

The steering system was upgraded from a mechanical to a combination mechanical/hydraulic control system.

An additional new rudderpost tube was fitted around the existing rudderpost tube. The new piece fitted around the existing rudderpost tube was fabricated from a length of schedule 40 steel pipe of either 3 1/2 or 4-inch diameter. The new rudderpost tube was not snug around the original rudderpost tube and left an approximately 1/16th inch concentric gap between the two tubes. The new rudderpost tube and the existing rudderpost tube were very nearly identical in length.

The fillet welds around the existing rudderpost tube at the under side of the rudder bearing flange and at the hull plate were largely ground away to make way for the new rudderpost tube. The existing rudderpost tube was cleaned of scale and polished to shiny metal before the new rudderpost tube was fitted.

The rudderpost fitting originally had three brackets to support the top of the tube. Two were mounted transversely, from a frame on the hull to the underside of the rudderpost bearing flange. A third had been mounted in the longitudinal direction on the aft side of the fitting from the rudderpost bearing flange to the hull. All three

brackets were removed to facilitate the repair. The two brackets in the transverse direction were reinstalled in kind after the repair with new angle iron of approximate dimension 2 inches by 2 inches. The longitudinal bracket on the aft side of the fitting was not reinstalled.

The pipe used to fabricate the new outer rudder post tube was sliced lengthwise in two and reassembled around the existing rudder post tube with two welded seams the length of the pipe. The edges of the pipe wall were prepared for welding with a grooved gap and a root dimension of approximately 1/16th inch. The new rudder post tube was welded in place around the existing rudder post tube from bottom to top using two passes on each seam. The orientation of the two seams was fore and aft. These welds were performed within approximately 1/16th inch from the original rudderpost tube, which is the concentric gap between the new and existing tubes. The welder did not intend to weld the new rudderpost tube to the original rudderpost tube. The lower end of the new rudderpost tube was prepped with a groove and approximately 1/8th inch root gap to allow for a full penetration weld to the hull plate. An experienced professional who once held a CG welding certification performed the welds on the new rudderpost tube. No written procedures were established for this welding. The welder used 7018 welding rod. The welding rod diameter was unknown. The machine was set at 50 to 55 amps. This welder stated he had good visual and physical access throughout this job. An inexperienced welder performed the welds on the rudderpost brackets.

No attempt was made to assess the alignment of the fitting after the repair. The rudder was not cycled while under observation after the repair.

The inside diameter of the rudder port fitting covers approximately 7 square inches of hull plate and the rudder post occupies approximately 3/4 square inch of that space. Calculations show that a hole in the hull plate in the vicinity of the rudder port tube with an area of 6 square inches would allow flooding to the point that stability would be compromised in approximately 30 minutes.

C. OPINIONS RELATIVE TO HYPOTHESIZED STRUCTURAL FAILURE

The rudder port fitting was certainly weakened by the modifications, mostly due to the lack of a fore and aft support bracket. The parameters of the welds that were removed and of those that were laid on the new outer tube were cannot be quantitatively analyzed without access to the specimens. No calculations were performed to evaluate the structural characteristics of the new configuration.

The rudderpost bearing would be subject to seawater head pressure intermittently in rough sea conditions and continually at extreme drafts. Since this bearing afforded no watertight seal, it is possible the initial flooding alarm was simply water spitting through this bearing. However, the indication of rapidly ensuing catastrophic flooding supports the theory that the initial bilge alarm was the result of a crack preliminary to the likely ultimate failure of the tube assembly.

It is not known whether the rudderpost brackets that were reinstalled were welded while the vessel was in the water or not. If these welds were performed while the vessel was in the water, the integrity of the welds between the brackets and the hull frame is suspect due to the heat sink effect of the sea on the hull.

The existing rudderpost tube was subject to the heat of the welding on the new rudderpost tube. The welds running the length of the new rudderpost tube may have involved the existing rudderpost tube, especially if the groove and gap was as reported. Welding on the new rudderpost tube may also have blown through the wasted metal of the existing rudderpost tube where it was thinnest. The existing rudderpost tube was likely subject to distortion due to its wasted condition, thin structure, and proximity to welding on the new rudderpost tube. It is entirely likely the original tube was intermittently involved in the outer tube weld and simply disintegrated in other places in the vicinity of the outer tube weld. These discontinuities in the assembly may have resulted in distortions of the tube assembly and very likely imposed locked-in stresses and stress risers in the assembly. The alignment of the Cutless bearing may have been altered if the original rudderpost tube became distorted, adding stress to the assembly.

The load on the rudder port fitting would be substantially greater with the new hydraulic system than with the original fully mechanical system. The rudder port fitting was not strengthened to account for this added loading and, in fact, was weakened by the omission of the only triangular bracket in the longitudinal direction.

The connection between the original rudder port tube and the hull was severely weakened by the substantial removal of the fillet welds to make way for the new rudderpost tube. This connection was further weakened by the fillet weld between the new rudderpost tube and the hull within the heat-affected zone of the original weld between the existing rudderpost tube and the hull plate.

The loads on the rudder port fitting were greatly increased by the new hydraulic steering system and possibly also by misalignment resulting from the repair work.

The most likely place for the structural failure to begin was at the connection between the existing rudderpost tube and the hull plate. If failure occurred here first, the Cutless bearings and the detached existing rudderpost tube were free to move within the new rudderpost tube. With the loss of integrity of the Cutless bearing, the lateral loading on the rudderpost bearing (at the top of the rudder post tube) would increase. With no stiffening of the rudder post tube in the longitudinal direction, as the bracket there was not reinstalled, the rudder post bearing and the rudder post tube were not well supported. The loading on the rudderpost tube, exacerbated by the loss of support at the Cutless bearings, and with no support brackets in the longitudinal direction, would result in large moments at the connection between the new rudderpost tube and the hull plate. As this weld was made to old metal in an existing heat affected zone, the integrity of this connection is suspect, especially under large loads. Contributing significantly were the discontinuities in the weld along the length of the new rudder port outer tube, imposing stress risers and relative weaknesses as the weld alternated between involving and not involving the inner tube, and perhaps blowing through the inner tube in some areas as well. The new rudderpost tube, in all likelihood, separated from the hull exposing perhaps a 6 square inch breach. If the brackets in the transverse direction were welded to the hull frame while the vessel was in the water, these welds may not have held up to the increased loading on the rudder port fitting and may have also failed. Without support structure in any direction, this would result in the greatest possible moment at the weld between the new rudderpost tube and the hull. Even with the transverse triangular brackets in place, the bending stresses in the fore and aft direction, believed to be the orientation of the hydraulic control ram, would be critical due to the weld discontinuities since the seam welds of the new tube were oriented fore and aft as well. The stress risers likely in those seams were aligned with the substantial fore and aft loading on the fitting.

The amperage for the new rudder post tube welds was low compared to guidance in the Hartford Technical Data Handbook, which recommends 70 amps minimum for this weld. However, no compulsory standard applies to this weld or this repair. Using low amperage can result in incomplete fusion and a weaker weld. Also, this investigation cannot conclude that two passes are sufficient to complete this weld if the gap was prepared as described with a proper groove.

The rudderpost bearing would not be subject to seawater head pressure in calm conditions and therefore would not exhibit leakage in a static sea state. Therefore, the integrity of this fitting cannot be adequately observed at the pier. It is entirely likely the rudderpost bearing allowed for leakage as seas built, even before failure of the fitting.

D. CONCLUSIONS RELATIVE TO HYPOTHESIZED STRUCTURAL FAILURE

The rudderpost fitting most likely failed structurally, either in stages or catastrophically, in either case eventually allowing flooding of the lazarette (coinciding with bilge alarms identified in testimony) progressing into the adjacent void space at a rate unmanageable by the installed pumps. The vessel succumbed to free surface-induced loss of stability and capsized. Capsize was likely hastened by down flooding in other spaces after the vessel turned down-sea. Capsize may also have been hastened by seas boarding on the stern quarter which tended to cause greater rolling than when a vessel headed into the sea.

PRODUCTION FACTORS

A. HUMAN ERRORS AND VIOLATIONS BY LINE WORKERS

The most likely contributory human errors are as follows:

- The failure to properly assess the type of repair appropriate for the rudder port fitting.

- The failure to assess the structural loading imposed by the new hydraulic system on the rudder port fitting.

- The failure to refit all triangular brackets supporting the rudderpost tube. Combined with the new weld on the rudder post tube in the fore and aft direction, and possibly the orientation of the hydraulic control ram in the fore and aft direction, longitudinal stiffening would be critical to the integrity of the overall fitting.

- The failure to secure the access plate between the lazarette and the void.

- Turning the vessel down-sea hastened downflooding and exposed the vessel to greater rolling. This maneuver, in-turn, hastened the inevitable capsize by adding to the free surface effect in the hull from downflooding as seas boarded over the stern and entered through the non-watertight deck fittings. By exposing the vessel to seas on the stern quarters, which tend to incite rolling more than seas on the bow quarters, the vessel rolled more violently and therefore more readily encroached on the limits of transverse stability.

B. EQUIPMENT FAILURES

The most likely contributory equipment failure is the failure of the rudder port tube.

C. SOFTWARE/AUTOMATION FAILURES

None identified.

DEFENSE FACTORS (INITIATING EVENT)

A. HUMAN ERRORS:

Consult an engineer on repairs and upgrades. Maintain watertight integrity of all below deck fittings.

B. EQUIPMENT FAILURES:

Maintain structural integrity of critical fittings. Include in any upgrades adequate augmentation of structure.

C. UNSAFE CONDITIONS IN PEOPLE:

Acquire expertise in basic marine structures and stability.

DEFENSE FACTORS (INCIDENT PROGRESSION)

A. HUMAN ERRORS IN DEFENSIVE SYSTEMS.

Maintain heading into seas to limit strain on steering components when lazarette flooding occurs, to limit boarding seas and downflooding, and to limit rolls induced by encountering seas on the stern quarters.

B. EQUIPMENT FAILURES IN DEFENSIVE SYSTEMS

Bilge pump capacity was inadequate for the flooding that occurred. However, the bilge system was determined to be in substantial compliance with the regulations based on the testimony.

C. UNSAFE CONDITIONS IN PEOPLE LEADING TO DEFENSIVE SYSTEM FAILURES

Seek refuge of survival gear early when vessel is discovered to be foundering.

D. UNSAFE CONDITIONS IN EQUIPMENT LEADING TO DEFENSIVE SYSTEM FAILURES

Maintain survival gear in excellent condition to facilitate seamless donning and/or application.

PART 5: ANALYSIS OF HUMAN ERROR

A. THE GENERIC ERROR MODELING SYSTEM

In its annex to the Code for the Investigation of Marine Casualties and Incidents, the International Maritime Organization suggests member nations analyze human error using Dr. [redacted] Generic Error Modeling System (GEMS). The Coast Guard has used GEMS in analyzing the human errors occurring during this incident.

Dr. [redacted] GEMS is in turn based on the work of his mentor, Dr. [redacted]. Dr. [redacted] work explores how people solve problems and perform tasks. It identifies three levels of performance and suggests (not surprisingly) that the kind of human error people make depends on what level of performance they were engaged in at the time.

This incident is found to most closely resemble the knowledge-based performance criteria (KB) of Dr. [redacted] pattern matching human performance model. In KB performance, people use their mental resources to the fullest because the pre-packaged responses and patterns simply don't apply and answers must be worked out on-line, in real time.

B. HUMAN ERROR ANALYSIS

The human errors cited in this report are overwhelmingly indicative of people assessing risks and taking actions with inadequate basis.

The pattern with which the owner may have considered his choice of repair method likely included knowledge of the common practice of doubling. Doubler plates are often welded over holes and wastage in hull and deck plating. In effect, the repair he chose to the rudder port tube was a doubler arrangement. However, he did not fully consider the effect of removing the weld from the bottom of the original tube and the effect of welding in close proximity to the tube.

The addition of hydraulic controls was apparently absent of consideration of the additional mechanical loading on the rudder port assembly.

The choice to turn down-sea likely followed a pattern of seeking to mitigate turmoil onboard. Though heading into the sea eliminates seas boarding over the sinking stern, limits roll, and applies less strain on the rudder port fitting, it is an inherently uncomfortable ride. When the situation became critical, the choice to turn down-sea was likely to smooth the ride while they attended to problems, but it did not fully account for the conditions on the vessel.

The choice to sail with the access port open between the lazarette and the void space forward of it was not fully considerate of the risk of flooding and the implication on stability of free surface effect.

PART 6: REFERRAL FOR ENFORCEMENT ACTION

Referrals

Pursuant to 46 U.S.C. 6301(4) and (5), 14 U.S.C 89, and 46 CFR 4.07, the Investigating Officer has determined that there is no evidence of an act subjecting any individuals to administrative civil penalties, judicial civil penalties, or criminal sanction.

Safety Recommendations

For the Fishing Industry Mariner:

1. Be cognizant of the condition of hull structure and appurtenances and of potential sources of flooding and address concerns appropriately, including rudder port fittings, hull plating, deck fittings and hatches.

2. Eliminate any breaches in watertight integrity between hull compartments, including bulkhead fittings and passages. Do not go to sea with missing covers, open doors, or holes of any kind in otherwise watertight bulkheads below deck. Maintain all watertight fittings and structures as such.

3. Renew wasted metal in-kind or seek guidance from a qualified engineer before modifying the structure of a rudder port fitting or any fitting or appurtenance vital to hull integrity or stability or that bear substantial load.

4. Recognize that adding metal to a structure is not necessarily going to result in a stronger structure and may even result in a weaker one. Consult an engineer when in doubt.

For the Coast Guard:

5. Promulgate the findings of this investigation via "Safety Alerts", press releases, industry events, and other public awareness campaigns, particularly amongst trade press and media markets covering major fishing ports.

6. Continue to identify at-risk vessels, creatively pursue opportunities to board these vessels with highly trained inspectors competent in structural and stability analysis, and seek to educate the fishing industry in the hopes that they will remedy risks as identified, similar to Marine Safety Office Portland's Uniform Enforcement Template risk assessment and mitigation program.

7. Advise political leaders that this type of incident cannot be effectively prevented within the current legislative framework. Seek endorsement from the Commercial Fishing Industry Vessel Advisory Committee (CFVIAC) on this recommendation. Further seek CFIVAC opinion on establishing training and competency standards for fishing vessel crews regarding intact and damaged stability, subdivision and progressive flooding, fundamentals of vessel structures, and advanced survival systems expertise.

8. If provided authority and funding by Congress, establish regulations for structural and watertight integrity and stability for all fishing and fish tender vessels, and for competency standards for fishing vessel crews, regardless of size or operating area. Develop fishing industry safety programs and resources of equal professional competence and of equal proportion to fleet size, as other existing marine inspection and marine personnel certification programs. Compare the fatality rate of all marine industries and apply the most highly trained resources to the industry segments found to be at the greatest risk in sufficient numbers to mitigate risk to levels comparable with other forms of marine commerce.

9. Safety management system regulation and oversight, and survival suit approval processes, should be mindful of the performance of survival suits to maintain a person face up in the water even when the person is unable to keep their arms extended.

10. With the exceptions stated elsewhere in this report; there is no evidence of actionable misconduct, inattention to duty, negligence, or willful violation of law or regulation on the part of licensed or certificated personnel; nor evidence of failure of inspected equipment or materiel; nor evidence that any personnel of the Coast Guard or of any other federal agency, or any other person contributed to this casualty. Therefore, it is recommended that this casualty investigation be closed.

PART 7: EVIDENTIARY EXHIBITS

Exhibit 1:
Commander, First Coast Guard District Letter of Designation dated January 27, 2000 for LCDR John E. Cameron.
Exhibit 2:
Party in Interest Letter for Long Island Sea Ventures Inc.
Exhibit 3:
Subpoena for Mr. [redacted]
Exhibit 4:
VCR tape of F/V TWO FRIENDS aerial debris.
Exhibit 5:
3.5" floppy disk containing 4 digital pictures of diagram sketches of the F/V TWO FRIENDS.
Exhibit 6:
2 photographs of the EPIRB registered to F/V KATE AND SHAWN.
Exhibit 7:
4 photographs of the survival suit worn by Mr. Harry Ross, Sr.
Exhibit 8:
Micro-cassette recording of F/V TWO FRIENDS on 25JAN00.
Exhibit 9:
Computer print out of digital picture of rudderpost of F/V LA MACARELA.
Exhibit 10:
Letter designating Mr. [redacted] Esq., as legal representative for Party in Interest (Long Island Sea Ventures, Inc.).
Exhibit 11:
Survey report from Casco Marine Consultants, Inc. dated January 10, 2000.
Exhibit 12:
Copies of Fishing Permit (MA), Mobile Gear Coastal Access Permit, Two (2) Commonwealth of Massachusetts Special Permits (all numbered 4314).
Exhibit 13:
Letter designating Mr. [redacted] as legal representative for the Estate of Mr. Lawrence Rich and Mr. [redacted] individually.
Exhibit 14: Copy of Mr. [redacted] (marine surveyor) file on F/V TWO FRIENDS
Exhibit 15: Letter requesting "Presumption of Death" from Attorney [redacted]
Exhibit 16: Subpoena for Long Island Sea Ventures, Inc.
Exhibit 17: Gowen Marine invoice number 9155.
Exhibit 18: Gowen Marine invoice number 1414.
Exhibit 19: 3 photographs of F/V TWO FRIENDS (with negatives).
Exhibit 20: 3.5" floppy disk containing digital pictures of photographs
Exhibit 21: Vessel Services Inc. invoice number 04-30496.
Exhibit 22: Statement from AST3 [redacted] USCG, assigned to Air Station Cape Cod.
Exhibit 23: Statement from QM2 [redacted] USCG, assigned to the CGC WRANGELL.
Exhibit 24: Statement from GM3 [redacted] USCG, assigned to the CGC WRANGELL.
Exhibit 25: Copies of log sheets for January 25 and 26, 2000 from the CGC WRANGELL.
Exhibit 26: USCG Vessel Documentation package for F/V TWO FRIENDS.
Exhibit 27: Marine Safety Information System (MSIS) printouts for F/V TWO FRIENDS (24 pages).
Exhibit 28: W.L. Blake Invoice number 3506463A.
Exhibit 29: Revere Survival Products Certificate number 023186.
Exhibit 30: Revere Survival Products Certificate number 19641.
Exhibit 31: Maine Liferaft and Inflatable Service Co. invoice dated 1/14/2000.
Exhibit 32: Maine Liferaft and Inflatable Service Co. service order/invoice dated 5/27/99.

Exhibit 33: Copies of Coast Guard SITREPS on F/V TWO FRIENDS.
Exhibit 34: U.S. Coast Guard chain of custody record for 406 EPIRB, serial number ADCD02139500801-5349.
Exhibit 35: State of Maine Annual Report for Long Island Sea Ventures, Inc.
Exhibit 36: CG-2692 for F/V TWO FRIENDS from Mr. [redacted]
Exhibit 37: EPIRB registration forms for F/V's TWO FRIENDS and KATE AND SHAWN.
Exhibit 38: Medical Examiner's report (number 2000-0171-A) for Mr. Harry Ross, Sr.
Exhibit 39: Subpoena for Mr. [redacted]
Exhibit 40: Subpoena for Mr. [redacted]
Exhibit 41: Subpoena for Mr. [redacted]
Exhibit 42: Subpoena for Mr. [redacted]
Exhibit 43: Schematic of the F/V LA MACARELA from Marine Safety Satellite Office Brownsville, TX (sister vessel of F/V TWO FRIENDS).
Exhibit 44: Transcript of the hearing for USCG Marine Safety Office Portland investigation of the sinking of the F/V TWO FRIENDS on January 25, 2000.
Exhibit 45: Marine Safety Center Letter on Casualty Analysis dated February 23, 2000.
Exhibit 46: Marine Safety Office Portland Maine "Presumption of Death" letter